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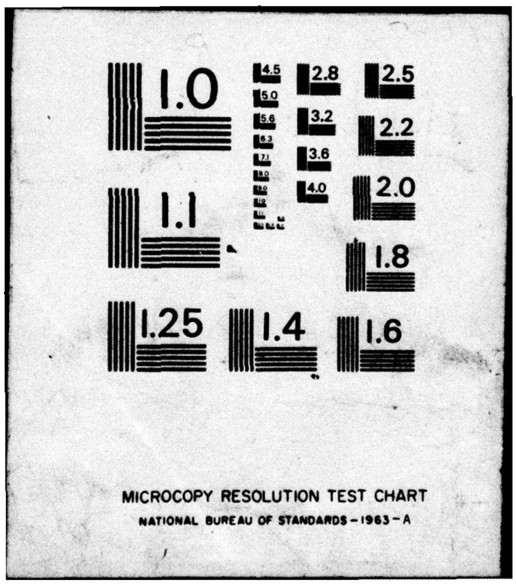
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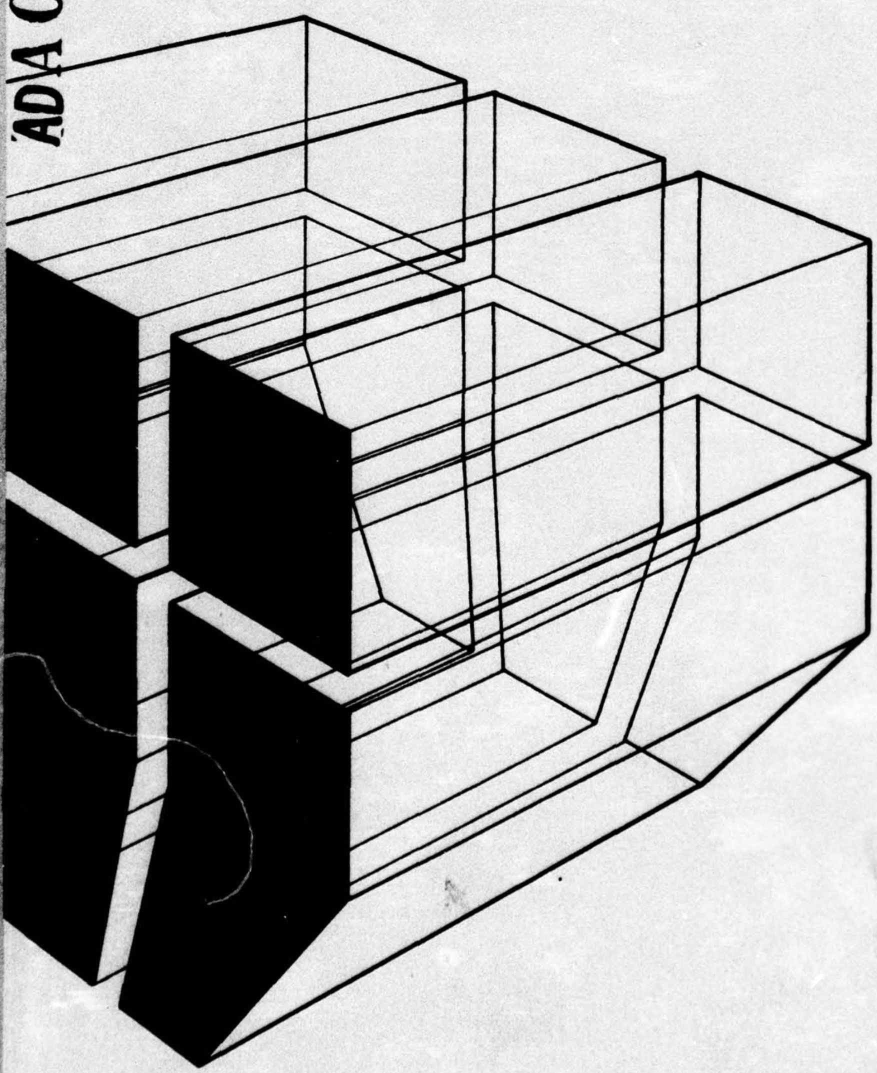
PROGRAMMING FOR HABITABILITY: SYMPOSIUM PROCEEDINGS



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This report contains the proceedings of the symposium "Programming for Habitability" held September 22-24, 1974 at Allerton House, University of Illinois.

The three major topics discussed were habitability criteria generation processes, communication of habitability criteria, and design and social scientist collaboration. In the first area, analogies between habitability

programming and testing of NASA's space flight environments and of everyday buildings were sought. Several approaches to the formulation of habitability criteria based on research information were presented. Formats and problems for the communication of habitability criteria, specifically in the institutional section, were exposed in the second topic area. Three charrettes simulating designer and social scientist collaboration in programming various building types were held in the third area.

The symposium revealed severe communication problems among those providing and using habitability information in building programming, including design administrators, designers, and researchers. A better understanding of criteria generation processes must be gained if the quality of buildings is to be improved.

FOREWORD

The Symposium on Programming for Habitability was sponsored jointly by the Department of Architecture and the National Clearinghouse for Criminal Justice Planning and Architecture at the University of Illinois, the U.S. Army Construction Engineering Research Laboratory (CERL), and the American Institute of Architects.

CERL's Facilities Habitability and Planning Division (FH) has a research work unit (6.21.21A-4A162719AT03-01-003) entitled "Development of Architectural Standards to Satisfy Human Needs in Military Facilities." Its purpose is to develop methods and procedures for generating design criteria responsive to human requirements in military facilities and to incorporate these procedures into Corps of Engineers building delivery procedures.

The Symposium on Programming for Habitability addressed issues faced in this work unit by providing an opportunity for representatives of various research organizations and government agencies to exchange ideas, experiences, and expertise in generation and communication of habitability criteria with practicing architects. The symposium thus offered the opportunity to gain useful information as a preliminary step in improving Corps of Engineers procedures.

These proceedings were initially published by the University of Illinois Department of Architecture as part of a monograph series, and are reprinted with permission of the Board of Trustees.

Wolfgang F. E. Preiser of FH edited the proceedings. Dr. R. Dinnat is Chief of FH. COL M. D. Remus is Commander and Director of CERL and Dr. L. R. Shaffer is Deputy Director.

ACKNOWLEDGMENTS

The preparation of this symposium was made possible through the generous funding and manpower assistance provided by the four sponsoring organizations. Dr. Robert M. Dinnat, Chief of the Facilities Habitability and Planning Division, U.S. Army Construction Engineering Research Laboratory, encouraged initiation and conceptualization of the symposium. The help of the following persons is gratefully acknowledged:

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The hospitality of the managers of Allerton House, Jennifer and Gary Eickman, is gratefully acknowledged. Thanks are owed to the Office of Conferences and Institutes of the University of Illinois for their excellent arrangement and organization of facilities and materials for this symposium--Pat Bond, Elmer Edwards, Pat Mrizek and Brandt Pryor. The good cooperation of Henry R. Spies, Editor, Small Homes Council--Building Research Council is acknowledged for expediting production of these proceedings.

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CONTENTS

CASE STUDY PRESENTATIONS

PROLOGUE

The symposium on "Programming for Habitability" was cosponsored by the U. S. Army Construction Engineering Research Laboratory; the Department of Architecture of the University of Illinois; the National Clearinghouse for Criminal Justice Planning and Architecture, University of Illinois, Urbana-Champaign; and the Office of Research of the American Institute of Architects, Washington, D. C.

The purpose of the symposium was to present and discuss current ways of generating identified human needs and data on man-environment relationships into habitability criteria, i.e. environmental standards to satisfy human needs. This topic was the focus of presentations and discussions of the two-day symposium held September 22-24, 1974, at the Conference Center, Allerton House, University of Illinois. The fifty-five invited participants from government agencies, the design professions and research organizations dealt with problems and characteristics of habitability criteria and their translation processes.

It is a sad indication of our times that institutions have become so large that they need to formalize and regulate user-oriented criteria for programming and design guidance of "repetitive" building types. The need to legislate habitability criteria may in part be a function of the technological development and values of a society such as ours. Reference is made to the changes in communication, transportation, lifestyle, etc. all of which influence the habitability of everyday environments. Habitability is a relative concept and difficult to define. Inherent in formalizing programming and design criteria is the danger that they become cemented for too long a period of time before adjustments and necessary changes are made. There must also be found some means to permit ultimate users to contribute ideas on habitability for the programming and design of their buildings.

Or, as Lee Windheim says in his position statement (Chapter 3.4):

> We must not encourage an assumption or pretense that there is an ultimate kernel of static truth regarding man, his activities, and environment that can be discovered and fitted into the ultimate building.

Institutions control an ever increasing share of programming and design activity for almost any kind of building type. The need to continuously improve the quality and habitability of institutional environments for the benefit of the users is recognized. Manuals and guidelines for the programming and design of repetitive building types require the help of social science in order to cover habitability criteria adequately.

In this context, the symposium on "Programming for Habitability" dealt with three basic issues and was directed to the major interacting groups in the field of habitability criteria generation, communication and application in practice:

1. <u>Designer and Social Scientist Collaboration: A Process Model</u>
   When and how in the building delivery process can social science help to improve the habitability of institutional environments?

   Recommendations on applications of the process model for collaboration between architects and social scientists are directed to design professionals, especially in the context of programming and design of institutional environments.

2. Generating of Habitability Criteria
What are the conceptual bases and available processes for generating habitability criteria?

Feedback and recommendations on modifications to existing habitability criteria generation processes are directed to architects and researchers involved in data collection which is supportive of criteria generation.

3. Communication of Habitability Criteria to Design Administrators and Architects
What formats in institutional programming and design guidance literature are primarily directed to administrators in federal agencies and to architects working with large institutional clients?

The short duration of the symposium and the relatively large size of several of the workshop groups made it difficult for some participants to become familiar with the many topics to be discussed. A more serious problem was the inability of the attendees, representing many disciplines, to communicate effectively with one another. Of prime importance is the need for a common language for the contributors and potential users of habitability research. H. H. Parsons appropriately summarized the consensus of the attending group when he said:

> It requires much verbal agility to
> analyze habitability. Discussing
> criteria just makes us all weary.
> Let's simply design the facility!

Champaign, Illinois
January, 1975
Wolfgang F. E. Preiser
Symposium Coordinator

1 HABITABILITY CRITERIA GENERATION PROCESSES

1.0 PURPOSE AND OVERVIEW

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The purpose of these sessions was to attempt to define the concept of habitability, to identify valid approaches to formulating habitability criteria, and to discuss the appropriateness of these approaches in the institutional context.

Sessions

Three kinds of sessions were held in sequence. First, a presentation of some conceptual approaches to habitability research for isolated environments was given by E. Wortz in the general session. Second, selected approaches and examples of habitability criteria generation were presented in workshop sessions, including a discussion of organizational requirements and the process by which these requirements can be combined with other information to support the generation of criteria. Third, discussion sessions centered on the appropriateness of various criteria generation processes to the institutional context.

Overview

The preliminary program for the symposium offered for discussion a concept of habitability adapted from the NASA report on "Habitability Guidelines and Criteria" (Fraser)[1]:

"Habitability is that equilibrium state resulting from the interactions among the components of the man-constructed environment complex (including buildings and the equipment they accommodate) which permit man to maintain physiological homeostasis, adequate performance and acceptable social relationships."

It was also suggested that this definition allowed habitability to be dealt with at three distinct levels, roughly analogous to the Maslow[2] scale of hierarchically ordered levels of human experience and needs: 1) the physiological or survival level; 2) the functional activity levels, and 3) the psychological comfort and satisfaction level.

In the workshop session on criteria generation, five distinct approaches were presented.

Hermann Field discussed the formulation of criteria from an iterative evaluation process in hospitals. The process includes the initial development of design concepts, implementation of the concepts, evaluation in use, development of new design concepts based on the evaluation, and so on.

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[1] T. M. Fraser, "The Intangibles of Habitability During Long Duration Space Missions," NASA CR-1084, National Aeronautics and Space Administration (Washington, D. C.), June 1968.

[2] A. H. Maslow, "A Theory of Human Motivation," Psychological Reviews, 50 (1943), 370-398.

Theodorus Ruys discussed the steps taken in the development of a full-scale mock-up of a dental clinic system. Literature was searched, field observations were made, interviews were held, and a clinic system was designed. A mock-up of the design was evaluated in use against a scale of priorities which included personnel needs. Modifications were then made using an iterative evaluation process such as that discussed by Field.

William Pulgram discussed the formulation of criteria as a process of survey and synthesis. Information on human requirements is gathered using questionnaires and interviews. Charts and tables are developed to show total client needs, individual needs, communications, adjacencies, paper flow and very personal needs. The criteria are then represented in a proposed design solution.

H. McIlvaine Parsons discussed the formulation of criteria through a human factors and task analysis approach. Task behavior is observed and analyzed including operational flows and time lines. Desired criterion measures are then stated in the form of performance or design specifications.

Tom Davis discussed the formulation of criteria as a synthesis of research data. The data are selected by matching research information to habitability requirements. The synthesis takes the form of a probability statement containing all elements of both the requirement and the criterion. The criterion can then be extracted from the probability statement.

From a review of the first four presentations it can be seen that they represent at least two basically different approaches to gathering data for criteria formulation: field studies of existing user occupied facilities; and laboratory studies of models, simulations or mock-ups. In both these approaches, the objective is to correlate physical behavior of the occupant, or occupant and/or expert opinions, attitudes and beliefs, to a physical environment or facility. The probability induction approach is unlike the others in that it assumes the existence of a representative set of valid data and formulates performance from the data.

It can also be seen from a review of the five presentations that each speaker uses a different term for what he calls "generating of criteria." Field calls it a design concept, Ruys generates an experimental mock-up, Pulgram ends up with a proposed design specification, and Davis formulates performance criteria. These semantic and conceptual differences were impediments in the group discussion which centered on the formulation of criteria in the institutional context.

An attempt was made to lead the group in a discussion of specific approaches to formulating criteria for classrooms and student counseling spaces in a general education facility. It became apparent that the discussion was floundering with semantic and conceptual difficulties regarding the meanings of such stock-in-trade words as objectives, requirements, needs, criteria, standards, environment, and so on. As a result of this experience it is recommended that future interdisciplinary task-oriented symposia or forums on habitability be organized with a set of operational definitions of these and other key concepts (such as those recommended in the Manual of Practice)[1] agreed upon in advance.

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[1]The Construction Specification Institute, Inc., Manual of Practice, 1150 Seventeenth Street, N.W., Washington, D.C. 20036.

1.1 THE DESIGN OF HABITABLE ENVIRONMENTS

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Introduction

Previous to 1969, activities involving design for habitability were considered in terms of human engineering and architectural standards. The studies done were similar to the study illustrated in Figure 1. In this, we were concerned with the movement of a crew in a lunar base as they went through a day's activities and to discover if there were problems with the design that could be observed.

In 1969 Dr. Deutsch of NASA asked me to study habitability criteria for long-duration space missions. It became clear that as the duration of the mission increased from a few weeks to a few months and then to a few years, a spacecraft would need to be more self-sufficient until it contained everything necessary for survival and well-being of the crew. The question then was: What is everything? Habitability became very interesting to me. What does a person need? It depends on what is required for psychological and physiological maintenance. But, maintenance to what standard? In a totally open ecological system, man is free to find the means to fulfill his needs from the bounty of nature. In the totally closed ecological system of a long-duration spacecraft, the needs to be met must be provided for by the designer. As world population increases and societies become more complex and industrialized, the natural habitat of man is becoming more and more closed. In the future, on earth and in a spacecraft, man's needs must be provided for by the designer. But what are the criteria?

Symposia

My first approach to the problem was to arrange, with my colleagues, for a symposium to exchange ideas on the topic of habitability. In May 1970, the first National Symposium on Habitability was held in Venice, California. We invited architects, city planners, physicians, philosophers, artists, engineers, psychologists, and political and social scientists to help us get a perspective on the problem. We decided to make the symposium something of an experiment by designing the environment for the symposium (from arrangements to meeting rooms). The intent was to have a symposium environment to fit our topic. We were successful in this effort. Participants were bused each day from the International Hotel near the Los Angeles International Airport to Venice. The Venice area at that time was in transition, partly torn down and in disrepair. The site of our major meeting hall was Robert Irwin's studio at 72 Market Street. The entrance to the hall was through an alley adjacent to a flophouse. A hole had been knocked out through a brick wall to form the entrance. In contrast with the exterior, the meeting hall was almost pristine in beauty, elegance, and simplicity. The studio was completely white. There were two large skylights with louvered glass inserts. The glass strips, lightly colored by vacuum deposition of many materials, were created by Larry Bell. The illumination in the room was really superior. Participants sat in an "island." There were chairs only for the discussants. Each day the hall was substantially altered. For example, on the third day, one wall was completely open to the street. Local people wandered in to join the symposium group.

Lunches were catered each day and were exceptionally good. As the symposium progressed, the eating patterns varied. By the third day, the whole assemblage was eating lunch while sitting on the curb, feet in the gutter, and quite comfortable.

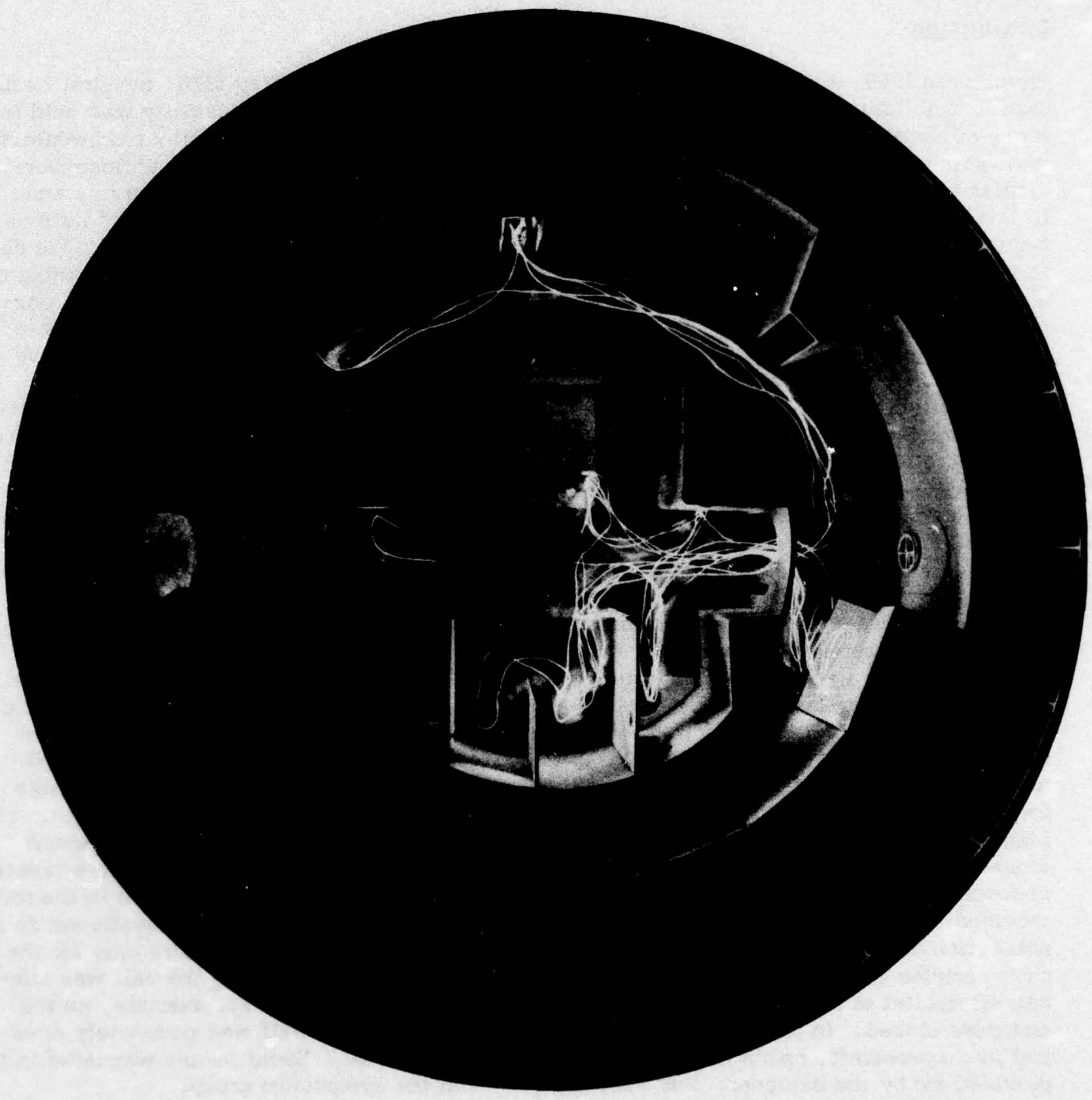

Figure 1. Traffic Flow Pattern in the Lesa Lunar Base

Afternoon sessions centered on smaller discussion groups composed of people with heterogeneous backgrounds. Settings for the discussions were several rooms in Larry Bell's studio, Duane Valentine's and Bob Irwin's studios, and the adjacent beach. Groups rotated through these meeting rooms.

The individual meeting rooms had been designed for the Symposium by Irwin and Bell. One room was totally white, brilliantly illuminated, and rounded inside with no corners or edges. Discussants in this room discovered that they would become nauseous if they did not glance at other participants. A second room had skewed walls and was highly reverberant. Participants felt that they were sitting on a hillside. They kept moving their chairs closer together to hear one another talk. A third room, completely black, was lighted with one bare bulb. The room went unused because each discussion group assigned to it opted to go somewhere else--mostly to the beach. Interviews after the Symposium revealed that virtually no one was aware of the impact that these treatments of the meeting rooms had on the behavior of the participants.

Upon our return to the hotel each afternoon, a free bar was opened to soothe our frayed nerves and to aid in dialogue. Discussion group leaders met each evening to exchange information on the outcome of the particular group sessions.

The tenor of the Symposium shifted from very uptightness at the beginning to a feeling of comradeship at the end.

The uptightness was probably fostered by the initial challenge to each individual's perceptual and conceptual structure. The challenge, we believe, was promoted by the unusual environment, unique format, nature of the topic, differences in dress, personal background and objectives. The comradeship as a new perceptual and conceptual structure was established with the sharing of the new and changing perceptions, jointly weathering the rough spots, participating in the animated discourses, and eating and drinking together. Special events included a harp recital by Elizabeth Turrell just before lunch on the third day. Music as part of a technical symposium? Yet for the problem on which we were working, the music was an exquisitely appropriate substrate for our thoughts and emotions.

We left with the feeling that something had been accomplished, and with a desire to get back together again.

Much of the content of the papers prepared for the Symposium found its way into an initial attempt at generating habitability criteria for a space station and into the design of a space station simulator. Charles Righter[1] was the principal designer.

We learned many things from the Symposium apart from the papers; they were: (1) the observation of the interrelationships between perceptual and conceptual structure, and (2) that people are generally unaware of how environment affects their behavior, especially when they are highly motivated for task objectives.

As a result of the content and process of our symposium, we began to define the habitability of an environment in terms of the environmental factors which influence both the quality of life of the inhabitants and the ways in which they perceive their life quality. These factors are believed to operate at three levels: those that can be perceived directly; those that affect our perception of life quality in a covert, subliminal, or interactive fashion; and those that are primarily biological in nature. It is inherent to the nature of the problem of designing habitable environments that the effects from all these levels must be considered simultaneously.

Our most recent symposium on habitability was conducted for the California Council of the AIA in November 1973. The proceedings are available from CCAIA.

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[1] "Habitability Guidelines and Criteria," NASA Cr-103028.

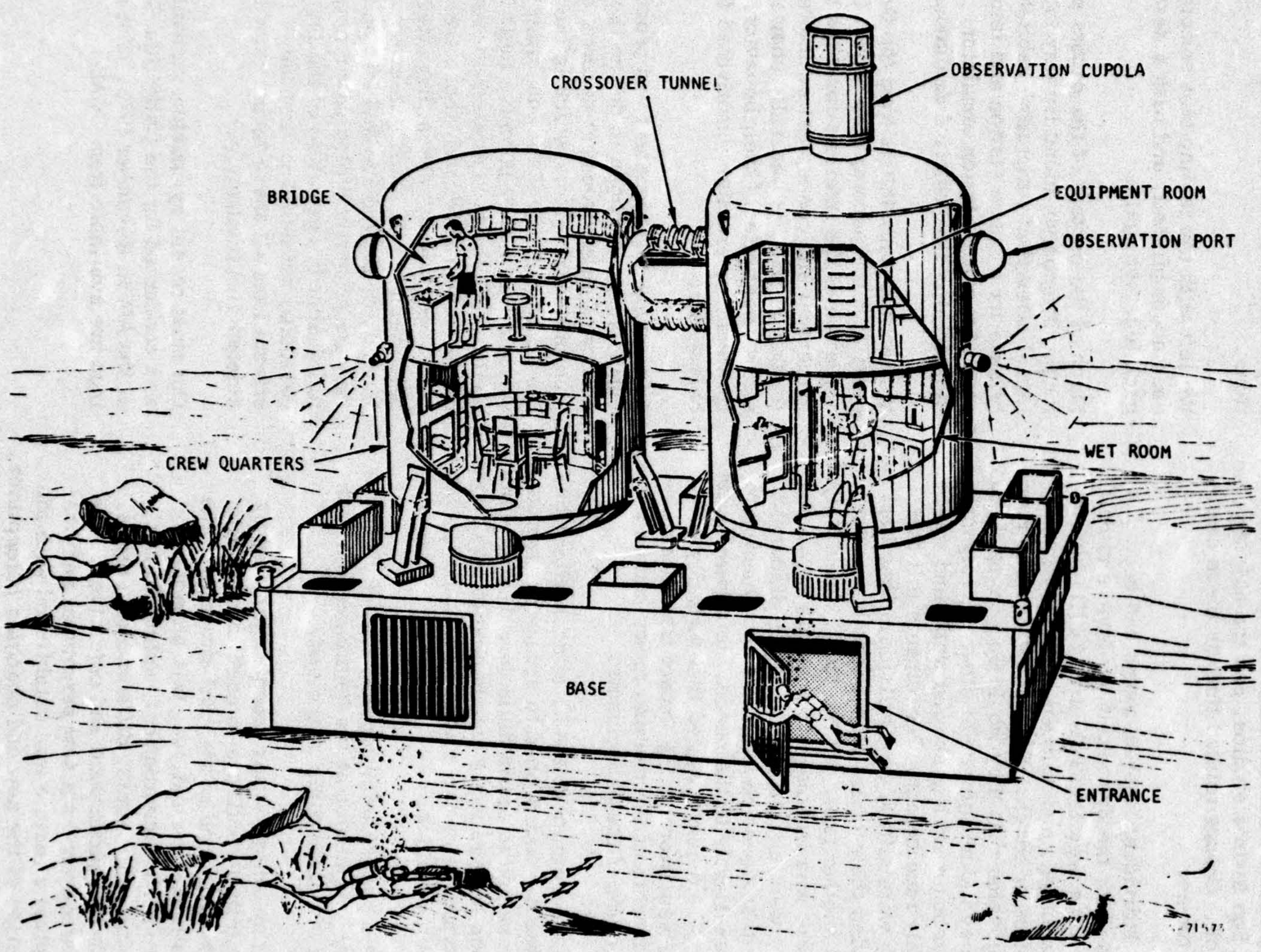

Figure 2. Tektite II Research Habitat

Experiment and Measurement

A major problem in trying to design for life quality is that of making some aspects of design a science. In a science, the impact of the design on the inhabitants would be known and predictable in advance. In just the last few years, measuring the impact of environments on the inhabitants has been attempted. Measurement may be the key to understanding and predicting the impact of the man-built environment. Research in habitability attempts to learn how the goals of individuals and groups interact with personal, social, physical, and temporal constraints to affect the adequacy of a situation. Of particular interest are the physical constraints of a situation and their manipulation to help achieve habitability.

Our initial venture into the measurement of habitability came as part of the Tektite II program[1] (Figure 2). The Tektite II was an undersea habitat anchored off St. John's Island in the Virgin Islands. The Tektite II program, with its emphasis upon scientific missions, its relative isolation from the shore support, and its several crews of scientists and engineers, both men and women, provided an opportunity to conduct a direct study to confirm previous hypotheses, and to begin to evaluate habitability measurement techniques.

Four types of data that provide information on habitability: measurement of ongoing responses, background data on each person, evaluation of the properties of the environment itself, and measurement of the physiological and psychological consequences. The measurement instruments we employed in the Tektite II program were concerned with the first two categories of data.

In measuring ongoing response, the focal point of this study had to do with the evaluations of parameters affecting life quality in underwater living in the Tektite II habitat by the 48 men and women who became the aquanauts of the program. These were scientists and engineers of unusual intelligence, imagination, and stability who descended into the habitat with important professional tasks to perform. In general, the habitat was found to be deficient in supporting the kinds of research programs being undertaken; they did not provide a sufficient variety of activities and stimuli, required for missions of long duration.

We learned much from the Tektite experiment:

(a) Habitability can be measured.

(b) Privacy has an important impact on habitability.

(c) Leisure time was very important to the aquanauts. They spent far more time at leisure activities than they or anyone had anticipated. The activities were primarily unplanned and of short duration. They took place in all parts of the habitat. View ports, audio cassettes, and books were among the most common resources for leisure because they provide stimulation and novelty in intermittent situations.

(d) The aquanauts felt that choice of food was very important. There were far fewer complaints when they could select their own food even though the initial reaction to preprogrammed food was positive.

(e) The single most important variable in the perceived habitability of the Tektite II environment was the degree to which aquanauts found the habitat supportive of the scientific and engineering tasks. It is logical to assume that the finding can be generalized and applied to many other habitats and situations.

(f) In general, as indicated in Figure 3, although the initial attitude towards the habitat was highly positive, there was a tendency for these positive attitudes to decline with the increasing lengths of stay. Almost all attitudes concerning life quality in the habitat were less

[1] "Tektite II Habitability Research Program," Airresearch Report No. 71-6192-1.

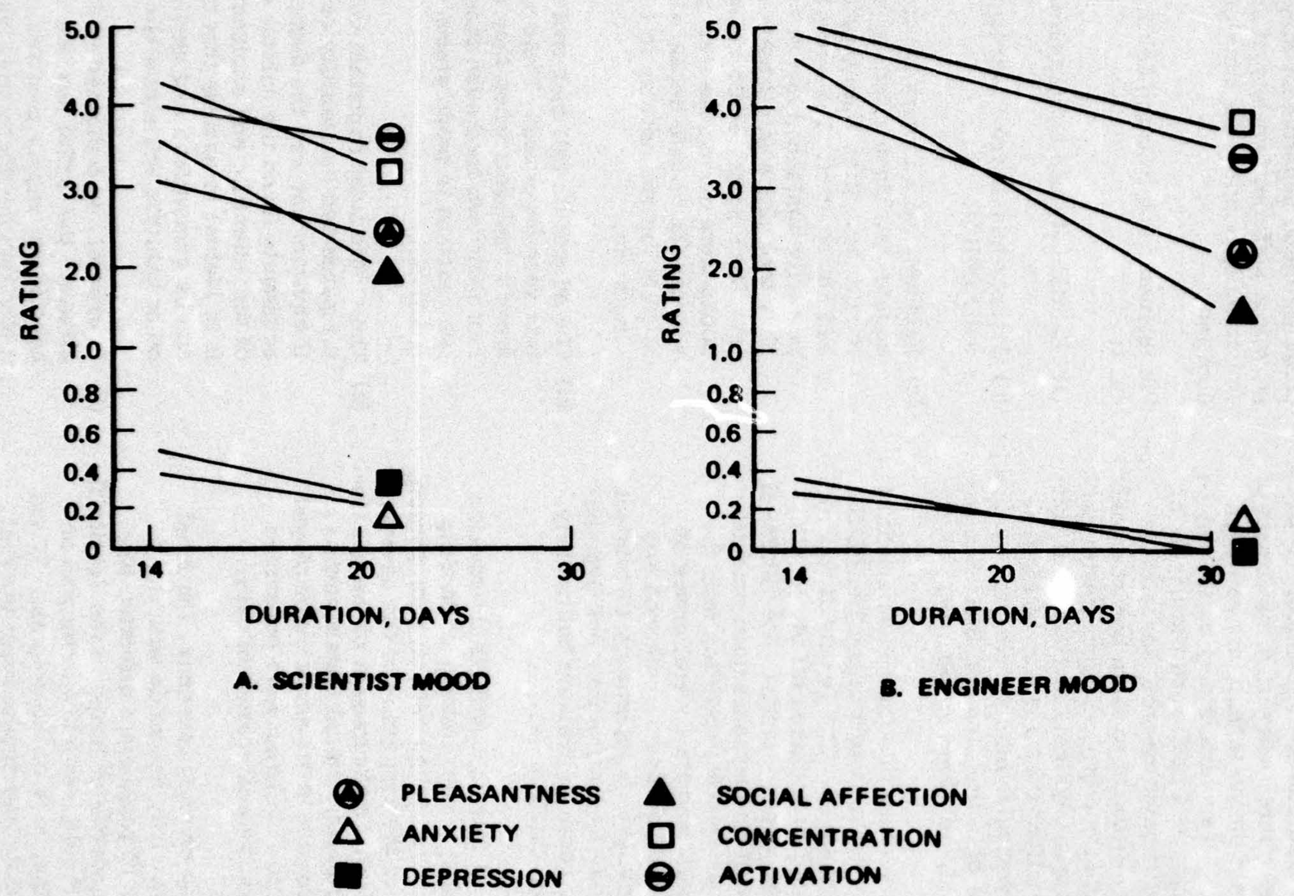

Figure 3. Effect of Mission Duration on Mood

positive in longer-duration experiments. As the aquanauts became habituated to their environment they shifted toward somewhat flat and unemotional dispositional states and showed less activation and less concentration. They also tended to work less and to sleep more.

(g) The principal personality factors that correlate with adaptation to habitat are intelligence and lack of suspiciousness.

(h) A unique feature of the habitat was the continuous auditory and visual TV feedback between the aquanauts in the habitat and the test crew on shore. Much time was spent with each crew watching the other. This type of continuous feedback between the two crews kept each crew continuously informed of the problems and situations of the other.

There was no hostility between the chamber crew and the test crew. Such hostility often arises in stressful isolation. This observation on feedback communication has many implications for design concepts.

(i) The one important difference between the responses of men and the responses of women toward the habitat was that the female aquanauts liked the habitat better. It is believed that both their smaller body size and the unique challenge of being the first female underwater team had much to do with their attitude.

(j) Multiple-use spaces in isolated habitats can create a wide variety of physical and attitudinal problems for the residents. In particular, compartments utilized by the inhabitants for task-related activities must be designed with special care because they have more impact on life quality than leisure areas.

In summary, the results indicate that task support, variety of stimuli and behavior, privacy, opportunity for self-selection of foods and activities, and visual feedback communication are key parameters to be considered in the improvement of life quality.

Comprehensive Habitability Data Plan[1]

Our experience in attempting to measure habitability on Tektite II revealed some gaps in the previous work we had done.

To understand better the relationships between environment and behavior, we developed a multi-level habitability assessment system. In this comprehensive testing plan, we began to study covert and overt responses to the environment, including both dispositional and actualized behavioral patterns.

We also attempted to quantify both long- and short-term responses, as well as immediate and retrospective attitudes evoked by the habitat in question; individual and group patterns of reaction; and evaluation by observer and inhabitant. A synopsis of our approach, described more fully in a report by David Nowlis (1972), is given in Tables 1 and 2.

The comprehensive habitability testing program as envisioned by my colleague, Dr. Nowlis, comprises four major categories of data sources: These are measures of personality and environmental dispotions; evaluation of the environment by outsiders; evaluation of the environment by inhabitants; and behavioral observation of the inhabitants.

Environmental Richness

The effect of environmental factors such as temperature and noise on human physiology has been reasonably well studied. Now, other factors such as environmental complexity or richness are being demonstrated as affecting such parameters as the IQ of children and the brain weight and behavior of animals. Researchers in the field of child development have found that culturally impoverished children develop more

[1] "Comprehensive Habitability Testing Program," Airresearch Report No. 72-8834.

TABLE 1

SYNOPSIS OF TEST ADMINISTRATION COMPREHENSIVE HABITABILITY TESTING PROGRAM

Type of Measure	Subcategories	Measures to be Used	Time of Administration	Special Comments
Personality and Environmental Dispositions	Intelligence, suspiciousness, etc.	Forms A and B of the Cattell 16 PF Test	40 minutes per form, given prior to inhabitation	Form A added since Tektite
	Environmental dispositions	Environmental Response Inventory	30 minutes, prior to inhabitation	Test now in final development phase at University of California at Berkeley (will also be given to outside observers)
	Leisure dispositions	Leisure Activities Blank	10 minutes, prior to inhabitation	Test now in final development phase at University of California at Berkeley (will also be given to outside observers)
Evaluation of Environmental Attributes by Outside Observers	Hardware	Revised Habitat Assessment Rating Scales (HARS)	30 minutes, prior to inhabitation	See below
	Systems	Environmental Supportiveness Scales (ESS)	15 minutes, prior to inhabitation	See below
	Functional units	Atmosphere of Habitat Area (AHA)	15 minutes, prior to inhabitation	See below
Subjective Responses During Inhabitation of Isolated Environment	Moods	Mood Adjective Check List	2 minutes each day, during inhabitation, for subjects and observers	New factor added, "calmness", from Thayer, to all 6 alternate versions
	Attitudinal: Objectives during inhabitation	Habitat User's Goals (HUG)	5 minutes, once before and twice during inhabitation	New scale, needs pretesting
	Attitudinal: Perceived instrumentalities	Perceived instrumentalities	Same as HUG	New scale, needs pretesting
	Attitudinal: Hardware	HARS	30 minutes, once during inhabitation	Briefer than Tektite version, includes column on relevance to life quality
	Attitudinal, Evaluative: Systems	ESS	15 minutes, once during inhabitation	Briefer than Tektite version, considerably simplified
	Attitudinal, Evaluative: Functional units	AHA	15 minutes, once during inhabitation	New scale, will give more congruence with other studies, needs pretesting and factor analysis
	Post-inhabitation impressions	Debriefing interview and content analysis	1 hour, once immediately after inhabitation	Revised from Tektite version
Behavior Observation During Inhabitation	Molecular	Helmreich system	Full time, during inhabitation	
	Molar	Molar Observation System	Beginning, middle, and end of mission	New system, needs pretesting and factors analysis should not be done by debriefing personnel
	Leisure	Leisure Time Categorization	All day for 2 days beginning, middle, and end of inhabitation.	Same system as used with Tektite observations

TABLE 2

SYNOPSIS OF TEST SCORING AND INTERPRETATION COMPREHENSIVE HABITABILITY TESTING PROGRAM

Measure	Scoring	Interpretation
Forms A, B of the Cattell 16 PF Test	By established factor. These include Factor A, reserve vs outgoingness; Factor B, intelligence; Factor C, emotional stability and ego strength; Form E, dominance; Factor F, surgency; Factor G, conscientiousness; Factor H, shy vs venturesome; Factor I, tough- vs tender-minded; Factor L, trusting vs suspicious; Factor M, practical vs imaginative; Factor N, artless vs shrewd; Factor O, self-assured vs apprehensive; Factor Q_1 conservative vs liberal; Factor Q_2, group adherence vs self-sufficiency; Factor Q_3, strength of self-sentiment integration; and Factor Q_4, relaxed vs tense. Scoring can be done readily by hand or by computer.	Provides a general background of personality dispositions to be used in interpreting other data. Norms have been established on the general population and normative data is available for Tektite II. Of available personality tests, the 16 PF has been the most successfully used in studies of man-environment interaction.
Environmental Response Inventory	By factor. The factors have been tentatively established and include need for privacy, environmental time orientation, environmental adaptation, materialism, and stimulus seeking, among a number of others. Research has been going on this spring and summer on further validating these factors, and final establishment of the factors will occur by Fall. Scoring can be done by hand or by computer.	Provides a background of personality dispositions toward the environment that will be quite helpful interpreting other data. Norms are being established on a sample of about 50,000 and should be available this Fall, thus comparison will be possible with the general population. Of available environmental disposition tests, this one has been worked on the most extensively and carefully.
Leisure Activities Blank	By activity. A list of 121 leisure activities, plus space for others, rated by each individual subject for past participation and planned future participation. Can be scored by hand or by computer.	Provides a specific background on leisure time dispositions, which will be especially helpful in interpreting the Leisure Time Categorization observation system. Norms are being established on a sample of about 50,000, so comparison with the general population can be done. This test is one of the few attempts at comprehensively assessing long term leisure dispositions.
Mood Adjective Check List	By established factor. The new version of the MACL contains 12 factors: calm, depression, surgency, anxiety, pleasantness, activation, skepticism, deactivation, aggression, social affection, concentration, egotism. Scoring is very simple and can be done especially easily by computer.	Provides information regarding predominant mood, morale, and psychological atmosphere during actual living in an isolated habitat. The test has been one of the most successful in studying the psychology of adaptation to special environments. Norms are available, and intercorrelations with other tests in many cases are already tentatively established.
Habitat Assessment Rating Scales	By item and by area of deficiency. Yields general ratings on 74 specific items common to most isolated habitats, a rating of the habitat as a whole, and deficiency area information relevant to each item regarding performance of function, ease of maintenance, convenience of location, comfort in use, aesthetic quality, and safety. Scoring can be done readily by hand. Now includes a perceived instrumentality rating for all items.	Provides attitudinal information toward specific hardware of any habitat, isolated habitats in particular. The test was successfully employed in Tektite II, but those are the only norms available. Results will be interpreted in and of themselves, in relation to Tektite norms, and in respect to intercorrelation with other measures.

TABLE 2 (CONTINUED)

Measure	Scoring	Interpretation
Habitat User Goals and Perceived Instrumentalities	By goal pending factor analysis, by factor thereafter. A list of 28 potential habitat user goals is rated by the user for importance to him, and according to the degree he perceives the habitat to instrument the goal. Can be scored by hand.	Provides information as to the motivational context in which subjects are working while residing in the habitat. This aspect of the psychology of habitat living has been found to be highly influential in effecting responses on other subjective and observational tests, both in other research on environmental psychology, and in the habitability studies done of living in Tektite II. Norms still need to be established for this test.
Environmental Supportiveness Scales	By overall support for each of 8 habitat activities, by overall supportiveness of environmental systems, and by specific problem areas. Can be scored by hand.	Provides attitudinal information toward felt support for specified activities, such as sleep, research, eating, etc., and toward specified systems that play a part in the environmental design, e.g., lighting, acoustics, odor control, layout, and equipment. The test was successfully employed on the Tektite II habitability program, but those are the only norms available. Results can be interpreted in and of themselves, in relation to Tektite norms, and in respect to intercorrelations with other measures.
Atmosphere of Habitat Area	By factor. Tentatively the factors include aesthetic quality, friendliness, organization, space, privacy, and stability. Of all the tests, however, it would be particularly helpful to have a factor analysis on this relatively new and expanded test. Scoring can be done by machine or by hand.	Provides attitudinal information concerning the felt atmosphere of given areas of the habitat. Norms have not yet been established, but there are enough similar, although less comprehensive, tests being used now by environmental psychologists that comparisons with other designed environment atmospheres will be relatively easy.
Debriefing Interview and Content Analysis System	By content analysis categories and by complaints. This test is one that must be scored by hand, and must be scored by raters who have not been involved with any scoring of other tests.	Provides information concerning (1) complaints about the habitat made just post-mission; (2) post-mission attitudes toward the habitat, mission, and general mission support; (3) apparent general dispositions in discussing the project (humor, flexibility, involvement in work, etc.); and (4) stated objectives for the mission.
Molar Observation System (MOS)	By category during mission observations and tentatively thereafter, until factors are established, then category scores will be condensed to factor scores. Scoring must be done by hand, and will be relatively the most demanding scoring project except for the molecular behavioral observations. It would not be necessary to have MOS observers on hand constantly during a mission, but 2 out of every 6 days should be covered, and included in the schedule should the first two, middle two, and last two days of the whole mission. Scoring would be done immediately after each half-day of observation.	Provides information regarding the overall behavioral context of the crew interaction with their environment and with each other. Key parameters, such as involvement and enjoyment in work, psychosocial sensitivity, involvement in maintaining the built environment, and positive personality adjustment are monitored, with observers able to take in the behavior of an entire morning, afternoon, or evening in making their ratings. Results will be interpreted in and of themselves, and in relationship to other variables. Many of the debriefing categories are designed to provide a detailed cross-check of MOS categories.
Leisure Time Categorization	By category. Ratings are to be made on all leisure activities of number of crew members involved, duration of leisure activity, and location of leisure activity. Ratings can be made at the same time as the MOS, and can be made by the same observers.	Provides information on all leisure activities that occur in the habitat. Norms have been established from Tektite II. Interpretation will be based on comparison with those norms, on the scores themselves, on changes with scores over the duration of a mission, and on interrelationships with all other measures, particularly the Leisure Activities Blank.

slowly than enriched children. In some cases, it has been demonstrated that the detrimental effects of early impoverishment have been reversible after enrichment programs.

Studies with animals (such as rats and monkeys) indicate both behavioral and neurological consequences of environmental enrichment or impoverishment. Impoverished monkeys and rats tend to be more emotionally reactive, aggressive, and afraid of novel environments than normal animals even after they become adults. The feature of enrichment contributes to the highly interactive relationship between the organism and the complex and/or continuously novel environment. Enriched animals have a heavier cerebral cortex (an area of the brain associated with intellectual functioning and information processing) than impoverished animals. It also appears that the effect is not just limited to the polar extremes, but that it is a continuum as a function of environmental richness. The implications of this type of research to the design of environments for adults as well as children are profound.

Psychological Mediating Processes

David Nowlis and I wondered about exceptions to the general underlying notion that good habitability response came from good setting design. For example, how is it that an opportunity to express certain ideals or creative needs can make a seemingly poor environment a positive one? We encountered this in Venice, California. Venice is a run-down community and most of the buildings barely pass local building codes, yet it has some well-disposed, vigorous residents. Why was it, we pondered, that such citizens report that they actually prefer an impoverished urban or rural area for a well-designed, efficient, seemingly supportive area? In discussion with such people, we learned that an opportunity to be doing things they considered to be meaningful overrode many serious and obvious environmental deficiencies.

As another example, we wondered why a highly successful businessman working in a plush, beautifully designed office and living in a home worth several hundred thousand dollars found that he was happiest in his crude cabin in the woods during the one-week vacation he took every year?

Then we wondered why poor housing seems to be correlated with high crime rates and high physical and mental illness rates in some cities and countries, but not in others.

How might environmental design affect such variables? Our own studies and the research of other environmental psychologists suggest that three main components are involved: individuality, sense of purpose, and availability of choice or options. The overlapping aspects of man-environment interaction seem to be of major importance in understanding habitability.

Individuality: In the 1960's, the University of California at Berkeley erected carefully designed dormitories for graduate students. Rooms in these relatively new and attractive buildings rent inexpensively, but financially have proved a failure. For some reason, students prefer much more expensive, but poorly designed rooms and apartments in the city. These latter habitats would often rate poorly on many of our habitability tests. The University asked Van der Ryn and Silverstein (1967) to study the problem. After extensive observation and interviewing, the authors concluded that the dormitories were often described as being somewhat like a motel and, to increase efficiency, were designed for one optimal pattern for all users. Not surprisingly, Van der Ryn and Silverstein concluded that students do not behave according to any single pattern; and they tend to prefer environments which allow considerable latitude for individuality and choice.

From this it can be stated that if you design for the average, you design for nobody.

Sense of Purpose: In a study of soldiers stationed in the arctic, Washburne (1963) found that when men remain in well-designed stations, morale goes down, especially among the men uncertain of their next assignment. When the same men go out in the field, in some instances sleeping in weather 50° below zero in tiny tents, morale goes up. Presumably, Washburne's results illustrate the way in which sense of purpose can override design in affecting habitability.

Similarly, Pope and Rogers (1969) investigated the environmental response of scientists conducting research in the arctic under very adverse conditions. Using psychiatric interviews and various psychological tests, they were unable to predict which scientists would do well in the arctic environment and which would show mental disruption. They found a clear relationship, however, between sense of purpose and successful psychological adaptation to the adverse environment. The scientists who had gone to the arctic merely because it was a job they could do for awhile did poorly, even if their psychological health appeared to be excellent.

The studies done in the arctic agree well with results from Tektite II. Although much design effort was put forth to insure that the habitat would be a comfortable one, the scientists who worked in it appeared to have increasingly negative reactions with longer habitation periods; in retrospect, they had mostly negative things to say about it. What the designers apparently forgot was that they were designing the habitat for committed scientists, many of whom were the sort of people who wouldn't care if they had to sleep on the floor as long as they could get serious, scientific work done while they were there. As the time passed and the novelty of the elaborate living arrangements wore off, the inconveniences caused by poor provisions for scientific research in the habitat became increasingly apparent to these scientists.

Sense of Choice (Perception of Options):

Many studies show that freedom of choice can dramatically increase evaluation of food. Kamen and Peryam (1960), for example, found that subjects with an opportunity to plan their own menus from a fixed and limited supply were considerably more satisfied with their meals than those who were fed preplanned menus from the same supply.

Serendipitous findings are available from our research on Tektite II. It so happened that three missions were given self-selection of foods, requests being filled via the closest market on St. Thomas Island. The other seven missions were given high-quality preprogrammed foods, largely frozen. We had sampled this food ourselves, and it was indeed delicious. To our considerable surprise, in spite of the expense and care spent on the preprogrammed foods, and in spite of the fact that tropical storms occasionally made it impossible for the self-selecting missions to have any food at all, whereas the preprogrammed missions always had ample food, we found that 39 of the total 40 debriefing complaints made about food quality came from the missions with preprogrammed food.

This leads us to the two principal conclusions on psychological mediation. There is the Nowlis-Wortz first principle of habitability: as environmental influences become more stressful, organismic needs for the establishment of individuality, purpose, and choice become stronger. Next, is our second habitability principle: if we find a man with a personal sense of his own individuality, with a sense of purpose, and with a perception of the options and choices available to him, we will likely find an environment that, no matter how crude in design, he has found habitable. If we find a man without these three factors, we are likely to find an environment that, no matter how beautifully designed, the man considers to be low in habitability.

Summary

In summary, we know that environmental habitability affects health, longevity, behavior, perception of life quality, job satisfaction, moods, attitudes, dispositions, and even brain weight.

We know how to get data on habitability to guide our criteria and designs--from existing man-built environments; by experimentation; by information exchanges; by feedback from our designs; from scientific data; from isolated habitats; and by simulations.

What we need, however, is a major program in which we can design and build environments to specific psychological, social, behavioral, and physiological objectives. We need to build and then test these constructions, tear them down, and then rebuild if need be. In this country we would not think of building sophisticated weapon systems without testing them. They wouldn't work. Neither should we build the world in which we live without testing to find out what we are doing.

1.2 FORMULATING HABITABILITY CRITERIA FROM RESEARCH INFORMATION

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Introduction

The problem considered in this paper is as follows:

a) Given a habitability requirement for the design of a facility, e.g., "to provide comfortable, climatal living conditions in classrooms for soldiers";

b) Given the existence of habitability research information (which for purposes of this discussion, we must assume is valid) on the same topic, e.g.,

"Seventy percent of sedentary college students in a controlled environment laboratory wearing clothing equal to 0.52 clo were comfortable within a climatal envelope specified by five points as follows:

Points	Wet Bulb Degress F	Dry Bulb Degrees F	Percentage of Relative Humidity
1	55	80	17
2	59	75	38
3	64	81	42
4	73	78	77
5	74	76	83

c) What steps must be taken in order to formulate a habitability criterion for the requirement and in light of the known research information? An example of such a criterion is as follows: "Inside heating design temperatures should conform to the following: living and administrative areas--inactive employment, 70-75°F; working areas--active employment 50-60°F."

The discussion of these steps is divided into three sections: quantifying requirements, selecting research articles, and formulating criteria.

Quantifying Requirements

Step 1. Quantify the habitability requirement. If the requirement does not already state a level of achievement, the requirement maker must be consulted to make a quantification such as: "provide...for 90 percent of all soldiers." These quantifications are seldom made explicit. However, in order to formulate a quantified criterion, a quantified "target" objective is required so that both requirement and criterion can be stated in the same terms. The quantification must take into account habitability requirements having to do with functional activities, health and welfare, comfort and satisfactions, and motivations for all activities. Little guidance is available at this time as to appropriate procedures for establishing these quantified requirements. Problems such as habitability requirement hierarchies, sub-sets, needs vs. wants, minimums, maximums and so on, plus the interaction of other objectives for efficiency, economy and effectiveness could all be involved in varying strength in this quantification procedure.

Selecting Research Articles

see Diagram 1

Step 2. Identify the physical facility component of the habitability requirement: e.g., "climatal conditions in classrooms" is the physical facility component of our example, leaving "comfortable living" as the subjective qualitative component.

Step 3. Query the research literature on habitability for articles relevant to the physical facility components identified in Step 2, e.g. query the research literature for articles containing information on both "climate and "classrooms." In order to obtain a sufficient number of really appropriate articles on a topic, it may also be necessary to use synonyms, analogies,

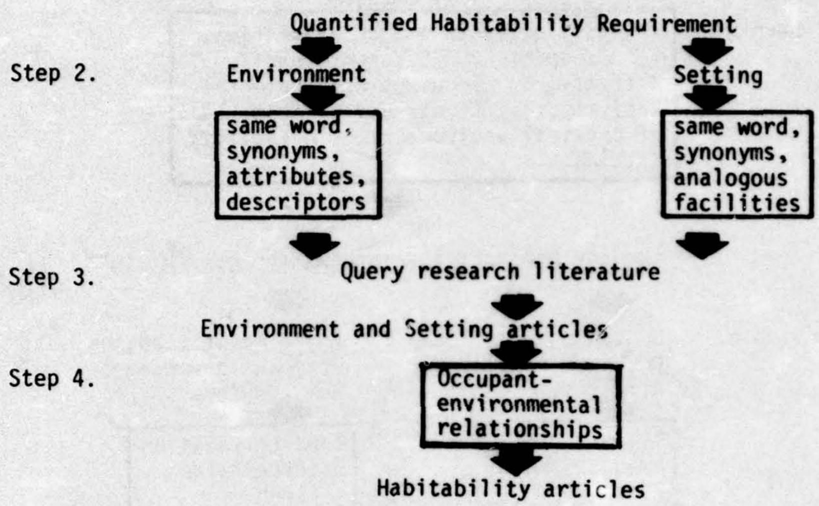

Diagram 1. Selecting Research Articles

attributes or descriptors to each term. For example, it might be necessary to also use the words "temperature, ventilation, humidity," etc. for "climate," and "lecture halls, seminar rooms," etc., for "classroom." If enough information for generalizing purposes still is not forthcoming, an alternate approach (field studies or laboratory experiments) must be taken.

Step 4. Select articles describing occupant-environment relationships. Obtain copies of the articles collected in Step 3, and select those which describe in what ways the occupant interacts with his physical environment, e.g., select those articles which have as a topic "occupant descriptions, preferences, needs, requirements, or ratings of climate in classroom."

Formulating Habitability Criteria
see Diagram 2

Step 5. Make summary statements (again, we assume their validity for the purpose of this discussion) of the habitability information contained in the articles. In order to formulate a criterion, each summary statement must contain all elements of both the habitability requirement and the proposed habitability criterion. An example of such a summary statement is shown in the Introduction, item (c). It contains the following elements:

(1) Occupant-individual, group and/or organization, e.g., "college students."

(2) Occupant functional activity, e.g., "sedentary."

(3) Occupant-environment relationship, e.g., "comfort rating"--level of involvement, e.g. "70 percent."

(4) Environment, e.g., "climatal"--counts and/or measures of environment, e.g., "0.50 clo, wet bulb temp," etc.

(5) Setting, e.g., "controlled environment laboratory."

Speaking parenthetically, it can be seen that the occupant, his functional activity, and the facility setting are essential elements of all three kinds of statements

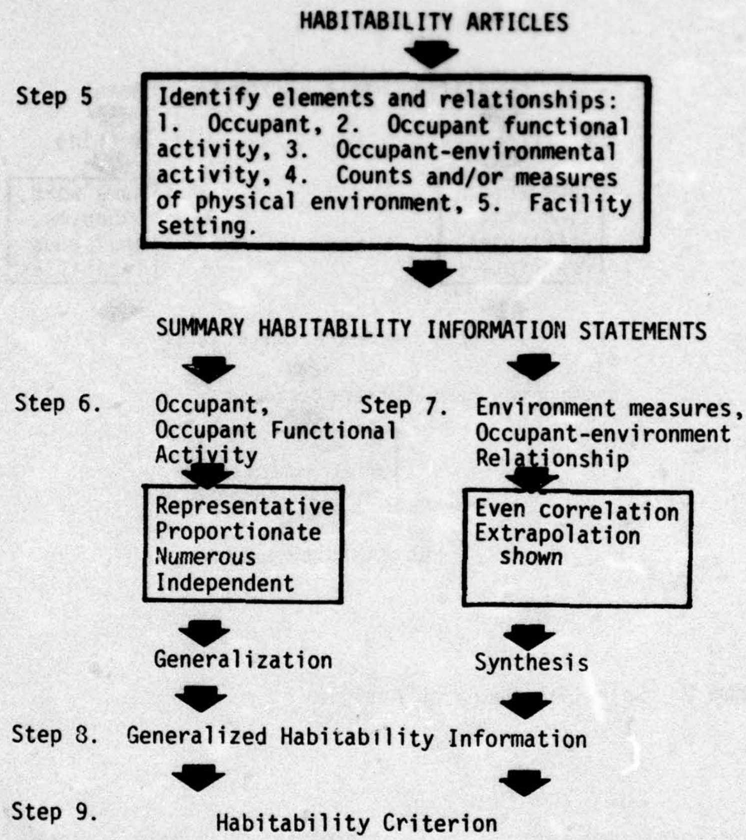

Diagram 2. Formulating Habitability Criteria.

(habitability requirements, research information, and criteria). With this analysis, the three kinds of habitability statements can be defined as containing elements as follows in Table 1.

Habitability Statement Contents

	Requirement	Criterion	Research Information
Occupant	X	X	X
Occupant functional activity	X	X	X
Occupant-environment relationship	X		X
Environmental descriptors		X	X
Setting	X	X	X

Table 1. Types of Habitability Statements

Step 6. Generalize the occupant and the occupant functional activity elements of the summary statements. The problem in generalizing is one of justifying the application of the research data to the habitability formulated. In our example the occupant is "soldiers" and the occupant functional activity is implicit in "classrooms." If it is interpreted as "all classroom activities required in training curricula," these activities must first be grouped into activity postures and levels of involvement which would require significantly different climatal conditions. These can be called activity categories. The process of generalizing is one of showing that the occupant and occupant functional activity data are sufficiently representative of "soldiers" and "all classroom activities" and that a synthesis of the data will validly represent them. The justification must show that the data: (a) represent all variants; (b) are proportional to the variants; (c) are numerous; and (d) are independently derived. It is important to note here that if these four conditions cannot be met from the research data, then this inductive approach must be terminated. An alternate approach (such as field studies laboratory experiment, model mock-ups, etc.) can then be tried to establish the criterion.

Step 7. Synthesize the environmental counts and/or measures and the occupant-environmental relationship elements for each activity category identified in Step 6. This is a process of recognizing a pattern in the data which can be used to represent all the data, e.g., "90 percent of the occupants were comfortable at dry bulb temperatures of 75° to 81° F." In this synthesis both the degree of fit of the correlations and degree of extrapolation must be shown.

Step 8. Generalize the summary statements. This generalization is technically called a probability induction (the other kinds being hypothetical and chance probability inductions). All the necessary justifications for making this generalization simply says that there is sufficient sample evidence to state a probable outcome for the total population. For our example, it might take the form: "The fact that 90 percent of all observed occupants wearing clothing equal to 0.52 clo were comfortable at dry bulb temperatures from 75° F to 81° F makes it probable that 90 percent of all soldiers will be comfortable under the same conditions." By our definition in Step 5, this can also be called a habitability information statement.

Step 9. State the habitability criterion. The probability induction made in Step 8 contains the elements and the justification for a habitability criterion. The criterion is a restatement of the induction in prescriptive form, eliminating the probability and occupant-environment relationship elements. An example of a criterion was given in the Introduction part c, and is repeated here as follows: "Inside heating design temperatures should conform to the following: Living and administrative areas--inactive employment, 70-75° F; working areas--active employment, 50-60° F."

1.3 DESIGN DIRECTIVES AND EVALUATION FOR HABITABILITY IN HOSPITAL ENVIRONMENTS

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During initial planning studies in 1961-62 for redevelopment of the Tufts-New England Medical Center in downtown Boston, dual goals were set: internally, to move toward a more human, patient-oriented hospital environment; externally, to link medical center growth with neighborhood revitalization through coordinated urban and health facilities planning and design.[1]

In respect to both, it soon became apparent that traditional planning and design processes were barriers to achieving these goals. In their place a pragmatic search began that lasted for 10 years. Two HEW grants aided in the endeavor. One grant was to generate new hospital design concepts; the other was to implement and evaluate the concepts.

The Development of Design Directives

The first grant from 1962 to 1965 was for a basic reexamination of pediatric hospital design with our own pediatric unit and its development plans as our research base.[2] On the assumption that usual design standards in hospital planning were largely retrospective and thus highly suspect in a period of accelerating change in biomedical technology and in sociobehavioral expectations, the project put considerable emphasis on experimenting with a number of criteria-generating processes. The aim was to start fresh and unencumbered on an analysis of goals of pediatric care in terms of today and tomorrow, asking what sort of operational patterns and institutional environments appeared most supportive of these, irrespective of existing hospital organization. We called this phase "uncoupling" of the hospital system. The environmental criteria that ultimately emerged would not only have to be in terms of care itself but would link this primary function of a pediatric teaching hospital with education and research. The project's goals were further complicated in that they had to be developed within the political constraints of the planning and design of a specific institution: the Boston Floating Hospital for Infants and Children, pediatric unit of our Center. The day-by-day research was carried on by an interdisciplinary team consisting of a social anthropologist, an urban institutional planner and an architectural designer; they were part of a larger interactive group consisting of key administrative and medical persons of this hospital. Studies ranged from analysis of changing patterns of health manpower, patient origin, disease entities and care to internal processing relationships, and finally to formulation of design-related behavioral, operational, technical and spatial criteria. Considerable use was made of manipulable wall displays for eliciting responses without resort to preconceived system relationships.

One of the most significant outcomes of this first study were the design directives and their impact on new inpatient configurations, especially the replacing of the traditional inpatient rooms along a corridor with a series of room clusters around activity spaces.

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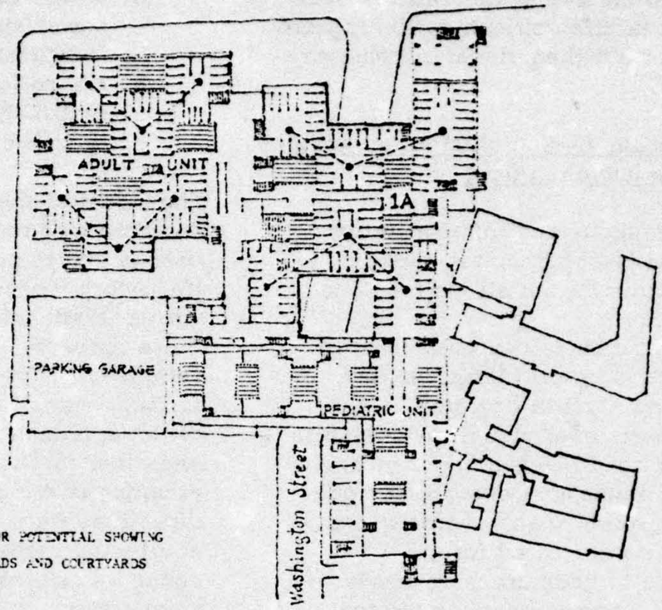
[1] Hermann H. Field, FAIA, "Medical Center Planning and Design Within the Total Urban Setting," World Hospital Magazine, Vol. VI, No. 2 (April 1970).

[2] Kreidberg, Field, Highlands, Kennedy, and Katz, "Problems of Pediatric Hospital Design," Final HEW Report, The Boston Floating Hospital for Infants and Children. Out of print.



INPATIENT FLOOR POTENTIAL SHOWING CLUSTER TRIADS AND COURTYARDS

Thirty-three directives were grouped into the following categories:

- <u>External Determinants</u>: those that follow from an assessment of contemporary conditions of relationship between the hospital, the university medical center and the community.
- <u>Operational Prerequisites</u>: those that stem from positions taken by a hospital on priorities of service, participation of important outside groups, and guidelines for operating policy.
- <u>Spatial Needs</u>: those directives that come from the interplay between activity requirements and feasible spatial possibilities.
- <u>Architectonic Criteria</u>: those directives that derive from the synthesis of requirements in setting the shape and layout of the hospital building.
- <u>Technical Considerations</u>: directives that come from the needs of the construction process.

Three directives, the first operational, the second spatial and the third architectonic are typical of the 33 directives that were formulated:

1. <u>Provide parents with a range of possibilities for participating in their child's hospital experience</u>.

BECAUSE:

a. The presence of a parent significantly reduces the emotional trauma during hospitalization...
b. Problem cases referred to the pediatric teaching hospital require that the parents be educated in the care of their child...
c. The child is usually unable to communicate the nature of his illness and history without interpretation from his parent...
d. The student pediatrician should have an opportunity to observe parent-child interaction...
e. Mothers can provide much of the care for their children in a hospital...
f. A range of accommodations are necessary since not all parents should remain with their children constantly or throughout all hospital procedures...

EXCEPT:

a. Where the parent's presence may upset the child and be detrimental to the medical care activity...
b. Where the parent's presence in the hospital may be detrimental to the well-being of siblings at home...

c. When the age of the child is such that tactile communication is more important than visual communication.

3. Place as many 10-bed clusters as possible on one unbroken floor.
BECAUSE:
a. Spontaneous and informal interaction among hospital staff is facilitated when all work on one floor...
b. Patient care is improved through coverage by all clinicians and nursing staff in one area...
c. The horizontal visual dimension is important to human occupants...
d. The arrangement establishes one place rather than several where patients are cared for...
e. Specialty beds are more likely to receive comprehensive nursing coverage...
f. The arrangement facilitates night coverage and supervision of nursing teams...
g. Physicians can visit more teaching patients quickly...
h. The arrangement strengthens communication at the functional level...
i. Student nurses and student physicians are exposed to a greater diversity of patient care needs in one area...
j. A larger number and range of servicing facilities and personnel are readily available...
k. Continuity is provided for effective medical coverage and teaching rounds...
l. The arrangement allows for the flexible use of units...
m. Similar servicing needs can be met by delivery systems which are not locked into vertical shafts...
n. The arrangement will allow for the initial construction of fewer beds than if they were stacked...
o. The arrangement allows for a reduction of circulation space and secondary supporting facilities not possible in a stacked arrangement...

EXCEPT:
a. When the construction site is too small...
b. Where the medical specialists' power structure forces beds to be linked to each service...
c. Where locked-in vertical supply and distribution systems are justifiably recommended.

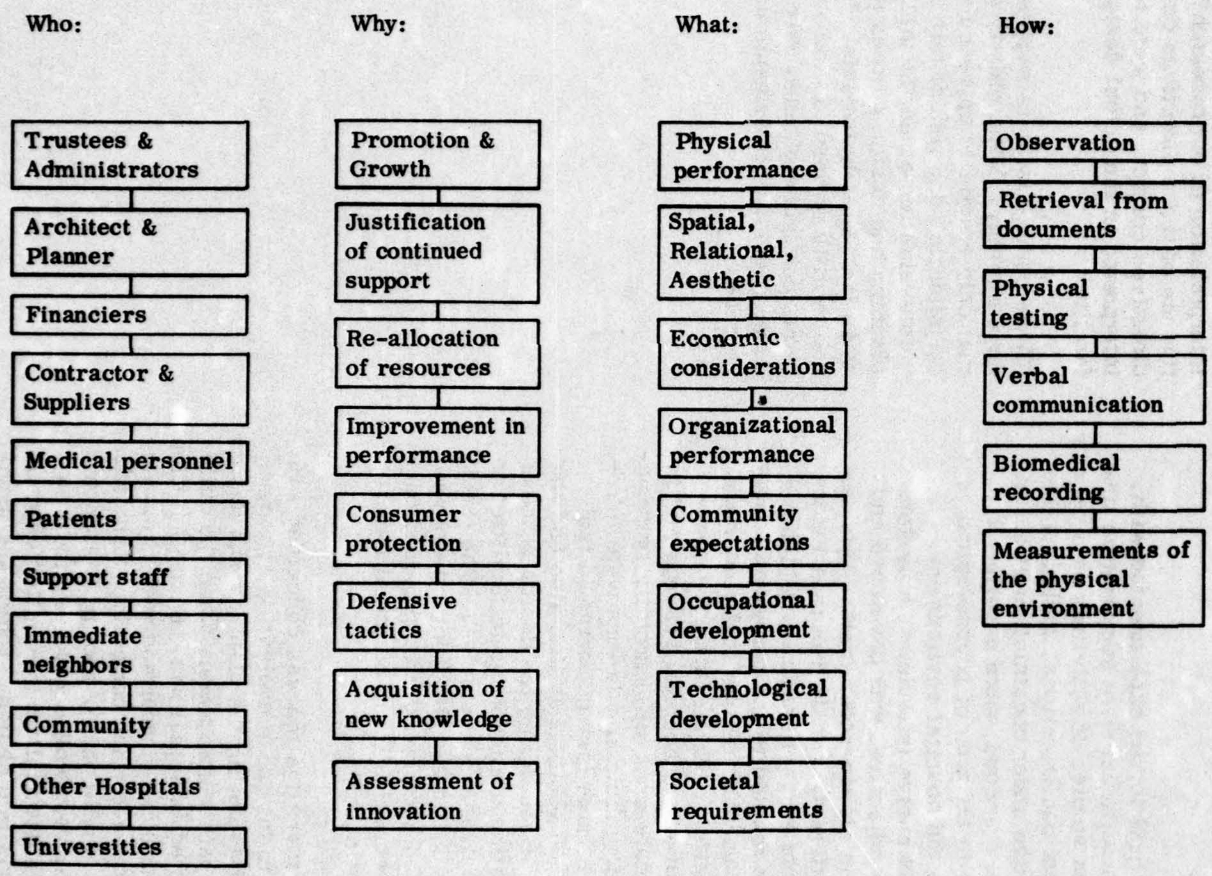
The intent of the 33 directives was to be broad enough to accommodate possible change and to provide direction within a framework that would allow maximum innovative freedom for the designer. In both these respects, the directives seemed to be more responsive than traditional criteria. In fact, since 1965 a number of adaptations of the approach have been tried in hospitals and other facilities. In the course of the planning of our own medical center, similar directives were later developed for the adult unit; these, together with design concepts originating in the pediatric study, were a major influence on the actual building designed by our architects, the Architects Collaborative of Cambridge. But there was a lack of any serious attempts at evaluating such criteria generation and especially the effectiveness in use of the inpatient clusters that have appeared in various forms at our institution and elsewhere since our study proposed them.

A Holistic Approach to Design Evaluation

The second study[1], from 1968 to 1971, belatedly and incompletely sought to address itself to this missing evaluation, using the adult inpatient environment instead of the childrens' as the test area. This was the first phase to go into construction and was based on a transferral--untested--of the inpatient cluster concept and on the directive approach to the design of the adult unit. Because of funding cutbacks, the grant was limited to the development of an evaluation methodology of general applicability to hospitals rather than being a conclusive evaluation of a specific facility.

[1]Field, Hanson, Karalis, Kennedy, Lippert and Ronco. "Evaluation of Hospital Design, A Holistic Approach," Final HEW Report, 542 pp., 1971. Available through Political Science Department, Tufts University, Medford, MA 02155.

Overview of Evaluation



Again, an interdisciplinary team was assembled consisting of a social anthropologist, an institutional planner, a human factors engineer, a human factors psychologist and an architect. The intent was to develop a holistic approach as indicated in the diagram on the following page. In fact, no real coming together of the main methodological approaches was ever achieved.

Of the methodologies experimented with, the most traditional were comparative time and motion studies of activities on a variety of inpatient configurations, including one configuration under construction at our institution. A second, more experimental route was in the area of psychological response to the hospital environment. Through extensive interviews, a system of bipolar adjectives was developed and rated on an eleven-point scale. This semantic differential scale was then incorporated into a questionnaire in which respondents reacted to the perceived hospital environment at the medical center and other hospitals. As an extension of responses in actual hospital settings and in our full scale mock-up, carefully systematized photographic simulations were introduced as a much less cumbersome technique. Such photosimulation also had the potential of use during the design process for evaluation of responses to facilities in the conceptual, preuse stage. The result of a fairly broad sample of interviews with only photographs being used provided parallel responses to those of actual experienced settings.

The third investigation was concerned with the need to interpose evaluation at a number of points during the planning and design process, rather than merely when the building is tested in actual use. Such limitation is very costly in comparison with checking out performance when corrections can still be made. Furthermore, poor performance in use may very well occur in spite of an apparently good initial translation of goals and criteria into design. During the usual passage of years between inception of planning and completion of the facility, any number of operational and health care shifts are likely to have occurred, bringing with them mismatches that could not have been foreseen. Given the instability of the health care sector and its institutions, evaluation must be broad enough to include these factors. Is the facility being used as originally conceived? In the case of our own planning, a great deal of analysis related to the design directives and their translation into design. Were our original pediatric directives a correct interpretation of our research? Was the influence of these directives on the adult directives correct, and were they correctly interpreted in the actual design of the facility?

All we could do was to suggest the outline for a strategy. What clearly emerged was that only a holistic approach with all its complexities and risk of failure could provide evaluation as an integral part of the planning and design process rather than when it is already too late. In turn, habitability of hospital and other environments can be heightened only by sophisticated checking of assumptions as the study proceeds.

1.4 MODULAR DENTAL CLINIC SYSTEMS ANALYSIS

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Identification of Need

During the next several years, the Army intends to build a large number of base dental clinics. These facilities will have a significant effect on the delivery of dental care within the Army over the next 20 to 25 years and will influence the methods of dental practice possible within the Army.

With the inception of an all-volunteer Army, an important consideration is the need to provide dental and other health care within the Army in a way that is as attractive to the patient and to the Army organization as the care available in civilian society. This in turn will require a change in the current approach to dental care delivery in terms of utilization of professional and paraprofessional skills, and in the patient treatment environment.

The combination of these two influences indicates the need to carefully analyze possible future and current requirements in order to develop design criteria for new clinics.

The Study Approach

The study approach was a pragmatic one. The literature was searched for available information concerning ongoing dental clinic facilities research and dental care delivery methods. Facilities were visited and administrators, dentists, support personnel, patients and equipment suppliers were interviewed and/or observed.

The most economical grouping of dentists, assistants and auxiliaries was analyzed; the findings were adopted as the basis for further development of the clinic system.

The design process progressed from analyzing the units of work space to the planning modules and the total clinic system. Alternative solutions were studied at each phase and evaluated against a scale of priorities which included personnel needs and equipment requirements. The two best solutions were developed further and the alternatives reevaluated.

The interest of this project lies in the makeup of the study team consisting of architects and management planners; its study approach from the smallest unit of work space to the overall clinic system; the design emphasis around dental care delivery techniques and dental equipment; and the concerns with the patients' sense of well-being and a maximum reduction of anxiety.

An important aspect of the study was the use of a full-size mock-up to study patient and personnel needs and the arrangement of equipment. Critical dimensions were verified.

An inexpensive cardboard model of the partitions and the casework was built; a dental chair, dental cart and stools were moved in. Dentists and assistants judged the operatory for functional and environmental requirements; necessary adjustments were made to the model. (see Figs. 1 and 2.)

The human requirements which were tested involved patient's privacy and dentist's visual control over multiple operatories.

Fig. 1 Dental Clinic Mock-Up

Fig. 2 Dental Clinic Mock-Up

1.5 A HUMAN FACTORS APPROACH TO HABITABILITY CRITERIA

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Design criteria related to human behavior are indeed familiar to psychologists, engineers, physiologists, and physical anthropologists dealing with the interface between human factors science and technology. Such criteria have been contained in research reports, design specifications, and handbooks for many years. Perhaps requirements indicated for work places in new man-machine systems come closest to habitability criteria. General guidelines have been developed from anthropometric surveys, studies in biodynamics and psychophysiology, and experimental or analytical performance research. These can be found, for example, in the Human Engineering Guide to Equipment Design and the Bioastronautics Data Book.

But general guidelines have to be fitted to specific situations. Work places differ in different systems. Engineers find it difficult to translate human engineering generalities into specifics. Human factors practitioners often assist them. They perform task-equipment analyses of particular system functions and locations, to determine just what equipment operators do or can be expected to do; analyses need to be relatively fine-grained. Then the design criteria can be derived by combining the analyses with the general guidelines. An experimental test or simulation (operations in a mock-up) may first have to be conducted to produce the time and error data needed for the task-equipment analysis.

It has been found that design engineers pay relatively little attention to human factors design criteria in handbooks even when these are directly applicable and the handbooks are readily available. Hence it has been advisable for the practitioners to work with the engineers in the same engineering department, as either employees or consultants, interacting on a daily basis. This collaboration is strengthened if the purchasing agency (such as the Air Force) specifies it in its contract with the design/development/production organization or in general specifications to which that organization must adhere. Collaboration also profits from suitable professional caliber and experience among the human factors practitioners as well as from patience and diplomacy. It may be essential for practitioners to enter the design process early.

How far can this whole process be transferred into the design of living spaces for habitability? For one thing, the kinds of behavior to which habitability criteria apply are different. By and large, they consist not of work performance but of daily living--and nightly living, too. For example, hitherto there has been relatively little involvement in research on sleeping and in the design requirements of bedrooms and beds. Second, human factors researchers and practitioners have to work with architects rather than engineers. This means another long-term experience of mutual adjustment between disciplines, and one in which those of us in human factors science/technology must learn something about architectural practices and language and the way these differ from engineering. But the transfer to habitability should and will take place.

Another requirement is to develop a suitable framework for sorting out the ways in which any constructed environment influences human behavior. One such framework would consist of two sets of categories, environmental and behavioral, representing causes and effects. The categories of the designed environment might consist of:

(1) Resources. For example, a bathroom is a resource which may or not be provided. If provided, its location may be important to the users. How its components--toilet, shower, etc.--are designed also has much significance for human engineering.

(2) Spatial Arrangement. Walls, stairs, openings, furniture arrangement and other spatial characteristics determine a substantial amount of human behavior, notably locomotion, vision, and social interactions.

(3) Communications. A designed environment may include certain communication devices (e.g., telephones), particular acoustical properties, or incorporation of communication aids such as coding or aids for the blind.

(4) Appearance. Traditionally, architects have paid particular attention to evocative properties which produce enjoyment or liking (or the converse) in themselves, other designers, and users. The appearance of building exteriors, interiors, and environs also gives rise to reactions which are simply descriptive.

(5) Consequation/Potentiation. Structures and their components can function as incentives and nonincentives--stated otherwise as rewards or punishments (positive or negative reinforcers). These strengthen or weaken various behaviors of which they are the consequences. For them to have an effect, there must often be some kind of initial deprivation or aversive situation which "potentiates" the consequence.

(6) Protection. An environment may be constructed so that it protects individuals from ambient conditions and from other persons who might injure their health and property. Conversely, it may contain hazards to health or features which lead to accidents.

The behavioral categories do not bear a one-to to-one relationship to the environmental categories. An environmental category may be associated with more than one behavioral category, and one behavioral category may be associated with more than one environmental category. The categories of <u>behavior</u> influenced by the designed environment consist of:

(1) Functional Activities. These are the various kinds of things we do in work or play or daily living--studying, cooking, card-playing, eating, sleeping, etc.--with attributes such as effectiveness, effort, comfort, and convenience. This behavioral category is most dependent on the environmental category of Resources.

(2) Locomotion. People move from place to place within structures, enter and leave structures, circulate between them. Most of the locomotion is ambulatory. This category is highly related to Spatial Arrangement.

(3) Social Interaction. Members of families interact with each other in many ways, as do workers, friends, and strangers. Parents care for children. Groups gather and talk. Interactions include conversation and expressions of privacy, territoriality, and personal space. Social Interaction is strongly influenced by Spatial Arrangement and Communications.

(4) Feelings. We have emotional and esthetic reactions to a designed environment, whether favorable or unfavorable. These may color our reactions to elements within them. Moods and emotions are influenced, especially by Appearance and Consequation/Potentiation.

(5) Perception. We also process information from an environment without necessarily having feelings about it or using the information as cues for functional activities. We simply "absorb" it, think about it, and maybe describe it in words or images. Most responsible for Perception is the environmental category of Appearance.

(6) Motivation. If this is defined in terms of Consequation/Potentiation, then those aspects or features of a designed environment which potentiate or consequate our behavior can be viewed as "motivators."

(7) Health and Safety: By stretching the term slightly one can view these as constituting a "behavioral" category, and certainly it is necessary to include them in our framework. Ill health and accidents resulting from faulty environmental design must be minimized. The environmental correlate is Protection.

From the point of view of habitability assessment and evaluation, it is necessary to weight the importance of each behavioral category for its contribution to "habitability" in a particular designed environment. For example, in military barracks the need to optimize "perception" and "feelings" may be less important than the need to optimize "functional activities" and "health and safety." On the other hand, "feeling" and "communications" might be the paramount behavioral categories for a religious edifice. In short, the goals of the system, structure, or environment determine what behaviors should be emphasized within it. The structure's overall objectives must be specified.

As another step, one attempts to figure out how well alternative design options in the various environmental categories support the behavioral categories. Options in each environmental category have to be examined for their contributions to behaviors in each behavioral category. Finally, it is necessary to consider together the weights of the behavioral categories, the relative contributions to these from each environmental category for each design option, and the trade-offs which have to be made to establish compatibility among component design options and to hold costs to a particular level. This process is not new to architects and designers, it is simply more systematic.

Where does criteria generation fit into this process? The criteria are (1) the overall goals of the structure (system), and (2) the weights attached to the categories of behavior within it. Criteria are stated in general terms, through words in the case of the overall goals, through numbers (or even quantitative adjectives) in the case of weights. One must distinguish between <u>criteria</u> and the <u>measures</u> used to define criteria or assess how close the system comes to achieving them. These are called "criterion measures." In the case of habitability, a criterion measure is the quantitative effect of a design feature in an environmental category on some behavior within a behavioral category.

Though such measures may quantify <u>actual</u> behavior resulting from a design feature, they also can indicate <u>desired</u> behavior. Determining <u>desired</u> criteria measures is the ultimate step in criteria generation for habitability. Criteria can constitute performance or design specifications. Clearly, they are more difficult to establish for some kinds of behavioral categories than for others--and more difficult to establish in habitability design than in system design. What minimum enjoyment rating on a 5-point "feeling" scale should an interior color scheme achieve? 4.2? Why? What should be the maximum probability of a fall on some stairs? .0003? Why? What minimum should be specified for the width of a bed? 36 inches? Why? For man-machine systems, research in human factors has led to many such measures. Human engineering "cookbooks" are full of them. They may have to be approximate or stated as desirable rather than mandatory. Individual specifications may have to be evolved for a particular system, through task description/analysis and ad hoc investigation. Can this approach to human factors be extended to habitability? At some sacrifice to precision and assurance, and with sufficient research, I believe it can.

1.6 PROGRAMMING FOR OFFICE RELATED INTERIORS

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In developing criteria for the habitability of office-related interiors, we follow the survey and synthesis approach, i.e., we collect considerable information on user needs. We recognize that information gathering includes "facts" and "feelings." Information on the "feeling" portion can best be assembled by interviews after questionnaires are completed. Since the "designers" who develop the ultimate design solution for a specific project participate in the research and programming, there has been no necessity for elaborate documentation of the "feeling" portion of our research other than the suggested design solution. From the research, which deals with total company needs, individual needs, communications, adjacencies, paper flow and very personal needs, we develop charts and tables explaining our findings and thereafter design solutions. The various visual explanations of our research varies from project to project--maybe it can be and should be more standardized. We are searching and changing our methods as we go along.

The same holds true for the evaluation process after completion of a project. We have done it informally and want to do more of it in the future.

Below are examples of questions and issues considered by the Facilities Requirement Analysis questionnaire which our firm has developed and is continuing to revise and improve.

<u>Facilities Requirement Analysis</u>

<u>Instructions to respondents</u>. The information you provide on the attached forms will comprise the basis for the development of a rational space planning program for the *Miller & Miller Company*. Since it will also be used to project facilities growth over the next few years, it is imperative that you carefully and thoughtfully answer all questions on the attached forms and predict future needs as accurately as possible.

Representatives of Associated Space Design will meet with department and sections head after the information provided in these forms has been analyzed, in order to discuss your requirements further.

The following are explanations of what information is sought in the forms to assist you in filling them out. Please read the instructions and explanations carefully before completing each section.

The first page(s) to be completed involve the listing of each employee presently employed in your section.

<u>Data Listing</u>

<u>Personnel</u>-- In the far left-hand column, assign consecutive numbers to each employee in this section.

a. <u>Name</u>--Fill in the employee's full name, last name first.
b. <u>Job Function and Title</u>--While titles should also be included, job functions are more useful and descriptive for planning purposes. List the job function which best describes each employee.
c. <u>Sex</u>--Place a mark in the appropriate column.

<u>Space</u>

d. <u>Location</u>--Place a mark in the appropriate column to indicate current location of the employee. Also indicate the floor on which employee is located.
e. <u>Type of Space</u>--Place a mark in the appropriate column to indicate whether that employee is <u>presently</u> housed in a fully enclosed private office with a door, a semi-enclosed space (this might be full height or lower partitions), or is located in a larger open area with other employees.

f. Number of Meetings--Indicate the number of meetings this person has per day at his work station.

g. Number of Persons Present--Indicate the average number of persons present at the meetings described above.

Equipment

h. Telephone--private or shared

i. Furniture--desks, tables, credenzas

j. Number of Guest Chairs

k. Electrical Equipment and Business Machines--Indicate any such equipment now in regular use at that person's work station. If other electrical equipment or business machines are used, please so indicate and mark with an asterisk.

l. Noisy Machines--Please check this space if special acoustical treatment should be provided for extremely noisy equipment operated by this person.

m. Number of Cabinets--Mark the number of cabinets of a given size. If more than one size is used by this person, list the quantities of different sizes, one below the other.

n. Number of Drawers Per Cabinet--In the column adjacent to the number of cabinets for a given size, show the number of drawers in each cabinet.

o. Type of Cabinet--Indicate legal (leg.), letter (let.), card (c), or other (o). If other, give the type of cabinet on the back of the page.

p. Shelves, Open--List the total number of lineal feet of open shelving required to store material for this employee, and separately for groups of employees.

q. Shelves, Closed--This type of shelving might be included in storage cabinets, credenzas, etc. Calculate the lineal footage required exactly as described for open shelving, for individual employees, and groups of employees.

r. Number of Cabinets--Mark the number of cabinets of a given size. If more than one size if used by this person, list the quantities of different sizes one below the other.

s. Number of Drawers Per Cabinet--In the column adjacent to the number of cabinets for a given size, show the number of drawers in each cabinet.

t. Type of Cabinet--Indicate legal (leg.), letter (let.), card (c), or other (o). If other, give the type of cabinet on the back of the page.

Special Areas

Note: This includes areas which involve considerably more than typical office work stations, such as reception areas, mail rooms, reproduction areas, receiving rooms, conference rooms, etc. If an employee is stationed in such an area, the special area name should be listed in the column with that employee's name. If the area is not occupied, it should be listed in its own space.

u. Special Area--Name--In the horizontal column referring to employees occupying a special area, list the area's name. If it is not occupied, list it in its own separate column.

v. Special Area--Size--Adjacent to the special area's name, write in its approximate dimensions (length and width, to the next largest foot). If it is a complex shape, attach a simple diagrammatic plan drawing.

Present Space

Questions in this category pertain to adequacy of floor area, location, crowdedness, degree of privacy (visual, acoustic, security), active material storage space, disturbances through traffic and efficiency of layout of floor space.

Future Personnel Requirements

On the chart provided, fill in all existing job titles and categories in the left-hand column. In the other three columns, list only the number of persons you expect to add or subtract from that category during the time period indicated. For example, if you now have 4 clerks and plan to add 2 more prior to 12-31-74, then subtract 1 between 12-31-74 and 12-31-77; then add 4 more between 12-31-77 and 12-31-80; the numbers entered in the columns should be +2, -1, +4 respectively, not 6, 5 and 9. Any new job categories not presently existing, but anticipated by 1980 should also be entered. If new job categories are listed, add a note on the back of the sheet, indicating that existing job category which would have a similar type of work station, so that we have adequate information to project space requirements for the new job category.

Interaction with Other Sections or Departments

In studying communications patterns, quantity and method of communications are of secondary importance. It is the quality, the critical nature of the communications which is of major import. Consider whether any given personal communications situation, regardless of quantity or method, is regularly critical to the continuance of the task(s) at hand for the people. Analysis of the cumulative effect of such individual communications patterns between groups will begin to establish which other groups of people are most critical to the functional success of your group.

In the left-hand column, enter, in order of importance, the names of other sections within your department with which communications interaction is critical. In the right-hand column, do the same with other departments (or, if applicable, specific sections in other departments).

Provide any pertinent comments about communications between your group and others.

Anticipated File Growth

Note: This section is for files used by groups, not files that are a part of individual work stations.

The left-hand column lists six generic types of files. Two additional spaces are provided for you to add any type of file used by your section which has not been listed. The figures inserted in the remaining columns should indicate only anticipated additions or subtractions during those time periods, not cumulative totals.

Expansion

Provide any comments regarding new special areas or equipment which may be required, any anticipated changes in work procedures, and any other foreseeable changes which might affect the space needs of your department.

Special Conditions

This information allows us to predict feasibility, timing and cost or relocation or construction of special conditions, e.g. referring to lighting, electrical power supply, HVAC, acoustical treatment, plumbing, etc.

Conference Areas

This information will provide the data necessary to determine the optimum size, location and physical features required for conference spaces. It includes number of conferences per week, average length of conferences, numbers of participants, special equipment required (chalkboard, clock, display rail, projection, etc.) and amount of storage needed.

Mechanization

The comments provided here, along with those in the preceding Sections 3 and 6, will provide not only quantitative personnel projections, but insight into the reasons for them, and the facility ramifications.

Comments

If there are other conditions peculiar to your group, or if you have additional comments or recommendations that might be beneficial, attach supplementary material.

1.7 SOLICITED POSITION STATEMENTS

Aesthetics and Habitability Criteria Generation

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Habitability in the broadest definition is closely correlated with the recent concept of environmental aesthetics, or quality of life. Considerable attention has been focused on these more or less intangible aspects of the environment, partly because of a genuine concern by planners and decision-makers for their inclusion in policy statements and project planning and partly in response to the requirements spelled out in the National Environmental Policy Act (NEPA) of 1969. Regardless of the reasons behind the consideration of the less tangible aspects of the environment, the need for an improved understanding of their importance in planning is well accepted. Unfortunately the state of the art for the understanding of human needs and values as related to conditions in the environment is sorely lacking.

Attempts to consider aesthetics in environmental planning and impact assessment serve to illustrate the complexity of the problem. If we accept environmental planning to mean: the deliberate actions of man to control the use of the natural and man-built environment, aesthetics is considered in the context of the man-environment interaction. A definition of aesthetics is: that which is concerned with the characteristics of objects and of the human being perceiving them, making the objects pleasing or displeasing to the senses. This definition not only considers the characteristics of the environment (or aesthetic attributes) which man perceives through his senses but also accounts for the observer's state of mind in the psychological and social sense.

Unlike other scientific technical specialties, it is not adequate to describe aesthetics solely as an independent set of environmental attributes. Instead, aesthetic factors are best assessed as an integral part of a number of environmental attributes. In some cases, as in the physical sciences, aesthetics is used to describe a certain physical property, such as the chemical content of surface water as related to color or the particular composition of the atmosphere related to visibility. In other instances, aesthetics describes the way in which man interacts with particular environmental attributes, such as hunting or fishing in the area of ecology, or his use of open spaces for recreation and leisure activities in the area of land use. The term aesthetics is also used to describe certain conditions in the environment: noise and health science, where human tolerance levels have been established based solely on aesthetic criteria. Aesthetics, then, covers a broad spectrum of environmental concerns.

Regardless of the way aesthetics is considered, either quantified or qualified, it is essentially dependent on man's perception of the good and the bad. Therefore, it is difficult, if not impossible, for any one person to determine unquestionably the magnitude of the aesthetic impacts of project development. The cliche, "beauty is in the eyes of the beholder" applies likewise to aesthetics. It is therefore essential that aesthetic impacts identified for agency activities be evaluated as they pertain to the community involved. This can best be accomplished by establishing an interactive social policy between agency planners and surrounding communities.

The development of habitability criteria is similar in nature to that of assessing aesthetic impacts. A common understanding of the concept itself is needed along with some mechanism for obtaining reliable feedback from the subjects of concern--people. It is too great a task for the experts alone to solve without the valuable input from those affected.

Health As Affected By Shipboard Habitability

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As an activity of the Navy Bureau of Medicine and Surgery, the Naval Health Research Center is concerned primarily with scientific research involving the physical and mental health of naval personnel.

It has been recognized for many years that motivational problems, mental disorders, physical illnesses and accidents are a major drain on human resources. Medical research programs seek to reduce this loss by identifying causes and suggesting certain preventive or remedial measures.

Our present shipboard environment and health study was begun with a review of psychiatric admissions for all ships in the Navy. The results of examining these records was that while differences in incidence for types of ships were found, large differences were also found among ships of the same type. For example, destroyers of similar age and operation schedules might have large differences in the number of men hospitalized for psychiatric reasons.

In a special study involving six ships, we found that substantial differences in general illness rates could not be explained in terms of differences in operational schedules, crew composition, or illness reporting procedures; it was therefore hypothesized that a combination of environmental conditions or habitability and organizational or social context variables, as well as interactions among these factors, were involved in the variations in illness rates aboard the ships studied. We initiated a research project supported by the Navy Bureau of Medicine and Surgery and the Office of Naval Research to test the general proposition that illness and accident rates and job attitudes could be explained to some degree by differences in environmental and organizational characteristics of the ships. If conditions could be identified which were associated with high illness rates, appropriate corrective or preventive measures might then be suggested.

Presently, we are analyzing data gathered from some 20 Navy ships. Research data-gathering methods include questionnaires, interviews, rating forms and checklists, observational methods, ships' records, and personnel and medical information. Two sources of information pertain specifically to the evaluation of the habitability features of the ships. The Ship's Evaluation Form is used by trained research staff members to gather specific environmental characteristics of each of the ships in the study. The second major source of habitability information in the study is a questionnaire survey method. It included approximately 150 specific items for crew members to fill out. This procedure gives crew members' perceptions of the same spaces that were previously measured by trained research staff on such dimensions as crowding, cleanliness, temperature, noise, lighting, privacy, etc. One of our concerns is comparing the objective assessments of the environment, as provided by research staff ratings, with the perceptions of the crew members who actually use the spaces and how these relate to the criterion of illness.

The preliminary results of the analysis of our data make it clear that, as hypothesized, both physical properties of ships and individual perceptions of environmental characteristics contribute significantly to the prediction of illness criteria. Furthermore, the effects of each of these can be separated from the effects of individual personnel characteristics or social environment (organizational climate).

In summary, our definition of habitability is one that is concerned not only with the actual physical environment but with the perceived environment. It is our feeling that the perceived component needs to be considered in any definition of habitability since the research literature and our data seem to indicate that an individual's reaction to his environment is based on his perception of the environment.

ASTM and Habitability Criteria

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The question has been asked as to whether the American Society for Testing Materials (ASTM) has any interest or capability in writing habitability criteria. It might be misleading to answer this two-part question with either a direct "yes" or "no." Probably the best answer is that ASTM is interested in all writing of standards where a voluntary consensus procedure is deemed necessary or advisable.

Some facts and figures about ASTM's policies and activities may clarify this statement. It is true that ASTM is the largest producer of voluntary consensus standards in the world. Each year it publishes 47 volumes in its "book of standards," i.e. a total of over 5,000 standards. The subject matter ranges widely, varying from the earliest interest of ASTM in engineering materials to subjects such as meats, shoes, vacuum cleaners, product liability litigations, environmental acoustics, etc. There is no limit to the scope and subject matter of ASTM activity, provided a group of people have an interest in developing standards in a given area. The essential thing in ASTM is to recognize that it provides a mechanism for developing standards and for the development of voluntary consensuses, and that this mechanism is open to all who care to participate. The ASTM has no limitations as to subject matter; and activities are determined by the degree of voluntary participation that can be generated. If there is no interest, there is no activity.

The ASTM system is designed to achieve a consensus between the various interested parties in any given standard development. It is easy to define the opposing interests in the case of a basic material. On the one hand, we have the producer of the material; and on the other, we have the user or the consumer of the material, and those who have a general interest. In accordance with ASTM bylaws, the producer members of a committee developing a standard cannot exceed the general interest-user-consumer group. In addition, ASTM's regulations require that the chairman of the committee be from the nonproducer segment of the committee membership. Another regulation of vital importance to the ASTM concept of consensus is that any negative ballot must be reconsidered by the subcommittee and committee and reasons as to why the negative ballot is not considered persuasive by the committee must be made to the individual casting the ballot. The balloting of an ASTM standard occurs at three levels, the subcommittee, the main committee, and the Society at large.

With regard to ASTM's capability in the area of "habitability criteria": ASTM has no capability or expertise in any area; the capability or expertise lies in the membership of the ASTM committee. The older committees have been concerned with "hardware" standards, but some of our newer committees may be oriented more toward "software." For example, the E-40 Standard on Products Liability Litigation is breaking new ground in the ASTM. This committee grew out of the interest of a research team of lawyers and engineers at Carnegie Mellon Institute who were concerned with the lack of standards in this area of litigation. The type of subjects they expect to include in their activities are related to these questions: How long should quality control records of products be kept by a producer? What standard format should be used in presenting technical evidence to the judge and jury? What standard means of reporting tests are desirable? In other words, the standards produced by this committee will be essentially of a software nature. Thus, the activities that one might expect in the development of habitability standards might parallel to some degree the activities of E-40. It is interesting to note that people participating in the E-40 activity are lawyers for the plaintiff, attorneys for the defendants, engineers and others. The important thing to point out here is that people who ordinarily do not meet together in their professional societies are grouped under the ASTM system to develop mutually agreeable standards for these activities. It seems that developing habitability criteria for varied disciplines which normally are not in one organization, would be appropriate for the ASTM system.

Since I was not present at the meeting because of an unexpected request from the Building Research Advisory Board, I anticipated some possible questions. For example: How is an ASTM committee organized? If there is interest in a new subject area, the organizational matters are handled by the development department of ASTM and generally follow a two-step procedure. First, all interested parties are invited to an exploratory meeting. If sufficient interest to organize an activity is indicated an organizational meeting is held. The soope of work and the subcommittee structure are developed and the officers are selected. Then the committee begins its activities.

Such an activity on habitability criteria might be organized as a totally new committee. Or in the preliminary stages, it might be advisable to organize it as a subcommittee of an existing ASTM committee. One possible location would be in Committee E-6 on the Performance of Building Construction. Committee E-6 at the present time has two subcommittees which are somewhat more oriented toward software. One is concerned with "Definitions and Nomenclature of the Building Construction" and the other with "Modular Coordination for Building." The latter subcommittee is reworking the current American National Standards Institute (ANSI) standards for modular coordination, adjusting them for possible conversion to the metric measurement system. It is coordinating its activities with the National Metric Council for the day when the metric is implemented in this country.

In Summary. ASTM provides a mechanism for the development of standards. That mechanism is organized to guarantee that all interested parties have an opportunity to enter into the development of the standards. The only requirement is that there be a sufficient number of qualified individuals to contribute their efforts to the process of standards writing. The ASTM standards are developed by volunteers. The use of these standards is entirely voluntary unless some authoritative body chooses to desianate them as part of a legal requirement, such as a code.

Standardization of User Need Studies

On a slightly different subject, I would like to comment on the need for standardization in this area of concern of social scientists and designers. One of the beauties of using an ASTM standard method of test for buildings lies in the fact that the test of the materials, the structures, etc., can be done on a comparable basis throughout the country. Tests on concrete, for example, can be made in California or New York, according to an ASTM-designated test. The persons concerned can be sure that they are dealing with comparable systems of evaluation. On the other hand, although the social scientists have established techniques for making studies of individual response to building environments, I am not aware that they have established any standard test methods. It is my understanding that each time a study is made in this area a new questionnaire or survey form is designed by the investigators involved. Thus, to compare studies under widely different circumstances, we are not only handicapped by the fact that the subjects are different, but also by the fact that the precise method of study is not consistent throughout the country. It would seem useful to me if more standardization could enter into the process. How this might be accomplished is not clear, although social scientists have apparently standardized I.Q. measurements. Of course, it could be done under ASTM procedures, but it might also be done by a professional society of social scientists who are interested in this type of measure. This problem gets at the roots of some of the difficulties with the performance concept.

1.8 WORKSHOP PARTICIPANTS' REFLECTIONS

Habitability Criteria for Educational Facilities

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With a repetitive building type such as an educational facility, it would seem that a stock design solution would be appropriate. This is a direction that emerges periodically but there is no record of success for the so-called "stock plan." There is merit to exploring the possibilities of the "systems" approach to the actual building process, but this technical phase should not be confused with the more human aspect of planning the building function.

As the "Habitability" participants debated space planning criteria for Army service schools, the discussions returned time and again to the question of standards. The general resistance to standards was evident in remarks such as "We need open-ended standards;" or, "Design Guidelines are more sympathetic and easy to change."

On the other hand, no design professional should quarrel with owner requirements. This is the owner's prerogative. It is when requirements become rigid, with no justification in reference to space use, that trouble results. Too often, standards, even when set as minimum become maximum. Why should the Army build repetitive facility types when the users of these facilities vary greatly in their characteristics? In public education it is realized that a school community has diverse needs. This explains the pheonomenal growth of the movement for alternative schools.

There is, however, a definitie void in the "why" of space for education. The case of windows versus no windows in schools is a good example. There is really no hard information on which type is best because of the tremendous variance in any environment. The "open plan" school is a current example. Those of us who believe in some form of open plan cannot really answer the question if it makes a difference in learning. We believe the environment does have an effect but we have no real research to back our "seat of the pants" feeling. The behavioral scientist can be of great help in this area. Unfortunately, meaningful research is costly and is the reason more has not been done.

To this writer, a logical approach is:

1. Concentrate more on guidelines to help satisfy a stated goal.

2. Initiate a program of reevaluating the success of these guidelines.

3. Store this knowledge so that it is readily retrievable.

4. Arrive at a vocabulary understandable by diverse disciplines, to avoid confusion and suspicion.

5. Change with change and experience as quickly as possible to avoid continuation of past failures.

With this systematic approach to planning, we should satisfy the goal as implied and stated by Habitability.

Ranges of Criteria Specifications

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As far as the workshop session was concerned, the discussion tended to ramble and became confused with anecdotal material or jumped from one level of problem analysis to another, e.g., from the aims of service education related to strategic objectives to how big or small a counseling room should be. This is likely to happen if one is trying to keep in mind the ultimate objectives. One needs more time, more interpersonal acquaintance and knowledge of shared assumptions for a successful workshop session on our topic.

It seems to me that if one is to base the design of buildings on the satisfaction of human needs, one must be clear about the criterion used. For some purposes performance criteria are useful. For others, physiological, behavioral, or purely psychological criteria are employed. Nor does this exclude multicriteria, so that a design is related to more than one of these. After all, most successful buildings achieve success in satisfying requirements judged by more than one criterion. Doesn't this go back to Henry Wootton's classical definition of "firmness, commodity, and delight" as the criteria of good architecture?

I have always felt that the criteria which are used to frame a specification will tend to range from the hardest--performance, hygiene, cost--to the softest: user satisfaction expressed verbally, according to the extent to which one can identify the precise purpose of a building. The narrower and more easily defined, the harder the criteria. When you get to something like a family dwelling, it is difficult to be sure of its exact purpose. It is also difficult to narrowly define criteria in this way. Sub-criteria have to be related to the overall criterion of family satisfaction.

I wonder why we have never performed a factor analysis by the principal components of user satisfaction to identify and weight the criteria? This should not be difficult to achieve, if a subject were asked what they like or dislike about their home. If the answers are classified into criteria groups (performance, cost, convenience, hygiene, etc.) and related to overall satisfaction rating, then the principal components will appear. The correlation between the first component and its component items generates the regression weights for the components. We then know (if the procedure works!): What criteria people use to judge a home by; and what the criteria consist of and in what proportion; whether there is a consensus; and if not, whether there are systematic group variances. I am merely sketching out how a social scientist might try to select criteria for building types. Of course, any architect would know this from experience.

Assuming that we have our criteria, we can then either try to measure how a building (or a design) performs in terms of them, or alternatively try to establish performance levels and design according to them. When we have a correlative continuum--e.g., between temperature and work efficiency, or noise level and speech comprehension, or space and feelings or satisfaction (three criteria types)--we can then mark some minimum point along the criterion dimensions. This is now a standard. It may not be a legal or mandatory requirement, it can be merely a strong recommendation, but it is still a standard.

The next thing is to figure costs. To reach any particular standard (i.e., of temperature, quietness, space) there will be a building cost per m^2, bracketed according to different construction methods, plus costs of maintenance and repair. One can then correlate an overall cost for the building, to achieve certain standards. The architect is free to decide how he will achieve this. The specification of performance for items, components, systems is left free, using "deemed-to-satisfy" rather than a spelled-out specification. The technique of the cost yardstick, using "deemed-to-satisfy" specifications is really the essence of performance-based design. One cannot really begin performance-based design with fixed, nonperformance specifications (i.e., like the old European daylighting rule: fenestration must not be less than 20 percent of floor area). Of course, I am using "performance" here in relation to building components, not of the building as a total facility. I have explained, performance may be the criterion as contrasted with satisfaction or cost or adaptability.

Thus, it may be useful to regard criteria as "human-oriented" and standards as "hardware-oriented." The criteria are the dimensions on which we choose to gauge the standards. The dimensions are the categorization of the user's requirements and the hardware, the means by which requirements are satisfied.

As I think back to the discussion in the workshop it seems to me that many of the contributions could have been fitted into an algorithm. Some contributions suggested important criteria for service schools, others indicated what standards should be laid down. Perhaps the tape recordings will provide the basis for a structured content analysis.

One alternative is clear: either one accepts ready-made sets of standards and designs, or one rejects them in favor of empirical, performance-based standards. If the latter is the case, then habitability criteria must be developed. What seems pointless is to decide in favor of the latter and then get bogged down in a methdological dispute about whether these should be explored and selected by behavioral or attitudinal research, while looking over your shoulder to the ready-made standards as a guide!

Lessons from Spaceflight Habitability

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Even before the first man orbited the earth, there was a question as to how long man could dwell in space. It was recognized that truly effective exploration and exploitation of this new environment would likely involve voyages of unprecedented duration. The first question, perhaps, involved systems: propulsion systems, data and guidance systems, life support systems. Could these be built with the requisite reliability or redundancy? With this question answered in the affirmative, the next concern centered upon man's physiological tolerance of the space environment. Would certain deleterious trends, observed in short-duration flight continue linearly with time until astronauts were totally disabled, or would these trends level out at some point? Could a program of exercise compensate for deterioration? Now, Skylab has put this concern to rest. But the question of duration has not been fully answered.

We now have the technical ability to sustain life in space, and we know that man can physiologically adapt to, and survive in, the weightless environment, but there is still no assurance that we possess the know-how to build a microenvironment which is truly habitable. Although we've been concerned with this issue for some time we're still not sure what habitability [illegible] or how it might best be measured; let alone, from a design standpoint, how it can be promoted. With these fundamental questions in mind, I found the topic of the criteria generation processes most interesting.

As the title of our session "Processes for the Generation of Habitability Criteria" suggested, our goal was to examine not habitability directly, not even habitability criteria, but possible processes whereby habitability criteria might be developed. How could we go about devising the standards by which executed designs could be judged? At first, I felt we never quite considered this main question. There were two reasons why I felt this way:

1. Before one can discuss criteria generation processes, one should have a clear idea of what the criteria are meant to measure. There was no consensus as to the nature of habitability--at least not a sharp enough understanding to permit operationalization and measurement.

2. Both behavioral and design professionals appeared to question the need for, or even the desirability of, prespecified criteria. Perhaps this resistance relates to the fear that criteria, once adopted might stifle innovation.

These side topics were useful. Perhaps they did not entirely obscure the main theme of the session.

One of the more useful threads which ran through the discussion and which bore some relevance to the initial issue, was the notion that the design and building process should be viewed as basically experimental.

An owner or administrator observes that certain aspects of an existing environment are disfunctional. He is fairly explicit about the nature of the disfunction (too crowded, too much unrest, poor company image, few reenlistments, etc.), and he calls upon an architect to correct the identified shortcomings. The designer has certain theories as to why the existing environment isn't working. He also has some ideas as to how he might make some improvements--ideas which are eventually translated into a new space. This usually marks the completion of the transaction between client and designer. It is suggested, however, that the designer's ideas are really hypotheses--testable hypotheses--about man-environment interactions.

During our session there was some concern about counseling facilities provided by the Army in training centers. Use of these facilities evidently carried some stigma. Perhaps the facilities would be better frequented if they were located more privately, so that fewer noncoms and peers could observe a GI entering and leaving. In all this discussion, it was clear that the underlying concern was usage of the facility. The Army's concern was that, for whatever reason, few soldiers were using the counseling facilities. This ia a clear problem with clear measures for design success, and an example of the experimental nature of design process.

Other valuable insights were those offered by T. A. Davis and Ed Wortz whose papers are included in this volume. Davis' seven "links" have all seen application in various forms within NASA; and Dr. Wortz habitability criteria had their first application in the joint Tektite II program of NASA and the Department of the Interior. His various measures were also applied to NASA-sponsored simulations at the University of Alabama and to an in-house simulation project, Concept Verification Testing. I think that his measures could be more broadly applied to the assessment of many different kinds of environments.

In summary, our discussions frequently strayed from the intended main point of the session. But the deviations were fruitful, and because of them, processes for generating habitability criteria were considered more thoroughly than they might have been otherwise.

2 COMMUNICATION OF HABITABILITY CRITERIA

2.0 PURPOSE AND OVERVIEW

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The purpose of the sessions on communication of habitability criteria was to identify and discuss problems associated with transmitting information on human requirements, user needs, and similar aspects in building planning, programming and design procedures.

There are many types of problems in communicating habitability criteria. Behavioral scientists and architects must be able to speak the same language and this is a typical interdisciplinary problem. Architects and building owners must have a thorough understanding of the organization and operations of the building's occupants. Architects must be completely briefed on the requirements or objectives of building owners. Designers and planners must know what is required or specified by regulating agencies or special interest groups.

Habitability information must be expressed in formats which architects can deal with. Habitability information must be organized to bear upon each of the decisions in the building design and delivery process. As the organizations owners, occupants and regulatory groups grow in size, each aspect of communication is complicated by fragmentation of decision-making and inaccessibility of appropriate information for each decision. Architects and planners must be able to present to a client a clear understanding of the proposed solution in order to obtain useful feedback. Many of these problems and their solutions were discussed in the sessions.

Several methods for documenting and communicating habitability criteria were presented, each method emanating from a different institutional or bureaucratic context. In Performance Specifications for Office Buildings (PBS)[1] performance specifications (presentation by Robert Wehrli of the National Bureau of Standards), criteria are written in measurable terms (tests) and respond to specific objectives (called requirements in PBS) which are to be achieved. This makes the language more precise for anyone who deals with the information, and permits flexibility in solutions generated by designers. The PBS has added a fourth category, called commentary, to explain the rationale for criteria.

As an information-gathering and disseminating agency, HEW's Office on Aging (presentation by Jessie Gertman) has attempted to disseminate design information on the aged population in a variety of forms--journal articles, pamphlets, etc. The burden of finding and including this information in design rests largely with the designer. Out of his own interest in quality, he must search for this information and structure it to the decisions in his design procedures.

One of the most complex institutional building delivery processes is that of the

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[1]D. B. Hattis, and T. E. Ware, <u>Performance Specifications for Office Buildings</u>, U.S. Department of Commerce, National Bureau of Standards, Report 10527, Washington, D.C., January 1971.

Corps of Engineers in the U. S. Army. This construction agency's responsibilities are highly structured, resulting in voluminous documentation for criteria as well as procedures. With the goal of incorporating all pertinent design information and regulations for a facility type into a single volume, the Army has begun to develop "Space Utilization and Design Guides" for repetitive building types (presentation by Richard Cramer). In addition, as a means for getting local client or user requirements recorded for various decisions in the design process, a document called a "Project Development Brochure I" is being developed and tested.

The National Clearinghouse for Criminal Justice Planning and Architecture has developed procedures for collecting building owner and occupant data and for combining these with the Guidelines for the Planning and Design of Regional and Community Correctional Centers for Adults. In order to deal with a variety of bureaucratic and institutional organizations (as explained by Fred Moyer), consultants are sent out to help these organizations and their architects interpret both procedural and substantive information in the Guidelines to fit a local situation.

Practicing architects have attempted to overcome some of the communication problems related to habitability information or user requirements. The experiences which several architects had with a variety of institutions were reported informally in the sessions. These attempts at communicating user requirements are typified in the presentations of Roderick Robbie. He also suggests a structure and content for guidelines on habitability as a solution to communication problems.

Below (in no particular order of importance) are some salient conclusions about communicating habitability criteria which emerged from discussions.

1. Architects prefer to work with information presented in graphical form, rather than verbal or statistical.

2. Habitability information cannot be stated in the form of criteria alone but must be accompanied by problem statements or objectives.

3. Criteria must be specified as ranges rather than fixed values. Architects need to know how flexible the criteria are in making design trade-offs.

4. Criteria need to be modified in light of new data and must respond to changing societal values.

5. Habitability information and criteria must be organized to suit each point in the building programming and design process. Conceptual information is needed early in the process; highly detailed information is needed later in the process.

6. A fragmented approach to disseminating criteria information is not very effective. Architects work under time constraints which do not permit extensive searches for habitability information.

7. In order to facilitate interdisciplinary communication standardized use of terms and an information system or data base for access to habitability information is needed. Validity and reliability of data must be known. Clear statements of relationships between human response and physical environment are important.

8. Criteria must be written so that they are measurable, i.e., so that it can be determined whether a solution has achieved the intended objectives.

9. Criteria must respond to local conditions. Statements of design problems need to be expressed in terms of response to local conditions.

2.1 FORMATS AND PROBLEMS FOR THE COMMUNICATION OF USER-ORIENTED DESIGN CRITERIA

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General Introduction

The symposium was concerned with the problem of making man-built accommodations provided by very large U.S. Government Departments as sensitive as possible to the needs of individual users.

These agencies of Government drew the symposium's attention to the substantial difficulties of managing large and diverse construction programs efficiently, while at the same time trying to be responsive to the needs of individual users as perceived by those users.

The symposium tended to turn into a discussion of the role of behavioral scientists in the building design and delivery process, and of the decision-making territorial prerogatives of project architects and their behavioral consultants.

In retrospect, I believe that as a result of this focus on the professional territories of architects and behavioral scientists, the symposium drifted away from its objective of proposing a means by which large Government agencies could make their building programs more sensitive to the habitability requirements of the individual user.

A discussion of a systems approach to the facilities built by large public agencies would have insured a balanced consideration of all the factors bringing about such facilities, including all the human factors and the practical building, bureaucratic management and political considerations which form the key ingredients of public building programs.

I had been asked to speak at the symposium on the topic FORMATS AND PROBLEMS FOR THE COMMUNICATION OF USER-ORIENTED DESIGN CRITERIA. My address was divided into two parts. The first part was a prepared statement on the historical and spiritual aspects of the user effectiveness of buildings. This statement is reproduced in the form in which it was given at the symposium.

I followed this with an ad-lib review of the projects with which my partners and I had been concerned since 1958, for which behavioral scientific consultation was sought, or which involved the analysis of user requirements.

As in all cases, this user requirement analysis formed part of a systems approach to problem-solving (although the approach was not so identified in the early projects). I have chosen in this written record of my participation in the symposium to record the highlights of the wider systems format which was adopted for each of the projects reviewed.

I conclude this chapter with the "guidelines" proposals I made at the morning session on September 24. The form in which they were presented represented my "quick and dirty" findings of a systems approach to the symposium. Seeking, as a result, to balance the much stated user interests of the symposium and what I believed were the more or less unstated bureaucratic realities of putting any user-sensitive requirements into practice.

Part 1: Some Gross Influences on the Effective Use of User Requirement Specifications

User-oriented design criteria, like user requirements specifications, are fancy ways of saying what a building should be like, if it is to house some definable activities. As members of the human species, we have been using such criteria in various ways since the beginning of time, whenever a need to build arose.

With various interpretations of theism forming the active core of all cultures until, perhaps the last 100 to 150 years, all buildings to varying extents had religious purposes or conveyed associated meanings.

Building for milennia had been a consecrated act. Buildings as a result--until recent decades--have enjoyed a slightly mystical and spiritual status. Buildings as a consequence, throughout history, until the comparatively recent death of God and of gods, had both spiritual and functional content and significance.

In the past, to make a building suitable for the housing of human activities, was simply a matter of making it pleasing to God, or the gods. Society proceeded on the infallible principle that a building which was acceptable to God was more than adequate for man.

The absolute homogeneity of social-spiritual belief in the past made it possible for every builder and every building user to enjoy accord in an instinctively common knowledge of what was right and what was wrong in building. In such a context of common spiritual beliefs it was necessary only to describe the environmental requirements of buildings in the vaguest of qualitative spiritual terms, together with the general dimensions and constructional requirements of a project, to establish the criteria for the design process to begin.

Project cost was usually a vague and relatively unimportant matter. Functional and user performance--individualized to specific users--was the key design consideration within the generalized spiritual context already mentioned. Building user requirements so defined, automatically drew their credibility and useability from widely-held spiritual, moral, and emotional views.

Parallel to reliance of our ancestors on deities to guide their lives, they also had, by the 17th century, a growing concern for the achievement of individual rights and freedoms for everyone.

This concern had found a significant and early expression in the signing of Magna Carta, by King John of England in 1215 at Runnymede. Magna Carta placed restraints on the arbitrary use of powers by the King against his baronial subjects, and thereby initiated reestablishment of the basic tenets of democratic government which had been largely lost since the end of the classical Greek civilization. The Parliamentary Writ of 1679 established Habeas Corpus as the cornerstone of individual legal and social rights. It was through this act of the British Parliament of 1679 and its predecessor of 1614 that the British established the universal concept of the inalienable right of personal freedom, which was extended to the inalienable right of property, particularly that of home and other man-built property. It gave rise to the saying: "The Englishman's home is his castle."

This concept of habeas corpus was brought from Britain by the early settlers of North America and became one of the principles upon which the United States of America was founded. By the 17th century, in Britain, a fusion had been established between the spiritual aspects of life and the rights of individuals to enjoy a private life without external interference from the state or social leaders. It is a fact of history that this ideal was never wholly achieved. However, it was achieved to a sufficient degree in the matter of the power of an individual to have self-determination over his dwelling in order to establish a stable, emotional, spiritual and intellectual heart to British society during the 17th and 18th centuries.

I believe that the innate belief of the individual of this period, of his primal rights and feeling of territoriality over his dwelling, gave to the individual a tranquility and belief in self, and a consequent optimism about life. In part, this widely held uncompromised sense of sovereignty, enjoyed by everyone, may have enabled British and Americans to weather the human abuses of the Industrial Revolution, without significant social breakdown. A by-product of the Industrial Revolution, and its associated increase in population, was the institutionalization of society. With institutionalization came the beginning of the erosion of individual identity.

To this basic 19th century institutionalization of society, the 20th century added a massive dose of applied science and para-scientific techniques. The primary effect, if not objective, was to quantify life on a cost-optimization basis. The result has been largely to destroy a sense of self-consciousness for many people and to destroy their belief in rights and freedoms. Primary among these losses has been the personal sense of self-determination in man-built accommodations. The institutionalization of social life has in effect disenfranchised individual life.

Reviewing for a moment these 19th and 20th century events, we see that with the advent of the effective mass harnassing of artificial energy about 200 years ago, the perennial human fear of physical extinction, through starvation and exposure to the weather or animal or to human predators, ceased to be the primary concern. In a sense, our remote ancestors had invented God and the gods to hold the unknowns of the natural world and daily life, sufficiently at bay to permit them to remain mentally and physically functional. In a very real way, the harnessing of mass artificial energy killed God and the gods, by cutting down to seemingly manageable proportions the threat of nature to human survival.

Getting rid of God downgraded the influence of the spiritual content of life and left our predecessors with the direct responsibility of finding an alternative to the pleasing of God as a means of solving most problems. We replaced religious superstition in solving the problems of daily life with what we call the scientific method. This new belief in the scientific method, was and is used with the same blindness as was its religious predecessor. It was applied first to those activities which bore directly on our creature comfort: nourishment, movement and communication and, finally, to building.

The application of science to the production of food, the conveyance of water and sewage, the lifting and moving of heavy loads, the facilitation of communication and the provision of clothing, helped to unburden personal loads and gave to everyone the potential opportunity to pursue a personal course towards civilization. During the first 150 years of the era of artificial energy, a union existed between an evolving science-based culture and a generally superstition-based man-built environment.

Apart from the large pockets of rank squalor which existed in the principal industrial cities, buildings, particularly houses provided a direct lineal connection for everyone holding to the values of the superstitious past. Building was real in ancient human terms and had an intrinsic aura of absolute security, stability and reliability. Everything else in life was moving and changing out of all recognition, but building was standing still like an ancient and reliable rock. The advent of the modern movement in architecture at the turn of this century, with its advocacy of the notion that to directly express building science was synonymous with architecture or the emotional and sensuous environmental housing of life, started the process of undermining the social-spiritual stability of building as the mystical shelter of human life.

The tripartite interaction between this scientific--fundamentalist--architectural theory, commercial cost-optimization and the rapid growth of the industrialization of all commodity manufacturing, killed the spiritual and mystical content in building. Building stopped being the architectural housing of life and live processes and became functionally efficient. The 19th and 20th century institutionalization of social processes was the primary means of practically wiping out in a little less than a century a commonly understood individual sense of place, which had existed since the beginning of time.

The final seal of death to the intangible qualitites of building was applied in the 1960's, when scientific programming, planning and performance-quantifying techniques, developed as a means of designing weapons systems.

In no small measure, we are, perhaps, here today to examine the proposition that programming techniques developed to produce efficient means of mass killing are possibly not wholly appropriate to defining and translating into practice the physical requirements for mass living.

Techniques for mass killing require the highest levels of efficiency in short-term, one-time performance, where the conditions of application can be defined with considerable clarity. Housing of life processes on the other hand means acceptance of a long term of indefinable and unpredictable changes, where, because survival is not threatened, monetary resources will be meagre. Because of the extreme precision and short duration of weapons processes, it is often necessary to subjugate the freedom of self-determination of weapons system operators to the requirements of those systems. Such man-machine interface situations are well suited to analysis and design, using the scientific method. Even so, the resulting pieces of hardware usually cost millions of dollars.

If we apply the same techniques to the design of an elementary school and accept the fact that the students and teachers cannot be preprogrammed, it is probable that the design development and construction cost of a single 700-place school would exceed the Gross National Product of the United States and perhaps that of all industrial nations.

I believe that a sole dependency on science-based methods of describing user requirements makes the fallacious assumption that any society can afford the cost and time to define and quantify life. This, of course, assumes that we know what life is. With a lack of such resources, the inevitable result is to try to tailor life processes to fit scientific findings.

With institutions gaining influence over the man-built environment it is perhaps necessary that they take steps to modify the negative effects of their presence on the life of individuals. Some points to consider are:

(a) Accepting the fact that the user has a higher right of place in any given building than the institution which owns it.

(b) Most institutions might be usefully severed or at least radically restructured to enable their construction arms to respond in a direct and sensitive way to local users. Where a centralized institutional structure exists, operational concern tends to be towards the politics of personal promotions rather than for the championing of local user interests.

(c) User requirement studies should involve actual users in their formulation, and be carried out using techniques, terminology and methods of presentation which lay persons can understand.

(d) User needs should be given primary consideration over financial considerations in all institutional programs as a means of restoring environmental social awareness.

(e) The consideration of the man-built environment should cease to be a debate between cost-optimization and cost-benefit but be one of effort-optimization versus effort-benefit, on the premise that the achievement of beneficial environments usually involves much effort.

Part 2: A Statement of Experience in Programming for Habitability

Design and the Systems Approach to Building and Building Systems

The systems concept in building is still relatively new, and under active development. Each group working the field has its own approach to the generalized concept. I have chosen to describe my own experience and that of my partners at Robbie/Williams Partnership, Architect and Planners, Toronto (formerly Robbie, Vaughan & Williams) and at Environment Systems International Inc. (ESI) of Albany, Boston and Toronto, as one group's means of introducing the concept of cost-benefits in building, and views of the place and means of introducing industrialized building.

Introduction

In the new jargon of building, much confusion exists over the meaning of the terms "the systems approach to building" and "building systems."

The term "the systems approach to building" describes a means of comprehending and managing on a cost-benefit or effort-benefit basis any building program or project from its origin to its completion, in any political, cultural, social or economic milieu.

"Building system" is a set of parts from which a complete building, including mechanical and electrical services, can be constructed.

Building systems may be closed or open. In a closed system, there is only one choice of components to meet each building function. Components from a different manufacturing source will not fit. An open building system can use products of many manufacturing origins and designs to serve a given function. (See Fig. 1.)

Most European industrialized building systems and their North American licensed derivatives are closed building systems. Most indigenous North American building systems are of the open type. When a specific selection of sub-systems is made from an open system the system is closed around this selection. The system from which the building is built is a closed-open building system.

A closed building system tends to be marketed as a complete building system from a single marketing source. The organization and execution of specific projects are relatively simple, being under the control of a single proprietorship. Because the whole building system is proprietory, marketing requires the acquisition of a series of whole building projects. The exercise of proprietory control tends to lead to the establishment of plants for the specific manufacture of each closed system. The method is well suited to a country having centralized, government-controlled purchasing, as in Russia. It is badly suited to free market economies such as are found in Canada and the United States.

In fact, in a rough way the effectiveness of the closed systems approach to industrialized building shows a pattern of deterioration, moving west from Russia, through Europe to the United States. Closed building systems give a minimum of real planning or design choice and have tended to show optimum performance when concrete is the prime material. Open building systems offer real planning and design choice.

An open building system is conceived as a series of sub-systems of diverse manufacturing origin--a number of manufacturers offering their own interpretation of each sub-system's performance requirements. Because of this diverse manufacturing origin, the problem of sub-system interfacing is critical to the cost, quality, assembly and performance of any closed-open system choice. The planning, programming and management of projects becomes critical to insure the proper performance of any specific closed-open system. The open systems approach requires more building professionals and more investment in the building phases of a project. It requires a greater diversity and sophistication of skill. It also requires the rationalization of building regulations, building contracting and labor practices. Unlike closed systems, the method does not require high in-plant capital investment which must be retired over the systems projects secured. Sub-system products can be sold into systems and conventional projects. The open systems approach can be tailored to the specific needs of individual projects.

I do not believe there is a significant future for the widespread application of closed building systems in North America, except in the area of single family dwellings and low-rise, low-to-medium density dwellings. For these building types, there is a future in an industrialized continuation of traditional wood and metal stud and joist construction.

With this view of the commonly accepted closed form of industralized building, I

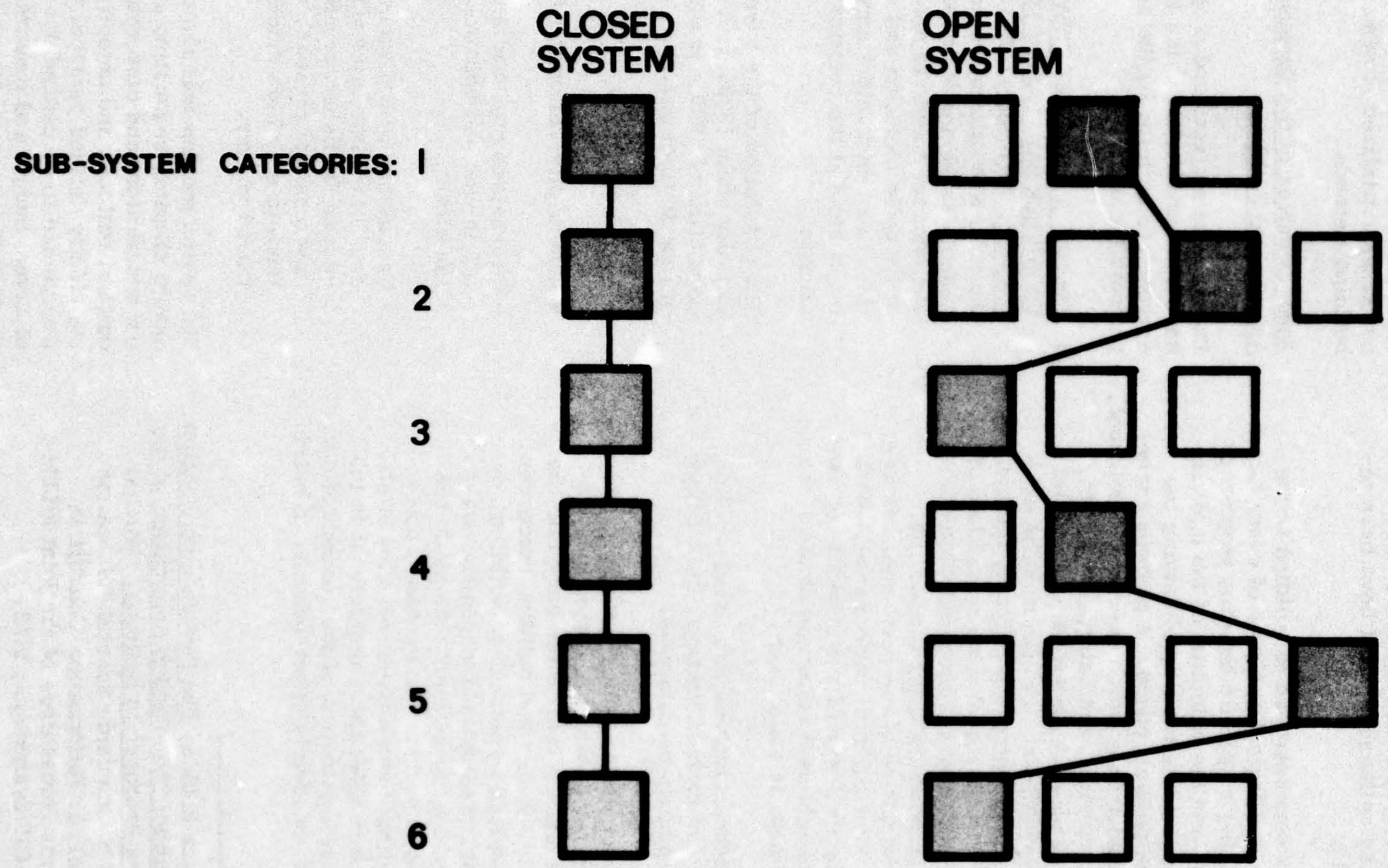

Fig. 1 Open Building System

have focused the rest of this paper on a review of the systems approach to building and the application of open building systems and the systems approach on projects for which my colleagues and I have been responsible.

The systems approach to building is the orderly and logical analysis of every factor influencing a specific building program or project, and the selection of the most rational and sensitive way of solving the building problem posed. A program analysis is undertaken which defines the political, social, cultural, regulatory, economic, business, market, labor, environmental and local influences which must be considered in defining and anlyzing the problem.[1] From this analysis, a schedule of user requirements is prepared which defines the building's accommodation, the interrelation of the parts and their required environmental performance. With the program analysis and schedule of user requirements as a statement of the problem, the solution is undertaken.

The process involves three stages: The design and project strategy, the building design and its construction.

After the building is complete and operating, its performance is periodically reviewed and the results fed back into the analysis, design and building processes. In the systems approach to building, the thinking, creating and managing aspects usually take up as much time as do the building aspects. The systems approach to building takes a balanced view of all the factors affecting a project. It is the practical application of the concept of cost-benefit, or ideally effort-benefit, to building.

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[1]Roderick Robbie, <u>The Performance Concept in Building: The Working Application of the Systems Approach to Building</u>, National Bureau of Standards Special Publication 361, Vol. 1, Performance Concept in Buildings Proceedings of the Joint RILEM-ASTM-CIB Symposium, 1972.

The building method used under the systems approach to the construction of a specific project may be of any type. The systems approach to building does not imply the use of industrialized or semi-industrialized building methods.

<u>Some Examples of the Systems Approach to Building</u>

Examples of projects and programs which have been undertaken using the systems approach to building by the author and his partners include:

1. <u>Fig. 2. A PROPOSED NEW TOWN FOR FROBISHER BAY, BAFFIN ISLAND, NWT, 1958-62</u>. Architects: Ashworth, Robbie, Vaughan & Williams; Peter Dickinson Associates; Rounthwaite and Fairfield. The concept sought to resolve problems of living in isolation and social friction; fire, mechanical servicing, operating costs and the creation of a micro-climate.

   The population of the town was small, initially about 1800, with an ultimate population of 5000. It was comprised of four distinct groups:

   - Nomadic Eskimos
   - Industrially-culturized Eskimos
   - Caucasians of Canadian and European origin who had vocations related to the arctic.
   - Caucasians of Canadian, American and European origins who had been sent to Frobisher for military or governmental reasons, or who were there to earn high income in a short period of time.

The design problem was the conflict of severe climate, suggesting extreme building compaction; and disparate social and cultural outlooks and objectives, suggesting clearly defined personal territories. Design had to be carried out in a context of severe budget and time restrictions and the logistical constraint of delivery of heavy materials to the site for only one week per year.

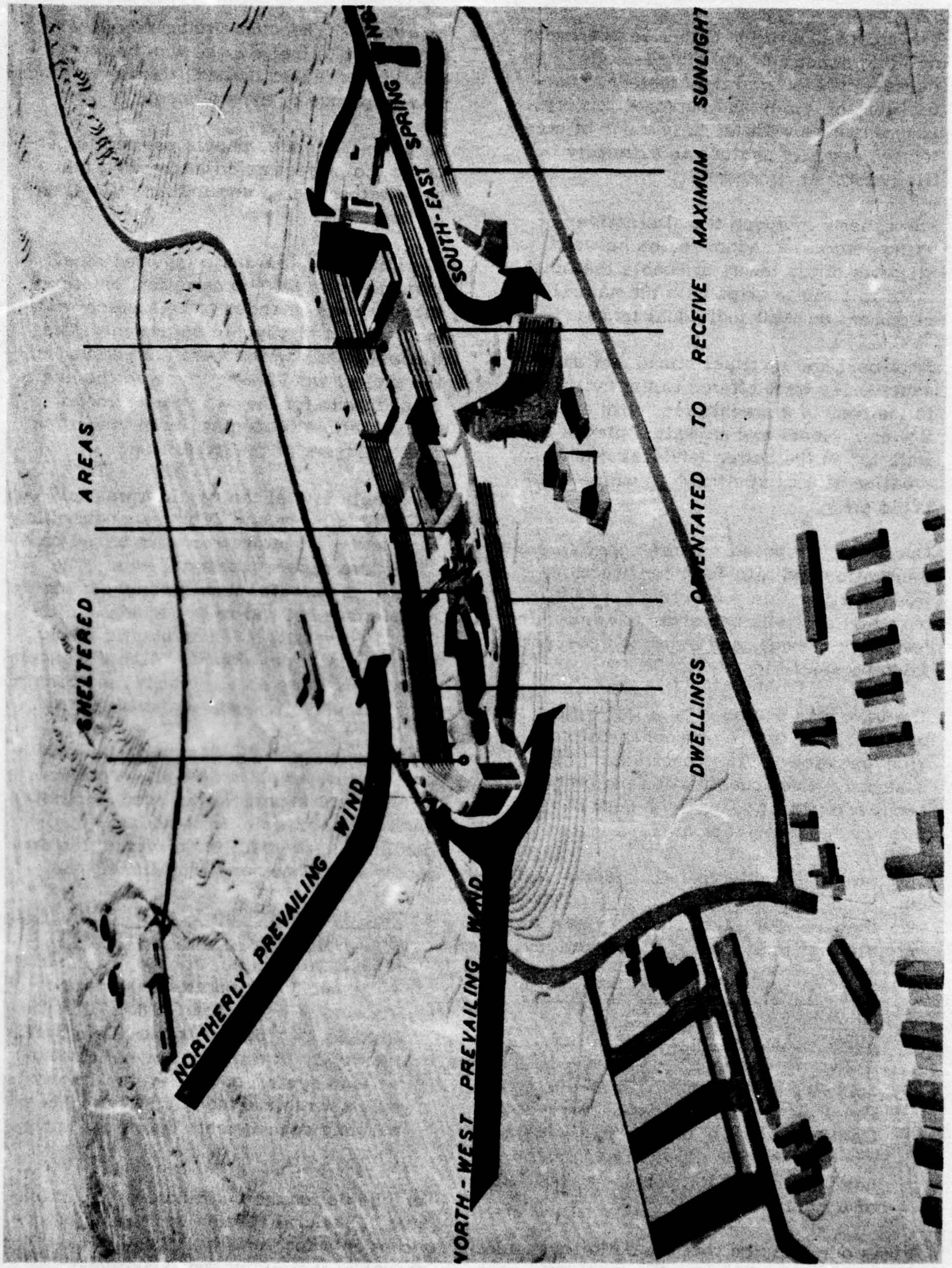


Fig. 2 A Proposed New Town for Frobisher Bay, Baffin Island, NWT, 1958-62

The proposed medium high-rise apartment building scheme of the single-loaded corridor type offered the greatest opportunities for family and personal privacy, commensurate with the provisions of collective security against an extremely hostile natural environment.

The scheme included the alternatives of using outdoor or indoor routes between all parts of the town, to enable the inhabitants to come to grips with the natural environment on their individual terms.

Emotional and spiritual stimulants and sanctuaries were offered to the inhabitants in the form of a greenhouse, with exotic flowers, plants and animals; "places to walk to" in the barren landscape; and creation of a microclimate in which trees could grow.

Our design proposed on-site concrete prefabrication and slip-form construction, free growth within a coherent concept, based on shipping two sizes of reinforcing bar, bulk cement, and building accessories from the south.

The town was designed on a fail-safe basis in case of fire or mechanical service breakdown. The construction method assumed a total construction period of about two years, using a 24-hour day through the daylight months.

The town site was prepared, the hospital and power plant built, but then the project was abandoned in favor of piece-meal development of individual social functions.

2. <u>Figs. 3 and 4. THE CANADIAN GOVERNMENT PAVILION EXPO '67, MONTREAL, 1963-67</u>. Architects: Ashworth, Robbie, Vaughan & Williams; Schoeler & Barkham; Z. M. Stankiewicz. The project was required to represent Canada's unity in diversity, the vastness of its land and the problems of handling 25 million people in a period of 6 months.

It was our decision that the building should give the user and visitor free choice to enter or leave the exhibit at any stage in its sequence, and be light and airy in character. Under no circumstances was the visitor to feel that he was being "processed" or "brainwashed" through a mandatory sequence of experiences.

As a consequence, people seemed to perceive the project as an interesting place to be rather than a demanding cultural experience.

The Katimavik (the large inverted steel pyramid--the Eskimo name for "meeting place"--was intended to be a place with many levels of psychic enjoyment. The highest levels which were not pursued in the project would have involved the use of TV and radio for the two years prior to the exhibition's opening, with visual and audio triggers at the exhibition.

The whole site of the pavilion was laid out on 72'0" primary and 24'0" secondary planning grids; all structures were based on a 30-degree square pyramidal form. The pyramidal form was used to suggest the mosaic cultural nature of Canada and its unity in diversity. A new plastic fabric was specially developed. With the exception of the large steel pyramid, all construction was very elementary and temporary.

Many behavioral and design skills were used in the project's design. A project management approach was used, which was partially successful in the design stages and fully successful in delivering the project within money and time limitations.

3. <u>Fig. 5. PROPOSED DESIGN FOR SENECA COLLEGE, NORTH YORK, TORONTO, 1968</u>. Architects: Robbie, Vaughan & Williams; John Andrews Associates; Mathers & Haldenby; Gordon Adamson Associates. Sought to provide a building policy in which a new community college system could develop its curriculum while making minimum permanent building commitments during its early years.

As a basis for the building design, extensive behavioral studies were made on environments for working, learning and casual associations and their respective group sizes.

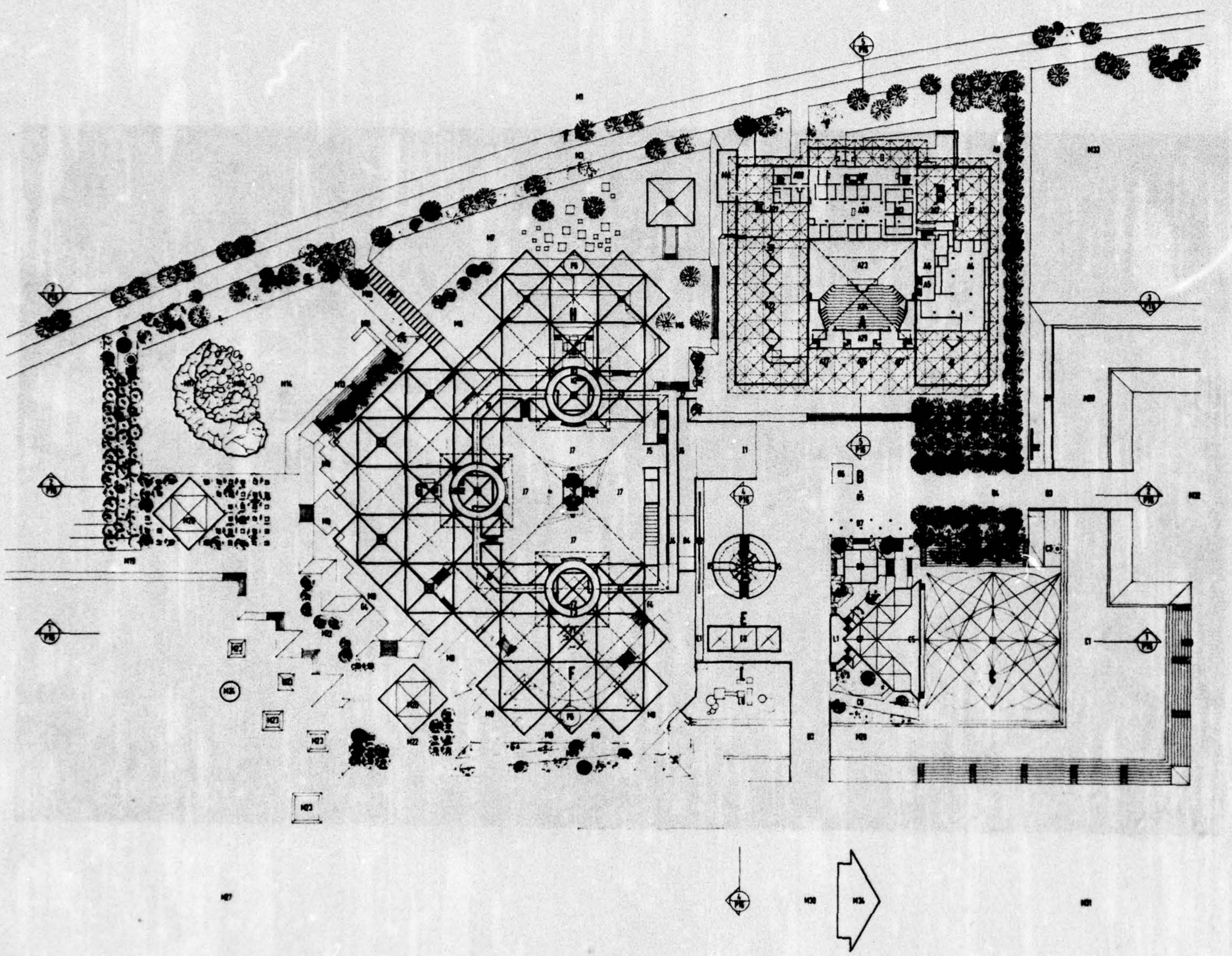
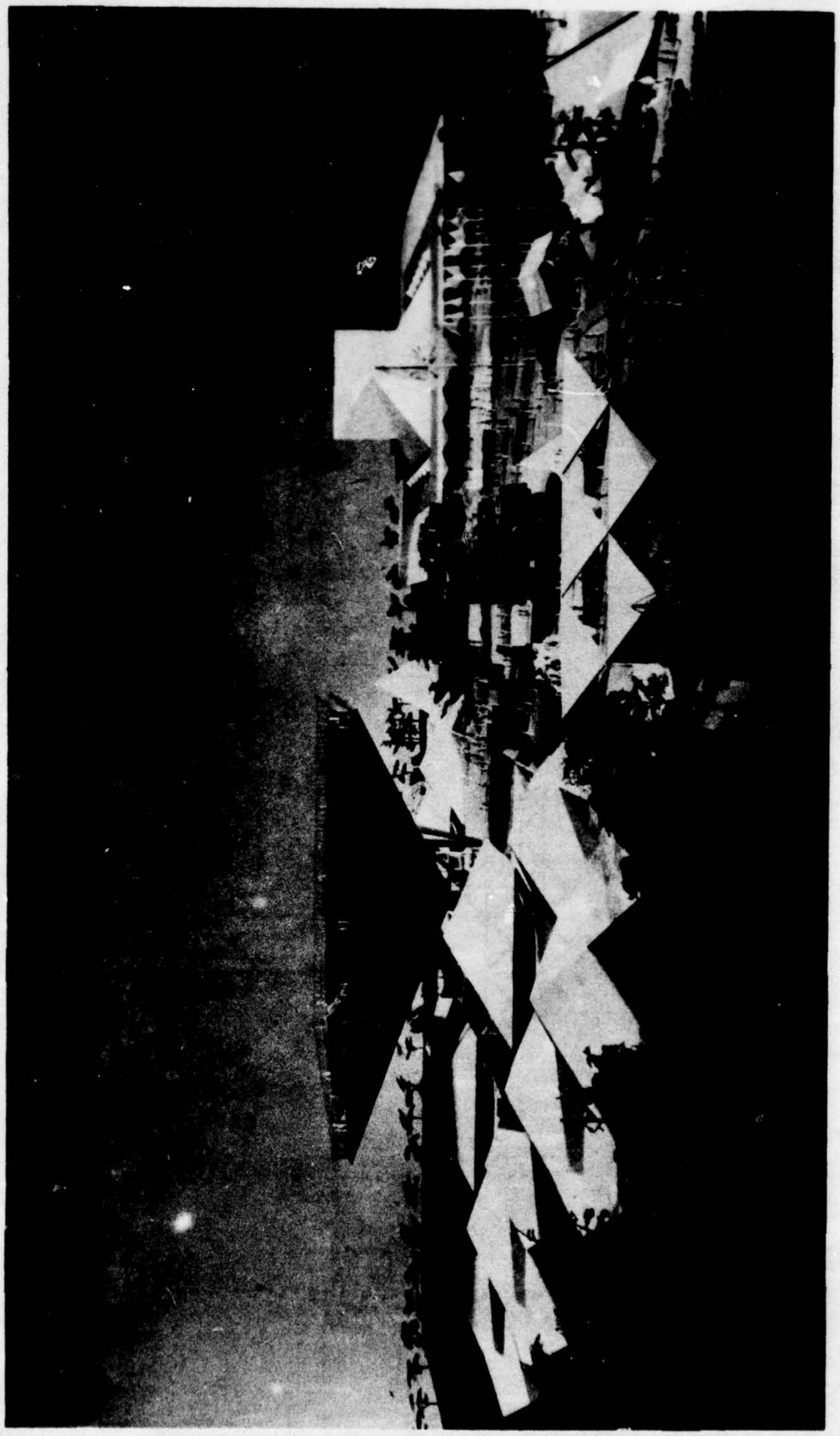


Fig. 3 The Canadian Government Pavillion EXPO '67, Montreal, 1963-67



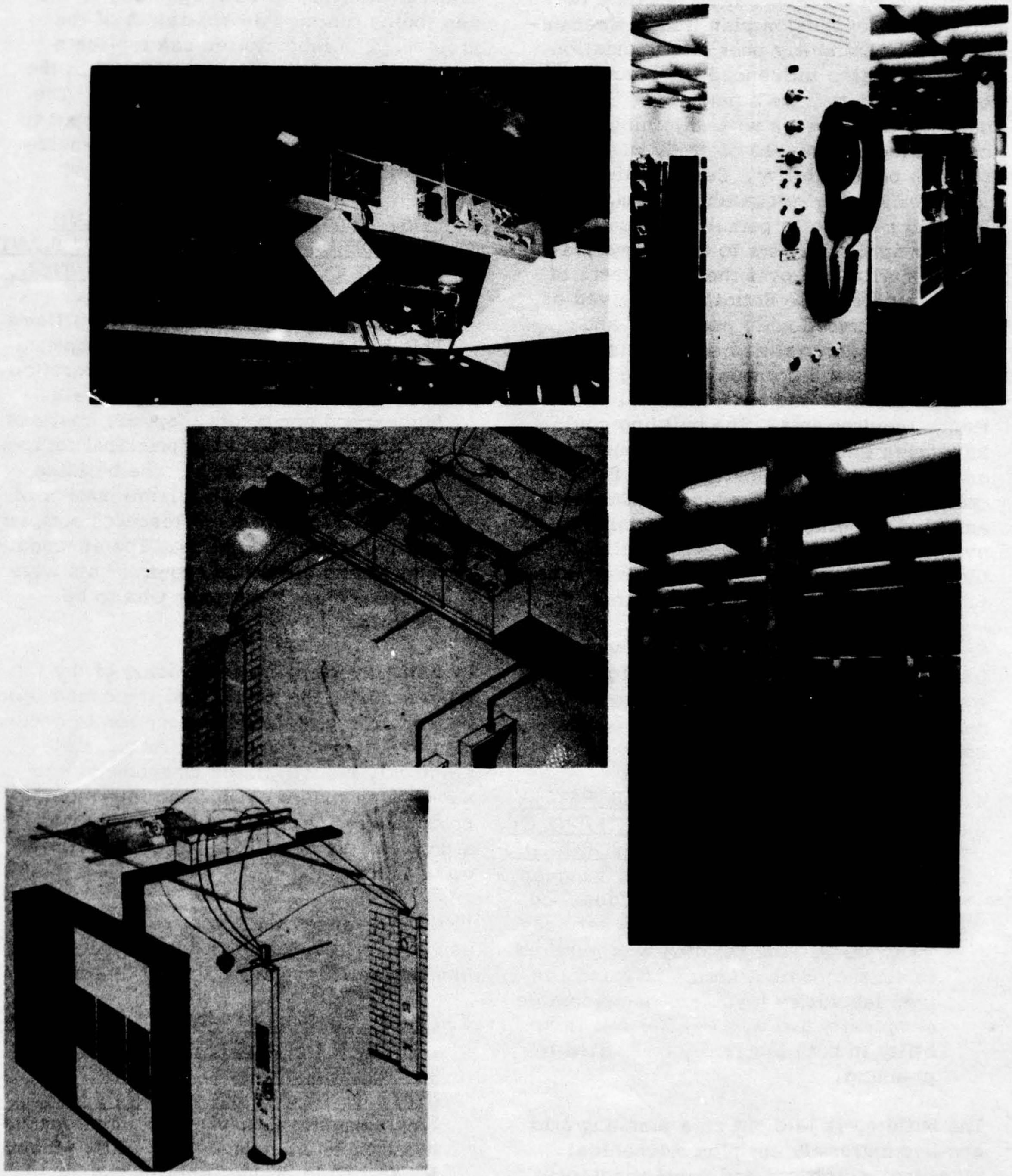


Fig. 5 .

In addition, means were sought to enhance emotional and creative features of the varied levels of temporariness of many of the proposed buildings.

The building concept was based on a two-directional expansion plan from a mechanical core. Extremely poor site foundation conditions also influenced the layout. The building was to have a permanent "street" carrying all services with adjoining permanent space for courses of study with reliable predictability. Beyond this were to be temporary, relocatable and mobile building modules to permit modification of floor space clusters to suit formalization of curriculum over the early years of the college's life. Building conceived as a hybrid of traditional, permanent and temporary industrialized and mobile building methods on a common planning grid, interfacing user and environmental performance requirements. The building could have been functionally and environmentally among the most responsive in the field of college and university education in North America, it being not only responsive to evolving educational needs, but also to the progressive availability of construction funds and changing building requirements.

The project, as described above, was abandoned when the architects resigned from the commission because of disagreement with the owner over the project's comprehensive design philosophy.

4. <u>Fig. 6. FOOD AND DRUG LABORATORY FOR ONTARIO FOR THE DEPARTMENT OF HEALTH AND WELFARE, SCARBOROUGH. 1971-73.</u> Architects: Robbie, Vaughan & Williams. The building provides food, drug and pesticide inspection services for Ontario. The building was required to accommodate a series of standardized laboratory layouts of considerable complexity and was to offer full flexibility in both laboratory and office replanning.

The building is laid out on a planning grid and has extremely complex mechanical, plumbing, electrical and supplementary services. It was bid 16 percent below budget and was built largely by traditional and off-the-shelf industrialized construction.

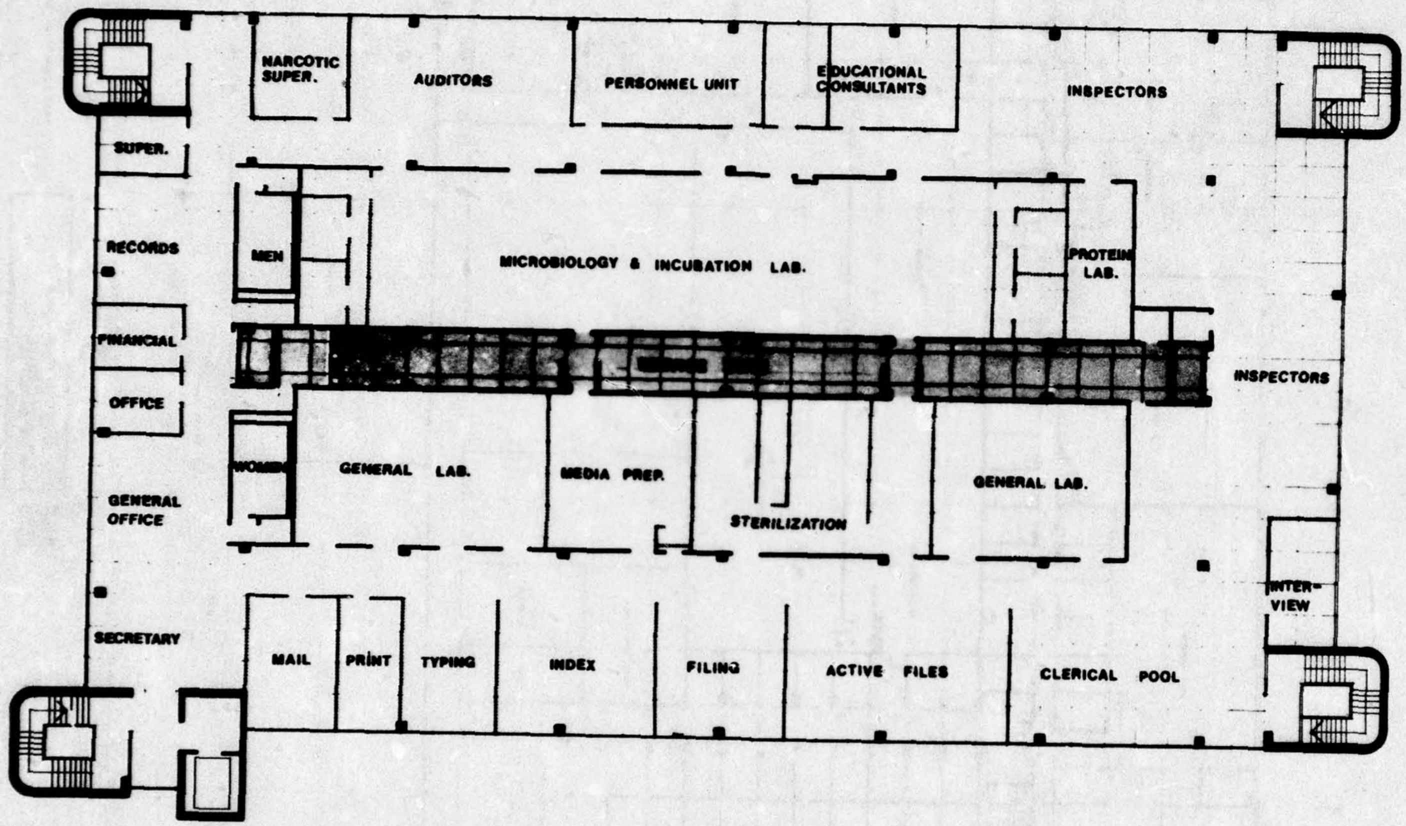
The principal user problem was to humanize the building's extremely functional and clinical interior, while responding to the demanding functional constraints of the project. The laboratories can replicate every science-based function found in the food, drug and pesticide industries. The architects provided the behavioral input to the project's design brief, after extensive discussions with the building's users.

5. <u>Figs. 7 and 8. NEW RESEARCH AND DEVELOPMENT CENTRE AND PILOT PLANT FOR THE CONTROL DATA CORPORATION, MISSISSAUGA, ONTARIO, 1971-72.</u> *Architects:* Robbie, Vaughan & Williams. This building was part of a development program by the Control Data Corporation to produce a new line of large-scale, high-speed computers. Speed, cost and quality control were the principal factors in the building program. The building was required to house a large number of private offices, a large research compter and production facilities. The air conditioning and electrical requirements were very complex. All space was to be flexible.

By using overlapping sequencing of the programming, the design and the construction phases, the project from inception to occupation took 11 months. Whenever possible, practical, industrialized components and sub-systems were used. The interfacing of products from various manufacturers was a problem, as on all the projects reviewed up to this point.

In this instance, the owner requested the use of user requirements data developed at similar facilities in the United States.

6. <u>SAREF. SYSTEMS APPROACH FOR REHABILITATION OF EXISTING FACILITIES FOR THE OFFICE OF GENERAL SERVICES, STATE OF NEW YORK, FEBRUARY 1971.</u> Environmental Consultants: Environment Systems International Inc. (ESI), Albany, N. Y. This project applied the systems approach to the reorganization of the legislative and executive procedures



TYPICAL FLOOR PLAN

Fig. 6 Food and Drug Laboratory for Ontario for Department of Health and Welfare, Scarborough, 1971-1973

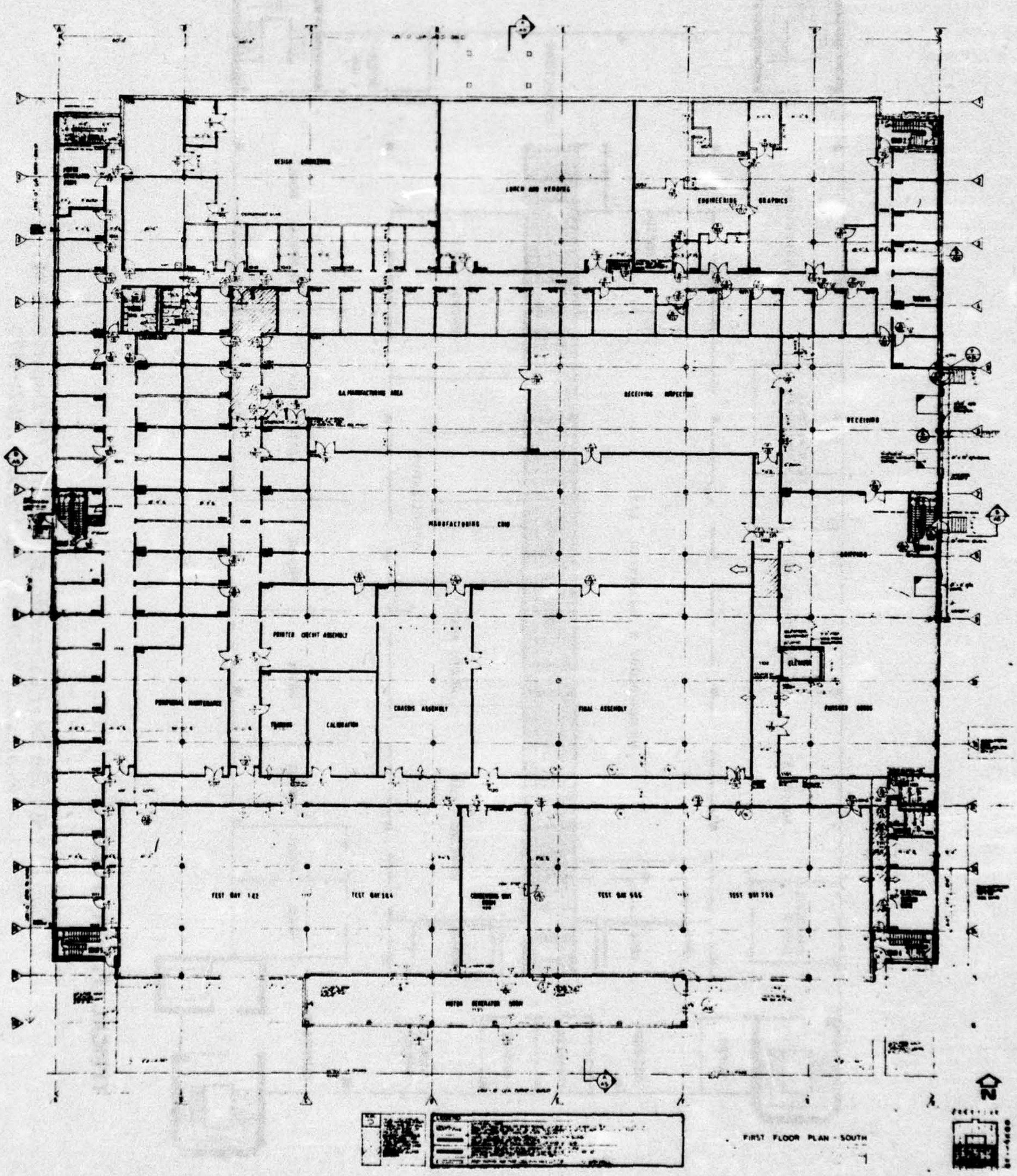


Fig. 7 New Research and Development Center and Pilot Plant for the Control Data Corporation, Mississauga, Ontario, 1971-72

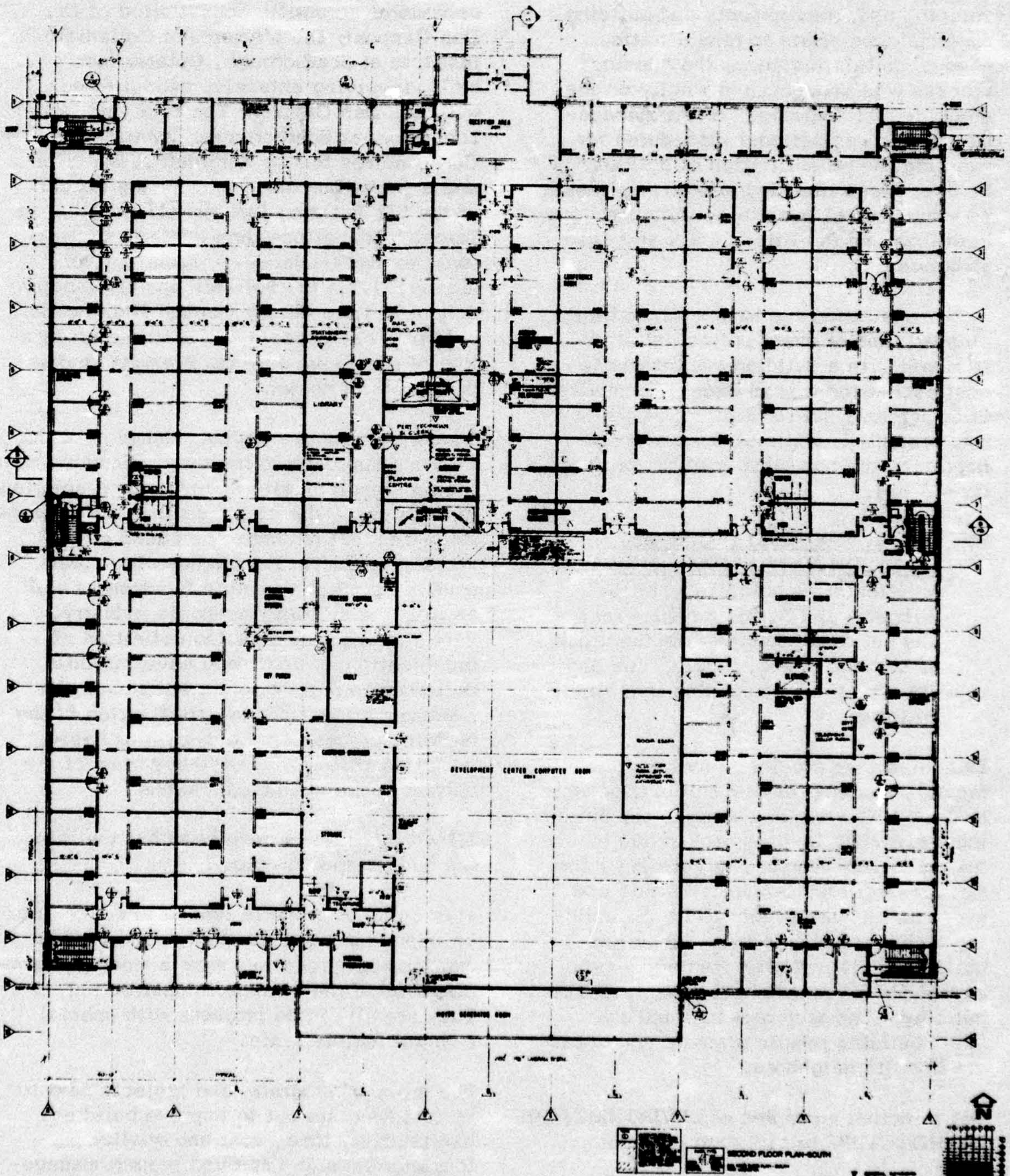


Fig. 8 New Research and Development Center and Pilot Plant for the Control Data Corporation, Mississauga, Ontario, 1971-72

for handling the rehabilitation requirements of 8,000 buildings owned by the State of New York.

The study also set out the means for developing user requirements and building systems appropriate to rehabilitation needs. In this instance, the "design" process was concentrated wholly on the analysis and "redesign" of the management and organizational procedures for handling the rehabilitation of building types. These included offices, colleges, prisons, mental hospitals, transportation buildings and facilities, and many special structures.

By demonstrating the means for cutting elapsed time of every project by 12 to 18 months, in a building market whose cost escalation was in excess (annually) of 12 percent, substantial cost-benefit was predicted, while at the same time improving the habitability of the projects considered.

7. Fig. 9. UNIVERSITY CENTRE, CARLETON UNIVERSITY, OTTAWA. Architects: Robbie, Vaughan & Williams and Z. M. Stankiewicz. The building combines the functions of student centre, faculty club and university administration in a single building.

Extensive user studies, involving the faculty, students and administration were made. It was decided to make the building a spatially inviting crossroads of the university campus, rather than a formal piece of architecture. To this end every means was sought to fit the building architecturally to its neighboring buildings. The attempt was successful except for the new School of Architecture building. The architect insisted that "his" building remain discrete and separate from its neighbors.

Our principal examples of ENVIRONMENTAL ARCHITECTURE to this date include:

The New Town of Frobisher Bay in the North West Territories (not built); Seneca College North York Toronto (not built); The Canadian Government Pavilion Expo '67 (as functioning between April and October 1967); The University Centre, Carleton University Ottawa; The Alexander Mackenzie Secondary School at Sarnia, Ontario (involving the extensive use of behavioral scientific consultation of Dr. Dan Cappon); The L'Amoreaux Collegiate Institute at Scarborough, Ontario (not built, involving extensive consultations with Dr. Dan Cappon); The Food and Drug Laboratory at Scarborough, Ontario; The Day Care Centres for the Retarded at Waterloo and at West Lincoln, Ontario; the schools of the SEF Building Program (27 schools) in Toronto; Educational and Systems Consultants to Richard Jacques, Architect, of Albany, N.Y.: the Ballston Spa Elementary School and the Albany Central High School. Both of these schools included the preparation of extensive user requirement studies prior to their design.

These projects are typical examples of the systems approach to building. They examine the problem logically and propose a solution. In each case, the steps outlined above were followed. All tended to be based on an underlying dimensional order which grew from the project's generic function as well as from the building materials industry. Each involved the detailed definition of organizational, user, and environmental performance requirements; each used the maximum amount of industrialization of the building process on a sub-system basis, commensurate with a best-buy view of the current building methods market.

All were, or could have been built within the budget and on time.

This group of projects tended to concentrate on improvement of the design and project management processes with a modest rationalization of the means of construction. They are all single projects with special owners' requirements.

The group of programs and projects next to be reviewed set out to improve building, habitability, time, cost and quality performance through improved project management, quality control and sub-system interfacing, and by simplifying design, purchasing and installation procedures.

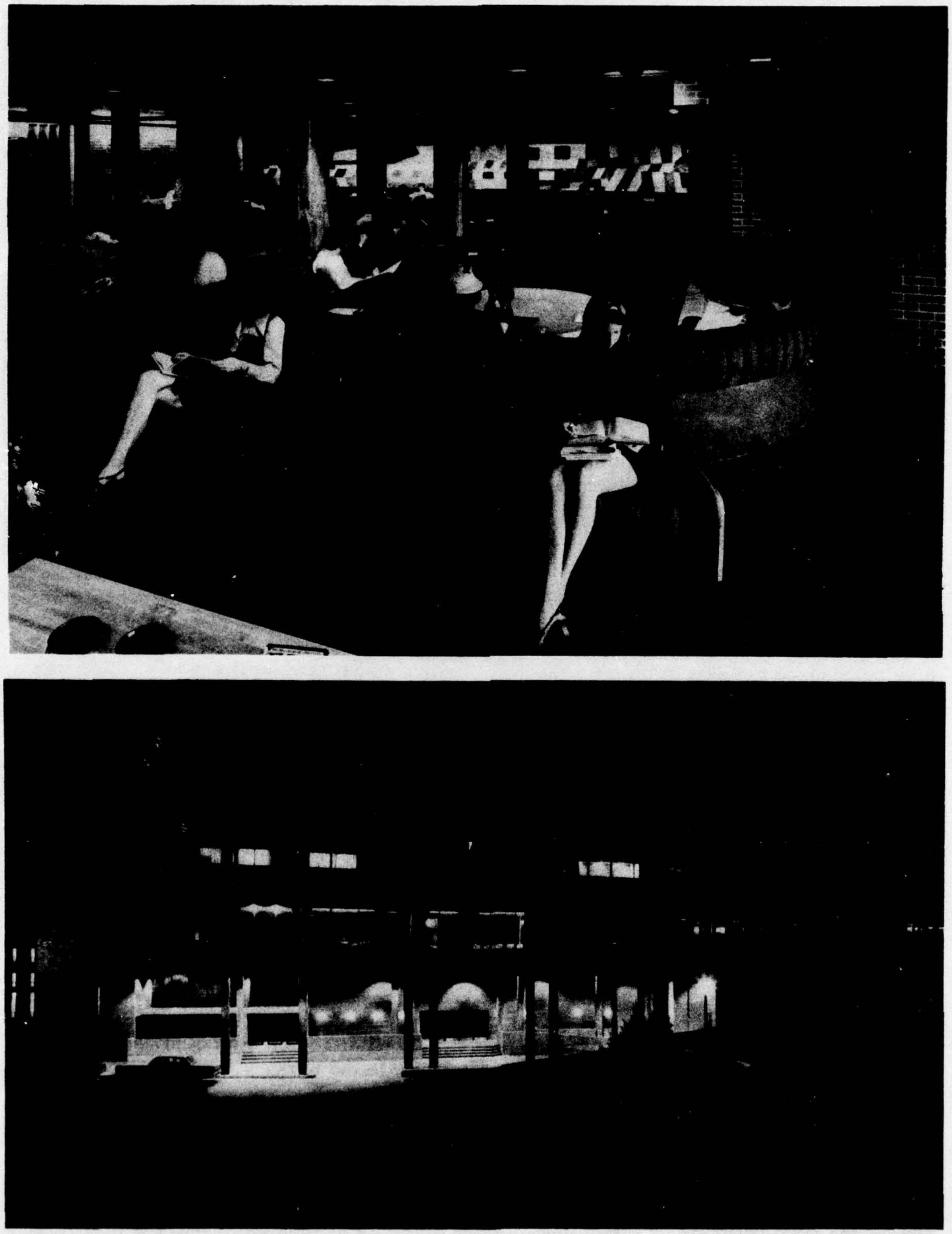


Fig. 9 University Center, Carleton University, Ottawa

The achievement of these objectives was and still is, to varying degrees of extremity, limited by all of some of the following factors: the environmental amnesia of the overwhelming majority of building users and providers; the unpredictability of government and private procurement of buildings; the complexity of building and other regulations and their interpretations; the means by which the design and construction of building are financed; the fragmented organization of building professions and labor on a trade basis; the extremely low level of research and development investment in building; the marketing practices of building manufacturers of their product, almost universally without more than passing regard for interfacing; the emerging awareness of the public of the long-term effects of the man-built environment upon the quality of life.

Some Examples of Open Building Systems

As noted above, open building systems offer the economical means of using both traditional and industrialized building methods to give customized building solutions. Each of the following examples drawn from the recent experience of Environment Systems International and of the author, sought to improve the rationalization of building manufacture and assembly, and sought to achieve the objectives of the systems approach to building already described.

1. Figs. 10 and 11. SEF, THE METROPOLITAN TORONTO SCHOOL BOARD'S STUDY OF EDUCATIONAL FACILITIES and First SEF Building System for 1 to 2 million square feet of school and office building at up to 32 different locations. Architects: Metro School Board, R. Robbie, Technical Director, and 25 consulting architects for field application of the building system.

This was the largest and most comprehensive program to this date which sought to apply the systems approach to every aspect of the program. It combined the preparation of the most complete user requirements and specifications for a generic building type within a specific market so far undertaken in any country. It included the use of performance specifications, fast-track scheduling and construction management within its concept of project management. It was introduced within flexible building plans and totally flexible mechanical and electrical services. The project developed a contractual means in the "mandatory, interfaced sub-system bidding method" of insuring the interfacing of sub-systems of disparate origin in a finished building on the basis of the low bid. The first SEF system produced 13,040 full building systems.

The prototypical nature of the programs prevented full development of the open systems concept, as bidders expected a large order in return for the large amount of work involved in the first bid. The program concept was a continuum of at least five successive systems program bids over 8 to 10 years. By this means, the full advantages of the open systems concept would be realized. At this time, a second SEF building system of about 200,000 sq. ft. is being bid. A majority of the schools were evaluated over a two-year period from the user viewpoint, against traditional open space and fixed-wall schools. This was a substantial user study undertaken jointly by the SEF office and York University.

2. BOSTCO I, THE BOSTON STANDARD COMPONENTS PROGRAM 1969-72; SCHOOLS FOR THE CITY OF BOSTON. Architects: Environment Systems International Inc., Boston and Toronto. This is a large, long-term program.

Two test schools were built using the First SEF Building System as a means of refining all other aspects of the process; user requirement specifications were prepared for each of the test schools undertaken by ESI, with the SEF User Study as a base to initiate the work.

The schools were built in 65 percent less time than normally required, with a 15.0 percent cost saving over current traditionally built school projects, and provided superior flexibility and quality. The SEF furniture system was used; the user responsive interiors of the SEF system were well received by the test school students and teachers.

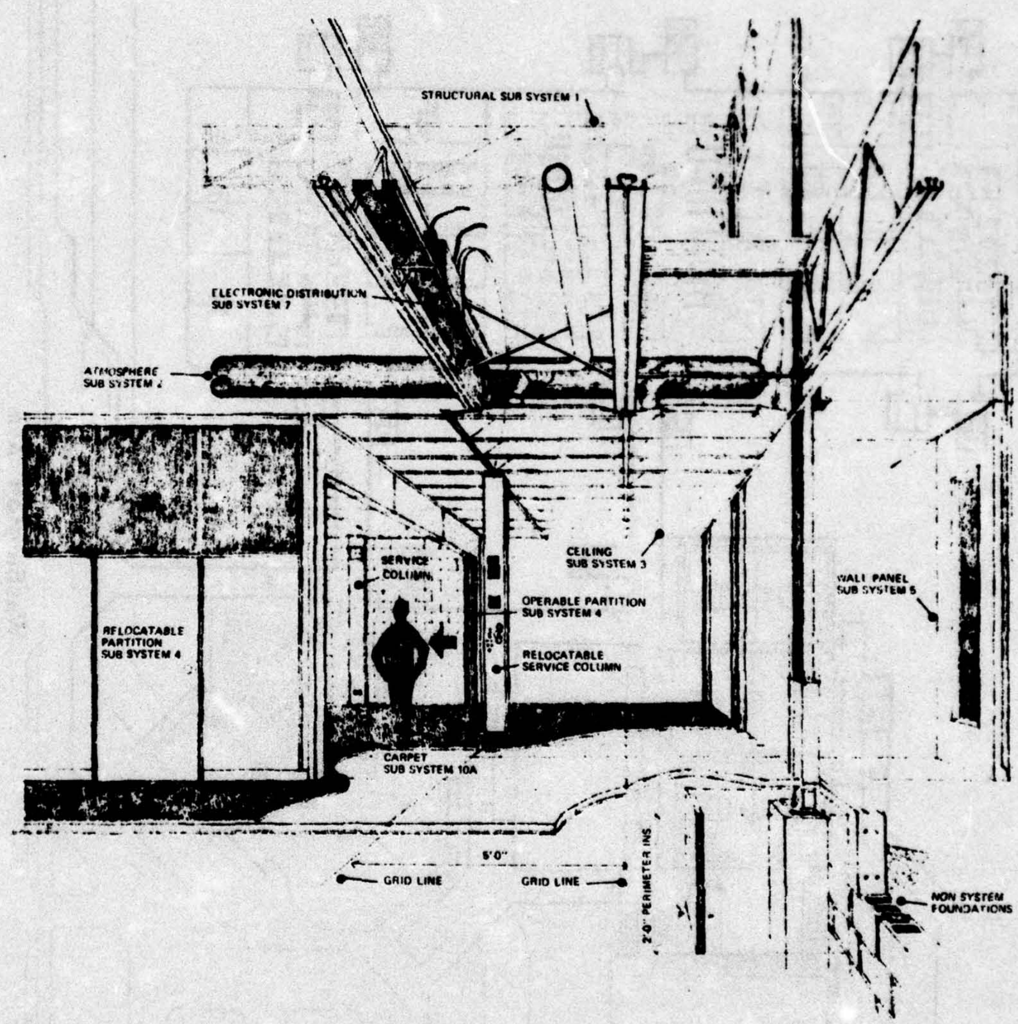


Fig. 10 SEF, The Metropolitan Toronto School Board's Study of Educational Facilities and Building System

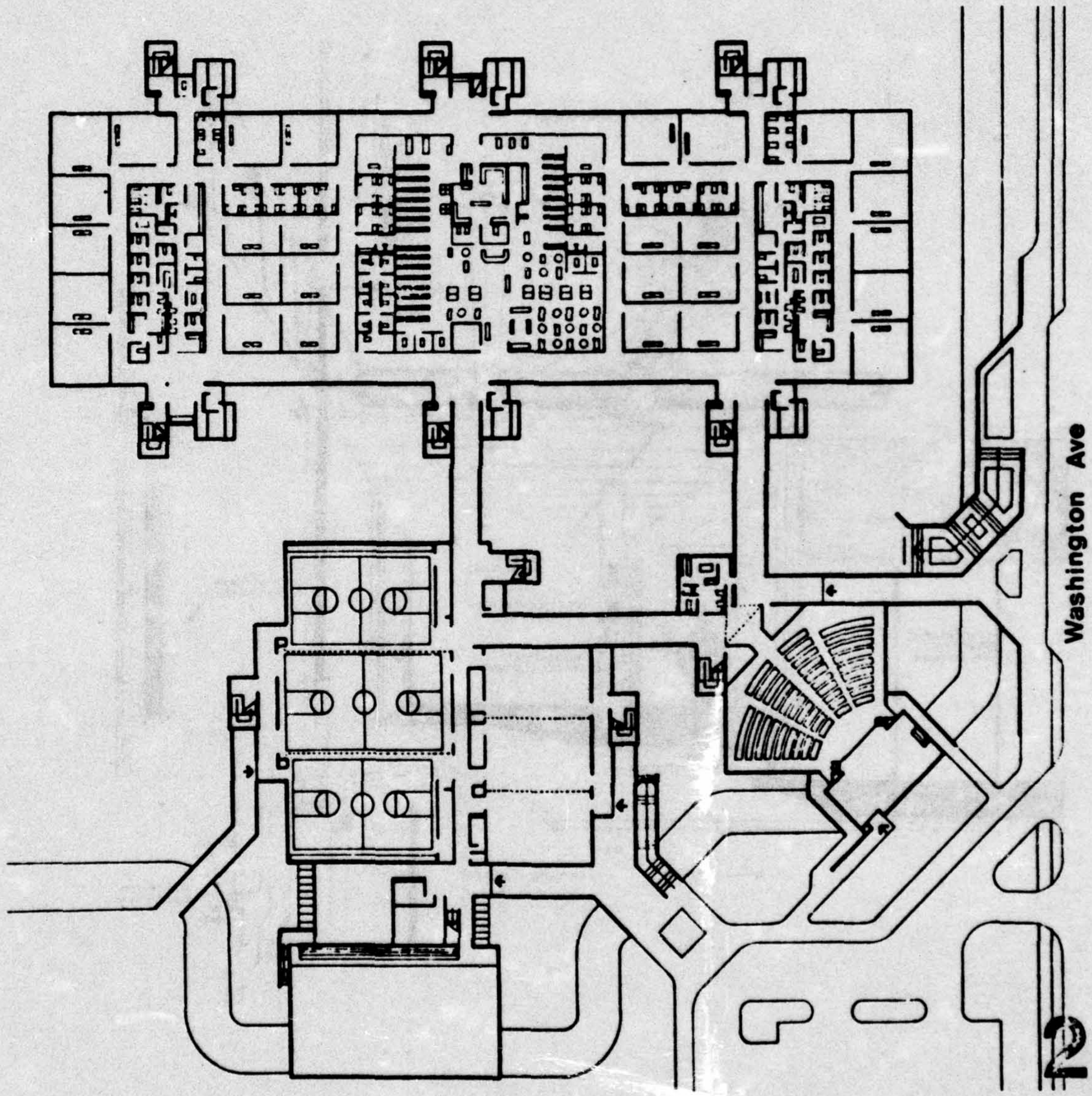


Fig. 11 SEF, The Metropolitan Toronto School Board's Study of Educational Facilities and Building System

3. C.S.P. THE CONSTRUCTION SYSTEMS PROGRAM FOR THE DETROIT SCHOOL BOARD. Systems Consultants: Environment Systems International Inc. Toronto.

Four large high school additions were built using local architects with time, cost and quality performance similar to BOSTCO. Again, user requirement specifications were prepared by local committees concerned with each school.

4. SBSP. CITY OF NEW YORK, SCHOOL BUILDING SYSTEMS PROGRAM, SEPTEMBER 1970. A proposal prepared by Environment Systems International, Toronto.

This program proposal sought to suggest a means of overcoming New York City's shortage of new school space, while taking due account of the racial, cultural, political, social, economic, business, labor, user, bureaucratic and other factors which control school building in that city. The proposal sought to build 7 million sq. ft. of schools in six years. The high front-end cost of the proposal, about $11 million (including School Board staff costs) on $350 million of construction, killed the proposal. As such, it typified the difficulty of getting an acceptance of the level of cost and comprehensive effort required to deal with problems such as those posed by the building needs in the older, larger cities. Development and planning funds of the scale suggested in the SBSP proposal would, I believe, have been accepted as normal by government authorities developing space or weapons systems.

5. MILTON TERRACE ELEMENTARY SCHOOL, BALLSTON SPA, NEW YORK. ALBANY CENTRAL HIGH SCHOOL, ALBANY, NEW YORK. Architect for both projects: Richard Jacques, Albany, N. Y. Systems Consultants: Environment Systems International Ltd., Toronto. Both projects illustrate the application of systems building techniques and construction management, within the context of the systems approach on single projects; all design and construction management were under the direct control of the architect.

In each case, the buildings are laid out on a 5'0" x 5'0" planning grid and use a mixture of conventional and systems building products, chosen on a performance-cost basis. Time savings on both projects over conventional construction is of the order of 50 percent and cost savings of 15 percent and 25 percent, respectively. Quality and user acceptability are equal or better than conventional building and flexibility of space and services is superior.

As in the case of SEF and BOSTCO, we have sought to develop a systems proposal for housing in Ontario and then reapply it in the U.S. Whereas we succeeded in the field of school buildings, we have failed, up to this point, to gain acceptance of the systems approach to the development of housing in Ontario or elsewhere. This is in spite of the fact that the social benefits to accrue from a systems approach to housing would be substantially more significant than those in educational buildings.

6. CO-OP I. A PROPOSAL FOR HOUSING IN ONTARIO. Sponsors: Cooperative Housing Foundation. Consultants: Robbie, Vaughan & Williams Systems, Spring 1969. The project sought to combine the principles of cooperative ownership, Provincial Land Banking and open systems building, within the concept of the systems approach to building. It sought to test the proposal in urban areas of all sizes throughout southern Ontario near Highway 401, through the construction of 3,000 units by the end of 1971.

The proposal was intended to develop a means of citizen participation in housing design, construction and management, to seek out new ways of involving financial institutions in low-income housing, to review the efficiency of official and regulatory procedures, and to reinvolve the architectural profession and professional builders in housing. It was expected that the program would provide incentives to initiate a number of indigenous industrialized housing systems as well as many combinations of traditional and industrial construction. Like SEF I, CO-OP I was beginning a series of publicly sponsored projects to establish open building systems in housing. It was considered to be a rationalization of the operational and quality control procedures affecting all aspects of housing.

7. MHP 1 and 2. THE MASSACHUSETTS HOME PROGRAMS 1 AND 2, 1970-71. Consultants: Environment Systems International, Inc., Albany and Toronto. This proposal was prepared at the request of the State Department of Community Affairs. It sought to put into wide effect the objectives of the U.S. Government's Operation Breakthrough in the areas of low income housing. Again, as in the case of the New York City School Building proposal, the only means of dealing with the complex and interlocking problems was to undertake a relatively large program over a number of years--in this case, 32,000 units over six years throughout the state.

The techniques developed would have been applicable throughout North Eastern United States and, in general terms, nationwide. The front-end consulting and owners' staff cost was $14 million on $800 million of construction which ESI proposed be put up by a consortium of foundations. These costs were in addition to professional fees on each project. The program rests at this point. In its structure, it offered the mass production advantages of purchasing in an open systems context to 130 local housing authorities. It was arranged to introduce user requirement specifications and to reintroduce the architect and local contractor at the local level into effective community contact. The program also offered the time and means for manufacturing, contracting, labor, financing, housing and building regulations interests to rationalize an immensely complex and archaic situation within building, while still meeting a social need. MHP 1 and 2 exemplified the systems approach at its most sensible and effective level.

In the projects outlined above, notably the housing program, the means of getting effective public involvement and user satisfaction have been prime considerations. Achieving the cost, quality and user objectives of the CO-OP 1 and MHP 1 and 2 programs would mean many changes in current patterns of trade, professional involvement and official powers, and the means of applying regulations. There is no doubt but that the scope, size and cost of these changes are impediments to action.

Not until the urban and man-built environments are treated with the same urgency as the development of space shuttles, SST's and bombs, will the proper scale of funds in sufficient concentration be applied to start an effective solution to our housing, educational and health care building problems. The solutions cannot be jerrymandered from the traditional professional fee structure, as this in itself is inadequate to sustain a healthy building professional capability. On top of the normal 7.5 percent cost of building design, a full 7.5 percent to 12.5 percent of additional funds is generally needed if public environmental aspirations are to be achieved.

Some Cost-Benefits of the Systems Approach to Building

The cost-benefits of the systems approach to building with the use of open building systems include:

1. A means of defining all aspects of the whole problem to be solved in each instance.

2. The method, unlike the present methods of producing most buildings, particularly housing, produces buildings which are user-sensitive and through spatial and services flexibility are resistant to obsolescence.

3. Full use is made of the skill and resources of manufacturers and sub-contractors.

4. Where industrialized sub-systems are developed with proper interfacing, an improved working relationship is developed between manufacturers and installers. The result is higher quality of finished work, and improved cost and time performance.

5. Where open systems and industrialized sub-systems are used, with effective construction management under the architect's direct control, substantial amounts of financing can be cut from the project through proper work scheduling.

6. The direct control of all aspects of the work by the architect insures the practice of cost-benefit rather than cost-optimization, where the useability of the finished building in whole and in part, as well as in its environmental, operational and maintenance aspects are considered, in balance with the lowest capital cost of construction.

7. Better analysis of the problem, preparation of the contract documents and coordination of the work may raise the fees payable for professional and management services, but has also shown cuts of the gross building cost in excess of the cost of the higher fees. Traditional practice, including most of the rules of thumb, used by developers, government and private financing authorities, usually allows 5 percent for professional services and leaves an indeterminate amount for builders' overhead and profits within the cost of the building work. We have found that the combined architectural and management fee, including systems work on single projects, where the work is to be fast-tracked, should vary between 15 percent and 20 percent depending upon the complexity and size of the job, with the smaller, simpler jobs receiving the lower fee. These projects have yielded overall capital savings of 15 percent to thirty-five percent, with significant overall project time savings and improved building quality and flexibility.

8. The systems approach provides reliable means of long-term building operation and maintenance costs and signficantly reduces the costs of functional obsolescence and future layout changes.

9. The method uses money, material and skill resources efficiently and is the only practical way of reaching most of the proposed government and political goals of social welfare which include a building component, while retaining freedoms of personal and collective choice.

10. The method works, regardless of the level of technological development, on condition that the will to solve the problem exists and a means of translating the systems techniques into locally understood terms is available.

11. The systems approach does not mandate the use of industrialized building systems, or techniques. It does, however, imply an above-average investment of effort into a project's management, problem definition and solution.

2.2 DEVELOPMENT OF SPACE UTILIZATION AND DESIGN GUIDES

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Given the present military construction process, it has been and will continue to be necessary to standardize design criteria, especially for application to repetitive type facilities. Standardization allows for ease of programming and budgeting justification, for reduction of both repetitive design costs and manpower, needed to review and evaluate project designs. This has promulgated the development of standard and definitive designs for site adaptation by the Department of Defense and the Army along with policies that encourage site adaptation of successful designs for special facility types.

The Volunteer Army Program of the 70's has been and perhaps will be the most significant influence for change within the history of the Army. Army programs, from housing and medical care to general education development and recreation, are in processes of change, and sponsoring agencies such as the Surgeon General's Office and the Adjutant General's Office have turned to the Office of the Chief of Engineers for new design criteria. A new program such as the Volunteer Army often has impact on the man-built environment as was the case with the "New Generation Barracks." Barracks criteria were completely redeveloped in order to reflect the philosophy of the new program.

While definitive designs are still seen as an effective form of communicating criteria to the varied and numerous players who are involved in the military construction process, progress is being made in the area of design accountability, especially where design criteria are based on less tangible, psycho-social requirements suggested by the philosophy of a given program. Our recent move to the Space Utilization and Design Guide (SUDG), as a form of criteria communication, shows great promise.

The SUDG provides design criteria covering the interiors, architecture and engineering of a given facility type. The SUDG is primarily for use by design personnel who prepare (in-house or under contract), and evaluate project designs for military facilities across the country. The SUDG is also intended to aid in the development of project requirements in the planning and programming phase (justification, budgeting and authorization) of the military construction process. In addition, the SUDG is expected to aid facility managers in operating and maintaining new facilities and in improving or renovating existing facilities.

The SUDG form of criteria communication is a narrative and graphic statement of criteria and design principles. Applications of criteria and principles are illustrated in the form of character sketches, space organization diagrams, and case study designs. The SUDG is intended to facilitate the development of project designs through an evolutionary process which allows the user of the guide to apply the criteria and principles contained therein in individual ways in response to a local situation.

The basic contents of the SUDG, include sections on general design considerations, individual space criteria, and space organization principles; there is a section on illustrative criteria and a general bibliography of references.

The section on design considerations treats the philosophy of the type of program, such as general education development, which is to be accommodated: its elements, participant-users, staff, etc. The section also discusses factors associated with planning and programming a new facility in relation to DOD criteria and also deals with the requirements of the using service and installation. This is followed by a discussion of factors related to the design of the site, the facility, and the interiors;

furthermore, maintenance and operation are discussed.

The section on individual space criteria delineates specific approved criteria for the physical and environmental aspects of individual spaces or areas to accommodate the necessary user activities, supporting functions, and required equipment and furnishings. Recommended space allowances and adjacencies are specified along with a space utilization sketch showing typical furniture arrangements, dimensions, etc.

The section on space organization identifies the principles to be used in organizing spaces in relation to one another and to the site. The principles must provide a basis for auditing the design development and for evaluating design concepts, not only with respect to the approved physical and environmental criteria but also with respect to the organization of the design. Schematic diagrams are used to show potential application and variation with respect to expandability, climate and site differences, etc.

In the section on illustrative criteria, case study designs are provided to show how the criteria and principles in the SUDG are applied in the evaluation of a design or designs corresponding to gross facility sizes authorized by DOD criteria. Space allocation and organization are summarized and the case study design is presented in plan and cross section. It is not the intent to prescribe definitive designs, although the case study designs are adaptable to such use when further developed and combined with requirements at the installation level.

In short, the SUDG is a tool to be used by those involved to solve problems in ways which respond to both the local requirements and to the required standards which are necessitated by quality and cost control during the phases of programming, planning, design, and design evaluation in the military building delivery process.

The SUDG is applicable to all new construction projects for the facility types covered, and to projects involving modernization of existing facilities. Draft Space Utilization and Design Guides have been completed or are nearing completion for Recreation Centers, Physical Fitness Centers, Skill Development Centers, Auto Self-Help Garages, NCO and Officer Clubs, Chapels and Religious Education Centers, General Education Centers, Libraries, Criminal Investigation Centers and Army Service Schools. Publication is late in 1974 or early 1975.

Our experience with the SUDG form of criteria communication indicates a potential for improving the specification of psychosocial design information. Difficulties associated with communicating criteria in the military construction process are generally related to the need to define specific criteria for use by those involved in the planning and design phases of the process.

Formulating information and guidance to help program requirements in the planning phase are necessary functions if appropriate criteria are to be included in early planning decisions and budget activities. A major difficulty exists in that much of the psychosocial design information, normally left to the intuition and experience of the designer in the design phase, is not made available in an objective format for use in the planning phase. To great extent, criteria formats for such information are undeveloped, or are difficult to use with confidence in the Military Construction context, or they simply do not exist.

The lack of an objective format is equally troublesome in the design phase where it is essential to provide both the designer and the design reviewer with standard criteria for quality and cost control. While competent and professionally trained designers may be able to make intuitive applications of psychosocial design information in both design and design evaluation, it is more likely that without objective design criteria to cover some of the more important issues, such facets of the design may lose out in competition with some of the more quantifiable issues.

2.3 *GUIDELINES FOR THE PLANNING AND DESIGN OF CORRECTIONAL FACILITIES*

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Recent interest in collaboration of effort by behavioral scientists, architects, and other members of the environmental design professions, has led to an explosion of potentials. The explosion concerns a relatively small number of disciplines which are moving into many directions. Interest in the collaboration is manifested by some behavioral scientists who have drifted from the core of traditional topics in social science and operational concerns for "pure" research--usually implying a disconnection from any interest or possibility of practical application. They have also departed from the reward system which perpetuates that tradition.

To some extent, it is appropriate that exploration of a new arena should involve the consideration and testing of various options. Such exploration is needed to formulate optimal strategies. Yet constraints in both function and scope which accompny these forays, particularly as to the time or funding for actual research, severely limit the potentials. In observing characteristic interaction of the behavioral scientist and the architect, one might suggest that a measure of dishonesty exists in claims of breakthroughs, or that behavioral science has "findings" ready to be applied to the complex array of issues inherent in any architectural problem. Even efforts to generate another "process model," with all the conflicts to be established between its authors and the authors of other process models, range from well-intentioned to self-serving efforts. The outcome tends to be the formulation of elite cliques, isolated from the mainstream of architectural practice and environmental decision-making processes, cliques which alternately wage warfare with one another, or negotiate their differences.

Portions of the Allerton Conference on Habitability Criteria are appropriate illustrations. In one session, representatives of East and West coast design methods disagreed intensely on the appropriate representation of the design process. They argued whether some areas of their debate were even necessary or important. The debate was passively moderated by an unaffiliated third party.

From a larger perspective, the import of such proceedings for the creation of humane and supportive environments may be equivalent to having rearranged the deck chairs of the Titanic.

The need is recognized for a more structured and systematized collaboration between behavioral science and architecture, and for such activity to be correlated to information and dissemination of mechanisms to the public and to the professions: technical assistance for practitioners who deal with live, repetitive problems (not repetitive buildings); and a direct linkage with large-scale policymaking by responsible private or public agencies. Multidisciplinary collaboration for generating habitability criteria is the first logical phase of activity. It must be followed by establishing a delivery system mechanism to facilitate dissemination of information and of feedback loops for the continual refinement and updating of both method and content.

In at least one significant area of social need this has occurred. The criminal justice system has witnessed the development of the National Clearinghouse for Criminal Justice Planning and Architecture, of the Department of Architecture at the University of Illinois, Champaign-Urbana.

The full range of the National Clearinghouse's goals, research topics, collaborative methods, operational strategies, staffing, communication techniques and evaluation components has evolved over a period of five years. The National Clearinghouse developed from a unique opportunity to deal with the core issues of behavioral science and architecture. Faced with a responsibility to respond nationally to inadequate and counterproductive physical environments in the police, courts, and corrections components of the criminal justice system, the Law Enforcement Assistance Administration of the United States Department of Justice called for the formulation of planning and design criteria. A team of researchers at the University of Illinois, Champaign-Urbana, responded to the challenge. The sequence of events which established the National Clearinghouse for Criminal Justice Planning and Architecture is of importance to the subject of habitability criteria, their generation and application.

Congress, in passing the Part E Amendment to the Omnibus Crime Control and Safe Streets Act of 1968, mandated that "advanced practice" in facility design was to be a prerequisite in the awarding of federal funds under provisions of the Act. The Law Enforcement Assistance Administration, charged with administering the mandate, recognized the need for criteria or guidelines by which to evaluate individual applications from the various states and local jurisdictions. A search of the literature and inquiry into current practice revealed no models which could respond to contemporary needs or be capable of widespread dissemination as standards in the particular subject area Concern that new money would be lost in a repetition of past errors, either through perpetuation of former planning and design practices or by a national enforcement of obsolete standards, led to focus by LEAA on the need for multidisciplinary research and a total system orientation to the problem.

It is recognized that any real progress in developing responsive, man-made environments in any social problem area will be achieved only through such orientation and resolve by a major agency operating on a large-scale basis.

This is not to discourage or discredit a wide variety of initiatives which can have a positive impact upon such an effort. The range includes the improvement of teaching [illegible] in schools of architecture to the resolution of social ills affecting the nature of the problem to be considered. Positive impact will also be realized through the independent professional practice of thoughtful and competent individuals operating under a sufficient mandate from, perhaps, a generous client. But such a combination of elements tends to be rare and isolated, and the lack of a systematic transfer of information both impedes the likelihood of successful performance as well as its replication elsewhere.

When it is recognized that new knowledge must be generated in a particular area and that it is vital that such new knowledge find its way into widespread application in ameliorating a problem having a large-scale need, nothing short of major research sponsorship and integral linkage to policy-making will suffice for the most effective use of current and future resources. Such a recognition accompanied the evolution of the National Clearinghouse for Criminal Justice Planning and Architecture and its support by the Law Enforcement Assistance Administration of the U. S. Department of Justice. The first task was to develop guidelines to adminster the mandate contained in the Part E Amendment (1971) to the Omnibus Crime Control and Safe Streets Act of 1968.

As a result of the interdisciplinary approach to the analysis of the highly complex problems encompassing criminogenic theory, contemporary social norms, prevailing judicial practices and statutory constraints, new orientations in corrections, fragmented system contexts, entrenched treatment practices and vested interests, a legacy of deteriorated and counterproductive physical environments, and the great need for total systems planning, the National Clearinghouse team went to work on a nationwide research investigation. A strategy for action to bring about positive change resulted in the Guidelines for the Planning and Design of Regional and Community Correctional Centers for Adults. It is a flexible planning instrument with a methodology suitable for application in widely varying contexts. Solutions to individual problems are developed from a process which surveys community problems and resources in defined service areas.

The process evaluates individual offender profiles, provides linkage for individualized correctional program responses, and generates environmental criteria and strategies for action.

The Guidelines is now recognized as the criterion to promote advanced practices in the correctional system. The manual is being used nationwide and on every level: county, regional, and state. Extension of the research and service dimensions of the operation of the National Clearinghouse is provided by subsequent responsibilities directly tied to implementation, evaluation, and the generation of new knowledge. Planning assistance, project evaluation, and continuing research activities comprise important segments of such activities. Over 1,000 instances of application of the Guidelines process have been tracked and assessed by Clearinghouse staff offering the multiple functions of a service clinic, a review and recommending agency, and an interdisciplinary research group. Interface is firmly established with federal, state, and local government officials, administrators in the criminal justice system, line staff in institutional and noninstitutional capacities, system clients (including offenders), planning personnel at state and local levels, architects and consultants, and members of the academic community. These contacts revolve around a broad range of specific problem contexts and provide a forum for measuring the efficacy of the most promising approaches to the routing and treatment of the offender. Consistent with the open-ended structure of the Guidelines, results of continuing research are incorporated into its contents on a continuing basis.

The concept of the Guidelines has been extended to the law enforcement and courts components, resulting in comparable and compatible planning instruments. The conceptual orientations of these new documents, Guidelines for the Planning and Design of Police Programs and Facilities and the Guidelines for the Planning and Design of State Court Facilities and Programs, are identical in that they emanated from the corrections Guidelines model. They include the development and postulation of basic planning principles, the incorporation of flexible, but basic, survey instruments for the assessment of community problems and resources, the presentation of a broad variety of programs and operations which serve specified objectives, together with the correlation of these functional needs and goals to their architectural equivalents.

Some details of the history of the development of the National Clearinghouse for Criminal Justice Planning and Architecture are pertinent. The Law Enforcement Assistance Administration originally solicited proposals from various universities in April of 1970. The Law Enforcement Assistance Administration subsequently selected the approach and the team developed by the University of Illinois at Champaign-Urbana in May. A twelve-month contract was written. Even though the early proposal suggested the development of a flexible planning instrument, which would be capable of application in diverse service area contexts, and would have periodic updating to incorporate new knowledge and thus avoid obsolescence, a continuing participation by its authors beyond June 1971 was not envisioned.

The suggestion for this continuing role came after completion of the Guidelines, at a meeting of the LEAA-appointed Ad Hoc Committee on Correctional Architecture. Maintaining the project team was viewed as an appropriate resource for inforporating feedback concerning the field application of the Guidelines planning process, and for updating the manual. Extension of the multidisciplinary team was also considered useful for measuring individual project compliance with the Part E requirement of "advanced practice" in design, and for providing advice to LEAA and demonstration applications of the Guidelines in selected contexts. Thus, the National Clearinghouse, and later the National Clearinghouse Office of Review, came into being.

As the number of Part E projects has grown, and the number of applications has increased, the multidisciplinary staff of the Clearinghouse has also expanded. As the context for demonstration applications widened from individual counties to entire state systems, diverse talent was introduced into the staff. To that extent, the staff now includes, in addition to its original architects and sociologists, survey researchers, lawyers, clinical psychologists, urban planners, landscape architects, social workers, urban economicsts, library researchers, computer simulation experts, and courts specialists; as well as former police officers, former offenders, former probation officers, and former correctional institution line and administrative staff. An Indian desk has been established to relate to the special needs of that minority group, and an internship program for black architectural students is being developed. In the process of assimilating a microcosm and cross section of participants in the criminal justice system, with correlated academic disciplines, the very nature and function of the Clearinghouse has in many ways been fulfilled and significantly expanded. The National Clearinghouse is both a model and a mechanism for multidisciplinary collaboration which extends beyond the partial, superficial and rather infrequent nature of the usual interaction with environmental problems.

To repeat, the Guidelines was originally designed as a tool for use by the planner, correctional administrator, and architect, without participation or involvement by its authors in the ensuing dialogue and planning process. It continues to serve in that way, not only across this country but in 18 other countries around the world. Various forms of involvement by staff, including project review and technical assistance, have developed as a catalyst to attaining the original intent. Five basic roles are now discernible: project review and evaluation, technical assistance to individual projects, comprehensive correctional master planning, information dissemination, and research.

In project review, pursuant to Part E funding recommendations, specific components of facilities are related to Guidelines criteria according to their intended purpose. Proposed capacities of new facilities are correlated to Guidelines recommendations for the analysis of inmate populations characteristics and for maximum projection and development of alternatives to incarceration. On the basis of these considerations, and the range of resources available to the community, the need for any new construction at all is measured.

Technical Assistance staff use the Guidelines as resource material for considering widely varying criminal justice problems in widely varying contexts--contexts which also number in the hundreds. These considerations include focusing upon crisis intervention efforts, pretrial diversion programs, remedies to overcrowded pretrial detention facilities, outmoded and deteriorated physical plants, relationships between various system components including police, lockup, booking, courts and detention facilities, classification methods, survey of community resources, transitional programs including halfway houses, specialized programs and facilities for the mentally ill offender, trends in judicial practices, statutory review, network concepts in defined service areas, alternatives to incarceration, and a range of institutional program and facility responses allowing individualized approaches to offender reintegration.

After site visits, assessment of local problems and discussions with planners and officials concerning practices, planning methodology and innovative trends, the Guidelines is used as resource material for the implementation of total systems planning and the achievement of program and facility alternatives.

On yet another level, Clearinghouse staff have been afforded the opportunity for application of the Guidelines in the development of comprehensive correctional master plans on a statewide basis. Working in close cooperation with the respective Criminal Justice State Planning Agency and LEAA Regional Office, the National Clearinghouse makes an effort towards participation by State Departments of Corrections, county officials, regional planning bodies, probation and parole departments, institutional administrators, line staff, inmates of correctional institutions, ad hoc citizen advisory groups, community agencies, state universities and various consultants and contributors. This application of the Guidelines is continuing and expanding. It offers valuable experience for staff and rich resource for the refinement of the Guidelines process, and verification of its applicability to large-scale service areas.

Other staff experience with the Guidelines includes that of the Information Resource Center in their response to inquiries from all over the country: from architects, county administrators, judges, sheriffs, correctional administrators, planners, inmates, former inmates, interested citizens, news media representatives, state planning agencies, officials of foreign governments, manufacturers, students, professors, legislators, Congressional Committees, librarians, the Indian nations, professional organizations, lawyers, researchers...the list goes on. The encyclopedic aspect of the Guidelines has accelerated individualized response and interest for information not currently found in the Guidelines, and it has generated several current Guidelines updating projects.

Staff experience in the Research Division has generated investigations utilizing Guidelines precepts as hypotheses for a variety of pursuits. Since research and evaluation are at an early stage of development in criminal justice, and because the Guidelines highlights the most promising trends in contemporary practice, implementation of the Guidelines is noted with particular interest by this research component. Among the areas currently completed or under development are an analysis of the effects of closed circuit television in correctional environments; the Intake Service Center concept; classification instruments for early assessment and evaluation; substance abuse program alternatives; definitive criteria for halfway house program planning and facility acquisition, renovation or design; special needs of the mentally ill offender; comparative analysis of alternative physical environments for institutional program; and many more.

Principally intended as a sequentially employed planning tool, the manual has been found to serve in other capacities. Certainly, the range of users is expanded well beyond the architect, correctional administrator, and criminal justice planner. The sheer size of the Guidelines, and even the briefest survey of its contents, suggest that a certain complexity accompanies the determination of correctional needs or facility support requirements. This might well be called the shock effect. In many instances, the shock is sufficient to underscore the need for a greater level of deliberation in decision-making relating to the replacement of jails, or the estimation of present and future jail capacities. Such deliberation has included the use of the Guidelines in several subsequent capacities. Prominent has been its use as a basic reference for correctional programs and space utilization concepts. In the majority of such instances, no new construction was contemplated or needed. Instead, insights were offered as to the means by which existing system processes could be made more effective; how a variety of program operations could be made more effective; how a variety of program operations could be introduced into existing routines; and how adaptations of existing facilities could be accomplished. Often, even a minimum of capital outlay can further the support of program objectives or even bring new program operations to the threshold of realization.

In summary, previous efforts, especially by architects, to promulgate widely applicable design methodologies or "languages" have met with difficulty in not fitting "design behavior." The methodology contained in the Guidelines encompasses a broader scope of analysis and synthesis than is normally engaged in by architects. The reason for this lies in its orientation to problem-solving on an extremely comprehensive basis rather than to the usual limits of the architectural profession. Nonetheless, the methods and concepts are communicated by symbols familiar to architects. Organization is structured according to action sequences normal to design activity. Additionally, sectionalization clearly indicates the scope of specific concerns and their relationship to later decision-making. A common planning process is offered with respect to participants other than architects in the policy, planning, and design-making process.

2.4 SOLICITED POSITION STATEMENTS

Systems Programs and Habitability Criteria

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Our office has been heavily involved in the generation and communication of habitability criteria. Ordinarily, this work has developed as part of a large-scale systems program. All our big systems programs like those for SCSD, URBS, ABS, and the Veterans Administration, have involved the development of user requirements and the communication of information to program participants.

We also have done considerable programming work independent of system programs; and most recently, we have worked on two Space Utilization and Design Guides for the Corps of Engineers.

From our experience and thinking, I have a few observations to make:

1. The problem of communication is greater than that of criteria generation itself.

2. The specific audience--direct users, indirect users, design professionals, and approving authorities--is critical to the communication problem.

3. Communication is critical because all participants in the design process have a vested interest in their present criteria, both explicit and implicit.

4. Information overload occurs frequently. Most design participants can tolerate only small doses of additional information or criteria revision.

5. Criteria must be useable and related to the information specificity and needs of the participants in the design process.

Design Directives in the Military Construction Cycle

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It is highly desirable to meet Congressional demands for obligations of funds within the year of appropriation. The problem of late funding, i.e., construction funds becoming available as late as February, adds to the jamming up of contract awards at the end of each fiscal year. Two contributing factors have added to the problem. These are lack of adequate advance planning and the late issuance of design directives. The procedures for issuance of design directives need to be revised to match the time requirements for various types and sizes of projects. To this end it is necessary to understand the routine of scheduling in the Military Construction Cycle. A standard project requires the following design schedule:

Project Type and Size	Design Time
Up to $2 Million	10 to 12 months
$2 Million to $10 Million	14 to 16 months
$12 Million and above	16 to 20 months
Hospitals	24 months
Barracks Complex	18 to 22 months

From this schedule it is evident that even the smaller projects were to be advertised early in the fiscal year; design directives from OCE must be issued about a year in advance of building contract bids. For designs of larger building complexes, design directives should be issued up to two years ahead of the desired advertising dates. Since directives for most programs have been issued in the three- or four-month period prior to the start of the construction appropriation year, completion of the design often occurs in that year.

The item noted above indicates problems which arise without adequate advance planning. It is a well known fact that issuance of design directives does not incorporate contemplated criteria; it has necessitated a great deal of effort to secure the necessary criteria.

The issuance of AR 415-20, the Army Regulation on "Project Development and Design Approval" dated 28 March 1974, will have a direct bearing on the task of securing adequate design criteria. The time frame included in this regulation approximates four years. Presently, we are receiving directives at the end of the four-year span.

Three major items appear to be necessary prior to initiation of authorization for final design:

1. Master Planning: In this state, it is believed that the checklist required for PDB-1 (Project Development Brochure) should be completed at this stage, and that a complete analysis of utilities be made.

2. Advance Planning: PDB-2 should be prepared with an addition of more detailed information and preconcepts to provide a more realistic funding document, i.e. Form 3086 for development of final design.

3. Adequate Preconcept and PDB-2: An adequate PDB-2 with preconcept documents should suffice for use in lieu of additional design instructions.

2.5 WORKSHOP PARTICIPANTS' REFLECTIONS

Criteria Communication in the Corps of Engineers

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The Military Construction Directorate of the Corps of Engineers is right in the middle of the criteria communication issue. Generally speaking, we neither generate building programs nor design the final buildings. For the most part, we are a construction agent of the building users (our clients), and we represent them to the design professionals. Today, this is an increasingly common arrangement. Fewer and fewer buildings that are constructed involve any direct interaction between the designers and the users. Of course, in military construction there are exceptions to this situation, the most notable being medical facilities and laboratory buildings.

Getting user information and criteria appears to be a simple task. We merely go to the user and ask him what he wants us to build. We package the information into something called a project description or building program. We then hire a design professional, give him the project description and come back later to verify that he has done what we hired him to do.

All this assumes several things: first, that our client knows what he wants; second, that he can communicate this information to us; and third, that we can communicate this information to the designers. In short, it assumes that the communication is complete and that the very act of communicating the information is not a learning process in itself. In reality, these assumptions are poor ones to make. Rarely does one encounter a client who can clearly articulate his building need in terms that are not filled with biases resulting from his present environment. For example, he will say that he needs an office. If his present office works reasonably well, he will describe that. If it doesn't work well, he will usually ask for a bigger office, but seldom will he describe what he does in that room. Later, when the designer inquires about alternative possibilities, there will be little objective information to use as the basis for accepting or rejecting the design alternatives.

Much of the work that the Corps is now engaged in involves providing tools for the users. These will guide their planning decision process so that building needs will be stated in a way that can be readily communicated to and used by the design professionals. The planning decision process that the user goes through has several decision points. At each decision point there may be several alternative answers to choose from.

On any given project there tends not to be the learning process that would be possible if the designer interacted directly with the ultimate users of the buildings. However, with a construction program the size of the Corps', over $1 billion per year, it is possible to create a semblance of a designer-user interactive learning process over time, by incorporating feedback from projects already built.

The difficulty in implementing an approach such as this has been to decide on what to communicate. This involves answering many questions: which alternatives should be considered or not considered at each decision point; what questions are more properly answered by the user; what questions are more properly answered by the designer; how do we elicit answers to these questions without having the user make design decisions and not having the designer making program decisions.

Socio-Physical Technology

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The field of environmental design is emerging as a major factor for our society's way of making its decisions concerning the man-built environment. The field itself is, of course, very fragmented. It remains for us all to link science with practice without losing the human touch. It is not clear that our bridges to urban growth processes are even at the pontoon stage. The dialogues at Allerton left this observer with three basic conclusions concerning professionalism, application and the milieu.

1. Professionalism

In my opinion, professionalism is coming along reasonably well. Younger minds are being trained to start where most of us leave off. The jargon is not such a difficulty as it once was and evidence exists that conceptual understanding is not far away. Significant syntheses have emerged from the ballpoints of such investigators as Rapoport, Craik, Stea, Gutman, Zeisel, Archea, Pastalan and others. No "lingua franca" is forseeable, but useful perspectives are now well in hand. Conway has been amassing a wealth of references, schemas for transference, and timid sources of support for something that resembles a retrieval system. This remains a technical imperative before "D-Day" (Design Day) can be mobilized. The field is clearly multidisciplinary and increasingly interdisciplinary. Sobering is the word of someone's recent list of some 53 human sciences presently in business.

2. Application of Socio-Physical Technology

Not much can be said for this dimension. It is appalling that only U.S. Army barracks, jails and mental institutions have become the main users of socio-physical technology. Federal agencies are indifferent to their blind support of business-as-usual urban growth and development. The Department of Transportation avoids thinking about how it should induce better land use patterns. The Department of Housing and Urban Development is echoing the Congress in its formulation of the new National Institute for Building Technology as a strictly hardware operation. The Congressional mandate for design standards in mobile homes (now 90 percent of new housing starts under $20,000) is focused upon "safety" in the narrow sense, repeating in Pruitt-Igoe style the underwriting of unexamined social impacts of residential environment. Meanwhile, maverick designers and social science practitioners are continuing to work at all scales of the man-built environment.

One question remains: who knows better--the specialist or the user? Even with taxonomies and technologies to apply, do we have design and development processes in force that can match research evidence fairly with individual user preferences?

3. The Milieu

The environmental movement is politicized and enfranchised in our system of justice. The man-built environment is not and perhaps cannot be harnessed in the same way. Public officials cannot respond to racial and economic divisions at the same time that they cope with the rebuilding of America. Still, an issue such as habitability can be shown to have importance for our society in the future. The present time offers ample cause to say this, and the increasing level of sophistication in interdisciplinary environmental design may become of greater interest in the public (and political) eye.

If the milieu for the application of socio-physical technology is to improve, then people in the field of environmental design, who believe in their work, will have to be able to reach decision-makers at all levels of government.

Guideline Proposal for Criteria Communication

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I believe that the systems approach is the only means to achieve the objectives of the Symposium on "Programming for Habitability." As a consequence of this view I proposed at the final session the use of written guidelines with a means of constantly updating them, for implicit in the systems approach is the responsibility of all parties to be decisive and accountable. I have reproduced in its original form my guideline proposals made at the closing session of the Symposium. These are offered as a first draft of a possible format for guideline procedures:

General Guidelines--a set of books.

Vol. 1 Building types broken down on a generic basis and a sub-generic basis as proposed in my paper of May 2, 1972, "The Performance Concept in Building."

Vol. 2 Description of administrative procedure--overall and by district.

Vol. 3 Specific building project requirements.

I suggest that a small group of executive assistants at the national and district levels assist in facilitating and refining the guideline system proposed herein.

Vol. 1 General Problem Statement
A Functional Generic Guideline

1.0 Generalized guideline document setting out in plain or simple English, diagrams, charts, graphs or statistics, whichever presents the vital data with the greatest clarity.

1.1 The use for which the building is to be built.

1.2 The departments or elements of the function which are to be housed.

1.3 The required proximity and levels of interaction between the functions to be housed. The scale of circulation loads.

1.4 The usual area provisions provided for the discrete spaces of the functions to be housed.

1.5 Any critical dimensions, i.e., length, width or height of the discrete functional areas.

1.6 The general and special provisions to be made for the users in each of the discrete functional areas.

1.7 The detailed description of planning, functional details, equipment or other finite conditions, about which true factual data exist or which constitute the best way of handling a repetitive or unique problem in planning, design, or building burnishing or equipment, e.g., details of wheelchair operation.

1.8 Details of some optimum environmental service provisions.

1.8.1 By whole building

1.8.2 By discrete functional area covering:

Heating
Ventilation
Cooling
Special Ventilation
Air Conditioning

Water Supply
Sewage Disposal
Storm Drainage
Space Electrification
Lighting
Fire Control
Security Surveillance
Intercommunication
Data Retrieval
etc.

1.9 The external and internal building goods and people; conveyance systems, including truck, bus, automobile, motorcycle, bicycle, helicopter, aircraft or other technique.

1.10 The requirements of overall building security which will affect:

1.10.1 Gross building design

1.10.2 Detailed building design

1.11 The requirements of site layout:

1.11.1 Site form

1.11.2 Paved areas

1.11.3 Fences, gates and observation provisions

1.11.4 Landscaping

1.12 A synopsis of broad experience and up-to-date bibliography of the building design and construction techniques favored and/or acceptable in the principal climate regions to be served.

1.13 Any favored building construction quality standards presented on the standard specification format.

1.14 A brief review of standard procurement contract conditions which may affect building design and construction for the specific building type under consideration in this volume.

Vol. 2 General Problem Statement
<u>Project Administrative Procedures</u>

2.1 A description of the institution's authority structure.

2.2 A description of the relationship between the above authority structure and project size for the purpose of final approvals of project design and cost.

2.3 A description of the approval steps to be followed, the documentation involved and why.

2.4 A typical project PERT or Critical Path Diagram (CPM) from the beginning of the planning stage to the final and finished building in operation.

2.5 Areas affecting the institution's general operations which the building designer is free to comment on and which do not formally form part of a design brief.

2.6 Clear instructions on the level and degree to which the project must conform to municipal, state or federal laws controlling planning, the environment, and building.

Vol. 3 <u>Specific Project Problem Statement</u>

3.1 A concise statement of the overall purpose of the man-built facility and the general characteristics of its staffing, operation and management.

3.2 Project budget cost, building quality, followed by all the same items that appear in Vol. 1, but specific, project-related items, plus:

3.2.1 Site survey
3.2.2 Restrictions on the use of land
3.2.3 Local factors--all local labor, material, business, political factors

3 DESIGNER AND SOCIAL SCIENTIST COLLABORATION

3.0 PURPOSE AND OVERVIEW

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One of the things I like most about research is that you cannot lose. If a researcher conducts a test and the answer comes out different from the one expected, he can always say, "This negative result is important new information and we have learned something from the test." On the other hand, if the test results come out as predicted, the researcher can always say, "Aha, just as I expected!" The three papers that follow are fine examples of this principle in action.

As the reader will soon learn, the charrette portion of the Allerton Conference was designed to test a process model developed at the 1973 Coolfont Conference in Berkeley Springs, West Virginia. In the present papers, this model is referred to generally as "the Coolfont Process Model." The charrette was a conscious effort to let three teams of architects and social scientists collaborate in a désign situation in order to find out whether or not, and to what extent, the Coolfont model really worked.

As editor of the Coolfont document, I thought it appropriate to disqualify myself as the charrette evaluator and post-conference reporter. For this task, I was fortunate in recruiting Michael Durkin and Walter Moleski, neither of whom had been involved in the Coolfont Conference and who could provide some degree of objectivity in their observations and report. Their papers are included in this chapter.

In addition, it made sense to get a first-hand report from an architect and a social scientist who had worked together on a real-world project within the general framework of the Coolfont model. The case study made by Edward Ostrander of Cornell University and by Jim Groom of The Architect's Collaborative appeared ideal for this purpose.

The lumping together of such diverse notions, such as a charrette test of the Coolfont model, a number of uncommitted observers, and a real-world case study appears to have worked out well. What emerges from the three papers that follow is:

1. A sense of teamwork and allegiance to a common set of ideals about the need for in-depth information about human requirements and responses to the man-built environment.

2. Some very important notions about cost benefit and cost effectiveness because of the TAC-Cornell collaboration on the Oxford Project.

3. Some degree of confirmation that the process model as developed at Coolfont provides at least a working guide for architects and/or social scientists who may be attempting their first collaboration.

4. A great deal of confirmation that the Coolfont Process Model is an oversimplification of a touchy, but important and dynamic, relationship that develops between a designer and a social scientist when they do attempt to collaborate.

3.1 THE COOLFONT DESIGN PROCESS MODEL: A FINER GRAIN LOOK[1]

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The text of this paper is based primarily on the transcription from the talk and slide presentation given by the authors at the Symposium. Because of cost limitations it was not possible to reproduce most of the illustrations describing the case study project, the nursing home in Oxford, New York. The charts and tables are reproduced from "Social Science and Design: A Process Model for Architect and Social Scientist Collaboration;" Report of the Coolfont Conference edited by Donald Conway and published by the American Institute of Architects, Washington, D. C. 1974. (Editor's note.)

> Conferences, symposia, and vast bibliographies keep exhorting toward 'interdisciplinary collaboration,' but the specifics of how to collaborate have been elusive. The catch phrases we share now across disciplines have not proved useful, and the need pervasively felt is for new ground on which an authentic collaboration can be directed toward action. There is no doubt, moreover, that our whole culture's transformation from the rhetorical to the scientific--in attitude if not in fact--has also been occurring within the design professions. (Perin, 1970, p. 3)[2]

I sincerely believe that Constance Perin's remarks describe a situation that is well behind us. This is not to say that collaboration between behavioral scientists and people in the design professions is an everyday occurrence, nor that it is always a pleasant and constructive experience. But it is true that there is an increasing willingness on the part of a greater number of professionals in each discipline to listen to the other party before they reject these ideas.

The Coolfont Conference may not have paved the way for this kind of cooperation, but it formulated some ideas for many people to understand. We seem to be dealing with an idea whose time has come. In this paper we are briefly reviewing the emergence of the Coolfont interdisciplinary process model. We look at its substance, and then discuss a collaborative effort between The Architects' Collaborative and behavioral scientists from Cornell University. We do not claim to have solved all the problems.

The Coolfont Story

It was approximately a year ago that Don Conway, Director of Research Programs, AIA, brought together three social psychologists, Robert Bechtel, Edward Ostrander, Robert Sommer, and sociologist John Zeisel, along with architects George Agron of Stone, Marracini and Patterson, Shelton Peed of I. M. Pei's Office, Louis Sauer of Louis Sauer Associates, and George Hartman of Hartman and Cox in Washington to share ideas on interdisciplinary collaboration. The goal was to develop a process model that would validly describe the phases which architects go through in creating a building and also indicate the timing and nature of behavioral science contributions.

There was a general structure for the scheduled sessions at Coolfont. After an open

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[1] See Footnotes at the end of this paper.
[2] C. Perin, With Man in Mind (Cambridge, Mass.: The MIT Press, 1970).

session, recorded by a stenotypist, the nine people moved into three interdisciplinary groups to develop process models. In these work groups we debated and created our models which were later presented before the entire group as three agreed-upon versions of the design process.

Each team making a presentation described their model and clarified ramifications. These were reacted to and criticized by the others. During the course of the two-and-a-half day retreat other issues pertaining to the collaboration process and the resulting models were discussed.

Conway took the 274-page transcript along with various scribblings and graphics back to Washington. In a little over two months a streamlined 90-page version of the work appeared highlighting a single composite model and giving details of the three team models.

Basic Phases of the Design Process Model

It may be helpful to look briefly at the entire model (see Figure 1) and see the basic design phases and related behavioral science contributions that were suggested. The design phases include:

1. Pre job
2. Schematic design
3. Design development
4. Working drawings and bid
5. Construction and pre-occupancy
6. Occupancy
7. Future projects

Study of these phases shows that the linear model includes the major phases with which most architects would probably agree. However, there may be information feedback loops at many points along the way.

The prejob phase includes information preparation in the design office or in the field for presentation to the client.

The schematic design phase involves assembling the project team, defining terms, working out pre-programming, developing the program, creating the schematic designs and presenting the schematics to the client.

Design development incorporates human engineering design and general information.

Working drawings and bids concern negotiations.

Construction and preoccupancy focus on the structure and preparations before arrival of the user.

Occupancy includes fine-tuning of the building and the settling in of users.

The final phase, "future and other projects," refers to wrap up activity on the project. This is a basis for handling similar future projects with comparable user groups.

Behavioral Science Contributions to Early Phases

The contribution to each phase by behavioral science was described in the model in terms of content and form. For example, in the prejob phase, "psyching out" the client prior to the presentation was considered to be a valuable aid. Heightening the awareness of the design team to the function of the setting, and adding to the available information on the various user groups appeared to be appropriate at this point in the project.

The following description of the preliminary phases of the design process are elaborations upon the Coolfont model. They are based on the writer's experience and on discussions with architects.

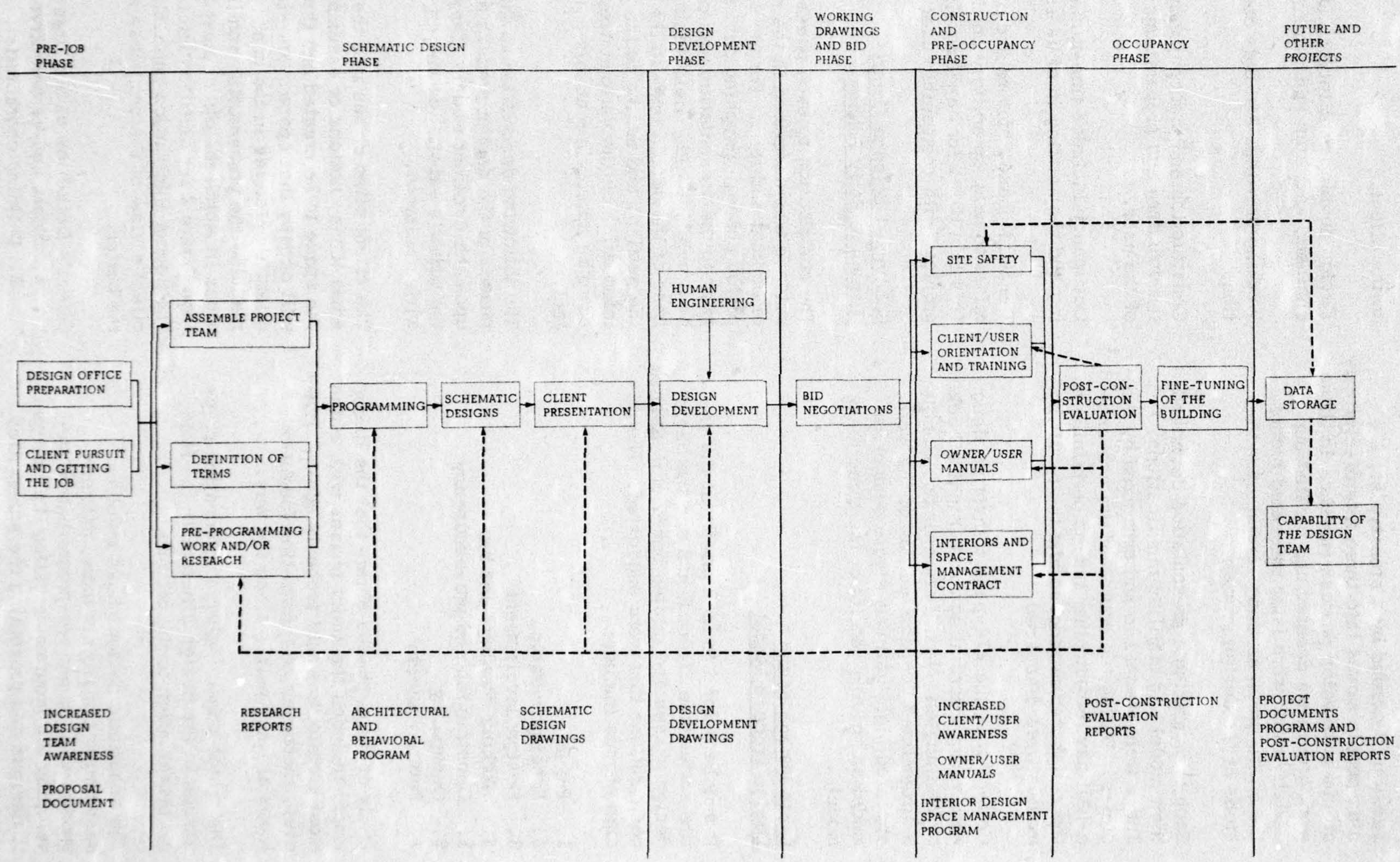
The client often comes into the project with some ideas, notions or assumptions about the space to be created and the users who will occupy that space. Knowledge of the client's "pictures in the head" will aid in planning the presentation and in identifying areas in which the client must be educated. (See Figure 2 for clarification of these points.) The sooner information pertaining to the client's view of the project is made explicit, the better.

Client's Definition of the Project

1. Goals and/or objectives
2. Building characteristics: type, space, form, tone

FIGURE 4

PROCESS MODEL
FOR
ARCHITECT-SOCIAL SCIENTIST
COLLABORATION



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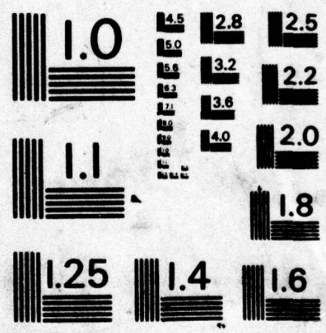


MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

DESIGN OFFICE PREPARATION.

A series of pre-job activities intended to better equip a design office to work with a social scientist. Activities consist of training seminars, library development, "networking" or establishing contact with other offices or social scientists.

CLIENT PURSUIT AND GETTING THE JOB.

Activities consist of proposal writing with special reference by the social scientist on the behavior/user section, initial or early client contact by architect and social scientist -- "psyching out" the client, identifying additional social scientist consultants; dry run review of client presentation; and architect and social scientist proposal presentation to potential client.

ASSEMBLE PROJECT TEAM.

Early definition of social science problems to round out the usual design team of architects, structural, mechanical engineers, etc. Architect/social scientist contract is probably negotiated at this point. Roles of the team members and scope of activities are defined at this point.

DEFINITION OF TERMS.

Identification and explanation of design philosophy, design team and client values are identified and compared, criteria for project's success are identified and made explicit.

PRE-PROGRAMMING WORK AND/OR RESEARCH.

Experience of architectural office and social scientist is reviewed in terms of preliminary design problems statement. Priorities and strategies for architectural program are established, relevant literature is reviewed, issues to be addressed and ignored are identified. Design problem is "negotiated" between architect, client, and social scientist. Relevant research from same or similar building types is collected. Programming methodology is determined at this stage. Data analysis methods and strategies for programming are determined.

PROGRAMMING.

Client/user/organizational needs and wants are determined. Behavior issues not identified by the client are made explicit. Interviews, questionnaires, behavior observation, simulation, and gaming techniques used as required to arrive at final program documents. Program documents reviewed with client/user. Early design problem statement reviewed, expanded, discarded in response to final program.

SCHEMATIC DESIGNS.

Social-behavioral issues and problems are incorporated into design concepts. Activity clusters translated into physical form, physical form and concepts are compared to behavioral program and alternative design concepts are generated. Schematic design concepts are reviewed before presentation to client and additional programming/research items identified and collected as needed to firm up schematic design concept.

CLIENT PRESENTATION.

Social scientist participation in presentation of schematic design to the client can reinforce and explain the organizational and administrative issues inherent in the design concept. Presentation of the social and behavior concepts of schematic design may carry more complete explanation and credibility by social scientist participation in the presentation.

DESIGN DEVELOPMENT PHASE.

Decisions about hardware details and special requirements are monitored by the social scientist to assure conformance with the social and behavioral aspects of the design concept. Human engineering and intricate user/need requirements for hardware items may be introduced at this point.

BID NEGOTIATIONS.

Social scientist team members assist in making trade-off decisions during bid negotiations in order to preserve or strengthen the social-behavioral aspects of the design concept.

SITE SAFETY.

Possible social scientist involvement of a human engineering nature to insure worker safety and smooth flow of communication teams during the building process.

INTERIORS AND SPACE MANAGEMENT CONTRACT.

Social scientist analysis of organizational space requirements and space management policies provides insights that increase the probability of architectural firm getting the interiors, layout and furnishings contract.

CLIENT/USER ORIENTATION AND TRAINING.

Training sessions for key client/user personnel can be conducted to insure understanding of design concept and space use possibilities and design intentions. Additional orientation and training to mechanical equipment and detail features at this point can serve to optimize user efficiency and satisfaction with the building.

OWNER/USER MANUALS.

These serve as additional orientation and training devices to insure and reinforce owner/user understanding of design concepts, space use potentials, and space management policies. Existence of manuals provides for change in up-date as buildings change over time and as new users come into the building.

POST-CONSTRUCTION EVALUATION.

Social scientist and architect data collection probably towards the end of one year guarantee period. Main purpose is to provide data for "fine tuning" building to owner/user needs and new behavior patterns that have developed in response to the new building. Second purpose is to aid the architect design team in its own development and to provide "feed forward" data for subsequent design projects.

FINE-TUNING OF THE BUILDING.

Recognizes the change in user or organizational behavior patterns that results from the new building and corrects deficiencies that stem from original program weakness and/or the difficulties of the design/build process. Extent of building alterations will vary with nature of user or organizational change and strength of original program.

CAPABILITY OF THE DESIGN TEAM.

Is strengthened by insuring systematic and accessible storage of information gained from post-construction evaluation and other stages of the process model. Specific task of feed forward into programming into future projects must be assigned to an individual in the design office.

3. Budget and economic flexibility
4. Site strengths and shortcomings
5. Users: number, characteristics, status, role, etc.
6. Social organization
7. Timetable and extent of flexibility
8. Aspirations, personal preferences, etc.

The design team also has some assumptions about the project in the initial meetings with the client. These assumptions may be well founded because they are based on previous experience with similar users or building types. In cases of unique user groups that the firm has not had much experience with, its assumptions about users and functional spaces may be somewhat inaccurate. The assumptions can be checked against valid user profile information (see Supplement at conclusion of this paper) which the behavioral scientist may be able to provide at the time of the presentation or when programming is considered.

Previewing the architectural firm's presentation is another area where the behavioral scientist can contribute. The range of competence which firms reveal in putting their best foot forward has to be understood to be appreciated. Too often the presentation becomes a slide show covering the firm's total experience instead of focusing on the client's concerns. Even "old pros" can get carried away on tangents in the heat of the presentation. Let's look at some points to consider.

Architectural Firm's Formal Presentation and Proposal:

1. Team members and manner of introduction
2. Establishing the firm's credibility and competence or personnel's ability
3. Evidence of experience and talent relative to:
   a. User groups (primary, support users)
   b. Building type
   c. Site potential and constraints
   d. Special functional considerations
4. Preliminary concepts or perspectives regarding proposed construction.

When we move into the schematic design phase, the researcher can offer considerable information as to substance. A concise listing conveys a sense of the possibilities and provides a target to shoot for.

Architect's Preschematics, Conceptualizing and Preprogramming:

1. Assemble user profile to permit checking of assumptions regarding users
2. Identify functional space problems as viewed by various user groups
3. Compile information on organizational patterns of functioning and norms
4. Serve as sounding board for initial thoughts on design concepts
5. Facilitate squatter sessions with staff, administrators or decision makers, and primary users.

The architect and behavioral scientist working together to establish the time table and the information to be collected may take some self-conscious effort in the beginning. But as the collaborators win each other's confidence, the joint effort can be highly effective.

When behavioral and architectural programming becomes the focus of concern, the behavioral scientist may be involved in the following activities:

1. Developing the fact finding team, assigning duties and determining authority relationships
2. Collaborating on the identification of priority fact-finding issues, timetable and target dates
3. Reaching agreement on the grain of the supplementary information needed on user groups, functional considerations, adjacencies and preferences
4. Analyzing the data in response to the design decisions
5. Interpreting the data into a format and at a level of specificity that is essential for design decision-making
6. Discussing the trade-offs that data may suggest

Translating the research data into a behavioral program on which to develop schematics requires the collaborator's patience and communication skill.

FIGURE 2 THE DESIGN PHASES AS COGNITIVE ACTIVITY AND THE TYPE OF USER BEHAVIOR INFORMATION NEEDED FOR EACH TYPE OF DESIGN DECISION

A

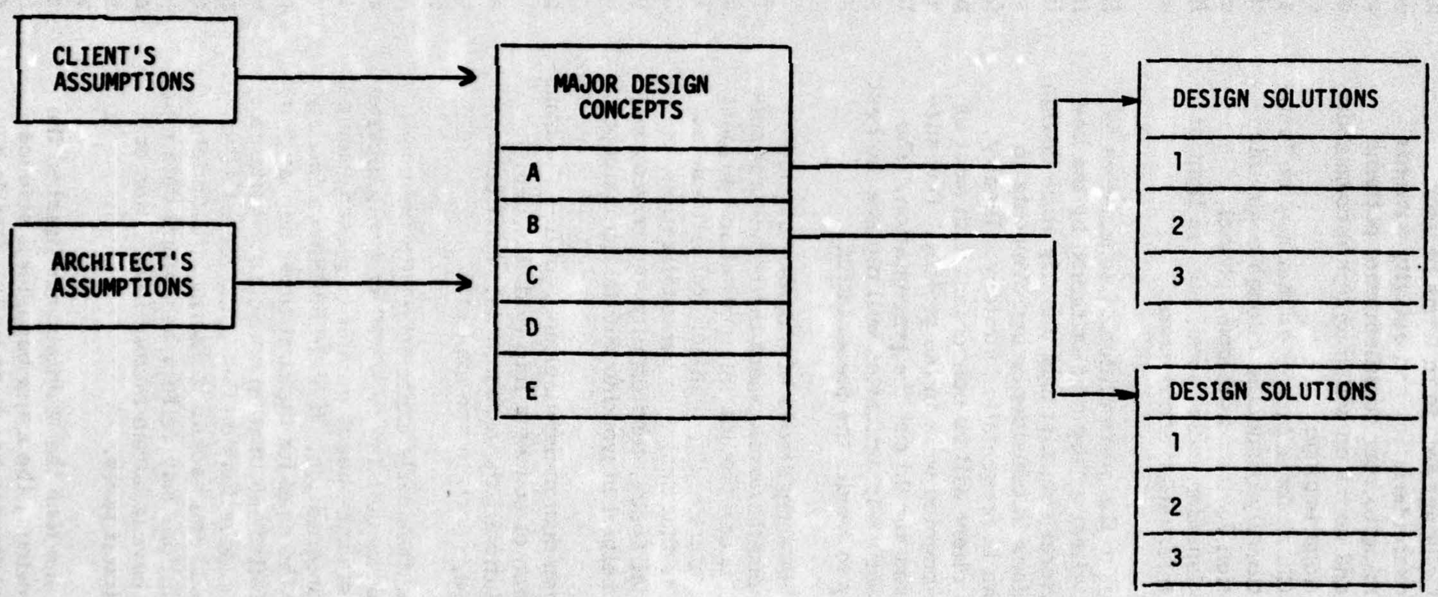
Information on users' physical and mental characteristics, behavior patterns, attitudes and preferences - Individual and functional sub groups

B

Information on theories of human behavior at the individual level dealing with perception, motivation & learning and at the group level dealing with social interaction, proximity, privacy, etc.

C

Information from research on human factors or ergonomics, psychology, sociology, and anthropology that enumerates critical activity related anthropometric data on users, physiological and physical information at a high level of statistical precision and with high reliability and validity



Schematic Design Review:

1. Enumerate goals and key design concepts that facilitate goal directed behavior
2. Consider design in terms of user characteristics and activity patterns
3. Bring to bear organizational patterns and norms on which design recommendations impinge
4. Check for adjacencies that may be functionally connected through communication devices (intercom, phone)
5. Consider scale, form, etc. in light of information about users

Prior to the presentation of schematics to the client a "dry run" critiqued by the behavioral scientist may identify some design options to consider or improvements to make in presentation strategy. Ideally, the client will be conversant with most of the ongoing work in the project. Few surprises should mar the presentation. The client's sophistication will dictate the best way to handle the presentation.

In the early stages of programming and schematic development the behavioral scientist can provide information and suggest literature rather than hard research data. Ideas that deal with personalization, personal space, territoriality and privacy may be helpful in working out design concepts.

When design development requires the translation of concepts into workable design solutions, the research data must be concise, concrete and explicit.

The designer's experience with the users and the building type will probably dictate whether he needs greater or lesser amounts of information. If he is building a facility for the aged for the first time, he may want detailed information on mobility patterns or suggestions on designing for arthritic hands and backs. Selecting appropriate solutions may call for behavioral data that go beyond human factors information or cultural facts.

By the time the architect has finished the drawings, the major behavioral science contribution has been made. Coolfont participants appear to agree on this point.

Behavioral Science Contributions: When Users Become Occupants

Once the construction is under way there may be only limited on-site work by the behavioral scientist. His next big effort concerns the user as an occupant. The same collaborative effort is needed with the designers responsible for the interior space and the amenities. There may be a rerun of the presentation effort in order to win the contract for the interiors and furnishings. Interior space programming can draw on the user research already completed.

Depending on the facility, users and staffing situation, there may be merit in developing orientation and/or training sessions for staff and users prior to or at the time the facility opens. This approach would be especially appropriate for medical facilities, apartment buildings and office buildings. User orientation or training activity can be supplemented by the development of a user's manual to clarify space management policies and to explain optimum use of the facility.

The researcher can also bring valuable skills to postconstruction evaluation studies. These efforts can help to fine-tune the building and spot minor changes in design or policy that might prove advantageous. The whole topic of postconstruction evaluation merits extended discussion in a separate paper but will be mentioned but briefly here. When the user profile and program documents are thoroughly developed, the postconstruction research can focus on questions that will shed light on design decision-making. As more postconstruction work is undertaken, the importance of "front end" documentation seen as the foundation for postconstruction work, becomes clearer. A section of the program document should include a set of research hypotheses that grow out of the program. These could be tested at the time of the postconstruction evaluation. As things now stand, too often the "front end" documents either do not exist or are so sketchy that it is difficult to determine whether the malfunctioning building is a result of inappropriate or inaccurate assumptions, poor selection of design concepts or faulty execution of the design solutions. The effort required to produce those instructive program documents is minimal.

The behavioral scientist may also bring something to final review sessions that deal with the question: What did we learn from this experience? If a building can be considered as an experiment, we should look at the evidence and use it to improve the next project. Reflection may bring a number of money saving insights.

The Pros and Cons of Collaboration

The art of collaborating has to be learned. Professional work norms and individual quirks create difficulties. The visual-semantic communication gap may be a barrier that does not bridge easily. Professional territoriality brings about disagreements.

We believe the agony is worth the ecstasy. The specific evidence for our faith is revealed in the documents and drawings. The truth will be revealed in the building.

Dimensions of Collaborative Friction: Two Viewpoints

We have considered a model for interdisciplinary collaboration and described its meaning on a job. Now we'll candidly discuss some of the elements in collaboration that have the potential for generating friction. The eight elements listed below are not mutually exclusive. Many are so interdependent that they cannot readily be separated.

1. Time frame
2. Professional work norms
3. Visual-semantic communications gap
4. Criteria for data quality
5. Cost/benefit ratio of research activity
6. Professional territoriality
7. Roles, status and authority relationships in project
8. Personality and personal styles

We will deal with issues by having each of us discuss points on which we have definite feelings. The exchange provides different perspectives.

Ostrander:
When we got into this project I always had the feeling that the researchers didn't have a power base from which to operate. It may have been because so many others involved were in a position to make what they said stick. So many people had a say. I'd like to write a book titled, The Project Without a Client. On the one hand, the Health Department was the ultimate client. The building would be turned over to them. The Dormitory Authority, on the other hand, handled the funding; so in a sense they were the client. We, as researchers, operated as advocacy planners for the users on the site. So we were representing the user clients. The administrator of the facility, who had been there for 16 years, might also be thought of as a client. He often provided valuable information about the people and the facility. Lucille Nahemow, gerontologist and consultant to the Health Department, was a client too. There were five clients in all.

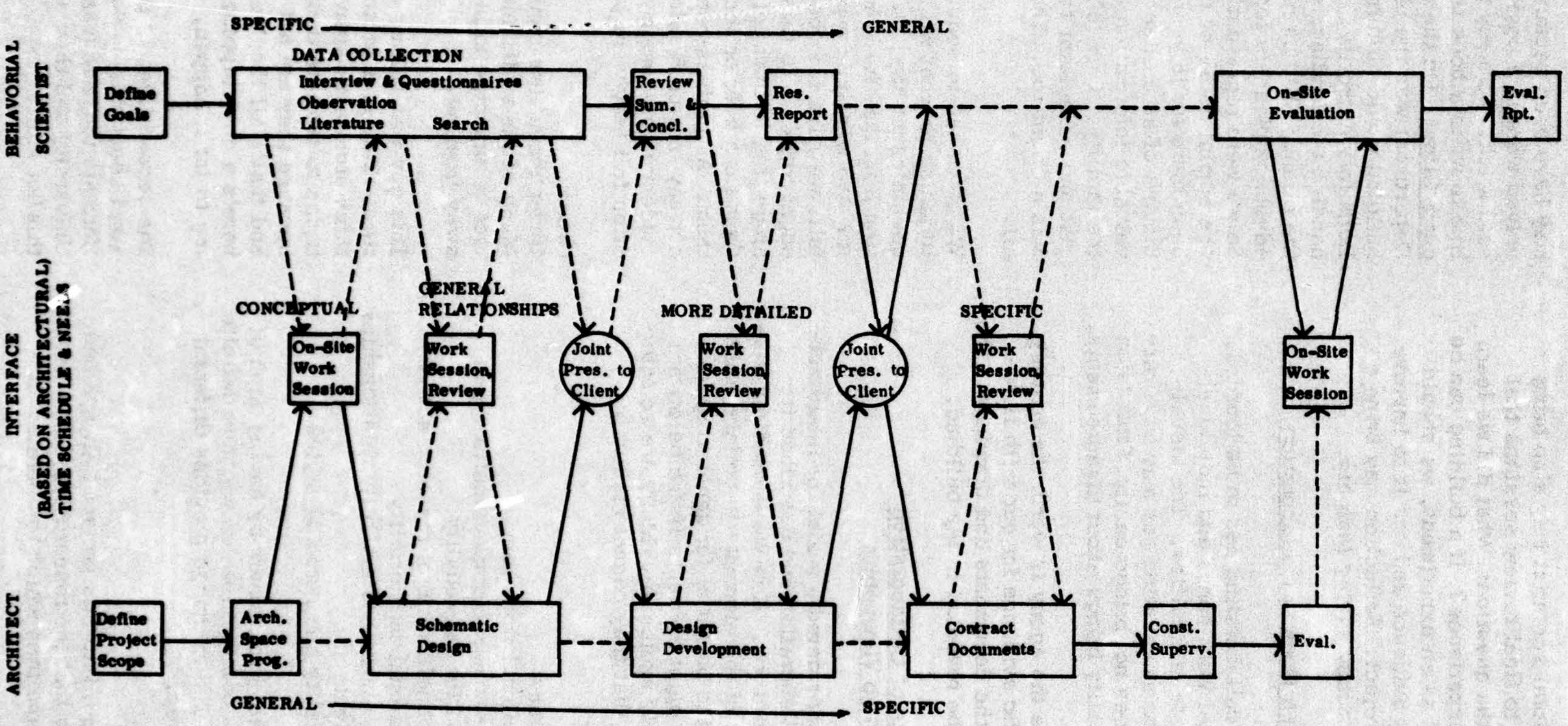
We often had to seduce the architects into listening to what we had to offer. We couldn't just say, O.K., here's our information from the site. Are you going to go with it? We were just a part of the act. I often felt, we have the goodies here, you really ought to listen to this. But we often ended up getting to them informally. We'd take them for a beer or something and lean on them. As professionals we should have had our say in a professional way. Here is my evidence, give me my day in court. But, I often felt they were putting us on.

Groom:
Under these time constraints I was frustrated. Many of the traditional roles that an architect is expected to play were being taken away from me.

This guy was telling me what to do all the time. This is a personal opinion again. I think architects spend an awful lot of time trying to promote their professional image because they are not getting paid that much and that's all they've got. As a professional, here's a guy chipping away and I'm not going to let it happen.

The second thing is that we were somewhat awed about this social science information. Here are these researchers from Cornell University and they are coming up with all this hot stuff!

CONFLICT OF ARCHITECTURAL PROCESS AND THE PROCESS OF BEHAVIORAL SCIENCE



In a way, in the beginning we treated nearly everything that they said as hard research in perhaps a dangerous way. However, there is a problem for us in being too isolated from the user by using social scientists as go-betweens.

Ostrander:
Another thing about the time frame is that as a researcher, I may have a three-year project. So I really don't sweat it for about two years and a half. And then I've got to sort of hustle. I tend to think in terms of years. If I don't get my research done this week, I get it done next week or the week after that. It doesn't matter. But suddenly you work with these architects and they are saying we need the research results tomorrow. As Henry Sanoff put it: "O.K., Mr. Behavioral Scientist. I am going to do these drawings tonight with or without your input. If you have it, give it to me."

So Jim said if I had good research information, he would at least look at it.

In any case, if we don't have information on time and we miss the train, the train keeps moving. To the behavioral scientist, the idea of quick and dirty fact finding is a bad thing. If I do quick and dirty research, my peers feel that I am a prostitute. I sometimes draw a picture of a bridge. Here's the pure behavioral scientists, on one side; here's the applied architect over on the other side and here I am in the middle, a keystone.

And the scientific purist over here says, you fraud, you have really gone down the road. You are doing sloppy work. The architectural practitioner says, you are so fuzzy headed, so unreal, too idealistic. I will be attacked from all sides.

I like to believe that I am really smarter than both the purist and the practitioner because I understand their viewpoints. Having to do fast research is very trying. I try to adapt, but professional social science peers who do not work with designers question the practice of quick and dirty research.

Groom:
This is a real problem. However, there are stages in the project where the collaboration was easier than other times.

Ostrander:
Let's discuss the visual-semantic communication gap. I think we, the researchers, have to learn to live with that gap and to convey things in a more visual manner than we were used to doing in the past. We often put designers on the defensive. In earlier research projects, nine times out of ten we came up with data from buildings that gave us the opportunity to say bad things about designers. Most people don't like to be criticized. We found a solution. We sometimes showed people slides and said here is a good way and here is a bad way to approach a problem. We let the visuals speak for us.

Verbiage is the real communication issue. Our Oxford Report (referred to later) runs to 209 pages. If we had made tear sheets, e.g. on the bathroom or on the doorknob, this would have been much better than the report.

Groom:
The Oxford Report was in two stages. The first stage was not indexed for lack of time. It was not too well illustrated. The second version had more bar graphs and illustrations which I could understand quickly.

The index was very helpful in the later stages because it was keyed to the way we looked at the problem.

Ostrander:
Regarding the criteria for data quality, we were trying to collect new data on the aged. We have an ongoing gerontology project and used Oxford as an extension of that project. We put some Cornell University money into the project in order to obtain additional behavioral data.

Very often we were trying to get research data above and beyond what Jim needed. One of our problems frequently was that we were getting data of higher quality when we didn't need it. For example, Jim was concerned about adjacencies. Where do the people belong? Where should the nursing head be relative to the administrators? We interviewed the staff and checked with them to find out what they did all day.

We were getting this information on 130 staff members. It wasn't going very fast. One day Jim handed out a piece of paper and said, "What do you do on your job? Where do you do it?" This was not an adequate questionnaire. It was very simple. We wanted something clear and comprehensive, so we went the long interview route.

One day Jim asked, "What have you got on adjacencies?" We said, "We've got only half of the interviews done." We then discovered that there was a notebook in the manager's office containing all the job descriptions!!!

The experience of finding such an unexpected source of information gave us an important insight. All Jim had asked for at that stage in the design process was a rough guess concerning adjacencies of functions in the Oxford Nursing Home project. He did not need a complete questionnaire survey.

How much information is needed at what stage in the design process? That is the real question. Often, a rough guess will suffice in the beginning, and more detailed information will be provided later as the project develops.

Groom:
I don't have more to say on data quality. We might try the next point on cost benefits of research. This again would be my opinion supported by several people at TAC. The behavioral scientists contributed in two ways:

They saved us money because they helped us stay away from false starts. I talked about that earlier. We got some information that we could live with. For us it was a foundation, it cut down our board time, our planning time, our total project time.

In this case we, the architects, didn't pay a fee to the social scientists. The fee was paid by the Health Department. We could have paid their fee out of our fee and the results still would have been of value to us. By the successful demonstration of this project, I hope, that is exactly what we will do with our next project.

The researcher has to be a real consultant to the architect just like any other consultant. You have to be convinced that they can save you time in their area of expertise. It is worth paying a portion of the architect's fee for such a service.

Ostrander:
The fact that there are personalities and personal styles of collaborators should not be ignored. Obviously, we are fallible human beings. There is some overlap here with No. 2 on work norms. I am a psychologist and was trained at the University of Illinois. I'm Ed Ostrander, an easterner. Jim Groom has his Texas background. There were times when we really worked well together. It's like a marriage. You spend a lot of time together and deal at a level of your professional identity. If you really find that you can't get along with the person, it's very hard. I think we are learning to do much better all the time. Reflecting on the experience for the presentation, we brought out into the open some things we have never talked about during the project. They may have been too difficult to handle at the time.

For instance, they kept saying, "You guys are saving us money. Why don't you tell the Health Department?", or, "Oh, no, we can't do that, they'll cut back on our fee." I often thought that wasn't a very good strategy. The individual's professional training imposes one set of constraints and his personality imposes another. I don't have the answer. De we need a training program for collaborators?

It does seem to me that behavioral scientists do not have all the answers to the architect's questions. I would certainly not say, go to your local college and pick out a behavioral scientist and you're all set. It's not true. One thing is clear, architects and social scientists have to be flexible.

The real challenge is for the social scientist to discover the architect's need for varying degrees of specificity of social science information.

SUPPLEMENT: "THE COOLFONT DESIGN PROCESS MODEL - A FINER-GRAIN LOOK"

User Profile: Definition

A user profile is an enumeration and assembly of information about a particular user group presented, and in a form that can be used by designers to make design decisions. The information may be drawn from the research literature, from experts familiar with the user group and by means of direct empirical research with the user group.

Nature and Scope of Information

Human Factors:

1. Mobility status of users: How does the user group move through the space and interact with the designed environment? With special user groups - the very young, the very old or handicapped - it is important to consider their ability to walk unaided vs. being prosthetically aided (use of canes, walkers, crutches.) Walking, assisted by other persons, or with the use of wheelchairs is information that should be documented.

2. Agility of users: Can the user move about through the space and function with ease and flexibility? Agility refers not only to lower limbs and mobility, but also to general body coordination and flexible use of the upper limbs.

3. Dexterity of users: How well can the users employ their hands and feet? Physical problems such as arthritis, paralysis or immature coordination are examples of causes of reduced dexterity.

4. Sensory Acuity: How well do the major sensory functions serve the user? Sight, hearing, smell, tactile sensitivity, equilibrium and kinesthetic sense all have an impact on interaction with space and objects.

5. Activities: What activities or behaviors are likely to be engaged in by the user group? The range should consider all the functions likely to occur in the space or with the objects. Recreation, work, daily living functions should be considered. In organizational settings job descriptions may provide useful information.

Psychological and Social Factors

1. Preferences for aesthetic or symbolic features: Does the group currently surround itself with repeated patterns of color, shapes, spaces and objects? Do these environmental attributes have symbolic meaning for the group? It should be recognized that expressed preferences, especially for spaces and objects not previously experienced, must be taken in with caution. However, inventories of existing preferences can be matched with expressed preferences.

2. Demographic information: Sex, age, socio-economic status, educational level are quite u[illegible] to have.

3. Cultural and life-style information: How do the users live and what do they value? How is their time spent? The symbolic meaning of objects and events (see No. 6) should be recognized as well as the overt behavior norms.

FOOTNOTES

The work described in this paper was carried out in part under a contract with the Dormitory Authority of the State of New York.

The views expressed are those of the authors. They do not necessarily represent the views of the New York State Department of Health or the Dormitory Authority of the State of New York.

Ms. Lorraine Snyder was codirector of the project with responsibility for on-site data collection; Ms. Joan Pease also participated in data collection, analysis and discussion with the architects.

3.2 PERCEPTUAL WORLDS IN COLLUSION: REPORT ON THE PROCESS MODEL CHARRETTES

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Introduction

The use of the word collusion in the title of this report is perhaps a misnomer since the purpose of the AIA Process Model and of the Workshop on Designer and Social Scientist Collaboration was not to engender a conspiracy between architects and social scientists. However, the title does attempt to characterize the current state of affairs regarding collaboration between these two groups. In most instances, the situation does, in fact, involve an attempt at cooperation between disciplines operating in different perceptual worlds. In this context, collaboration involves differences not only in professional jargon but also in approaches to problem solving, professional allegiances, attitudes about research and design, and mind sets. A detailed description of these factors will be left to a subsequent paper. However, it will be important in reading this review to keep these factors in mind.

Architects are becoming increasingly aware that the impact of today's complex environments on people often defies conventional methods of architectural analysis. This has led to an increased interest in incorporating the wisdom of the social sciences in design solutions. The trend has been paralleled by increased attention among social scientists to the behavioral aspects of environmental design. The magnitude of this attention is being documented by Andrew Euston at HUD who has compiled a list of over 45 disciplines and subdisciplines which are currently generating information relevant to architecture. Unfortunately, the problem with much of this information is that it is not usable by architects. Of the hundreds of social studies produced, very few convey information which can be applied by architects directly to particular design projects.

This report will deal generally with the third type of strategy and will focus specifically on a review of the Collaboration Workshop which was part of the symposium on "Programming for Habitability." It provides a review of the simulated application of the newly developed AIA Process Model for architect-social scientist collaboration. More importantly, it deals with implications for future collaboration derived from this experience.

The AIA Process Model for Architect-Social Scientist Collaboration

The Process Model grew out of a three-day meeting in Coolfont, West Virginia, of four social scientists and four architects interested in the collaboration problem. It was convened by Don Conway, the AIA Director of Research. Essentially, the Coolfont participants tried to answer the question, "How can social science information be usefully incorporated into the architectural design process?" The model which resulted is an initial attempt to pinpoint entry points for social scientists during the typical architectural design process and to coordinate and describe potential useful roles for the social scientists at these points. The model was actually used in practice during the design of a nursing home project in Oxford, New York. This particular project was carried out by the Architects Collaborative under the direction of Jim Groom; it employed Ed Ostrander, a social scientist at Cornell University. The Process Model is not intended to be a final statement on collaboration, but to provide a general set of guidelines and propose a structure in which collaboration is possible.

The Purpose of the Designer and Social Scientist Collaboration Workshop

The Designer and Social Scientist Collaboration Workshop had several goals. It was hoped that participation in the workshop would help to create, among both designers and social scientists, an experiential sense of the possitilities, dynamics, and problems of collaboration. The workshop was also intended as a means of evaluating the AIA Process Model in the hope of incorporating the lessons learned there in subsequent refinements of the model. Efforts were also made to record this endeavor so that the results of the experience could be shared with other symposium participants and ultimately with other interested designers and social scientists.

Operation of the Workshop

The actual workshop was preceded by a morning presentation to all symposium participants of the AIA Process Model and its application in the Oxford project. In the afternoon, workshop participants divided into three teams, with each consisting of several designers and at least one social scientist. One social scientist on each team had participated in the Coolfont Conference and had worked with architects on previous design projects. Each team engaged in a simulated design charrette, which lasted through the afternoon and into the early evening. Teams were given different fictitious design problems. Team A was assigned the design of military housing at Fort Redundant; Team B tackled a community-use school facility for Wahoo Valley; and Team C was charged with student housing for Podunk University. The programs had been developed in advance by Don Conway. It was felt that the particular choice of projects was best suited to the previous experience of the social scientists assigned to each team. Teams were instructed to develop their designs into schematic proposals during the time allotted. They then presented these proposals at 9 p.m. to workshop participants. A general discussion of experiences followed.

During the course of the exercise, Don Conway served as a surrogate client for each project. In this capacity he answered questions from team members, further refined the specific programs, and reacted to final proposals.

During the workshop, Walter Moleski, Sheldon Peskin and I served as observers. We rotated from team to team during the session and recorded our observations. Approximately a week after the symposium I conducted a telephone interview of 11 of the 15 participants to determine their experiences during the workshop: whether they felt it had benefited them and their attitude about the prospects of future collaboration between social scientists and architects. What follows is an analysis of the workshop, incorporating our own observations as well as feedback from interviewed participants.

Team Performance During the Workshop

Perhaps the most noticeable aspect of the workshop was the different approaches employed by the three teams in attempting to solve their respective design problems. The following three models can be used to summarize the diverse strategies:

> The generation and definition of the problem and its solutions through an iterative process of unstructured group interaction which was utilized by the Fort Redundant team.
>
> A highly structured, linear and analytically oriented process characterized by group interaction under the direction of a single team leader adopted by the Wahoo Valley team.
>
> An analytically oriented procedure utilizing both structured individual input and group interaction during the problem definition phase which was expressed in the work of the Podunk University team.

Although the reasons for these different approaches are probably highly interrelated, several factors can be identified. These include the composition of the teams, the role played by individual team members, especially the social scientists, team goals with respect to the product that they were producing, and individual expectations about the nature and purposes of the workshop itself.

The Fort Redundant team was composed of three architects, an interior designer and a social scientist. Two of the architects had had previous experience in working with social scientists and employing non-traditional design methodologies. After a brief period of competition, the two served as the chief coordinators of the group activities. The activities tended to be predominantly design oriented with physical implications proposed and discussed from the outset. Concepts of iteration and "fast-tracking" were also discussed. This orientation is probably the result of the heavy concentration of designers in the group.

In this context, the social scientist acted almost entirely as a resource person. He responded to questions from other team members and provided behavioral information when needed. He was later described by fellow team members as having been supportive, knowledgeable, and resourceful. Perhaps these are three of the most important characteristics for a social scientist operating in a designer dominated mode.

"Psyching out the client" is a role which many designers perform instinctively but which a social scientist might be able to accomplish more effectively. During the Fort Redundant process the social scientist assumed this role. In his own words, "A lot of time was spent by the architects trying to analyze the kind of person the client was. Would he want a choice in order to make the final decision himself? Was he an authoritarian? Finally, it was decided to send the social scientist to interview the client in order to answer these questions. This new role helped speed the design process considerably."

The Wahoo Valley team was composed of two social scientists and three architects. One of the social scientists served as a team leader and in this capacity coordinated a linear, analytically oriented approach to behavioral issues. It began with the identification of users and their activities. A discussion of related human requirements followed. Finally, potential behavioral settings were discussed and design implications considered. During this time, the social scientist volunteered a considerable amount of behavioral information about education and other relevant aspects of the problem. He also solicited information and opinions from individual team members and the team as a whole. This role was admittedly more active than what the particular social scientist would attempt in real practice. However, the intent was to demonstrate the range of contributions that the social scientist could make to the process.

The Podunk University team, also composed of two social scientists and three designers, behaved in a linear, analytically oriented but unstructured fashion. During these activities the social scientists played a cooperative and supportive but nondominant role. One social scientist felt that the role of the social scientist has to keep a low profile at first and to gradually develop his credibility; and to recognize that coming on too strongly in the beginning might violate the territoriality of the architects. In this particular case, the activities of the social scientists complemented one another. One scientist provided helpful information including statistical data about user requirements in student housing. The other tended to focus primarily on process concerns. For example, at his suggestion, each team member privately jotted down his or her own opinion of five principal concerns that the project should consider. These were later synthesized by the group into a set of design requirements. This activity, incidently, was the most structured aspect of the team's problem-solving work. Later, one of the architects played a more active role in coordinating the preparation of the schematic presentation.

The difference in team approaches to problem-solving can also be partially explained by a comparative look at respective goals for the final product. The Fort Redundant team attempted to determine the client's requirements and concentrated on the development of a solution which would satisfy these requirements. The Wahoo Valley team, on the other hand, concentrated on developing a better product and paid little, immediate attention to selling the project. Meanwhile, the Podunk team devoted its energies to developing a generic design solution, expanding the client's awareness of the problem area and trying to promote social change.

Although the goal of each team was ostensibly to produce a convincing design product, this task tended to be deemphasized during the course of the workshop. The Fort Redundant team became very excited about their discovery of the iterative concept. They concluded that it was a better representation than the AIA Process Model of what had actually developed during the Oxford project. Much of the team's energy was then devoted to developing a methodology which would reflect and emphasize this concept during the later presentation. The Wahoo Valley team also focused on developing a methodology which one of the members said substituted very early for the surreal client.

Individual expectations of the workshop also seemed to be reflected in this change of emphasis. Participating designers in general felt that producing a physical design solution was not as important as discovering whether or not they could develop a comfortable working relationship with social scientists.

This dual focus on process and product became apparent during the evening presentations. While each team did present a design solution, the solutions were only preliminary. The real emphasis in selling the project to the client was placed on the user-oriented methodologies which formed the rationale for the solutions and which would still be employed in arriving at the final design solution.

The Workshop: Sucess or Failure

Participants differed in their opinions of the effectiveness of the workshop. The social scientists were generally pleased with its outcome. They felt that they had succeeded in demonstrating that collaboration between the two professions was possible and that the workshop showed some of the ways in which collaboration is possible. In general, participating designers who had not previously worked with social scientists agreed with this assessment. Many indicated that they would attempt to include social scientists in future projects. In fact, at least one of the social scientists has already been so employed as a result of his participation in the workshop.

A dissenting view was offered by two architects who had previously worked with social scientists. One felt that the workshop was a poor simulation of the collaborative process and that nothing new was learned. The other added that "if anything new was to be learned...it would necessarily be related to how one went about the task of design with unknown individuals from a variety of professional backgrounds."

Although the Designer and Social Scientist Collaboration Workshop did seem to accomplish its goal of increasing awareness about the possibilities of collaboration, it fell short in facilitating a comprehensive evaluation of the AIA Process Model. This was mainly because time constraints and the design of the simulation. There simply was not enough time for social scientists to perform many of the roles outlined in the AIA Process Model. formal data gathering, design review, etc. Also, team goals were too artificial and not defined clearly at the beginning of the charrette. Finally, the assignment of different design problems to each team made a comparative analysis of team performance extremely difficult. Additional attention to the details of simulation design will make subsequent experiments more easily evaluated.

trained in both the social sciences and one or more of the design disciplines. These people are in most advantageous positions in that not only do they speak the language of both fields, but, to a certain extent, they have absorbed the attitudes and values of each field. This enables them to translate the information and thereby serve as synthesizer, communicator, and intermediary between both disciplines.

Another aspect of this issue is the probable future trend toward specialization among social scientists. As social scientists work more and more with architects, they will tend to specialize in terms of the environmental settings. Their experience will be a result both of the extremely specialized nature of certain types of environments, such as hospitals and nursing homes. Architects also tend to specialize in the building types they do for the same reasons.

The state of the art in environmental psychological research is marked by "general purpose" methodologies for obtaining information. These approaches can, theoretically, be used in analyzing a number of types of different environments. However, as basic knowledge about particular environments becomes more cumbersome and refined, specialization will probably take precedence over particular methodologies and approaches. This emerging trend was exemplified by the choice of different design problems for workshop participants.

The enthusiasm of workshop participants concerning future collaboration between designers and social scientists might be misleading because of the self-selected nature of the conference attendees. However, an increase in the popularity of such collaboration will probably result in the apperance of immediate experts as well as sincere individuals. The result might be considered similar to developments during the initial years of environmental impact reporting. Several architects who attended the symposium suggested that an effort should be made to make a list of social scientists who have been working in the environmental field and to categorize their areas of specialization and the types of projects they have been involved with. The list would be a directory which would help architects in their quest for social scientists.*

In spite of the AIA Process Model and the workshop, questions still remain as to the social scientist's role during the collaborative effort. For example, one participating architect who spent a considerable amount of time working with social scientists on design projects feels that the social scientist should be merely a consultant who contributes information at the beginning of the process. An opposing stand was taken by several other architects who felt that the social scientists could most effectively contribute when they were involved in the design process from beginning to the end as design critic, collaborator, and contributor, and that this could be most effectively accomplished when the traditional professional roles were temporarily eliminated.

Results of the workshop seem to indicate that there is no "either/or" solution to the question. The emerging role of the social scientist in the collaborative process will continue to be defined through negotiations between architects and social scientists in specific design projects. The AIA Process Model provides a useful set of guidelines for this endeavor.

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Implications for the AIA Process Model Derived from the Workshop

Several results of the workshop do, however, have implications for further development of the AIA Process Model. The model gives the impression of a linear process. Perhaps this linearity was intentional or a result of the particular graphic device used to represent it. In any case, subsequent editions of the model should reflect the iterative nature of the collaborative process as suggested by the Fort Redundant team members.

The existing model is incomplete in that it fails to include specific procedures for translating behavioral information into physical design solutions. This was pointed out by one of the architects on the Wahoo Valley team. He mentioned that his firm had developed a procedure for achieving this translation. Additional iterations of the model should attempt to incorporate this as other translation procedures becomes better known.

The present model also gives the impression of a very structured, well-defined process for collaboration. However, the results of the workshop suggest that many factors interact to determine the dynamics of a particular collaborative effort. These factors include the philosophy and theoretical position of group members, their concepts of problem-solving, and the interpersonal dynamics which influence group decision-making. Certainly, continuing efforts should be made to incorporate in the revised model pertinent information from the voluminous accumulation of science literature in the subject area. Also implied is that collaboration can take place in a variety of forms, and that the collaborative process might have to be individually tailored to specific design projects. This dimension should also be reflected.

Additional Implications for Future Collaboration

Perhaps the most notable deficiency of the Process Model in its present form is its single focus with respect to social scientists. The model tends to view all social scientists as possessing the same variety of skills: that of group facilitator, environmental evaluator, etc. However, social scientists tend to specialize. Some, because of their training and personal inclination, become competent group facilitators; others are more adept at research. The implication for architects attempting to use the Process Model is that perhaps more than one social scientist is needed to adequately carry out all of the model phases. Perhaps several social scientists with complementary skills are required, or maybe these skills can be supplemented by the architect.

Another aspect of the situation is simply that not all social scientists are adept at handling architectural projects. The experience and skills required of social scientists working with architects varies greatly. Euston's list of 45 contributing disciplines and subdisciplines is a first effort at identifying those social scientists who have contributed research and are interested in issues of environmental psychology.

During the past 10 to 15 years there has been a movement within the social sciences as well as within the design professions toward a synthesis of the two disciplines. The synthesis is extending to the fourth generation of environmental psychologist. In the first generation were traditional, nonphysically oriented social scientists. They were contacted by architects who felt that social scientists could contribute useful information to design projects. When they could not do so, many architects became disenchanted. The second generation was composed of traditionally trained social scientists who later became interested in the physical environment. They more or less maintained their professional base, although some of them became associated with schools of architecture and design. The third generation of environmental psychologists were trained in schools of psychology and architecture and in environmental psychology. However, they did not receive adequate design training. And now, the fourth generation is composed of social scientists and architects who are trained in both the social sciences and one or more of the design disciplines. These people are in most advantageous positions in that not only do they speak the language of both fields, but, to a certain extent, they have absorbed the attitudes and values of each field. This enables them to translate the information and thereby serve as synthesizer, communicator, and intermediary between both disciplines.

Another aspect of this issue is the probable future trend toward specialization among social scientists. As social scientists work more and more with architects, they will tend to specialize in terms of the environmental settings. Their experience will be a result both of the extremely specialized nature of certain types of environments, such as hospitals and nursing homes. Architects also tend to specialize in the building types they do for the same reasons.

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3.3 SUMMARY STATEMENTS BY CHARRETTE CONSULTANTS

Some Critical Issues

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The charrette I worked in had the task of attempting to apply the Coolfont Process Model to the design process. We proceeded to drop the model immediately. This is no reflection on the model. It was not intended as the last word in the process of designing; its major intent was to show at what points in the design process the social scientist could help.

The process we settled for became known as the spiral or corkscrew model. Essentially, it overlapped all the normal steps of the design process, compressing them in time, and then having a feedback on each step (hence the spiral apperance) that produced a finer and finer definition at each stage.

During our work, a role for the social scientist came forth that was not mentioned in the Coolfont model or considered in the spiral process. This was the role of the social scientist in "psyching out the client." The architects spent time trying to analyze the kind of person the client was. Would he want a choice in order to make the final decision himself? Was he an authoritarian? Or, did he want us to make all the decisions for him? Finally, it was decided to send the social scientist to interview the client in order to answer these questions. This helped to speed the design process considerably.

After the charrettes, all three groups heard the presentations and discussed the issues. Perhaps the most interesting issue was the apparent split between the East Coast designers and the West Coast designers. Without intending to belittle, but nevertheless with some satisfaction, the West Coast designers pointed out that they had been using social scientists for some years. Why weren't the East Coast designers doing the same? It was also pointed out that the spiral model was really developed from the Design Methods Group and had been in use for some time.

No one was able to handle the issue of why there was a difference in practice between the East and West Coast, nor even to discern whether this was more a result of the kinds of people who attended the conference. To me, it was the most interesting question raised.

The issue of how the architects would pay the social scientists was not dealt with in the charrettes because they were set up with the social scientists being prepaid by the client. I wonder if things would have worked out differently if they had not been prepaid?

The charrettes were an interesting and valuable experience for all participants. If the two other sections of the conference had been similarly organized there might have been more satisfactory experiences.

Reflections on the Allerton Conference

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At this conference, the promised marriage between social scientists and architects did not take place, but there were some blind dates which included the holding of hands, questions of innocence, and promises of romance. I do not think that the "Son of Coolfont" was conceived, as "Matchmaker" Conway had hoped, but there was some talk about proceeding down the garden path.

The charrette session revealed that the Coolfont Process Model does not lend itself to explaining how the collaboration between social scientists and architects might take place. It describes the points of mutual interest where collaboration is possible. It might best be described as the map of the garden path, showing where the couple could dally, if they were so inclined.

It was evident in both the presentation and the working sessions that the architects were quite naive about the working style of social scientists. If this had been a conference comprised of social scientists, I am quite certain that they would have been equally naive about the functions of architects and environmental designers. In essence, the Coolfont Process Model effectively points out to the architect where collaboration can take place and what its potential product will be. The manner in which the collaboration is carried out will vary considerably with the diverse contexts in which it takes place and the personalities of the participants.

The presentation of the Oxford Nursing Home Project was one example in which the environmental psychologists were involved long before the architects. The psychologists were responsible, to a degree, for selecting the architects. To the architects, it represented a "shot-gun wedding;" when they received the commission, they also inherited the client's social scientists. In this case, the relationship between the two developed differently from the more typical situation. The more common practice is for the architect to employ the social scientist as a consultant. The architect seeks help in solving a complex problem; the social scientist sells his services in a particular field of expertise such as corrections; or the client demands a more in-depth solution to his environmental problems.

When faced with the task of establishing a working relationship with a social scientist, how does the architect achieve effective collaboration? First, as a designer, the architect must develop a clear understanding of his needs for information and a realistic expectation of how the social sciences can help him design a better environment for people. If the architect does not know what he wants from the collaboration, there will be a lot of wasted effort to get on the right path. The architect must understand how he structures his personal design approach, how he identifies problems, develops and applies information, makes decisions, and evaluates priorities. In seeking aid in problem-solving, the architect must be aware of the impact that the information will have on his problem-solving activities.

The architect must also become familiar with the theory, knowledge, and methods of the social scientists in order to understand their effectiveness and limitations in producing information. All too often the architect will have the unrealistic expectation that a social scientist will come up with answers to all the human problems involved in a project: predicting behavior of the users, and giving the architect scientific information that will enable him to create the perfect human environment. Much like architecture, the environmental social sciences are not exact and are at an elementary stage of development. Several recent publications fully examine the relationship between human behavior and design.[1] The architect must realize that he can solve only problems which are inherent in the design of the physical environment and not the social or economic problems of

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[1] J. Lang, C. Burnette, W. Moleski, D. Vachon, Designing for Human Behavior: Architecture and the Behavioral Sciences (Stroudsburg, PA.: Dowden, Hutchinson & Ross), 1974.

W. Ittelson, H. Proshansky, L. Rivlin, and G. Winkel, An Introduction to Environmental Psychology (New York: Holt, Rinehart, Winston), 1974.

R. Sommer, Design Awareness (San Francisco: Rinehart Press), 1972.

the users. To aid the architect in solving design problems, the social scientist can sensitize the architect to human concerns about environmental design or a particular building type. Or he can define the human requirements for a particular project in fine detail by describing the user population, identifying environmental needs of the users, predicting the fit between needs and form, and evaluating design decisions. But the objective approach of the social scientist will not relieve the architect of the responsibility of creating a good environment. It has been our personal experience that no matter how involved we are as environmental psychologists in a project, its success as a human environment is largely dependent upon the ability of the architect to synthesize the information made available to him. To paraphrase Louis Kahn, it is the responsibility of the architect to take the inputs of social scientists and change them "to put them into the realm of architecture, which is to put it into the realm of space."

Questions

The first question the architect must ask is, "Why do I need a social scientist?" If one cannot define this need, a successful working relationship cannot exist with a social scientist or any other consultant. With his professional traditions and practices, the architect knows why he employs the services of a structural or mechanical engineer and what to expect from their participation. He recognizes a need to hire a consultant to solve a complex structural problem, if he cannot solve it himself. Likewise, an architect must decide if the services of a social scientist are required for a project or if he can make the investigation on his own.

The architect's second question is, "How can the behavioral scientist contribute to the project?" The Coolfont Process Model serves as a general guide. The model is conceived as an abstract process and does not indicate how a particular collaborative effort should develop, based on the interpersonal dynamics of the working relationship or on the requirements of a particular project. Although it points out many areas in which collaboration may take place, the economics of architectural practice generally limit involvement of consultants. Unless the services of the social scientist are paid by an additional contract, it is unlikely that the collaboration would be as complete as described in the model. Thus, the architects must analyze the project and determine what the impact of the social scientist should be on the design efforts.

Perhaps the greatest effort is to be placed on programming to ascertain project design criteria; or it may be on post-construction evaluation so that the architect gains feedback on his design decisions. It may be on developing an information bank for a building type in which the architect specializes. In other words, the architect must develop a critical path of information flow for the project so that the data may be developed in a form and level of detail which is meaningful and clear to the architect.

The third question the architect must answer is, "What role should the social scientist play in the process?" Should he be an active member, generating ideas toward solutions to environmental problems; should he be an advocate of the users, forcing the architectural designer to respond to their needs? These are all roles that a social scientist can play in any of the areas delineated by the Coolfont Process Model. The architect must decide which role will suit his needs, individual working style, and the requirements of the project.

The final question is, "How does the architect locate his favorite neighborhood social scientist?" There are four characteristics important in selecting behavioral/social science consultants. Previous experience in working with architects will save the architect time in teaching the mysteries of the design process, how to interpret the drawings, and how the physical environment is structured. The behavioral scientist will then not be naive about intuitive leaps in the process, astonished by unreasonable time constraints in collecting data, flabbergasted at lack of scientific concern, and baffled by the unfamiliar jargon. Moreover, the behavioral scientist who is academically and laboratory oriented, uninterested in the effects of the built environment on users' behavior, and unconcerned with applying research in the real world, should not be selected.

Also, the social scientist must be willing to work outside his traditional milieu in a manner that may be considered unscientific by his own colleagues. To perform as part of the design team, the social scientist will be asked to compromise when there is no time to conduct a rigid statistical investigation. Or he may respond to questions that developed during the design process and which require his value judgments. Unless he is flexible in both personality and work style, the collaboration will be less than successful. However, the social scientist must remain objective and employ the rigors of science as best he can.

The behavioral scientist should also have experience in working on the building type in question. This is most important in the initial phases of the Coolfont Process Model, such as design office preparation, client pursuit, and preprogram research. The ability of the behavioral scientist to gather and analyze data and generate design criteria will transcend the importance of having experience in a similar building type.

And, there should be a common belief in the nature of the relationship between the man-built environment and the behavior of the users. Obviously the social scientist should know that the two are in some way related. Since there are as many theoretical positions in the social and behavioral sciences on this relationship as there are in architecture, the architect has to evaluate these positions and choose the behavioral scientist who most fully meets his needs and strengthens his capabilities as a designer.

After the architect has satisfactorily answered the questions about collaboration to his own satisfaction, he must initiate a dialogue with his now-favorite social scientist to gain an understanding on the issues. Is there a legitimate need for involvement of the social scientist in the project? The architect feels that there is, and the social scientist must believe that he can make a contribution. In what way can he contribute most effectively to the project? What kind of useful information can the social scientist provide the architect about the project? How will the project be structured? Finally, what roles will each member play? Both parties should get to know each other and not be inhibited by artificial, professional boundaries.

Problems

It is recognized that the value systems of the two professions are quite different and in many ways lead to conflict. Architects, by training and experience, are synthesizers who tend to deal wholistically with views of the problem. In general, they are not analytic types. The social scientist is an analyzer who tends to dissect a problem into components and statistical entities. There must be a unified view of the design process which integrates the approaches of architects and social scientists.

Another dimension of the conflicting value system is that architects are change-oriented. They must make value judgments in order to initiate action. Social scientists concerned primarily with the recording of behavior are traditionally not required to make value judgments. Since collaboration in designing the environment is action research, the behavioral scientist will have to give up his non-involved scientific approach and make value judgments about actions that must be taken to build a more human environment.

The final aspect of the conflicting beliefs of the two groups is that architects work in a highly intuitive manner, making creative leaps to problem solutions and relying on subjective feelings to guide their actions. The social scientist, because of the pressure to be scientific in an area that resists quantification, is often rigidly objective. To establish a working collaboration, both groups will have to understand each other's positions. Architects must become more objective but still rely on their intuition; social scientists must make room for subjective feelings about the environment but remain objective.

Another potential conflict concerns legal responsibility. The architect is held legally responsible for his actions. Fortunately for him, this responsibility does not include habitability aspects of building. However, with greater emphasis on consumer protection and new legal interpretations of design responsibility, the architect may soon be held legally responsible for meeting a project's human needs. Currently, the social scientist has no contractual liability in predicting human behavior in a given design, as well as no means of accountability for his judgments. The question then arises as to how much reliance an architect can place on his social scientist consultant. The architect can hold his engineering consultant responsible for failures in the structural system, but will he be able to hold his social scientist responsible for failures in the human system?

While those social scientists participating in the charrette sessions are not in conflict with the work patterns and belief system of the architectural and planning professionals, they are not typical representatives of their disciplines. Some have had previous experience with architects in a design context, and they are very willing to work outside the traditional confines of their professions. They are concerned with the effect of the man-built environment on the users. Of course, there are any number of similar social scientists who did not participate in the conference but who will also be willing to collaborate. In addition, there is a growing number of multidisciplinary people who have backgrounds in both design and social science. These people have crossed both boundaries: architects who have studied environmental psychology or sociology; social scientists who have studied design and planning. They form the core of a new segment of the environmental design profession: environmental analysts and programmers whose role is to relate the social sciences to design in a systematic fashion.

To insure the success of the collaboration, several precautions must be taken. Involvement of the social scientist should be early in the project, in the preproposal stage and continue to the end of the project. This enables the architect to prepare for the project by way of sensitizing his staff to the implications of the design, and to develop the necessary feedback loops by evaluating design decisions scientifically and objectively. Finally, there must be a mutual understanding of the potential roles each partners in the collaboration is to play. The traditional boundaries of each profession should not be rigid. The architect has tremendous intuitive and first-hand experience as to how people behave in space; the behavioral scientist is a source for design concepts and ideas which may lead to design solutions.

<u>Summary</u>

In summary, it is obvious that collaboration has considerable potential if architects are to become more knowledgeable of the social sciences and if social scientists are to become more knowledgeable in environmental design. The benefit of the charrette session was that it allowed one professional group to become better acquainted with the other and to point out the salient features of a collaborative model. The next step in developing the Coolfont Model should be to analyze more collaborative efforts, such as Ostrander's work with TAC; Zeisel's with Louis Sauer; Davis' and Roizen's with Kaplan-McLaughlin; Moleski's with Hartman-Cox; Wheeler's with Ewing Miller; and Sommer's with Sam Sloan. Only by looking at these efforts, made within the constraints of everyday practice can a working process model be further developed. The Coolfont Process Model could serve as the structural guide for the analyses suggested above.

3.4 SOLICITED POSITION STATEMENTS

Educating for Behavior and Design Research

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There are four problem areas to discuss: (1) formal means for bringing practicing design professionals and behavioral scientists together scarcely exist; (2) formal channels for placing graduated behavioral scientists in design-associated jobs hardly exist; (3) opportunities for bringing design students and behavioral science students together during their periods of training are at present minimal; and (4) the quality of behavioral science instruction currently being offered to design professionals and design students is not always satisfactory.

1. Cooperative efforts involving behavioral or social scientists and design professionals have been based on accidents of acquaintance or friendship; word-of-mouth recommendations; chance reading of articles in a widely scattered literature; and, in the last few years, reference to more or less complete directories of interested specialists. The growth of associations such as The Association for the Study of Man-Environment Relations (ASMER) should be of great help in promoting interdisciplinary collaborations, but even these channels are not a complete solution. Much of the problem is economic: we don't know where to put the costs of behavioral research in the total design budget and we haven't accustomed clients to the urgent need for such expenses. Lack of ability to cooperate is not as large a problem now as is lack of money to finance some cooperation. This means, I believe, that we must attempt educational programs aimed not so much at the committees, councils, corporate and government bodies, and other groups, but at the sources of financing which create client bodies.

2. Young, newly fledged, behavioral and social scientists can be hired more cheaply than the old hands at the game. Many new PhD's are also not finding academic positions of reasonable quality today. Those with environmental training could be extremely useful in architectural firms, city and county planning agencies, and in a variety of positions that involve either environmental design or environmental planning and management. What can we do to help these trained young people find the places where they are needed? We should be developing internship programs in other fields for them, in a fashion similar to the medical training model, and groups such as ASMER should encourage potential employers to advertise job openings and should distribute lists of such opportunities to all behavioral science graduate departments where environmental training is given. Word-of-mouth and friendship channels are no longer sufficient means for getting young behavioral scientists into the mainstream of environmental design and management.

3. Older people in the design professions and in the behavioral-social sciences cannot take time out to learn each other's fields of expert knowledge. Young people in training can, however, learn a great deal about the languages and techniques of their peers in a second discipline, if they are brought together early enough and if room is made in their curricula for cooperative problem-solving. At the University of Arizona, and elsewhere, efforts are being made in this direction, but I believe that we must enlarge these programs and see that they are well funded and that good training is provided. Our new generation of designers and behavioral scientists will face enormously complex problems, much worse than those we face today. We should do all we can to arm them against future shock.

4. The behavioral and social science models and techniques that are being offered to help designers solve their problems, are a mixed bag. There are Freudian or, at least,

psychoanalytic models, Gestalt and Lewinian models, transactional models, behavior-modification and operant-conditioning models. There are techniques borrowed from old-style differential psychology, from multidimensional scaling and factor analysis, from human-factors engineering handbooks, and from signal detectability theory. Where, in all this potpourri, can the design professional find firm ground for selecting the techniques most suitable for a given problem? Which behavioral or social scientist should he listen to? How does he decide whether the science he is hearing is up-to-date? This is an agonizing problem, because the behavioral people have not reached agreement and cannot provide clear and simple guidance for design professionals. The best advice I can give designers is to look carefully at the training and experience credentials of the behavioral people. The earmark of the serious, enlightened scientist is, I believe, a firm unwillingness to supply easy, quick answers to complex problems. But charlatans can act this way too, so the matter of credentials may be our only safeguard. Even this is not a 100 percent guarantee that the right man has been chosen for the project in hand. The state of the art is moving fast today, and the question of underlying behavioral theory for environmental problems is not solved. The least we can do is be honest about this and look at each new problem in the broadest possible terms. Let's not be too easily turned on by anyone's faddish technique.

Comments on the Design Process

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A comment on the application of the Process Model for the architect and the social scientist in designing environments for man is offered.

The Report of the Coolfont Conference of October 1973 and the developed "Process Model," remind us of some pertinent questions:

1. Are personnel requirements and the functional activities best defined and communicated in operational and performance terminology or by the use of the names of architectural or building spaces?
2. Does the activity shape the space or vice versa?
3. Is the transactional process of programming and design a linear one and done once? Or is it done better as a series of iterations of simultaneous activities?
4. Is it of major importance that as activities and procedures change over time within the constructed environment, the enclosure, conditioning and supporting systems adjust accordingly?
5. Should buildings be designed to facilitate change or provide best first fit? Or, is a close-coupled first fit actually detrimental to future activity evolution?
6. Why should experts or architects presume how people should live, work, or play? Perhaps the answers are:
   Yes, because adaptability is difficult to accomplish and administer and, since no one else can design better, perhaps the architects should do the job.
7. In terms of total costs and effects, where should the emphasis be, on facility, activity, first cost, life cycle cost, social cost, personal cost, etc.

It is recognized that most of these and related issues were a part of the considerations at Coolfont. However, there is evidence that the purposes of the process may not have had man, his activities and his en-environment valued in that order.

Note these references in the Coolfont Report:

Page 52 "...There is an adaptation period during which the users accommodate themselves to the building."

Page 60 "Under esthetics, I have three kinds of accountability: the personal ones of the architect to himself; peer group esthetics; and user esthetics.

Of these three, I say, beyond a doubt, that personal esthetics are of the first importance to the practitioner..."

Page 35 "...the user's learning curve, that is, they learn the building and what goes on there."

It may be that this tentative alarm need not be sounded, that is, that the architectural and social science institutions have man and mankind well in their central focus. They understand the ends and will not allow the means, the process, to configure the product.

The Process Model must not become the elite pattern and encourage an assumption or pretense that there is an ultimate kernel of static truth regarding man, his activities and environment that can be discovered and fitted into the ultimate building.

Long-lived man-built environments must instead be flexibly designed to meet increasing change. The design processes must be dynamically organized with emphasis on every man's participation.

3.5 CHARRETTE PARTICIPANTS' REFLECTIONS

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My comments on the symposium, "Programming for Habitability," are as follows:

1. No, I did not learn anything new. I have tried to program and design projects using background information sources that were in print.

2. Social scientist-designer collaboration is worthwhile. The feasibility of use without the owner's ideas or resources would be determined by project size.

3. At the present time the Process Model is under advisement, with the social scientist's help in programming recommended for priority action.

4. The content of the charrette was to follow the Process Model which could be continued with data collection and processing (re: Dennis Green); practice background, West Coast style (re: C. M. Deasy).

5. The Symposium gave me good background on the contribution of a social scientist in architectural practice. Our firm will be involved with this type of collaboration on future projects.

Our firm is involved with the Corps of Engineers on projects in which help from social scientists would have been of value.

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As to my experience at the Symposium, specifically the charrette sessions in which I participated, I will attempt to be as candid and reflective as possible.

Question: Did you learn anything new?
Answer: I did not leave the Symposium with an identifiable piece of information that was directly linked to the flow of information from speakers to listeners. Perhaps the reason is that the other workshops which dealt with habitability criteria and concepts, whereas the charrette sessions were experiential and task oriented. If anything new was to be learned from them, it would necessarily be related to how one went about the task of designing with unknown individuals from a variety of professional backgrounds. In this case, I was reinforced in a feeling (I must admit that until the Symposium, this feeling was untested) that group design is not possible without the introduction of higher-order goals. Several individuals in other groups attempted to make the selling of the client such a goal. In our group (Brave New World), the introduction of a methodology and the group's attempt to understand and work within it led, I believe, to a successful solution. Once the methodology was presented it became the real topic, and was substituted for the surreal client. After it was understood and accepted (accepted by four out of six individuals), it became the catalyst for discussion, the logbook of ideas and finally the menu for selecting suitable options.

Question: In your opinion, is the social scientist-designer collaboration worthwhile and feasible?
Answer: I doubt that anyone invited to the conference would question the value of such collaboration. If the same question were addressed to architects who were not present, perhaps 50 percent would answer in the affirmative, but never actively attempt to engage social scientists in their design

endeavors. The real question is how can designers and social scientists produce worthwhile results?

It is not the task of architects who engage social scientists as consultants to tell them what to do in specific instances to make their designs acceptable. The task is also not accomplished by architects and social scientists working in their respective specialties in isolation. It is this designer's contention that only through a real team approach, with designers and social scientists interacting without labels, can good collaboration take place.

Another factor must be considered. Architects are trained to be generalists. Some of their training has included the standard sociological works. They feel justified in passing preemptory judgment on what sociologists would pronounce as qualified facts based on in-depth research. On the other hand, most individuals (including social scientists) regard the success of architecture as a matter of taste. Most have also read the Fountainhead. This combination makes most individuals believe they may have as good an idea of what architecture should be as architects themselves. This has led to understandable conflicts, not the least of which is the reluctance on the part of architects to collaborate with specialists. I believe the problem can be turned to advantage if an architect is willing to share design responsibilities. However, there is no reason to believe that an architect who has never collaborated would begin to collaborate now.

Question: Are you planning to implement the Process Model in your practice, and if so, how?
Answer: Perry, Dean and Stewart is at the present time implementing the missing half (maybe two-thirds) of the model. As applied by Dr. Ostrander and TAC, the designer-social scientist collaboration is not evident. The architect's process of design did not seem to have been altered since there was no good process for making information applicable directly to design. This is not to say that the Coolfont Model is not usable. But, it is to say that it is incomplete. We could probably merge our own methodology with the Coolfont methodology and achieve satisfactory results. I plan to investigate this possibility.

Question: What would you change in the content and structure of the charrette?
Answer: It was not immediately obvious that the social scientist(s) had participated in writing each program. This became clear when preconceived ideas on form rose to the surface; in our case they were nurtured by our social scientist collaborator. This may have been intended to give the social scientist a headstart. Perhaps this was unnecessary. It should have been enough to match the interests or areas of investigation of the social scientist with a program. The program should not have been known to the participants in advance of the conference in order to avoid prejudiced views of the charrette problems.

Some individuals expressed concern that in the end there was no evaluation and selection of a team to complete the design. We never felt we were competing with other teams, especially since the projects were different. However, since there was only one visible client, the concept of competition could have been assumed. There should have been more than one individual issuing orders - either three separate persons or a group (committee). Finally, it was never clear what should be produced as a result of the charrette. Was it an object or a process? The vagueness did allow for free interpretation, but it was not clear why the client was forcing his social scientist on the architect (was he doing the evaluating?); did the client really want a building designed at the end of eight hours? Perhaps future groups will first be formed and talked with independently of the others. Each group would be given a different task. For example, Group 1 would be asked to design a building, Group 2 would have to develop a method for social scientist-architect collaboration, and Group 3 would be asked to determine the points of interaction and specialist information need. The results, I believe, would be extremely interesting.

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The Symposium was a very good experience.

1. During the charrette, our group explored two methods of solving the problem. One was tightly structured and rational; information was categorized and matrices were developed into concept sketches which were later analyzed in reference to design goals. The other method was more intuitive; goals were set first and then all the information was ordered, tested and reordered intuitively to insure that the evolving concept was in accord with those goals. In comparing the results, the intuitive method proved to develop a more workable solution in the time permitted.

2. The social scientist-designer collaboration should add greater depth to the design process with the net result of a stronger, more credible solution. As for the feasibility of the collaboration, it can work if the social scientist will allow himself to consult with the designer and not require that every project become a full blown research project. He must become part of the design team and react with it in solving the problem.

3. Our office is using consultants to some extent. The Medical Department uses programmers, usually ex-hospital administrators, to interpret the needs of a hospital and to help the designer develop a concept. It would be impossible to design an institution as complex as a hospital without that help.

4. The charrette session was very good because it was not too structured. Because it was necessary to work out our own process methods, we learned how to work together and something about group problem-solving.

5. Of the three sections of the symposium, the charrette session was most beneficial to me. The other two sections, criteria generation and communication, seemed like an endless discussion about procedures and rules.

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1. I learned a great deal. Although I have been interested for some time in collaboration with social scientists and have read a great deal, there were many questions that needed direct answers from Moleski, Wheeler, Ostrander, and Bechtel. I got my answers.

2. For me, there is no doubt as to the value of collaboration. The desire to participate in this kind of design was my prime reason for leaving General Services Administration and forming my own firm. I feel that today the intuitive approach to design is somewhat irresponsible.

3. I felt that the charrette was the quickest and most effective means of demonstrating to the participants the process. However, at the time I was unhappy with the excessive amount of time spent on the product. I saw the charrette as an experience in learning to interact, and I needed the limited time available at the conference to meet and talk to participants in other groups.

4. The Symposium was the first one I have attended on this subject, so my enthusiasm is great. As a designer who regularly attends the usual conferences in New York, Chicago, Aspen, etc., I felt that this one was the most worthwhile and exciting I have experienced in the past five years.

4 SUMMARY REMARKS

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"So we beat on, boats against the current, borne back ceaselessly into the past."

F. Scott Fitzgerald in
The Great Gatsby

In trying to be the "clerk of this Quaker congregation" (to refer to a role described by Fred Moyer on the first morning), and to attempt to express the sense of the meeting, I feel some compulsion to use this large and impressive mansion (the Allerton House) and its grounds as both symbolic of our efforts and an example of our difficulties.

Robert Allerton, who donated this house and grounds to the University of Illinois more than twenty years ago, was the son of a Chicago banker. The family wealth enabled him to become a humanist (free from the pressure of earning his way in a "capitalist" world), a cultivator of the arts and architecture. This house was not built to any performance criteria for habitability, based on cost-benefit analysis or minimal user needs. It was fashioned on the grand scale as an elegant setting for art treasures acquired from all over the world. The house with its spacious formal gardens was given to the University of Illinois to be used for a purpose never imagined by the designers. No amount of careful analysis of the needs of the Allerton family, no philosophy of building in America at the turn of the century, no forecasts of institutional growth and decay likely entered into the design decisions for this estate. It is also reasonable to assume that the University made no such studies when they converted the estate into a center for continuing education.

Yet, how well it all works for our purposes! We are not only able to adapt the purposes of our symposium to the conditions of this estate, but its grand scale and architectural character add a dimension of elegance and delight not otherwise available in "normal" university educational spaces. The design character of Allerton is more than would be called for by a careful analysis of our needs, that it seems central to our deliberations. We have not resolved, nor is it likely that anyone could resolve our questions of design decisions based on an ordered treatment by analysis, i.e. I am referring to the question of designers who work with rational design criteria versus the poetic licenses of the intuitive artist-designers.

There is another symbolic message for us in the grounds of this estate. As I walked through the formal gardens this morning, impressed by the precise geometry of the well-trimmed hedges that constituted the design material for these gardens, I came upon a sign which read "DON'T JUMP OVER THE HEDGES." I must admit that the sign startled me. I had not been contemplating a jump, but now I wondered if I would in defiance of whatever blinded bureaucrat had been compelled to make such a sign. On further reflection, I decided that college students these days probably were less inclined to respect the dignity and charm of these well-kept gardens, so that the gardens were in fact subject to damage by joyful leaps of youthful exuberance. I also could not help feeling that such signs were probably considered a challenge by youth rather than a deterrent. While I was walking and pondering these thoughts, I came upon a second sign: "JUMPING OVER THE HEDGES IS A NO NO." There was authority with empathy! Still the same order, but with "humanism" and a sense of the "now" generation. It did not help to make the order any more sensible, or any less challenging to the youthful reader. It served only to delude the sign creator into thinking he was in tune with the times.

How appropriate such signs are to the process in which we have been engaged! We spoke bravely, even passionately, about the need for interdisciplinary teams to generate and communicate habitability criteria, but almost always with a hedge around the formalism of our discipline, which we did not want others to jump over. We said we were each cultivating the gardens of our intellectual or professional concerns; that we were certain that the other person had some blossoms that would combine with our flowers to produce a beautiful bouquet; that true strains came from rigorous weeding out of weak characteristics. But we really did not want to encourage any major cross-pollination that would cause ugly mutations, or cause our branch of truth to disappear as a known species. That's not so strange, the world has never quite accepted bastards. What is strange is that we, with our liberal inclinations and joint rhetoric, should delude ourselves into thinking that because we are more human (jumping over disciplines is a no no!) in how we said it, we were making real progress towards synthesis.

In our deliberations, especially the workshop on the generation of habitability criteria, we faced a constant problem of focus. If the paradigm of the physical sciences causes us to use reductionism to the point where we tend to consider only small and finite problems (a perceived weakness in trying to use this paradigm to understand man-environment interactions) to the exclusion of an holistic view, the natural inclination of the design professionals confronted with problem analysis is to "doorknob" it. Let me explain.

Several years ago I served as the Director of the Institute for Applied Technology at the National Bureau of Standards. Because I had research contracts to award, I would sometimes be approached by young architect-would-be-researchers looking for a contract. I have made up a story to illustrate what would sometimes happen:

After discussing his skills, I would ask the young architect-researcher if he would be interested in designing a new doorknob for my office door for a modest fee. He would agree enthusiastically to the project and would go away for a week or two to "research" the problem. Then he would reappear to say that he had arrived at a point in his analysis that raised some question about the nature of the door itself. He wondered if there wasn't "a better way" to open and close the entrance to my office. After all, we have had doors around for so long that we have been blinded to the possibility of alternatives. I said I liked to encourage innovative thinking, so that if he needed no more money, why, by all means study the "door" problem!

When he next appeared he was excited by the discovery of the concept of "landscaped" offices. Did I realize that if I eliminated walls around my office, the door problem would go away? I said okay to the new problem statement but with words of caution about how complex the problem was becoming.

A few weeks later he would appear with a new intellectually belligerent attitude to say that he had decided he could not possibly work on the question of a landscaped office for me until I could explain just what I thought my duties were as Institute Director. He left with an unsatisfactory explanation that I would reconsider the problem.

In the final episode, he arrives in my office to announce with some definance that unless he and I could agree on the need for a capitalistic form of democracy for the United States, he did not see how he could be expected to work on <u>my</u> problem.

Moral: Any problem, no matter how simple it may look to the original framer, can be seen as a sub-problem of a larger problem. The biggest problems tend to be intractable and therefore may be abandoned by the novice analyst, or reduced to a polemic.

The workshop activities that seemed to be the most fun and produced the most light with the least heat (a good metaphor in these energy-conserving times) were those simulated problems worked on by collaborative teams. The three problems of military housing, student housing, and a community-based school program lent themselves to the games being played by architects, engineers and social scientists who had all previously developed pet methodologies for such problem-solving. Some genuine communication developed between team members on how to use their methods of analysis. The products did not reveal any new insights into habitability criteria as a result of the collaboration, but the process did show that some collaboration was possible across the hedges of the disciplines.

It's not clear that we went away from this symposium any more satisfied with the clarity of our combined ideas about generating habitability criteria or communicating such criteria to the building design process. Those who came believing that human factors research developed in man-machine studies could be used for understanding man-environment needs went away confirmed in their beliefs. Other designers who came believing that the evocative properties of designed solutions can be stated well enough by simple prose descriptions went away believing that the social sciences are loaded with unnecessary jargon. Still others came believing that as long as there is some communication between disciplines, there is hope for interdisciplinary insights. They went away believing that one more small step on the road of progress had been made. As for myself, I find such symposium activities to be both a ray of hope (at least we're talking) and a discouragement (we don't seem to know what we are talking about). I realize that we are still dealing with uncertainty in an uncertain world. We still are not sure how to provide a satisfactory model for the good life in a democracy dedicated to that proposition for all its people. We still have no clear idea of how we can all have liberty with some resulting justice for all. We still lack the specifics of what each of us can, or could, or would do in the pursuit of happiness. Yet life, liberty and the pursuit of happiness go on.

Perhaps, as Fitzgerald suggests in his last line from the unrealized drams of the great Gatsby, we still beat on, boats against the current; but perhaps, just perhaps, we are not doomed to be borne ceaselessly into the past. We know that we should be creating places where people live, wc k and worship, places that relate to their needs. We know that we need a better paradigm to help us frame these needs into criteria. We know that we can communicate when we try. It may then be possible to add some joy to our lives, and to add some joy to the lives of others.

5 APPENDIX

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