

ARCHITECTURAL SCIENCE EDUCATION FOR DESIGNERS

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Summary

The Australian and New Zealand Architectural Science Association was founded in 1960 with an informal meeting of architectural science teachers brought together by Professor Henry J. Cowan. In the year of his retirement we returned to the subject of architectural science teaching. From time to time the association has explored these problems, (in fact it would seem that we do this every five years - 1974, 1979 and now 1984).

The idea to study this again with new experience came as a result of a survey by the author of Architectural and Building Science Educators in 1983. The results of which showed a keen desire to explore the integration of Architectural Science into the Design Process. Many felt that there was a need to discuss the teaching methods used and to explore ways of improving the 'penetration' of Architectural Science into Architecture Studio design process. This paper will review that workshop and examine the ideas that were exchanged by educators from almost all schools of architecture in Australia and New Zealand.

The thirteen papers presented in this workshop covered a wide range of views from within the architectural teaching profession. The program began with a philosophical debate on the problems of the design process and where it originates from. The program then progressed to a series of papers which studied the interrelationships of science and design in the design process.

Introduction

The resolution of the problems of integration are very elusive, in spite of the fact that as an association we have met regularly over the years to discuss this problem. The Australian and New Zealand Architectural Science Association was founded in 1960 with an informal meeting of architectural science teachers brought together by Jack Cowan. It is fitting therefore that this year of his retirement we return to the subject of architectural science teaching. From time to time the association has explored the problems, (in fact it would seem that we do this every five years - 1974, 1979 and now 1984).

A survey of Architectural and Building Science Educators in 1983 showed a keen desire to explore the integration of Architectural Science into the Design Process. Many felt that there was a need to discuss the teaching methods used and to explore ways of improving the 'penetration' of Architectural Science into Architecture and the Studio design process. It is important that as many disciplines as possible participate in such meetings as this and it was gratifying to see that there were quite a few design studio staff participating.

The two day programme was divided into six sessions of approximately 90 minutes each, preceded by a welcome by Dick Apperly, Head of the School of Architecture and a very stimulating keynote address by Peter Kollar.

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The first sessions of the workshop began with a discussion of the integration of sciences into the design process. The relationship of intuition to the deductive reasoning of the sciences. The need for effective integration within design teaching was accepted by both design staff and science/technology staff. As the first days papers progressed we moved on to papers from those who teach science subjects and also participate in the design studio. In summary the speakers on the first day explored the philosophical and logistical aspects of integrated design in schools of Architecture. The development of a design/science intuition or experience would seem to be a common goal in most schools.

On the second day, papers generally discussed course experiences with examples of how the integration of science material into the studio program is being implemented. The final papers then discussed the role of practical application and laboratory or experimental experiences and its integration into the design studio exercises.

The aim was to stimulate thoughtful discussion on ways of implementing the effective integration of science and technology into the design studio process. I hope that discussion continues.

#### The case as presented to the Workshop

##### The Two Faces of Architectural Endeavour

In his paper Peter Kollar discusses the 'two-faced' nature of Architecture as he sees it, the barriers of architectural science and architectural design. Such barriers are formed due to the way in which each perceives the other. The 'scientist' as rational, analytical, impersonal and the 'designer' as vague, illogical and negligent in the face of 'scientific facts'. It is argued that these positions are taken up by each party without full regard for the detailed nature of each others actions. He concludes amongst other things that the actions of the architectural scientist is to 'design' in his or her own way. That being so, he suggests then that there is the 'Comprehensive Designer' and the 'Specialist Designer', the latter being the architectural scientist or other architectural specialist. Later in his paper he spells out in detail the activities of the two:

Summing up the distinctions between the two major groups of designers of the architectural profession we observe that one group tends to design comprehensively for the whole man based on instinctive, rational and intuitive knowledge, whilst the other tends to design specialised components for the corporeal man, based only on rational knowledge verified by the modern scientific method.

Peter Kollar later goes on to say that both acts of designing must go together to make a unified whole and that they may be undertaken by one or many people in the one project. 'Comprehensive design is a necessary prerequisite to specialised design' whether undertaken both by the one person or not.

### The Process of Design

Proudfoot in his paper takes up the problems of design; 'Sciences of the Artificial' after H.E. Simon (1). Simon maintains a concept of a design science in that the Science of the Artificial deals with that material that relates to man-made relationships (design) to enable it to stand alongside the natural science of physics and the environment which are subject to natural laws. His paper examines current design teaching in Australian Architectural Schools 'in relation to the dichotomy between theory and practice and the application of individual subject teaching to design teaching'. He compares the position of Simon with that of Professor Llewelyn Davies of the Bartlett School of Architecture at London University and others such as J.M. Richards and Walter Gropius in their stance of architecture as a social art and the use of intuition.

Proudfoot concludes that perhaps Simon's concept of a 'Design Science' is more appropriate in professional education:

'In their separate ways both Llewelyn Davies and H.A. Simon assert that most of the complexity of man's behaviour may be drawn from his environment, from his search for good designs. But whereas Davies Man-environment paradigm advocated that the entire spectrum of environmental disciplines should be studied, Simon in opposition to this, stresses the unity of organism and environment in their mutual interaction. It would also seem that the man-environment paradigm is divisive in professional education whereas Simon's "Science of Design", at the very least, suggests how teachers and workers concerned with the built environment can carry on a mutually rewarding conversation about design, how they can begin to perceive the common creative activity in which all are engaged, and how they can begin to share their experiences of the creative, professional design process.'

Bruce Forwood discussed the issues related to the teaching of traditional architectural science subjects in a school of architecture. Because the traditional view of architecture is perceived as a design based discipline with a series of peripheral service subjects, such as architectural science, it is necessary to re-define the boundaries of architectural design. The factors contributing to this view were discussed along with some of the ramifications of attempts to re-define those boundaries.

### Towards Integration

Both Hayden Willey and Steve King address the problems of integration of science material into the design studio and draw on the experiences of their own schools to illustrate the problem and some solutions. Hayden Willey is from a relatively large school (Auckland) whilst Steve King is from a small school (Canberra CAE.); their papers highlight the implications of their situations.

Hayden Willey in his paper discusses the need for 'hands-on' experience of the application of architectural science principles and procedures in the early years of the design studio. The connection between the two must be more than visitations in the studio by architectural science lecturers as consultants. The method used at Auckland is to offer a studio design

program with full integration of science into the design process alongside the normal lecture programs which are taught in an academically rigorous way. In using this approach they felt that only architects should be used to teach architectural science in those early years. This is important in the communication and integration between science and design. The later year or advanced programs the subjects become more self-contained in respect of application exercises.

Steve King describes a programme where the teaching of Architectural Science is combined with design problems and field studies which are a basic component of the early stages of the design problem.

The basic goals of both are toward the development of an intuitive understanding and ability to combine intuition with knowledge of basic principles. The practitioner can then seek expert knowledge to fill in the gaps.

### Case Studies, Projects and Experiences

The three papers by Ken Wyatt, John Hunt and Kit Cuttle et al continued with the discussion of science-design studio integration. Ken Wyatt presented a series of structural design tools for use in the studio situation which are intended to help develop the students intuitive structural design understanding. These tools will be made available later this year (early information is available directly from Ken).

John Hunt describes another approach to the integration of technologies into the design process that is applied at the third year level. In this approach there is a discrete technology program inserted into the middle of the design program for a specific project. This is quite different to that described by Hayden Willey above.

The paper by Kit Cuttle from Victoria University, Wellington dealt with Environmental Science Design Exercises which augment their Building Science program by providing an opportunity to develop experience and confidence in the application of the knowledge gained in formal lectures. The design exercises set are of four hours duration and students work in groups of six to resolve a solution to the problems. The solutions are developed to a schematic or system design level, it would seem that the solutions are not necessarily directed toward a building design but rather the conceptual arrangement.

### Teaching and Practice

Nancy Ruck presented a paper which looked back at the conference topic and considered the effects of practice and research on architectural education. Developments of the Building Performance Research Unit at the University of Strathclyde are discussed with regard to building system performance and the application of such material in assisting the designer to gain a better overview of the task in hand. This goes some way toward dealing with the problems raised by John Hunt in coming to grips with the complexity and magnitude of a large scale design problem. The paper also discusses the need for the designer to understand the dynamic qualities of environmental factors (such as daylighting, the behaviour of sound and thermal comfort) and to be able to quantify those effects to ensure their performance as designed.

George Baird et al in his paper describes a teaching method that he has found successful based on the interactive seminar approach. The students involved research material in support of a solution to a problem then debate its worth with the other students in the group. The adaptation of a seminar teaching procedure developed by Stanley Nisbet (2) for students of education. The technique is being used at Victoria University to expand the students experience in the environmental sciences areas.

#### The Environmental Laboratory

Susan Cumming described the use of models in their school for the teaching of thermal design and lighting. Physical models are used for the study of lighting design in studio projects and computer models are used for thermal analysis of design proposals. The process of integration of sciences into the studio is thereby assisted with such tools being readily available.

Derek Carruthers posed the question of the value of laboratory work in the teaching of building science to architecture students. The needs of an engineering student are compared to the architecture student in regard to the development of certain levels of technical skill or competence. The role of the laboratory experiment in architectural schools is more to demonstrate a phenomenon and provide visualisation of concepts developed in the lectures. The question of the role of computers as a replacement to laboratory work was also discussed. It was felt that perhaps the student may not fully comprehend the magnitude of the concepts and there is a danger that students accept blindly the results which are incorrect. The reasons for such incorrect results may not be apparent as the computer presents as a 'black box'. The concluding remarks suggest that the final and significant justification for retaining laboratory work is the lasting visual impressions of the concepts demonstrated.

#### Where do we go from here

Architectural Science as a discipline within architectural courses has evolved slowly from its origins in both engineering and physics disciplines. Despite the efforts of some to resolve the problems of integration it with design, we have not really been able to address the problems of architecture as a discipline of both the arts and the sciences. The greatest difficulties lie with the arts aspects of architecture and yet really (architectural) science is a fundamental part of the 'whole architecture'. Without one the other is unfinished or inappropriate; and perhaps quite wrong.

Many of the papers presented described efforts to link the science components of architectural courses to the basic design application work of the studio. The key surely is to work within the studio as a fundamental component of the studio program and not just as a consultant to the studio members, called in on demand to smooth the way. To achieve this many would agree that the 'studio/science' people must be based in architecture for as a first priority their communication roots must be close to the heart of the whole - architecture.

### Conclusion

The presentations of this conference contain a rich volume of ideas that cover the philosophical concepts and ideas of the 'design' staff papers to the frank and open discussion of the studio programs offered by others with an active concern for true integration of science in the design process, if one accepts that integration is needed per se. Perhaps it is all design, really! I would commend the full proceedings to anyone interested in the future of architecture and architectural education.

Copies can be obtained (whilst stocks last) from the Secretary of ANZASCA, c/o Dept. Architectural Science, University of Sydney.

### References

- (1). Quoted by Proudfoot as H.A. Simon, *The Sciences of the Artificial*, M.I.T. Press, Massachusetts Institute of Technology, Cambridge Ma. U.S.A., 1969, 2nd Ed., 1981.
- (2) Quoted by Baird as Nisbet, S., "A Method for Advanced Seminars", *Universities Quarterly*, June 1966, pp349-355. and also Nisbet, S., "Statements Worth Making", *University Teaching Methods, Newsletter No.3*, Leeds University, December 1977.

Papers Presented at the 17th ANZASCA Conference, November 1984.

IS ARCHITECTURE TWO FACED ?

Associate Professor L. Peter Kollar.

THE PERCEIVED BOUNDARIES OF ARCHITECTURAL DESIGN

Bruce Forwood

H.A.SIMON'S SCIENCES OF THE ARTIFICIAL AND THE STRUCTURE  
OF ARCHITECTURAL PROBLEMS.

Dr. Peter R. Proudfoot.

AN INTEGRATED APPROACH TO DESIGN

Dr. Hayden B. Willey.

ARCHITECTURAL SCIENCE FOR ARCHITECTS ACHIEVABLE RESULTS  
WITH LIMITED RESOURCES

Steve King.

THE INTEGRATION OF TECHNOLOGY IN THE STUDIO DESIGN  
PROJECT: SOME AUCKLAND EXPERIENCES

Dr. John Hunt.

ENVIRONMENTAL SCIENCE DESIGN EXERCISES

Kit Cuttle, Mike Donn and George Baird.

THE LEARNING THROUGH DISCUSSION METHOD - EXPERIENCE OF  
ITS USE AS A TOOL FOR TEACHING ASPECTS OF BUILDING  
SCIENCE TO STUDENTS OF ARCHITECTURE AT THE ADVANCED LEVEL

George Baird, Kit Cuttle and Mike Donn.

DESIGN, INTEGRATION PROJECTS FOR BUILDING SCIENCE AND  
ARCHITECTURE STUDENTS

Mike Donn, George Baird and Kit Cuttle.

CHANGING TRENDS IN ARCHITECTURAL SCIENCE EDUCATION, THE  
EFFECTS OF PRACTICE AND RESEARCH ON DIVERSIFICATION AND  
INTEGRATION

Dr. N. C. Ruck.

MODELS AS A TOOL IN LEARNING ENVIRONMENTAL SCIENCES

Susan Cumming.

OF WHAT VALUE IS LABORATORY WORK IN BUILDING SCIENCE TO  
ARCHITECTURE STUDENTS

Dr. D.D. Carruthers.

