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The Ohio State University

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THE EFFECTS OF PLAY ENVIRONMENT COMPLEXITY
ON THE MOTOR AND SOCIAL ACTIVITY
OF DEVELOPMENTALLY DELAYED
PRESCHOOL CHILDREN

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Donna Jean Hester, B.S., M.A.

* * * * *

The Ohio State University
1983

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DEDICATION

To Mom and Dad -- thanks for the love, patience, support and understanding you have always given and for the courage to try.
ACKNOWLEDGEMENTS

There are many people I would like to thank for assisting in the completion of this dissertation. To Dr. Jacqueline Herkowitz for her assistance and support and for giving me room to grow. To Dr. Walter Ersing for his confidence in my ability and for the opportunity to experience many avenues of learning. To Dr. Larry Miller for his help throughout the writing of this dissertation.

To the children, teachers, and administrators at Forest Park Early Education Center and Ohio State University Child Care Program who participated in this study and the pilot study, for their cooperation and accommodation of my needs. To Andrew, Jesper, Doug, Jill, Elizabeth, and the children at Nisonger for playing to establish the design of the play environment.

To Dr. Paul Peliquin and his staff for providing the technical advice and equipment and to Dr. Fred Ruhland for his statistical and computer wizardry.

A special thanks goes to all those involved in the data collection and coding procedures: to Janet Pennington, Jody Wallace, Ginny Politino, Mary Kirk, Carol Rantala, Jean Ontrop, Barbara Miller, Peg Funsch, Donna Dugas, Tracey Sieklicki, Carol Plimpton, Lisa Picini, Gina Johnson, Dan Joseph, and Sue Combs.

Finally, to my parents, family, and friends for their constant encouragement until the final hours, thank you.
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CHAPTER I

INTRODUCTION

The importance of play in the physical, motor, cognitive, and social development of children is well documented (Bruner, 1976; Moore, 1980; Piaget, 1962; Piers, 1972). In recent years, the play behavior of children on playgrounds and in playspaces has attracted the interest of educators and playground designers who are seeking to better understand the role that playground environment variables play in influencing the social and motor behaviors of children (Ellis & Scholtz, 1978; Gramza, Corusch, & Ellis, 1972; Scholtz, 1973; Sussman, 1979; Wade & Ellis, 1971, Weilbacher, 1980; Wright, 1982). The variables studied include physical properties such as color, positioning, and manipulability and collative properties such as novelty, familiarity, and complexity.

The relationship between playground environment variables and the play behavior elicited on playgrounds can be understood within the context of arousal theory. Arousal theory contends that humans are motivated to seek an optimal level of stimulation or excitement (Duffy, 1962; Hebb & Thompson, 1954; Landers, 1980; Sage, 1977) and to avoid boredom and overstimulation by engaging in stimulus-seeking and stimulus avoidance (Ellis, 1973). Play is viewed as a stimulation or arousal-seeking behavior (Ellis & Scholtz, 1978).
Within the context of arousal theory, the complexity of a play-space has been shown to influence the play behaviors exhibited by children (Ellis & Scholtz, 1978). Functional complexity, according to Ellis and Scholtz (1978), refers to the play potential of an object from the viewpoint of a child. High complexity environments initially elicit high levels of motor activity and are capable of sustaining these high levels over long periods of time. Low complexity environments initially elicit high levels of motor behavior but are unable to sustain such levels over time. As children continue to play in low complexity environments, the number and extent of motor behaviors evidenced begin to decrease and the number and extent of social behaviors evidenced increase. The children begin to seek stimulation from social sources in the environment (i.e., other children) when motor sources no longer provide optimal levels of arousal.

The behaviors demonstrated by developmentally delayed children in play environments of low and high complexity have not been defined. The recent issue of mainstreaming raises questions concerning the appropriateness of existing playgrounds and playspaces, originally designed for normal preschoolers, for the developmentally delayed. If developmentally delayed children respond to low and high complexity environments in a manner similar to normal children, then both may use common playspaces. However, if the motor and social responses of developmentally delayed children are not like those of normal children, then modifications in the design of playgrounds and playspaces or separate playspaces for the two groups of children may be necessary.
The identification of how developmentally delayed children respond to low and high complexity play environments over time is important. Such information could be helpful in designing and purchasing equipment for indoor and outdoor playspaces, in selecting environments to facilitate motor activity and/or social interactions, and in determining the characteristics of play apparatus most often used and enjoyed by children. This knowledge could be useful to agencies such as public schools, day care programs, recreational programs, and special programs for the handicapped in meeting the needs of all children.

Problem of the Study

The problem of this study was that differences in the amount of motor, social, and motor-social activity exhibited by developmentally delayed preschool children when playing in a low complexity environment as opposed to a high complexity environment during the early, middle, and late days of an 11-day period were unknown.

Hypothesis

The hypothesis of this study was there will be no difference in the amount of motor, social, and motor-social activity of developmentally delayed preschool children when playing in a low complexity environment as opposed to a high complexity environment during early, middle, and late days of an 11-day period.

The subhypotheses of this study were:

1. There will be no significant difference in the amount of motor activity on the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.
2. There will be no significant difference in the amount of motor activity on the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

3. There will be no significant difference in the amount of motor activity off the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

4. There will be no significant difference in the amount of motor activity off the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

5. There will be no significant difference in the amount of extraneous activity exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

6. There will be no significant difference in the amount of extraneous activity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

7. There will be no significant difference in the amount of non-motor-social activity exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

8. There will be no significant difference in the amount of non-motor-social activity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

9. There will be no significant difference in the amount of motor-social activity on the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high
10. There will be no significant difference in the amount of motor-social activity on the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

11. There will be no significant difference in the amount of motor-social activity off the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

12. There will be no significant difference in the amount of motor-social activity off the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

13. There will be no significant difference in the amount of extraneous-social activity exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

14. There will be no significant difference in the amount of extraneous-social activity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

15. There will be no significant difference in the amount of non-activity exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

16. There will be no significant difference in the amount of non-activity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.
Definitions

Functional Complexity

"The complexity of play objects has to be evaluated in terms of number, variety, and quality of responses the objects are capable of eliciting and sustaining. This is defined as the object's functional complexity" (Ellis & Scholtz, 1978, p. 41). In this study, responses were motor, social, and motor-social in nature.

High Complexity Environment

The high complexity environment was a heptagon-shaped playspace bordered by a cone and rope barrier on all sides which contained two metal trestles, two aluminum boards, a firefighter's ladder, and a large plastic box (see Figure 6).

Low Complexity Environment

The low complexity environment was a heptagon-shaped playspace bordered by a cone and rope barrier on all sides which contained two metal trestles and one aluminum board (see Figure 7).

Motor Activity On the Apparatus (MON)

Motor activity on the apparatus (MON) was the amount of time a child was engaged in locomotor or nonlocomotor activity while in physical contact with or encapsulated by the equipment within the play environment (i.e., the trestles, boards, ladder, and box) during the two early days, two middle days, and two late days of the study. Locomotor and nonlocomotor movements were movements of the body which involved traveling from one place to another in space (e.g., walking, running, hopping,
jumping, sliding) or movements of the body in place (e.g., swinging, hanging, bending, twisting). Encapsulation occurred when a child was inside or under a piece of equipment. MON did not include time spent in physical contact with or encapsulation by the apparatus while not moving or while engaged in social activity. Recording of MON started when the child physically contacted or was encapsulated by any part of the apparatus while moving and not engaged in social activity.

Motor Activity Off the Apparatus (MOFF)

Motor activity off the apparatus was the amount of time a child was engaged in locomotor or nonlocomotor activity on the floor (that is, while not in physical contact with or encapsulated by the equipment) within the play environment during the two early days, two middle days, and two late days of the study. MOFF did not include time spent off the apparatus while not moving or time spent off the apparatus while engaged in social activity. Recording of MOFF started when the child began to move a body part while not in contact with the apparatus and not engaged in social activity.

Extraneous Activity (EXTR)

Extraneous activity was the amount of time a child was engaged in movements that were not categorized as locomotor or nonlocomotor while on or off the play apparatus within the play environment during the two early days, two middle days, and two late days of the study. EXTR included interactions with components of the environment exclusive of the play apparatus (i.e., the cone and rope barrier, the mats, the tape and bolts, the walls) and other movements such as pulling on clothing,
shoes, or eyeglasses. EXTR included repetitive behaviors often characteristic of delayed children (i.e., tapping fingers, flapping hands and arms, rotating the head, clapping hands) as well as movements such as rubbing the eyes and touching the hair.

Nonmotor-Social Activity (NMS)

Nonmotor-social activity was the amount of time a child was engaged in associative or cooperative group play (Parten, 1932) with at least one other child while not engaged in locomotor or nonlocomotor activity during the two early days, two middle days, and two late days of the study. Associative and/or cooperative group play occurred when a child interacted with another child (children) in similar if not identical activity. NMS included talking to, singing with, laughing at, holding, touching, or being in contact with another child and occurred either on the apparatus or off the apparatus. Nonmotor-social activity did not include time spent engaged in solitary or parallel play (moving or nonmoving), onlooker behaviors, or combinations thereof.

Motor-Social Activity On the Apparatus (MSON)

Motor-social activity on the apparatus was the amount of time a child was simultaneously engaged in social activity with at least one other child (children) and motor activity (locomotor and nonlocomotor activity) while in physical contact with or encapsulated by the equipment within the play environment (i.e., the trestles, ladder, boards, and box) during the two early days, two middle days, and two late days of the study. MSON included activities such as following another child, performing movements that were similar or identical to those of another
child, talking to or singing with another child, or touching another child while moving and in physical contact with the apparatus.

**Motor-Social Activity Off the Apparatus (MSOFF)**

Motor-social activity off the apparatus was the amount of time a child was simultaneously engaged in social activity with at least one other child (children) and motor activity (locomotor and nonlocomotor activity) while on the floor (that is, not in physical contact with or encapsulated by the equipment) within the play environment during the two early days, two middle days, and two late days of the study. MSOFF did not include time spent off the equipment not moving and not engaged in social activity. MSOFF included following another child, performing similar or identical movements as another child, talking to or singing with another child, or touching another child while moving not in physical contact with or while not encapsulated by the play apparatus.

**Extraneous-Social Activity (EXTRS)**

Extraneous-social activity was the amount of time a child was simultaneously engaged in social activity with at least one other child (children) and movements that were not categorized as locomotor or non-locomotor while on or off the play apparatus within the play environment during the two early days, two middle days, and two late days of the study. EXTRS included interactions with components of the environment exclusive of the play apparatus; movements such as pulling on clothing, shoes, or eyeglasses; repetitive behaviors previously described; and movements such as rubbing the eyes and touching the hair while simultaneously talking to, singing with, touching, or holding another child.
(children).

**Nonactivity (NA)**

Nonactivity was the amount of time a child was not engaged in one of the seven motor, nonmotor-social, or motor-social activities within the play environment during the two early days, two middle days, and two late days of the study. NA included standing, sitting, or lying on or off the equipment while not engaged in locomotor or nonlocomotor activity, extraneous activity, or associative or cooperative group play with at least one other child.

**Play Apparatus**

Play apparatus referred to the specific pieces of play equipment for the study. The specific pieces were the two metal trestles, two aluminum boards, a firefighter's ladder, and a large plastic box. The pieces of play equipment are described in detail in Appendix C and are shown in Figures 2 through 5.

**Playgroup**

A playgroup referred to four children who played together in one of the environments during the study. A total of six playgroups participated in the study.

**Play Session**

A play session was a 15-minute period of time scheduled for free play within a play environment.
Developmentally Delayed Children

Developmentally delayed preschool children were those children of the study who attended Forest Park Early Education Center, Columbus, Ohio, during the Summer of 1983. A child was considered to be developmentally delayed if there were significant deficits of one year or more in at least two of the developmental areas (gross motor, fine motor, language and communication, self help, and socialization) as determined by the Early Intervention Developmental Profile (Rogers, D'Eugenio, Brown, Donovan, & Lynch, 1977).

Early, Middle, and Late Days of the Study

The early days of the study referred to the second and fourth play sessions conducted for each playgroup. (Data from the third session was lost due to audio mechanical failure.) The middle days of the study were the sixth and seventh play sessions conducted for each playgroup. The late days of the study were the tenth and eleventh play sessions conducted for each playgroup.

Limitations

The following limitations exist for this study:

1. The investigation was conducted for 11 school days over a three-week period. During the first week four play sessions occurred, during the second week three play sessions occurred, and during the third week four play sessions occurred for five of the six playgroups involved in the study. The sixth playgroup participated in three play sessions the first week and four play sessions the second and third weeks.
3. The school involved in the study was purposefully selected.

4. The results of the study are specific to the play apparatus and the heptagon-shaped space in which the study occurred.

5. The results of the study are limited to the nature of the children studied as defined by the Franklin County Board of Mental Retardation and Developmental Disabilities.

Assumptions

1. Social interaction leads to the development of social skillfulness.

2. Motor activity leads to the development of motor skillfulness.
CHAPTER II

REVIEW OF LITERATURE

This review of literature begins with a brief discussion of the theoretical explanations of play proposed throughout history followed by an in-depth analysis of arousal-seeking or activation theory. Physical and collative variables that have been shown to influence play behaviors are discussed as well as the relevant research involving these variables within the play environment. Finally, the characteristics and play behaviors of the mentally handicapped, proposed theoretical concepts, and the implications of arousal-seeking theory for designing play environments for this population are discussed.

Play Theories

Many theories have been proposed to help explain why people engage in playful behavior. "Theoretical formulations of play can be viewed as they position differing definitions of playful behavior and differing motivation for the play activity itself" (Barnett, 1978, p. 114). Ellis (1973) categorized play theories as classical, recent, and contemporary. A brief discussion follows.

Classical

Classical theories include surplus energy, recapitulation, and relaxation. These theories are concerned with the purpose of play and the components of human nature that lead people to play without taking
into account responses that comprise play or individual differences in play behavior (Ellis, 1973). Classical theories attempt to provide an explanation for why play occurs and view play as "a preexistent tendency to emit behavior when none of the other more powerful or prepotent instincts were at work" (Ellis, 1973, p. 23). The recapitulation theory of play maintains that play is a result of inheritance; that the evolutionary history of the species is repeated in the behaviors of the developing child. The theories of surplus energy and relaxation hold opposing views of why play occurs. Surplus energy theory, dating back to the 1800's, contends that humans play in order to expend excess energy that is not needed for work activity. On the other hand, relaxation theory indicates an existent need for relaxation from mental fatigue brought on by work demands. Play is believed to help satisfy this need.

**Recent Theories**

Recent play theories such as the cathartic, psychoanalytic, and developmental theories are concerned with the actual form of play behavior and attempt to connect antecedent and subsequent events through cause and effect. They are concerned with individual differences in play behavior and try to explain why particular individual responses are emitted (Ellis, 1973).

The cathartic and psychoanalytic theories view play as compensatory; that is, play "allows the restoration of equanimity in the person after unpleasant experiences or tendencies" (Ellis, 1973, p. 49). Aggression, frustration, stress, and anxiety are reduced through play. Developmental theory postulates that the cognitive structure of the child
is responsible for the occurrence of play. The ways in which children play are determined by the cognitive processes of the child rather than the environment (Ellis, 1973).

Modern Theories

Two modern theories are competence/effectance and arousal-seeking (Ellis, 1973). Competence/effectance is based upon the premise that play is caused by a need to produce effects in the environment thus demonstrating competence which results in feelings of effectance. Arousal theory, the theory which provides the context in which the present study is undertaken, is reviewed in the following section.

Arousal Theory

A modern theory of play that began with the work by Hebb (1949), Berlyne (1960), and Fiske and Maddi (1961) which has since been advanced by Ellis (1973) and Ellis and Scholtz (1978) is the arousal theory. According to Wehman (1975), "Ellis has done an excellent job of integrating information theory, behavior theory and physiological psychology into a highly tenable theory of play" (p. 240). The model incorporates theories of optimal arousal level (Hebb, 1955; Helson, 1959; Leuba, 1955) with the motivation to play stemming from a sensoristatic drive state based within the individual (Schultz, 1965).

There are two basic tenets of this theory; persons are motivated to seek levels of stimulation at some intermediate level and there is an optimal range of arousal that is most pleasurable and efficient (Barnett, 1976).

Stimulation seeking. Ellis and Scholtz (1978) state that humans tend to generate or seek variable stimulation. According to Levy (1978),
"this new motivational theory is formulated on the premise that man (sic) often seeks stimulation from the environment for the sake of stimulation alone and not necessarily to reduce biological needs" (p. 136). This statement is supported by Hebb (1949), Berlyne (1960), and Hunt (1969) and challenges the popular drive-reduction theory of the 1940's. Drive-reduction theory contends that behavior occurs due to homeostatic needs, painful stimulation, or other stimuli associated with these. This theory implies that in the absence of such stimuli, individuals are immobile (Ellis & Scholtz, 1978). Based upon accumulated evidence, Ellis and Scholtz (1978) suggest the contrary; "when awake and in the absence of such stimuli, humans and other mammals continue to behave and tend to generate or seek variable stimulation" (p. 31).

Barnett and Wade (1979) are supportive of this hypothesis when they state "there is a substantial body of evidence that indicates the presence of a secondary drive state that compels the organism to seek stimulation from the environment when little or no external rewards are present" (p. 14).

According to Ellis (1973), an organism behaves to avoid boredom and overstimulation by engaging in stimulus-seeking and stimulus avoidance. "Living things by their nature are active and have a tendency to seek varied stimulation" (p. 32). This suggests a continuum of potential arousal states ranging from deep sleep (quiescence) to intense excitement. Persons are motivated to seek or to act to produce an optimal level of stimulation or excitement (Hebb & Thompson, 1954; Landers, 1980; Sage, 1977). "The underlying notion here is that for a given person there is a level of arousal that is normal or appropriate
for that person, and behavior is motivated towards achieving and main­
taining that normal state of arousal, and that individuals will engage
in behavior to decrease his or her arousal level when it is too high
and increase it when it is too low" (Sage, 1977, p. 463).

Levy (1978) reviews the most critical hypotheses of Fiske and
Maddi (1961) in terms of play behavior that were previously summarized
by Sage (1977). The first hypothesis is when no specific motive is
present, the organism will behave in a manner so as to maintain acti­
vation at the level characteristic of the organism. Thus, for each
individual there is a "unique, normal and adaptive optimal level of
activation" (Levy, 1978, p. 140) which may vary over time and across
individuals. The level being sought is thought to be based upon pre­
vious experience (Sage, 1977) and cognitive abilities and tendencies
(Dember & Earl, 1957).

As discrepancies occur between the normal and actual level of
stimulation of the individual, the second hypothesis of Fiske and
Maddi (1961) comes into play. That is, a negative affect occurs when
there are large discrepancies between actual and normal activation.
Positive affect occurs as the two levels become more similar. As
stated by Ellis (1973), with support from Leuba (1955), Berlyne (1960),
and Hinde (1966), "deviations from the optimal level become increasingly
aversive and the individual acts to diminish the aversiveness " (p. 91).

Schultz (1965) called the drive to maintain optimal levels of
arousal sensoristasis which corresponds to the homeostatic mechanism
described by Cannon (1932). "Sensoristasis can be defined as a drive
state of critical arousal which impels the organism (in a waking state)
to strive to maintain an optimal level of sensory variation . . . to
maintain a constant range of varied sensory input in order to maintain
cortical arousal at an optimum level" (Schultz, 1965, p. 30). Hunt
(1961) spoke of "the problem of the match" in reference to finding the
most preferred (optimal) state of uncertainty.

Berlyne (1960, 1969) discusses the concept of optimal stimulation
level in terms of the need of humans to process information or knowl­
dedge. Information is defined as that which reduces uncertainty
(Ellis, 1979) and occurs when the outcome of an event cannot be de­
termined from existing stimuli. Varying states of arousal are influ­
enced by the quantity of information or uncertainty perceived to be
present by the individual. "Fluctuations in arousal level are deter­
mained by the quantity of informational input derived by the individual
from the uncertainty presented by the setting" (Barnett, 1976, p. 11).

According to Scholtz (1973), prolonged or repeated exposure leads
to a reduction of the uncertainty. The outcomes become predictable and
further interactions carry little information and arousal potential.
"It is this information potential that determines the appeal a stimulus
or configuration of stimuli may have for an individual" (Ellis & Scholtz,
1978, p. 35). Objects or settings with low degrees of uncertainty pre­
sent little new information or stimulation, therefore, arousal level

Sources of arousal. In order to raise the level of arousal, the
individual must depend on internal and external stimuli that have impact
or arousing potential. External stimuli acting as sources of information
arrive from viseral, somatic, visual, auditory, and olfactory receptors.
These signals are dispersed to the cortex of the brain and lower nervous system structures by way of the reticular formation. Internal stimulation occurs when the individual cognitively or motorically responds, thereby gathering information.

"Not all external stimuli spontaneously appeal to the individual. Attending to stimuli from the major sources depends on preferences which in their turn are determined by the collative properties of the stimuli; i.e., their novelty, variation, complexity, conflict, uncertainty, and surprisingness" (Ellis & Scholtz, 1978, p. 35). Just as the preferred level of arousal is unique to the individual, so are the stimuli that will send the arousal level toward optimum. Individuals have limited capacities for uncertainty and can only cope with information in the environment that corresponds with the existing processing ability of the individual (Dember & Earl, 1957; Ellis, 1973; Ellis & Scholtz, 1978).

Many human behaviors, including play, originate in the workings of cognitive information processing and are intrinsically motivated (Ellis & Scholtz, 1978). Cognitive experiences that are novel, surprising, incongruous, and dissonant carry the potential to arouse the individual and to elicit what are called "epistemic behaviors" by Berlyne (1960). Epistemic behaviors relate to play as the center of play behavior even when play consists of motor activity (Ellis & Scholtz, 1978).

"Together with behaviors such as exploration and manipulation, play is now widely viewed as a kind of stimulation or arousal-seeking behavior" (Ellis & Scholtz, 1978, p. 31). Experimental evidence is
slowly emerging that supports the hypothesis of a relationship between play behavior and stimulus attributes (Ellis & Scholtz, 1978). Play is comprised of various attempts to manipulate the environment in order to raise a suboptimal arousal level to the optimal range (Barnett & Wade, 1979; Ellis, 1973). According to Ellis (1976), the pivotal aspect of play is that "it is an individual cognitive process in which the individual seeks information and its integration with previous experiences" (p. 129).

**Environmental Properties**

"Stimulus events in the environment must have certain characteristics for an organism to seek them out" (Wehman & Abramson, 1978, p. 557). The arousal-seeking model of play is operationalized through the use of the collative properties, i.e., novelty, complexity, and familiarity, described by Berlyne (1960) as well as physical properties such as color, position preference, and manipulability. These properties can be manipulated in order to vary the level of information present in a given play environment. This information level determines the arousal level and, therefore, the play behaviors of the individuals within the environment. A discussion of the characteristics of each property as well as relevant research involving the properties follows.

**Physical Properties**

The effects of various physical properties on play activity have been reported by Ellis and Scholtz (1978). These studies were undertaken in order to provide information for the design of toys and play environments for children. The real value of such studies lies in the
refinement of research methodology in this area of play. Because several variables seem to have interacting effects, they must be thoroughly understood and controlled in order to produce internally and externally valid results (Ellis & Scholtz, 1978).

Color. The effect of color in determining the usage of play objects has received limited attention. Two studies have shown the lack of preference for any one color by children. Gramza and Witt (1969) and Solomon (1970) allowed nursery school children to play with colored blocks presented in varied spatial arrays. While significant position preferences were shown, color preference was an insignificant factor.

Position preference. Few studies have been reported regarding the positioning effects of play apparatus. Witt and Gramza (1970) reported the first experimental analysis of the role of position of equipment upon usage patterns. The patterns of four groups of nursery school children were observed when two trestles were positioned in either the center or corners of the room. A preference for centrally located trestles emerged.

Sussman (1979) recently demonstrated that centrally positioned play apparatus were used more frequently by children than when peripherally located, thus supporting the results of Witt and Gramza (1970).

Manipulability. The attraction of play equipment has been shown to increase with the ability to move it from place to place. Gramza (1976) demonstrated that preschool children preferred high manipulability (an unattached rope) over low manipulability (rope attached to a trestle).
Weilbacher (1980) found no difference in the amount of movement of children in static and dynamic environments but did find differences in social behaviors between the groups. Manipulability is thought to influence and determine the complexity of a play object (Gramza, 1976) and will be discussed later in this review.

**Collative Properties**

Collative properties of stimuli such as novelty, complexity, and familiarity have become the emphasis of studies dealing with play environments for children. These stimulus qualities have been shown to help understand behavior (Ellis & Scholtz, 1978). "We shall be finding . . . the chances of a particular stimulus pattern in the contest for control over behavior depend, among other properties, on how novel the pattern is, to what extent it arouses or relieves uncertainty, to what extent it arouses or relieves conflict and how complex it is" (Berlyne, 1960, p.18).

**Novelty and familiarity.** Novelty relates to previous encounters with stimuli and represents the extent to which something is new and unfamiliar (Ellis & Scholtz, 1978). According to Hutt (1970), novelty refers to immediate, recent, or past experiences of an organism. The degree of novelty, as stated by Ellis and Scholtz (1978), is determined by the discrepancy between what is presently being perceived and what can be remembered from previous encounters with the stimuli. These authors continue to state that optimal degrees of novelty are dependent upon and vary with the experience, expectation, and stage of development of the individual.

Berlyne (1960) indicated that the effects of novel stimuli are not strongest with maximum novelty. "They seem rather to be most strongly elicited by an intermediate degree of novelty, with a stimulus that is
rather like something well known but just distinct enough from it to be 'interesting'" (p. 21). Hebb (1949) concurs that individuals prefer what is new but not too new. Ellis (1973) points out that too much novelty can be aversive and too little novelty boring, both of which may lead to avoidance of the stimulus.

Familiarity also relates to previous encounters with stimuli. However, familiarity represents the extent to which something is recognized as having been experienced before. "Individuals in varying degrees remember what has been encountered before" (Ellis & Scholtz, 1978, p. 45). Therefore, the amount of novelty or familiarity of a given stimulus is an individual quality.

Novelty tends to increase the probability that an individual will manipulate or expose oneself to a stimulus object, thus indicating preference for the stimulus (Berlyne, 1970). "In everyday life, there are times when something is more attractive than something else because it is more familiar, just as there are times when something is found particularly appealing because it is novel" (Berlyne, 1970, p. 279).

These two opposing views are cited in the research literature regarding the preference for novelty or familiarity. Zajonc (1968) and others indicate a preference for familiarity as the predominant pattern, whereas Hebb (1949) and Berlyne (1970) report data supporting novelty as the preferred quality.

**Novelty and preference.** In a series of studies by Berlyne (1970), adult subjects were exposed to sequences of colored shapes and asked to verbally report the degree of pleasingness and interestingness. Results showed that both dependent variables increased with novelty.
Infants and young children have been shown to favor novel stimuli as well. Ross, Rheingold, and Eckerman (1972), when studying human infants, found that the infants tend to approach and interact with novel objects in environments that are novel and free from fear. Bronson (1968) added to this indicating that the presence of a familiar adult lessened the fear and anxiety provided by the novel stimuli enabling interaction with the novel object.

Cantor and Cantor (1964, 1966) observed that kindergarten children chose to project novel material rather than familiar visual stimuli onto a screen for longer periods of time. These authors inferred that the novel stimuli had a richer information load.

Other studies showing that children had greater preference for novel visual stimuli include Cantor (1968), Cantor and Kubose (1969), and Siebold (1972). Ellis and Scholtz (1978) propose that the above findings suggest a preference of moderately novel stimuli that declines as familiarity increases with exposure.

A number of studies have been conducted by Gramza, Corush, and Ellis (1972), Wueblner (1969), Gilmore (1966a, 1966b), and Mendel (1965) involving the novelty-preference relationship in play situations and will be discussed later in this review.

**Familiarity and preference.** As previously mentioned, the opposing view of preference for novelty is that of familiarity-preference. The hypothesis by Zajonc states that preference and attraction increase with familiarity and is based upon the premise that unfamiliarity causes conflict that results in negative affect toward the novel stimulus (Ellis & Scholtz, 1978). Harrison (1968) stated that exposure to
novel stimuli should elicit a tension state causing negative attitudinal ratings; repeated encounters should lead to reduction of the tension and in turn positive affect and attitudinal ratings.

Experimental support for the Zajonc familiarity hypothesis is found in the works of Perlman and Oskamp (1971) and Saegert, Swap, and Zajonc (1973) in which repeated exposure to initially aversive stimuli leads to more positive affect. Other studies show attraction to stimuli with increasing frequency exposure (Harrison & Zajonc, 1970; Saegert & Jellison, 1970; Schick, McGlynn & Woolam, 1972).

Doyle, Connally, and Rivest (1980) studied the effect of familiarity or prior acquaintance with peers on the quality and quantity of social interactions in young children. Sixteen children ranging in age from 36 to 46 months were groups in four-member, same-sex playgroups. Each child was observed on two occasions during 1-hour play sessions with a same-sex peer from his/her playgroup. In one session, the peer was familiar, in the other the peer was unfamiliar. Social participation was assessed using the Parten (1932) categories while cognitive level of play was assessed according to a modified version of the Piagetian categories. The results of the study indicated the amount of social participation of the children was significantly higher with a familiar peer than with the unfamiliar peer. During the social interactions, the complexity of toy play also increased in the presence of a familiar peer.

Contradictory to Zajonc (1968), Maddi (1968) indicated that repeated exposure and thus familiarity leads to monotony along with negative affect and attitudinal ratings. Studies by Cantor (1963) and
Gullickson (1966) involving children found a preference for novel stimuli over familiar ones. The effects of novelty and familiarity on preference have been shown to be interactive with a third collative property, complexity.

**Stimulus complexity.** "Many stimulus variables which are effective in eliciting exploration are related to a greater or lesser degree with one another" (Hutt, 1970, p. 120). Novelty has been shown to elicit responsiveness while complexity sustains responsiveness (Ellis & Scholtz, 1978). According to Hutt (1970), complexity and novelty refer to different aspects of the environment-organism interaction. Novelty refers to immediate, recent, or past experiences of the organism while complexity refers to the variety in the stimulus.

The complexity level of a stimulus can be increased or decreased by manipulating the dissimilarity and number of distinguishable components. In this way, the components are not categorized as one item and reacted to as a simple stimulus (Berlyne, 1960). Berlyne (1960) refers to stimulus complexity as the amount of variety or diversity in the pattern of the stimulus.

In a series of studies with chimpanzees, Welker (1956) demonstrated that exposure to novel and more complex objects generates more exploratory, manipulatory, and playful responses than novel and simple objects. These findings support the contention that habituation is slower when the stimulus is more complex (Scholtz, 1973). Other studies have shown similar results with humans (Dent & Simmel, 1968; Faw & Nunnally, 1968; Munsinger & Weir, 1967; Unikel & Harris, 1970). Berlyne (1966) demonstrated that more vigorous and prolonged exploration is attracted by
objects that offer more varied or irregular stimulation, thus suggesting the sustaining quality of complexity.

The assumption that individuals grow more complex with age supports the further assumption that the degree of complexity preferred in stimuli will follow the same pattern. One study supporting these hypotheses is reported by Black, Williams, and Brown (1971) who found that 4-year-old children preferred stimuli more complex than those preferred by 3-year-old children. Similarly, Hutt and McGrew (1969) studying 5-, 8-, and 11-year-old children found the younger children viewed simple pictures longer than complex ones. Switzky, Haywood, and Isett (1974) and Wohwill (1975) concurred, finding similar results.

As was noted previously, the processing ability of the individual determines his or her preferred level of arousal. Much in the same manner, the uniqueness of sensory and environmental history may determine the level of stimulus complexity that will be preferred (Dember & Earl, 1957; Unikel & Harris, 1970). However, Dember and Earl (1957) point out that the general pattern is that of preference for increasing complexity. The concept of "pacers", that preference proceeds by gradually paced increments, was introduced by Sackett (1965). Arkes and Boykin (1971) state that a new, higher pacer is selected as the level of complexity of the individual rises to the present level of the pacer.

The previously reviewed studies have dealt primarily with visual stimuli and have generally shown a preference for high levels of visual complexity. Visual complexity is but a single component of the overall
complexity of an object or environment. In the words of Gramza and Scholtz (1974), "visual complexity is a unimodal phenomenon and is commonly operative within a larger multimodal sensory setting" (p. 895).

Gramza and Witt (1969) and Gramza and Scholtz (1974) have shown that visual complexity alone is not enough to effect the object-use preferences of preschoolers within a play setting.

Derivable from these studies is the behavioral importance of multimodal complexity . . . made up of the total number and variety of sensory and motor options contained within a play (or other) object setting. Multimodal complexity is seen to encompass, condition, and often supercede individual modality (unimodal) stimulus complexity" (Gramza & Scholtz, 1974, p. 896).

Functional complexity. In their review of stimulus attributes, Ellis and Scholtz (1978) describe the complexity of play objects in terms of number, variety, and quality of responses elicited and sustained as the functional complexity of the object. An important attribute of functional complexity demonstrated by Gramza (1976), previously mentioned, is the manipulability of the object. Eighty nursery school children were exposed to stable play objects (including an attached rope) in one setting. The second environment contained the same stable objects plus a manipulable rope and was, thereby, presumed to be more complex. Results indicated that the manipulative property of the rope increased usage and provided larger numbers of movements options.

Functional complexity would, therefore, seem to be a form of multimodal complexity. Functional complexity is a term used by Ellis and Scholtz (1978) to try to express the idea that attractive play objects are ones that are complex in what can be done with them. "Information
comes from the interactive possibilities rather than the complexity of the object itself" (Ellis & Scholtz, 1978, p. 130).

Wright (1982) attempted to further distinguish the stimulus complexity of Berlyne (1960) and the functional complexity referred to by Gramza, Ellis, and Scholtz. According to Wright (1982), "functional complexity, the degree to which the play equipment is capable of eliciting and sustaining types or qualities of motor and social responses, seems to play a larger role in determining equipment usage than simply the number of pieces of equipment available for use" (p. 171). The functional complexity of a play environment appears as a key element to be considered when studying play behaviors of children and designing play environments.

In the following sections of this review, complexity and novelty will be viewed in terms of their effects upon play behaviors within play environments.

**The Effects of Novelty and Complexity on Motor and Social Behavior of Children in Play Environments**

The manner in which novelty and functional complexity characteristics of play environments interact defines, to a large extent, the demonstration of motor and social behavior in those play environments. A number of studies have shown that the manipulation of novelty and functional complexity in play environments significantly influence the arousal levels and play behaviors of children.

Early playground studies by Johnson (1935) and Cockrell (1935) found complex apparatus settings were associated with the demonstration
of a greater variety of motor activities than simple ones. Johnson (1935, p. 66) indicated that "the more extensively equipped playground ... is characterized by a greater combined amount of bodily exercise and play with materials and fewer social contacts ... and undesirable behavior." The reverse was true for lesser equipped playgrounds (i.e., less bodily exercise and play with materials but more social interaction and conflicts).

Hutt (1966) found that 33, 3- and 4-year-old children spent a greater proportion of time playing with a novel toy when complexity was increased by incorporating both visual and auditory feedback within the toy than was the case when only visual feedback was provided. This suggests a preference for interaction with complex play objects (Ellis & Scholtz, 1978).

Wuellner (1969) measured the amount of overt activity of 4- and 5-year-old boys and girls over nine successive 15-minute play sessions. The playroom was equipped with stationary objects in a specified arrangement. After six sessions, a novel piece of apparatus was introduced resulting in an interruption of locomotor activity (presumably due to the attraction to the novel object).

Gramza et al. (1972) studied the effects of functional complexity on usage preferences of 4- to 5-year-old children in a playspace. During phase I of this study, 40 boys and girls were exposed to an environment containing a wooden rocker, a plastic saucer, an enterable paperboard tube, and two, 92-inch high, A-frame trestles. One trestle was left intact while the other trestle was complexified with the addition of two, 48-inch square, blue, chipboard panels fastened one to each of
the sloping sides of the trestle. Each panel covered the entire width of the trestle and had an assortment of hand-foot holes cut into it. Children entered the play area in groups of 10 (five boys and five girls) for 12 to 15 minutes daily. The responses of the children were measured through group and individual time-sampling of presence on one or the other trestle. Data were collected during the first six days of exposure to the environment. After four additional weeks of continued exposure, four more days of trestle-usage measurements were taken. Eight weeks after phase I was concluded, phase II testing began. Subjects, procedures, and design of the apparatus remained the same with the exception of the complexified trestle. In this phase, the modified trestle was changed to include three irregular triangular and quadrangular blue chipboard panels with hand-foot holes, two rectangular horizontal platforms, a plank extending down and away from the trestle, and a nylon rope extending from the top of the trestle to near the floor. The sizes of the various attachments were smaller than those of phase I, thus exposing more of the original design of the trestle. Data collection occurred, as in phase I, during the first six and last four days of the exposure period.

Results of phase I indicated that initially children used the modified trestle in preference to the intact trestle; however, after four weeks the intact trestle was preferred. In phase II, children preferred the complexified trestle over the intact trestle throughout the entire study.

Gramza et al. (1972) offer several interpretations of these results. Phase I illustrates the importance of novelty effects as
demonstrated by the initial attraction to the modified trestle but subsequent preference for the intact trestle. In terms of the complexity of the trestle, the modifications decreased rather than increased functional complexity by taking away potential movements such as swinging on the horizontal bars. The complexified trestle in phase II added complementary play features and functions rather than removing the original basic play dimensions of the trestle design. This points out the importance of meaningful complexity of play objects.

Numerous studies have been cited in which the social environment was shown to provide a source of arousal. Wade and Ellis (1971) exposed eight boys and eight girls of kindergarten age to different levels of environmental complexity. Complexity was increased by adding a greater number and variety of objects and by increasing the size of the playgroup. Children played alone, in dyads, and in quadrads in the two playroom conditions. The playroom conditions consisted of low equipment and high equipment configurations both containing mats as floor covering, a set of boxes, and a steel horse. The low complexity configuration had, in addition, a small wooden beam and a small cylinder. The high complexity environment contained additional apparatus (i.e., two wooden boxes, two steel trestles, a rope ladder, one long cylinder, an extra box, and a rocker).

Observations of the activity of the children were made from behind one-way windows for each of the 44- to 60-minute sessions. A four-point activity scale was used to provide information regarding overt movement patterns. Heart rates were also monitored to serve as a measure of activity level. The scores of the observers showed an increase in
activity levels with increasing group size. This was confirmed by analysis of heart rate variance. The effects of the low and high complexity were not significant as measured by both the observational scale and the heart rate telemetry system. An increase in complexity due to larger group sizes raised the general activity level of the subjects, while the two levels of functional complexity failed to produce reliable differences. This study demonstrated the social environment to be a more powerful source of arousal and elicitor of activity than the physical environment. Wright (1982) suggested that peers are more complex and variable than objects or apparatus; over time preference for peers increases as preference for objects decreases. If Wright is accurate, the results of Wade and Ellis (1971) should be of no surprise due to the relatively lengthy play sessions that were incorporated in the procedures of the study.

The variables of novelty and complexity were shown to interact in two studies by Scholtz (1973) and Scholtz and Ellis (1975). Scholtz (1973) exposed 60, 4- to 5-year-old boys and girls to one of three initially novel environments (i.e., low complexity, high complexity, and progressively complexified apparatus settings) over 15 play sessions of 15-minutes duration. The high complexity setting contained a great assortment of play apparatus while the low complexity setting contained a relatively small assortment. Eleven dependent variables were measured by film analysis. These included apparatus interaction, group play in the open space, disengagement from overt play, extraneous activity (interaction with the wall, windows, etc.), individual play in the open space, and horizontal movement. Results of this study indicated
that the total amount of apparatus interaction was positively related to the complexity of the physical setting. The amount of group play in the open space, disengagement from overt play, extraneous activity, and individual play are inversely related to the complexity of the physical setting. Therefore, the higher the complexity, the more likely interaction with apparatus was to occur, while group play in the open space was less likely to occur.

Repeated exposure to the same play setting resulted in a decrease of apparatus interaction but an increase in group play and horizontal movement. Scholtz (1973) stated that across time, high complexity settings will yield and sustain more interaction with play objects but less open space group play than low complexity settings.

Scholtz and Ellis (1975) reported additional information in terms of object and peer preference in the low and high complexity environments. In observing the responses of the 40 children, 4 to 5 years old, the results indicated that object preference declined in both environments over the three week period but remained higher in the high complexity environment than in the low complexity environment. This finding is in contradiction to that of Zajonc (1968). The Zajonc hypothesis received support, however, from the fact that peer preference increased with repeated exposures. Exposure to the low complexity environment sustained more play with peers than the high complexity environment. Scholtz and Ellis (1975) explain these findings in that as the play objects became more familiar and, thereby, provided less information, the children turned to the other source (their peers).
More recently, Wright (1982) compared the motor, motor-social, and social behaviors of 40, 4- and 5-year-old children over a period of eight days while manipulating the functional complexity of two environments. In one environment, two ladders remained separated while in the other environment, the ladders were joined to form one piece of apparatus. This was intended to increase the functional complexity of the object. Other objects within both environments were a stool and a horizontal bar. Wright found that more motor and motor-social activity occurred on the double ladder as opposed to the single ladders. Social activity levels between the two environments were not significantly different. However, there was an increase in social activity on the two single ladders on the last day of the study, and a decrease in social activity on the double ladder on the last two days of the study. These findings tend to support those of Scholtz (1973) and Scholtz and Ellis (1975). Perhaps a more lengthy study of these variable would have resulted in other statistically significant differences.

The findings of Weilbacher (1980) are also supportive of the explanation by Scholtz and Ellis (1975) when applied to environments varying in manipulability. Weilbacher (1980) attempted to determine the effects of a static environment and a dynamic environment on the motor and social behavior of 32 kindergarten girls over a two week period of time. Both environments contained the same three pieces of play equipment (a trestle, a ladder, and a slide) but differed in the degree of changability. The static and dynamic environments elicited
different kinds of motor behaviors and different amounts and kinds of social behaviors. Results indicated that motor interactions occurred in the static environment until there was no challenge, at which time more peer group play took place.

Motor and social behavior have been shown to relate to complexity and novelty in the context of play environments. Most of the research reviewed points to the idea that environments with high degrees of complexity elicit more motor activity in children while less complex and novel environments tend to promote more social activity.

Play Research, Arousal Theory and Mentally Handicapped Children

The importance of play as a vehicle for physical, motor, cognitive, and social development is advocated by psychologists and educators (Bruner, 1976; Moore, 1980; Piaget, 1962; Piers, 1972). Play is largely accepted as being a critical factor in the behavioral and cognitive development of all children and is often considered to be spontaneous and natural. Play occurs as a matter of course and is the means by which children develop and demonstrate competency in dealing with their environment (Frost & Klein, 1979). The development of play in handicapped children has been proposed to be similar to (Field, 1980; Mindes, 1982; Woodward, 1959) but slower than (French & Jansma, 1982) that of normal children.

In this review, the terminology used to identify children with cognitive developmental deficits include handicapped, mentally handicapped, retarded, mentally retarded, delayed, developmentally delayed, cognitively delayed, sensorimotor handicapped, and exceptional. The
terms were used within the context of the research cited and are intended to reflect various levels of cognitive developmental deficits (i.e., mild, moderate, severe, and profound).

**Significance of Play for Mentally Handicapped Children**

Play has been used for assessment (Belsky & Most, 1981; Deutsch, 1978) and intervention (Garwood, 1982; Guralnick, 1981; Pelligrini, 1980) purposes. Play is essential for the development of retarded children. Some of the major functions of play that are of value for the mentally retarded child include the pleasure or joy aspects of engaging in play or leisure time activity, the facility with which play can be utilized as a reinforcer or as an instructional activity, the potential development of collateral behaviors such as gross or fine motor skills, language, or social behavior, and the inhibiting effect upon socially inappropriate behaviors (e.g., aggression and self-stimulation) (Wehman, 1977). Independent play is also important for successful integration into school and other community settings (Hopper & Wambold, 1981; Levy, 1978).

Through play activities, mentally handicapped children can obtain beneficial stimulation required for appropriate development. "Since play is the principle vehicle of stimulation for retarded children, it follows that failure to provide play for them can only lead to deterioration" (Benoit, 1955, p. 45). A handicapping condition that results in play deprivation will also result in the child's inability to interact with people and objects (Frost & Klein, 1979).

As previously discussed in this review, many theories have been formulated throughout history to explain and predict play behavior.
The applicability of these theories to the play of handicapped children has received limited attention. Two theories that have been applied in the past are psychoanalytic theory and cognitive-developmental theory.

Based on the early works of Freud, a psychoanalytic orientation describes the play of children as being intrinsically motivated. Playful activities are sought out to relieve inner emotional energies that have accumulated. This explanation led to techniques of psychotherapy and personality assessment based on the assumption that play reveals information about the dynamics of the child (Deutsch, 1978). Play therapy has used this basis in treatment of emotionally disturbed and mentally retarded children using play as a clinical tool rather than a developmental medium (Wehman, 1977).

Within the cognitive-developmental theory advanced by Piaget, play and intelligence are inseparable. The principles of this theory are assimilation, bending reality to fit the needs of the individual; accommodation, shaping actions to fit reality; and equilibration, a balance between the two. Play results as a consequence of assimilation taking primacy over accommodation. Piaget sees play as a cognitive activity of which the resulting behaviors reflect the mental structures and cognitive processes of the player (Deutsch, 1978). The sequence of play development proposed by Piaget has been used to assess the development of play in Down's syndrome children (Hill & McCune-Nicolich, 1981) as well as hospitalized profoundly retarded children (Whittaker, 1980). Although not originally intended to be used with cognitively delayed children, developmental theory has proven to be potentially
useful in assessment and intervention strategies.

**Play Research and Mentally Handicapped Children**

Woodward (1959) suggested that handicapped children follow a developmental sequence similar to that of normal children and performed a structural analysis of observations based on the Piagetian levels of sensorimotor development. Woodward found that severely mentally handicapped children approximated the sensorimotor developmental sequence proposed by Piaget.

The ability to play appropriately requires a crucial cluster of developmental skills (Hopper & Wambold, 1981). Much of the available literature cites that mentally handicapped children often lack the skills necessary for effective play due to unique characteristics. The characteristics include poor attention span (Council for Exceptional Children, 1966; Wehman, 1976), lack of spontaneity and self-initiation (Gordon, 1973; Horne & Philleo, 1942; Wehman, 1977; Witty & Beaman, 1933), and less exploratory and play behavior (Weisler & McCall, 1976) when compared to nonretarded children. Because of such characteristics, many have proposed that play and other associated behaviors must be systematically planned for and taught (Council for Exceptional Children, 1966; French & Jansma, 1982; Frost & Klein, 1979; Li, 1981; Thomas, Phemister, & Richardson, 1981; Wehman, 1975).

The extent to which these characteristics can be universally applied to mentally handicapped children must be viewed with caution. Considerations must be given to the degree of the cognitive delay (i.e., mild, moderate, or severe) of the children considered as well as the conditions under which the children are observed (i.e., residential
institutions, special schools, or public schools). These factors become evident in the comparison of the following two studies.

Horne and Philleo (1942) compared the play activities of 25, 5- to 8-year-old normal children from a public school and 50, 9- to 12-year-old mentally handicapped children from a county training school with reported intelligence scores indicating mild cognitive delays. Subjects were matched for mental age.

The investigators discovered that concrete suggestions for use of the various play materials were necessary for the mentally handicapped children. Analysis of the types of play behaviors in which the children engaged demonstrated a greater superiority of the normals in terms of spontaneous creative activity. This implies that mentally handicapped and normal children of the same mental age react differently when faced with a choice of using objects creatively or in a more familiar manner.

Hulme and Lunzer (1966) observed the unstructured free-play activity of 18 normal children with a mean mental and chronological age of 3 years, 4 months and 18 children ranging from 3 years, 5 months to 11 years, 5 months of age with mild to severe cognitive delays. No differences were found in the level of organization (i.e., the degree to which play objects are used appropriately and constructiveness of the play behaviors) shown in the free play of the subjects. These findings contradict the findings of Horne and Philleo (1942) regarding the ability of mentally handicapped children to structure their own environment (i.e., to cope within an unstructured free play situation). Hulme and Lunzer (1966) caution that one cannot conclude
that mentally handicapped children have as much initiative as normal children of similar mental age based upon this study. The fact that the handicapped children were older, noninstitutionalized, and relatively well adjusted could account for the differences between the findings of the two studies. Mogford (1977) states "what this research established positively is that mentally retarded children at various levels can and do play in environments which specifically encourage them" (p. 174).

Social Aspects of Play for Mentally Handicapped Children

While a considerable amount of literature is available regarding the play of normal children, there is a paucity of research dealing with the play of handicapped children. The majority of studies conducted thus far have dealt with play behavior and the relationship of play behavior to cognitive and social development.

Field, Roseman, Destefano, and Koewler (1982) compared the interactive behaviors of 12 children, 3- to 5-years-old, with various sensorimotor handicaps (cerebral palsy, Down's syndrome, mental retardation, speech and hearing deficits) to 36 normal children of the same chronological age in a free play setting. The children had been assigned to groups according to their developmental age or degree of developmental delay (i.e., severe, moderate, minimal, or normal). The investigators attempted to confirm the developmental sequence of social interactions found in normal children (i.e., progression from self-directed to toy-directed to peer-directed). "Comparisons between handicapped and nonhandicapped children of similar chronological age but different developmental ages yielded a number of differences that
suggest a developmental sequence" (Field et al., 1982, p. 33). For example, severely and moderately delayed children showed more self-directed behavior (hand flapping, mouth rubbing, and ear tapping) than the minimally delayed groups. The amount of peer-directed behavior was inversely related to the amount of developmental delay; that is, normal children looked at, were physically close to, and shared toys with peers more than the minimally delayed children. In turn, the minimally delayed children showed more of these behaviors than the moderately delayed children who showed more than the severely delayed children.

Mindes (1982) studied the differences in social and cognitive play patterns among educable mentally retarded, learning disabled, and behaviorally disordered children. Seventy-four children ranging from 40 to 73 months of age with an IQ range of 50 to 139 on the Stanford-Binet Intelligence Scale participated in the study. A time sampling procedure was used to record social participation (Parten, 1932) and cognitive functioning (Smilansky, 1968) during a free play period on each of 20 school days. There were no significant differences in cognitive play levels due to diagnosed handicap, IQ, age or sex. For social play there were significant differences in parallel and group play due to age. Other significant differences were more onlooker behavior in girls than boys, and active conversation occurred more often in the behavior disordered children than in the educable mentally retarded children. Mindes (1982) concluded that "young handicapped children are less socially mature than might be expected from a developmental viewpoint" (p. 51). Mindes indicated the importance of
encouraging play that is appropriate to the cognitive and social level of the child.

Arousal Theory and the Mentally Handicapped Child

The applicability of arousal theory to the play of exceptional children has received only limited attention. Despite the limited attention paid to play research involving handicapped children, an analysis by Wehman (1976) indicated the arousal theory to have considerable potential for explaining and predicting play within this population. Arousal theory is largely based on learning theory and environmental constructs which are applicable to all levels of functioning. Stimulus characteristics which have been shown to modulate arousal levels are suggested. By assessing activity level, play behaviors can be measured to determine the effects of such stimuli.

Wehman (1976) contends that arousal theory can explain and predict behavior excesses such as stereotypic behavior by identifying stimuli in the environment responsible for eliciting the inappropriate actions. This has implications for the selection of appropriate play materials for handicapped children.

Linford, Jeanrenaud, Karlsson, Witt, and Linford (1971) compared the activity of 11, 4- to 8-year-old children with Down's syndrome to 32, 3- to 5-year-old nonhandicapped children in a free play environment. Apparatus within the environment included a wooden "boat" rocker, two steel trestles, two 6-foot tubes (one closed at one end, the other open at both ends), three 2-foot square enterable blocks, three similar blocks connected to form one unit, and a set of wooden blocks for balancing. Results indicated that the group of nonhandicapped
children exhibited a greater amount of movement, moved more often, and moved at a faster pace than the Down's syndrome group. The group of Down's syndrome children made more use of the less complex free space while the nonhandicapped group spent longer periods of time on the apparatus. The two groups showed preferences for different pieces of apparatus which will be discussed in a later section of this review.

Inferences regarding the quality of playful interactions with the apparatus demonstrated by children in the Linford et al. (1971) study cannot be made. However, evidence regarding the quantity of activity of the two groups of children is clear. The results of the study confirmed that children exhibiting Down's syndrome were hypoactive. The reason for the proposed hypoactivity was not likely due to physiological limitations but rather that other factors, most probably of a psychological nature, did not reinforce active engagement with the setting (Ellis & Scholtz, 1978).

Conover (1973) indicated that if the development of the retarded individual is to be enhanced by the reshaping of the environment, the stimulus properties of the available objects and the responses elicited by them must be considered. The lack of spontaneity and low activity level of mentally handicapped children may be due to ineffective environmental cues and stimuli. This indicates the importance of monitoring the intensity of environmental stimuli and cues to ensure their appropriateness for a given group of children.

The "problem of the match" (Hunt, 1961) appears to have direct applicability to this situation. That is, the problem of arranging a proper relationship between environmental contents and preestablished
schemata. Switzky, Ludwig, and Haywood (1979) addressed this issue and explained that discrepancies which are too large may lead to avoidance behavior due to anxiety or ignoring behavior due to lack of having the relevant schemata activated initially. However, a perfect match results in boredom; therefore, a small discrepancy between the schemata and stimulus is needed for the individual to be attracted to the environment. This seems to be an appropriate line of reasoning when considering the play behaviors of both normal and mentally handicapped children.

The stimulus attributes of an environment are known to be related to the arousal level and play behaviors of individuals within the environment. By manipulating the physical and collative properties of the various sources of stimulation, Scholtz and Ellis (1975), among others, have successfully demonstrated this relationship and hence, operationalized the arousal theory. The extent to which these properties and other factors influence the play of mentally handicapped children has not received extensive attention. The limited research available will be reviewed in terms of the following properties: position preference, complexity, novelty, and object preference.

The preferences of handicapped children for various play objects within a play environment have been shown to be affected by their relative positions. Using Down's syndrome subjects, Witt (cited in Ellis & Scholtz, 1978) repeated the study by Witt and Gramza (1970) discussed in an earlier section of this review. The findings were supportive of the previous study in that preference was for the trestle located in the center of the play environment as opposed to the trestle
in the corner of the play environment.

Bowers (1980), in an ongoing study of play behaviors of handicapped children in various play learning centers, reported the effects of novelty on play behavior. When large foam blocks and large, soft playground balls were introduced to a play center after 30, ½-hour sessions of unstructured play, a substantial increase in the play behaviors occurred. Increases in both movements on the equipment and manipulative activities were observed.

Thomas et al. (1981) found that mentally handicapped children were as attracted to novel objects as nonhandicapped children. Twelve nonhandicapped children 12 to 22 months old and 17 mentally handicapped children ranging from 6 to 16 years old and functioning at the 1- to 2-year-old level, served as subjects. Children were exposed to three conventional toys while the latency period to contact the toys was measured. Following this initial exposure, a novel object was introduced; again latency periods were measured. Results indicated there was no significant difference between groups on any measures. Both groups played more with the novel toy than with the conventional toys.

In terms of object preference, Horne and Philleo (1942) conducted a study involving normal and mildly mentally retarded boys and girls matched for mental age (6 to 8 years old). Children were individually exposed to an array of toys in a playroom and given a chance to play. Results indicated that the mentally retarded children preferred more structured material, while nonretarded children preferred constructive materials. The nonretarded children showed greater preference for
creative activity as opposed to activities involving toys that prescribe a pattern of play. In reference to the results by Horne and Philleo (1942), Li (1981) inferred that the play of the mentally retarded children was connected with the stimulus characteristics of the play material.

In the comparative study of the free play activity of Down's syndrome and normal children discussed earlier, Linford et al. (1971) indicated that the two groups showed preference for different pieces of apparatus. The most preferred objects of the normal group were a set of moveable boxes and the least preferred an enterable tube closed at one end. The Down's children most preferred the enterable tubes and least preferred a wooden rocker. The stimulus parameters of these objects were not studied, therefore, inferences cannot be made. Further research is needed to be able to do so.

In a study by Conover (1973), 11 institutionalized mentally retarded boys, 39 to 83 months old, were systematically observed while interacting with five toys (a climber, a ball, blocks, a wagon, and an inner tube). Five familiarization sessions in which each toy was presented to each boy on a single basis occurred. No demonstrations or suggestions were given as to how to play with the toy. One session was held in which all five objects were presented simultaneously in order to determine object preference. As a group, no object was preferred more than all others, however, the climber was the least preferred toy. The movement behaviors displayed during both the familiarization and object preference periods were categorized according to the body parts predominantly involved in each movement. The
movement behaviors most displayed were rather inactive and sedentary in nature.

Conover (1973) concluded that the mere presence of appropriately selected objects placed in the environment do evoke movement behaviors, but, the nature and extent of the movement behaviors displayed may be improved with instruction in the use of the objects and with the added stimulation of human interaction. "To surround custodial and trainable retarded boys with objects in a setting devoid of human contact is not sufficient for the establishment of stimulating and functional environments" (Conover, 1973, p. 137).

Favell and Cannon (1981) presented 20 different items to 11 severely retarded females between the ages of 11 and 26 years. Results showed strong preferences for 10 of the items including a rocking horse, music box, videotaped "Sesame Street", and a rocking chair. The amount of engagement with the objects was twice as high when only the 10 most popular items were available as when the 10 least popular objects (toy bulldozer, stuffed animal, wooden rocking boat, wagon, and tricycle) were present. Another finding of this study of added interest was that preference of toys could not be based upon adult intuition. Low correlations emerged between staff predictions of preferences and actual engagement by subjects with the toys. This result points to the importance of empirical data on which to base toy selection.

The implications of the information presented in this chapter seem to lead to the premise that the play and development of young children are affected by sources of stimulation available in the environment. The selection of toys and design of equipment that serve as such
sources of stimulation greatly influence play patterns.

Ellis (1973, p. 135), in keeping with the tenets of arousal theory, set forth three principles to serve as a guideline for play material selection: "(a) children play for the stimulation they receive, (b) that stimulation must contain elements of uncertainty (they are to some extent novel, complex, or dissonant) and (c) the interactions producing the stimulation must rise in complexity with the accumulation of knowledge about or experience with the object."

In short, "only with novel, diverse, and reinforcing toys commensurate with an individual's mental age and functioning level can play activity lead to development across many dimensions of behavior" (Wehman, 1981, p. 457).

A Synthesis

Arousal theory purports that individuals are motivated to seek an optimal level of stimulation. According to Shultz (1979), play serves as the mechanism that changes the arousal level of a child. "When his (sic) arousal level is too low and certain other conditions are satisfied, the child plays, with the result that his (sic) arousal level increases to some preferred level" (p. 8).

The series of studies conducted by Ellis, Scholtz, and associates of the Motor Performance and Play Research Laboratory at the University of Illinois have demonstrated the ability to operationalize the tenets of the arousal theory. Using the collative variables proposed by Berlyne (1960), various kinds of play objects and their effects upon the activity of normal children were investigated.
Functional complexity, a variation of one of the collative properties proposed by Berlyne (1960), "describes the potential for responsiveness on the part of the organism to the object" (Ellis, 1979, p. 158) and served as the independent variable in several studies (Gramza, 1976; Scholtz, 1973; Scholtz & Ellis, 1975; Wright, 1982). Functional complexity, defined as the number, variety, and quality of responses the object is capable of eliciting and sustaining, increases with the number of degrees of freedom offered the child by the object (Ellis, 1979). Play objects and settings with higher levels of functional complexity have been shown to elicit and sustain more motor activity than objects and settings of lower functional complexity, while social behaviors have demonstrated an inverse relationship.

The social and motor behaviors of mentally handicapped children in playground environments are not as clearly described due to the lack of empirical research. Much of the research on this population has incorporated play as a means to study cognitive and social development rather than as an end in itself. Conover (1973) and Bowers (1980) are among the few to specifically address the issue of the effects of environmental properties upon the behaviors of mentally handicapped children within play environments.

The motor and social responses of mentally handicapped preschool children to the various levels of functional complexity of play objects in a playground configuration have not been studied. This information is imperative to the design and construction of appropriate playgrounds that will enhance the motor and social development of mentally handicapped children.
The importance of the social development of mentally handicapped children in play environments has been expressed by investigators using the social aspects of play as dependent measures (i.e., Field et al., 1982; Mindes, 1982; Parten, 1932). The importance of the development of motor behaviors of the same population are often expressed but have been studied by few (Bowers, 1980; Conover, 1973; Linford et al., 1971). With these aspects of play in mind, the present study was designed.
CHAPTER III

PROCEDURES

The purpose of this study was to determine the effect of the functional complexity of a play environment upon the amount of motor, social, and motor-social activity exhibited by developmentally delayed preschool children as observed for 11 school days over a three week period. In this chapter the procedures employed throughout the study are described. Included is a consideration of the selection of subjects, research site and equipment, play session and data collection procedures, research design, and analysis of data.

Selection of Subjects

The subjects of this study were 23, 4- to 6-year-old children attending Forest Park Early Education Center (FPEEC) during the Summer of 1983. FPEEC is an early childhood education program under the guidance of Franklin County Board of Mental Retardation and Developmental Disabilities (FCBMR&DD), a public agency funded by the State of Ohio. FCBMR&DD offers a free, comprehensive habilitation program for individuals of all ages found to be moderately, severely, or profoundly retarded or who have a substantial developmental disability. (Franklin County Board of Mental Retardation and Developmental Disabilities, Note 1). Early childhood education classes (ages 0-6) include parent-infant classes, early childhood training, and preschool classes which
are designed to give instruction to special needs children who are not of mandatory school age (FCBMR&DD, Note 1).

Children enrolled in the early childhood education classes at FPEEC attended either a morning or an afternoon session five days a week and had been identified as being significantly delayed in at least two developmental areas (gross motor, fine motor, language and communication, self help, and socialization) as determined by the Early Intervention Developmental Profile (Rogers et al., 1977). The children were grouped into classrooms according to cognitive skill development, age, compatibility with other children in the class, as well as play and language skill development. Classroom activities concentrated on each area of development (e.g., communication, language, speech, motor development, cognitive and play development, social and emotional development, self-care and functional daily living skills) (FCBMR&DD, Note 1). "These programs emphasize the importance of focusing on play as a vehicle for all infants and children to integrate the skills they have learned and apply them in their daily life" (FCBMR&DD, p. 2, Note 1).

All preschool children at FPEEC participated in 20 minutes of free play daily in the gymnasium of the school. Within the gymnasium were various pieces of climbing apparatus, balance boards, slides, tricycles, and other small and large play objects. A limited amount of outdoor climbing apparatus was available for use by the children. Sensory-motor activities were provided weekly by an occupational or physical therapist. Outdoor play activities (i.e., water and sand play, finger paints, and other fine motor activities) occurred weekly for all
children while a small number of the children left the building for swimming lessons every other week.

The 23 subjects were chosen from 35 boys and girls with parental consent to participate in the study. The twenty-fourth subject was dropped from the study after the second day due to an adverse reaction when taken into the play environment. The subjects were selected on the basis of cognitive level of functioning (i.e., one to three years delay), gross motor ability (i.e., physical capability to climb and maneuver on the play apparatus), and compliant behaviors (i.e., willingness to cooperate within a free play setting). The cognitive level of functioning, gross motor ability, and compliant behaviors were determined by examining results of assessments on file as well as by soliciting the professional judgments of the Assistant Director of Early Childhood Education and classroom teachers. Data regarding the cognitive developmental level and age of each child are located in Appendix B.

A proportionate stratified randomization procedure based upon scheduled field trips and swimming lessons was used to assign children to one of six playgroups (three morning and three afternoon). This was done to insure that scheduled absences from school would occur on the same day for all group members and to minimize the number of children from the same class in each group. No more than two children from each of the five morning classes and five afternoon classes were assigned to the same playgroup. Each of the six playgroups were in turn randomly assigned to the two levels of treatment (i.e., low and high complexity). Two morning and one afternoon playgroup received the high complexity
treatment while one morning and two afternoon playgroups received the low complexity treatment.

Permission to undertake the study was granted by the Behavioral and Social Sciences Human Subjects Review Committee of The Ohio State University (see Appendix A). Permission for the participation of the children from FPEEC was obtained from the Assistant Superintendent of the FCBMR&DD (see Appendix A). Only those children receiving parental consent were permitted to participate in the study (see Appendix A).

Research Environment and Play Equipment

The research environment was located within a 9.6 m by 7.7 m classroom at FPEEC (see Figure 1). Several standard items found in all of the classrooms at FPEEC are illustrated in Figure 1. The items include a washbowl and paper towel dispenser in the northeast corner of the room, two chalk boards on the north and south walls, a bulletin board on the south wall, a heat register and three windows on the east wall, and a bookcase on the west side of the room. The bulletin board, heat register, and bookcase were covered with muslin cloth in an attempt to minimize extraneous sources of stimulation in the environment. The window shades were drawn and brown butcher paper covered the spaces between the window shades.

The videotape equipment was placed on a small table in the north-west corner of the room. The camera, mounted on a tripod, was placed as far back into the corner as possible to maximize the camera angle. Two chairs adjacent to the bookcase on the west side of the room provided seating for the investigator and assistant.
Figure 1. Research Environment
The play apparatus included two metal trestles, two aluminum boards, a firefighter's ladder, and a large plastic box. The trestles, boards, and ladder were purchased from PlayLearn Products, Inc., St. Louis Missouri. The "snap together" plastic box was purchased from Learning Products, Inc., St. Louis, Missouri. The eight tumbling mats which covered the floor of the playspace were manufactured by Nissen Corporation, Cedar Rapids, Iowa (see Figures 2 to 5). Descriptions, dimensions, and modifications of all pieces of apparatus are found in Appendix C.

The high complexity environment (see Figure 6) contained all of the equipment previously mentioned. The low complexity environment was arranged in an identical manner excluding the inclined 2.4 m board, the firefighter's ladder, and the plastic box (see Figure 7). All equipment was bolted together and taped to the floor to prevent manipulation by the children. The ends of both boards were padded for safety. A cone and rope barrier surrounded the playspace and marked the boundary.

Play Sessions

The children in each of the four-member playgroups played in the assigned environments for 15 minutes per day for 11 school days during a three week period. The exact number of days per week for each group was partially dependent upon swimming lessons and field trips scheduled as discussed previously in the Selection of Subjects section of this chapter. The sessions for each playgroup occurred at the same time each day with three groups in the morning and three groups in the afternoon. Each playgroup, in turn, was brought into the play area by
Figure 2. Trestles
Figure 3. Ladder
Figure 4. Boards
Figure 5. Box
Figure 6. High Complexity Environment
Figure 7. Low Complexity Environment
the investigator at which time the assistant checked the children for untied shoelaces and loose jewelry. The children sat in a designated area on the mats at the front edge of the environment and put on a colored T-shirt (red, blue, green, or yellow). Each child wore the same color for each session to ensure accurate identification during later data retrieval from the videotapes. As soon as the children were ready, the investigator instructed the children to "go play" and activated the camera while the assistant began timing the 15-minute play session. If a child did not respond to the initial starting signal, the investigator again told the child to "go play" and physically prompted the child. Intervention during the play session occurred only when a child appeared to be in a position in which injury could occur or when a child exited the playspace.

When the 15 minutes elapsed, the assistant announced to the children to "stop playing". After the T-shirts were removed, the children were returned to the classroom by the investigator while the assistant prepared the environment for the next session.

Data Collection

The data collection involved a number of considerations: equipment selection, observer training sessions, observer coding sessions and reliability checks, and pilot study.

Equipment Selection

A portable Panasonic VHS video cassette recorder, model #NV-8410 was used to record all sessions onto Scotch 4" video cassette tapes. A Panasonic color video camera, model #WV-3400/12X, was mounted on a tripod
in the northwest corner of the room. An omnidirectional microphone was placed in the chalk tray on the north wall 2 m from the playspace to record the verbal behaviors of the children. A second lavalier microphone was used by the investigator to record the color of the T-shirt worn by a child as he/she engaged in any verbal behaviors that were social in nature (that is, the child was verbally interacting with at least one other child). A mixer was used to combine and record both audio recordings onto the videotape.

Observer Training Sessions

Eleven different observers were trained to collect data from the videotapes recorded during a 12-day pilot study as well as during the fifth day of the present study. A 10-second interval recording procedure (i.e., the first 5-seconds were to observe, the second 5-seconds to record) was used to determine the amount of motor and social behavior exhibited by each child. To facilitate the retrieval of data, the observers were trained to record the motor behavior and social behavior of the target child separately. Each observer was given a verbal and written description of the coding procedures as well as verbal and written definitions of four motor-coding categories and two social-coding categories (see Appendix D). The coding categories and definitions were as follows:

Motor Activity On the Apparatus (MON). MON occurred when a child was engaged in locomotor or nonlocomotor movements while in physical contact with or encapsulated by the play apparatus (i.e., trestles, ladder, slide, and box) within the play environment for the majority
of the five second interval. Locomotor movements were movements of the body which involved traveling from one place to another in space (i.e., leaping, walking, running, galloping, skipping, jumping, sliding, climbing, scooting, crawling, creeping, rolling). Nonlocomotor movements were movements of different body parts or the body as a whole while remaining in the same location (i.e., swinging, swaying, bending, stretching, rising, falling, rocking, twisting, turning, lifting, pushing, pulling, striking). Encapsulation occurred when a child was inside or under a piece of apparatus.

**Motor Activity Off the Apparatus (MOFF).** MOFF occurred when a child was engaged in locomotor or nonlocomotor movements on the floor (that is, not in physical contact with or encapsulated by the equipment) within the play environment for the majority of the five second interval. Locomotor movements were movements of the body which involved traveling from one place to another in space (i.e., leaping, walking, running, hopping, galloping, skipping, jumping, sliding, climbing, scooting, crawling, creeping, rolling). Nonlocomotor movements were movements of different body parts or the body as a whole while remaining in the same location (i.e., swinging, swaying, bending, stretching, rising, falling, rocking, twisting, turning, lifting, pushing, pulling, striking).

**Nonmotor Activity (NM).** NM occurred when a child was in a stationary position (e.g., sitting, lying, kneeling, standing) within the play environment for the majority of the five second interval.

**Extraneous Activity (EXTR).** EXTR occurred when a child was engaged in movement behaviors that were not categorized as locomotor or
nonlocomotor movements for the majority of the five second interval. EXTR included interactions with components of the environment exclusive of the play apparatus (i.e., the cone and rope barrier, the mats, the tape and bolts securing the apparatus, the walls) and other extraneous movements such as pulling on clothing, shoes, or eyeglasses. EXTR also included repetitive behaviors that are often characteristic of the population (i.e., tapping fingers, flapping hands and arms, rotating the head, clapping hands) as well as movements such as rubbing the eyes and touching the hair.

Social Activity (SA). SA occurred when a child engaged in associative or cooperative group play (Parten, 1932) with at least one other child (that is, physically or verbally interacted with another child in similar if not identical activity). SA included talking to, singing with, laughing at, holding, touching, hitting, following, or imitating another child. SA occurred when holding, touching, hitting, following or imitating another child took place for the majority of the five second interval or when verbal interactions (i.e., talking, singing, laughing) occurred within the interval (as determined by the cues of the investigator on the videotape).

Nonsocial Activity (NS). NS was defined as the opposite of SA.

Criterion of Acceptable Training. Each observer recorded the motor behavior of the target child for 3 minutes. At the end of the 3-minute session an interval by interval comparison was made with the prerecorded judgments of the investigator. This procedure was repeated until the agreement between the observer and the investigator reached 80% when calculated as follows:
The above procedure was repeated for each observer until 80% agreement was reached for three and five consecutive 3-minute sessions. Identical procedures were used to train for social behaviors.

Observer Coding Sessions and Reliability Checks

A total of 132 play sessions for the 23 subjects were coded by the eleven observers. As few as four and no more than 15 sessions were recorded by one observer. (The unequal number of recorded sessions per observer was necessary due to observer time constraints.) When possible, each observer coded a particular subject no more than one time and coded an equal number of early, middle, and late days.

Reliability checks were performed by the investigator on no less than \( \frac{1}{4} \) of the total number of sessions coded by each observer. Interval by interval comparisons were made of the first, third and fifth 3-minute portions of the randomly chosen sessions. The resulting means of rater agreements ranged from 82% to 96% for motor categories and 90% to 96% for social categories (see Appendix E).

The final step in the data collection procedure was to compute the amount of time each child engaged in each of the target behaviors (i.e., MON, MOFF, EXTR, NMS, MSON, MSOFF, EXTRS, and NA) during the two early days, two middle days, and two late days of the study. The target behavior for each 10-second interval was obtained by combining the motor-coding category and social-coding as follows (see Coding Sheet in Appendix D):
At that time, the mean value of the two early days, the mean value of the two middle days, and the mean value of the two late days for each target behavior were calculated. Therefore, the raw data for each subject consisted of three values for each target behavior (see Appendix F).

**Pilot Study**

Several pilot studies including groups of developmentally delayed and normal preschoolers were conducted in order to determine the appropriateness of the play apparatus, videotaping procedures, and coding procedures. The most extensive pilot study involved 24 normal boys and girls who attended the Ohio State University Child Care Program (OSUCCP) during the Spring of 1983. Permission for participation of the children was obtained from the Director of OSUCCP. The 12 boys and 12 girls receiving parental consent to participate were randomly assigned to a four-member playgroup with classroom peers. Each group was then randomly assigned to the low or high complexity environment.
Due to various reasons (i.e., chicken pox, noncompliance, and absence from school) several subjects did not complete the study. However, the 12-day pilot study resulted in the refinement of videotaping procedures, play sessions procedures, and coding techniques. The play of the children on the apparatus provided information concerning the appropriateness of the equipment used in the present study. Upon viewing the environments as arranged for the pilot study, a panel of four specialists in motor development used the criterion established through research by Ellis, Scholtz, and others to confirm that the two levels of complexity were in fact low and high in nature.

**Research Design**

The research design of this study was the posttest-only control group design (Campbell & Stanley, 1963) with multiple measures on the posttest.

\[ R \times X_1 0_1 0_2 0_3 \]
\[ R \times X_2 0_1 0_2 0_3 \]

- \( R \) = Randomization
- \( X_1 \) = Treatment, Low Complexity Environment
- \( X_2 \) = Treatment, High Complexity Environment
- \( O_1 \) = Observation, \( \bar{X} \) of Two Early Days of the Study (days 2 and 4)
- \( O_2 \) = Observation, \( \bar{X} \) of Two Middle Days of the Study (days 6 and 7)
- \( O_3 \) = Observation, \( \bar{X} \) of Two Late Days of the Study (days 10 and 11)

**Internal Validity**

Potential threats to internal validity include history, maturation, testing, instrumentation, statistical regression, selection, mortality,
and interaction of selection and maturation. The nature of the posttest-only control group design controls for the threats to internal validity.

History, as defined by Campbell and Stanley (1963), is the "specific events occurring between the first and second measurement in addition to the experimental variable" (p. 5). The study occurred for 11 days over a 3-week period. Parents and teachers were asked not to discuss the procedures of the study with the children. Therefore, the threat of history was not of significance to this study.

Maturation is a threat to internal validity when "an observed effect might be due to the respondent's growing older, wiser, stronger, more experienced and the like" as a function of time rather than the treatment of interest (Cook and Campbell, 1979, p. 52). Because of the brief length of the study (165 minutes over a span of 11 days) little maturation would be expected in the preschool children. The threat of maturation, therefore, was not considered to be of significance to this study.

Testing "is a threat when an effect might be due to the number of times particular responses are measured . . . . familiarity with a test can sometimes enhance performance because items and error responses are more likely to be remembered at later testing sessions" (Cook & Campbell, 1979, p. 52). Tests were not administered during this study, therefore, testing was not considered to be a significant threat to internal validity.

Instrumentation, as defined by Campbell and Stanley (1963), refers to "changes in the calibration of a measuring instrument or changes in the observers or scorers used (that) may produce changes in the obtained measurements" (p. 5). The eleven observers remained the same throughout
the study and used the same procedures for coding each session. Observers were randomly assigned to days, playgroups, and children and were not informed of the day or group being observed. Observer fatigue was controlled by limiting each coding session to two hours in length. Because of the controls, instrumentation was not considered to be a threat to internal validity in this study.

Statistical regression is defined by Campbell and Stanley (1963) to be "operating where groups have been selected on the basis of their extreme scores" (p. 5). The subjects of this study were chosen from the same population and randomly assigned to groups, allowing the assumption of equal groups. Comparisons of activity levels were made only between the parallel groups, therefore, statistical regression was not considered to be a threat to this study.

Selection is a threat when an effect may be due to the difference between the kinds of people in one experimental group as opposed to another" (Cook & Campbell, 1979, p. 53). The children were randomly assigned to levels of treatment. To this extent, the children receiving the low complexity treatment were considered to be equal to the children receiving the high complexity treatment.

Mortality refers to the "differential loss of respondents from the comparison group" (Campbell & Stanley, 1963, p. 5). One child from a low complexity group was dropped from the study, therefore, only 11 children received the low complexity treatment. A second child in a high complexity group did not complete the late days of the study. The scores used for the statistical analysis of this child were the average scores of the group to which the child was assigned.
Selection-maturation interaction "results when experimental groups are maturing at different speeds" (Cook & Cambell, 1979, p. 53). The occurrence of maturation during the 11 school days over a three week period of this study was not likely, nor were the two groups selected in a non-parallel manner; therefore, selection-maturation interaction was not a significant threat to the internal validity of the study.

External Validity

Due to the purposeful selection of the school involved in this study, the results may not be generalized beyond the population studied. The "clinical approach" taken in this study limits the generalizability. Replications in other settings are necessary in order to generalize the results to other populations and settings.

Analysis of Data

The data were analyzed by eight separate two factor analyses of variance, ANOVA, (Winer, 1971) with repeated measures using Process GLM for unbalanced ANOVA of the Statistical Analyses System (SAS Institute Inc., 1982). In all analyses the between factor was complexity (two levels: low and high) and the within factor was time (three levels: early, middle, and late). In the first ANOVA, the dependent measure was MON. The dependent measures for analyses two through eight were MOFF, EXTR, NMS, MSON, MSOFF, EXTRS, and NA, respectively.

A significance level of .05 was used for all tests. Fisher's least significant difference, lsd, (Steele & Torrie, 1980) was calculated to locate differences within significant main effects and interactions. The means and standard deviations were calculated for all
dependent variables.
CHAPTER IV

RESULTS

The effect of the functional complexity of a play environment upon the amount of motor, social, and motor-social activity exhibited by developmentally delayed preschool children was assessed. Twenty-three 4- to 6-year-old children attending Forest Park Early Education Center (FPEEC), Columbus, Ohio, were the subjects of the study. All of the subjects were observed while playing in a play environment of low or high complexity during 11, 15-minute play sessions. The amount of time (i.e., number of 10-second intervals) each child engaged in eight motor, social, or motor-social behaviors was recorded from videotapes by trained observers. The collected data were statistically analyzed using eight separate two factor factorial analyses of variance (ANOVA) with repeated measures. The a priori level of significance was set at the .05 level.

In all analyses, complexity (two levels: low and high) and time (three levels: early, middle, and late) were the factors analyzed. Motor activity on the apparatus (MON) was the dependent measure in the first ANOVA. The dependent measures for analyses two through eight were motor activity off the apparatus (MOFF), extraneous activity (EXTR), nonmotor-social activity (NMS), motor-social activity on the apparatus (MSON), motor-social activity off the apparatus (MSOFF), extraneous-social activity (EXTRS), and nonactivity (NA), respectively.
Fisher's least significant difference, LSD (Steele and Torrie, 1980) was calculated to locate significant main effects and interactions. Means and standard deviations for all dependent measures were calculated (see Tables 1, 2, and 3 and Figures 8, 9, and 10).

Table 1
Complexity Means and Standard Deviations for Dependent Variables

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Complexity</th>
<th>Low (n = 33)</th>
<th>High (n = 35)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>MON</td>
<td>15.58</td>
<td>12.28</td>
<td>32.49</td>
</tr>
<tr>
<td>MOFF</td>
<td>10.24</td>
<td>8.01</td>
<td>8.56</td>
</tr>
<tr>
<td>EXTR</td>
<td>9.89</td>
<td>13.37</td>
<td>6.01</td>
</tr>
<tr>
<td>NMS</td>
<td>4.94</td>
<td>4.15</td>
<td>4.04</td>
</tr>
<tr>
<td>MSON</td>
<td>14.12</td>
<td>9.40</td>
<td>17.53</td>
</tr>
<tr>
<td>MSOFF</td>
<td>20.18</td>
<td>14.57</td>
<td>6.50</td>
</tr>
<tr>
<td>EXTRS</td>
<td>2.05</td>
<td>2.63</td>
<td>1.91</td>
</tr>
<tr>
<td>NA</td>
<td>13.12</td>
<td>11.33</td>
<td>13.28</td>
</tr>
</tbody>
</table>
Figure 8. Complexity means for dependent variables.
Table 2
Time Means and Standard Deviations
for Dependent Variables

<table>
<thead>
<tr>
<th></th>
<th>Early(^a)</th>
<th>Middle(^a)</th>
<th>Late(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variables</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>MON</td>
<td>28.78</td>
<td>18.95</td>
<td>23.91</td>
</tr>
<tr>
<td>MOFF</td>
<td>11.93</td>
<td>9.24</td>
<td>7.87</td>
</tr>
<tr>
<td>EXTR</td>
<td>5.78</td>
<td>7.39</td>
<td>8.74</td>
</tr>
<tr>
<td>NMS</td>
<td>3.65</td>
<td>3.77</td>
<td>3.98</td>
</tr>
<tr>
<td>MSON</td>
<td>15.98</td>
<td>14.70</td>
<td>15.57</td>
</tr>
<tr>
<td>MSOFF</td>
<td>9.48</td>
<td>10.75</td>
<td>13.87</td>
</tr>
<tr>
<td>EXTRS</td>
<td>1.20</td>
<td>1.71</td>
<td>2.13</td>
</tr>
</tbody>
</table>

\(^a_n = 23\) for each group
Figure 9. Time means for dependent variables.
Table 3
Complexity x Time Means and Standard Deviations for Dependent Variables

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Early</th>
<th>S.D.</th>
<th>Middle</th>
<th>S.D.</th>
<th>Late</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MON</td>
<td>19.23</td>
<td>14.89</td>
<td>11.36</td>
<td>10.56</td>
<td>16.14</td>
<td>10.76</td>
</tr>
<tr>
<td>MOFF</td>
<td>13.23</td>
<td>11.23</td>
<td>8.91</td>
<td>5.09</td>
<td>8.59</td>
<td>6.21</td>
</tr>
<tr>
<td>EXTR</td>
<td>7.50</td>
<td>10.20</td>
<td>12.00</td>
<td>16.19</td>
<td>10.18</td>
<td>13.95</td>
</tr>
<tr>
<td>NMS</td>
<td>4.64</td>
<td>4.18</td>
<td>4.50</td>
<td>4.01</td>
<td>5.68</td>
<td>4.56</td>
</tr>
<tr>
<td>MSON</td>
<td>17.41</td>
<td>12.67</td>
<td>13.82</td>
<td>7.99</td>
<td>11.14</td>
<td>6.01</td>
</tr>
<tr>
<td>MSOFF</td>
<td>17.00</td>
<td>11.23</td>
<td>22.91</td>
<td>16.19</td>
<td>20.64</td>
<td>16.49</td>
</tr>
<tr>
<td>EXTRS</td>
<td>1.59</td>
<td>2.22</td>
<td>3.00</td>
<td>3.65</td>
<td>1.55</td>
<td>1.54</td>
</tr>
<tr>
<td>NA</td>
<td>9.41</td>
<td>10.94</td>
<td>13.50</td>
<td>12.07</td>
<td>16.45</td>
<td>10.85</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Early</th>
<th>S.D.</th>
<th>Middle</th>
<th>S.D.</th>
<th>Late</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MON</td>
<td>37.54</td>
<td>18.49</td>
<td>35.42</td>
<td>15.96</td>
<td>23.77</td>
<td>12.61</td>
</tr>
<tr>
<td>MOFF</td>
<td>10.75</td>
<td>7.28</td>
<td>6.92</td>
<td>5.68</td>
<td>7.95</td>
<td>6.12</td>
</tr>
<tr>
<td>EXTR</td>
<td>4.21</td>
<td>3.02</td>
<td>5.75</td>
<td>4.92</td>
<td>8.27</td>
<td>7.99</td>
</tr>
<tr>
<td>NMS</td>
<td>2.75</td>
<td>3.27</td>
<td>3.50</td>
<td>3.90</td>
<td>6.05</td>
<td>5.50</td>
</tr>
<tr>
<td>MSON</td>
<td>14.67</td>
<td>16.80</td>
<td>17.17</td>
<td>15.11</td>
<td>21.05</td>
<td>16.06</td>
</tr>
<tr>
<td>MSOFF</td>
<td>2.58</td>
<td>2.88</td>
<td>5.58</td>
<td>8.87</td>
<td>11.77</td>
<td>7.91</td>
</tr>
<tr>
<td>EXTRS</td>
<td>0.83</td>
<td>1.03</td>
<td>1.33</td>
<td>1.25</td>
<td>3.09</td>
<td>3.97</td>
</tr>
<tr>
<td>NA</td>
<td>17.04</td>
<td>8.80</td>
<td>14.33</td>
<td>10.58</td>
<td>8.05</td>
<td>4.82</td>
</tr>
</tbody>
</table>

\(^{a_n} = 11\)

\(^{b_n} = 12\)
Figure 10. Complexity x time means for dependent variables.
The hypothesis of this study was there will be no difference in the amount of motor, social, and motor-social activity of developmentally delayed preschool children playing in a low complexity environment as opposed to a high complexity environment during early, middle, and late days of an 11-day period. The subhypotheses of this study were:

1. There will be no significant difference in the amount of motor activity on the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

2. There will be no significant difference in the amount of motor activity on the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

3. There will be no significant difference in the amount of motor activity off the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

4. There will be no significant difference in the amount of motor activity off the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

5. There will be no significant difference in the amount of extraneous activity exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

6. There will be no significant difference in the amount of extraneous activity exhibited by developmentally delayed preschool
children during the early, middle, and late days of the study.

7. There will be no significant difference in the amount of nonmotor-social activity exhibited by developmentally delayed preschool children in the low complexity environment and in the high complexity environment.

8. There will be no significant difference in the amount of nonmotor-social activity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

9. There will be no significant difference in the amount of motor-social activity on the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

10. There will be no significant difference in the amount of motor-social activity on the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

11. There will be no significant difference in the amount of motor-social activity off the apparatus exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

12. There will be no significant difference in the amount of motor-social activity off the apparatus exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

13. There will be no significant difference in the amount of extraneous-social activity exhibited by developmentally delayed preschool
children in the low complexity environment and high complexity environment.

14. There will be no significant difference in the amount of extraneous-social activity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

15. There will be no significant difference in the amount of nonactivity exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

16. There will be no significant difference in the amount of nonactivity exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

Subhypothesis one, there will be no significant difference in the amount of motor activity on the apparatus (MON) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was not supported. Subhypothesis two, there will be no significant difference in the amount of motor activity on the apparatus (MON) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was not supported. The results of the analysis of variance of MON data are summarized in Table 4.

The complexity main effect was significant \( (F = 9.43; \ df = 1, 4; \ p \leq .05) \) demonstrating significantly less MON in the low complexity environment than the high complexity environment.

The time main effect was significant \( (F = 6.66; \ df = 2, 41; \ p \leq .05) \), therefore, the amount of MON exhibited across early, middle, and
late days was significantly different. Fisher's LSD analysis (see Table 5) indicated that more MON was demonstrated by the developmentally delayed preschool children during the early days of the study than during the middle and late days of the study.

Table 4
Analysis of Variance Summary Table for MON

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>4555.11</td>
<td>1</td>
<td>4555.11</td>
<td>9.43*</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>1931.44</td>
<td>4</td>
<td>482.86</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>863.40</td>
<td>2</td>
<td>431.70</td>
<td>6.66*</td>
</tr>
<tr>
<td>Error</td>
<td>2658.52</td>
<td>41</td>
<td>64.84</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>836.69</td>
<td>2</td>
<td>418.35</td>
<td>6.45*</td>
</tr>
</tbody>
</table>

*p ≤ .05

Table 5
Matrix of Differences Between Time Means for MON

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>-</td>
<td>4.87*</td>
<td>8.83*</td>
</tr>
<tr>
<td>Middle</td>
<td>-</td>
<td>3.96</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05
The complexity by time interaction was significant ($F = 6.45; df = 2, 41; p \leq 0.05$) and is graphically represented in Figure 11. Inspection of the means graphed in Figure 11 indicated the developmentally delayed preschool children in the high complexity environment demonstrated more MON than the children in the low complexity environment during all days. The means also show the amount of MON decreased across days in the high complexity environment. In the low complexity environment, MON decreased between the early and middle days but increased between the middle and late days of the study.

In order to locate significant differences in the amount of MON exhibited by the children in the low complexity environment versus the high complexity environment, Fisher's LSD procedure was performed (see Table 6). The LSD analysis indicated significantly more MON occurred in the high complexity environment during the early and middle days than in the low complexity environment. The amount of MON during the late days of the study was not significantly different.

Two Fisher's LSD analyses were also performed to locate significant differences in the amount of MON exhibited by children during the early, middle, and late days (see Table 7). The analysis indicated that in the low complexity environment significantly more MON was demonstrated by the developmentally delayed children during the early days than middle days. No other low complexity differences were significant. The amount of MON demonstrated in the high complexity environment during the late days of the study was significantly less than the MON demonstrated during the early and middle days of the study.
Figure 11. Graphic representation of the complexity x time interaction effect for MAN analysis for variance.
Table 6
Matrix of Differences Between Complexity Means for MON Complexity x Time Interaction

<table>
<thead>
<tr>
<th>Low Complexity</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>18.31*</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Middle</td>
<td>24.06*</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Late</td>
<td></td>
<td>7.63</td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05

Table 7
Matrix of Differences Between Time Means for MON Complexity x Time Interaction

<table>
<thead>
<tr>
<th>Low Complexity</th>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early</td>
<td>—</td>
<td>7.87*</td>
<td>3.09</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>—</td>
<td>4.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Late</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Complexity</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>—</td>
<td>2.10</td>
<td>13.77*</td>
</tr>
<tr>
<td>Middle</td>
<td>—</td>
<td></td>
<td>11.65*</td>
</tr>
<tr>
<td>Late</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05
Subhypothesis three, there will be no significant difference in the amount of motor activity off the apparatus (MOFF) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was supported. Subhypothesis four, there will be no significant difference in the amount of motor activity off the apparatus (MOFF) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was not supported. The results of the analysis of variance of MOFF data are summarized in Table 8.

Table 8
Analysis of Variance Summary Table for MOFF

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>48.53</td>
<td>1</td>
<td>48.53</td>
<td>0.17</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>1130.64</td>
<td>4</td>
<td>282.66</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>231.60</td>
<td>2</td>
<td>115.80</td>
<td>3.47*</td>
</tr>
<tr>
<td>Error</td>
<td>1368.97</td>
<td>41</td>
<td>33.39</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>10.22</td>
<td>2</td>
<td>5.11</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*p ≤ .05

The complexity main effect was not significant (F = .17; df = 1, 4; p > .05) indicating the developmentally delayed preschool children in the low complexity environment did not demonstrate significantly more MOFF than the developmentally delayed preschool children in the high complexity environment. The time main effect was significant (F = 3.47; df = 2, 41; p ≤ .05), therefore, there were differences among the mean
values of MOFF for early, middle, and late days of the study. The results of Fisher's LSD analysis (see Table 9) indicated that more MOFF was demonstrated by the developmentally delayed preschool children during the early days of the study than during the middle and late days of the study. The time by complexity interaction was not significant ($F = 0.15$; df = 2, 41; $p > .05$). The developmentally delayed children did not exhibit significantly different amounts of MOFF in the low complexity environment than in the high complexity environment during the early, middle, or late days of the study.

Subhypothesis five, there will be no significant difference in the amount of extraneous activity (EXTR) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was supported. Subhypothesis six, there will be no significant difference in the amount of extraneous activity (EXTR) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was not supported. The results of the analysis of variance of EXTR data are summarized in Table 10.

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>-</td>
<td>4.06*</td>
<td>3.66*</td>
</tr>
<tr>
<td>Middle</td>
<td>-</td>
<td>-</td>
<td>1.60</td>
</tr>
<tr>
<td>Late</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*p ≤ .05
Table 10

Analysis of Variance Summary Table for EXTR

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>229.13</td>
<td>1</td>
<td>229.13</td>
<td>0.67</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>1364.43</td>
<td>4</td>
<td>341.11</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>166.79</td>
<td>2</td>
<td>83.39</td>
<td>3.33*</td>
</tr>
<tr>
<td>Error</td>
<td>1027.55</td>
<td>41</td>
<td>25.06</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>63.84</td>
<td>2</td>
<td>31.92</td>
<td>1.27</td>
</tr>
</tbody>
</table>

*p ≤ .05

The complexity main effect was not significant (F = 0.67; df = 1, 4; p > .05), thus, the amount of EXTR exhibited in the low complexity environment was not significantly different from the EXTR exhibited in the high complexity environment. The time main effect was significant (F = 3.33; df = 2, 41; p ≤ .05) indicating significant differences in the amount of EXTR among the early, middle, and late days of the study. Fisher's lsd, as shown in Table 11, indicated the amount of EXTR exhibited during the late days of the study was significantly greater than

Table 11

Matrix of Differences Between Time Means for EXTR

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>-</td>
<td>2.96</td>
<td>3.48*</td>
</tr>
<tr>
<td>Middle</td>
<td>-</td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>Late</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05
that exhibited during the early days of the study. The early-middle and middle-late differences were not significant. The complexity by time interaction was not significant (see Table 10) indicating the developmentally delayed preschool children in the low complexity environment did not exhibit significantly more EXTR than the developmentally delayed preschool children in the high complexity environment during the early, middle, or late days of the study.

Subhypothesis seven, there will be no significant difference in the amount of nonmotor-social activity (NMS) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was supported. Subhypothesis eight, there will be no significant difference in the amount of nonmotor-social activity (NMS) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was supported. The results of the analysis of variance of NMS data are summarized in Table 12.

Table 12
Analysis of Variance Summary Table for NMS

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>13.35</td>
<td>1</td>
<td>13.35</td>
<td>0.15</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>348.74</td>
<td>4</td>
<td>87.18</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>56.46</td>
<td>2</td>
<td>28.23</td>
<td>3.20</td>
</tr>
<tr>
<td>Error</td>
<td>362.21</td>
<td>41</td>
<td>8.83</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>12.35</td>
<td>2</td>
<td>6.18</td>
<td>0.70</td>
</tr>
</tbody>
</table>

*p ≤ .05
The complexity main effect was not significant \( (F = 0.15; df = 1, 4; p > .05) \) indicating there was no significant difference in the NMS exhibited by the developmentally delayed preschool children in the low complexity environment as opposed to the high complexity environment. The time main effect was not significant \( (F = 3.20; df = 2, 41; p > .05) \) indicating no significant difference in the NMS of the developmentally delayed preschool children during the early, middle, and late days of the study. The time by complexity interaction was not significant \( (F = 0.70; df = 2, 41; p > .05) \), confirming that the amount of NMS exhibited by the developmentally delayed preschool children in the low complexity environment was not different from that exhibited in the high complexity environment during the early, middle, or late days of the study.

Subhypothesis nine, there will be no significant difference in the amount of motor-social activity on the apparatus (MSON) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was supported. Subhypothesis ten, there will be no significant difference in the amount of motor-social activity on the apparatus (MSON) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was supported. As shown by the analysis of variance summary table for MSON (see Table 13), the complexity main effect was not significant \( (F = 0.16; df = 1, 4; p > .05) \) thus, the difference between the low and high complexity environments was not significant. The time main effect was not significant \( (F = 0.02; df = 2, 41; p > .05) \) indicating no significant differences in the amount of MSON exhibited
Table 13  
Analysis of Variance Summary Table for MSON  

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>182.16</td>
<td>1</td>
<td>182.16</td>
<td>0.16</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>4557.45</td>
<td>4</td>
<td>1136.89</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>3.42</td>
<td>2</td>
<td>1.71</td>
<td>0.02</td>
</tr>
<tr>
<td>Error</td>
<td>2863.03</td>
<td>41</td>
<td>69.83</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>400.47</td>
<td>2</td>
<td>200.23</td>
<td>2.87</td>
</tr>
</tbody>
</table>

*p ≤ .05

among days. The complexity by time interaction was not significant (F = 2.87; df = 2, 41; p > .05), therefore, neither the low nor high complexity environments encouraged significantly more or less amounts of MSON during the early, middle, or late days of the study.

Subhypothesis 11, there will be no significant difference in the amount of motor-social activity off the apparatus (MSOFF) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was not supported. Subhypothesis 12, there will be no significant difference in the amount of motor-social activity off the apparatus (MSOFF) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was not supported. The analysis of variance for MSOFF data are summarized in Table 14.

The complexity main effect was significant (F = 7.81; df = 1, 4; p ≤ .05); therefore, the amount of MSOFF in the low complexity environment was significantly greater than the high complexity environment. The time main effect was also significant (F = 5.22; df = 2, 41; p ≤ .05)
Table 14
Analysis of Variance Summary Table for MSOFF

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>3126.51</td>
<td>1</td>
<td>3126.51</td>
<td>7.81*</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>1601.32</td>
<td>4</td>
<td>400.33</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>469.14</td>
<td>2</td>
<td>234.57</td>
<td>5.22*</td>
</tr>
<tr>
<td>Error</td>
<td>1844.14</td>
<td>41</td>
<td>44.98</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>191.35</td>
<td>2</td>
<td>2.13</td>
<td>2.13</td>
</tr>
</tbody>
</table>

*p ≤ .05

indicating the differences across early, middle, and late days were significant. Fisher's lsd (see Table 15) revealed the significant differences to be between the early and middle days of the study as well as between the early and late days of the study. The complexity by time interaction was not significant (F = 2.13; df = 2, 41; p > .05) indicating no significant difference between the low complexity environment and high complexity environment on certain days of the study.

Table 15
Matrix of Differences Between Time Means for MSOFF

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>_</td>
<td>4.39*</td>
<td>6.72*</td>
</tr>
<tr>
<td>Middle</td>
<td>_</td>
<td>2.33</td>
<td>_</td>
</tr>
<tr>
<td>Late</td>
<td>_</td>
<td>_</td>
<td>_</td>
</tr>
</tbody>
</table>

*p ≤ .05
Subhypothesis 13, there will be no significant difference in the amount of extraneous-social activity (EXTRS) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was supported. Subhypothesis 14, there will be no significant difference in the amount of extraneous-social activity (EXTRS) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was supported. The results of the analysis of variance of EXTRS data are summarized in Table 16.

Table 16
Analysis of Variance Summary Table for EXTRS

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>1.47</td>
<td>1</td>
<td>1.47</td>
<td>0.18</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>33.52</td>
<td>4</td>
<td>8.73</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>16.19</td>
<td>2</td>
<td>8.09</td>
<td>1.47</td>
</tr>
<tr>
<td>Error</td>
<td>225.95</td>
<td>41</td>
<td>5.51</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>30.10</td>
<td>2</td>
<td>15.05</td>
<td>2.73</td>
</tr>
</tbody>
</table>

*p ≤ .05

The complexity main effect was not significant (F = 0.18; df = 1, 4; p > .05) indicating no significant difference between the low complexity environment and high complexity environment for EXTRS. The time main effect was not significant (F = 1.47; df = 2, 41; p > .05); thus, the amount of EXTRS demonstrated by the developmentally delayed preschool children across the early, middle, and late days of the study
was not significantly different. The complexity by time interaction was not significant \((F = 2.73; df = 2, 41; p > .05)\) indicating the amount of EXTRS exhibited in the low complexity environment was not significantly different than the EXTRS exhibited in the high complexity environment during any of the early, middle, or late days.

Subhypothesis 15, there will be no significant difference in the amount of nonactivity \((NA)\) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment, was supported. Subhypothesis 16, there will be no significant difference in the amount of nonactivity \((NA)\) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study, was supported. The results of the analysis of variance of NA data are summarized in Table 17.

Table 17

Analysis of Variance Summary Table for NA

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>3.57</td>
<td>1</td>
<td>3.57</td>
<td>0.01</td>
</tr>
<tr>
<td>Error (Group within Complexity)</td>
<td>1388.56</td>
<td>4</td>
<td>347.14</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>11.86</td>
<td>2</td>
<td>5.93</td>
<td>0.10</td>
</tr>
<tr>
<td>Error</td>
<td>2424.66</td>
<td>41</td>
<td>59.14</td>
<td></td>
</tr>
<tr>
<td>Complexity x Time</td>
<td>602.36</td>
<td>2</td>
<td>301.18</td>
<td>5.09*</td>
</tr>
</tbody>
</table>

*p ≤ .05

The complexity main effect was not significant \((F = 0.01; df = 1, 4; p > .05)\); therefore, the difference between the low and high complexity
environments for NA was not significant. The time main effect was not significant \( (F = 0.10; df = 2, 41; p > .05) \) indicating the amounts of NA exhibited during the early, middle, and late days of the study were not significantly different. The complexity by time interaction for NA was significant \( (F = 5.09; df = 2, 41; p < .05) \) and is graphically represented in Figure 12. Inspection of the means in Figure 12 shows disordinal interaction with more NA in the low complexity environment during the middle and late days of the study while more NA occurred in the high complexity environment during the early days of the study.

Fisher's lsd procedure (see Table 18) revealed no significant differences in the amount of NA exhibited in the low complexity environment as opposed to the high complexity environment for any of the early, middle, or late days of the study. Fisher's lsd for the comparison of time means for NA in both the low and high complexity environments (see Table 19) found several differences to be significant. For the low complexity environment, only the early-late days difference was significant whereas the middle-late days and early-late days were significant in the high complexity environment.
Figure 12. Graphic representation of the complexity by time interaction effect for NA analysis of variance.
Table 18
Matrix of Differences Between Complexity Means for NA Complexity x Time Interaction

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Complexity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td></td>
<td>7.63</td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td></td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td></td>
<td>8.40</td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05

Table 19
Matrix of Differences Between Time Means for NA Complexity x Time Interaction

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Complexity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td></td>
<td>4.09</td>
<td>7.04*</td>
</tr>
<tr>
<td>Middle</td>
<td></td>
<td>2.95</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

High Complexity

<table>
<thead>
<tr>
<th>Time</th>
<th>Early</th>
<th>Middle</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td></td>
<td>2.71</td>
<td>8.99*</td>
</tr>
<tr>
<td>Middle</td>
<td></td>
<td>6.28*</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p ≤ .05
Chapter V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The purpose of this study was to determine the effect of the functional complexity of a play environment upon the amount of motor, social, and motor-social activity of developmentally delayed preschool children. Twenty-three children attending Forest Park Early Education Center (FPEEC) during the Summer of 1983 were chosen and randomly assigned to one of six groups for participation in this study. Three playgroups were randomly assigned to the low complexity environment (i.e., two trestles and one board) while three playgroups were randomly assigned to the high complexity environment (i.e., two trestles, two boards, one ladder, and a box). Each playgroup was exposed to the respective play environment for 11, 15-minute sessions during a three week period. A videotaping and audiotaping procedure was used to record the motor and social behaviors of each child during two early days (days two and four), two middle days (days six and seven), and two late days (days ten and eleven) of the study. The mean values of the eight dependent measures were statistically analyzed by eight separate two factor factorial analyses of variance with repeated measures. The analyses were performed to test the 16 subhypotheses of the study.

The major hypothesis of this study stated there will be no difference in amount of motor, social, and motor-social activity of the developmentally delayed preschool children when playing in a low
complexity environment as opposed to a high complexity environment during the early, middle, and late days of an 11-day period. The null subhypotheses of this study follow. Subhypotheses 3, 5, 7, 8, 9, 10, 13, 14, 15, and 16 were supported while subhypotheses 1, 2, 4, 6, 11, and 12 were not supported.

1. There will be no significant difference in the amount of motor activity on the apparatus (MON) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

2. There will be no significant difference in the amount of motor activity on the apparatus (MON) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

3. There will be no significant difference in the amount of motor activity off the apparatus (MOFF) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

4. There will be no significant difference in the amount of motor activity off the apparatus (MOFF) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

5. There will be no significant difference in the amount of extraneous activity (EXTR) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.
6. There will be no significant difference in the amount of extraneous activity (EXTR) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

7. There will be no significant difference in the amount of nonmotor-social activity (NMS) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

8. There will be no significant difference in the amount of nonmotor-social activity (NMS) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

9. There will be no significant difference in the amount of motor-social activity on the apparatus (MSON) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

10. There will be no significant difference in the amount of motor-social activity on the apparatus (MSON) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

11. There will be no significant difference in the amount of motor-social activity off the apparatus (MSOFF) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

12. There will be no significant difference in the amount of motor-social activity off the apparatus (MSOFF) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.
13. There will be no significant difference in the amount of extraneous-social activity (EXTRS) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

14. There will be no significant difference in the amount of extraneous-social activity (EXTRS) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

15. There will be no significant difference in the amount of nonactivity (NA) exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment.

16. There will be no significant difference in the amount of nonactivity (NA) exhibited by developmentally delayed preschool children during the early, middle, and late days of the study.

In the analysis for MON, the complexity main effect, time main effect, and interaction effect were significant beyond the .05 alpha level. The complexity main effect indicated that significantly more MON occurred in the high complexity environment than in the low complexity environment. The main effect for time indicated a significant difference among the early, middle, and late days of the study. Fisher's LSD procedure indicated that there was significantly more MON during the early days as opposed to the middle and late days of the study. Fisher's LSD procedure, used to locate significant differences found by the interaction effect, indicated that the children in the high complexity environment exhibited significantly more MON than the children in the low complexity environment during the early and middle days of the
study. Significantly more MON occurred in the high complexity environment during the early and middle days when compared to the late days while in the low complexity environment, more MON was exhibited during the early days than during the middle days of the study.

In the analysis for MOFF, the complexity main effect and interaction effect were not significant. The time main effect was significant beyond the .05 alpha level. Fisher's lsd procedure indicated that the significant differences were between the early days and middle days as well as between the early and late days of the study. That is, significantly more MOFF was exhibited by the children during the early days than during the middle and late days of the study.

In the analysis for EXTR, the complexity main effect and interaction effect were not significant; however, the time main effect was significant beyond the .05 alpha level. Fisher's lsd procedure indicated significantly more EXTR was exhibited during the early days than during the late days of the study.

In the analysis for NMS, the main effects for time and complexity as well as the interaction effect were not significant at the .05 alpha level. This analysis indicated there were no significant differences in the amount of NMS exhibited in the low and high complexity environments and no significant differences among the early, middle, and late days of the study.

In the analysis for MSON, the complexity and time main effects as well as the interaction effect were not significant at the .05 alpha level. While the interaction effect was not significant beyond the .05 level, the F value approached significance ($F = 2.87; df = 2, 41;
In the analysis of MSOFF data, the complexity and time main effects were significant beyond the .05 alpha level while the interaction effect was not significant. The significant main effect for complexity indicated that across all days measured during the study, more MSOFF occurred in the low complexity environment than in the high complexity environment. Fisher’s lsd analysis procedure performed on the main effect data for time indicated the significant differences to lie between the early and middle days as well as the early and late days of the study. That is, there was significantly less MSOFF exhibited during the early days of the study than during the middle and late days of the study.

In the analysis for EXTRS, the main effects for complexity and time as well as the interaction effect were not significant at the .05 alpha level. This analysis indicated there were no significant differences in the amount of EXTRS exhibited in the low and high complexity environments and no significant differences among the early, middle, and late days of the study.

In the analysis for NA, the complexity main effect and time main effect were not significant at the .05 alpha level. The interaction effect was significant beyond the .05 level. Fisher’s lsd analysis procedure located no significant differences between the low and high complexity environments in the amount of NA exhibited. In the low complexity environment, significantly more NA occurred during the late days than during the early days of the study. In the high complexity environment, significantly less NA occurred during the late days than
during the early and middle days of the study.

Conclusions and Interpretations

Within the framework of this investigation, the following conclusions are justified:

1. Developmentally delayed preschool children exhibited more MON in the high complexity environment than the developmentally delayed preschool children in the low complexity environment. This result supports the results of previous research by Cockrell (1935), Gramza (1976), Gramza et al. (1972), Johnson (1935), Scholtz (1973), and Scholtz and Ellis (1975) with normal children. As predicted by arousal theory, the environment of greater functional complexity elicited more interaction with the equipment than the environment of less functional complexity.

2. Developmentally delayed preschool children exhibited more MON during the early days of the study than during the middle and late days of the study. In keeping with arousal theory, the amount of MON exhibited decreased during the 3-week period. That is, with repeated exposure to the same play setting, a decrease in apparatus interaction occurred. These results are similar to those found by Scholtz (1973) and Scholtz and Ellis (1975). While studying normal children, these researchers found that preference for objects (i.e., play equipment) declined over a 3-week period. The decrease in the amount of MON exhibited throughout the 11-day study is in direct contradiction to the hypothesis set forth by Zajonc (1968), and is more in line with the views of Hebb (1949), Berlyne (1960), and others. Preference for the
play apparatus did not increase with exposure as Zajonc would predict, but rather, decreased as supported by Cantor and Cantor (1964) and Wuellner (1969).

3. There was no significant difference in the amount of MOFF exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment. Although the amount of MOFF exhibited in the low complexity environment was greater than in the high complexity environment, the difference was not statistically significant. This result is in contradiction to the arousal theory in that the expected result was for MOFF in the low complexity environment to significantly exceed the MOFF in the high complexity environment.

4. Developmentally delayed preschool children did exhibit more MOFF during the early days of the study than during the middle and late days of the study. This result is in conflict with the expectations set forth by arousal theory. That is, arousal theory would predict MOFF to increase with repeated exposure to the play apparatus rather than decrease. As the children exhausted the movement possibilities and, therefore, exhibited less MON, MOFF would be expected to increase.

The procedures used for coding the behaviors of the children may explain the above results. If a child was engaged in motor activity off the apparatus which was social in nature, the resulting behavior was recorded as MSOFF. Perhaps the increase in MSOFF during the middle and late days of the study accounts for this result. The greater amount of MOFF may also have been due to the novelty of the play setting. Perhaps the newness of the setting was adversive to the children,
supporting the hypothesis by Zajonc (1968).

5. There was no significant difference in the amount of EXTR exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment. In other words, the level of complexity did not significantly influence the amount of EXTR. Wehman's (1976) account of the arousal theory purports that stimuli in the environment may be responsible for eliciting stereotypic behaviors. Although the difference between the low and high complexity environments was not significant, more EXTR did occur in the low complexity environment. This trend could suggest an increase of EXTR in the low complexity environment to be due to a lack of stimuli as opposed to excessive stimuli in the environment. Scholtz (1973) indicated the amount of extraneous activity to be inversely related to the level of complexity. Further research is needed to explain these results.

6. Developmentally delayed preschool children exhibited more EXTR during the late days of the study than during the early days of the study. This result supports the novelty-preference view. That is, the possibility exists that initially, the novel environment was successful in promoting other more appropriate behaviors. However, as stated by Maddi (1968), perhaps the repeated exposure and, thus, familiarity, leads to monotony and negative affect. Again, the extent to which this can be applied must be the subject of further research.

7. There was no significant difference in the amount of NMS exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment. Again, the
functional complexity of the environments had no significant effect upon the amount of NMS exhibited. This result contradicts the findings of previous researchers such as Scholtz (1973) and Scholtz and Ellis (1975). These researchers found that the amount of group play was inversely related to the complexity of the physical setting. Therefore, the expected results were that more activity should have taken place in the low complexity environment than in the high complexity environment. However, the nature of the recording procedure used in the present investigation may have had an effect upon the NMS data. That is, the lack of difference may have been due to the differentiation of nonmotor social activity (NMS) from social activity with simultaneous motor activity (MSON and MSOFF) and social activity with simultaneous extraneous activity (EXTRS).

8. There was no significant difference in the amount of NMS exhibited by developmentally delayed preschool children during the early, middle and late days of the study. This result does not support the previous research by Scholtz (1973) and Scholtz and Ellis (1975) who found that repeated exposure to a play setting resulted in an increase in group play. The lack of significance also contradicts the hypothesis of Zajonc (1968). Perhaps the lack of social maturity (Mindes, 1982) often exhibited by delayed children accounts for this result. That is, if the developmentally delayed children did not have the skills to engage in associative or cooperative group play, little change in the amount of NMS could be expected.

While the reported F value was not significant at the .05 alpha level, the F value did approach significance. The trend of the data
is supportive of Zajonc and Scholtz and Ellis. Perhaps the division of the social behaviors into motor-, nonmotor-, and extraneous-social categories prevented the investigator from finding significance in the NMS data. That is, larger differences may have resulted had the social behaviors been recorded into one of two or three categories (i.e., those involving simultaneous motor activity on and off the apparatus and social behaviors occurring simultaneously with nonmotor activity).

There was no significant difference in the amount of MSON exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment. While the analysis of MSON data revealed no significant differences due to complexity, the trend of the data is in agreement with the findings of Wright (1982). That is, more motor-social activity (in this case, on the apparatus) occurred in the high complexity environment as opposed to the low complexity environment. The results of Scholtz (1973) and Scholtz and Ellis (1975) are supportive of the theory that environments of higher complexity elicit more motor activity/interaction with the play apparatus while environments of lower complexity elicit more social activity. If motor behavior is predicted to be greater in the high complexity environment and social behavior is predicted to be greater in the low complexity environment, predicting the trend of the combined motor-social activity category is difficult.

There was no significant difference in the amount of MSON exhibited by developmentally delayed preschool children during the early, middle, and late days of the study. This result indicated there was no change in the amount of MSON exhibited due to time. The lack of
increase of MSON with repeated exposure is in contrast to the expectations of Zajonc (1968). The expectancy set forth by Zajonc is that interactions with both peers and the apparatus should increase with repeated exposure (i.e., familiarity).

11. Developmentally delayed preschool children exhibited more MSOFF in the low complexity environment than the developmentally delayed preschool children in the high complexity environment. This result is in keeping with the prediction set forth by previous research with normal children (Scholtz, 1973; Scholtz and Ellis, 1975; Wright, 1982). That is, children playing in environments of lower levels of functional complexity tend to exhibit less amounts of motor behavior on the apparatus but rather seek stimulation from other elements of the environment (i.e., other children). Therefore, this finding indicates that in the instance of the present study, developmentally delayed preschool children behaved in a way similar to normal children.

12. Developmentally delayed preschool children exhibited less MSOFF during the early days of the study than during the middle and late days of the study. This result is supportive of previous research conducted with normal children by Scholtz (1963), Scholtz and Ellis (1975), and Weilbacher (1980) that over time, children tend to satiate on the motor potential of the play equipment and begin to seek optimum levels of arousal from other sources in the environment. In this case, the other source was associative or cooperative activities with a peer on the floor of the playspace.

When the motor and social components of this variable were considered separately, the result is supportive of the arousal theory. The
expected motor outcome was an increase in the amount of time spent off the apparatus over the length of the study. Social behavior, in the context of arousal theory, would be expected to increase over time.

13. There was no significant difference in the amount of EXTRS exhibited by developmentally delayed preschool children in the low complexity environment and high complexity environment. Minimal amounts of EXTRS were exhibited by both groups of children in this study. The slightly greater amount of EXTRS of the low complexity group is in keeping with previous research by Scholtz (1973). The findings by Scholtz (1973), that extraneous activity decreased with higher levels of complexity and that social activity was greater in environments of lower complexity, were in agreement with the results of this study.

14. There was no significant difference in the amount of EXTRS exhibited by developmentally delayed preschool children during the early, middle, and late days of the study. Again, the minimal amount of EXTRS exhibited by the developmentally delayed preschool children may explain the lack of significant findings. EXTRS tended to increase across the early, middle, and late days. Although not significant, the increase from early to late days was in agreement with the results of previously discussed research. Increases in social activity were expected to occur with repeated exposure, while increases in simultaneous extraneous activity were also expected in light of the discussion of Maddi (1968).

15. There was no significant difference in the amount of NA exhibited by developmentally delayed preschool children in the low complexity environment and the high complexity environment. The amount of time
children spend disengaged from activity has been reported by Scholtz (1973) to have an inverse relationship to the level of complexity of the environment. Therefore, in order to support the results of Scholtz (1963), the amount of NA exhibited in the low complexity environment would have to be greater than that of the high complexity environment. The result of the NA analysis for the present study did not show significant differences due to the level of complexity. The scores for both environments are nearly equal. Due to the large number of intervals in which NA occurred in both the low and high complexity environments, the understanding of such data appears to be important.

Two factors that may have contributed to the high level of non-activity include the uniqueness of the play situation (i.e., the play equipment, the presence of two unfamiliar adults) and environmental variables such as the excessive temperature of the research environment during several days of the study. Another possible explanation involves the lack of initiative exhibited by many of the developmentally delayed children.

16. There was no significant difference in the amount of NA exhibited by developmentally delayed preschool children during the early, middle, and late days of the study. The amount of time spent disengaged from activity was not statistically different at different points throughout the study. Minimal differences were seen among the days of the study with a slight increase occurring from early to middle days followed by a decrease between the middle and late days. The relatively large amount of NA exhibited throughout the days of the study appears to be of importance. As previously discussed, determining the reason for...
such behavior is important to the understanding of the behavior of developmentally delayed preschool children in play environments.

17. Developmentally delayed preschool children exhibited significantly more MON in the high complexity environment during the early and middle days of the study than in the low complexity environment. This result, as well as that of other MON data, was supportive of arousal theory. As predicted, the amount of motor activity in connection with the play apparatus was greater in the high complexity environment during the early and middle days.

Low complexity data indicated an increase in MON between the middle and late days. This increase was not supportive of arousal theory. The expected outcome was one of continual decrease. This can possibly be explained in that one group of children who showed large gains in MON during the late days required consistent intervention due to inappropriate social behaviors (i.e., fighting). When this behavior occurred and the investigator stopped the inappropriate behavior, the children frequently returned to play on the apparatus.

Another explanation was one that supports Zajonc (1968). That is, upon repeated exposure to the apparatus, more interaction occurred.

The results of the present investigation were both supportive and contradictory of existing research based on the arousal theory. These results are important in that they help define the behaviors of developmentally delayed preschool children in play environments.

In the present investigation, the effect of time appeared to have a greater impact upon the motor and motor-social behaviors of the children than the level of complexity. The amount of MON, MOFF, EXTR, and
MSOFF changed with time. Only MON and MSOFF were significantly different due to complexity. Of the significant results, only those associated with MOFF due to time did not support the results of previous research based upon arousal theory. The statement, therefore, may be made that developmentally delayed preschool children behaved in similar fashion to normal children in terms of the MON, EXTR, and MSOFF exhibited in play environments of low and high complexity.

Implications for Practice

The behaviors demonstrated by developmentally delayed children in play environments of low and high complexity had not been defined prior to this investigation. The results of the present investigation may be viewed in terms of their application to individuals concerned with providing appropriate play environments for mentally handicapped preschool children.

For the landscape architect and educator interested in designing indoor or outdoor playspaces for mentally handicapped children, the results of the present study indicate that a play environment of high complexity is effective in eliciting large amounts of MON and lesser amounts of MSOFF than low complexity play environments.

For public school and recreation personnel interested in providing play opportunities for mentally handicapped children in a mainstream situation, the following may be noted. Mentally handicapped preschool children exhibited motor and motor-social responses similar to those of normal children across time in environments of low and high complexity. Therefore, it may be possible for mentally handicapped and normal children to share common play environments. The success of common
usage requires the acknowledgement of and provision for the range of physical abilities possessed by the children.

For teachers and parents interested in developing motor and social skills within mentally handicapped children, the results of this study supported the idea that play environments can be designed to elicit desired responses. That is, if motor behaviors are the desired outcome, then environments high in complexity are called for.

The effect of repeated exposure to play apparatus over longer periods of time needs to be taken into consideration as well by those involved in designing play opportunities for mentally handicapped children. Repeated exposures are shown to influence the type of activity exhibited. If social behaviors are desired, continuous interaction with the same play apparatus should lead to the display of social activity. On the other hand, if motor activity while interacting with play equipment is desired, then a periodic change in the configuration or pieces of equipment may be in order.

Implications for Further Research

The following recommendations for further study are based upon information gained from the present investigation:

1. Repeat this study to determine the effect of unfamiliar peers and more novel play equipment upon the motor, social, and motor-social behaviors of developmentally delayed preschool children. The degree to which a child is familiar and compatible with the other children in the playgroup and familiar with the play equipment may influence his/her play behaviors. Situations within the groups of children involved in the present study indicated the importance of peer familiarity. While
this was not measured, certain children were noted to avoid other children within the group. This behavior may have had an effect upon the motor and social behaviors of the child.

2. Repeat this study with children grouped according to developmental level (i.e., 1-year delay, 2-year delay, etc.) based upon a standardized test given at the time of the investigation. In the present study, children were randomly assigned to groups resulting in a combination of children of various levels. Understanding the behaviors of children of specific developmental levels could be useful in situations involving homogeneous classrooms or schools.

3. Repeat this study with different age groups (e.g., ages 2, 3, 7, 8). The 4-, 5-, and 6-year-old children involved in the present study responded to the functional complexity differences of the two environments. It would be interesting to see the motor, social, and motor-social responses of children of various ages. Such information could be helpful in designing appropriately complex play environments to be used for a range of age groups.

4. Repeat this study to determine whether sex is an influential factor upon the motor, social, and motor-social behaviors of developmentally delayed preschool children. In the present study, the number of same-sex peers within each group of children was not controlled. Two groups consisted of three boys and one girl, while three groups were made up of two boys and two girls. The sixth group contained three boys. The tendency may exist for the behaviors of a single child of one sex to be influenced by the other children of the opposite sex.
5. Repeat this study using children of normal cognitive development as models for developmentally delayed/mentally handicapped children. That is, compare groups of delayed children to groups of other delayed children in which normal models are present. In the present study, situations occurred in which some of the children did not initiate play until a peer within the group began to play. The presence of normal models may also influence the initiation of play.

   Normal models may also influence the variety and quality of motor, social, and motor-social behaviors exhibited by the delayed children. Differences between the quality of play of the delayed children and the normal children from the pilot study were noted and are worthy of further investigation.

6. Repeat this study as part of the daily free play of a class of children in a naturalistic setting. By observing the play behaviors of an entire class, more insight may be obtained as to the influence of larger numbers of children upon the motor, social, and motor-social behaviors of preschool children.

7. Repeat this study to improve the external validity. In the present study, the school involved was purposefully selected, thus limiting the extent to which the results may be generalized. By replicating the present procedures, the results may have greater generalizability to other settings.

8. Repeat this study with parallel groups of normal and developmentally delayed preschool children. By observing the motor, social and motor-social behaviors of both normal and developmentally delayed children in identical play settings, more direct comparisons may be made.
Such information would give insight to situations in which normal and developmentally delayed children share common playspaces.
APPENDIXES
BEHAVIORAL AND SOCIAL SCIENCES
HUMAN SUBJECTS REVIEW COMMITTEE (HSRC)
THE OHIO STATE UNIVERSITY

Submission Date: ____________________ Protocol No.: B3B0060
Meeting Date: 4-15-83

The research protocol entitled "THE EFFECTS OF PLAY ENVIRONMENT COMPLEXITY ON
THE MOTION AND SOCIAL ACTIVITY OF NORMAL AND DEVELOPMENTALLY DELAYED PRESCHOOL
CHILDREN" by Jacqueline Herkowitz, Donna J. Hester
(Principal Investigator)
Health, Physical Education & Recreation
(Department & College)
109 Pomerene Hall, 1780 Neil Avenue
(Campus Address)

was presented for review by the Human Subjects Review Committee to ensure the proper
protection of the rights and welfare of the individuals involved with consideration of the
methods used to obtain informed consent and the justification of risks in terms of potential
benefits to be gained. The Committee action was:

☐ APPROVED
☐ APPROVED WITH CONDITIONS BELOW
☐ DEFERRED - COMMENTS BELOW
☐ DISAPPROVED
☐ NO REVIEW NECESSARY

(Signature of Committee Member)

CONDITIONS/COMMENTS:
Subjects were deemed NOT AT RISK and the protocol was unanimously APPROVED WITH THE FOLLOWING
CONDITIONS:
1. Provide indication of agreement from OSU Prep
School and Forest Park School
2. Provide copy of the letter describing the study
to the parents (should request permission to
use school records and inform parents of the use
and disposition of the video tapes)

If you agree to the above conditions, please sign this form in the space(s) provided and return it with any additional information requested to Room 205, Ohio State University Research Foundation, 1314 Kinnear Road, Campus, within one week. Upon such compliance, the approval form will be mailed to you. (In the case of a
defered protocol, please submit the requested information at your earliest convenience. The next meeting of the Committee is two weeks from last meeting date.)

Date: April 20, 1983
Signature

(Date of Submission)

Signature

(Date of Review)

(Signature of Committee Members)

(Chairman, Behavioral and Social Sciences
Human Subjects Review Committee)

Form 2A-01A
OHIO STATE UNIVERSITY
Social & Behavioral Sciences
Human Subject Review Committee
Research involving Human Subjects

PROTOCOL NO: 025B
ORIGI/NAL REVIEW
CONTINUING REVIEW
FIVE-YEAR REVIEW

ACTION OF THE REVIEW COMMITTEE

With regard to the employment of human subjects in the proposed research entitled:

THE EFFECTS OF PLAY ENVIRONMENT COMPLEXITY ON THE MOTOR AND SOCIAL ACTIVITY OF NORMAL AND DEVELOPMENTALLY DELAYED PRESCHOOL CHILDREN

is listed as the principal investigator.

Jacqueline Herkovitz, Donna J. Heather

Health, Physical Education & Recreation

The Social & Behavioral Sciences Review Committee has taken the following action:

☐ Approved  ☐ Disapproved
☒ Approved with conditions *
☐ Waiver of Written Consent Granted

* Conditions stated by the Committee have been met by the Investigator and, therefore the protocol is approved.

It is the responsibility of the principal investigator to retain a copy of each signed consent form for at least four (4) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subject Review Committee for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the Review Committee, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: MAR 15 1983

Signed:  [Signature]

Chairperson

cc: Original - Investigator

File

HS- 025B (Rev. 7/81)
Ms. Donna Hester  
632 Jasonway Avenue  
Columbus, Ohio 43214  

Dear Ms. Hester:

Thank you for clarifying the issues involved in conducting your study on The Effects of Play Environment Complexity on the Motor and Social Activity of Normal and Developmentally Delayed Preschool Children. This letter serves as the official approval for your study to be conducted at Forest Park Early Education Center. Your next step will be to contact Ms. Sherrie Ireland to assist you in the logistics of the study.

I am enclosing several summary forms which must be submitted to me on a monthly basis.

Good luck with your study and if you have any more questions please contact me.

Sincerely,

Lynn Krause, Ph.D.
Assistant Superintendent

cc: Sherrie Ireland

Enclosures

LK/JW
REQUEST FOR DISCLOSURE OF EDUCATIONAL RECORDS
BY ORGANIZATION CONDUCTING A STUDY

Name: The Ohio State University/School of Health. (Organization conducting study)

Address: 1760 Neil Avenue, Columbus, Ohio 43210

Contact: (Name) Donna J. Hester or Dr. Jacqueline Herkowitz (Telephone) 422-8564/5679

I, Donna J. Hester, as the authorized agent of the above named organization, request the disclosure by the Franklin County Board of Mental Retardation and Developmental Disabilities (FCBMR/DD) of the following educational records:

Those educational records that will define and verify the nature and extent of
the developmental delay of each child participating in the study.

This disclosure is requested in order to assist the above named organization in conducting the following study:

The Effects of Play Environment Complexity on the Motor and Social Activity of Normal and Developmentally Delayed Preschool Children. which study is being conducted for, or on behalf of, the following educational agency or institution:

(Name) Same as above (Address)

The purpose of this study is: a) To develop, validate, or administer predictive tests; b) to administer student aid programs; or c) to improve instruction. (Circle a, b, or c)

(Explain specifically) The purpose of this study is to contribute to the understanding of the effects of manipulating the functional complexity of play environments upon the amount and type of motor and social activity of normal and developmentally delayed preschool
children.

This study will be conducted in a manner which will not permit the personal identification of students and their parents by individuals other than representatives of the above named organization. The disclosed information will be destroyed when no longer needed for the purposes for which the study was conducted. Upon completion, a copy of the study will be provided to FCBMR/DD.

Signature: Donna J. Hester

Date: 4/19/88 Title: Graduate Teaching Assistant

MJK:jb
Letter to Parents

May 31, 1983

Dear Parents,

I am a graduate student at The Ohio State University and am currently working on a Ph.D. degree in Physical Education. The topic of my dissertation involves how much time preschool children spend moving on various pieces of play equipment. The research is being supervised by my advisor, Dr. Jacqueline Markowitz, Associate Professor of Physical Education at The Ohio State University. I have received permission from Dr. Lynn Krause to do my study at Forest Park Early Education Center. With your permission, I would like your child to be a participant.

Let me tell you what the experience will be like for your child. Several pieces of play equipment (trestles, a slide, a ladder, a walking board, and a large plastic box) similar to those found in the school will be set up in the gymnasium. The equipment is constructed of high quality materials and is very safe. All necessary safety precautions will be taken to avoid possible injuries. Two adults will be in the playspace observing and providing supervision. Mats will cover the floor of the entire playspace to provide extra protection. Along with your child, there will be three other children from the same class playing on the equipment. The four children will remain in the playspace for fifteen minutes each day for twelve consecutive school days. All of the sessions will be recorded on videotape and viewed at a later date to determine the amount of time spent playing on and off of the equipment alone and while interacting with the other children. Each child will wear a different colored vest as a means of identification.

To ensure confidentiality, your child's name will not be recorded on the tapes or within the text of the dissertation. I have requested information from the school regarding the developmental status of each child. This information will not be connected with the name of the child but it will be included in the dissertation.

I have arranged for the study to take place from Monday, June 27 through Wednesday, July 13. It will be very helpful for your child to attend school every day during that period. However, I understand that circumstances such as illnesses and special events may occur that will not allow your child to attend every day.

After reading the description of the study, I hope you will agree to allow your child to participate in the play activities. This should be an enjoyable experience for all of the children involved. Please sign the attached permission slip and return it to your child's teacher by Tuesday, June 7. If you have any questions, please feel free to call me at 422-8586 during the day, 459-2368 during the evening, or call my advisor during the day at 422-5679. Thank you for your cooperation.

Sincerely,

Donna J. Wester

cc: Lynn A. Krause, Ph.D.
PERMISSION FORM

I give permission for my child __________ to participate in the research study conducted by Donna J. Hester for her dissertation work and supervised by Dr. Jacqueline Herkowitz, Associate Professor. The nature and general purpose of the research procedure has been explained to me. I understand that any further questions that I may have will be answered. I understand that my child, along with three other children from his/her class, will be videotaped while playing for fifteen minutes each day for twelve consecutive days. Two adults will be observing and supervising these sessions. The videotapes will be used only for purposes of this research or as a means for instructing other researchers or teachers. The videotapes will not be sold or used for commercial purposes. I understand that my child's name will not be revealed. Finally, I understand that I am free to withdraw my consent and discontinue my child's participation at any time following the notification of the investigator, Donna J. Hester. A copy of this form will be given to me upon request.

_________________________  _______________________
Signature of Parent          Date

_________________________
Investigator

I would like to receive a copy of this permission form:  YES  NO
Follow-up Letter to Parents

June 16, 1983

Dear Parents,

On June 1, 1983, you received a letter from me asking permission for your child to participate in a research study on motor and social play behaviors of four- and five-year-old children. This project is the final step in completing my Ph.D. degree at Ohio State University.

Because of busy end-of-school-year schedules, I understand that some letters may have been misplaced or you may not have had time to return the consent form. I have appended a copy of the previous letter and another consent form for your use. This letter describes the nature of the play sessions and tells you how to contact me if you have questions. I would be most happy to talk to you about the play sessions or to show you a videotape of my pilot study.

In order to make this project acceptable, a larger portion of the four- and five-year-old preschoolers attending Forest Park is needed. Your permission for your child to participate will be greatly appreciated. If you will give such permission, please return the signed consent form by Wednesday, June 22, 1983 in the enclosed stamped addressed envelope.

Thank you for your cooperation.

Sincerely,

Donna J. Hester

cc: Lynn A. Krause, Ph.D.
    Sherrie Ireland
Thank you Letter to Parents

July 12, 1983

Dear Parents,

Thank you for allowing your child to participate in my research study on the motor and social behaviors of preschool children. The play sessions have gone very well and the children have been eager to participate.

The last two days of the project are scheduled for Thursday and Friday of this week. Hopefully, all of the children will be present for these final play sessions since these two days are very important to the results of my study.

Again, thank you for your cooperation and that of your child. If you have any questions, please feel free to call me at 459-2368. The results of the study will be available from Sherrie Ireland in September.

Sincerely,

Donna J. Hester
APPENDIX B

DEVELOPMENTAL INFORMATION
Table 20
Developmental Information by Subject

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*Down's Syndrome Child
Table 21
Developmental Information by Group

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APPENDIX C

DESCRIPTION AND

DIMENSIONS OF PLAY APPARATUS
Description and Dimensions of Play Apparatus

The play apparatus for this study included two 70 cm by 115 cm by 90 cm metal trestles, a 185 cm by 23 cm aluminum board, a 246 cm by 23 cm aluminum board, a 170 cm ladder, and a five-sided plastic box that measured 70 sq cm on each side. Eight tumbling mats (four 122 cm by 183 cm mats, three 183 cm by 183 cm mats, and one 183 cm by 366 cm mat) covered the floor of the play area.

To insure that the apparatus was not moved by the children, the two metal trestles and the plastic box were secured to the mats with heavy duct tape. Holes were drilled in the trestles, boards, and ladder so that bolts and wingnuts could be used to secure the ladder and boards to the trestles.
APPENDIX D

CODING SHEET AND OBSERVER TRAINING INSTRUCTIONS
Observer Training Instructions

Motor

When you hear the signal to observe interval one, observe the assigned child for the five second observation interval. Upon hearing the signal to record, indicate the appropriate motor category on the coding sheet. Continue this procedure for three minutes.

In determining the appropriate motor category make a judgment regarding the child's movement that occurred for the majority of the five seconds. If the movements are locomotor or nonlocomotor in nature (see attached sheet for definitions), then the category will be MON or MOFF. If the movements are not locomotor or nonlocomotor, then the category will be EXTR. An interval involving no movement whatsoever will be recorded as NM.

Social

When you hear the signal to observe interval one, observe the assigned child for the five second observation interval. Upon hearing the signal to record, indicate the appropriate social category on the coding sheet. Continue this procedure for three minutes.

In determining if a child is engaged in Social Activity (SA), two interactive behaviors must be attended to--those involving touching, hitting, holding, following, and imitating as well as verbal interactions such as talking, laughing, and singing. The verbal interactions will be cued by the investigator and heard as the color of the shirt worn by the child involved. SA should be recorded when the color worn by the observed child is heard at any time during the five second observation
interval. SA should, also, be recorded when the child engages in any of the other social behaviors for the majority of the five second interval (i.e., touching, hitting, holding, following, imitating). Anytime a child is out of the playspace and his/her color has not been named, indicate the social behavior as NS.

Motor Activity On the Apparatus (MON)

MON occurred when a child was engaged in locomotor or nonlocomotor movements while in physical contact with or encapsulated by the play apparatus (i.e., trestles, ladder, slide, and box) within the play environment for the majority of the five second interval. Locomotor movements were movements of the body which involved traveling from one place to another in space (i.e., leaping, walking, running, galloping, skipping, jumping, hopping, sliding, climbing, scooting, crawling, creeping, rolling). Nonlocomotor movements were movements of different body parts or the body as a whole while remaining in the same location (i.e., swinging, swaying, bending, stretching, rising, falling, rocking, twisting, turning, lifting, pushing, pulling, striking). Encapsulation occurred when a child was inside or under a piece of apparatus.

Motor Activity Off the Apparatus (MOFF)

MOFF occurred when a child was engaged in locomotor or nonlocomotor movements on the floor (that is, not in physical contact with or encapsulated by the equipment) within the play environment for the majority of the five second interval. Locomotor movements were movements of the body which involved traveling from one place to another in space (i.e., leaping, walking, running, hopping, galloping, skipping,
jumping, sliding, climbing, scooting, crawling, creeping, rolling).
Nonlocomotor movements were movements of different body parts or the body as a whole while remaining in the same location (i.e., swinging, swaying, bending, stretching, rising, falling, rocking, twisting, turning, lifting, pushing, pulling, striking).

Nonmotor Activity (NM)

NM occurred when a child was in a stationary position (e.g., sitting, kneeling, standing, lying) within the play environment for the majority of the five second interval.

Extraneous Activity (EXTR)

EXTR occurred when a child was engaged in movement behaviors that were not categorized as locomotor or nonlocomotor movements for the majority of the five second interval. EXTR included interactions with components of the environment exclusive of the play apparatus (i.e., the cone and rope barrier, the mats, the tape and bolts securing the apparatus, the walls) and other extraneous movements such as pulling on clothing, shoes, or eyeglasses. EXTR also included repetitive behaviors that are often characteristic of the population (i.e., tapping fingers, flapping hands and arms, rotating the head, clapping hands) as well as movements such as rubbing the eyes and touching the hair.

Social Activity (SA)

Social activity occurred when a child engaged in associative or cooperative group play (Parten, 1932) with at least one other child (that is, physically or verbally interacted with another child in similar
if not identical activity). SA included talking to, singing with, laughing at, holding, touching, hitting, following or imitating another child. SA occurred when holding, touching, hitting, following or imitating another child took place for the majority of the five second interval or when verbal interactions (i.e., talking, singing, laughing) occurred within the interval (as determined by the investigator's cues on the videotape).

Nonsocial Activity (NS)

NS was defined as the opposite of SA.
Definitions of Locomotor and Nonlocomotor Movements

Locomotor Movements

"Walking is the transfer of weight from one foot to the other while moving forward or backward. One foot must always be in contact with the floor" (walking surface) (Kirchner, 1981, p. 54).

"Running is the transfer of weight from one foot to another with a momentary loss of contact with the floor by both feet" (Kirchner, 1981, p. 56).

"Leaping is the transfer of weight from one foot to the other. The toe of the takeoff foot leaves the floor last, while the ball of the landing foot contacts the floor first" (Kirchner, 1981, p. 58).

"Galloping involves the combination of a step and a hop with the same foot always leading in the direction of the movement (moving forward or backward)" (Gallahue, 1982, p. 197).

"Jumping is the transfer of weight from one foot or both feet to both feet" (Kirchner, 1981, p. 59).

"Hopping is the transfer of weight from a foot to the same foot" (Kirchner, 1981, p. 60).

"Skipping is a combination of a long step and a short hop, alternating the lead foot after each hop" (Kirchner, 1981, p. 61).

"Sliding is a sideways locomotion, one foot brought sideways close to contact with the other foot, which then moves sideways away from the body; weight shifts from side to side in one direction" (Seaman and DePauw, 1982, p. 371).
Crawling involves keeping the abdomen in contact with a surface, moving forward or backward by pushing or pulling with the arms and pushing with the legs (Arnheim and Pestolesi, 1978, p. 96).

Creeping involves a four-point position for locomotion. It consists of moving forward on hands and knees, elbows and knees, or hands and feet (Seaman and DePauw, 1982, p. 367).

Climbing involves using the limbs in opposition to the force of gravity to pull the body (also to include descending) (Gallahue, 1982, p. 204).

"Rolling is defined as continued transference of weight along adjacent body parts, or body parts that are made adjacent" (Logsdon, 1977, p. 103).

Scooting involves a slide forward in a seated position using the heels with which to dig in; arms may be used as well (Cratty, 1979, p. 61).

Nonlocomotor Movements

"Swinging is a pendular movement with the axis of support above the moving parts, such as an arm swinging from the shoulder in a downward and backward movement or a leg swinging from side to side" (Kirchner, 1981, p. 63).

"Swaying is the same type of movement (as swinging), but with the support below the moving parts" (Kirchner, 1981, p. 63).

"Bending is flexing any or all parts of the body" (Kirchner, 1981, p. 64).

"Stretching is extending any or all parts of the body" (Kirchner, 1981, p. 64).
"Rising is the slow movement of the body or any part of it to a higher level" (Kirchner, 1981, p. 65).

"Falling is the controlled gradual relaxation by the body or any part of it while moving to a lower level" (Kirchner, 1981, p. 65).

"Twisting is the rotation of the body or any part of it while maintaining a stable base of support" (Kirchner, 1981, p. 66).

"Turning is a partial or total rotation of the body, thus shifting the base of support" (Kirchner, 1981, p. 66).

"Striking is a percussive-type movement directed toward an object or person, real or imaginary" (Kirchner, 1981, p. 67).

"Pushing is directing a force or object away from the base of support, such as pushing a door open or pushing against an imaginary object with one foot" (Kirchner, 1981, p. 68). "A push is a forceful movement made to move some object away from the body or a movement made against an object to move the body away from it. A push may be made by the legs, wrists, arms, feet, hips, shoulders, or combinations of these" (Schurr, 1980, p. 249).

"Pulling is directing a force or object toward the body, such as pulling a wagon" (Kirchner, 1981, p. 68). "Pulling is a forceful movement made to move or draw an object toward the body" (Schurr, 1980, p. 248).

A lift is a movement that raises an object or body part from one level to another (Schurr, 1980, p. 248).

"Rocking occurs when the center of gravity is fluidly and gradually transferred from one body part to another" (Dauer, 1983, p. 201). "Rocking occurs when the body weight is transferred back and forth along the same body surfaces" (Logsdon, 1977, p. 102).
APPENDIX E

CODER RELIABILITY CHECK
Table 22
Coder Reliability Checks

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Table 23 (continued)

ID = Identification number of each child.

COMPLEX = Level of Complexity, 1 = Low Complexity, 2 = High Complexity.

GROUP = Identification number of each group.

TIME = Days - 1 = Early Days, 2 = Middle Days, 3 = Late Days.

MON = The number of intervals engaged in Motor Activity On the Apparatus.

MOFF = The number of intervals engaged in Motor Activity Off the Apparatus.

EXTR = The number of intervals engaged in Extraneous Activity.

NMS = The number of intervals engaged in Nonmotor Social Activity.

MSON = The number of intervals engaged in Motor-Social Activity On the Apparatus.

MSOFF = The number of intervals engaged in Motor-Social Activity Off the Apparatus.

EXTRS = The number of intervals engaged in Extraneous-Social Activity.

NA = The number of intervals engaged in Nonactivity.
REFERENCE NOTES
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LIST OF REFERENCES
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