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THE EFFECTS OF PATTERN SCALE IN THE NEAR ENVIRONMENT ON PRESCHOOL PLAY BEHAVIOR

A Thesis

Presented for the

Master of Science

Degree

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Janis Brickey

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ABSTRACT

This research investigated if scaled pattern designs affect children's play behavior, specifically play segment length. The sample included three and four year old children at a child development laboratory. The behavioral setting analyzed was located in an existing quiet area during free play. Under control conditions, the spatial area, 42" x 42" x 36", was regulated to validate the experimental conditions. Subjects acted as their own controls while playing under three conditions, control and two experimental (large and small pattern applied to vertical surfaces). Data were collected by observation and video taped for reliability.

Felt board and Fisher Price used as table toys, were rotated throughout the study. The arrival and departure of each subject who played with the toys in the area were recorded. Analysis of variance tests were conducted across conditions. Results confirmed that the small pattern scale conditions augmented play segment length while subjects play with the felt board. Play with the Fisher Price toys was statistically insignificant. These results are applicable to design of environments where attention span increases are desired.

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1.0 INTRODUCTION

In the typical preschool, different activity areas and learning centers nurture the children's developmental needs. The staff selects a range of toys and tasks to foster social, emotional, and cognitive growth. During free time, children seek out and explore the different types of play opportunities. It is normal that children prefer high interest, interactive toys. Consequently, since free play is limited in many preschools, children may not gain valuable exposure or even adequate time with lesser interesting but developmentally important toys. Since areas during free play are self selected, attention must be given to encourage children to experience the variety of play challenges in the environment provided by the preschool curriculum. Can alterations in the preschool classroom increase play time with certain types of toys?

Imagine the following scenario during free play. A child is walking through a preschool classroom. Passing a group activity, the child is asked to participate by one of his or her classmates. The child continues to walk toward the quieter corner of the room. In the felt board area, the child sits at the table which is partitioned from the room by bookcases and a low screen. While playing with the felt board pieces, the child hears the normal sounds that accompany various play activities that are scattered throughout the room. There is a pause in felt board play as the child seemingly stares at the "walls"

surrounding this quiet area. The child stands up and glances around the room, then leaves to join the other children.

Obviously, the child originally was not interested in the group play, but his or her choice for a quiet activity did not maintain interest. What if something about the periphery influences this child to maintain or increase his or her play? Can modification of the near environment promote and encourage play behavior in children?

Levy (1978) contends that social interactions are more influential than the physical environment on play behavior. Furthermore, the environmental effects cannot be separated from the social factors contributing to play behavior. However, the size and scope of the environment determines the types of activities or social interactions that can feasibly occur within a space. It is known that the environment can be a constant, stable influence on the play behavior of children (Weinstein, 1987). Unlike peer interaction which is subject to differences in age, culture, and personalities, or adult interaction which is subject to the staff's interpretations of the children's needs or the curriculum, the environment is not as volatile.

The following thesis study examines how the alteration of the micro-environment, through addition of scaled pattern design, can affect preschool children's play behavior. Essentially, this study investigates how a change in the preschool environment (pattern scale) can alter spatial scale perception

(relative size of child to near environment), to affect behavior (measured by length of time in play under scale conditions). The underlying principle is that perceptual scale changes relative to the individual will affect information processing (De Long, 1981; 1985). Changes in information processing which affect attention span are recorded as variations in play behavior, specifically play segment length.

Interdisciplinary research from the areas of environment and behavior and child development research provide the conceptual framework for this thesis. This interdisciplinary approach to play behavior and the environment was previously tested through a direct application of spatial scale changes in the environment. De Long, Tegano, Moran, Brickey, Morrow, and Houser (in press) found that children advance into more complex forms of play behavior and engaged in them for longer periods of time under reduced scale conditions.

This investigation is important to both designers and educators as an alternative way to change the environment inexpensively and effectively without extensive alteration to preschool environment or curriculum. The remainder of this chapter focuses on the following topics as a prologue for this study: the importance of play in the lives of preschool (three and four year old) children, how the environment affects behavior, and scale as a factor influencing children's perception of the environment thus altering play behavior.

1.1 The Importance of Play in the Lives of Children

"Play is real life for children" (Tegano, Sawyers and Moran, 1989, p. 93). Play is the principal means for children to discover and conquer their world. Through play investigations, where there are no right or wrong answers, children will explore the immediate surroundings and realize their separate identities from the environment and others (Gibson, 1991). This principle of dual perception is important to understand the effects of scale on children. Adjustment to scale differences is dependent on this awareness.

Play explorations are considered essential to children's processes of assimilation and accommodation of the environment (Piaget, 1963, 1967). Thus children learn basic mechanisms of adaptation through play exposure to problems. Children will imitate adult behavior in situations and environments to establish their interpretation of proper behavior. A typical childhood game is "playing school", where a dominant child is the teacher and others assume student roles.

Child development experts contend that processes of play in preschools are precursors to later problem solving skill development (Vandenberg, 1980; Tegano, Sawyers and Moran, 1989). Play successes and failures are integrated into a child's coping and approach and tactics for later life tasks and problems. Adults planning a preschool must orchestrate the space to provide secure, spontaneous play opportunities for preschoolers and thus, facilitate the early

stages of problem solving. Matlin (1989, p. 301) cautions that "problem solving is difficult when people have developed a habitual way of responding to objects or problems". To understand how the environment can facilitate the development of good problem solving methods, the direct relationship between environment and behavior must be understood.

1.2 The Influence of the Environment on Behavior

Lewin, one of the earliest researchers to emphasize the importance of the environment on behavior, stated: $B = f[E,P]$, (Lewin, 1951). Behavior (B) is equal to the function (f) of person (P) interacting with environment (E). The interaction of the person with the environment incorporates all activities. Interaction or behavior depends on factors of both the environment, such as location and size, and the person's age or size.

Many behavioral responses are adaptations from previous interactions with the environment which reflect ones's early training and association. Piaget (1963, 1967) considered adaptation a critical component of his theory of development. Through processes of "assimilation and accommodation", a child will achieve an 'equilibrium' between the environment and his or her concept of the environment. It is noted that not all adaptation has positive or acceptable behavioral effects.

Altman and Wolhwill (1978, p. 2) stated that "environmental stressors" such as noise and crowding may have a more detrimental effect on children as

compared to adults. They hypothesized that children have not learned sophisticated processes of coping. Adaptation to an inappropriately designed environment can result in an injurious behavior.

Furthermore for a child, the environment is regulated by adults. A child's explorations and formal enculturation at home and school establishes a major portion of the child's concept of the world. Hall (1966, p. 4) states that "the relationship between man and the cultural dimension is one in which both man and his environment participate in molding each other."

The process is a continuous exchange between the internal world of the developing child and external information from the environment. Developing children need sponsorship to achieve equilibrium and cope with the world. Every activity from eating, playing, talking, and sleeping is affected by the environment (Lewin, 1951).

1.3 Environmental Models

Several researchers have explored ways to understand how the environmental system affects behavior. For this thesis project, it is first important to comprehend how the designed environment helps or hinders functioning of people. Second, it is pertinent to understand how environments promote repeated behavior and allow people to predict patterns in similar contexts. Finally, the design and scale of the environment promotes certain behaviors to occur. The size of the individual relative to the size of the

environment defines certain guidelines for interaction.

The Designed Environment as a Code

Humans require a high degree of predictability for proper functioning. However, the environmental system is very complex. By classifying the environment, we can "code" our surroundings through imposing order (De Long, 1980, p. 261). People develop expectations similar to "stereotypes" when interacting with the environment. Through coding, the environment is recognized as a discrete set of characteristics which is predictable to users (De Long, 1980).

During construction, the man made environment is encoded for anticipated behavior and communication. A person's interaction with the environment is the process of decoding the space. For instance, any campus of higher learning will have two types of sidewalks. The first variety will be part of the original design by the planners usually constructed of cement or asphalt. The second type of walkways that people typically use are shortcuts across the grass. Most designers do not consider before assigning pathways (coding) how the space will be defined by the end user. Zeisel (1976) suggests that vandalism such as pathways cut across grass can be controlled or eliminated by waiting six months after the school's occupancy to pave. Users can define or 'encode' their preferred or natural shortcuts (Zeisel, 1976, p. 30).

Factors such as age, gender, cultural background, disabilities, and physical

size may be predisposing people to decode the environment in ways different than intended or predicted by the designers. Often, the users cannot voice their problems with the environment or cannot verbalize limitations of designs. They automatically adapt, often poorly, to the environment. The actual use and decoding process can be the reverse of the expectations of the designer who implanted "signals" in the environment for the decoding process. This is especially important when designing for use by children. Both home and education situations need to foster secure, supportive environments for children which support the "need to move, the need to feel comfortable, and the need to feel competent in the setting," Olds (1979, p. 92).

Phyfe-Perkins (1980) contends that children come to school with various agendas, the environment that they encounter does help to shape their interactions with it (P.119). The quality of interactions with the environment is dependent on the "environmental provisions" (Olds, 1979).

Environment provisions are similar to Barker's milieu, (1968) and Gibson's affordances (1979). Barker's milieu relates to the manmade and natural features which encompasses the behavior (1968, p.19). Affordances as defined by Gibson (1979, p. 127) are the "features of the environment that are offered to the animal, what it provides or furnishes, either for good or ill. The term affordances implies the complementarity of the animal and the environment which is relative to the species."

Patterns of Behavior in the Environment

A method for measuring the structure of the environment and its impact on behavior is presented in Barker's Behavioral Setting Studies (Barker and Wright, 1955; Barker, 1963). Barker (1963) studied behavior in natural settings to establish the principle of "standing patterns of behavior". Behavioral pattern(s) occur regularly in response to specific environments which he termed "behavioral settings". Standing patterns of behavior are defined by unique characteristics that persist even when the participants change (Barker, 1968, p. 18). The environment will consist of a finite number of parts or behavior settings. The functional requirements of a behavioral setting are perceivable properties that stem from the relationship between environment and behavior relationship to the individual (Barker and Wright, 1955, p. 31)

In behavioral settings both human and nonhuman components are bounded by time and space (Wicker, 1979). Essentially, the attributes of the environment must be identified before subsequent behavior can be accurately viewed as a function of the person and environment interaction. Carlson et al. (1980) states that typical names for behavioral settings are defined by function and these names can 'signal' the appropriate behavior. For instance, preschool settings have multi-use areas whereby the standing pattern of behavior is determined by the time of day and the items made available for use by the staff. The use of large group tables found in most preschools illustrates this

point. While children are having snack or lunch, the table supports the standing patterns of behavior for eating. During other hours, a table can be a cooking center, an art activity center, or the block center. Even when the children change in the setting, the behaviors will remain constant as defined by the time of day and materials.

The staff knows that these areas are defined by the curriculum. However, the children may perceive that the staff or the adults in charge establish the rules. These rules for use of spaces and the structure of time allocation within the classroom are part of the formal culture of the setting. Hall (1959, p. 70) explains that there is a triad (formal, informal, and technical) defining how people learn and experience the culture of an environment. In the preschool setting, the definition of activity areas and time are considered formal. All questions have direct answers which reflect the schedule, rules, and expectations of the staff as defined by the type of curriculum. Learning and information are transmitted through someone, typically the child, making a mistake and being promptly corrected by an adult or another child. All early learning begins with formal cultural instruction in childhood. Once the rules are known, informal learning where "one looks to others for behavioral cues" (Hall, 1959, p. 70). The technical aspect occurs when a child is given reasons for not behaving a certain way in a setting. For instance, a child will be told not to throw toys because someone may be injured by his or her actions.

Affordances and Environmental Provisions

Heft (1989) comments that Gibson's affordance theory is generated from a relational approach based on the scale differences between the environment and the creature. Scale indicates for the individual whether or not the environment affords a proposed action. Affordances are objective, physical attributes independent of the person. For instance, a dining chair to an adult affords the action of sitting at the table for a meal. A child restricted by his or her size relative to the scale of the chair cannot readily use the chair to sit at the table. In contrast, a low ledge along a walkway is a natural bench for a child. Adults using the same surface have their knees in their faces. The ledge does not 'afford' the same action for the adult.

Eleanor Gibson, wife of the late James Gibson stated that "our relationship with the environment is close, essential, direct system in which the environment and the creature maintain an equal and a reciprocal relationship that needs no intermediary (Gibson, 1991, p. 94). This reciprocity is dependent on the description of the environment relative to the scale of the animal and the 'position' of the animal within the setting."

1.4 Scale Affecting People-Environment Relations

Scale differences can affect behavior of animals and humans in many ways. Dominance hierarchies are usually based on the relative sizes of animals within groups. Hall (1966, p. 14), in his introduction to ethological issues of behavior,

describes Mc Bride's work on the social distances of animals. McBride contended that size of the group defines the social organization and behavior. The size of both the individual in the group and the group contribute to the effects of the space or immediate environment on behavior.

Ching (1987, p. 136) states that "scale is related to proportion. Both scale and proportion deal with the relative sizes of things." Since scale is a size relationship, it is always relative to the individual organism, or a standard. Scale is one of the natural ways that we learn to "decode" or interpret the environment. People use objects that are sized to standards such as floor or ceiling tiles to estimate the size of a room. People will use their own bodies as a scale reference to determine the height of a room.

Warren and Whang (1987) report how people use their body size relative to a space as a scale reference to move through narrow openings. Objects between the observer and the horizon (which is relative to the individual) are automatically scaled to size for the observer in terms of their relationship to the horizon and his or her own height. A later study by Warren (1990) reports how adults judged changes in the height of stairs based on their own height relative to the altered riser by employing knowledge of their own height compared to a standard riser height.

Hall (1966) states that man's perception of space and potential movement is dependent on distance receptors which are the basic sensory preceptors

provided by the eyes, ears, and nose. The central nervous system relies on information from the proprioceptors and exterioceptors. The propricoceptors are critical to movement as a tracking mechanism of man's kinesthetic action in space. People judge distance as a result of the interaction between current information and past experience. Furthermore, movement occurring in the periphery of the visual field is exaggerated. The use of regularly spaced trees along a street will slow down movement and traffic in an area. Thus, people are affected by regulation of the scale of distances in the periphery (Hall, 1966, p. 71).

In summary, the interactions of people with their environments affect behavior. De Long's (1980) model of communication in the environment suggests that the environment is coded by designers and decoded when used by others. Problems will exist when the environmental code is different from the decoding abilities and expectations of the users. Barker's theory of standing patterns of behavior can be used to isolate how the environment and behavior interaction can be identified for a particular setting (Barker and Wright, 1955; Barker, 1963). The affordance theory by James Gibson (1979) illustrates that the environment or objects in the environment will present opportunities which are relative to the scale and intended actions of the individual. Finally, people subconsciously use their body scale relative to the environment to access their movement and capabilities.

1.5 The Importance of Scale and Scale as a Design Feature in the Preschool

In general, the built environment is designed to adult scale. Doorways and ceilings of buildings are designed to accommodate adult male figures which are one third larger that the average six year old child (Panero & Selnick, 1979). Some aspects of the environment are adapted for children, but this is mainly for the safety of children and for the convenience of adults. Products such as car seats and high chairs make the adult environment more accessible by essentially functioning as physical scale adaptations.

Areas such as the preschool classroom should provide for the scale needs of children while providing ease and accessibility of adult caregivers. Relative scale, however, is always determined by perception. Often the planner takes some areas under consideration, but in general, the environment is scaled for adult use. Environmental changes must relate directly to a child's perception of the environment instead of an adult's, in important areas where scale is a factor. Adults must be careful to be aware of potential situations where behavior may be a ramification of problematic coping in the environment.

The following example illustrates what happens when the environment fails to support the needs of children in the adult scale world. Each morning, the children arrive to the preschool where this thesis project was conducted

with parents. The children enter into the classroom through the lobby, through the storage and restroom area (check-in) and are typically left to assume play with other children and adults. Most mornings, transition occurs within the preschool classroom. As the parent is leaving, many children want to wave good-bye as part of their separation ritual. A child will go to the door which separates the classroom from the lobby. The wood door is a combination panel, sash type with nine panes which begin at a height of 46" from the floor. The typical four year old is approximately 42" to 44" tall. If an adult is not present, to lift the child to a height to make eye contact, the children can use a step stool placed at the door to provide access. When this step is moved to facilitate the mobile carts for morning snack, then the children cannot see their parents to wave good-bye. Some children will quickly move on to other activities. There are others who will be grumpy and remain in an bellicose mood all morning due to their size limitation relative to the physical environment. Consequently, the disappointment of one or two children can affect the whole preschool.

Within preschools, standards such as the National Association for the Education of Young Children in conjunction with state and local requirements are used for designing preschool spaces (Krichevsky & Prescott, 1977). Unfortunately these address minimum standards which excludes attention to details which foster, and may alter, the child's perception of the environment.

For instance, a given room is typically divided into areas by square foot percentages to provide various play areas, instead of using the activities to regulate and determine the size of the space. The reality is that many preschools are created to fit into existing spaces. Room size, existing openings, and shape restrictions often govern space allocations and layout of preschool classrooms. In the consideration of children's scale, existing spaces can be particularly difficult for adaptation for children's use.

Furniture and play items sized for children are used consistently in the preschool environment. However, materials and finishes for many individual areas are decided without regard to scale perception of children. A person's eyes are the principal means to gather information about the environment (Hall 1966, p. 66). Acuity in perception of actual objects is a combination of current perception and past experience, such in the case of camouflage. In the animal kingdom, chameleonic measures will disguise animals from prey and foe. Man's acuity to perceive despite the animal's camouflage has contributed to the near extinction of some species. Movement through space is dependent on the information received through the senses as a means to stabilize the world. However, provisions for the visual variation of preschoolers are often not considered or interpreted to children's scale and needs.

Design recommendations deal with practical maintenance or matters of hygiene such as vinyl resilient tile under art areas. Surfaces for quiet areas and

corners for reading areas have been suggested to be "homey" and comfortable (Krichevsky & Prescott, 1977). An adult might view a vinyl covering placed under a table as another surface which keeps the carpet beneath clean, but to a child the surface is another 'break' or transition in the floor. Children might fantasize that the new surface is a new play castle or a far away land while playing in the area.

This study investigates the addition of related large and small pattern designs to play micro-environments to measure the effect on the length of time in play. Minimal research is available on this topic. Most perceptual studies from psychology focus on object perception or thresholds of perception. Research with children has been limited to perception of figure ground relationships (Millar, 1974) and what immediately surrounds an object of play. The complexity of pattern and design have been addressed as a feature of the toy (Gramza & Scholtz, 1974). Little is known about pattern design as an attribute of the surrounding near environment.

Perceived scale of objects in the environment can be related to the embellishment or design of the object. Pattern design on an object can be distracting in the scale assessment process. In design, pattern is related both to scale (size of the design motif) and rhythm (repeat and/or distance between repetitions of the motif). The rhythm of the pattern may be a stimulus affecting perceptual processes. For this thesis project, both of these factors are relevant.

Simple rhythmic pattern designs with regulated scale changes may produce behavioral changes relative to children's activities such as play.

1.6 The Effects of Pattern Design as a Stimulant

Most stimulus studies report that pattern designs which are busy and full of contrasts are very stimulating. Santosefano (1978) reports that learning disabled children cannot function well when exposed to highly stimulating disruptions on association tests. However, this work concentrated on children in atypical environments with specialized tests. The natural environment where children exist requires a different approach.

Hyperactive children may benefit from a stimulus rich environment (Olds, 1979, a). These children may be freed from relying on their own activity for required nervous system stimulation; and may settle into activity for sustained periods of time if the conditions are right.

The primitive awareness of scale and the subsequent stimulation of individuals was documented by Oliver Sacks (1973). Sacks worked with the patients who had contracted sleeping sickness or encephalitis lethargica. Portions of his documentary novel, Awakenings, describe how he stumbled on the fact that environmental stimuli such as pattern elicited a response or "awakening" in his patients who appeared to be in a trance or sleeping. Two independent cases where pattern design in the environment prompted responses from the patients were important to the doctor's development of a

theory to justify treatment with the drug L-DOPA, a stimulant.

The first instance involved a subject who seemed to be watching a television which appeared to be out of focus as if someone purposely disrupted the vertical hold. Sacks thought that the patient could not reach to fix the vertical hold. When the doctor adjusted the screen, the patient lapsed back into a sleeping sickness stance. The pattern as opposed to normal television was apparently more stimulating to him thus holding his attention.

In the other case, a female patient would repeatedly walk across the floor of the large activity room to a point where the black and white floor tile was replaced with solid white tile. This nonpatterned area surrounded the water fountain and windows which were the only view to the main entrance to the hospital. Once she made it to the point where the flooring changed, she would stop and lapse into a sleep like trance. Dr. Sacks thought that she wanted to go to the water fountain. However, she was responding to a deeper, more emotional need than to quench her thirst. Sacks and an assistant painted black squares on the white solid area to continue the checkerboard pattern throughout the area. The patient traveled past the fountain to gaze out of the windows at the only view of the entrance to the building to where she had entered for treatment many years before (Sacks, 1973).

In both of these instances, the regular environment did not contain pattern movement to maintain brain stimulation. By changing the environmental

pattern, the patient in the former example had sufficient information to use the environment to achieve her goal. In the former case, the loss of stimulation caused a negative behavior.

From this information, it is obvious that the pattern design in certain environmental situations enables people to better use the environment. In the next chapter, the relationship between changes in scale and alterations in the brain activity of subjects will be introduced through the time relativity model of De Long (1981, 1983). This information is essential to understanding the importance of pattern scale as an environmental feature of preschool play areas.

2.0 CONCEPTUAL FRAMEWORK

2.1 Time Relativity Model by De Long

De Long observed during a series of studies with adult subjects that the scale of the environment affects the individual's sense of timing. Further studies led him to develop an experiential model relating space and time to explain his findings. Additional work with tasks and information processing of subjects illustrate the relationship between the scale of the environment and environmental features to the individual's perception of time.

De Long's time relativity model is directly related to biological and physiological forces within animals. The model presents a direct ecological link between environment and behavior. The following section will present the progressive studies of his model developed through natural observation while conducting scale model research for other intentions.

Synopsis of Scale Model Studies

The natural report of informants was the starting point of how the scale of the environment directly influences perception of time. Adults participated in studies to investigate the reliability of using scale models to design homes and to help determine the most appropriate scale representation of a full size environment. Repeatedly these informants reported that the time spent with the model was longer than the clock time (De Long, 1977; De Long, 1976). The

subsequent progression of questions and answers from the secondary results of these scale model studies constitute the experiential space time model's foundation.

De Long (1981) reported a series of findings based on his work with scale models. Apparently, the differences in scale from normal world to scale model environment alters peoples' perception of time. From his studies with adults, De Long derived the formula: $E = x(T)$. Where E is the experiential temporal duration, and T equals the elapsed stop watch duration and the factor x is the reciprocal of the scale of the environment being evaluated. For instance an informant in a 1/12 scale model (x=12) feels like 30 minutes (E) has passed for his scale figure in roughly 2.5 minutes of elapsed, stop watch time (T). Differences in real and perceived time passage are relative to the scale of the model. Viewing a reduced scale model, one proportionally smaller than the subject being modeled, makes the individual viewing it feel larger. For adults, the proportion to the real world is a 1/1 scale relationship. Since the adult size world is large in comparison to children, a relationship of $E < T$ (scale ≥ 1) may denote the relationship between children and time experience. In summary, when people feel large relative to their environment, time perception speeds up. When individuals feel small relative to their environments time perception slows down.

Synopsis of Time Perception and Task Studies

De Long and Lubar (1979) found that under three types of large and small scale modifications, EEG readings changed in adult subjects. These conditions included: three dimensional scale changes using 1/12th and full scale environments, two dimensional scale changes (large and small slides shown to subjects) and ambient scale changes (blue and red color slides). All of the smaller scale conditions registered increases in EEG readings. The findings suggested a more alert brain and/or increased information processing.

A study on task performance associated with information processing (De Long, 1983) was conducted with large and small video screens, 23" and 7". Dependent measures consisted of game scores and the length of games recorded by stop watch. Results indicated that efficiency of the player increased with the smaller screen. Players reported that when playing on the smaller screen that the game seemed slower, but higher scores were recorded in less time under the smaller scale conditions. Performance increased by 12-15% on the smaller screen. Scale apparently influences information processing and thus task/game playing performance.

Synopsis of Work with a Primitive Reptile Genus

To examine the effects of scale changes on behavioral timing, and to see if this phenomenon might be evolutionarily primitive, the exploratory latencies of lizards in novel environments were investigated (De Long, Greenberg, and Keaney 1986). Novel environments consisted of two spaces finished with the same visual pattern in two different scales. The difference in the size of the patterns was a 2/1 comparison, large to small. Lizards were alternately placed in large and small novel settings after habituating to a similar home environment. If scale changes directly mediate the behavioral timing of the lizard's latency response before the beginning of exploratory behavior, then dividing large scale latencies by small should result in an index ratio of 2.0. De Long reported an index of 1.91.

In summary, De Long's space time relativity research suggests that scale influences a very primitive part of our functioning and coping within the physical environment. Since adults reported differences in time perception relative to the scaled environments (De Long, 1981) and tasks (De Long, 1979, 1983), it is logical that children may be processing information at rates relative to their sizes in the environment. In working with children, the concepts of scale and timing would be difficult to understand and report to researchers. Therefore observation of children at play is an appropriate measure of their interaction with the environment.

2.2 Play Behavior and Problem Solving

The Complexity of Play

Play is more complex than most people assume. Smilansky (1968) proposed three levels of play, exploratory, constructive, and dramatic. Most children will progress through the cycle from exploratory play to the next levels, constructive and dramatic. Exploratory play is identified as when children approach a toy and question what can one do with it (Hutt, 1979). Constructive play may be the most critical period for preschoolers. Here, a child has identified the toy and will investigate different play approaches. He or she can use other objects to study what can happen to the toy, such as cutting play dough with a knife. The significant play behavior associated with constructive play is building or constructing something. Dramatic play occurs when the object constructed becomes an imaginary object. For example, the play dough strips constructed at the earlier stage in this hypothetical cycle may become pretend toast.

Problem Solving and Play

Smilansky's play cycle was identified by Tegano, Sawyers, & Moran (1989) as a critical component of their problem solving model in children. Essentially, children need to experience each level of play to develop their own problem solving skills. Recent work by Tegano has focused on how free play time in the preschool classroom affects the progression and completion of the play cycle.

Issues of Play and Time in Play

Christie, Johnson, and Peckover (1988) studied the duration of indoor free play periods using a random rotation for observation. They found that children in longer periods of play (30 minutes) exhibited higher percentages of mature (constructive and dramatic) play relative to shorter (15 minutes) periods of free play. Mature play maybe a significant factor in problem solving (Tegano, Sawyers, & Moran, 1989).

Tegano and Burdette (1991) tested Christie and Peckover's findings using a continuous sampling method. This investigated the amount of time required for children to enter and potentially complete the play cycle during an activity period. Children were observed playing with blocks and play dough. Results supported Christie's findings that long periods of play (greater than thirty minutes) are needed for more complex play, constructive and dramatic play.

More recent research by Tegano, Lookabaugh, and May (1991) used blocks and play dough to ascertain the points where different children progress through the levels of the play cycle. Of special interest to the investigators were observations of children in constructive play. Tegano, Sawyers and Moran (1989) reported that the construction phase of play is where problem solving is most likely to occur. Observation of the level of play was determined by the type of play activity, the facial expression of the children, and comments by children. Measurements included the level of play and the

sequential amount of play (if appropriate) in each level per each child's play session. Results of this study indicate that constructive play is apparently increased when children are allowed to impose their own structure on play. In contrast, teachers imposing high structure on play are likely to see a decrease in constructive play of children.

2.3 Interdisciplinary Work: Spatial Scale Effects on Play Behavior

Through a grant from the American Society of Interior Designers, De Long, Tegano, Moran, Brickey, Morrow, and Houser (De Long, in press) conducted a study on the effects of scale on preschool play. Based on De Long's experiential space time relativity model and Tegano's 1991 study documenting the levels of children's play, the rationale was that the effects of spatial scale would produce alterations in the play behaviors of preschool children.

Children were observed during morning free play at the play dough table. Two conditions, normal/control designated by a large sheet of vinyl on the floor and three chairs at the table; and a scale condition which consisted of a screen porch structure including a ceiling was placed on the vinyl floor. Eleven children were observed for a ABAB research design (full scale, reduced scale conditions). Results indicate that the reduced scale environment prompted a reduction in the mean amount of time to enter complex play, and that children spent a greater percentage of their time in complex play.

Investigation of how the environment can promote and foster play helps

both educators and those people involved in the decision making processes of preschool design. Children's perception of spatial scale may not always involve a physical change in the amount of space. Subtle pattern designs may produce similar behavioral effects by altering the children's perception of the scale of a given area relative to themselves.

3.0 PROBLEM STATEMENT

Previous research suggests that spatial scale affects the play behavior of preschool children. Reduced scale environmental conditions have resulted in increases of constructive time in play and sustained play of children in a preschool setting (De Long et al., in press). It is hypothesized that changes in the perceptual abilities of individuals can be affected by the addition of pattern in the environment. Since the alteration of scale appears to result in changes in information processing and attention span, pattern scale may have a similar effect on children's play.

Play has been linked to problem solving skill development. Preschool research has established that longer periods of free play are required for children to advance into higher levels of play. The question becomes, what environmental attributes can be inexpensively modified with surface pattern to test for the effects on play behavior?

This thesis study addresses the question of how the scale of surface patterns in the preschool near environment will affect children's play with toys. More specifically, will changes in the scale of patterns applied to vertical surfaces of a play activity area affect the length of play in preschool children?

Hypothesis:

Small pattern designs will result in longer play segment lengths as compared to larger scale pattern design applied in the near environment.

For this study, the link between the amount of time in play and the level of interaction by each child will investigated by computation of the mean play segment length. This measure is defined as the operational definition of attention span. Comparisons of the play segment lengths should show that the small pattern condition foster longer play segment lengths than the large scale pattern design condition.

4.0 METHOD

4.1 The Existing Preschool Setting

A physical site defines many of the controls and subjective variables which affect behavior. Ideally, a natural setting allows the subjects to respond to stimuli while remaining unaware that their behavior is under observation. Gump (1975) considers the preschool environment an ideal location for observing young children for accurate accounting of their behavior. Unlike observations which are conducted within residential settings, the variables which may affect behavior are more stable and consistent for the children in the preschool setting.

The White Avenue Child Development Laboratory was an excellent setting for this study. Since the lab is operated by the Department of Child and Family Studies, children are accustomed to observation and having multiple adults in their classroom environment. The staff carefully monitor the subjects during research to assure the safety and rights of the children. Additionally, the program at White Avenue facility is responsive to child development research.

White Avenue contains two preschool classrooms. The east classroom was selected for this study because there was less disruption to existing routines for both children and staff. Efforts were made throughout the study to maintain the regular or normal schedule of the preschool. The following section

describes a typical day at this preschool.

East Classroom: Daily Schedule

The children arrive each morning and proceed to either the west classroom or outdoors, weather permitting. Four year old children gather for morning activities in the East classroom at 9:00 am. They have a snack, and then, shift into 'free play' from 9:15 until 10:00 am. 'Free play' is defined by the staff as a play period when the children are not required to participate in scheduled, group activities. Children can select from several activity centers throughout the room throughout the play period time.

The four year old children have "group time" until 10:30 and proceed to either outdoor play or the West classroom. "Group time" consists of a story or a quiet organized activity. Meanwhile, the three year old children arrive at the east classroom for 'free play' until 11:00 am. Then, both age groups are outdoors until 12:00 pm when the four year old children adjourn to the East classroom for lunch and afternoon nap. From 3:00 until 4:30 pm, all children have 'free play'. Recreation time takes place either outdoors with all children, or if the weather is inclement, the children divided into age groups indoors. At 4:30. both groups assemble for 'free play' in the east classroom and to await the arrival of parent(s) for departure.

Observation occurred during regular 'free play' periods in the East classroom. Session times were as follows: the four year old group was from

9:15 to 10:00 am, the three year old group from 10:30 until 11:00 am, and mixed group from 4:30 until 5:15 pm. If special activities were planned during free play, the staff informed the researcher and observation did not occur. Special activities included guest speakers and field trips, such as going to the library.

East Classroom: Activity Areas

This classroom provides multiple areas for interaction by children with well defined arrangements that allow children to seek out activities. The physical layout, the control of participation by the number of chairs present, the amount of adult supervision, and the fixed time schedule for activities present at White Avenue are consistent with methods identified by Moore (1987) to create boundaries for levels of interest in children.

There are many activity areas for children in the East Classroom during 'free play'. Toys throughout the preschool classroom vary with staff planning for holiday and learning themes. Activity areas during this research included; a book corner, an art easel, puzzle and game areas, an audio area, quiet areas and a water table. Plastic bins with small motor toys are available on the floor in front of the observation booth. At the large semi-circular tables, children can participate in adult supervised activities, such as cooking.

A quiet corner located to the right of the semi-circular tables was selected for this research (Figure 1.). Children used this area as part of their typical play activities within the classroom. Normal toys in this area include a wall

hung felt board and table toys, such as Fisher Price. In addition, children in this area could be video-taped and observed from the observation booth area.

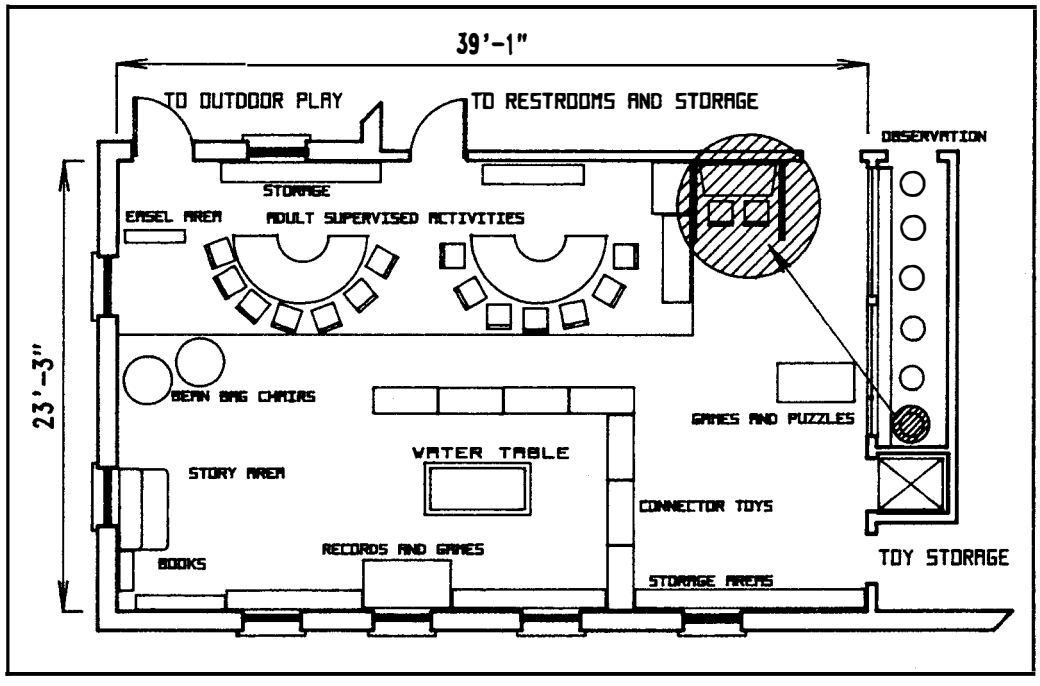


Figure 1. Floor Plan of the East Classroom of White Avenue Child Development Laboratory, University of Tennessee, Knoxville.

Adults normally cycle through play areas to help foster play. During this research, staff members were asked to avoid this area, unless their assistance was required to subdue disruptive behavior or assist with occasional problems such as regulation of the number of children in the space. At White Avenue, one of the methods of turn-taking is to govern the number of children playing in an area at one time. The number of chairs "signal" to the children the

maximum limit of participants in the activity. Additionally, a staff person might interrupt play to escort a child to required activities, such as a visit with the speech therapist or the restroom.

4.2 Sample

During the study, an aggregate of twenty-nine, three and four year old children were enrolled at White Avenue. Prior to the start of the study, the parents were introduced to the project's objectives at their summer meeting by the researcher.

Parents were contacted during early October to obtain permission for their children's participation. At the start of data collection, eighty-six percent of the parents had granted permission for their children to be observed. By the end of the first two weeks of observation, all parents had granted permission. Since all the observation sessions were video taped, all children were included in the study. One child left the preschool during the study and was dropped from the analysis. The mean age of the three year old class (fourteen total) was 3 years 9 months and the mean age of the four year old group was 4 years 8 months (fifteen total). The mean age of all subjects was 4 years 2 months.

4.3 Toys Used During Children's Play

Two types of toys were rotated throughout the study to reduce boredom. During the four months prior to this study, the toys were rotated every two weeks in this area. Throughout the study, toys were rotated every three days

of observation. The toys used were Fisher Price theme environments and felt board.

The Fisher Price toys used in this study are commercially available depictions of common environments such as a barnyard, school house, and a multi-story house. Figures are simple, block type people without arms or legs. Movable appendages on the farm animals, make these toys more interactive for children. Plate 1 shows a subject playing with Fisher Price toys under experimental conditions.



Plate 1. Photograph of Child Playing with Fisher Price Toys under Experimental Conditions.

The other toy type rotated during this study was a felt board designed for the table top. Black felt on the board surface repeated the color of the existing wall mounted board. New felt dolls were made and scaled to match pieces in the preschool. The new figures were more detailed with faces and posed in action positions. Felt dolls were dressed in themes such as school clothes and sports costumes to emulate play situations like the Fisher Price toys. Plate 2 illustrates a subject playing with felt board toys under experimental conditions.

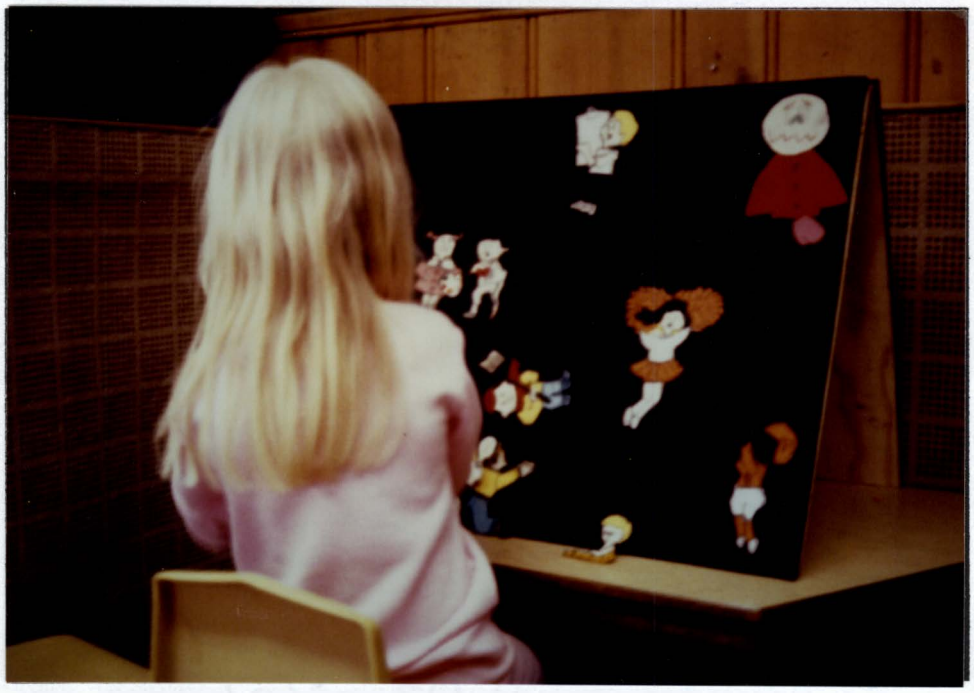


Plate 2. Photograph of Subject with Felt Board Toys

The play themes of the toys were selected to engage the children in related play situations. The new felt board and figures were introduced into the classroom prior to the start of the study. Preschool staff and play specialists on this thesis committee thought that these toys would be of equal interest to the children. The same rotation of play themes was repeated throughout the study. For instance, the barnyard theme in the Fisher Price would be followed by the same with the felt pieces.

4.4 Research Setting: Spatial Dimensions

The study involved manipulation of the quiet area described in the opening section of Chapter 4. For the control condition, this behavior setting was manipulated by the rotation of toys, the movement of felt board play from the wall to the table top, and the positioning of an existing screen to define the experimental area. Data collectors had an unobstructed view of the room's activities and the research area from the observation booth which has a one-way mirror. (Refer to Figure 1.)

Description of the Control Condition

Under regular classroom conditions, a portable screen separates this quiet area from the doorway area to the main lobby of the center. This screen, 47 1/2" wide x 33" high, provides privacy at a child's seated height. A trapezoid table (47" back x 42" front x 19" side) and two chairs were moved into this space several weeks prior to the study's start. The length or hypotenuse of the

table was aligned with the wall. The chairs faced the wall. Bookshelves to the left (48" wide and 12") deep, separated this area from the semicircular tables. Plate 3 shows children in the research area under the control conditions.



Plate 3. Photograph of control condition. Note the Location of Screen Relative to Surrounding Area. This Space Was Replicated by Research Structure.

Description of the Experimental Conditions

A portable structure, comparable to panel systems surrounding employees in an open space office space, was designed and constructed to sustain normal preschool activity. During the conditions with pattern design, the unit remained in the classroom at all times. Its location and design was

nondisruptive to the daily routine. For instance, cots for sleeping were placed within the area during afternoon nap time. It was important that the structure could be dismantled, easily moved and stored during the control condition. Additionally, the height of 36" permitted video taping of the subjects from the observation booth while maintaining privacy for children. [1]

Since the height of the screen used in regular conditions is 33", a 36" overall height for the new structure allowed for carpet to be installed at the same height as the existing screen height. The additional 2-1/2 inches was exposed wood which blended with the area's existing wood paneling.

Volumetric space across conditions was held constant. Changes in the scale design of the pattern affected the linear scale environment. The planned size for the structure's floor perimeter was 50" x 62" x 50". Due to the carpet manufacturer's limitations, the structure size was reduced to accommodate large carpet samples custom dyed for the project. The final inside measurements were 47" x 55" x 47". See Appendix A for description of structure and illustration. Plate 4 shows the research structure and the immediate surrounding area of the preschool corner.

1. Considerations used to determine the best height included; class charts of the subject's heights, the Human Dimensions (Panerao & Zelnik, 1979, pp. 107) standards for a child seated at a table, and the maximum height which would afford privacy for the children and allow visibility for staff and video observation from the booth.



Plate 4. Photograph of Structure on Location.

4.5 Research Setting: Linear Pattern Scale

Surfaces within the play area considered for pattern design application were the vertical surfaces, the floor, and the table top. The consensus was to restrict pattern designs to vertical surfaces similar to wallpaper in a home setting.

Carpet was selected as the source of the pattern design for two reasons. First, carpet exists in the normal setting as a floor covering and on large block-type dividers in the preschool. Second, the manufacturer was capable of producing pattern and color combinations in small quantities as samples.

Durkan Carpet Mills, Inc. of Dalton, Georgia, manufacturers of printed

commercial carpet for the hospitality industry, produced the patterned carpet. Any of their hundreds of patterns can be custom fabricated in multiple color combinations. By using manufactured products which are custom dyed, the uniformity of the pattern replication and the dye process were assured.

Most of Durkan's pattern designs are fairly complex to hide spillage on the floors of restaurants and bars. Simple, nondiagonal patterns were selected from stock designs for initial evaluation. For this research, square patterns are used to establish that a simple motif in the near environment will affect play behavior.

Pattern Design Selection Procedure

Twelve related simple (2 tone) pattern designs of similar 'square' motifs were selected from stock designs by the researcher. Equal numbers of visually larger and smaller pattern repeats were selected for the consensus test. Full scale mockups were rendered in marker on 18" x 24" sheets of paper. The carpet industry commonly uses this size for samples. Exact scale and measurements between the elements of the pattern design were verified with a mill trip. Colors for the mockups were limited to neutral taupe and browns.

Graduate and entry level interior design classes were independently polled for their selections. Criteria for judging included similarity in design and appropriateness of scale for the study. Student judges were told that wallpaper and textile manufacturers commonly use the taupe/neutral range to gauge

pattern response independent of color. Selection of pattern motifs of similar design was emphasized, not the color of the samples or finished product.

Mockup samples were randomly numbered and mounted on the classroom walls. A simple synopsis of the study's intent was given. Each student was asked to critique and select two sets of one small and one large design to be used in this study. The most popular set was approved by the thesis committee. Final colors were selected by this researcher to match the existing area used for the research. Samples were selected to blend with the wood wainscoting in the preschool. The manufacturer's pom pom system which allows designers to match yarn samples to their color schemes was used. The manufacturer was given information on the existing lighting conditions to make appropriate adjustments during dyeing.

Pattern Design Description

The Durkan pattern designs selected were small pattern: Durkan Pattern # 1288A and large pattern: Durkan Pattern #133 A (reverse, two colors). In Plate 5, the two patterns are shown together. In Plate 6, the scale relationship between the subjects at play with the felt board toys and the surrounding small pattern design is shown.

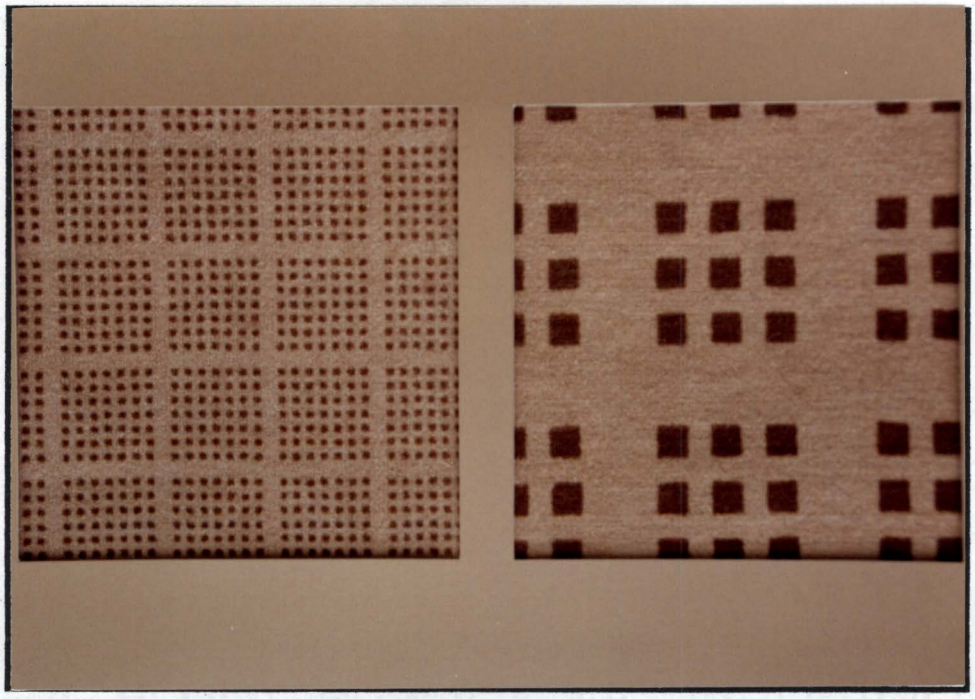


Plate 5. Photograph of the Small and Large Scale Carpet Pattern Designs.



Plate 6. Subjects Playing with Felt Board under Small Scale Conditions.

Linear Scale Relationship between the Patterns

The design of the large pattern is composed of nine (three by three) 3/4" squares which are separated by 3/4" of ground color or a 3 3/4" design. The small pattern is composed of forty nine (seven by seven) 1/8" squares which are separated by 1/4" of ground color or a 2 1/2" design. The large scale pattern is 1.5 times the size of the small scale pattern. The relationship between the number of figures in the two patterns is seven (small pattern) to three (largepattern). The repeat of the small pattern is three inches and the repeat of the large pattern is six inches. Therefore, the figure/ground scale relationship of the large to the small pattern is 2 to 1. As part of the periphery environment, the effect should be similar to one's perception while driving down a tree-lined street as mentioned by Hall (1966, p. 71). Comparisons are shown in Figure 2.

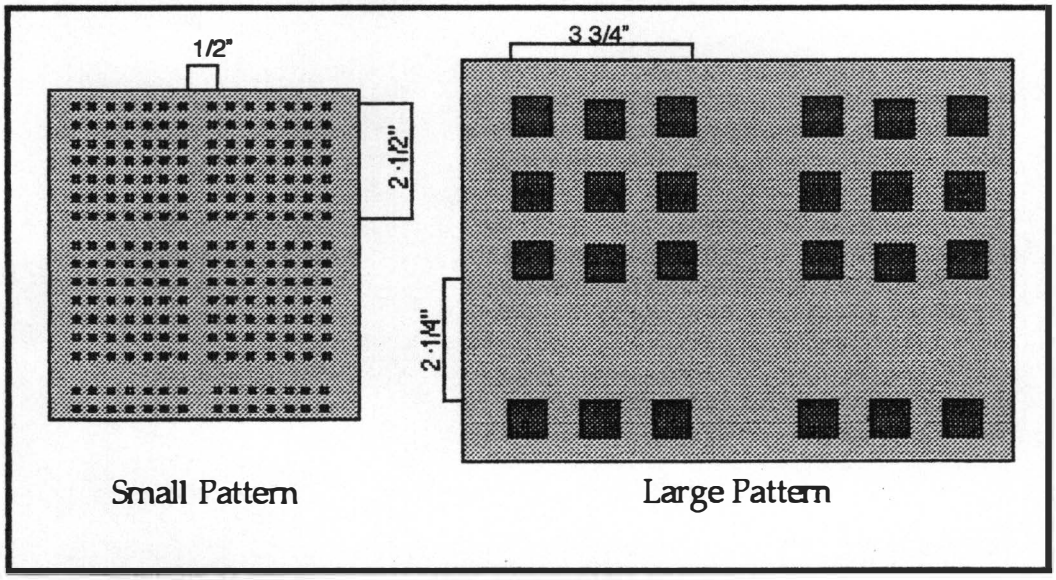


Figure 2. Graphic Replications of Carpet Pattern Designs. Approximately 25 % of original size.

4.6 Procedure

The observation schedule consisted of three conditions, each with two levels. The normal classroom condition with no pattern and the existing screen was Condition A or control condition. Condition B consisted of the 'small scale' pattern. The third condition, C, was the 'large scale' pattern design. As stated previously, the toys were rotated every three days.

All three conditions contained two levels each as part of the design and as a reliability check. Each level of the three conditions was observed for one week, or approximately fifteen sessions. Potentially, each day there were three potential sessions to observe 'free play', two morning and one afternoon. A break of one week(fifteen observation sessions) was inserted to guard effect of predictability of the research design. Additionally, the staff was instructed to put other toys in the area and to leave the screen alone.

The research design was originally consisted of the following sequence of conditions; A1, B1, C1 Break C2, B2, A2. However, due to miscommunication, the small pattern scale (condition B, level 2) was inserted after the break. The final sequence was as follows; A1, B1, C1, Break B2, A2, C2, B3. In summary, the research design consisted of no pattern (A1), small pattern (B1), large pattern (C1), break (without any regulation of the preschool setting), small pattern (B2), no pattern (A2), large pattern (C2), and small pattern (B3). The research design was structured to allow for statistical comparisons between

conditions (specifically, small and large scale patterns) and within levels or repetitions of the conditions.

There were 105 possible observation sessions during the two month study. Fourteen sessions were not observed during the observation time due to other group planned activities or extraneous circumstances. A total of ninety-one play sessions were observed.

4.7 Data Collection

During the trial period prior to the start of the study, tests were conducted with the data collection methodology to establish guidelines for observation and an appropriate instrument to record pertinent information about the daily activities.

As the permission slips were returned by parents, numbers were randomly assigned to subjects. In the observation booth, a photograph album identified staff members and children. Stickers with the aforementioned numbers were used to identify the children in this album. If a subject was difficult to identify, data collectors were instructed to note their clothing, and later ask the staff to identify the child using the photograph album.

Undergraduate students from Interior Design Program and Child and Family Studies department received research hours as an independent study or class credit while assisting in data collection for this study. Students were individually trained by the researcher. Their responsibilities included: setting

up a video camera in the observation booth to record the session, rotating the toys in the research area, filling out the instrument described below, and recording the entry and exit of each child into the research area. Data collectors were suppose to note if the child played with the toy, the reason that the child left the area (in many cases, the dialogue or children's comments gave this information), and anything unusual about the play episode. Data collectors were instructed to position themselves in the far stools of the observation booth indicated by darkened circles on Floor plan (See Figure 1)

Room activities and the general mood of the children along with any unusual occurrences were documented on the research instrument (See Appendix B). Each day instrument notations about class activities were reviewed by the researcher to track the number of sessions (AM and PM) of observation per condition.

Additionally, information above described in the data collectors' responsibilities was noted in a place for each child's identification number. This information was used after the research was completed to evaluate the preliminary data.

A random review of tapes was scheduled. In review of the study, it was noted that the data collectors' schedules were consistent but fairly spread out. For instance, one student observed every Tuesday and Thursday afternoon. Another observed every Monday and Wednesday morning. The researcher

conducted the observations on Friday afternoon and intermittently had to collect data for the students due to illness or other conflicts.

The instrument notations about the events appeared to be fairly consistent, but because of the number of data collectors (five plus the researcher) there appeared to be some inconsistencies in the report of actual play events. It was decided that a thorough review of tapes was necessary to double check data, note any unusual behavior which was not part of the data collectors' notation responsibilities, and serve as a base of information for future documentation on the recorded data of this study.

4.8 Data Analysis

The first step in the analysis of data was the thorough review of the instrument to note unusual occurrences which may have influenced the children. At this point, the Condition B3 observations were evaluated and dropped from the analysis. During Condition B3, there were many disruptions in the preschool environment. This condition took place during the preliminary holiday season (December 6-12) during which there were changes in the group composition. These included the addition of new children and the departure of a child. Some children were affected by a flu virus which closed the public schools prior to Thanksgiving. The period after this holiday was very busy indoors. All children had returned to 100% attendance and the seasonal weather changes caused an increase in indoor play. Observations

were not as consistent during this time frame due to examination schedules of student data collectors. Therefore, the data collected during condition B3 was inconsistent and dropped to insure internal validity.

Raw Data Analysis

Data entries (time in play and number of play sessions) were qualified by review of tapes. The following guidelines were used by the researcher to determine if a child's interaction with the space was to be entered as data.

- Children who approached the toy and played or interacted with it for more than 25 seconds (clock elapsed time) were recorded .5 minutes of play. Less than 25 seconds was recorded as zero, or no play.
- Any time less than one minute but more than the 25 seconds as described above were recorded as .5 minutes. After one minute, the actual clock time was recorded. For instance, upon entry the camera clock time was noted at 10:38 and the child left at 10:40. Two minutes of play for the child was entered.
- Children had to play or interact through apparent eye contact and some level of interest with the table top toys. If during the course of play the toys were moved to the floor or under the table, this was noted. The subjects had to keep the toy(s) in the area as defined by the structure or screen.
- Children who approached the toy without touching it but stayed close to the table with apparent eye contact for more than thirty seconds were counted.

- Children who entered the area, played with the toy, and left to seek help from an adult or friend to help with a problem and returned to interact with the toy were recorded for the total time.
- If a child had a problem, left for help, but got distracted and did not return, their play until their departure was recorded. Data collectors were instructed to watch the departing children to determine the next location of play. Since the sessions were taped, the entry of a new child could be determined from the review of tapes.
- Interactions with the space when children used the area for other activities such as hiding from parents or socializing with friends were not included.
- Children who brought other toys into the area for play but did not play with the research toys were not counted. If they brought another toy into the area but played with the research toy, they were included using the time guidelines as described above.
- Each play segment as outlined above was recorded during the observation sessions. The total number of play segments per child were recorded for each observation session.

The total number of play sessions per condition varied across conditions due to normal changes and variations in the classroom activities. Because the play in this area was self selected for quality and quantity by the

subjects, this research was treated as a non repeated measures design. The total amount of play relative to the conditions was the critical variable. All participation was important to determine the actual interaction between the subjects and the environment.

Statistical Procedures

Analysis of Variance, ANOVA, tests were performed on the Macintosh IIci using Statview II. Several tests of ANOVA were performed to test the hypothesis. All procedures were performed at the .05 level of significance.

The differences between the control condition and the pattern conditions are treated within the context of this analysis as secondary to the differences in play under the two pattern conditions. The function of Condition A was to control for novelty and possible after effects of pattern design exposure during the experiment. Therefore, Condition A was not included in the analysis.

The preliminary statistical analysis was a 3-Factor ANOVA compared toys (Fisher Price and felt board), sessions (AM and PM), and conditions (B1, B2, C1, C2). Results indicate significant differences between the two toys for play time, number of play segments, and mean segment length. The Fisher Price toys promoted a much higher level of interest across the conditions and parameters in review of the means for both toys. This was not anticipated. Probable causes and implications will be discussed later.

Additional analyses tested for the statistical significance of the differences

within and between the levels of the small and large pattern conditions of felt The results support the hypothesis that small pattern design in the near environment produces longer play segment lengths compared with the large scale pattern designs.

5.0 RESULTS

Statistical procedures on the sample population supported the research hypothesis that the addition of small pattern scaled design on the vertical surfaces of a preschool activity area were associated with increased play segment length. For this study, the play segment length (length in play/ number of segments) is the operational definition of attention span. Therefore, the attention span of the child playing in the small pattern environment was increased. Surprisingly, the results applied only to the felt board toys. In retrospect, the design and three dimensional features of the Fisher Price toys were more interesting.

5.1 2 x 2 x 4 Factorial Analysis of Variance Results

The independent measures were toys (felt and Fisher Price), sessions (AM and PM), and condition (B1, C1, B2, C2). ANOVAs on the three dependent measures yielded the following results. For the dependent variables length of time and number of segments, main effects were present for toys [$F(1,166) = 30.18 > p < .001$)] and [$F(1,166) = 5.8 > p < .001$] respectively, with no interaction effects.

For the measure of play segment length the results are more complex. Main effects existed for both toys ($F(1, 166) = 25.25 > p < .001$) and Condition ($F(3, 166) = 3.56 > p < .02$). Inspection of the means for the two toys indicates

that the Fisher Price toys were more interesting to subjects as compared with the felt board toys. In Table 1 the means for the Fisher Price are consistently higher than the felt board means. Additionally, there appears to be consistent readings within conditions, B and C for the felt board toys. In comparison, the Fisher Price toy results do not appear to be consistent within conditions. The differences between the means may be attributed to factors other the conditions of the experiment such as the three dimensional design of these toys. The remainder of the analysis focuses on the felt board toys.

Table 1. Means from the Incidence Table for Toys and Condition for Play Segment Length.

	Condition	Small B1	Large C1	Small B2	Large C2
Toys	Board	2.79	.83	2.99	1.79
	Fisher	6.21	3.64	3.76	4.74

5.2 Results of Analysis on Fisher Price Toy Play Within Levels of Conditions

The ANOVA results on the Fisher Price toys support the earlier speculation that the play with Fisher Price toys was not significantly affected by the conditions. None of the dependent measures were statistically significant. Inspection of the means and standard deviations by level (see Table 2) support the reasoning that the Fisher Price toy play was influenced by a number of factors other than the conditions. All of the SDs are relatively high

compared to the means of each of the levels of the condition. This means that the distribution around the mean possessed greater variance and therefore the influence of the conditions on play with Fisher Price toys was affected by other variables.

Table 2. Comparison of the Results on the Fisher Price Toys

	Time in Play		Segment Number		Play Segment Length	
Condition	Mean Time in Minutes	SD	Mean Time in Minutes	SD	Mean Time in Minutes	SD
B1	9.8	7.84	1.59	0.73	6.21	4.95
C1	8.98	8.36	2.32	1.55	3.64	2.61
B2	6.34	6.39	1.54	0.88	3.76	2.80
C2	7.69	5.40	1.95	1.47	4.74	4.21

5.3 Results of ANOVA on Felt Board Toys Between Conditions Divided by Levels

The next analysis compared the differences in the means between the levels of conditions B and C to ascertain if the differences in the means within levels of the conditions were significant for the felt board activity. If the differences in the means within conditions were significant, then factors other than the pattern scaled designs were causing the effects on play. Felt board play consisted of four levels (B1, C1, B2, C2 or small pattern, large pattern).

For the dependent measure time in play, the ANOVAs were significant with a ($F(3, 85) = 4.59 > p < .01$). Post hoc tests (Fisher PSLD and Scheffe F-test) indicate that the means within condition levels of both B and C were not statistically different and that the means comparing between condition classes were significant. No significance was found for the measure segment number.

In the results for play segment length, the means between conditions divided by levels were significantly different with a ($F(3, 85) = 4.04 > p < .001$). Post hoc tests indicated that the differences were between condition classes and not within levels of the conditions. Refer to Table 3.

Table 3. Comparison of Post Hoc Tests on the Differences Between Means of Play Segment Length within Conditions and Between Conditions. Note: * Indicates significance at the .05 level of analysis.

Comparisons	Fisher PSLD	Scheffe F-test
B1 vs C1	1.37*	2.67
B1 vs B2	1.26	0.03
B1 vs C2	1.61	0.5
C1 vs B2	1.35*	3.35*
C1 vs C2	1.69	0.43
B2 vs C2	1.19	0.74

In addition, from inspection of the means for the different levels of the Conditions B and C it appears that the children's play segment lengths were

almost twice as long under the B conditions as seen in Table 4.

Table 4. Comparison of Means Between and Within Conditions for Felt Board Play

Conditions	Mean Time (Minutes)		
	Time in Play	Segment Number	Play Segment Length
B1	3.73	1.27	2.79
C1	1.20	1.40	0.83
B2	4.05	1.43	2.99
C2	2.0	1.25	1.79

5.4 Analysis of Differences Between B and C Conditions for Felt Board Play

The final step of this analysis tested for differences between the conditions B and C. A significance for length of play was found with a ($F(1, 67) = 8.36 > p < .01$) . Comparison of the means for the two conditions 5.01 (B) and 1.81 (C) indicates that children played for almost three minutes longer on the average in the small pattern conditions as compared with the large pattern conditions. The differences were significant for both Fisher PSLD (2.21)and Scheffe F-test (8.36) post hoc tests at the .05 level. No significance was found in the analysis for the measure segment number. Play segment length results are significant ($F(1, 67) = 8.39 > p < .01$). Comparison of the means indicate that on the average children would spend 2.66 minutes in the small pattern condition when playing with the felt board as compared with 1.32 minutes in the large

pattern conditions. Again, both the Fisher PSLD (.93) and Scheffe F-test (8.39) post hoc tests were significant.

In summary, we can say that the small pattern scale conditions (B) have statistically significant effects on the felt board play behavior of children in this study. Since play segment length is the operational definition of attention span, we can say that the relative scale changes in the environment appear to alter attention span.

6.0 IMPLICATIONS

6.1 Specific Issues

There are five important issues in these research findings. The primary finding is that the alteration of the play environment affects the felt board play behavior of the preschool children in this study. Equally important is the finding that results similar to those found by the spatial scale research conducted by De Long et al. (in press) were present with a very subtle change in the environment, specifically a change in the scale of wall patterns. The issue of the use of pattern scale in the preschool classroom is pertinent to both designers and educators. The secondary findings of the pattern scale relationship to scale relationships used by De Long et al. (1986) should be addressed in future research. Additionally, the differences between the two toys used in this research is important. Apparently, the Fisher Price toy play was not subject to the same effects under the pattern conditions as the felt board play.

Felt Board Play Findings

From the primary finding that the felt board play was affected by the small pattern conditions, it is logical to assume that the smaller pattern design provided additional environmental support for the children's play. The smaller pattern appears to support concentration and thus attention during

play with the felt board toys. Like the Fisher Price, the felt board toys are interactive but require a greater amount of imagination due to the basic two-dimensional design. Play with other comparable toys may be similarly affected by the introduction of a smaller scale pattern. Other types of activities, such as academic study may be affected by the addition of similar scale pattern into environmental settings.

Comparisons with Interdisciplinary Spatial Scale Research

In the previous study by De Long et.al. (in press), the spatial scale was altered by a screen porch structure available to the children only during observation time. The structure was removed daily to accommodate afternoon play and nap time. Children experienced the real sense of entering into a different space within the existing preschool environment.

Even though the structure designed and built for this study presented walls and enclosure similar to an open office system for adults, there were more opportunities for interaction. Since this structure stayed in the room during the research, it became an extension of the walls and furniture. The colors chosen for this research pattern carpet were selected at the site to blend with the existing wood tones of the wood paneling. The simple pattern did not contrast extensively with the behavioral setting. By the middle of the study, children used the area for hiding from parents and as a prop to lean over and observe children at play at the table. Additionally, the area was used by

children for other activities. Occasionally, a child would bring a toy into the space and play until a staff member told him or her to restrict play to the toys available in the area.

Pattern Scale in the Preschool Classroom

As a part of the classroom, the finding that the subtle pattern condition was statistically significant in this felt board play area for this group of children is important. There is a tendency to limit or eliminate pattern design around children. Pattern application should be specifically defined in the classroom. The findings of this study suggest that certain types of activities may be enhanced by the addition of some pattern into an activity area.

There are probable limits to the amount and distribution of pattern in the near environments of preschool children. It is the contention of this research that pattern scale design should be used to enhance areas where children require greater concentration. It is reasonable to postulate that too much pattern, patterns which are highly, visually stimulating (diagonal, multicolored, or overwise distracting), and larger designs should be avoided.

Further research should test patterns such as the simple, linear design used for this study in different types of activity centers. Suggestions include reading corners, music listening areas, and other centers where small group or solitary play is expected.

Pattern Scale Relationship

A secondary finding is related to the two to one scale relationship used in the De Long et al. (1986) study. The patterns used to test lizard latency responses had a 2/1 scale design. As in that previous study, the behavioral measurement of this thesis research, time, was doubled under the smaller scale conditions (2.66 to 1.32 minutes per play segment length).

Since the patterns were selected for similarity of design, this direct relationship is to be interpreted with caution. This finding was not part of the hypothesis for this study. The 2/1 scale relationship is the figure/ground repeat which may have affected the children's peripheral vision. The influence appears to be present, but further study and a more rigorous research method would be necessary before that correlation can be stated without reservation.

Play Behavior Differences Between Felt Board and Fisher Price Toys

The most surprising aspect of this research is the differences between the play behaviors relative to the two toys. The two were selected as comparable preschool toys to reduce the boredom with the play area. Several reasons are probable for the differences. There may be an assumption by staff and observers that children play equally with Fisher Price and felt board. This was not found to be the case in this study. The notion that the two types of toys are equally appealing may be due to a lack of observation on the actual time spent playing with these two toys. Staff and observers may be more cognizant of

other aspects of behavior compared to the actual time spent in play with specific toys. Factors such as the gender of the children playing in the locality at a particular time, the other activities and toys available in the room, and the general rotation of the toys in the area may also affect play preferences.

However, one probable cause for the difference is the three dimensional design of the Fisher Price toys. The play environment such as the barnyard include the barn, farm animals, and small figures. Children manipulate the figures through the spaces and thus experience the movement of the play pieces. Therefore, the child while playing with the Fisher Price figures will act out or portray a role, such as the farmer figure. There is minimal detail on the Fisher Price people but the figures strongly suggest stereotypes that children can identify. This strong association allows the child to quickly assume a role while manipulating the figures.

Typically in this preschool to control for boredom, Fisher Price toys are placed in the classrooms but on a less frequent basis. Some children appear to have a strong preference for the three dimensional type of toy. Therefore, they may have dominated the Fisher Price play time, since access to this toy was restricted somewhat. Since this was not a repeated measures design, comparisons were not made on the repeated visits within a session by children.

Research should be conducted to explore the addition of subtle pattern in settings where concentration is required, such as a study area. Because pattern

is a related issue of scale and "self" in the environment, the size and intensity of the pattern may be related to age, size, or gender of the subject(s). Hall (1966, p. 63) states that "man's sense of space is closely related to his sense of self, which is an intimate transaction with his environment. Man can be viewed as having visual, kinesthetic, tactile, and thermal aspects of his self which may be either inhibited or encouraged to develop by his environment." Research should continue to explore how the environment can shape or mold the individual. Children with special needs can benefit from the positive influence of a supportive and stable physical environment. Quality research conducted in natural settings which investigates and communicates findings to the people who provide for special children is needed.

6.2 Generic Issues

Hall (1966, p. 4) stated that "man is capable of creating his biotype and thus determining what type of organism he will be". For children, the creation of self is dependent on the provisions of adults and the fostering afforded by the environment. The research and documentation of the interactions of children with their environments that promote the cognitive, cultural, emotional, and physical development are critical concerns to all concerned with the long term ramifications. The environment can be designed (encoded) and regulated to provide more optimal settings for children.

Problem solving skills emerge, form, and develop during the seemingly

simple task of play (Tegano, Sawyers, & Moran, 1989). All children require adequate time to explore and experiment during play. The preschool system through its formal or structured culture, may not promote extended play periods responsive to individual needs.

It is noted that the effects of pattern design as an environmental feature are generally not considered a factor in research in many fields. The results of this study should caution future researchers against this oversight in studies where the activity or behavior may be influenced by the addition or existence of pattern design in the near environment.

This thesis is an extension of the interdisplinary work which began an exploration of the factors in the environment that may alter the play behavior by increasing the attention span of children. The principle concern of this area of research is to enhance the learning and play environments of children. All children can benefit from this research. However, the fact that the physical environment can enhance play behavior and attention span is an important finding for those children with limited attention spans. Typically, amphetamines are used as treatment to speed up the brain's activity. Since the scale alteration affected the brain activity of adults during tasks and information processing (De Long & Lubar, 1979), and the level of play was positively affected by the spatial scale changes as reported in De Long et. al. (in press), it is logical that children with attention span problems may benefit

from this research. Further study in the area of attention span relative to environmental scale changes is necessary.

Additionally, the experience of time is an issue of the man environment relationship which needs further exploration. The ongoing work of De Long has established a link between people and a more primitive internal sense which regulates the experience of time relative to scale changes in the immediate environment. The physiological connection to time experience and scale through the nervous system is the foundation of this important link. As research establishes and strengthens the foundation this model, other aspects of the interaction between people and the environment will be understood.

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APPENDICES

APPENDIX A

DESCRIPTION OF THE RESEARCH STRUCTURE

Hardwood fir two by fours were used to construct the frame for the carpet to be mounted on vertical surfaces. The structure's interlocking joints provided stability. Metal mending plates and flat corner irons with predrilled holes were used to secure the wood members together. One person can assemble the three sections with a screwdriver. The inside was constructed to easily attach the 1/4" thick carpet to the exposed two by four wood members. A one by two wood strip is mounted center on the inner edge of the two by four frame to secure down the middle of the large carpet samples. The right wing perpendicular to the door was designed to blend with the existing wood paneling. A birch plywood panel was fitted inside the two by four wood frame and secured with quarter round molding. All wood surfaces were sanded and finished with shellac to blend with the existing wood wainscotting. The size, design, and weight of the structure enabled it to be freestanding without wall anchors.

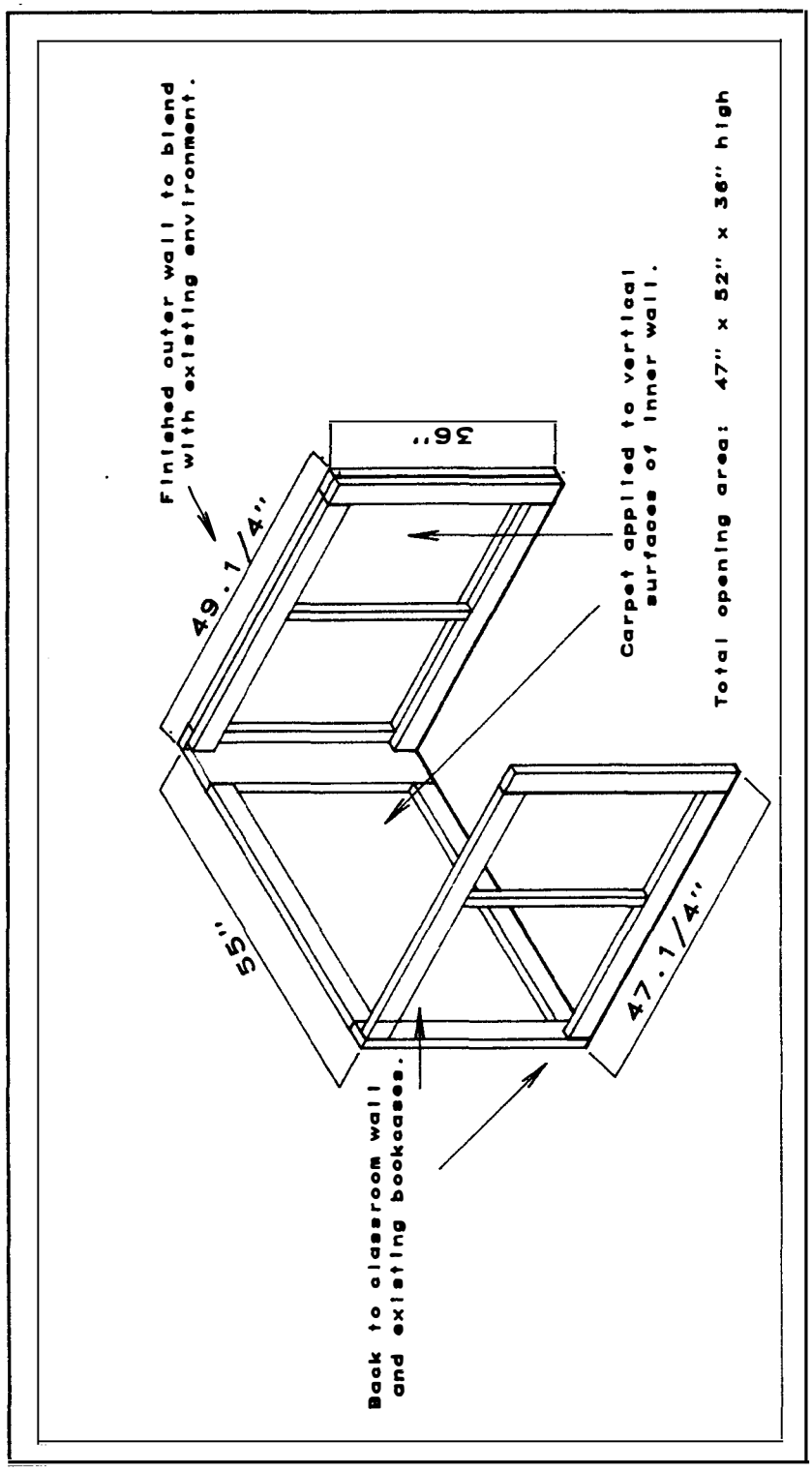


Figure 3. Drawing of Research Structure with Dimensions.

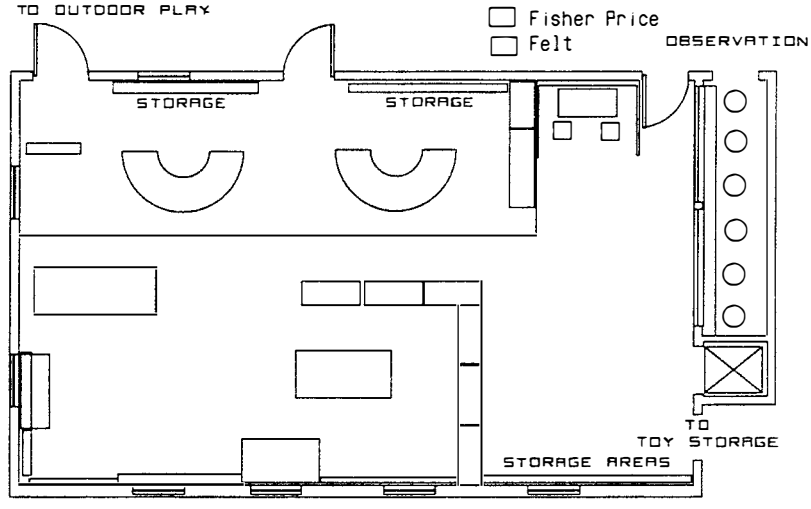
APPENDIX B

RESEARCH INSTRUMENT

Textile Pattern Research Observation Instrument
Master Thesis: Janis Brickey Dept. of TRID

Date:_____ Observer No:_____ Condition:_____
Film #_____

Classroom Activities ---Mark on



Subject #_
Time In:
Time Out:
Cause for leaving

Subject #_
Time In:
Time Out:
Cause for leaving

Subject #_
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VITA

Janis Brickey was born in Kingsport, Tennessee on September 9, 1958. Her family resided in nearby Gate City, Virginia where she attended elementary school and graduated from high school in 1976. After one year at East Carolina University, she entered Virginia Tech and graduated in 1980 with a Bachelor of Science in Clothing Textiles and Related Arts, with an Interior Design concentration. In September 1980, she started as a junior designer with Interior Concepts in Kingsport, Tennessee. After two years, she was promoted to senior designer. She completed a variety of commercial and residential projects during the ensuing nine years.

In 1989, she entered the University of Tennessee, Knoxville to study Interior Design at the graduate level. As a Graduate Assistant, she has worked with several interior design courses and as assistant to the Dean's Office. As one of the data collectors of the ASID grant research, she has been involved with several interdisciplinary projects.