

A monthly roundup of reports on new books of special interest to architects and engineers

This Month's Reading

REVIEWS

- Christopher Alexander, *Notes on the Synthesis of Form* ... 50
George Coedès, *Angkor: An Introduction* ... 90
Harold L. Orbach and Clark Tibbits, *Aging and the Economy* ... 90
Steen Eiler Rasmussen, *Experiencing Architecture* ... 102
Weiner, Norbert, *Cybernetics* ... 102
BOOKS RECEIVED. . . . 102

Towards a Science of Design

A critique by engineer Paul Weidlinger of a book which proposes a complex, formal method of relating functional analysis to design

NOTES ON THE SYNTHESIS OF FORM. By Christopher Alexander. Harvard University Press, Cambridge 38, Massachusetts. 216 pages. \$6.75.

The author of this book is trained in both architecture and mathematics and is presently teaching in the Department of Architecture at the University of California. In his book, he undertakes the rather formidable task of developing a rational, or what is probably equivalent to it, mathematical method of designing or maybe planning. Let me say at the outset that the book is an important book. This should be kept in mind, although I may have some harsh comments to make about it later on. In order to discuss its contents I will attempt to give a brief summary of the thesis presented by the author, even at the risk of oversimplifying his carefully worded and sophisticated concepts.

The book suggests that the process of design is distinct in various societies. In a primitive society, or what the book calls "unselfconscious society," the designer, maker and user is the same person and, consequently,

any errors or, as the book calls them, "misfits," in the design relative to its context are brought forcefully to the attention of the designer, resulting in its almost immediate correction. This feedback is lost in modern, or what the book terms "selfconscious," societies, since the designer and user are not the same person. The loss of this feedback, or as the author more picturesquely calls it, "loss of innocence," together with the much more complex demands on design, resulted in the current process of designing by rules: i.e., instead of correction of errors through this negative feedback, the design process is attempted by following certain rules prescribed or learned which are supposed to lead towards satisfaction of the design requirements.

The book now analyzes the process of designing of the simplest or even the most complex objects and proposes that the design process nevertheless must essentially consist of recognizing, organizing, and finally satisfying the various design requirements in such a manner that these requirements will fit the context; i.e., the function, of the design. More spe-

cifically, the book proposes that the individual (and usually very numerous) design requirements which he terms "misfit variables" are linked to each other; i.e., they interact. This means that the satisfaction of a certain design requirement (misfit variable) may imply the simultaneous satisfaction of one or other requirements, but also it may imply the non-satisfaction of some other ones. The author proposes that we visualize the requirements as a set, the members of which are linked to each other in a rather complex fashion. The linkage may be strong or weak, it may be positive if the satisfaction of one requirement implies the satisfaction of the other, negative if the opposite occurs, and finally there may be no linkage if interaction does not exist.

At this point the author proposes that because the large number of design requirements and the richness of interactions or linkages, it is extremely difficult to arrive at a satisfactory design because the process of adjusting or satisfying some of the requirements immediately influences numerous other ones. He suggests that traditional view on design is synthetic and, therefore, an effort is made to cope, preferably, with all requirements simultaneously. Because of the large number of variables and the richness of interaction, this process is beyond our normal intellectual capability and recourse is taken to an intuitive solution of design problems.

The book now proceeds to its main
continued on page 57

Required Reading

continued from page 50

thesis in suggesting that, although there is a complex and rich interaction between the members of the set consisting of design requirements; i.e., misfit variables, it is possible to discern individual subsets. The interaction between the members of these subsets is very strong but the linkage between the subsets themselves is very weak, or at best nonexistent. He further proposes that the subsets can be organized in a hierarchical order; i.e., we must visualize the subsets as a tree, or maybe as a pyramid, starting with one subset at the top, this one being linked with some other ones at the lower level which in turn, are linked with more numerous sets at increasingly lower levels. The author contends that once this hierarchical organization is recognized, we will find that it has broken the design problem into its natural components. Each subset will contain elements which are closely and naturally linked to each other. The satisfaction of the requirements within the subset itself will only weakly influence the require-

ments contained in other subsets and, therefore, permits us to proceed in a systematic fashion in solving the problem posed by the design.

The book contains two appendixes. In one appendix a worked example is shown. The problem treated is that of the planning of an agricultural village of 600 people in rural India. The second appendix contains the mathematical treatment of the decomposition of the design requirements in the previously described hierarchy.

It is clear that the objectives of the book are extremely ambitious and, if it had succeeded reaching these objectives, it could have properly claimed a major breakthrough in the solution of the eternal design problem. Unfortunately, but also not surprisingly, the book does not accomplish its stated objectives. In fact, it deals with an extremely difficult problem which is being attacked at the present time on a very broad front ranging from social sciences, the science of warfare, economics, to biology. The problem of design is essentially "non-structured" and the solution of such problems presents formidable difficulties and, in fact, is probably one of the central problems

in the forefront of mathematical research. This is why it is not surprising that the author has not really succeeded, but it is for this very same reason that the book itself is important to the extent that it represents a very serious effort.

I think that the validity and the impact of the book is weakened by the manner in which it is presented; it should have been either considerably more intensive or much more extensive. The book covers an extremely wide range of topics, and I have wondered at various points whether the author's knowledge was equally sound in all of his subjects. These doubts, I think, inevitably must arise in any book which is inter-disciplinary to the extent to which this book is. The book begins with certain anthropological conjectures which are insufficiently supported or at least leave a great deal of doubt in the reader's mind. But these excursions into anthropology are really not essential for the support of the thesis of the book. There follow some comments addressed to architecture and the interpretation of the intents of several outstanding architects. These

continued on page 72

Chemistry-Physics Building
University of Kentucky
Lexington, Kentucky

Brock & Johnson
Lexington, Kentucky; Archt.
Whittenberg Constr. Co.
Louisville, Kentucky; Contr.

BAYLEY

Windows and Curtain-Wall Systems

STEEL and ALUMINUM

84 Years of Reliability

PROVEN by thousands of well-known BAYLEY INSTALLATIONS from Coast to Coast.

CALL or WRITE when you start planning your project

The WILLIAM BAYLEY Company Springfield, Ohio

District Sales Offices

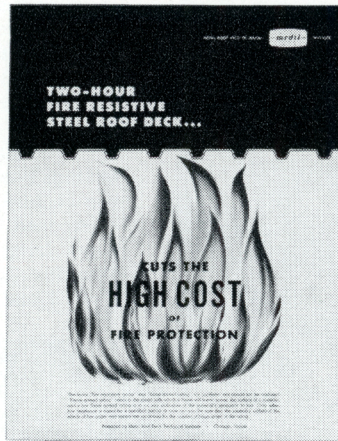
ATLANTA 5, GEORGIA CHICAGO 2, ILL. NEW YORK 16, N.Y. SPRINGFIELD, OHIO WASHINGTON 5, D.C.
255 E. PACES FERRY RD. 105 W. MADISON ST. 280 MADISON AVE. 1200 WARDER ST. 1426 "G" ST., N.W.
404-237-0339 312-726-5996 212-685-6180 513-325-7301 202-783-2320

Licensed Representatives In All Principal Cities Operating Through The Above District Offices.

For more data, circle 44 on Inquiry Card

TWO HOUR FIRE RATING with steel roof deck

**New Underwriters'
Laboratories
assignment permits
wider use of fast,
economical steel
construction,
with important
insurance savings!**



U. L. two-hour fire rating for steel roof deck *without concrete covering* means that now you can save as much as ten to twenty percent over conventional fire resistive roof construction! Equally important, you gain the advantages of lighter weight, quick installation, and earlier occupancy.

**SEND COUPON FOR FREE BOOKLET or
contact your local MRDTI member**

METAL ROOF DECK TECHNICAL INSTITUTE
53 WEST JACKSON BOULEVARD • CHICAGO, ILLINOIS 60604

Airtherm Manufacturing Company • Bowman Steel Corporation • Ceco Steel Corporation • Fenestra, Inc. • Granco Steel Products Company • Inland Steel Products Company • Macomber, Inc. • The R. C. Mahon Company • Plasteel Products Corporation • Republic Steel Corporation, Manufacturing Division • H. H. Robertson Company • Sheffield Division, Armco Steel Corporation • Wheeling Corrugating Company



METAL ROOF DECK TECHNICAL INSTITUTE
53 West Jackson Boulevard, Chicago, Illinois 60604

Send new, complete booklet on two-hour fire rating for steel roof deck.

Name _____ Title _____
Company _____
Address _____
City _____ State _____ Zip _____

Required Reading

continued from page 57

subjects are, of course, always controversial. Here and there the excursions of the author into technological fields are disastrous and contain erroneous statements (e.g., that the invention of the geodesic dome preceded the discovery of the method of its analysis). We also find ourselves involved with numerous other topics of which the extensive footnotes bear witness, ranging from Gestalt psychology to works in symbolic logic by Tarsky, etc. In some of these subjects again some doubts arise regarding their relevancy to the subject and also regarding the validity of the conclusions which are drawn by the author regarding these subjects. Fortunately for the thesis of the book, but unfortunately for its presentation, a great many of these conjectures are not relevant to the conclusions which are presented by the author. For this reason, the book would have been more serious if these subjects had been avoided or had been discussed more rigorously.

The mathematics of the author presented in the appendix is sound, although the proofs offered are sometimes sketchy. More important are a series of substantive objections which inevitably arise. The greatest disappointment probably is the worked example in Appendix 1. The author promises us an application of his method on the design of a village. We are shown the end result of the process of the de-composition of the design requirements in the hierarchical tree but, in effect, we are not shown a quantified and executed design. No further comment is made about the end result in the form of criticism and comparison with a design which would have been obtained without the use of the method proposed by the author.

Because of the difficulty of the problem itself, a series of simplifying assumptions must be introduced; e.g., higher correlation between design requirements is excluded, the strength of the linkage between various requirements is not measured. While these and other simplifying assumptions are no doubt necessary, it would also be well to know what their influence on the end result is.

We then stumble into some more
continued on page 80

For more data, circle 54 on Inquiry Card

LET'S GET RID OF

"OR EQUAL"

Honeywell speaks out on a specification phrase that does a disservice to clients and suppliers alike.

The innocent-looking "or equal" phrase has been around for years. Manufacturers of quality equipment don't like it. Price-cutting suppliers of inferior equipment hide behind it. Still, . . . architects and consulting engineers include it in their specifications. Let's look at some of the devastating effects of "or equal".

Presumably, the phrase has the creditable task of encouraging a number of suppliers to bid on a job. In fact, it causes buyers to select equipment on the basis of price alone by implying that all bids cover products which are equal in quality. Obviously, no two products are ever *really* equal . . . especially when it comes to complex equipment. No two companies have equal know-how or service.

The Base Bid type of specification does away with many of the evils of "or equal". It's better for clients, contractors, architects and manufacturers. And, except for certain Federal work, there is no legal basis for prohibiting it.

Actually, the "Base Bid with Alternates" type of specification assures accurate definition of quality and preserves maximum competition. And the contractors can price their bid with confidence. As a result, lower prices prevail, and the architect and his client can decide on quality, price, design,

life and service of a manufactured product in advance.

In Base Bid specifications, each item of equipment is clearly defined as to quality, capacity, function and performance. In addition, *the manufacturer's name and model number is given*. In other words, the choice of equipment is up to the owner, architect and engineer . . . not the contractor or the suppliers.

The contractor is not forced to "shop" to cut his bid. He knows exactly what he *and his competitors* must furnish. And, if he objects to the specified brand of equipment, he may specifically ask for a change.

Finally, manufacturers of quality equipment are not penalized. Differences in price and quality are out in the open. Buyers can specify as much quality as they feel reasonable and necessary.

How do you answer those who cry "favoritism" at Base Bid specifications? Any judgement on quality will be subject to criticism from a personal opinion standpoint, but the professional knows that this is not a valid excuse for not making the judgement. Favoritism? Yes—to the client.

Architect, contractor, and manufacturer can all share pride in the finished job . . . a job completed as it was conceived (and specified). And, in the last analysis, the owner of such a building benefits most of all.

Honeywell

Required Reading

continued from page 72

basic difficulties which are not satisfactorily resolved, namely the manner by which the requirements and the linkages are selected and, more important, definition of a criterion of merit by which the selections are made. The most fundamental theoretical difficulty of the proposed process is buried in a footnote. The whole procedure is based on a conjecture that the casual structure of the problem actually defines the physical constituents of a successful form. The author proposes that his intuition suggests strongly that this is the case. Actually, I have some great doubts about this assertion since, if it were true, it would imply, so to speak, the existence of a "uniqueness theorem" of the design process. This assumption is highly questionable and is probably too much to hope for.

Anyone who, in the last decades, has been exposed to operations research and systems analysis must have become to some extent cynical regarding overenthusiastic claims which have been made regarding the power of these methods. We have now learned that one of the major benefits which are derived from their application consists of the forcing of their practitioners to fully and exhaustively comprehend the problem to be dealt with. We have also learned that a great many of the beneficial practical results which have been obtained were more due to the fact that the problems have been exhaustively studied by people who are essentially unbiased and uninfluenced by previous knowledge and tradition and much less due to the power of the proposed methods.

In conclusion, therefore, I would like to say that it is not possible and it probably would be presumptuous to decide on the basis of this book the validity of the method put forward by the author. In fact, I do have serious doubts about it. On the other hand, unquestionably the effort is in the right direction. It is in the spirit of the times, and the minimum benefit which will be derived from its application is that of the thorough and systematic understanding of the components of a design problem. If this is accomplished, then this in itself could be called a major breakthrough.

continued on page 90