THESIS

BEHAVIORALLY ANNOTATED PLANS: BEYOND THE PRESENTATION TECHNIQUE

Submitted by

Julie Ann Smaglik

Department of Design, Merchandising,

and Consumer Sciences

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WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY JULIE ANN SMAGLIK ENTITLED BEHAVIORALLY ANNOTATED PLANS: BEYOND THE PRESENTATION TECHNIQUE BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS.

Committee on Graduate Work

Kenneth R Trembley Jr

Ron J Loomis

Craig Birdsong

Adviser

Carole J Makela

Department Head

ABSTRACT OF THESIS

BEHAVIORALLY ANNOTATED PLANS: BEYOND THE PRESENTATION TECHNIQUE

This research study investigated the use of behaviorally annotated plans as a technique for communicating research findings, enhancing design solutions, and increasing the awareness of designers toward the behavioral implications of their design solutions. This technique incorporates interior floor plans (or other design drawings) with written text (annotations) referring to human behavior in the environment. It is well suited as an aid in communication for designers who tend to be highly visual and their clients who tend to be more familiar with text than with design drawings as it brings together both visual and verbal methods of communication. Traditionally, behaviorally annotated plans are primarily reserved for the final communication of research findings in the presentation stage of the design process. This thesis proposes uses for behaviorally annotated plans beyond presentation.

The four objectives of this study were to (1) determine the state of the use of behaviorally annotated plans within interior design, (2) determine the elements utilized within behaviorally annotated plans, (3) devise a method for incorporation of behaviorally annotated plan into various stages of the design process, and (4) describe the benefits of this incorporation.

Content analysis was utilized to review publications relating to interior design and environmental design research retrieved by a keyword search. These publications, as well as three major journals, two professional organizations' conference proceedings, and five introductory interior design textbooks were examined for definitions, procedures, and uses of behavioral plan annotation.

Findings were integrated with a five stage design process (programming, schematic design, design development/presentation, implementation, and evaluation) for incorporating behaviorally annotated plans at various stages of design. During the programming stage, inclusion of behavioral information enhances the program by supplementing the physical requirements with behavioral requirements. Together, these requirements provide direction for developing alternative solutions in the schematic design phase. In the schematic design stage, the inclusion of behaviorally annotated plans aids discovery and decision-making by bringing attention to what is known and unknown regarding expected behaviors for the space. It also acts as a tool for exchanging information among design team members. In the design development/presentation stage, inclusion of behavioral annotations enhances the presentation by clearly communicating environmental design research and involves the client in feedback and decision-making processes. Inclusion of a behaviorally annotated plan in the implementation phase provides communication of the behavioral intent of the space to parties not previously included and serves as an orientation tool for personnel when provided in training materials. Results of post-occupancy evaluation benefit both the client and the designer. The client is able to make improvements to the space based

upon the results of the study, and the designer can build on this knowledge in designing similar interior environments. Recommendations were presented for the use of behaviorally annotated plans in interior design education and practice, and in further research.

Julie Ann Smaglik
Design, Merchandising,
and Consumer Sciences
Colorado State University
Fort Collins, CO 80523
Spring 1998

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CHAPTER I

INTRODUCTION

Interior designers are among those responsible for creating environments that are protective of the health, safety, and welfare of users (Thompson, 1992). To develop a good "fit" between the user and the environment, designers look to behavioral scientists for information about how people perceive their physical environments and what kind of needs these environments support. However, several studies spanning two decades show that there remains an incompatibility between research and design regarding the kind of information that is needed by designers and how it is presented by researchers (Hogland, 1992; Merrill, 1976; Russell & Ward, 1982; Sancar & Studer, 1994; Seidel, 1985).

This "applicability gap" between the presentation of behavioral research and the research needs of designers is created by several factors including research presentation format, types of information needed, and availability of information. Sommer (1983) highlighted the problem of research presentation involving a communication barrier which stems from the inherent differences between scientific research and design practice. Sommer describes designers as "highly visual people, concerned with practical problem-solving and aesthetics" (p. 16). Behavioral scientists, on the other hand, tend to be "highly verbal and abstract... and interested in theory and experimentation" (p.16). Additionally, designers are "place" oriented in that their interests focus on designing a specific location such as an office or a school. In contrast, behavioral scientists are

"process" oriented, studying behavioral effects such as privacy, crowding, and territoriality, irrespective of place.

In addition to the problems in research presentation, the types of information utilized by designers vary from that presented by behavioral scientists. A study by Dickson and White (1993) focusing on interior design practitioners' perceptions of research found that sources of information most commonly used by practitioners are "soft" (e.g., design magazines, product catalogs, and books) as opposed to "hard" sources (e.g., scholarly journals, government reports, and behavioral studies). This pragmatic view of research suggests that designers prefer research information presented by familiar, tangible, and graphic methods with practical intent such as descriptions of actual behavior or preferences.

A study by Merrill (1976) found that a designer's need for information is based on the availability of that information. The demands of a designer's work frequently necessitates that information be accessible immediately; there is little time to wait until a research study is conducted. This immediate need for information on a short timeline and a restricted budget imposed by most clients requires designers to limit their search and decision-making process. They proceed with the information at hand and are willing to accept non-research based data. This is a method of coping which encourages designers to rely heavily on personal experience. Information that is inconsistent or not linked with their experience is often rejected.

Despite the seemingly overwhelming differences between designers and behavioral scientists, great strides have been made toward bridging the applicability gap,

including the formation of the profession of environmental design research (EDR). Environmental design research is the study of the inter-relationship between human beings and the physical environment. It is "the attempt to use the theories and methodologies of the social, behavioral and other sciences ... to uncover users' needs and reactions to the built environment and, where possible, test hypotheses about how users respond to environments" (Dudik & McClure, 1978, p. vi).

The growth of environmental design research is evident in the amount of research on acoustics, materials, lighting, and behavioral needs incorporated into current design codes and textbooks. In addition, numerous jargon-free, highly-illustrated books relating to special environments such as housing for the elderly, play areas for children, and site planning for family housing (Wehrli, 1986) have been developed. In his book Inquiry by design: tools for environment- behavior research, Zeisel (1985) suggested various tools that can aid in sharing "common ground" between design and research. This thesis focuses on one of these techniques, behavioral plan annotation.

Definition of Behaviorally Annotated Plans

Zeisel (1985) defined behaviorally annotated plans as follows:

> Behavioral plan annotation is a technique for presenting behavior information together with traditional symbolic design information: diagrammatic and schematic plans. Annotated plans are design drawings on which, written in words or other easily understood symbols, is information about the relation between the planned environment and behavior (p. 42).

Anthony (1991) added, "Producing an annotated plan simply means adding notes onto the plan itself ... indicating key points from your design and showing exactly how they relate back to the research" (p. 59).

An example of a behaviorally annotated plan is shown in Figure 1. The figure consists of an elderly care facility, illustrated in two ways: (a) the floor plan with architectural features and furniture and (b) behavioral descriptions of how the plan may influence behavior. Informational components of the annotation itself typically include reference to the user, a physical environmental element, and behaviors associated with that element. In this example, the users are the residents and the various environmental elements include the common dining room, the main stairs, the health care office, and the front porch. Associated behaviors include feelings of support, homeyness, and identity. The addition of the annotations enhances the value of the floor plan when concern is directed at how design influences the behavior of users by clearly communicating key design decisions to the client in a familiar language, the written word.

Traditionally, behaviorally annotated plans are primarily reserved for the final communication of research findings. This thesis considers possible uses for the behavioral plan annotation beyond the presentation technique. To accomplish this consideration, the design process is reviewed and analyzed for appropriate stages at which integration of behaviorally annotated plans would help to communicate research findings, enhance the design solution, and increase the awareness of designers toward the behavioral implications of their design solutions.

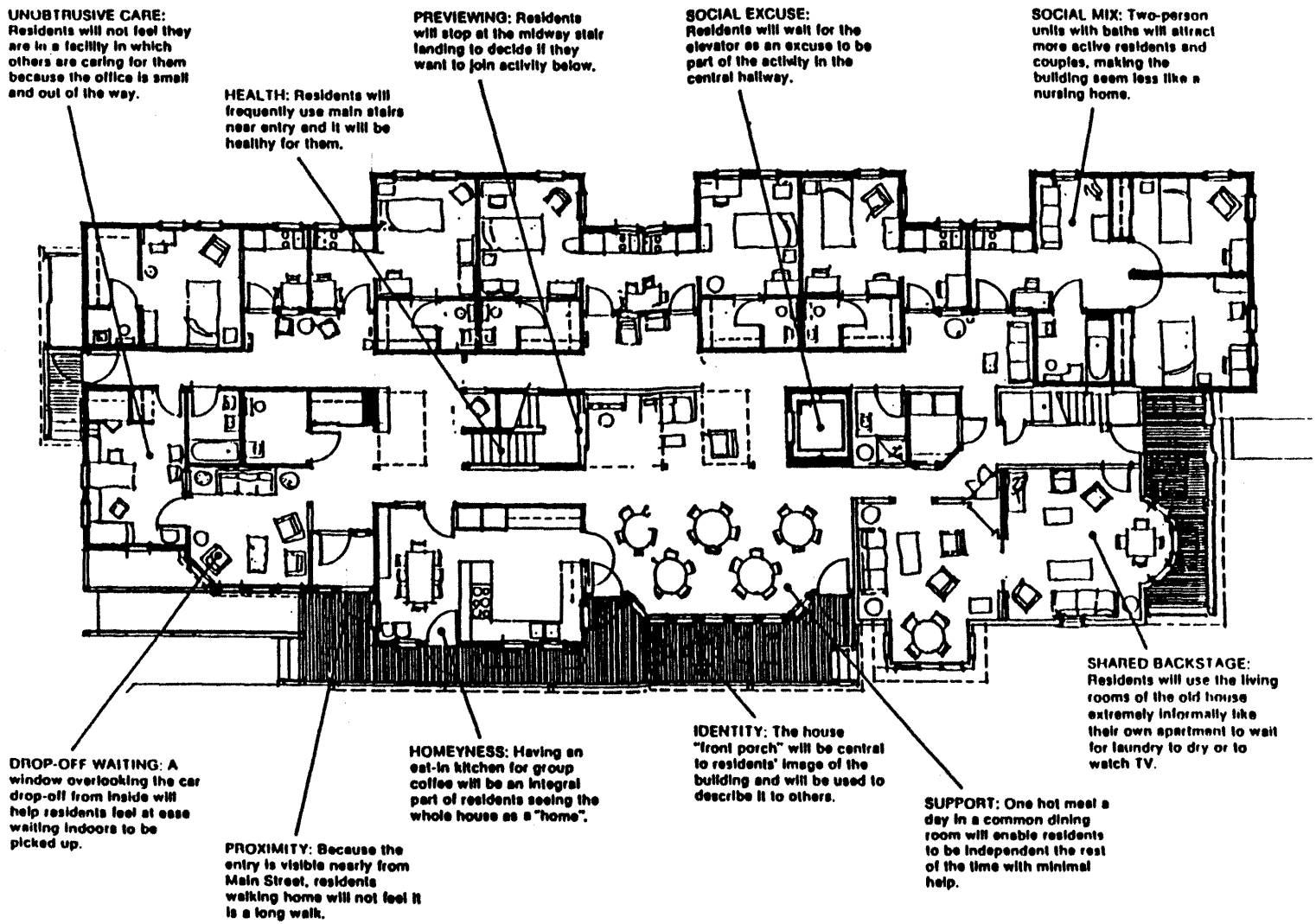


Figure 1. Behaviorally Annotated Plan (Zeisel, 1985, pp. 44-45).

Purpose of Study

The purpose of this study was to identify uses of behavioral plan annotations at various stages of the design process and to highlight the benefits of incorporating this technique at each appropriate stage. The following research questions were devised to accomplish the purpose of this study:

(1) What is the state of the use of behaviorally annotated plans within interior design and related professions?

(2) What are the elements utilized within behaviorally annotated plans?

(3) How can behaviorally annotated plans be incorporated into various stages of the design process?

(4) What are the benefits of incorporating behaviorally annotated plans into various stages of the design process?

Significance of Study

This thesis represents a step toward bridging the gap between researcher-driven information and designer-needed information. The research revitalizes an environment-behavior research technique and takes it beyond presentation. In addition to effectively communicating environment-behavior research information, behaviorally annotated plans can act as a structured link between research information and design decisions. They can also serve as a tool for learning and method of discovery because behavioral plan annotation encourages designers to develop behavioral rationale for each design decision. Environmental design research results presented with strong visual appeal and

short, easy to read key findings can be a powerful factor in influencing a client's decision to implement design recommendations (Sommer, 1990). Presenting relevant environmental design research to clients demonstrates that designers are concerned about their clients' needs and the needs of those people using the spaces. This demonstration of concern reaches beyond client interaction and helps to foster a more favorable image of the design professions to the general public (Anthony, 1991). The identification of a purpose and a benefit for use at each stage of the design process is presented.

Format of Thesis

This thesis contains five chapters. Chapter I describes the purpose and research questions guiding the research. Chapter II contains the literature review focusing on the use of behaviorally annotated plans within architecture, environmental design, and interior design. Chapter III details the methodology of content analysis used in this thesis. Chapter IV reports the results of the content analysis, proposes a use for behavioral plan annotation at each stage of the design process, and identifies the benefits of incorporating this technique. Chapter V states conclusions of the study and suggests recommendations for the use of behaviorally annotated plans in education and practice, and in further research.

Definitions

For this thesis the following definitions are provided:

Awareness - Familiarity with basic information and procedures; the ability to recall and correctly associate knowledge with appropriate circumstances (Foundation for Interior Design Education Research, 1995).

Behavioral implications - Human action and reaction as a direct result of experience with the environment.

Design process - Method of problem solving containing the distinct stages of programming (defining the problem and its parameters), schematic design (developing alternative solutions), design development/presentation (refining the chosen solution and presenting it to the client), implementation (documenting the solution and constructing the project), and evaluation (testing the solution against the program parameters).

Environmental design research - The study of the inter-relationship between human beings and the physical environment; "the attempt to use the theories and methodologies of the social, behavioral and other sciences ... to uncover users' needs and reactions to the built environment and, where possible, test hypotheses about how users respond to environments" (Dudik & McClure, 1978, p. vi).

CHAPTER II

REVIEW OF THE LITERATURE

This chapter addresses Research Question 1: What is the state of the use of behaviorally annotated plans within interior design and related fields?, as well as Research Question 2: What are the elements utilized within behaviorally annotated plans?

According to Fisher, Bell, and Baum (1984), scientific study of the effects of the environment on human behavior has its origins in the nineteenth century perception studies of light, touch, and sound. Moving into the twentieth century, these studies took on a behavioral approach when psychologists began to examine the effects of surroundings on learning, performance, and social interaction. The 1940s and 1950s gave way to human factors research related to performance and work efficiency. Lewin (1951, as cited in Fisher et al., 1984) was the first to propose an environment-behavior formula, $B = f(P, E)$; where behavior is a function of personality and environment.

At the same time, architects and behavioral scientists joined forces to examine the specific effects of the built environment on human behavior. According to Canter and Craig (1981, as cited in Fisher et al., 1984), "these professionals became convinced that the built environment should reflect not just the principles of construction and aesthetics, but also should be designed with a heavy emphasis on meeting the psychological and behavioral needs of those who are to occupy the buildings" (p. 5).

In addition, psychologist Sommer (1969) stated that in architecture "not only must form follow function, but it must assist it in every way" (p. 5).

Acceptance of environment-behavior research as a respectable and legitimate field is evidenced by the publication of the scientific journals of Environment and Behavior (beginning in 1969) and the Journal of Environmental Psychology (beginning in 1980). Additional evidence of acceptance is the creation of degree-granting programs in the field and the formation of professional societies devoted to the problem such as the Environmental Design Research Association (EDRA) and the Association for Man-Environment Relations, Inc. Interdisciplinary membership in these groups consists of psychologists, sociologists, anthropologists, architects, interior designers, and planners with an interest in understanding the relationship between people and space. This diversity in membership brings with it the advantage of representation from multiple disciplines involved with the design of the environment. However, the inherent differences in approach to research, research interests, presentation, and terminology among these diverse members create a barrier in communication which has been termed the "applicability gap."

Although hindered by the lack of theoretical guidelines in environmental design research, members of both the behavioral science and design communities have suggested ways to bring the professions closer together in order to bridge the gap. Among these efforts include attempts to develop a working theory for environmental design research, examine the appropriate uses of different research methodologies, and define basic terms used in environmental design research (Dudik & McClure, 1978).

Another aid in bridging the gap involves the investigation of presentation methods for the transfer of research information into design guidelines. As designers are highly visual people and use drawings to communicate ideas, presentation becomes highly important. Wehrli (1986) presented design as a pictorial process. Designers possess a "visual attitude, sharpened through design experience, ...thus designers have a strong preference for pictures over words, and researchers should respect this when presenting research findings and recommendations" (p. 29). A study by Seidel (1981) found that architects view research information to be of higher quality and usefulness if the results are presented with an extensive use of graphics illustrating the text. Purcell and Heath (1982) agreed that designers "tend to forget, underplay, or ignore matters which cannot be visualized or graphically represented" (p. 9). In addition, Pavlides (1991) suggested that " the inclusion of extensive illustration makes the material more meaningful to the architectural design process" and "presenting a setting in strictly verbal or diagrammatic terms limits the usefulness of the findings" (p. 279).

The addition of written text to drawings is referred to as an annotation. The act of annotating is "the process of furnishing critical commentary or explanatory notes" (American Heritage Dictionary, 1992). Annotated drawings have long been used in the design fields. Dimensioning floor plans and millwork drawings, labeling spaces with room names, adding material descriptions, and clarifying phrases are common annotations used in design and architectural drawings. Examples of these types of annotated drawings are shown in Figures 2, 3, 4, and 5. These examples vary from

behaviorally annotated plans in that the text in a behaviorally annotated plan refers specifically to behavior, not to dimensions or materials.

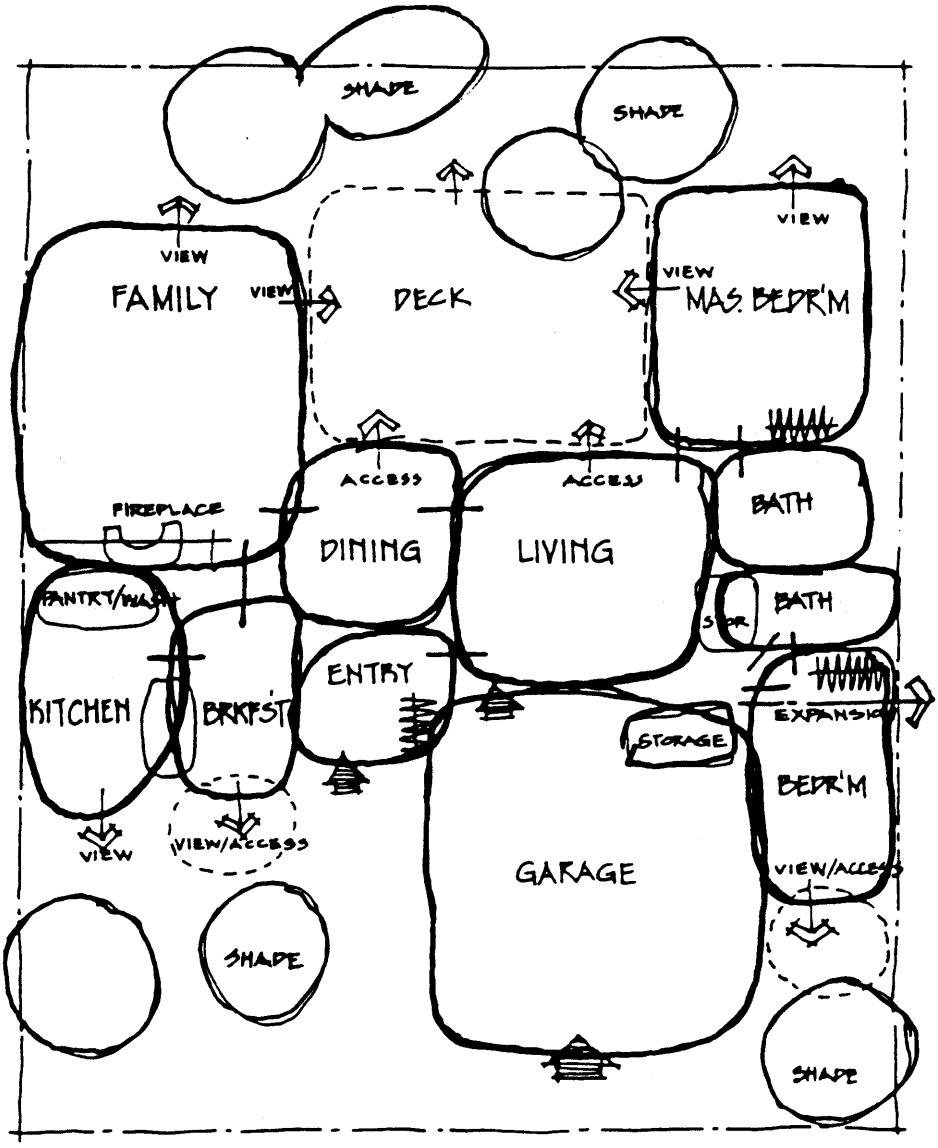


Figure 2. Schematic "Bubble" Diagram for a Small Home. Annotations Include Room Labels, Access, Expansion, and Views (Kilmer & Kilmer, 1992, p. 163).

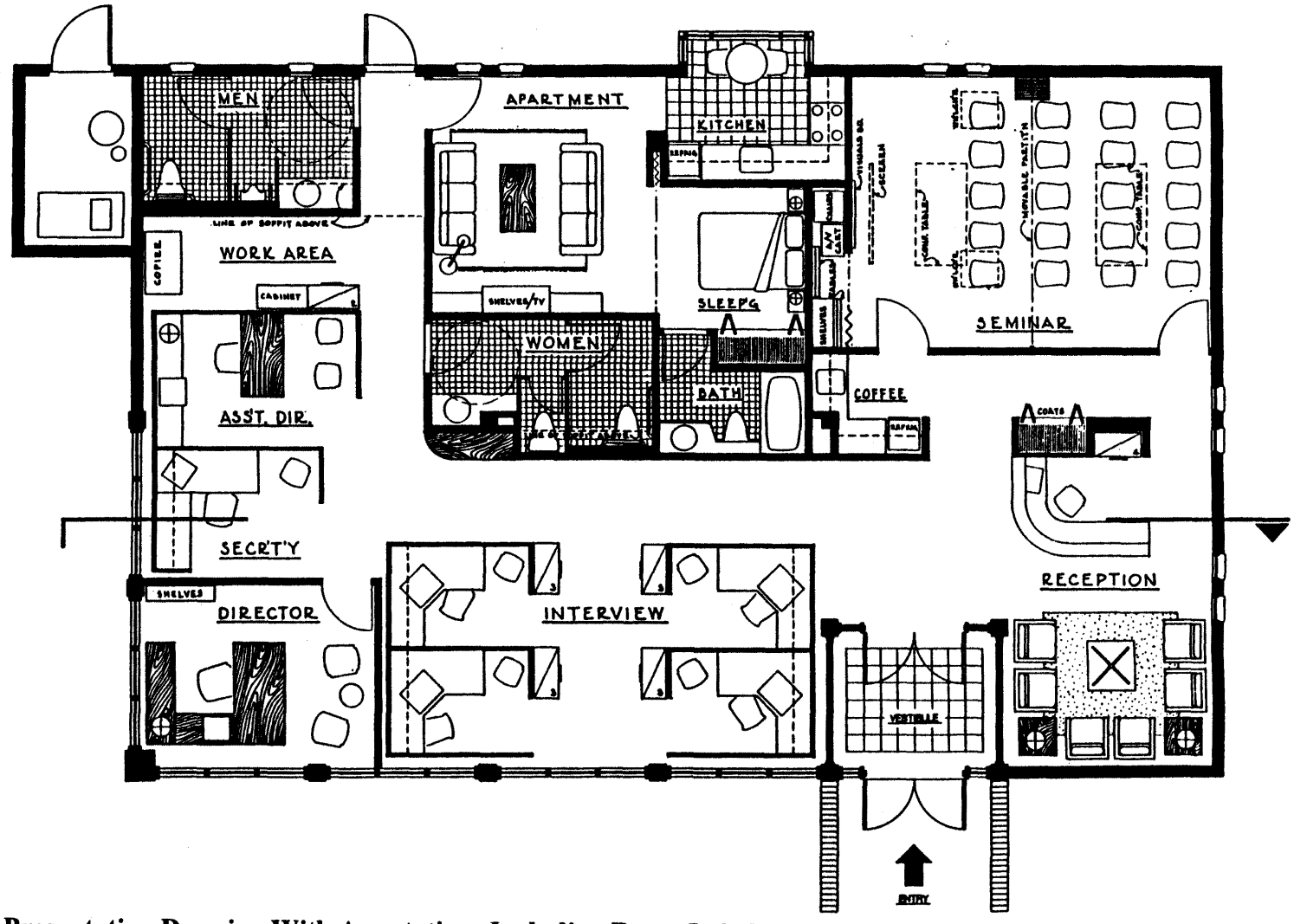


Figure 3. Presentation Drawing With Annotations Including Room Labels, Dimensions, Furnishings, and Architectural and Design Features (Karlen, 1993, p. 103).

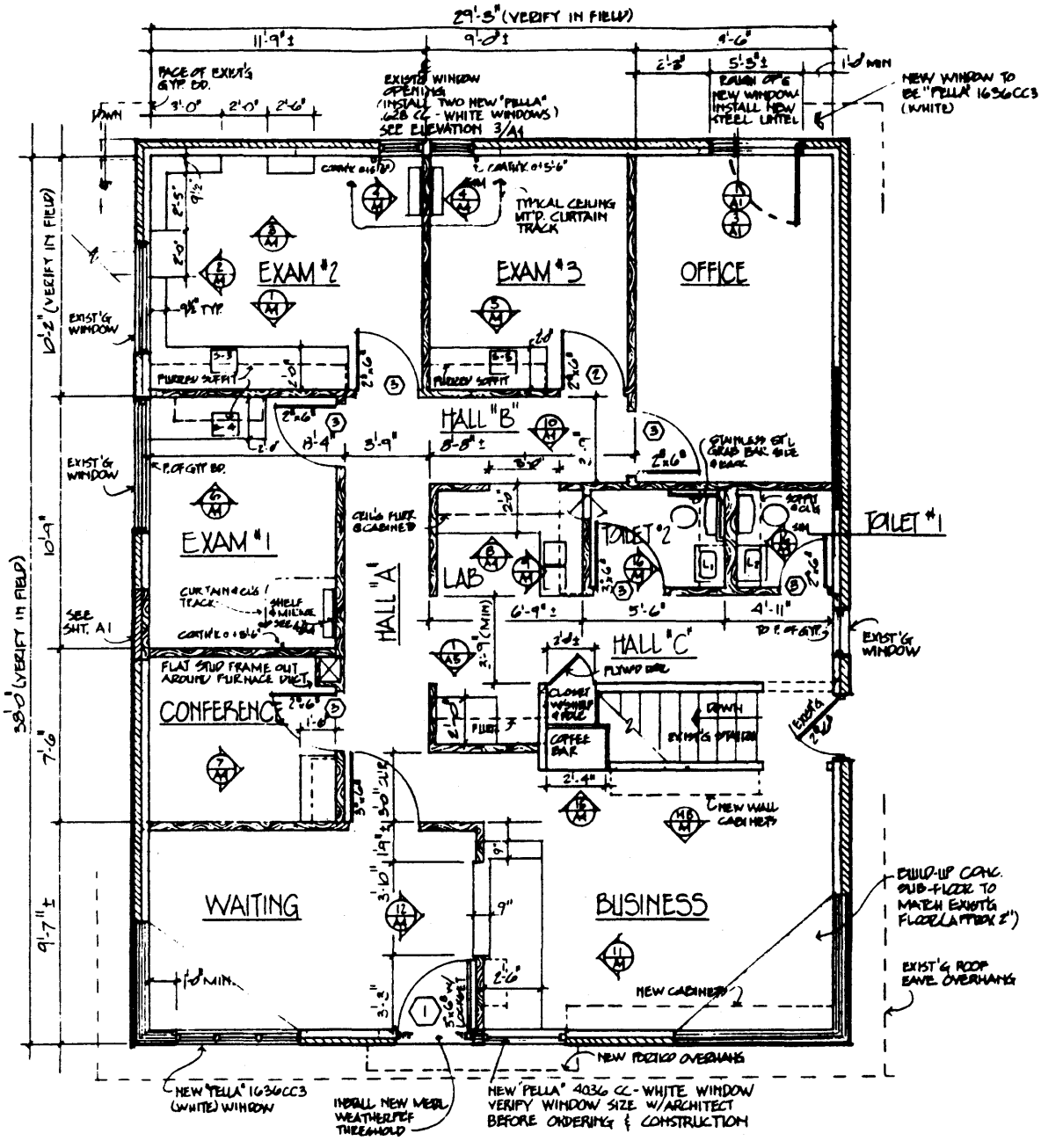


Figure 4. Construction Drawing With Annotations Including Room Labels, Dimensions, Architectural and Design Features, and Construction Notes (Kilmer & Kilmer, 1992, p. 555).

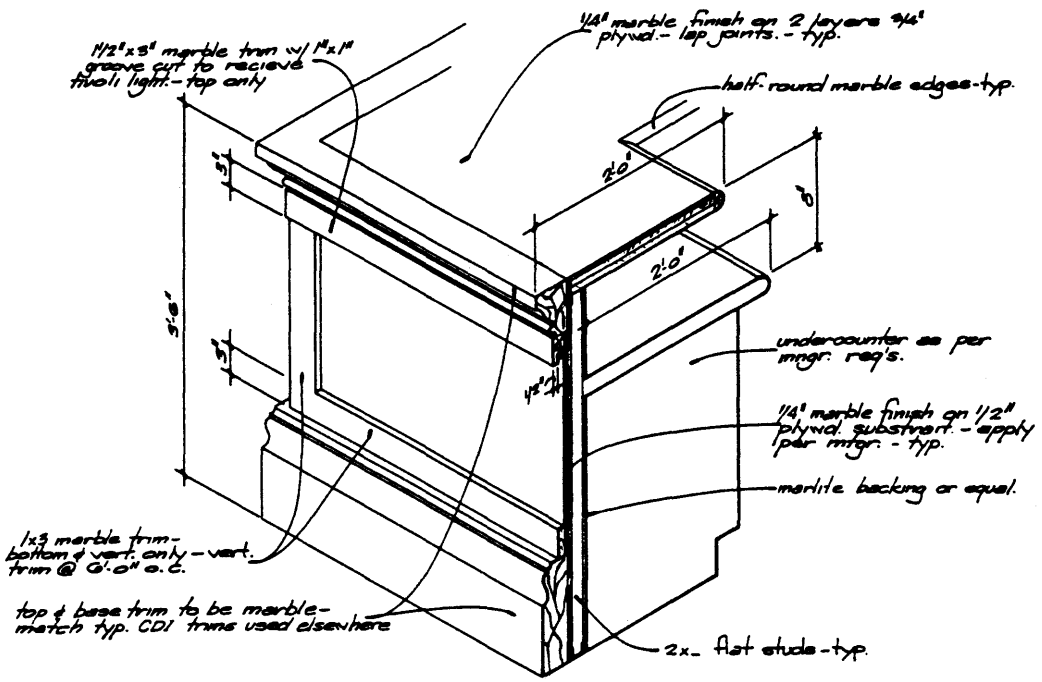


Figure 5. Millwork Detail Drawing With Annotations Including Dimensions, Construction Materials, and Finish Notes (Kilmer & Kilmer, 1992, p. 567).

An example of highly-illustrated environment-behavior research results which combine graphics and annotated text is an observation technique termed "behavioral mapping." Behavioral mapping is a technique concerned with noting specific human behaviors within specific settings (Sommer & Sommer, 1991). The technique uses a floor plan to indicate the location of people and their activities within the setting. The product of this observation is termed a behavioral map, similar to a behaviorally annotated plan. The difference between a behavioral map and a behaviorally annotated plan is that a behavioral map is concerned with quantitative, empirical data dealing with amounts of observed behavior. Behaviorally annotated plans on the other hand do not deal exclusively with amounts of behavior, but may also include behavioral expectations and hypotheses regarding behavior which supplement the design drawings and are

produced prior to occupancy. An example of a behavioral map found in the literature is shown in Figure 6.

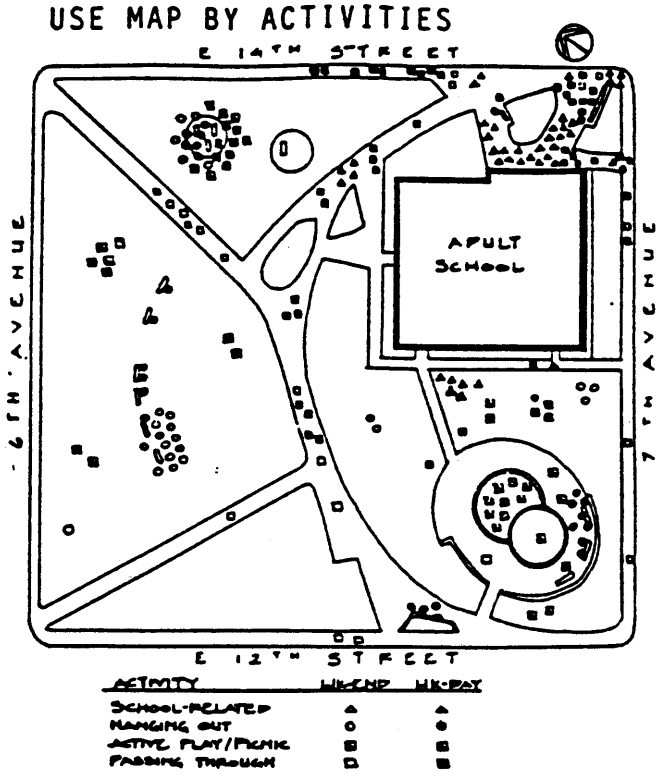


Figure 6. Behavioral Map (Merriman, 1985, p. 126).

Behaviorally Annotated Plans

Of importance to this thesis is the behaviorally annotated plan which brings together both visual and verbal methods of communication. A behaviorally annotated plan is typically produced as a presentation technique and includes both a graphic image (typically a floor plan) which is familiar to the designer, and interpretative text related to behavior (annotations) which is familiar to the client.

The graphic images provide information about the architectural features of the space such as walls, doors, and furniture (the concern here is with the manipulated

interior environment, not the natural exterior environment). Labels and dimensions may be present but are used to indicate physical areas (i.e., room names and sizes). Although broad behaviors can be implied by a room label, such as bedroom alluding to the behaviors of sleeping and dressing, they do not denote specific behaviors.

The addition of behavioral annotations provides information not readily interpreted from the drawing alone. This information can include data used for making design decisions, behavioral expectations, and hypotheses (predictions) about behavioral responses to be tested in post-occupancy evaluation (Zeisel, 1985). Information provided in the annotation is briefly stated, narrow in focus, and relevant to the problem under study. Typically, the annotation is written directly on the floor plan adjacent to the area referenced with a leader (arrow) pointing to that area. Components of the annotation itself typically include reference to the user, a physical environmental element, and a behavior associated with that element. Another method of presenting this information is to annotate the floor plan with a number or letter referring to a table containing the relevant behavioral information.

Examples of behaviorally annotated plans found in the literature include those used in both the schematic and formal presentation phases of the design process. The use of behaviorally annotated plans during the formal presentation phase of design (Figure 1) is clear, as they act as communication tools between designer and client. During the schematic phase (Figure 2), the act of preparing behaviorally annotated plans works as a method of discovery and aids the decision-making process by encouraging designers to examine the behavioral rationale of each decision.

As behaviorally annotated plans act as an archival record of rationale for design decisions, they also serve as a tool for post-occupancy evaluation. The growing awareness of the use of environment-behavior research in design has contributed to the increasing sophistication of design programs which include statements (hypotheses) regarding behavioral implications. These documented hypotheses become the basis for evaluation. When this type of program information is not available, a behaviorally annotated plan can be the source of these hypotheses. If interviews with the designer or observations of the space are not possible, investigators can use this archival record to test the success of the rationale or to make further recommendations without having to guess the intent.

Design Process

There are numerous ways to solve a design problem, and indeed much has been written documenting design methodologies (Kilmer & Kilmer, 1992). Although the methods may vary, a pattern or sequence of steps is a commonality. The design process used for the purpose of this thesis, to determine how behaviorally annotated plans can be integrated, consists of five distinct stages: programming, schematic design, design development, implementation, and evaluation. This design process was developed by the researcher and is a compilation of various design processes found in the literature (Heimsath, 1977; Kilmer & Kilmer, 1992; Pile, 1988). Figure 7 outlines this design process.

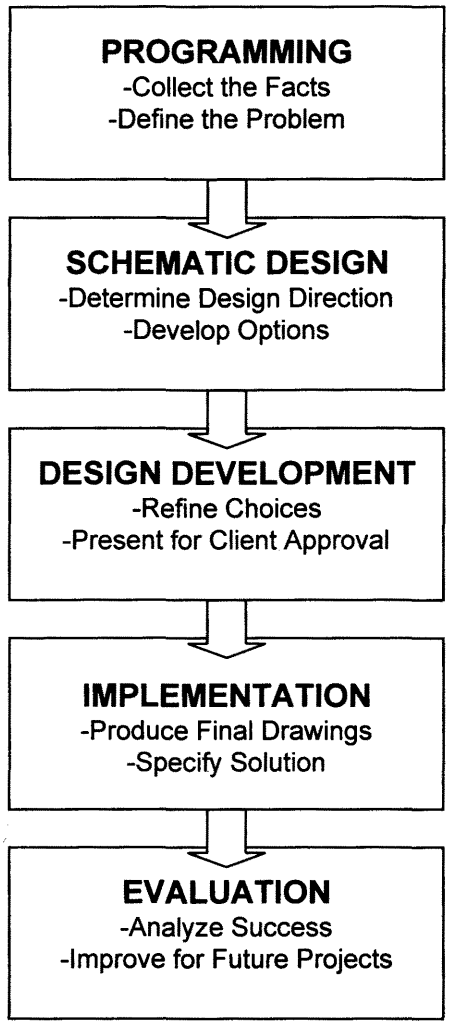


Figure 7. The Design Process.

Stage one: programming

Programming is the initial phase in the design process; gathering the facts to define the problem. Research into previous definitions and components of programming led Kriebel, Birdsong, and Sherman (1991) to define programming as "the process of collecting information relevant to a design situation and ordering that information into a useable form setting the parameters for design" (p. 32). They also identified three phases

of programming most consistently appearing in the literature: familiarization, compilation, and consolidation. The familiarization phase involves gathering information, becoming familiar with project-related terminology, defining the project, and organizing the program. Compilation considers the factors involved with the contextual, physical, aesthetic, behavioral, and financial aspects of the project. The phase of consolidation interprets data, develops design alternatives, and produces the final design program. Behavioral plan annotation can be used in the programming phase both to document the current use of space in an existing facility and as a tool to document research findings.

Stage two: schematic design

The schematic design stage analyzes the information collected in the programming phase to develop alternative ideas such as preliminary space allocation plans, design details, and color and material options. A successful schematic design package provides the client a clear idea of the design direction and the character of the environment, with alternatives for discussion and choice. The act of preparing behaviorally annotated plans during the schematic design phase serves as a method of discovery. As designers annotate the plan, they begin to test what they know now and what they still need to discover. It encourages designers to examine the behavioral rationale for each design alternative and thus aids the decision-making process.

Stage three: design development

In the next stage, design development, the designer develops and refines choices made by the client during the schematic design stage. This step involves refining the

drawings to represent actual square footage and reflect choices made by the client. The purpose of design development is to present refined drawings and design ideas to the client for approval prior to implementing working drawings. Behaviorally annotated plans are well suited for use in the presentation stage. This is reflected in the literature as the large majority of examples of behaviorally annotated plans were displayed in a presentation format.

Stage four: implementation

Implementation involves the production of a set of working drawings which provide detailed and specific information for construction. Working drawings include scaled floor plans, elevations, sections, and details, supplemented by notes and symbols to specify the exact requirements of a project. The implementation stage of the design process is highly annotated as dimensions and other notes for construction are added to the drawings. Supplementing the construction documents with a behaviorally annotated plan communicates the behavioral intent of the design to other parties who have not been involved in the design process previously, such as contractors and property managers. Communicating this information could prove to be beneficial if these professionals can add improvements or point out flaws prior to construction, based on their experiences which differ from designers.

Stage five: evaluation

Evaluation is a follow-up of the completed job to investigate how well the design solution is serving its users and meeting its stated program goals, and is termed post-occupancy evaluation. Behavioral plan annotation at this stage serves to document, as in

behavior mapping, how the space is actually being used so that it can be compared to the proposed use of space. This evaluation is an important part of the entire process as inefficiencies are noted and corrections are made to improve a project's success, the client's overall satisfaction, and the designer's performance on future projects.

Use of E-B Research in Introductory Interior Design Texts

An example of the growing interest in incorporating environment-behavior research in interior design can be obtained from a review of the content of introductory interior design college texts. Many of the authors of these texts incorporate the results of psychological/sociological studies and the findings from environment-behavior research into their interior design texts. A study by Potthoff and Woods (1995) identified the top ten most frequently used introductory interior design college textbooks published between 1986 and 1994. This study then examined the top seven texts on a topic by topic basis, thereby classifying the content into general topic and subtopic categories. The results were reported in the number of pages of text devoted to each general topic and subtopic.

Findings from the study revealed a strong representation and consensus among the authors for topics such as historical overview, design theory, and planning residential interiors. Fewer pages were allotted to the topics of interior design as a profession, design communication, design process, and human factors. Human factors is the category used for this study which presented ergonomic data as well as environment-behavior research on the effects of the interior environment on its occupants.

The Potthoff and Woods (1995) study is of interest to this thesis because it recognized trends in the profession and the education of interior designers as reflected by the content of textbooks. Content of the textbooks reflects a core of topics which are considered to be important foundations of interior design education and the profession. Of specific interest in the Potthoff and Woods study is the general topic of human factors, specifically its subcategory of psychological effects. This subcategory provides information about how the specific types of psychological effects contained in the textbooks are presented within an interior design framework. The depth of coverage (number of sentences devoted to a topic) may reflect the textbook authors' knowledge of or interest in a given topic.

For this thesis, the researcher reviewed the table of contents, index, and body of text for each of the top five textbooks in the Potthoff and Woods study. Only the top five of the seven texts were reviewed, as one of the seven books registered no pages devoted to psychological effects, and another book was an earlier edition of one of the top five books. Main topic headings and their psychological effects subtopics were noted along with the interior design framework (chapter heading and subchapter category) in which they were presented. General topic and subtopic categories were developed and the number of sentences dedicated to each of these categories was counted. As in the Potthoff and Woods study, only text material was recorded; end-of-chapter activities, drawings, photographs, charts, and captions were not recorded. The comparative depth of coverage was determined by the total number of sentences devoted

to a specific topic, in contrast to the total devoted to all other topics. The results of the topic categories and the depth of coverage comparison (rank) are presented in Table 1.

As shown in Table 1, chapters relating to color and light had the most sentences allotted to psychological effects (507) and thus ranked number one in depth of coverage. Proxemics, the study of the use of space by humans within a specific culture (Allen, 1992) and space planning (369) ranked number two, followed by interior lighting schemes (174) and design theory (154).

Table 1. Quantity of Text Allotted to Psychological Effects.

				Number of Sentences per Text				
Interior design context	**Psychological effects**	**Rank**	**Total no. of sentences**	**Pile 1988**	**Kilmer 1992**	**Faulkner 1986**	**Nielson 1990**	**Allen 1992**
Color & light	Psychology of individual colors & color groups; selection of colors to fit mood/personality; how we see; the eye	1	507	64	177	78	31	157
Proxemics & space planning	Crowding; privacy; territoriality; comfort; emotion related to space	2	369	114	63	98	78	16
Lighting schemes	Creating mood & emotion with light; Seasonal Affective Disorder	3	174	56	25	37	47	9
Design theory	Design process; applications; meeting all human needs; design & well-being; visual impressions	4	154	36	11	18	74	15

Psychological effects (responses or reactions to environmental stimuli) varied from topic to topic. Chapters on color and light focused on the psychology of individual colors and color groups, the selection of colors to fit a mood or personality, and how to

affect the appearance of a space through the use of color and light. Frequently included within the chapters was a section on vision, specifically the anatomy of the eye and its function.

Proxemics and space planning chapters devoted large sections to privacy, crowding, territoriality, comfort, and emotions related to the perception of space. The chapters often tied these psychological topics together with anthropometrics, ergonomics, and planning of specific rooms or space types such as home, office, health care, and retail. Lighting schemes varied from color and light in that lighting schemes provided information on how to use different lamp and fixture types, along with the lighting layout, to create various moods. Color and light used light to explain how color is created and manipulated.

Design theory encompassed chapters from the elements and principles of design, programming, and design quality. It included topics on the design process and applications for design theory. These topics emphasized that interior design needs to incorporate the human factor. "Taking into account the personal needs of the end user - including physical, emotional, and spiritual needs - is of utmost importance from the beginning of the design process to the completion of a project" (Allen, 1992, p. 5). Also, "a well-designed interior can certainly help smooth the rough edges of life" (Nielson & Taylor, 1990, p. 2). Finally, "The programmer must consider physiological, psychological, and sociological needs as well as structural, contextual, and economic needs" (Kilmer & Kilmer, 1992, p. 189).

Although the total number of pages devoted to the psychological effects of color and light ranked this topic as number one among all topics, not all texts reflected color and light as their number one topic on a book by book basis. Only two of the five textbooks allotted the most text to color and light; the other three allotted the most text to proxemics and space planning. This result may reflect the individual author's knowledge of, or interest in, a specific topic and/or the influence of the reviewers and editors.

Each of the five texts reviewed made extensive use of illustrations in the form of color photographs, black and white photographs, charts, graphs, and line drawings. Many of the drawings and other illustrations contained annotations in the form of dimensions and labels (room names and furniture types), but only one of the texts, Kilmer and Kilmer (1992), made use of behavioral annotations. None of the texts contained a definition or procedure for producing behaviorally annotated plans.

The results of this study can be used to provide an overview of the human factors and psychological effects represented in introductory interior design textbooks. They provide a summary of what is considered to be important from the authors' point of view, of what is taught, and what students are expected to learn regarding human factors and psychological effects. A consensus among the top five most frequently used textbooks reflects a core of topics related to psychology which become the foundation for this aspect of interior design education.

Summary

In answer to Research Question 1: What is the state of the use of behaviorally annotated plans within interior design and related professions?, the literature suggests that behaviorally annotated plans have been infrequently used, and have typically been reserved as a method of presentation between designer and client during the formal presentation phase of design.

A literature review of the design process suggests that behaviorally annotated plans can be used in other design phases besides formal presentation. Additional uses may include documentation during programming, discovery during schematic design, communication to other parties during implementation, and testing during evaluation. The production of behavioral plan annotations stimulate thought and aid decision-making. As designers begin to annotate plans, they test what they know now and what they still need to discover. As designers proceed through the design process using the behaviorally annotated plan technique, the planning process becomes documented and can be seen in the growth and development of the plans. Documenting the decision-making process can act as an aid in the planning of future projects as well as acting as a basis for evaluating existing projects to "prevent successive replications of bad solutions" (Sommer, 1972, p. vii). Several projects documented with behavioral annotations can serve as a basis of reference, adding to designers' knowledge base and increasing their level of expertise, thus attracting clients and creating new business.

An examination of introductory interior design college texts revealed core topics considered to be important foundations of interior design education and the profession.

The knowledge of human factors and psychological effects of the interior environment is included in this core.

In answer to Research Question 2: What are the elements utilized within behaviorally annotated plans?, the literature suggests consistent use of distinct elements:

(1) A design drawing or sketch, typically a floor plan, including permanent architectural and design features such as wall and doors and non-permanent features such as furniture.

(2) Annotations describing the behavioral influence, or hypothesized influence, of the permanent and non-permanent features. Informational components of the annotation itself typically include reference to the user, a physical environmental element, and behaviors associated with that element.

CHAPTER III

METHODS

This research was designed to obtain information about the use of behaviorally annotated plans by interior design and related professions. The methodology used to obtain this information was content analysis. This investigative tool was chosen as it systematically reviews the literature to identify and count the occurrence of specific elements. For this thesis, the specific elements analyzed were definitions, procedures, or illustrations of behaviorally annotated plans. Content analysis is sensitive to the context in which elements appear, thus it lends itself to the review of both the textual (definitions and procedures) and the symbolic (illustrations of behaviorally annotated plans) (Krippendorf, 1980).

Description of the Instrument

The instrument designed to review the selected literature took the form of a code sheet developed by the researcher. The Literature Review Code Sheet is shown in the Appendix. The first section of the code sheet consisted of bibliographic data including: publication type (journal, book, or proceedings), title (both source title as well as article/chapter title), author or editor, publisher and date, journal/proceedings title,

volume number, and number of pages. Additional data collected in section one of the instrument included the intended audience for the publication. Categories of audiences were specialized college text, summary/state-of-the-art knowledge, other colleagues or investigators, or other.

Section two of the instrument was used to record information relating to the descriptions, definitions, and uses of behaviorally annotated plans in the literature. Of special interest was the identification of a procedure identifying phases or components necessary for the production of behaviorally annotated plans. Section two documented the occurrence of (a) a definition of behaviorally annotated plans or other definitions of similar terms, (b) a documented procedure or process for the use of behaviorally annotated plans, and (c) diagrammatic/schematic examples of behaviorally annotated plans.

Sample Selection

Literature sources included journals and proceedings from the fields of interior design education and environmental design research. Selected journals included Environment and Behavior, the Journal of Environmental Psychology, and the Journal of Interior Design (formerly the Journal of Interior Design and Education Research, prior to 1985). The Journal of Interior Design was selected as it is currently the only journal published dedicated solely to interior design research and education. Environment and Behavior and the Journal of Environmental Psychology were selected because of their prominence in the field of environment-behavior research.

Annual conference proceedings included the Interior Design Educators Council (IDEC) and the Environmental Design Research Association (EDRA). Proceedings from both IDEC and EDRA contain state of the art knowledge and the most pressing issues at the time of the conferences. Additionally, books published within the last 15 years identified through a database search were reviewed.

Procedure for Data Collection

Environment and Behavior, the Journal of Environmental Psychology, and the Journal of Interior Design were reviewed for 16 years of publication (1980-1996). IDEC was reviewed from the initial publication of the conference proceedings in 1985 to 1996, and EDRA was reviewed for the past 15 years of publication (1981-1996). Copies of all journal and proceedings issues during this time period were obtained.

Books reviewed were published within the last 15 years (1981-1996) and were retrieved using a keyword search of the SAGE bibliographic databases at Colorado State University. The four major keywords were "interior design," "interior decoration," "architecture," and "environment." The major keywords were partnered with the minor keywords of "design" and "research" as well as secondary words relating to human behavior. Keywords used for the search are included in Table 2. This procedure retrieved only those books which included behavioral aspects and disregarded those books which dealt with topics irrelevant to this study such as upholstery/fabrics, furniture, or special pictorials.

Table 2. Keywords Used for the Search of the SAGE Bibliographic Database for Retrieving Books Relating to Behavioral Aspects of the Interior Environment.

Major Keywords	Minor Keywords	Secondary Keywords
interior design	design*	behavior
interior decoration	research	behavioral aspects
architecture		emotions
environment		feelings
		human actions
		human ecology
		human influences
		human response
		people
		perceptions
		psychology
		psychological aspects

*The minor keyword of "design" was not used in conjunction with the major keywords of "interior design" and "interior decoration" as "design" is synonymous with "decoration" and interchangeable with "interior design."

The literature sample was then reviewed using the Literature Review Code Sheet. Graphic representations of behaviorally annotated plans were collected for use in developing the proposed uses of behaviorally annotated plans at various stages of the design process. Additional information regarding the historical use of behaviorally annotated plans and other relevant information were noted. Lengthy definitions or descriptions of processes/procedures were photocopied and attached to the code sheet. All graphic representations of behaviorally annotated plans were photocopied and attached to the code sheet.

CHAPTER IV

RESULTS

This chapter presents results obtained from the instrument in order to address Research Questions 3 and 4: Can behaviorally annotated plans be incorporated into various stages of the design process?, and Are there benefits to incorporating behaviorally annotated plans into various stages of the design process?

The Sample

Books retrieved using a keyword search of the SAGE database at Colorado State University's Morgan Libraries reflect a sampling of books published relating human behavior to interior design and related professions. Keywords were grouped to produce 106 distinct searches. The method used to group keywords is shown in Table 3, along with the results. To illustrate how the keywords were grouped, consider the following example.

The major keyword of "architecture" was first paired with each secondary keyword producing 11 search pairs. Then the major keyword of "architecture" was grouped with a minor keyword (such as "design") and each secondary keyword, producing 11 additional searches. Lastly, the major keyword of "architecture" was grouped with both minor keywords ("design" and "research"), along with the secondary keywords to produce yet another 11 searches. This method produced a total of 33

searches for the major keyword of "architecture" and 33 searches for the major keyword of "environment."

The method utilized for the major keywords of "interior design" and "interior decoration" varied slightly. Since the minor keyword of "design" is interchangeable with "interior design" and synonymous with "decoration," the minor keyword of "design" was not used in conjunction with either major keyword. This produced a total of 22 searches for "interior design" and 22 searches for "interior decoration." Overall, keyword pairings were effective in reducing the number of books which did not relate some aspect of human behavior to the interior environment.

Table 3. Sampling of Books Retrieved from Keyword Search.

Books retrieved	Duplicate books	Non-relevant books	Relevant books	Books reviewed	Keywords		
					Major	Minor	Secondary
		Number					
135	49	30	56	53	Architecture	Design	Behavior Behavioral aspects Emotions
600	96	446	58	47	Environment	Research	Feelings Human action Human influence
13	3	9	1	1	Interior Design		Human response Perceptions People
22	14	3	5	5	Interior Decoration		Psychology Psychological aspects
770	162	488	120	106	**Total** (n)		

Column 1 of Table 3 shows the total number of books (770) retrieved from the pairings of the four major keywords. Pairings of minor and secondary words with the

major keyword of "environment" retrieved the majority of books (600). "Architecture" was second with 135 books. There were far fewer books retrieved for "interior decoration" (22) and "interior design" (13). Column 2 shows the number of books that were deleted because they were retrieved by more than one keyword pairing. That is, they were duplicates and thus deleted, as each book was counted only once. Column 3 shows the number of non-relevant sources. These were books that, although retrieved by the keyword search, did not address behavioral topics. For instance, the pairing of "architecture" and "behavior" returned books relating to the structural behavior of steel columns or the behavior of bees within the architecture of the hive. Behavioral terms paired with "environment" also returned many non-relevant books dealing with such topics as earth and soil or third-world ecology. Column 4 reflects the number of relevant books retrieved (120), less the duplicate and non-relevant books. Column 5 reveals the number of books that were actually reviewed for information regarding the use of behaviorally annotated plans. Eighty-eight percent of all books were acquired and reviewed for a total of 106 books. The remaining 14 books were not accessible.

Table 4 displays the selected sample of journals and conference proceedings reviewed: Environment and Behavior, the Journal of Environmental Psychology, the Journal of Interior Design, Proceedings of the Environmental Design Research Association, and Proceedings of the Interior Design Educators Council. The selected sample included all volumes published between 1980 and 1996. All 76 volumes were acquired and reviewed.

Table 4. Sampling of Selected Journals and Proceedings.

Relevant volumes	Actual no. of volumes reviewed	Journal / proceedings titles
16	16	Journal of Interior Design
16	16	Environment and Behavior
16	16	Journal of Environmental Psychology
12	12	Interior Design Educators Council Proceedings
16	16	Environmental Design Research Association Proceedings
76	76	**Total** (n)

Evidence of Behaviorally Annotated Plans

Tables 5 and 6 report the occurrence of (a) a description or definition of behaviorally annotated plans, (b) illustrations with behavioral annotations, (c) illustrations with annotations which are not behaviorally based (such as room names and dimensions), and (d) illustrations without annotations of any kind. For this study, an illustration is defined as a sketch, design, or architectural-type drawing of an interior floor plan or other perspective view of an interior environment. It does not include charts, graphs, matrices, flow diagrams, maps, or photographs.

As shown in the Total (n) row in Table 5, only two sources specifically described or defined a procedure for the use of behaviorally annotated plans. Twelve of the 106 books reviewed contained illustrations using behavioral annotations. Twenty-six books used annotated illustrations, but the annotations were not behaviorally based. Sixty-six books used no annotated illustrations.

Table 5. Occurrence of Information Relating to Behaviorally Annotated Plans Found in Books.

Description / definition of behaviorally annotated plan	Illustrations with behavioral annotations	Illustrations with annotations – not behavioral	Without annotated illustrations	Books reviewed	Major keywords: paired with minor & secondary keywords
		Number			
0	8	17	28	53	Architecture
2	4	7	34	47	Environment
0	0	0	1	1	Interior design
0	0	2	3	5	Interior decoration
2	12	26	66	106	**Total** (n)
1.9	11.3	24.5	62.3	--	**Percent Total** (%)

For the journals and proceedings, the Total (n) row in Table 6 shows that two descriptions or definitions of behaviorally annotated plans were found in proceedings. Four journal issues contained illustrations using behavioral annotations and 27 journal issues and proceedings used annotated illustrations, but the annotations were not behaviorally based. Forty-three had no annotated illustrations. A total of 20 behaviorally annotated plans or descriptions were found in the three publication types as summarized in Table 7.

Table 6. Occurrence of Information Relating to Behaviorally Annotated Plans Found in Journals and Proceedings.

Description / definition of behaviorally annotated plan	Illustrations with behavioral annotations	Illustrations with annotations – not behavioral	Without annotated illustrations	Volumes reviewed	Journals / proceedings titles
		Number			
0	2	13	1	16	Journal of Interior Design Volumes 6-22
0	1	6	9	16	Environment and Behavior Volumes 13-28
0	1	6	9	16	Journal of Environmental Psychology Volumes 1-16
0	0	0	12	12	Interior Design Educators Council Volumes 1-12
2	0	2	12	16	Environmental Design Research Association Volumes 11-27
2	4	27	43	76	**Total** (n)
2.6	5.2	35.5	56.6	--	**Percentage** (%)

Table 7. Total Number of Behaviorally Annotated Plans Found in Each Publication Type.

Number of behaviorally annotated plans	Publication type
14	Books
4	Journals
2	Proceedings
20	**Total** (n)

Description of Located Behaviorally Annotated Plans

A total of 20 sources contained either descriptions or illustrations using behavioral annotations. These 20 sources are described below:

(1) Accredited Standards Committee on Architectural Features and Site Design of Public Buildings and Residential Structures for Persons with Handicaps, A117, (1986). American national standard for buildings and facilities providing accessibility and usability for physically handicapped people. A set of guidelines relating to accessibility. Includes annotated illustrations demonstrating clearances and ergonomic data necessary for people with disabilities to navigate through space and interact with objects in the environment.

(2) Becker, F., & Steele, F. (1995). Workplace by design: Mapping the high-performance workscape. A perspective drawing of an office space with annotations relating aspects of the environment with the behavior of employees.

(3) Canter, D., Krampen, M., & Stea, D. (1988). Ethnoscapes: Current challenges Vol. 3. A perspective drawing of a restaurant interior with numbers added to objects in the drawing which relate to behavioral descriptions in adjacent paragraphs.

(4) Carr, S. (1992). Public space. Site plan of a street corner with annotations describing community activities such as lingering around the local post office.

(5) Chambers, S., & Guerin, D. (1993). AIDS hospice unit: Design criteria and prototypes. Journal of Interior Design, Vol. 19, (1). Prototype floor plans of a

residents' rooms, family lounge, and bathing room with annotations referring to behavioral criteria for the design of an AIDS Hospice Unit.

(6) Cherulnik, P. (1993). Applications of environmental design research – Case studies, an analysis. A floor plan of a prison housing unit with annotations explaining various levels of privacy.

(7) Cohen, U., & Day, K. (1993). Contemporary environments for people with dementia. A floor plan of an elderly care facility specially designed for dementia patients with annotations referring to privacy, security, and wandering.

(8) Cohen, U., & Weisman, G. (1991). Holding onto home. Perspective drawings of prototypical elderly care facilities with annotations referring to familiar space, privacy, security, socializing space, and wandering.

(9) Deasy, C. (1985). Designing places for people: A handbook on human behavior for architects, interior designers, and facility managers. Annotated illustrations relating to human behavior in social spaces such as intimate, personal, and social distances.

(10) Gibson, K. (1994). Cultivating the next generation of interior designers: The undergraduate as design researcher. Journal of Interior Design, Vol. 20, (1). Photograph of a student's research presentation board which includes behavioral annotations.

(11) Krupat, E. (1985). People in cities: The urban environment and its effects. Multiple floor plans of apartments for the elderly with annotations relating to privacy and security issues in paragraph form below the floor plans.

(12) Marcus, C. (1986). Housing as if people mattered: Site guidelines for medium-density family housing. A site plan of a small community with annotations indicating how various programming issues were translated into physical design and how the residents reacted.

(13) Mikellides, B. (1980). Architecture for people: Explorations in a new humane environment. Schematic drawing of an office landscape with annotations focusing on behavior in a complex office environment.

(14) Minami, H., & Tanaka, K. (1995). Social and environmental psychology: Transaction between physical space and group-dynamic processes. Environment and Behavior, Vol. 27, (1). A diagram depicting the relationship between group dynamic processes and physical environmental settings with annotations referring to behavior setting constraints, group territories, and public, semi-private, and private spaces.

(15) Moore, G. (1986). Spatial definition of behavior settings. Journal of Environmental Psychology, Vol. 6, (1). Diagrams illustrating the evaluations of spatially well-defined behavior settings for child care centers.

(16) Robinson, J., Emmons, P., & Graff, M. (1984). A role for the architect in environment-behavior research. Proceedings of the Fifteenth Annual Conference of the Environmental Design Research Association. This article discusses the use of graphic descriptions, written descriptions, and explanations that relate environmental features to hypothesized behavioral implications. The author developed behavioral "design principles: a non-reductive set of annotated

graphic descriptions of the differences between institutional and home-like settings" (p. 32).

(17) Sancar, F., & Studer, R. (1994). A comparison of behavioral and ecological knowledge integration expectations by studio instructors. Proceedings of the Twenty-Fifth Annual Conference of the Environmental Design Research Association. This article contains a description of the behaviorally annotated plan technique, but does not define it as such. It refers to the dimension of time in a person's understanding of how a proposed design will be experienced and describes it as, "(a) presentation of 'scripts' or stories accompanied by a series of visuals that would reflect formal responses to the scripts" (pp. 34-35).

(18) Smith, P., & Kearny, L. (1994). Creating workplaces where people can think. Numbers indicated on a floor plan of an office space with annotations relating to noise, privacy, and security issues in paragraph form below the floor plan.

(19) Valins, M. (1988). Housing for elderly people: A guide for architects, interior designers and their clients. Guidelines relating topics of accessibility specific to the elderly with annotated illustrations demonstrating clearances and ergonomic data.

(20) Zeisel, J. (1985). Inquiry by design: Tools for environment-behavior research. A floor plan of an elderly housing facility with annotations stating environment-behavior hypotheses to be evaluated after occupancy.

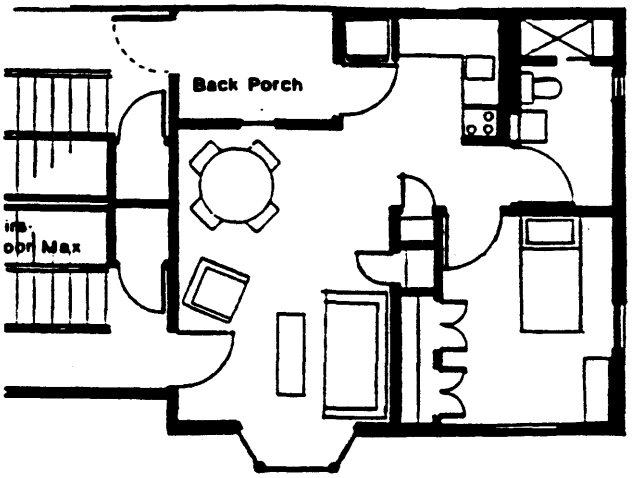
Assignment of Behaviorally Annotated Plans to the Design Process

This section responds to Research Question 3: How can behaviorally annotated plans be incorporated into various stages of the design process? It was problematic to assign the located behaviorally annotated plans to stages of the design process. One problem was that it was impossible to tell which illustrations came directly from a design project and which ones were pulled together for the sake of enhancing the accompanying text. Another problem with definitive assignment was the editorial constraints of the publications. Some books and journals may only accept simplified illustrations which are easily reproduced and readable, and proceedings may only accept abstracts.

Of the 20 located behaviorally annotated plans, 17 appeared to fit a specific stage of the design process. Assignments were based upon the type of information included in the annotation and the sophistication of the graphic. Graphics with a greater amount of detail and technical accuracy were considered to be produced in the later stages of the design process: design development, implementation, and evaluation. Those with less detail were considered to be produced in the earlier stages of programming or schematic design. Results of this analysis are discussed by stage of the design process.

Programming: Behaviorally annotated plans and drawings which illustrated basic ergonomic, accessibility, and standards data fit the problem-defining purpose of the programming stage. Sources found that support the use of behaviorally annotated plans at this stage included: Accredited Standards Committee (1986), Cohen and Weisman (1991), Deasy (1985), Smith and Kearney (1994), and Valins (1988).

Schematic design: Behaviorally annotated plans and drawings which possessed rough qualities to the presentation and inquires for further research in the annotations fit the option-generating purpose of the schematic design stage (Figure 8). Sources found that support the use of behaviorally annotated plans at this stage included: Cherulnik (1993), Krupat (1985), and Moore (1986).



Above
+ windows in kitchen and dining areas provide views
+ back patio provides some privacy to the living room from passersby in the back
+ bedroom has two orientation for natural light and views
- there is the potential for invasion of privacy with the large window in the bedroom

Below
+ large bay window in the living room next to front door can be used for sitting or display
+ bedroom has two orientation for better ventilation and views
+ back porch can be screened in to provide visual privacy while still allowing those inside to see out
- kitchen sink is not located under the window

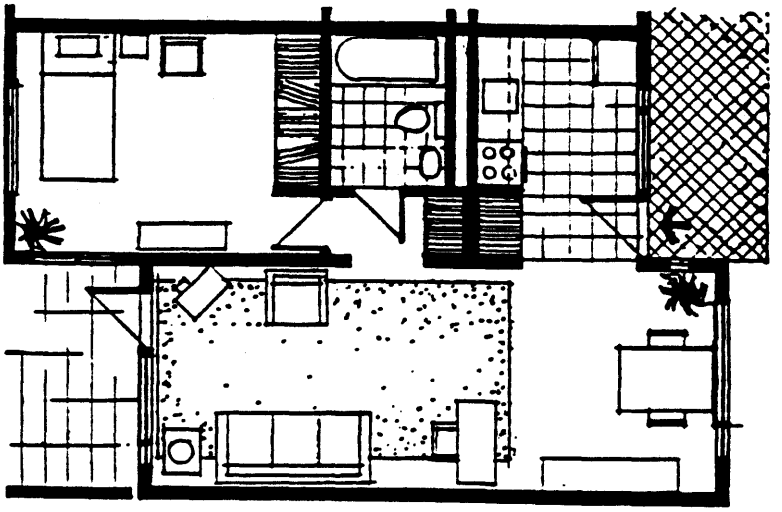


Figure 8. Behaviorally Annotated Plan, Schematic Design Stage (Adapted from Krupat, 1985, pp. 168-169).

Design development/presentation: Behaviorally annotated plans and drawings which possessed a finished quality to the presentation and a research base to the annotations fit the decision-making purpose of the design development/presentation stage (Figure 9). Sources found that support the use of behaviorally annotated plans at this stage included: Cohen and Day (1993), Gibson (1994), and Zeisel (1985).

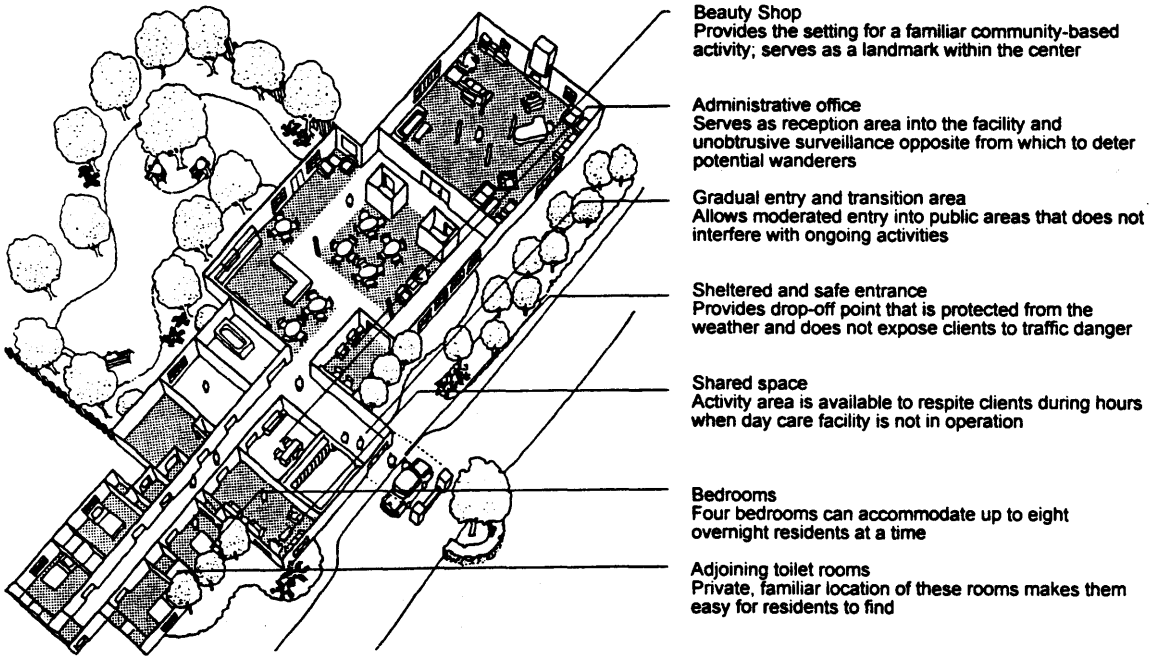
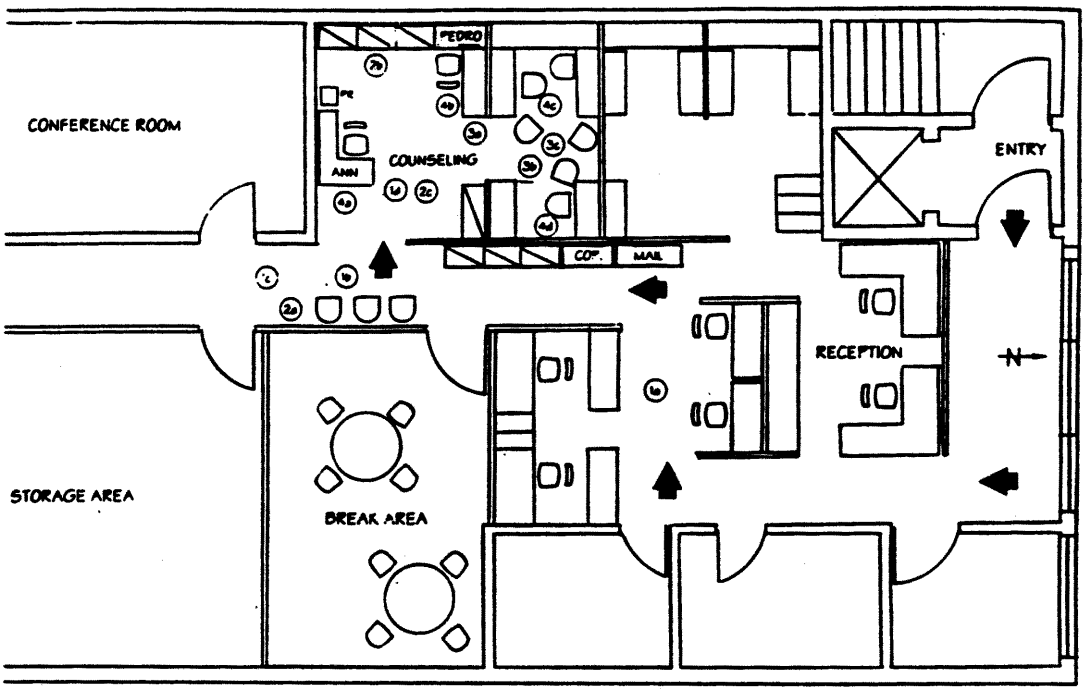


Figure 9. Behaviorally Annotated Plan, Presentation Stage (Adapted from Cohen & Day, 1993, pp. 134-135).

Implementation: No behaviorally annotated plans were found to fit this particular stage of the design process.

Evaluation: Behaviorally annotated plans and drawings which described the actual use of space after occupancy fit the investigative purpose of the evaluation stage (Figure 10). Sources found that support the use of behaviorally annotated plans at this stage included: Becker and Steele (1995), Carr (1992), and Marcus (1986).



1. **Location**
   1a. Confusing, inconvenient client access: delayed appointments
   1b. Exposure to traffic noise: distractions, slow interviews
   1c. Confusing route to rest rooms: interruptions for directions
   1d. No view of natural light: depressed feeling
2. **Common Furnishings and Equipment**
   2a. Lack of comfortable client waiting area: client stress
   2b. Inadequate F/E for receptionist an accountant: excessive attention demands.
   2c. Depressing feeling for entire space: stress (low energy, anger)
3. **Individual workspaces**
   3a. Inadequate separation of administration and counseling: distractions, interruptions
   3b. Lack of controllable child space: distracted clients, slow interviews
   3c. Lack of confidentiality: stress, poor interviews
4. **Individual workspaces**
   4a. Receptionist's lack of visibility: client confusion, stress
   4b. Unprotected accountant workspace: slowdown, errors
   4c. Lack of privacy for counselors: stress, poor interviewing
   4d. Inadequate F/E: files, storage, lighting: discomfort, inefficiency

Figure 10. Behaviorally Annotated Plan, Evaluation Stage (Becker & Steele, 1995, pp. 150-151).

Purpose and Benefits of Incorporating Behaviorally Annotated Plans

This section responds to Research Question 4: What are the benefits of incorporating behaviorally annotated plans into various stages of the design process? Analysis of the results suggests that specific purposes and benefits can be devised for using behaviorally annotated plans at various stages of the design process. Five distinct purposes and benefits are proposed and presented within the context of the design process.

Stage one: programming

Purpose for including behaviorally annotated plans: documentation. The purpose for using behaviorally annotated plans at the programming stage is to aid in documenting existing conditions and organizing research information. One of the primary programming tools is observation. This frequently used method is a means of collecting and quantifying behavioral information. During observation, the designer annotates a floor plan with behavioral information referring to the current use of the space: who is doing what, with whom, and for how long. Any apparent problems such as bottlenecks in circulation or wandering due to poor signage are clues to the designer for researching solutions to crowding and wayfinding problems.

Annotations written directly on the plan, relating specific behaviors to the exact space or object effected, act as a visual aid for the designer when back at the office/studio and away from that specific environment. The designer does not have to rely on memory to recall the use of the space, as it has been documented. For the programming of not yet constructed spaces, a designer can study similar building types

and note common problems. These notes can then be added to the schematic plan to be researched by the designer as the plan is developed.

Stage two: schematic design

Purpose for including behaviorally annotated plans: discovery. In the schematic design phase, the designer works out several possible solutions for the design problem. Annotating a sketch with behavioral information requires that the designer examine the solution with a critical eye toward the behavioral implications of that solution. Initially drawing upon memory, the designer becomes aware both of the environment-behavior research he or she knows supports the solution and of the behavioral issues which still need to be discovered through research. Behaviorally annotated plans can assist the designer in developing a checklist of information that needs to be considered. Clearly, larger, more complex projects require more extensive research. Once missing information is gained, the solution is enhanced based upon facts and not upon guesswork.

Another purpose in using a behaviorally annotated plan in the schematic design stage is that it acts as a method of exchanging information and ideas with other members of the design team. Feedback to the designer at this stage is essential. The benefit of using this technique as a tool for discussion is that it creates a common dialogue between the designer and team members.

Stage three: design development/presentation

Purpose for including behaviorally annotated plans: presentation. In the design development/presentation stage, the designer typically presents to the client a set of

design drawings including floor plans and elevations, and sample boards with suggested materials and finishes. Behaviorally annotated plans can be used during this stage for the purpose of conveying environment-behavior research findings. This provides the designer two advantages: (a) the use of a unique presentation tool which provides a familiar frame of reference for both the designer (the illustration) and the client (the annotation), and (b) involving the client in an effective, interactive way of obtaining feedback. This active participation in the design process has been shown to increase satisfaction with the final installation (Zeisel, 1985).

Stage four: implementation

Purpose for including behaviorally annotated plans: communication. Including behaviorally annotated plans in the implementation stage serves the purpose of communicating the behavioral intent and understanding of the space to persons who have not been involved in the previous stages of the design process. Construction managers and other parties included in the construction process, but not previously included in the design process, may be able to contribute useful information based on perspectives different from those of the designer. If a behaviorally annotated plan has already been developed and presented for the design development stage, including it with the working drawings may prove a valuable effort.

Particular parts of the construction document package, such as floor plans, are well-suited and frequently included as part of the training materials for personnel who will be using the building. If this is the case, behavioral annotations on the floor plans

effectively convey intentions for the use of the space and assist personnel in understanding the design rationale.

Stage five: evaluation

Purpose for including behaviorally annotated plans: testing. During the early stages of the design process, programming and schematic design, hypotheses are developed regarding the impact of the environment on its occupants. These original expectations are used to test the installation/design success in terms of post-occupancy. Once again, the designer observes and makes annotations on the floor plan regarding the use of and the behavior occurring in the space. These observations are compared to the intention in the original program to test how closely the intended design works.

In summary, inclusion of behavioral information during the programming stage enhances the program by supplementing the physical requirements with behavioral requirements. Together, these requirements provide direction for developing alternative solutions in the schematic design phase. In the schematic design stage, the inclusion of behaviorally annotated plans aids discovery and decision-making by bringing attention to what is known and unknown regarding expected behaviors for the space. It also acts as a tool for exchanging information between design team members. In the design development/presentation stage, inclusion of behavioral annotations enhances the presentation by clearly communicating environmental design research and involves the client in feedback and decision-making processes. Inclusion of a behaviorally annotated plan in the implementation phase provides communication of the behavioral intent of the space to parties not previously included and serves as an orientation tool for personnel

when provided in training materials. Results of post-occupancy evaluation benefit both the client and the designer. The client is able to make improvements to the space based upon the results of the study, and the designer can build on this knowledge in designing similar interior environments.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The goal of this thesis was to identify the use of behaviorally annotated plans at various stages of the design process and to highlight the benefits of incorporating this technique at each stage. This goal was accomplished by a review of the relevant literature to determine the use of this technique within interior design and to identify a procedure for utilizing this technique. In addition, a keyword search was conducted to retrieve publications which specifically related some aspect of human behavior to the interior environment. These publications were reviewed and analyzed to determine how behavioral information was presented and specifically, if these publications utilized behaviorally annotated plans. The information gained was used to determine the purpose and benefits for using behaviorally annotated plans at various stages of the design process.

Conclusions

The technique of annotating design drawings with behavioral information is not widely utilized within the interior design profession. An analysis of the literature associated with interior design and the related professions of architecture and environmental design revealed limited use of this technique as either a method to illustrate accompanying text or as an aid in the design process. Although annotated

illustrations were widely utilized in the books, journals, and proceedings reviewed, few of the annotations were behaviorally based. Of those sources found to use behaviorally annotated plans as a method of presenting environment-behavior research information, four sources mentioned the use of annotations. Of these four, only two sources specifically defined or described a procedure for their use (Sancar & Studer, 1994; Zeisel, 1985). Zeisel (1985) was found to be the most comprehensive source for information regarding the use of behaviorally annotated plans as a presentation technique, along with other environment-behavior research tools.

In addition, an examination of the top five introductory interior design college texts published between 1986 and 1994 revealed that although these texts made extensive use of illustrations, annotations associated with these illustrations took the form of dimensions, labels, material descriptions, and clarifying phrases. Only one text (Kilmer & Kilmer, 1992) made use of behavioral annotations, and none of the texts contained a definition of or procedure for producing behaviorally annotated plans.

The findings support the premise that behaviorally annotated plans can be effectively introduced in various stages of the design process. The use of this technique to enhance the design process facilitates user-supportive design through an emphasis on environment-behavior interaction. An analysis of behaviorally annotated plans retrieved by the keyword search, along with information gained in the literature review, allowed the researcher to determine a purpose and benefit for the use of behaviorally annotated plans at various stages of the design process. These findings are summarized in Table 8.

Table 8. Results Summary.

The Design Process		Behaviorally Annotated Plans		
Stage	**Purpose**	**Purpose**	**Method**	**Benefits**
Programming	• Gather the facts. • Define the problem. • Outline project requirements.	Documentation	Use a floor plan of the existing space to observe and note current use of space (behavior mapping).	Enhances the program with actual research done on site. • States specific features of the environment that assist or inhibit the occupants performance. • Acts as a visual aid (memory) of the space.
Schematic design	• Determine design direction. • Generate design ideas. • Develop alternatives.	Discovery	Annotate sketch drawings with behavioral hypotheses, research findings, and problems to research.	Annotating acts as a prompt for research. • Ask yourself, "How will people perceive this setting?" Annotating will encourage designers to review each component of the plan. • Test yourself: look closely at the behavioral rationale used in making design decisions. Annotations on schematic drawings will assist in communicating design ideas to colleagues. • Design ideas will be clearly communicated both graphically and with text, eliminating ambiguity.
Design development	• Refine ideas. • Present refined solutions to client.	Presentation	Annotate presentation drawings to present research findings.	Behaviorally annotated plans clearly present E-B research. • Involves the client in feedback and decision-making.
Implementation	• Prepare working drawings to graphically represent the project requirements. • Prepare specification requirements.	Communication	Supplement construction drawing package with annotated plan completed in the previous design stage.	Supplementing the construction documents will communicate the behavioral intent of the space to previously excluded team members. • Construction and property managers may have valuable input based on perspectives different than the designers. • Assists the user with orientation.
Evaluation	• Evaluate design. • Analyze success of design. • Make improvements.	Testing	Observe the site and annotate drawing after occupancy.	Post-occupancy evaluation tool. • Compare observations with program information to test success of design.

Limitations

One limitation of this study pertains to sample size. Although 770 books were retrieved using the keyword search combinations, only 120 of these books were in fact relevant to the study. A second limitation was use of the SAGE bibliographic database. SAGE catalogues only those books associated with the Morgan Libraries at Colorado State University and may not be representative of all books published which relate human behavior to the interior environment. A final limitation was restricting the review to only those sources published between 1980-1996. As a result, several sources published prior to the review date which are consistently referenced in environment-behavior research were not reviewed. Some of these sources include: The hidden dimension (Hall, 1966), Personal space: The behavioral basis of design (Sommer, 1969), Environmental psychology: Man and his physical setting (Proshansky, Ittelson, & Rivlin, 1970), An introduction to environmental psychology (Ittelson, Proshansky, & Rivlin, 1974), and Environment and social behavior: Privacy, personal space, territoriality, and crowding (Altman, 1975).

Discussion

This thesis was undertaken under the assumption that the use of behaviorally annotated plans could help interior designers to develop better design solutions based on user needs, perceptions, and environmental influences. As the purposes and benefits were devised, the literature posed a potential concern for the use of environment-behavior research in the design process. Steps taken to provide behavioral annotations

add additional time to the design process. The designer must prove that information relating to behavioral implications of the design is a benefit to the client justifying greater time and financial resources. In addition, designers must regard the effort involved in keeping abreast with environmental design research as a value to themselves and their careers, since much of this will be done on the designer's own time.

Recommendations

Results from this study suggest possible uses for the behaviorally annotated plan technique at various stages of the design process. The following recommendations for interior design education and professional practice are presented, along with implications for further research.

Interior design education

FIDER standards and guidelines (FIDER, 1995) require accredited interior design programs to provide students with an understanding of design theory, including aspects of human behavior. "Thorough knowledge of the elements and principles of design, design theories, and their evolution enables designers to understand the interrelationship between human beings and the environment" (FIDER, 1995, S2.8). It is recommended that in addition to researching pertinent environment-behavior information in books and journals, instructors include behavioral plan annotations in the studio as a hands-on, informal method for students to become familiar with working with this kind of research information.

All design projects are "problems to be solved," therefore, students must analyze the information at hand, deduce the problem solution, and develop research questions. Gibson (1994), referring to the benefits of undergraduate research in the studio, stated that: "Inquiry by the student will create a level of dedication and self-motivation that does not occur when one is assigned a research topic" (p. 44). Introducing the use of environmental design research early in students' design careers allows them to increase their confidence levels as they proceed through the design program. Students who learn to compare and criticize their solutions based not only on theoretical design principles, but also on behavioral principles, are more likely to generate design solutions that can be justified and defended. A study by Croft (1989) found that: "Students schooled in environmental research methods and applications are already perceived by design firms as being better prepared that those who are not" (p. 31). Consequently, students who are aware of the benefits of using environmental design research and feel comfortable with its use are more likely to use it as practitioners.

Interior design practitioners

Frequent and consistent use of behavioral annotations may increase designers' abilities to create personal, supportive, and interesting environments by fostering an awareness of various environmental influences. It is recommended that organizations sponsoring continuing education programs and workshops emphasize hands-on methods of using EDR, such as behaviorally annotated plans, as a method to direct designers toward successful design solutions through the combined influence of environment-behavior research and interior design. This recommendation also applies to those

organizations providing training sessions for the NCIDQ examination. Those designers preparing for NCIDQ certification should be aware that knowledge of human factors is tested within the theory portion of the exam. For this examination, human factors include not only anthropometrics and ergonomics, but human comfort and psychological and social influences as well. Topics such as behavior settings, territoriality, personalization, group interaction, and status are emphasized (Ballast, 1992).

Further research

As stated previously, the addition of annotations to a design drawing enhances the communication between designer and client. To foster good communication, designers should be aware that floor plans and other design drawings, which are the major communication tools used by designers, may not be easy for clients to understand. This is why the addition of text, or annotations, is important. According to Purcell and Heath (1982), designers think visually and communicate graphically whereas others are untrained in visual thinking:

> These things (design drawings) are so much a part of the designer's habitual way of thinking that he frequently fails to realize that to other people they are a totally foreign language; indeed worse than a foreign language in that a different mode of thought is involved (p. 9).

Further research is recommended into the nature of designers' visual thought processes and how they specifically impact the production of behaviorally annotated plans.

Determining the relevancy of environmental design research to a specific design project poses an interesting question for further research: How can the designer predict

users' perception of the environment in order to determine what features of the environment are relevant? Pavlides (1991) stated "it is not possible to determine what visual information is perceived by the users of a certain environment" and " the 'meaning' of architectural form is dynamic and changing - over time, at length and perhaps in one day" (p. 280). To compensate for this, designers must familiarize themselves with the available literature from behavioral science research in order to identify the issues and establish a base of what is already known. They must learn to observe behavior carefully and systematically. This knowledge base will then aid in formulating the hypotheses (predictions) that designers attempt to evaluate for their clients. Continual interaction between interior designers and researchers is recommended so that the newest research information is available and can be incorporated into design solutions as quickly as possible.

One aid to designers would be the development of an environmental design research database with information which could be applied to various interior settings would be. If this database were easily accessible (via Internet) and contained tangible, descriptive methods of presenting EDR, an increase of use of EDR by both students and practitioners might be seen.

This thesis did not address and does not provide an evaluation method for judging the success of incorporating behaviorally annotated plans into the design process. Further research is recommended into the attributes which would indicate successful performance in terms of sensitivity to, concern for, and successful application of appropriate behavioral information in a way that would be evident from the design

product. The ability to evaluate becomes salient when using this technique as a teaching method for incorporating behavioral information into the design process.

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APPENDIX

Literature Review Code Sheet

Literature Review Code Sheet

_____ *Journal* _____ *Book* _____ *Proceedings*

Title _____
Author _____
Journal/Publisher _____
Year _____
Volume/Pages _____

Intended Audience
_____ specialized college text_____
_____ other colleagues/investigators
_____ *behavioral scientists* _____*architects/interior designers* _____*educators* __
_____ summary/state of the art
_____ other: _____

Definition of behaviorally annotated plan *(or other definition of similar)*:
_____ *Yes* _____ *No*

Procedure/process:
_____ *Yes (attach to back)* _____ *No*
Notes:

Diagrammatic/schematic example:
_____ *Yes (attach to back)* _____ *No*
Notes:

Other useful information: