"SPREADING THE WORD": TOWARD A MULTIPLE LAYER PROGRAM FOR INFORMATION DISSEMIMATION

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ABSTRACT Why is bioclimatic architecture not as popular as other "environmentally conscious" concepts? What are the possible loopholes in current practices and how could these be taken care of? To answer such questions, this paper attempts to trace the synergetic effects of different activities within the context of Israel, and in particular that of the Israeli desert. It presents a review of academic work, professional courses and workshops, cooperation with ministries and development authorities, and planning and architectural design, trying to suggest the cause-and-effect links between different processes and events. These are used as an outline for a possible multiple layer model for information dissemination.

1 Introduction

Various papers and reports have been written investigating the relatively weak effect that bioclimatic and sustainable design concepts have had so far on professionals, decision makers and consumers alike. A quarter of a century after the oil embargo forced energy consciousness onto public awareness, it is still easier to stress the importance of subjects such as greenhouse emissions and ozone depletion, than stressing the importance of bioclimatic housing, thermal comfort standards and other design related issues.

Many subjects are not clear yet. For example, should priority be given to legislation and regulations, or maybe to raising consumer awareness; should research reach a certain level before demanding the implementation of its results, or could it advance in parallel with planning and design processes; should historical precedents be used, or should current paradigms be developed?

In the following pages an attempt is made to investigate and understand the reasons for the present state of matters, and suggest alternative, comprehensive approaches for a possible change. This is done through a case study of the Israeli context, and in particular that of the Israeli desert, in an attempt to trace the synergetic effects of different activities, among them academic work, professional courses and workshops, cooperation with ministries and development authorities, and planning and architectural design. The traced cause-and-effect links between different processes and events are used as an outline for a possible multiple layer model for information dissemination.

2 Identifying loopholes

Attention to the subject of alternative energy in general, and particularly that of bioclimatic design, rises periodically, mainly as a consequence of political processes, such as the oil

embargo of the 1970s and the Gulf crisis of the early 1990s. Although stressed during such periods, the importance of and interest in appropriate planning and design for energy conservation seem to be forgotten in the in-between periods, even though these issues have been directly connected in recent years to environmental problems (Nicklas 1992). Special research and development programs, and numerous publications produced with the help of governments and committees seem to miss their target, since a large number of planners and designers either ignore them or are unaware of their existence. This is quite unfortunate considering the fact that efforts and money are being invested in these programs on the one hand, while, on the other hand, both developed and less developed countries (LDCs) are missing the main aim of such efforts, namely – in the case of bioclimatic design – that of providing better, more thermally comfortable environments at lower maintenance costs. What are the main loopholes that allow such a gap between efforts and their actual impact?

2.1 The problem of "image" and curricula within academic institutions

Although generally identified as an important issue, energy efficiency and conservation in design seems to be underemphasized in, or totally left out of academic curricula. This is despite a growing interest among staff and students in the issue, as indicated in the results of a number of surveys and reports carried out in the UK. These indicate that the large majority of staff and students in schools of architecture closely link the solution to global warming with energy efficiency and the use of alternative energy sources. Roaf and Hancock (1991) sum the reasons for this anomaly as follows:

- lack of balance between importance of the topic and number of studio and theoretical work hours invested;
- teachers' low status in the schools, resulting in their being marginalized;
- part-time specialists teaching the subject in concentrated or isolated sessions, not being available for day-to-day consultation and close cooperation with students and staff;
- lack of communication between specialist and studio staff;
- lack of common teaching standards and cooperation among the different academic institutions involved in the teaching of specific topics;
- lack of funding for the provision of appropriate facilities and equipment (usually rather expensive) needed for training.

These conclusions comply with our experience, based on teaching and curricula in Israel and abroad, which usually include very condensed compulsory courses of a general introductory character (e.g. Wegner 1997), but few or no electives providing advanced learning. One may find certain connections between this condition and the results of a questionnaire circulated among graduate students of the Environment and Energy Studies Programme at the AASA (Meir 1992). These results showed that 71% of the participants were first confronted with the topic in discussion through academic courses (bioclimatic case studies were listed as secondary "inspiration" by 57%), a fact stressing the importance of curricula. Less than 42% thought that teaching might be among their future occupations, but only as a secondary one, while almost 60% considered theoretical research and private practice to be their main fields of interest in the future. Over 70% of the participants rated their chances of implementing knowledge accumulated during their studies only as "good", while 14% rated them as "poor" (none of them seemed to be confident enough to rate their chances as "very good").

2.2 The problem of information availability

Although the number of publications on energy conscious design is rapidly growing, these publications do not reach the wide professional user/client circles. This fact may be attributed to a number of factors, such as lack of awareness, insufficient research funds and poor communication links between researchers and users (Graham & Pather 1992).

- **Accessibility**: Most of the updated information is usually published in scientific journals, proceedings of conferences and books, which, by definition, address professionals specializing in the fields under discussion. This is also true for a large number of research programs funded by governments or affiliated organizations, usually producing research reports in limited numbers of copies, which in any case do not reach the wider architectural community [1].
- **Applicability:** Most of the material is of scientific nature (e.g. theoretical models and studies, or results of experimental projects) and therefore its applicability or translation to architectural solutions is not always obvious or direct.
- **Simplification versus generalization**: Professional publications dealing with the issues under discussion in a qualitative way (i.e. by presenting the assessed advantages of a project without providing quantitative tools for further applications) do not necessarily provide professionals with essential design tools.
- **Popularization**: Popular publications on architectural design tend to concentrate on aesthetics, fashion and practical techniques for refurbishment, rather than technological and environmental issues. Thus, these publications do not expose the wider public to either the theoretical imor tof environmental issues.

2.3 The problem of computer simulation software flexibility and reliability

One of the useful tools available to the architects/engineers concerned with environmental and energy aspects of design is simulation software programs. These address different design issues such as thermal behavior of buildings and components, daylight and ventilation. Some of them are pre-design tools, whereas others enable detailed analysis of a project or component. Useful as these tools may be, many of them are inefficient, inaccurate or non user-friendly, and still not widespread. Some of these problems seem to be built in the software, while others depend on the general attitude of architects toward Computer Aided Design (CAD), the use of computerization in general, and in particular the combination of different tools.

- **Extent of computerization**: The use of computers in architectural offices, especially the medium and small size ones, is becoming widespread, but on a basic level facilitating primarily drafting. Tools such as simulation software are still far from evident to most.
- **User-friendliness/accessibility**: Since most architects are not yet deeply involved in energy efficient design, the use of simulation techniques in this field would be encouraged provided such software would be cheap, user-friendly and easily accessible. This, however, is far from being the present situation. Most of the thermal and daylight simulation software programs reviewed for the purposes of this paper do not interface with computer drawing or design software. Even architectural firms with computer literate personnel and CAD software, would have to invest time creating numeric data files of their projects if they intended to check their properties and behavior – a time consuming task which would add to the overall time invested in a project. Furthermore, the basic investment in such software is relatively high. (It is hard to quantify this statement, since prices vary widely among countries and software.) Although a positive step has been taken by making energy consumption assessment and retrofit tools available on the Internet (such as *The Home Energy Saver*), these still demand long on-line data feeding and slow processing.
- **Variability**: Choosing the software suitable for one's specific needs may be a difficult task for the uninitiated architect. There seems to be a relatively large number of such programs, which at least overlap in certain areas. Antinucci et al. (1989) reviewed 128

[1] Recent attempts to alter this include Web sites, such as *DOE Energy Efficiency & Renewable Energy Network*, which provide information on and access to codes, institutions and software. In addition, there are some information centers, such as the Technical Information Service of the ASEAN Sub-Committee on Non-Renewable Energy Research (acting as a reprints distribution center), and various other frameworks, among them SKAT, IT, BASIN, GATE-gtz and various departments of the European Commission Directorates. However, these still are the domain of the few.

programs defined as "design tools on cooling". Feustel and Dieris (1992) reviewed 50 airflow models for multizone structures. Similar is the situation regarding software for heating, daylight etc. Lack of a central accessible data base which could enable comparative examination of the different programs available makes choosing the appropriate software difficult. The *Building Energy Software Tools Directory*, a Web site maintained by the US Department of Energy, may be a step toward solving this problem, but is still selective, and not easy to navigate through the massive information included (37 energy simulation tools are registered, whereas 21 new tools in various areas were listed only in 1998).

- **Accuracy and reliability**: The reliability and accuracy of the different software programs is often questionable. Comparative studies of the results given by different programs, and comparison of these to the actual performance of the simulated building often show considerable deviations. This has been demonstrated by a number of researchers, and may be attributed to the fact that different programs are based on different assumptions, algorithms and environmental conditions. The validation of each program based on its comparison to the actual behavior of a specific building in a given environment does not guarantee the same degree of accuracy when used for the simulation of different buildings under different conditions.
- **Adaptability/limitations**: Some of the existing software has been developed for a specific purpose and its capabilities and accuracy are limited to it. This makes it obsolete as standards on which it is based, or type of projects the software user works on, change (such are programs that operate within specific preset climatic conditions and settings).

2.4 The problem of demonstration material and projects

During the last 10-15 years many energy conserving projects have been erected and material on their performance and cost has been produced (such as *Project MONITOR* documenting 49 case studies, and *Building 2000* documenting over 30 others). In addition, popular material has been produced in a number of countries, dealing with energy conserving devices, and retrofit techniques. The Israeli experience has shown that popularized advertisement of relatively low cost improvements (such as thermal insulation) may raise public awareness and promote demand for improved construction. However, the idea of appropriate design of the building or cluster as a whole is more difficult to promote. Even widely published successful case studies have had negligible impact on the wider architectural circles and the general public. The reasons for this may be attributed to a number of factors (other than the lack of awareness and/or interest).

- **Experimental nature of projects**: Experimental projects may often deviate from the conventional perception of exterior looks or interior spaces. This is caused by the tendency to incorporate in them elements which are of scientific interest or of exaggerated relative importance (in size or location). These, in turn, may render the buildings in the eyes of the wider public as unattractive or overdesigned.
- **Specific solutions versus general principles**: The uninitiated designer or potential user may be unable to isolate the essence of a general principle from its specific implementation and appearance. Even more problematic is the case of specific solutions for different climates. Although bioclimatic strategies are similar for different climates and regions (passive heating and cooling, daylight and energy conservation), their translation into concrete design patterns and solutions has to differ from one region to another.
- Obvious advantages: Environmentally responsive design is based primarily on the correct orientation of clusters, buildings and fenestration (in relation to solar angles and wind directions). Complying with such demands should not have any effect on the price of a building or apartment. However, the appropriate design of the building details cannot but raise the price of the end product (additional insulation, better glazing etc.) The economic advantages such additions may have in the long or the short run should be obvious and easily enhanced in order to prove the claim that the added cost to the original investment is worthwhile and that the payback period is reasonable. It should also be stressed that one of the advantages of environmentally responsive buildings is the creation of thermal comfort

conditions through the employment of natural means (as opposed to air conditioning etc.) (Howarth & Andersson 1993).

4 Making the necessary adjustments

It is obvious that boosting professional and public interest in energy efficient design and planning cannot be achieved in a simple way. To a certain extent this is due to the conservative character of the construction industry and market. Two of the main reasons for this are the high price of the end product and its long life span. While innovation in other fields (such as computers, cars or electronics) is easily diffused, it takes two generations to establish whether an innovation introduced today may affect the life of a structure (Stern 1990). Tightening cooperation in environmentally conscious design between research and industry is one of the obvious steps (Argument et al. 1998). Considering these facts, future action should be multifaceted and coordinated in order to achieve the needed impact. Following are the parameters that should be included in a comprehensive effort.

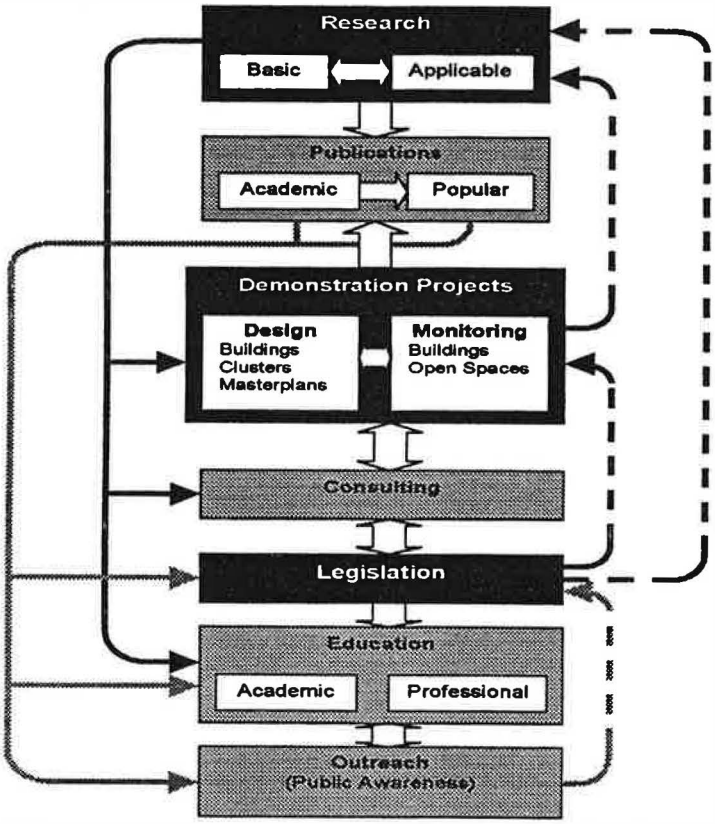

Fig.1 **Synergies and interactions: black background indicates primary activities; dashed lines indicate feedback.**

Legislation and standards: The legal framework that will enable the implementation of conserving policies, providing region-sensitive adjustments, and tools that will enable local authorities to enforce such measures (Bonaiti 1989; Brown 1993).

- **Design support tools**: User-friendly, not necessarily computer oriented, but the latter should be modular (heating, cooling, daylight, ventilation etc.), interrelated, interfacing with drafting and design CAD, and adjustable (building types, locations and climatic conditions). They should appeal to different user types (students, professionals, and even users). McCartney and Rhodes (1991) have demonstrated that such tools give students a better understanding of processes and accurate and faster assessment capability.

- **Updating of practising professionals**: Enabling them to become acquainted with such topics, providing them with practical tools, and achieve all of these within a reasonably short time, preferably through alternative flexible frameworks, incorporating site visits, case study analysis, theoretical background, teaching of design support tools and their applications (Meir 1991a, 1991b).
- **Updating academic curricula**: Making the subject central, essential and comprehensive, including modular, flexible syllabi (e.g. as suggested by Radovic 1996) and aids, being accompanied by appropriate funding for equipment and software.
- **Raising public awareness**: Construction of demonstration projects of "mainstream appeal", popularized publications, creation of economic incentives (such as funding retrofit projects and sponsoring design competitions) (Arias 1995; Meir et al. 1996), and massive advertisement.
- **Coordinating international research**: Through multinational funding and information dissemination, allocating research topics to different groups, balancing efforts and resources.
- **Creating a central, accessible data bank**: Accessible to the wider public through connections to academic institutions and professional organizations, as well as through the Internet.

5 A case study of synergies in a multiple layer model

Although *locus*-specific, the following case study is presented as an example of how multiple layer action may promote the cause of energy conscious, bioclimatic planning and design. The Center for Desert Architecture and Urban Planning, established in the mid-seventies, is by definition an applied research academic unit. As such, the Center's staff initiates, and participates in, **research** within national and international programs. The byproducts of these are **technical reports**, **refereed papers** and **presentations at conferences**. However, these have little impact on the professional circles. To overcome this lack of contact between academe and professionals, the following steps have been taken.

- **Demonstration projects design**: Including private, public, educational and institutional buildings, clusters and master plans, incorporating research results and demonstrating their use in "normal" buildings.
- **Monitoring**: Demonstration projects, and others of special interest, are monitored and the data are used as a first-hand illustration of the theory and its applications.
- **Educational and popular material**: A manual was produced through the funding of the Ministry of Energy and Infrastructure. First published in 1990, it has sold over 3000 copies (two editions in Hebrew and one in English), a relatively large number in a country of some 3000 registered architects. Additionally, popular papers are being published occasionally in journals popular among professionals, students and the wider public, maintaining scientific essence behind a down-to-earth facade and terminology.
- **Academic courses**: Although not directly affiliated to a regular school of architecture, the Center has been providing condensed courses for various schools lacking climate and energy oriented staff, and short topic-specific seminars for other schools. Such activities are becoming ever frequent, and in the past three years have encompassed all four major schools of architecture in Israel.
- **Alternative workshops**. As part of the outreach efforts, the Center initiated and operated a series of "traveling" workshops, each one concentrating on the constraints of a specific location. By bringing together academics, architects, planners, decision makers and local authorities representatives, the workshops enabled information dissemination through energy and environment policy oriented dialogue.
- **Consulting**: Starting on an informal base and small scale, the consulting efforts of the Center have been consolidated in recent years, and include practically every major master plan designed in the Israeli desert (some 65% of Israel's area). Most of these activities are commissioned by the Ministry of Construction and Housing, and to a smaller extent the National Land Authority, local planning committees, and private bodies. Recent trends

include environmental impact assessment of relatively large projects, demanded by the authorities in the region. Such projects have been brought to the Center's attention for analysis.

- **Participation in committees**: The Center has been represented almost continuously on a number of panels operated or supported by various ministries. Such panels deal with insulation standards; cooperation between industry and academe; fora working on regional development and cooperation; and targeting pre-university education, such as the STS (Science-Technology-Society) multidisciplinary group, a joined effort of the Ministry of Education, the Ben-Gurion University and the Sede Boqer Environmental College (Keiny 1996).
- **Professional library accessible to the public**: This is probably one of the most extensive topic oriented libraries in the country. Although modest in size, it is well equipped with publications covering climate, urban microclimate, bioclimatic design and planning, energy conservation and alternative energy utilization. The library is accessible to the wider public, and especially professionals and students.

To what extent are all of these functioning in a mutual support system? It is obvious that the academic work is the main factor which enabled the other activities of the Center, by establishing its firm academic base. Such work coupled with demonstration projects, initially modest, but growing bigger and more complex, justified the Center's activities as a "mediator" between academic research and design practice. The workshops framework, which operated intensively over a period of five years, created fertile ground for the spreading of energy conserving, environment conscious design concepts in the arid regions of Israel. It also enabled the acquaintance of most of the people in the Negev Desert actively involved in research, planning, design and construction, and promoted some interesting research projects, among them consulting, design and monitoring. Ideas such as the need for better implementation of insulation standards and practices, are slowly seeping in. Summing these in a – still limited – number of popular articles, and becoming known among the wider public has brought increasing numbers of professionals, students and laymen to visit the Center facilities and demonstration projects on campus, hopefully making a lasting impression which will have further impact in the future.

6 Conclusions

It would be presumptuous to claim that what has been presented here is the ultimate model for a comprehensive, multiple layer action model. Furthermore, the activities described in this paper have not always had the maximal possible impact. One such example is that of consulting within design teams, whereas the climate and energy induced guidelines are not always included as a whole set of compulsory regulations in the general building regulations accompanying the plan. There is still much to be done, but in order for future action to be effective and lasting, it has to be comprehensive, multi-layered, intra-active from within and interactive with the various levels of end users, policy makers and professionals. It should not be left to chance or the good will of individuals, but rather become consolidated in design practices and codes which will promote the creation of such and facilitate their operation. The complex interactions among the various parameters presented above point to the fact that impact is not the dependent on linear action and, therefore, the present state of knowledge allows to advance simultaneously on all fronts – research and demonstration projects, legislation and education, monitoring and publication.

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8 References

Antinucci, M. et al. 1989, 'Passive cooling - State of the art', in *Science and Technology in the Service of Architecture: Proceedings of the 2nd European Conference on Architecture*. eds T.C. Steemers & W. Palz, Kluwer Academic Publishers, Dordrecht, pp. 103-107.

Argument, L. et al. 1998, 'Environmentally conscious design: matching industry requirements with academic research', *Design Studies*, vol. 19, no. 1, pp. 63-80.

Arias, H. B. 1995, 'Financing energy conservation projects', *Proceedings of the 4th ASEAN S&T Week*, pp. 101-106.

Bonait, J. P. 1989, 'French energy conservation policies in housing since 1973', *ENER Bulletin*, no. 6, pp. 27-43.

Brown, M. A. 1993, 'The effectiveness of codes and marketing in promoting energy-efficient home construction', *Energy Policy*, vol. 21, no. 4, pp. 391-402.

Feustel, H. E. & Dieris, J. 1992, 'A survey of airflow models for multizone structures", *Energy & Buildings*, vol. 18, pp. 79-100.

Graham, C. W. & Pather, R. 1992, 'Technology development in the Natal building industry, *Building Research & Technology*, vol. 20, no. 1, pp. 38-48.

Howarth, R. B. & Andersson, B. 1993, 'Market barriers to energy efficiency', *Energy Economics*, vol. 15, no. 4, pp. 262-272.

Keiny, S. 1996, 'A community of learners: promoting teachers to become learners', *Teachers & Teaching*, vol. 2, no. 2, pp. 243-272.

McCartney, K. & Rhodes, P. J. 1991, 'Modeling wind/building interactions using computer animated graphics: an evaluation of educational effectiveness', in *Architecture and the Urban Space: Proceedings of the 9th International PLEA Conference*. eds S. Alvarez, J. Lopez de Asiain, S. Yannas, E. de Oliveira Fernandes, Kluwer Academic Publishers, Dordrecht etc, pp. 799-804.

Meir, I. A. 1991a, 'A prototypical information dissemination framework for sparselands', *Architectural Science Review*, vol. 34, no. 4, pp. 143-146.

Meir, I. A. 1991b, 'The Negev Design and Construction Workshop: an alternative education prototype', in *Architecture and the Urban Space: Proceedings of the 9th International PLEA Conference*. eds S. Alvarez, J. Lopez de Asiain, S. Yannas, E. de Oliveira Fernandes, Kluwer Academic Publishers, Dordrecht etc, pp. 793-798.

Meir, I. A. 1992, *Information Dissemination in the Fields of Bioclimatic Design and Energy Conservation*. Final Report submitted to the British Council and the Israel Ministry of Science and Technology, Desert Architecture Unit, Ben-Gurion University of the Negev, Sede Boqer Campus.

Meir, I.A., Erell, E., Etzion, Y. & Pearlmutter, D. 1996, 'Are design ideas competitions hitting the target?', *Energy & Buildings*, vol. 23, no. 3, pp. 299-306.

Nicklas, M. 1992, 'Oil and nuclear lobbies control energy issues at Earth Summit', *ISES News*, Newsletter 74, pp. 1-2.

Radovic, D. 1996, 'Bioclimatic design as the core of Environmental Programmes', *Energy & Buildings*, vol. 23, no. 3, pp. 271-275.

Roaf, S. & Hancock, M. 1991, 'Assessing and meeting the needs in energy and environmental education in the 1990s: the situation in Britain' in *Architecture and the Urban Space: Proceedings of the 9th International PLEA Conference*. eds S. Alvarez, J. Lopez de Asiain, S. Yannas, E. de Oliveira Fernandes, Kluwer Academic Publishers, Dordrecht etc, pp. 809-816.

Stern, A. 1990, 'Bridging the gap: building information – technology transfer', *Building Research & Practice*, vol. 18, no. 5, pp. 309-313.

Wegner, D. 1997, *Air conditioning systems and building climatology: Introductory Course Syllabus* (in Hebrew), Bezalel Academy of Fine Arts, Jerusalem.