THE EFFECTS OF COMPLEXITY ON PLAY EQUIPMENT USAGE OF THREE-, FOUR-, AND FIVE-YEAR-OLD CHILDREN

THESIS

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

By

Curt L. Fowler, B. S.
Denton, Texas
December, 1981

Fowler, Curt L. The Effects of Complexity on Play Equipment Usage of Three-, Four-, and Five-Year-Old Children. Master of Science (Physical Education), December, 1981, 79 pp., 7 tables, 8 illustrations, references, 58 titles.

Fifteen three-, four-, and five-year olds were assessed for the amount of time they spent on, off, under, and touching play equipment in an environment with play events and one without (i.e. the platform condition). An ABAB experimental design was used. Treatments lasted 3 days a week for 4 consecutive weeks, with each age group being videotaped 20 minutes each day.

Data collected from the videotapes was applied to a 3 x 4 (age x treatments) ANOVA and revealed at the .05 level (a) significantly more on and touching in the play event conditions; (b) significantly greater off and under in the platform (non play event) conditions; (c) a significant increase in off behavior from the first to second play event condition; (d) three-year-olds spent more time under and touching, and significantly less time on; and (e) significant interactions for on and under which seemed to be caused by the three-year-olds showing an inordinate amount of under behavior in the second platform condition. These results supported the assumption that play events would cause a significant increase in active child-equipment interaction.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION

During infancy and early childhood a large portion of what a child knows has been learned through what is normally called play (Caplan & Caplan, 1973; Hewes, 1975). This includes a child's knowledge of basic motor patterns (Beckwith, 1980).

One factor that can be influential in the acquisition of certain motor patterns during this period is the child's play environment (Caplan & Caplan, 1973; Espenschade & Eckert, 1980; McGraw, 1935). According to McClenaghan and Gallahue (1978) the environment should be structured to stimulate the repetitive use of a wide variety of motor patterns so that mastery of the patterns will occur. If the environment is restrictive with regard to motor development it may have adverse effects upon the child, not only motorically, but also psychologically (Espenschade & Eckert, 1980; McGraw, 1935) and intellectually (Caplan & Caplan, 1973).

In recent years play equipment designers have increased the complexity of their designs in an apparent attempt to stimulate environmental interaction. Studies isolating specific design features will help clarify their

influence on play, and thus their influence on the development of children.

Statement of the Problem

This investigation was concerned with how the play event design feature influences preschool children's use of a play environment.

Purpose of the Study

The purpose of this study was to compare a play environment with play events to one without play events through selected measures of equipment usage. This was done to determine if the play event design feature is a viable design factor to be considered when designing play environments.

Basic Assumptions

1. Basic to this project was the assumption that the amount of time children spent interacting with the environment was a measure of its complexity (or arousal).

2. Due to prior exposure to the play environment it was assumed that novelty did not affect play behavior.

Hypotheses

To carry out the purpose of the study, the following hypotheses were tested:

1. There will be significant treatment condition differences with respect to equipment usage.

2. There will be significant age group differences across treatment conditions with respect to equipment usage.

3. There will be significant age x treatment interactions with regard to equipment usage.

Significance of the Study

This study was conducted to ascertain the influence of play events on preschool children's play. This should be of vital interest to any person who deals with children and their development since the environment a child plays in can have such a profound effect on motor, psychological, and intellectual development (Caplan & Caplan, 1973).

This study was significant in that it

1. Determined how play events used in a play environment influence equipment usage.

2. Provided a rationale for the inclusion of play events in contemporary play environments.

Definition of Terms

Play (theoretical)--Play is an arousal-, or stimulus-seeking behavior (Ellis, 1973) "that maintains an optimal flow of stimulation for the individual" (Levy, 1978, p. 137).

Play Events (theoretical)--Play events are the arousal providing parts of a play structure (Beckwith, 1979b) and are considered a means of increasing structural complexity (Bruya, 1980a).

Play Events (operational)--The play events used in this study were a tire swing, wide slide, cargo net, suspension bridge, log climber, inclined boards, and sandboxes.

Traditional Playground (operational)--The traditional playground is made up of single pieces of equipment scattered across a designated area. The equipment is usually made of metal, frequently limits social interaction, and ordinarily encourages a single pattern of use (see Appendix A).

Contemporary Play Environment (operational)--The contemporary play environment is a unified structure (Shaw, 1976) with platforms or play staging areas used to link play events together. The platforms provide social areas both on and beneath them. The play events are often modifications of traditional play apparatus (e.g., a wide slide) or are unique pieces of equipment (e.g., a cargo net). Play events and platforms are designed to maximize creative play by implying that there is no wrong use. The variety of materials used (e.g., wood, rope, sand, gravel, rubber, metal, etc.), along with other sources of stimulation

(different colors, shapes, heights, textures, etc.) adds to the sensory information available to the child (see Appendix B).

Complexity (theoretical)--Complexity refers to the amount of variety in the stimulus environment (Ellis & Scholtz, 1978).

High-Complexity Setting or Play Event Phase (operational)--The high-complexity setting or play event phase is characterized by the inclusion of seven play events in a contemporary play environment (see Appendix C).

Low-Complexity Setting or Platform Phase (operational)--The low-complexity setting or platform phase is characterized by the removal of all seven of the play events from the play environment, and replacing them with platforms of approximately equal square footage which allow the same pathways of movement both on and under (see Appendix D).

Equipment Usage (operational)--Use of the equipment was categorized as follows: (a) on the equipment, i.e., the individual's weight is being supported by a play event or platform; (b) touching the equipment while off of the structure, but not under it; (c) under the equipment; and (d) off of the equipment, but not under or touching it (i.e., non-use).

Active Equipment Interaction or Usage (operational)--Active interaction with the equipment is defined as on and touching behavior.

Passive Equipment Interaction or Usage (operational)--Passive interaction with the equipment is defined as play behavior that occurs under the equipment.

Limitations

Each age group had a different number of children at the start of the study. Also, group size for each age differed from day to day due to sickness or other uncontrollable factors. This may have affected the children's behavior because of differing levels of social complexity (Wade & Ellis, 1971).

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Several factors have contributed to change in the design of playgrounds. These factors include such things as play theory, design theory, and play research. The following review was compiled to cover such pertinent areas, and by doing so, aid in the reader's comprehension of the project.

Classical Play Theories

As far back as the Greek civilizations, play has been the subject of speculation and conjecture (Ellis & Scholtz, 1978). Speculations and theorizations prior to the turn of the century have been described as the classical theories of play (Ellis, 1973). These include the surplus energy, preexercise, recapitulation, recreation, and relaxation theories of play (Levy, 1978).

The surplus energy theory of play proposes that "play is the result of a surplus energy that is no longer needed for basic survival" (Ellis, 1973, p. 78). It is based on the concept that when "the young are freed from the necessity of self-preservation through the actions of their

parents . . . . the aimless, exuberant pursuit of fun and happiness" (Levy, 1978, p. 78), or play, results.

The preexercise theory of play postulates that play is used to refine incomplete hereditary instincts necessary for survival in adult life (Ellis, 1973; Levy, 1978). It was heavily influenced by Darwin, who hypothesized that man inherits "some common blueprint of genes, which ultimately accounts for human conduct" (Levy, 1978, p. 81).

"The theory of play as a recapitulation argues that the process of development of an organism recapitulates the history of its development as a species" (Ellis, 1973, p. 42). Through this process play is seen as the re-enactment of behavior traits which have kept man alive over the ages (Levy, 1978). Though the original theory did not explicitly state that play follows a linear progression of the developmental stages associated with a race, it is now assumed to be part of the theory (Ellis, 1973).

In the recreation theory, play is perceived as the replenisher of energy. Work causes a deficit of energy by imposing heavy physiological and psychological demands on the individual. The individual is revived through self-directed activity that has no essential purpose and is a delusion of reality (Levy, 1978).

An extension of the recreation theory is the relaxation theory of play. This doctrine indicates that

recuperation from work occurs through play activities which simulate pursuits of primitive man, i.e., gross motor activities (Levy, 1978).

Despite their shortcomings and lack of empirical evidence each classical theory seems to explain certain aspects of play behavior:

> The play behavior of children does indeed seem to recapitulate, in a simplistic way, some of the behaviors that were presumably important to the race as it evolved toward its present state. Also, there does seem to be a mysterious capacity for the child to emit behavior that is unrelated to productive activities. It is reassuring to claim that there just happens to be an instinct for play. . . . In addition, quite clearly the activities of the child . . . at play practiced . . . responses that were used by the adult organism for productive activities. (Ellis, 1973, p. 45)

Likewise, how well the surplus energy theory of play seems to explain the explosion of play activity that often follows long periods of quiescence or deprivation (Ellis, 1973).

Recent Play Theories

At the beginning of the twentieth century play theorists began to attempt to link play behavior antecedent and subsequent events by way of cause and effect (Ellis, 1973). The theories that were popular during this period will be called the recent play theories. These theories grew out of psychological theories of personality, developmental psychology, and socialization theory.

Freud (1960), in his psychoanalytic theory of man, hypothesized that within the mind there lies a displaceable energy. This energy is used primarily in the service of the pleasure principle, which often results in play.

Freud (1950, 1958) explained that the child at play seeks pleasure and mastery. In other words the child "creates a world of his own, or more truly, he rearranges the things of his world and orders it in a new way that pleases him better" (Freud, 1958, pp. 44-45). In this pleasurable but serious world children strive for mastery over situations and things that have made a great impression on them in real life, while at the same time their play is dominated by the wish to be an adult and to do what adults do (Freud, 1950).

Like Freud, Erikson (1950, 1972) viewed play as a medium between fantasy and actuality. However, unlike Freud he viewed play from a social rather than an instinctive frame of reference. During play the child was thought to create model situations of reality where practice and eventual mastery occur. Erickson (1972) states that

> one of the playing child's tasks . . . is to try out some role pretensions within what he gradually learns is his society's version of reality and to become himself within the roles and techniques at his disposal. (p. 152)

Another cognitive psychologist, Dr. Jean Piaget, renowned for his developmental theory of intelligence, also

commented on play, imitation, and games and their cognitive correlates during development. His theory of ingelligence holds that mental structures are advanced through interaction with the environment by way of bringing to equilibrium assimilation (the bending of reality to fit present mental structures) and accommodation (the altering of mental structures to meet the demands of reality) (Piaget, 1962, 1976).

Piaget suggests that play occurs when a distorting or egocentric assimilation overrides accommodation (Piaget, 1976). Contrary to rational assimilation, which is based on the present, distorting assimilation is based on past experience, and as such, no attempt is made to accommodate the assimilated stimulus (Piaget, 1962). In other words, play is where a child does something just to do it with no attempt to increase intelligence. But as children increase in age and intelligence, they are seen to go through play stages of development where assimilation and accommodation increasingly differentiate, and in so doing become more complementary in their increasing equilibrium (Piaget, 1976). This increase in equilibrium or intelligence brings about a corresponding decrease in distorting assimilation and an increase in rational assimilation.

The reaminder of the recent theories are what Levy (1978) calls the socialization theories of play. These

theories are based primarily on the basic tenets of stimulus-response theory (Levy, 1978).

The supplemental and reactive compensation theories of play were founded on the premie that "people are motivated to play in order to compensate for a disability that delimits their behavior in other important spheres of life" (Levy, 1978, p. 162). The supplemental theory proposes that "desirable experiences, behavior and psychological states . . . that are insufficiently present in the work situation are pursued in a nonwork context" (Kando & Summers, 1971, p. 314). The reactive compensation theory describes play as an act where undesirable work experiences can be rectified (Kando & Summers, 1971). This includes the reduction of job tension and anxiety through play or recreation.

To determine why individuals emit certain types of behavior in a nonwork context, one must investigate variables other than the work-nonwork relationship. That is to say, one must look at how past experiences affect behavior responses to present stimuli. This general approach to the study of behavior implies that "learned play behavior responses to one set of stimuli, will also be evoked to other stimuli closely associated with the original set of stimuli" (Levy, 1978, p. 165). This generalization phenomenon, which has been termed "spillover" (Kando & Summers,

1971), accounts for some people's tendency to participate in nonwork activities which are the same as, or similar to, their work activities (Witt & Bishop, 1970).

In a theory of play which avoids the work-nonwork comparison, Roberts and Sutton-Smith (1962) introduced the concept of conflict-enculturation. This theory focuses on games and how they relate to the child-rearing practices of different societies.

Using information from 56 different societies Roberts and Sutton-Smith found that rearing practices seemed to have an effect on the games children play. The investigation revealed that games of strategy were related to obedience training and cultural complexity, games of chance were associated with high responsibility training, while games of physical skill or physical skill and strategy corresponded to societies which reward achievement and frequency of achievement.

> These relationships suggest a conflict-enculturation hypothesis of model involvement which . . . [advocates] that conflicts induced by social learning in childhood and later (such as those related to obedience, achievement and responsibility) lead to involvement in expressive models, such as games. (Sutton-Smith, Roberts, & Kozelka, 1963, p. 15)

These expressive models allow for the resolution of conflicts brought on by social learning, and as such, act as a place for the buffered learning of competencies needed in the large-scale culture (Sutton-Smith, Roberts & Kozelka, 1963).

The final socialization theory of play is the attribution theory. It is based on the assumption that a person's locus of control is a learned disposition. The theory asserts that persons with an internal locus of control will seek out play situations in which they can control the outcome, while persons with an external locus of control will look for play situations where any outcome will not be determined, completely, by their actions (Levy, 1978).

The recent theories of play are still being dissected through empirical investigation. With research and streamlining these theories may join the classics, but presently they remain somewhat uncertain explanations of play (Ellis, 1973).

Contemporary Play Theory

In 1973, Ellis rejected past play theories and formulated the stimulus-seeking theory of play based on research completed in the areas of human vigilence, manipulation and exploratory behaviors, and perceptual and sensory deprivation. These areas of research indicated a need for organisms to maintain an optimal level of arousal (Ellis, 1973; Ellis & Scholtz, 1978). This means an organism strives to increase low levels of arousal and decrease high levels of arousal. Stimulus-seeking achieves the former while stimulus-avoidance or reduction brings about the latter.

The concept of stimulus-seeking counters the drive-reduction proposition that the natural state of organisms is quiescence (Ellis, 1973; Millar, 1968; Weilbacher, 1980) and escapes the fault of previous theories based on drive-reduction, i.e., the lack of their ability to explain play or excess behavior emitted after all needs have been met (Ellis, 1973; Levy, 1978). As Ellis states, "The need to maintain optimal arousal has achieved the status of a new drive, and much of the surplus or playful behavior that is enigmatic can now be explained in terms of this drive" (p. 80).

> The drive for stimulation is an individual matter.
>
> First, each individual has a unique, intermediate level of arousal based on background experience and personal nature. Also, the level is nonpermanent and tends to grow and increase in complexity with experience and maturation. (Weilbacher, 1980, pp. 16-17)

Consequently, individuals seek stimulation appropriate to their unique level of optimal arousal, i.e., stimulus information which coincides or is slightly above their processing ability.

Once obtained, an individual tries to preserve an optimal level of arousal by depending on internal and external sources of stimulation (Ellis & Scholtz, 1978; Fiske & Maddi, 1961; Weilbacher, 1980). Although the external arousal sources are several, variation (or novelty and complexity) is noted for when there is an

absence of specific tasks (Fiske & Maddi, 1961), e.g., during play.

The stimulus-seeking theory of play focuses on the need to investigate the stimulus dimensions of play; in particular novelty or complexity. However, there is a lack of research in this area. Levy (1978) has asserted the need for field research to determine if laboratory findings are duplicated in a natural setting.

Playground History

Records indicate that the first American playground was built in New York in 1875 (Aaron, 1965). It included a wooden frame swingset that evidently became the precedent for the metal swingsets on many of today's playgrounds. Within ten years the city of Boston boasted of its first playground for children. This playground differed from New York's in that it was merely a supervised sand lot which had little or no equipment. Operating funds later provided equipment and pay for trained supervisors. In 1892, the city of Chicago opened a model playground in connection with the city's Hull House (Plantinga, 1977). The number of playgrounds increased as urbanization increased and men like Joseph Lee, the Father of the Playground Movement, fought for designated areas of play (Plantinga, 1977).

These early playgrounds, and equipment used on them, set the stage for concepts used in traditional play equipment design. This type of equipment design and its setting reflects two things: (a) the early, speculative nature of play theory, and (b) the wishes of city administrators (who purchase equipment) for durable, permanent, low maintenance structures (Dattner, 1969; Simpson, 1978). Because of this, equipment has remained primarily single-purpose metal structures which are scattered about a play area. Some people today would say that the designers of traditional equipment have failed to take into account the children's need for stimulus variation, social interaction, and lack of adult perceived order.

The stimulation provided by traditional equipment is greatly reduced after a child uses the equipment in its prescribed manner a few times (Caplan & Caplan, 1973). Frequently children are seen to resort to novel, and often dangerous, uses of the equipment (such as jumping out of a swing) after only a brief period of using the equipment in its designated manner. "What children actually do with play equipment is sometimes startlingly different from what its designers had in mind" (Stone, 1970, p. 15).

In 1943, C. Th. Sorenson, a Danish landscape architect, conceived the first junk (or adventure) playground based on his observation that children seemed to prefer

playing with scrap materials at construction sites rather than playing at playgrounds (Dattner, 1969; Frost & Klein, 1979; Plantinga, 1977; Simpson, 1978). This, the Emdrup Playground, was established in a housing development outside of Copenhagen, and was furnished with waste materials and a full-time supervisor (Dattner, 1969).

The idea that "children given the opportunity and the raw materials will design a playground far better than most facilities designed for them by adults" (Dattner, 1969, p. 61) spread throughout Scandinavia and many other countries in Europe. This is especially true in England, where one of the main proponents of adventure playgrounds, Lady Allen of Hurtwood (1968), has been highly involved in all aspects of their development.

Although the adventure playground movement has not been well received in the United States,[1] the belief that traditional playgrounds are insufficient in meeting the needs of children during play was adopted and used to create change.

In the early 1960's some designers attempted to alter or completely redesign play equipment to make it more conducive to play. These first attempts at designing new, creative playgrounds included architectural play structures,

---

[1]In 1977, The American Adventure Playground Association identified only 16 adventure playgrounds in the United States (Frost & Klein, 1979).

waste-material playgrounds, and well thought-out and planned playgrounds (Simpson, 1978).

Toward the mid-to-late 1960's people such as artists, architects, educators, and psychologists began to design what are currently called contemporary play environments. These environments, unlike those of the past, are often designed with a "contemporary knowledge of the physiological, emotional, social, and intellectual development of the child" (Beckwith, 1978, p. 1). They are often a complex series of platforms and arousal providing play events (Beckwith, 1979b) which are combined together to form an environment where the children playing can make the decisions on how it will be used. Frequently these environments include small semi-enclosed spaces, social places, and challenges at various skill levels that are not hazardous for children. They also usually make use of various materials, shapes, colors, textures, and surfaces to add to the stimulus properties of the environment.

Contemporary play environments often attempt to "give back" some of the experiences found in natural settings (Hewes, 1975) which were removed through urbanization. They also seemingly strive to foster creativity and imagination. Because of such intents these environments are often viewed as a learning tool for aspects of growth and development. As Miller (1972) states, "they are often freeing instead of limiting" (p. 38).

The functional use, along with the design of playgrounds, has changed drastically since 1875, with the greatest changes occurring in the last 30 to 40 years. Instead of designing pieces of equipment purely for recreational purposes, many designers now look at play equipment as a learning medium. This change has grown primarily from the observations of people such as C. Th. Sorenson, advances in play theory (see Fig. 1), and the recent increase in play research. These sources of information are and probably will remain the most important factors behind continual revisions in the understanding of play and play environments.

Variables in Modern Play Equipment Design

With the evolution of playgrounds certain variables were observed to be important in the designing of play environments. These variables include the play event, linking, and modular concepts (Bruya, 1980a).

Beckwith (1979a) was the first to label the play event concept for use in the design of play environments. The concept is based on the premise that play events are those parts of the play environment which are arousing to the individual (Beckwith, 1979b), and as such have play value. Thus, an environment with a multitide of play events will have a greater potential for play than one with fewer play events.

Play Theory

Pre 1850	
Speculation and Conjecture (Ellis & Scholtz, 1978)	Natural Settings (Aaron, 1965; Hewes, 1975)
1859	
Classical Theories (surplus energy, pre-exercise, recapitulation, and relaxation) (Ellis, 1973; Levy, 1978)	Natural Settings Vacant Lots designate for play; and Traditional Playgrounds (Aaron, 1965; Plantinga, 1977)
1920	
Recent Theories (psychoanalytic, developmental, and socialization) (Ellis, 1973; Levy, 1978)	Traditional Playgrounds dominate: Adventure Playgrounds begin; Modification of Traditional Equipment; and the Beginning of Contemporary Design (Beckwith, 1978, 1979b; Dattner, 1969; Frost & Klein, 1979; Plantinga, 1977; Simpson, 1978)
1970	
Contemporary Theory (stimulus-seeking (Ellis, 1973)	Contemporary Design considerations gaining support

Fig. 1--Play Theory and Playground Development

To optimize the play potential of an environment, Beckwith (1979d) suggests having one and one-half play events per child. This ratio allows for uninterrupted play because of the options or alternatives the children have available to them. This need for alternatives is especially important when an intervening variable such as heavy traffic on a selected event, or fear caused by an inappropriate choice, prohibits the use of one play event and requires the selection of another (Beckwith, 1979d; Bruya, 1980a).

When optimizing a play environment's play value by increasing the number of play events, the complexity of the environment is also said to be increased. However, complexity can be altered by other means as well. For example, one of the most prevalent ways of complexifying a play environment is to link or unify it (Bruya, 1979a, 1979b; Bruya & Buchanan, 1978a, 1979; Shaw, 1976). This is generally accomplished by the placement of platforms in adjoining proximity and positioning play events off the sides of the platforms. With this configuration children do not have to dismount the structure to get from one play event to another (Bruya, 1980a, 1980b).

> The implied movement through a series of events or from one connecting platform to another is thought to reflect the child's natural play behavior, especially when involved in creative play. (Bruya, 1980a, pp. 14-15)

In addition, the platforms connecting the play events provide children alternative play routes when they are confronted with an event that seems undesirable. This allows the child to change activity rather than experience possible failure at a given task (Bruya, 1980a).

Beckwith (1979c) believes that the platforms in front of play events act not only as structural complexifiers but also as social complexifiers. He states that the platforms serve as staging areas where children interact prior to engagement with the play event by planning the use of the play event, or deciding upon its purpose in their creative drama.

The final design variable considered here is the modular concept (Bruya, 1980a; Bruya & Buchanan, 1978b; Shaw, 1976). Play environments employing this concept are built so that the entire structure is made up of smaller modules or units linked together to form the whole. This enables systematic variation of the play environment through the addition, subtraction, or alteration of modules (Bruya, 1980a). "The great flexibility provided by moving these structures, and thus redesigning the play environment is the design variable's strength" (Bruya, 1980a, p. 17).

Novelty and Complexity

Novelty and complexity are relative terms. The degree to which something is novel or complex is based on the

difference between what is being perceived at the present and what can be remembered from past experiences. A stimulus with a high degree of novelty or complexity may elicit avoidance behaviors or actions designed to reduce the past-present conflict (e.g., exploratory behavior), while a stimulus with a low degree of novelty or complexity may receive variable or no attention (Berlyne, 1958; Fiske & Maddi, 1961; Vitz, 1966), or it may be manipulated in some manner to increase its stimulation capacity (Ellis, 1973). Between these two extremes lies an individual's preferred level of novelty and complexity.

However, an individual's preferred level is not stable. With repeated exposure to novel or complex stimuli, the discrepancy between past and present decreases. This is reflected in an individual's preference for relatively more novel or complex stimuli. Ellis and Scholtz (1978) state that "The optimal degree of novelty [and complexity] varies with each individual's past experiences, expectations, and stage of development" (p. 45).

While novelty and complexity are alike in many ways, they differ in one area that is of vital importance to the construction of quality play environments; the ability to sustain attention. The degree to which something is novel will determine the amount of attention given to it at the particular moment of initial interaction; however,

attention is sustained by the amount of complexity the stimulus holds (Ellis & Scholtz, 1978; Weilbacher, 1980).

> A fairly simple stimulus . . . will have impact at its onset but will be adapted to rapidly, so that it will have little impact after a short period of time. However, a complex configuration . . . may have undiminishing impact. (Fiske & Maddi, 1961, p. 30)

Thus, play equipment which is novel or simple will quickly lose its appeal. To sustain play a structure must be complex.

Age and Preference for Complexity

As previously mentioned, preference for complexity is assumed to increase through augmentation, in such a way that each experience with previously encountered stimuli builds on the last (Ellis & Scholtz, 1978). Consequently, it would be expected that as a person grows older and gains exposure to increasingly more complex stimuli, that person's preferred level of complexity would advance. Unfortunately, research has not always confirmed this.

At the North Texas State University Play Environment Laboratory, Bruya (1980b) studied the effects of linking (a means of complexifying) play equipment on the play behavior of three-, four-, and five-year-olds. He found that while linking play structures did not appear to affect motor pattern use, it did seem to affect the amount of time spent on the equipment. In the non-linked condition there

was an age trend with the five-year-olds spending more time on the equipment than the four-year-olds, and the four-year olds spending more time than the three-year olds. This pattern was disrupted, however, when the play structures were linked together. Although all age groups increased in time spent on the equipment, the increases for the three- and five-year-olds (6% and 1% respectively) were minimal when compared to the large increase of the four-year-olds (23%).

Using the same subject population as in the previously mentioned study, Fowler (1979) found results which paralleled Bruya's findings when measuring three- to six-year-olds' preference for complexity. After the children traversed lines with turns numbering from zero to five (five turns being the most complex), he found that the four-year olds indicated that they enjoyed traveling over the more complex patterns, more than did the three-, or five- and six-year-olds. Nevertheless, other non-play research concerning age and complexity has shown different results.

An example of this would be a comparison of two studies conducted by Munsinger, Kessen, and Kessen (1964). In the first study, using third graders, sixth graders, and undergraduates as subjects, and random word and letter sequences which varied in their degree of complexity as stimuli, they found that as age increased so did preference

for the more random sequences. However, all three groups found the extremely random sequences unfavorable.

The second study investigated preference for random shapes which varied in their degree of complexity by the number of turns they possessed. Here, using children in grades one through eight, and undergraduate students as subjects, the researchers found an age-invariant preference for intermediate complexity. But the interesting part of the study was when the investigators examined the differences in the preference scores for just the school children. Contrary to what might be expected, the younger children systematically preferred more complexity than did the older children.

Environmental Complexity

In 1935, Johnson conducted what was apparently one of the first studies concerning play environment complexity. He studied the activities of children on three playgrounds before and after a change in the amount of play equipment had been made. By altering the amount of equipment available for play, complexity was supposedly varied.

The results of the observations of bodily exercise, play with materials, undesirable behavior, games, and social contact indicated that in the more-complex settings bodily exercise and play with materials (specifically, play with experimental materials) increased, while undesirable

behaviors, social contacts, use of permanent materials, and games decreased.

Although Johnson did not measure preference for environmental complexity directly, the results can be interpreted in terms of object and peer preference. In the "low" complexity settings it seems the children looked more toward each other for stimulation through such activities as games. While in the "high" complexity settings there seemed to be greater object preference.

After Johnson's study very few investigations were conducted concerning play environment complexity until the Motor Performance and Play Research Laboratory, Children's Research Center, was established at the University of Illinois in 1966. Here a group of researchers studied the acquisition of motor skills and behavior during informal periods of activity (Ellis & Scholtz, 1978). The following two studies on environmental complexity came from this research effort.

In the first study Gramza, Corush, and Ellis (1972) measured children's preference for high-complexity and low-complexity play apparatus. The low-complexity apparatus was a traditional climbing trestle, while the modification of another trestle by attaching 48 inch square boards to the sides constituted the high-complexity apparatus. The results indicated a reliable preference for the more-complex apparatus.

In the second study Scholtz and Ellis (1975a, 1975b) investigated the effects of novelty, complexity, and repeated exposure on the peer and object preference of 60 children. This examination went beyond the high-, low-complexity comparison and included a play environment which was progressively complexified over the three week period of the study (i.e., it went from low-complexity the first week, to medium-complexity the second week, to high-complexity the third week through the addition of novel play objects after weeks one and two).

Analysis revealed that in the first session object preference was at its highest level in all three conditions and decreased with repeated exposure. The high-complexity setting sustained the greatest degree of object preference throughout the entire experiment, while in the progressively complexified condition each increase in novelty and complexity brought about a corresponding increase in object preference.

Peer preference, on the other hand, increased in both high- and low-complexity settings as a function of repeated exposure. However, the rate at which peer preference increased was affected by the complexity of the setting. The low-complexity environment resulted in significantly more play with peers than did the high-complexity environment over the three weeks, while a trend toward increased

peer preference was noted with repeated exposure to the high-complexity condition.

Another study looking at the relationship between repeated exposure to varying degrees of complexity and play was conducted by Hutt (1976). The stimulus used was a box with a lever that operated a bell, buzzer, and counters. It could be set for four different levels of complexity: (1) no sound or visual stimuli: the bell and buzzer were turned off and the counters covered up; (2) vision only: noises were turned off, but counters were visible; (3) sound only: bell and buzzer on, but counters covered; and (4) sound and vision: all noises on and counters visible. When the children were repeatedly exposed to the first two levels of complexity, the exploratory activity of the children progressively decreased. Yet in the third and fourth conditions the object was increasingly manipulated through five exposures. The use of contingent reinforcement that was auditory seemed to enhance the object's play value, and when the visual feedback was added to the auditory feedback it appeared to augment the responsiveness brought on by the sound condition. Thus, object preference was affected through increasing the stimulus complexity.

A different examination of complexity and its effects on play took place at The Ohio State University where Weilbacher (1980) looked at how repeated exposure to a

static or dynamic environment affects the social and motor behaviors of kindergarten age girls. For two school weeks, or 10 days, eight groups of four girls per group played in an area that had a trestle, a five foot ladder, and a six foot aluminum board that was either in a static, nonmoveable condition, or a dynamic, moveable condition. The ability of the girls in the dynamic condition to modify the environment was viewed as making this condition more complex than the static environment.

After data analysis Weilbacher noted that the two environments produced different behaviors. The static environment was explored in a number of different ways, but when its stimulus properties had been exploited the children turned to one another for stimulation by means of imitative locomotion and games. In the dynamic setting the equipment was continually moved about or manipulated. Through this manipulation the girls found new uses for the equipment which in turn seemed to keep the equipment stimulating to them.

Social and Environmental Complexity

In 1971, Wade and Ellis investigated the activity levels of children in play settings of varying degrees of complexity. In this study complexity was escalated through increasing the number and variety of play objects in the setting and by increasing the size of the playing

groups (i.e., the children played alone, in dyads, and in quadrads). The data revealed that although the manipulation of the physical environment failed to produce reliable changes in the children's activity levels, the higher complexity brought about by enlarging group size increased the general activity level of the children.

CHAPTER III

PROCEDURES

Pilot Study

A two-day pilot study was conducted at the North Texas State University Play Environment Laboratory to examine some aspects of the main study which had not been clarified. The following is a chronicle of these topics and decisions made concerning each.

First, since the Play Environment Laboratory was across the street from the nearest electrical outlet, and there was a need for electricity to power various pieces of equipment at the laboratory, a question arose concerning whether or not cars running over extension cords transmitting electricity would cause power fluctuations, and thus create a need for a generator. When tested, the extension cord system proved to be satisfactory since no apparent power fluctuations were detected when vehicles passed over the wires.

Another question concerned whether or not the studio videotape cameras available for use would work in the field. After running the electricity to the videotaping equipment, the cameras were activated and adjusted. Since no problems with the cameras could be identified they were considered appropriate for use.

Also of interest was the use of a 20-minute cassette tape marked at ten second intervals (i.e. 1-121) as a time sampling reference on the video recordings. The tape was broadcast using a large speaker attached to the cassette recorder used to play the tape. Because this audio metronome did not appear to influence the children's play behavior it was deemed satisfactory for use.

In addition to this, two methods for recording play behavior were compared. Human observers who took time samples at each signal of the audio metronome were compared with a split screen videotaping technique.

After inspecting each method of observation, it was decided to use videotaping since (a) with a few minor modifications in the videotaping technique a comprehensive view of the play area could be obtained; (b) videotaping would provide a permanent record of the children's play behavior; and (c) behavior could be measured continuously.

Videotaping procedures were improved after specific sections of the fence surrounding the play environment were redesigned to allow quick removal. When these sections were removed, wider and more inclusive camera angles were provided. In addition, a two tape procedure was selected to record each camera's view. These modifications provided the extensive view of play area required for the study (see Figure 2).

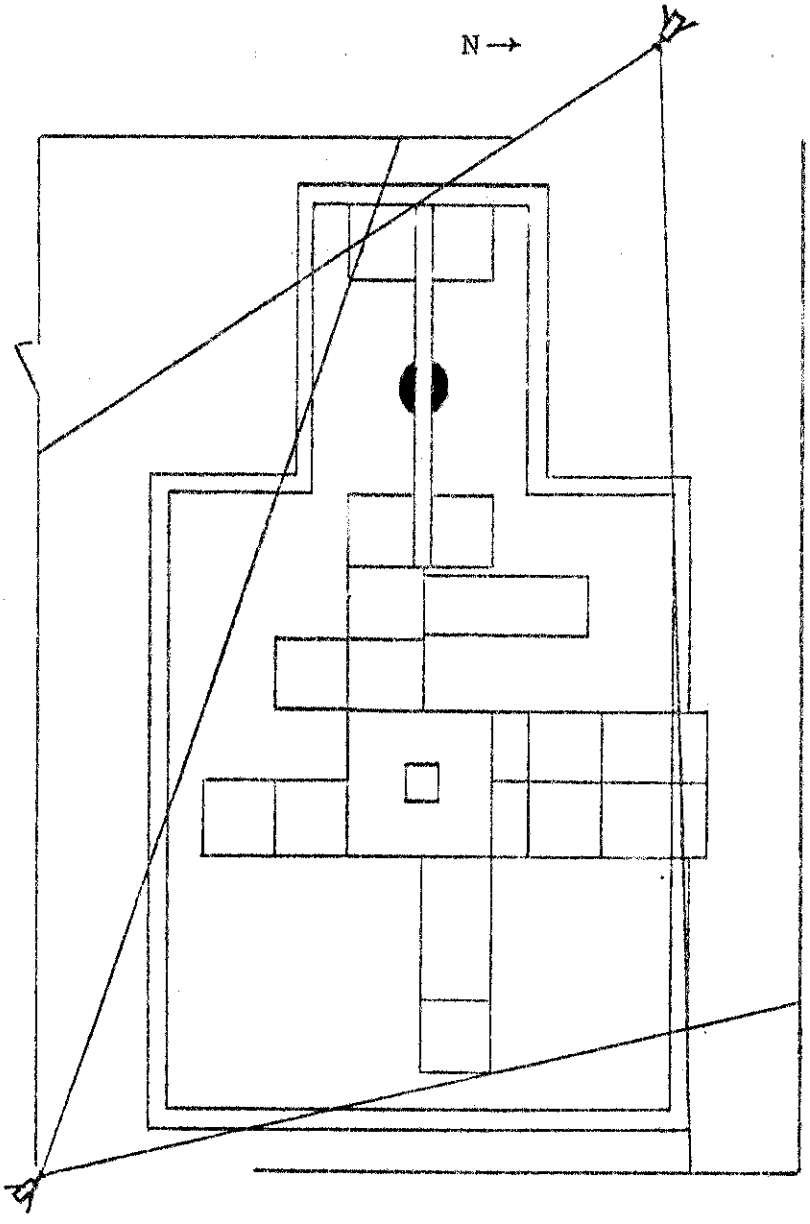


Fig. 2--Camera Placement and Coverage

The time taken to rearrange the play structure was also assessed during the pilot study. It was determined that the environment could be changed in the time allotted between treatments in the main study.

Besides the forementioned topics, the following decisions were the result of the pilot study.

1. The morning was found to be the best time for all concerned to participate in the study.

2. The best means of transporting the children between their preschool and the play environment was by a van that was driven by someone who did not have responsibilities directly related to either the study or the preschool.

3. Based on a previous study (Bruya, 1980a), procedures for bringing the children into the laboratory, distributing them along one end of the perimeter surrounding the play structure prior to play, reviewing rules of conduct, sending the children off to play, and getting them ready to depart from the laboratory were practiced and modified to fit the study.

4. Signals to start taping were established between the video technician and the investigator.

5. The children seemed to become accustomed to the play environment, sight of the cameras, and the sound of the audio metronome.

6. The necessity for color coded shirts as a means of identification was noted. As a result, during the primary study each child was assigned a specific colored shirt that they wore throughout the entire investigation.

7. Intrarater reliability for the investigator was established at .99 using the pilot study tapes.[2]

Subjects

The population of this study was from the Denton City-County Day Nursery; a nursery designed specifically for children of low-income families with working parents. The children at the nursery included Blacks, Caucasians, and Mexican-Americans ranging in age from three to five years.

From this population subjects were chosen on the basis of two factors: (a) whether or not they had participated in the pilot study; and (b) the number of absences they had during the main study. Only those children who took part in the pilot study and had no absences during the main study were used as subjects.

These delimitations were adopted for the following reasons. First, the children who were in the pilot study were used to the play environment, the investigator, the cameras; everything and everyone involved in the study.

---

[2]Using 20 three minute samples from the main study tapes, an interater reliability of .99 was established between the investigator and a colleague. Five of these observations were inspected twice by the colleague, and his intrarater reliability was .99 also.

This should have reduced any influence novelty might have on their behavior. Second, those children who were present every day of the treatment conditions would provide a more representative picture of their behavior than those who were absent.

Applying these restrictions to the population resulted in 5 three-year-old, 5 four-year-old, and 5 five-year-old subjects (7 males, 8 females) to be used for data collection and analysis.

Treatments

Three days during each of four consecutive weeks were used as treatment phases. Because of rain on Monday, the first treatment phase was on the Tuesday, Wednesday, and Thursday of the first week. During this phase the play environment was arranged in the platform condition (see Appendix C).

The second treatment phase was on the Monday, Tuesday, and Wednesday of the second week. Throughout this phase the play environment was arranged in the play event condition (see Appendix D).

The first three days of the third week duplicated the first condition by replacing the play events with the original platforms, while the fourth and final phase (held on Tuesday, Wednesday, and Thursday because of an electrical

malfunction on Monday) duplicated the first play event condition.

Each group of children played for 20 minutes during all of the twelve days of treatment.

Randomization of the treatment conditions was not used due to the experimental design employed. Thus, there is the possibility that the sequence of treatments may have tainted the results.

The Play Structure

Because of its modular design which allowed it to be changed from one condition to the other with a minimum amount of effort, the Timberform K3 play structure was used in this study. This structure is manufactured by the Columbia Cascade Timber Company, 1975 S. W. Fifth Avenue, Portland, Oregon 97201.

Technical Equipment

The videotape cameras used in this study were two Ikegami 240s, manufactured by the Ikegami Electronics Corporation, 37 Brook Avenue, Maywood, New Jersey 07607. They are three saticom tube color cameras with prism optics. They were recording on 3/4 U-matic video cassettes set in two Sony videocassette recorders, model VO-2610, which were manufactured by the Sony Corporation in Japan.

During data collection the two stopwatches used were both Casio digital quartz watches, model C-80, model number

133, manufactured by Casio, Inc., 15 Garden Road, Fairfield, New Jersey 07006. These watches were chosen since mechanical error was reduced.

Both the monitors and videotape recorders used during data collection were manufactured by Matsushita Electric Industrial Co., Ltd., of Japan. The monitors were two Panasonic Quintrix IIs, models CT-117 and CT-118. The two videotape recorders were also Panasonic, model NV-8160.

Videotaping Procedures

Prior to the arrival of the first age group each morning the videotape cameras and audio metronome were placed in position and checked for functioning. Also two signs with a visual date reference were placed so that each camera's view would include one sign.

Once the children arrived the colored coded shirts were put on and the chilren lined up along one side of the perimeter that held in the pea gravel safety surface. The rules of the laboratory were then reviewed and the children are allowed to play.

Each age group played for approximately 30 minutes during which 20 minutes were videotaped. For a more detailed account of the videotaping procedures see Appendix E.

Data Collection

To collect data from the videotapes the opposing camera angles had to be viewed at the same time. To

accomplish this two videocassette players were set inside a four foot cabinet and hooked up to two monitors that were placed on top of the cabinet. Once the tapes were in place and running, the audio metronome recording was used to synchronize the two tapes.

With the tapes synchronized two electronic stopwatches were used simultaneously to record the amount of time a subject spent in two of the four dependent variables. Then at the end of the observation the tape was rewound and the amount of time spent in one other dependent variable was measured and recorded. The amount of time spent in the fourth dependent variable was determined using a different technique.

Due to human and mechanical error it was impossible to attain four times which equalled the total time taken by itself. Thus, the fourth time was calculated by adding the observed times of the first three variables together then subtracting the total from the total time of that particular age group and day.[3]

Dependent Variables

The two basic variables of interest were equipment usage and non-usage. Non-usage consisted of the off

---

[3]This procedure may have biased the recorded time for the calculated variable since it was not randomly selected for each observation.

measure while usage was comprised of the on, under, and touching measures. The separation of the usage variable into three measures was done on the basis of observations made during a previous study (Bruya, 1980b) and during pilot work which suggested that altering levels of complexity affected each measure differently.

Data Treatment

The data collected from the videotapes were recorded in minutes, seconds, and hundredths of seconds. This data was converted into seconds, rounding off decimals to the nearest second. Although each trial should have lasted 20 minues as designated by the audio metronome, actual trial length varied due to machine error, recording error, and to deletion of unusable time segments. Thus, all actual trial times were adjusted using the following formula:

$$\frac{\text{Time x}}{\text{Total Time}} = \frac{\text{y}}{1200}$$

where Time x = actual time for dependent variable

Total Time = actual length of observation

1200 = 20 minutes in seconds

y = adjusted time

These adjusted daily times were used to assess the effect of novelty on the dependent variables. They were

also averaged over each treatment phase for individual subjects so that treatment effects could be computed.

Statistical Design

The factors of interest in this study were the treatment conditions (low- and high-complexity) and age. The effect of these factors on the amount of time spent on, off, under, and touching a play structure was assessed through the use of a reversal, or ABAB design (Baer, Wolf, & Risley, 1968; Hall & Fox, 1977). This design was chosen because it "is quite strong with respect to internal validity" (Kazdin, 1973, p. 522); internal validity being the degree to which the results are dependent on the experimental manipulation.

A 3 x 4 (age x treatment) ANOVA with repeated measures on the last factor was applied to the averaged data for each of the dependent variables (see Figure 3). In addition, the analysis of variance technique was utilized on the daily adjusted times to check for novelty effects within treatments and between corresponding treatments.

All analyses were subjected to a .05 level of significance decision rule. The Newman-Kuels post-hoc test was used if significant findings occurred to determine the source of the significance.

	Age by Years		
	3	4	5
Platform 1 (low-complexity)	n=5	n=5	n=5
Play Event 1 (high-complexity)			
Platform 2			
Play Event 2			

Fig. 2--Treatment Design

Use of Human Subjects

An Informed Consent form with the parent's or guardian's signature was required of all subjects who participated in the study (see Appendix F). If at any time a subject wished to stop participation, he/she was allowed to do so without question or fear of retaliation. The foregoing conditions follow the North Texas State University Use of Human Subjects procedures. All necessary forms were filled with the proper university committee to insure compliance.

Debriefing

Results of the study were presented to preschool personnel, parents or guardians of the subjects, and the subjects themselves in a form appropriate to each. These

presentations included an explanation of the changes made in the play environment, the expected effects of these changes, a brief discussion of the results, and a scheduled viewing of the videotapes. A question-and-answer period followed each presentation.

CHAPTER IV

RESULTS AND DISCUSSION

Novelty

Two separate sets of comparisons were used to assess novelty effects. The first was a comparison of the days within each condition. Using the Newman-Kuels post-hoc analyses from a one-way ANOVA for days no novelty effects were found.

The second set of comparisons made were between the days of similar treatments. Using the same post-hoc analyses it was found that the third day of first play event condition had significantly more touching than any of the days of the second play event condition. Since similar findings did not occur any other day it is likely that this effect was not due to novelty, but instead due to some unexplainable occurrence.

Treatment

The treatment analyses revealed that each of the dependent variables was significantly influenced by changes in conditions (see Tables 1 through 4). As Figure 4 illustrates, and post-hoc analyses identified, the play event conditions elicited significantly more on and

Table 1

Age x Treatment Analysis of Variance of the Average Amount of Time Spent On

Source	df	Mean Square	F
Between Ss	14		
B (Groups)	2	86679.80	5.31*
Error	12	16310.36	
Within Ss	45		
A (Treatments)	3	705908.19	51.73*
AB Interaction	6	38053.71	2.79*
Error W	36	13646.80	
Total	59		

*$p < .05$

Table 2

Age x Treatment Analysis of Variance of the Average Amount of Time Spent Off

Source	df	Mean Square	F
Between Ss	14		
B (Groups)	2	15583.72	0.44
Error B	12	35761.28	
Within Ss	45		
A (Treatments)	3	378400.02	46.27*
AB Interaction	6	8900.18	1.09
Error W	36	8177.25	
Total	59		

*$p < .05$

Table 3

Age x Treatment Analysis of Variance of the Average Amount of Time Spent Under

Source	df	Mean Square	F
Between Ss	14		
B (Groups)	2	86316.52	8.01*
Error B	12	10774.64	
Within Ss	45		
A (Treatments)	3	143854.15	19.40*
AB Interaction	6	33524.25	4.52*
Error W	36	7414.01	
Total	59		

*$p < .05$

Table 4

Age x Treatment Analysis of Variance of the Average Amount of Time Spent Touching

Source	df	Mean Square	F
Between Ss	14		
B (Groups)	2	12155.27	
Error B	12	2623.56	4.63*
Within Ss	45		
A (Treatments)	3	18367.26	14.72*
AB Interaction	6	492.84	0.39
Error W	46	1247.75	
Total	59		

*$p < .05$

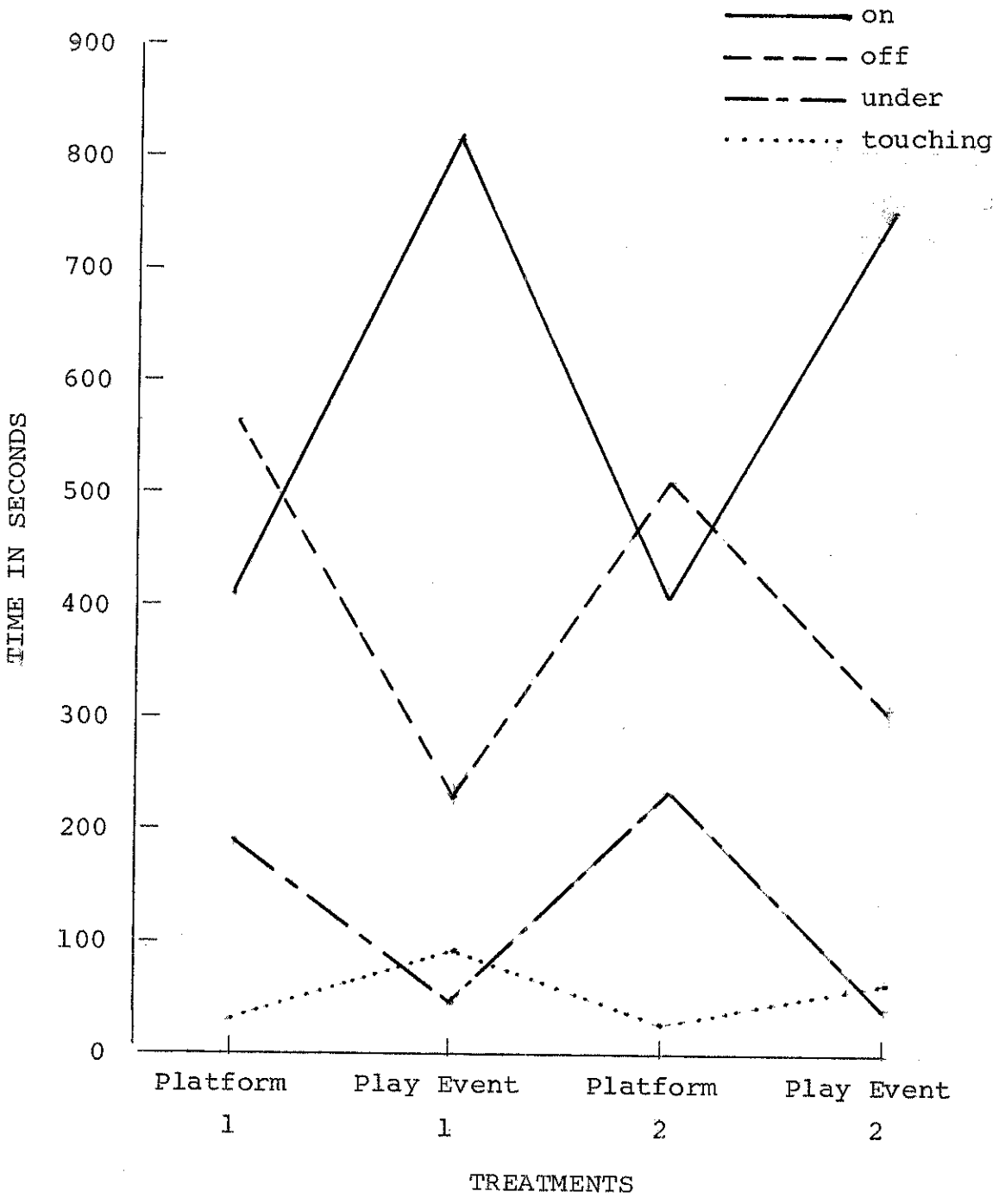


Fig. 4--Time Spent 'On,' 'Off,' 'Under,' and 'Touching'

touching behavior, while the platform condition produced significantly greater off and under behavior.

Evidently, by increasing the complexity and stimulus properties of the play environment through the inclusion of the play events the children attended to and explored the environment more by means of active interaction (i.e., on and touching behavior). Conversely, when the complexity of the environment was lowered, non-use (i.e., off behavior) and passive use of the equipment (i.e., under behavior) increased seemly because the structure itself held little attraction and the children in turn searched for arousal through such means as social interaction, imaginary play, and imitative play, which were observed to occur primarily off and under the structure.

In addition to these results, it was found that the second play event condition had substantially more off behavior than the first play event condition. As seen in Table 5 this finding may be accounted for by decreases in on and touching behavior in the second play event condition. These decreases may be an indicator of possible novelty effect which was unaccounted for in the novelty analysis.

Age

As indicated in Tables 1 through 4, there were significant group effects for all of the dependent measures except

Table 5

Means and Standard Deviations of the Average Time Spent On, Off, Under, and Touching the Play Structure During Treatment Conditions

	Platform 1	Play Event 1	Platform 2	Play Event 2
On				
Mean	411.47	819.20	415.40	753.33
SD	122.20	119.08	161.92	149.78
Off				
Mean	568.13	234.40	517.00	318.40
SD	151.50	91.13	94.76	132.23
Under				
Mean	190.20	49.40	240.60	49.73
SD	118.11	43.21	192.47	46.25
Touching				
Mean	30.13	96.93	27.07	78.60
SD	28.94	54.34	22.01	55.95

Note: Means are listed in seconds with a 1200 second maximum possible.

off, and significant interactions for the on and under variables. These results stem from the fact that the three-year olds spent considerably more of their time under and touching the equipment, and substantially less of their time on the equipment than either the four- or five-year-old group. Figures 5 through 8 illustrate in graphic form the age breakdown within treatments seen in Table 6, and Table 7 provides the group means used in the post-hoc analyses.

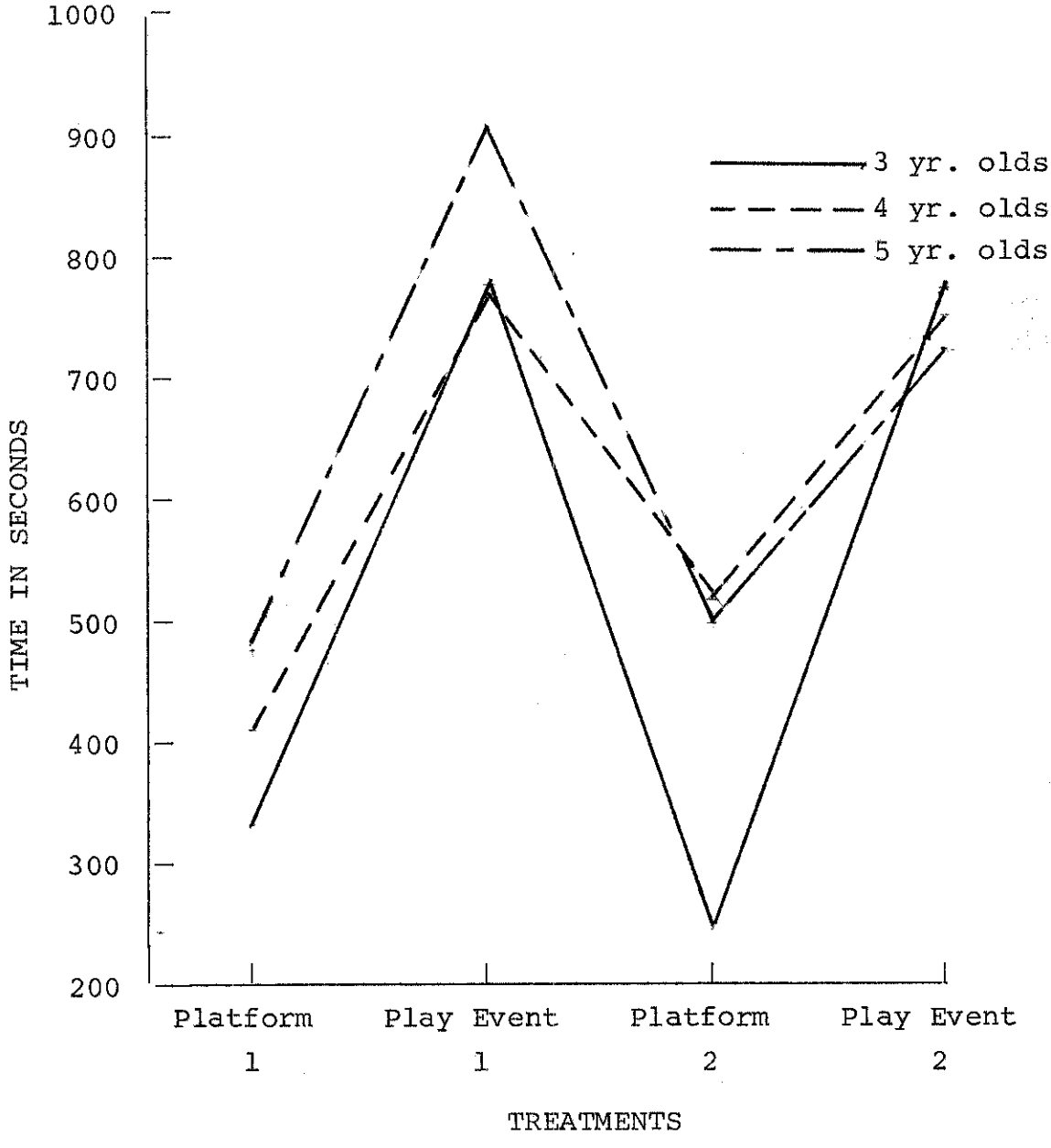


Fig. 5--Time Spent 'On'

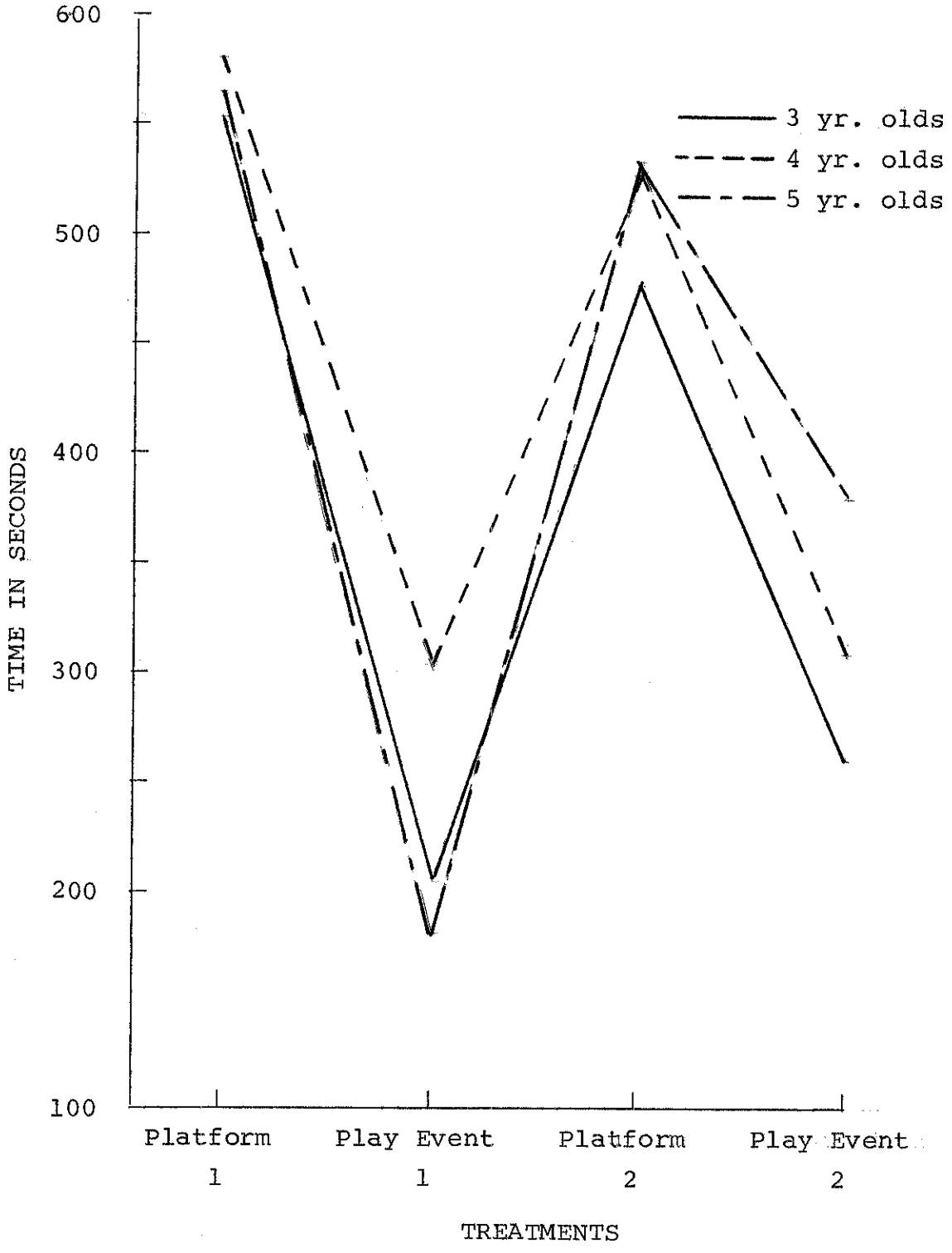


Fig. 6--Time Spent 'Off'

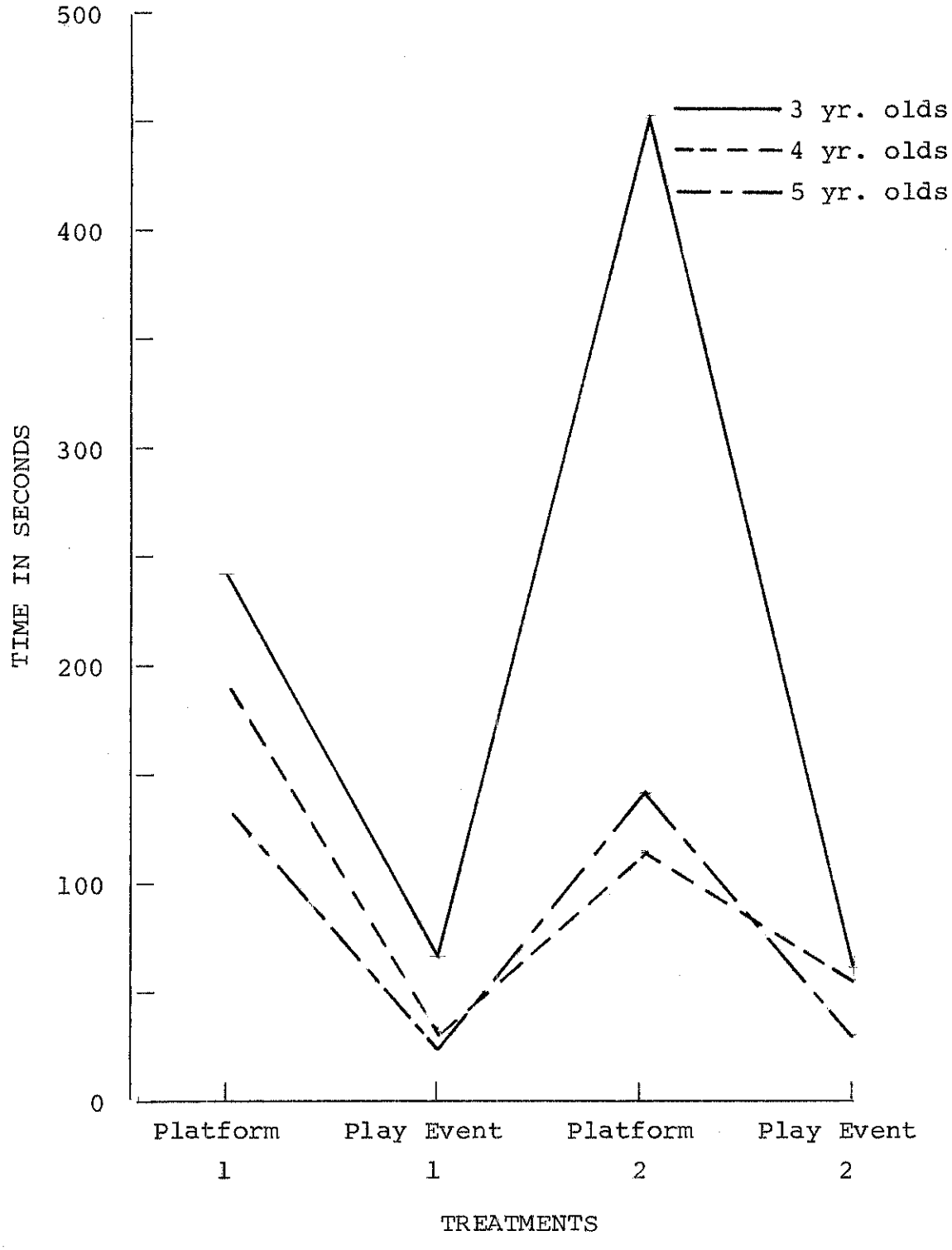


Fig. 7--Time Spent 'Under'

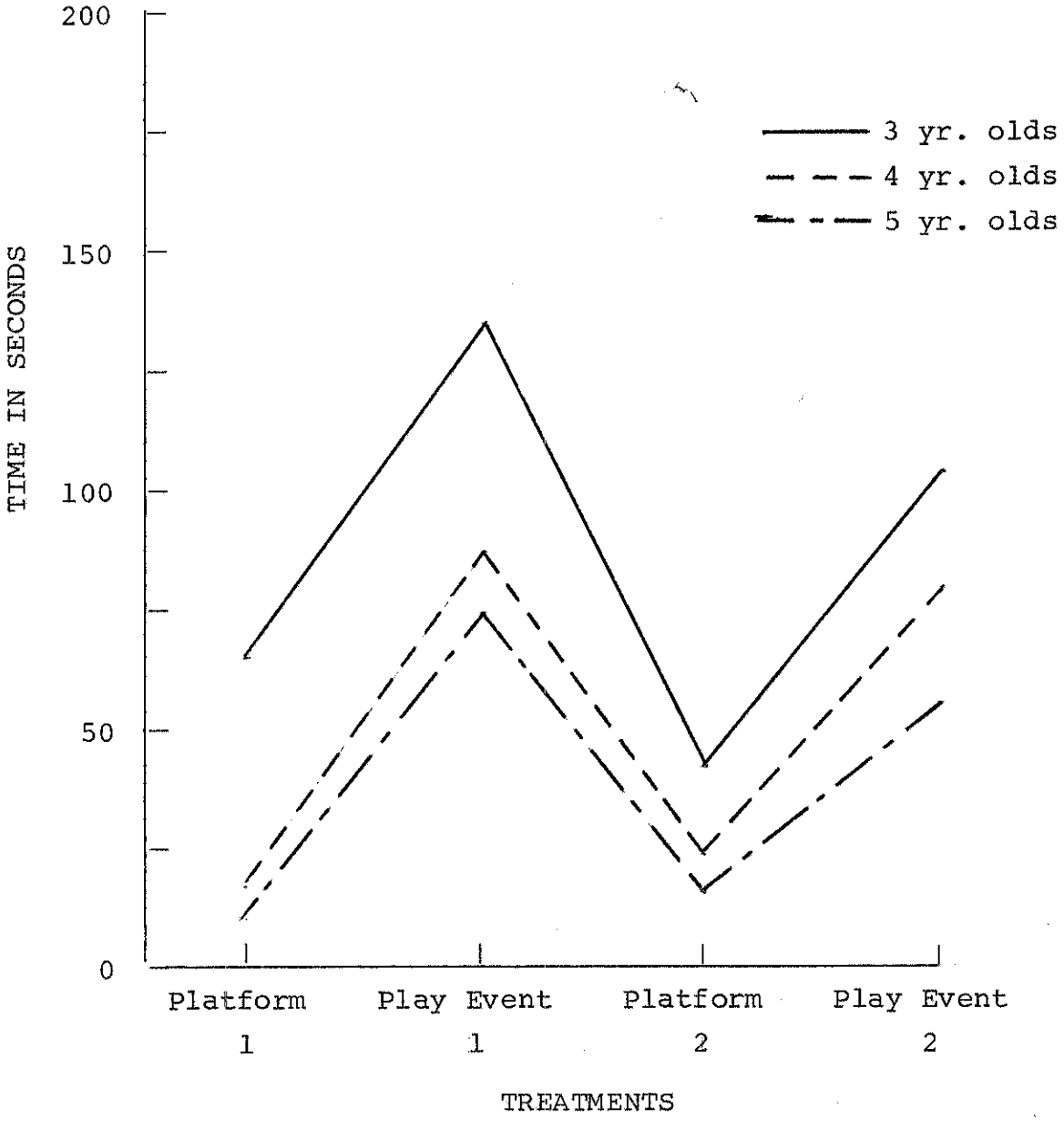


Fig. 8--Time Spent 'Touching'

Table 6

Group Means and Standard Deviations of the Average Time Spent On, Off, Under, and Touching the Play Structure During Treatment Conditions

	Platform 1			Play Event 1			Platform 2			Play Event 2		
Age	3	4	5	3	4	5	3	4	5	3	4	5
On												
Mean	334.60	411.40	488.40	775.60	772.40	909.60	224.20	521.40	500.60	776.20	756.20	727.60
SD	119.46	120.11	93.71	108.86	108.88	102.93	110.12	67.52	79.12	100.39	203.21	160.17
Off												
Mean	553.40	584.60	566.40	215.00	304.00	184.20	483.20	532.60	535.20	263.20	311.40	380.60
SD	54.39	222.47	165.12	77.89	95.84	64.36	56.36	102.06	125.25	89.53	145.51	152.65
Under												
Mean	248.40	187.80	134.40	73.60	38.00	36.60	451.40	121.80	148.60	58.60	56.20	34.40
SD	108.23	138.83	98.50	57.99	30.68	33.63	168.52	99.01	87.63	46.76	54.83	43.02
Touching												
Mean	63.40	16.00	11.00	135.80	85.40	69.60	41.20	24.60	15.40	102.60	76.20	57.00
SD	28.22	5.52	3.74	57.26	51.91	37.04	25.05	24.02	7.96	71.13	61.91	29.61

Note: Means are listed in seconds with a 1200 second maximum possible.

Table 7

Age Group Means Collapsed Across Treatments

	Age		
	3	4	5
On			
Mean	527.65	615.35	656.55
Off			
Mean	378.70	433.15	416.60
Under			
Mean	208.00	100.95	88.50
Touching			
Mean	85.75	50.55	38.25

Note: Means are listed in seconds with a 1200 second maximum possible.

One finding of particular interest was the interaction for the under variable because of its ordinal nature (see Figure 6) and possible influence on the on variable (see Figure 5). As indicated in Table 6 the three-year-old group mean for the under variable in the second platform condition was 451.40 seconds; 302.80 seconds greater than the next nearest time. While the exact cause for this large increase in under behavior for the three-year-olds cannot be determined it is believed that an "extraneous, unwanted, uncontrolled effect operating at one level of [the] experiment but not at another . . ." (Kerlinger, 1973, p. 268) was the probable cause. Attention has been

called to this interaction since it may have distorted the main effects for the under variable.

Despite the significant under interaction, the separation of the three-year olds subjects from the four-year old subjects seemed to be a result of the type of play exhibited by each group. The four- and five-year old subjects were observed to engage in a great deal of individual exploration characterized by movement throughout the play environment. They would often repeat patterns of play on one or several pieces of equipment until they tired, then duplicate the process at a different location.

The three-year olds, on the other hand, seemed to be less exploratory and more group oriented. They would often congregate underneath the equipment, which not only increased under behavior, but also touching behavior since contact with the equipment was often made when children were entering and exiting from beneath. In addition, if a module on which children were playing would not accommodate group play, those waiting to join were often observed touching the equipment.

Two factors may account for the difference between the play behavior of three-year olds and four- and five-year olds. First, the three-year olds may have been more interested in each other than in the complexity provided by the equipment (Wade & Ellis, 1971). Second, the lack of safety

rails may have influenced the use of the equipment since the younger children may have been frightened by the height of the equipment.

Sex

While sex differences were not of interest in this study, a 2 x 4 (sex x treatments) ANOVA was performed for each dependent variable. These analyses yielded no significant result.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The results of this study indicate the strength of the play event design feature as a complexifier and generator of active interaction with play equipment and may suggest the need for semi-enclosed spaces, especially for three-year olds. They also lend support to the stimulus-seeking theory of play, since during the high-complexity condition child-equipment interaction increased.

The results also justify the trend toward increasing complexity in play environment design. This information, when made available to those who work with young children, will help clarify the effects of complexity on play behavior.

Conclusions

Each hypothesis (p. 3) was tested and the following conclusions were drawn:

1. H_1 was supported. On and touching behavior was significantly greater in the play event conditions, while there was significantly more off and under behavior in the platform conditions.

2. H_2 was supported for the on, under, and touching variables. The three-year olds differed significantly from the four- and five-year olds with regard to on, under, and touching behavior.

3. H_3 was supported for the on and under variables. There were significant age x treatment interactions for the on and under behaviors.

Recommendations

The following recommendations are offered for further investigation:

1. Select a population which has had extensive exposure to the treatment conditions to be used.

2. Examine how mixed age groups affect play behavior.

3. Put safety rails on all structures on or above the four foot level to see if they have an effect on play behavior.

4. Record the effects of the perimeter (containment barrier) on play behavior.

5. Study the effects of the safety surface as a play event.

6. Examine the play routes of the children to determine equipment preference.

7. Investigate the influence of play event placement on play behavior.

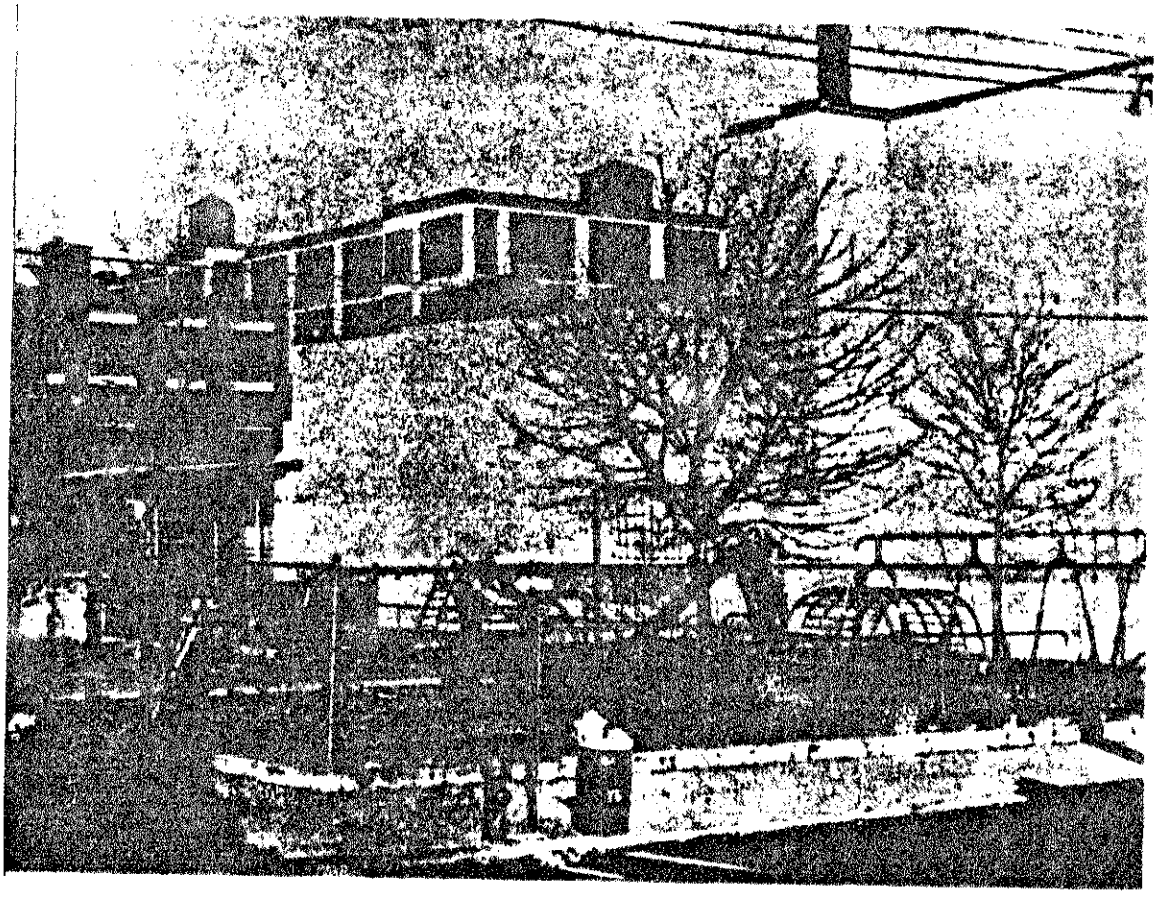
8. Examine the use frequency for each play event.

9. Study the amount of misbehavior in each setting.

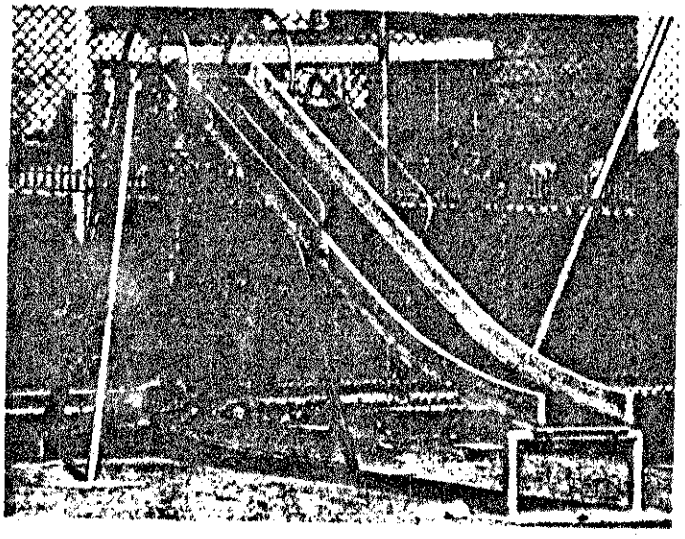
10. Investigate the types of play used in each condition.

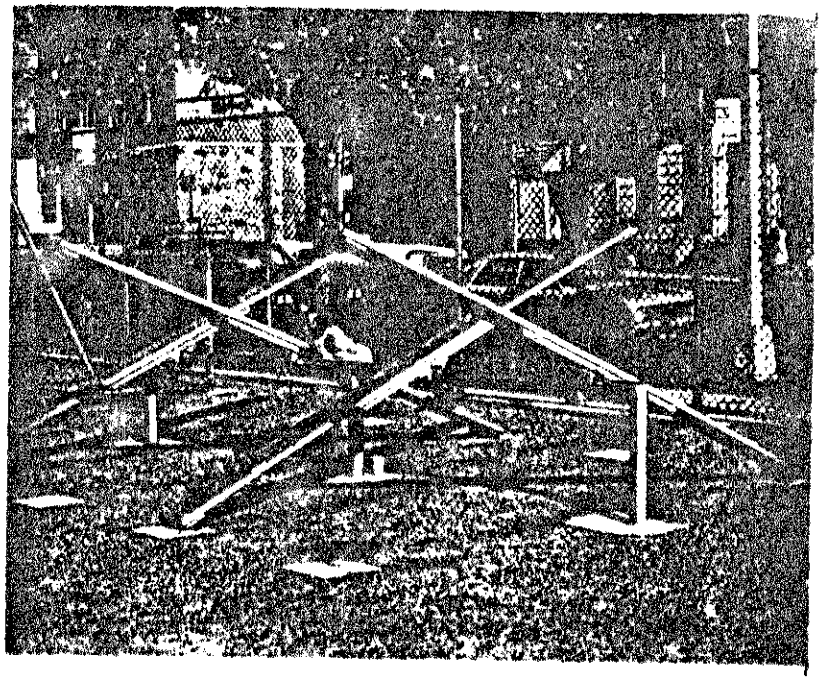
Appendix A

Traditional Play Environments



Hogan, P. Playgrounds for free. Cambridge, Mass.: MIT Press, 1974.

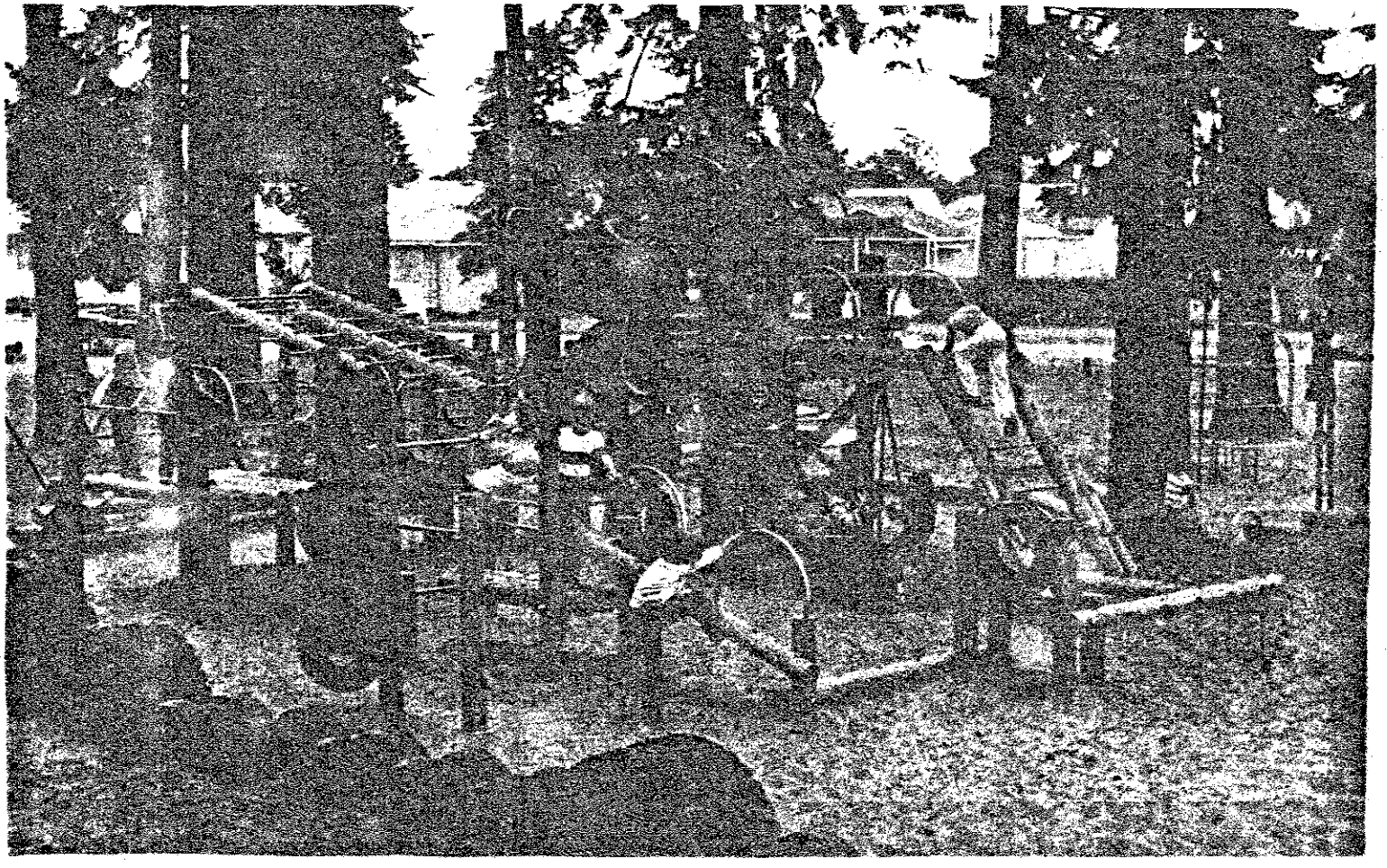




Friedberg, M. P. Playgrounds for city children. (Bulletin 27-A, included in 1968-1969 Annual Bulletin Order), Washington, D. C.: Association for Childhood Education International, 1969.

Appendix B

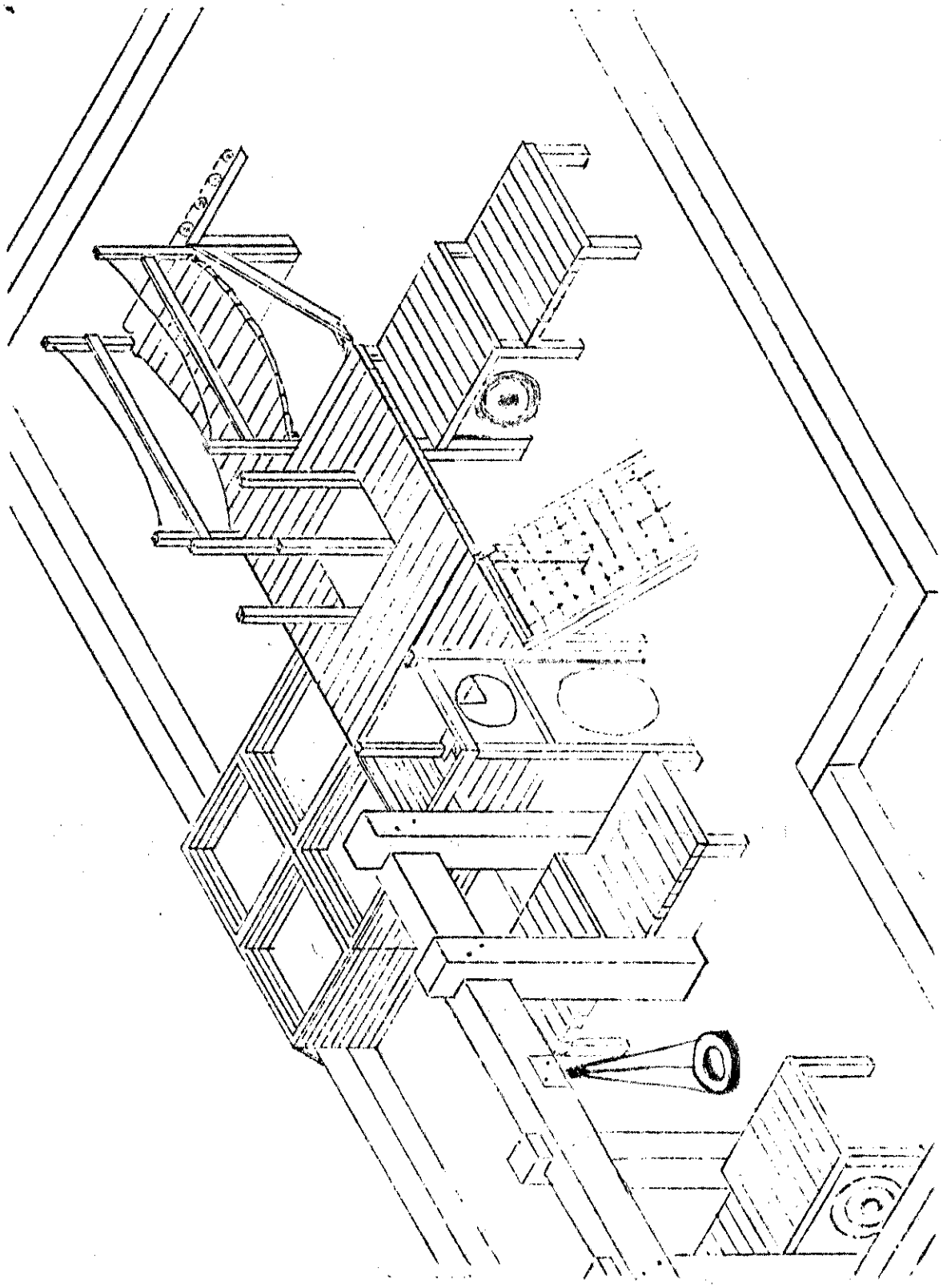
Contemporary Play Environment



Parks and recreation BigToys (catalog). Tacoma, Wa.: Northwest Design Products, 1980.

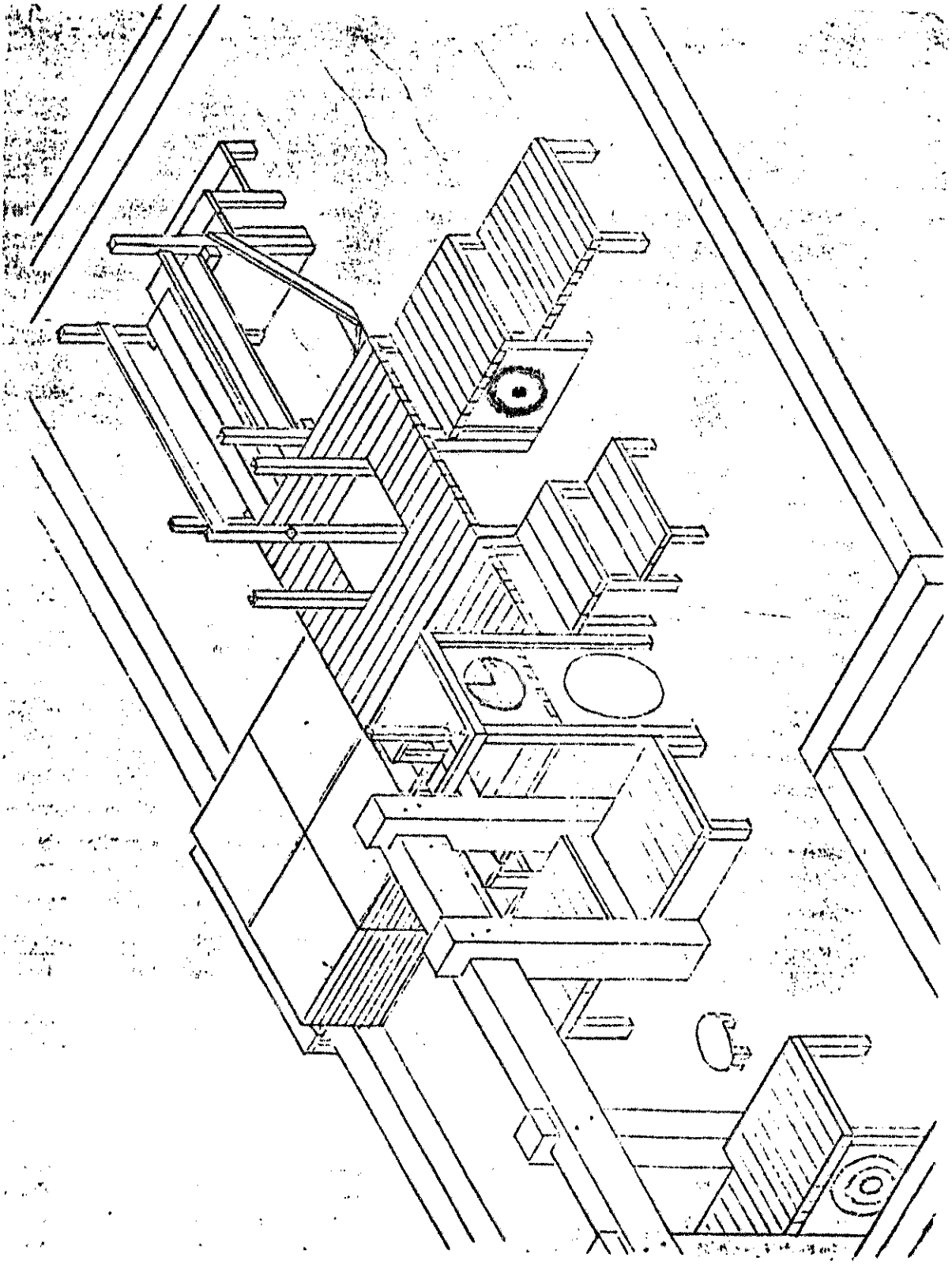
Appendix C

Play Event Condition



Appendix D

Platform Condition



Appendix E

Videotaping Procedures

Videotaping Procedures

Each morning the investigator arrived at the Play Environment Laboratory at approximately 7:30. Prior to the first group's appearance, three extension cords were retrieved from a room in a building which was across the street from the laboratory and were run from an electrical outlet on the outside of the building to the laboratory. These cords were taped down so that the connections would not be broken by people kicking the cords or cars running over them. Next, the fence sections were removed and wooden platforms set in place for the cameras. Then the cassette recorder and speaker of the audio metronome were set in position; the recorder on a footstool next to the south side of the fence and the speaker on top of the fence above by means of tape run around the pointed fence slats. The recorder was activated and allowed to play the tape to check its functioning. Also, the dates on two small folding signs were adjusted properly, and were used as a visual reference to the date of taping.

At about the same time as all this had been completed (around 8:15 to 8:30) the video technician arrived at the laboratory in a van carrying the equipment needed to video-tape. He parked the van along the outside of the southern portion of the fence, and with the help of the investigator,

and often times an aid, proceeded to (a) set up the cameras, (b) run the video cable from the control panel in the van to the cameras, (c) turn on the videotape machines so that they could warm up, (d) position a microphone that fed into both videotape recorders between the tops of the two fence slats near the metronome speaker and test it, and (e) adjust the cameras for proper focus and lighting conditions after they had warmed up. In addition, he ran both tapes to be used that day on fast forward to the end of the tape, then on reverse to the beginning of the tape. This was done to evenly load the tape on the spools of the cassette and to detect any bad tapes prior to their use.

Also at approximately 8:15 to 8:30, the person escorting the children arrived at the laboratory to determine if it was time to pick up the chilren. If all was on schedule the driver left to get the first group of children and bring them to the laboratory.[1]

At roughly 9:00 the five-year olds appeared at the laboratory with their teacher. The children were helped out of the transport van by their teacher one at a time and sent to the investigator who was standing at the fence gate. The investigator lined the children up along the southwestern side of the outer fence next to the gate.

---

[1]While transferring the children from their regular habitat to the play environment may have caused unrepresentative behavior to appear (Shaw, 1976), transporting children was the only option available.

At this point the children were dressed in their color coded shirt although the first group frequently suited up at the school to save time. The decision to follow this procedure was made since the shirts were washed at the nursery school prior to the next day's activities. Other groups suited up while standing along the fence at the main gate immediately following disembarkment from the transportation vehicle.

After all shirts were on, and everyone was in line, the investigator led the children into the laboratory and to the southeastern corner of the perimeter surrounding the play structure. Here, the children were sent one by one down the eastern end of the perimeter to await a review of the rules of conduct.

The three basic rules reviewed by the investigator were: (a) no pushing; (b) no throwing rocks (i.e., the pea gravel used as ground cover); and (c) no throwing sand. Following this review the children were told to go play.

For the next 3 to 5 minutes as the children were dispersing themselves throughout the play environment the investigator determined who was absent. These absences were recorded on paper, and an audio reference was recorded on the videotapes.

The latter was done through a series of signals between the video technician and the investigator that went as follows:

1. The investigator called, "Ready?" to the technician.

2. Once the technician had the color bars on the screens of both monitors in the van he said, "Ready."

3. At this point the investigator spoke into the microphone and recorded the date, age group, and who was absent, after which he asked again if the technician was ready.

4. If the technician signaled that he was ready the investigator said, "Go." This signal marked the initiation of both the audio metronome and the videotaping process.

During the majority of the 20 minutes of each treatment the investigator sat with the preschool teacher on a bench in the southwestern corner of the laboratory. This spot was somewhat removed from where the majority of play took place, yet allowed fairly easy viewing of the children and quick monitoring and interaction with them during times of misbheavior.

At close to "time 118" on the audio metronome (i.e., 19 minutes and 30 seconds) the investigator started toward the cassette player. At "time 121" (or 20 minutes) the investigator turned off the player and reversed the tape. The video technician also used this signal to stop videotaping.

If the next group of children were waiting to come in the laboratory when the tape was stopped and reversed the playing children were immediately asked by either the investigator or teacher to line up along the inner part of the southern side of the fence or to sit down on the southern side of the perimeter. However, if the next group had not arrived the children were allowed to play until the van appeared.

All the procedures outlined for the five-year-olds were replicated for the four-year-olds, and then again for the three-year-olds.[2] Also, the steps taken prior to the arrival of the first group were carried out each of the twelve days of the study.

Videotape Transfer

After all videotaping was done and the investigator wanted to start data collection it was found that there was a scarcity of videocassette players on the North Texas State University campus that would accommodate the 3/4-inch tape that was used. The investigator also found that the Media Library on campus had available two 1/2-inch players. Thus, all the 3/4-inch tapes were transferred onto 1/2-inch tape and the available videocassette players used in the data collection process.

---

[2]The order in which the groups came was determined by the nursery director according to their schedules.

Appendix F

Informed Consent

AN EVALUATION OF A PLAY ENVIRONMENT

DESIGNED FOR YOUNG CHILDREN

Dear Parents:

A research project has been organized in which a play environment will be assessed. The purpose of this project will be to determine the effect of structural complexity, designed as part of the play environment, on the play behavior of the children. As a result of this project each child will probably enjoy an increased interest in free play time at school as well as expanded motor behavior during that play.

This letter serves to request your permission to allow your child to participate in each assessment period in which the children will be allowed to play on the playground equipment. This assessment will take place prior to, and following rearrangement of the play environment. It will record select behaviors for all the children. There are no right or wrong play behaviors; we are interested in whether changes in the play environment will affect play behavior.

These assessments will take about one-half hour and will not identify the children individually.

Please feel free to call for answers to any questions at the following number: 788-2305.

Your cooperation and that of your child will be greatly appreciated. Please complete the attached Informed Consent Form and send it to school with your child tomorrow. Should you be dissatisfied with the project after giving permission, feel free to call and withdraw that permission.

Lawrence D. Bruya, Ph.D.
Division of Physical Education

Curt L. Fowler
Division of Physical Education
P.O. Box 13857
North Texas State University
Denton, Texas 76203

PARENTAL INFORMED CONSENT

I give my permission for my child _____, birthdate _____ to participate in the project entitled "How Play Is Influenced by Arousal Providing Events." I understand that my child will be involved in repeated assessments of play behaviors after changing the play environment as a part of this project.

Signed: _____

Name: _____

(please print)

Address: _____

Phone: _____

References

Aaron, D., & Winawer, B. P. Child's play, a creative approach to playscapes for today's children. New York: Harper and Row, 1965.

Allen, Lady of Hurtwood. Planning for play. Cambridge, Mass.: M.I.T. Press, 1968.

Baer, D. M., Wolf, M. M., & Risley, T. R. Some current dimensions of applied behavior analysis. Journal of Applied Behavior Analysis, 1968, 1, 91-97.

Beckwith, J. (no title). Paper presented at the meeting of the American Alliance for Health, Physical Education, and Recreation, Kansas City, April, 1978.

Beckwith, J. Personal communication, 1979. (a)

Beckwith, J. Personal communication, October 16, 1979. (b)

Beckwith, J. Personal communication, 1979. (c)

Beckwith, J. Schoolyard Big Toys: Playground planning and fund raising guide. Tacoma, Wash.: Northwest Design Products, Inc., 1979. (d)

Beckwith, J. Make your backyard more interesting than T.V. New York: McGraw-Hill, 1980.

Berlyne, D. E. The influence of complexity and novelty in visual figures on orienting responses. Journal of Experimental Psychology, 1958, 55(3), 289-296.

Bruya, L. D. Play environments for the deaf-blind child: Considerations for mobility and communication. Dallas, Tx.: South Central Regional Center, 1979. (a) Videotape

Bruya, L. D. The play environment as an effector of mobility and communication in deaf-blind children. In D. M. Compton, M. G. Burrows, and P. A. Witt (Eds.), Facilitating play, recreation and leisure opportunities for the deaf-blind children and youth. Denton, Tx.: North Texas State University Press, 1979. (b)

Bruya, L. D. Factors influencing the design of play environments. Manuscript submitted for publication, 1980. (a)

Bruya, L. D. Observed motor behavior on linked and non-linked play structures. Manuscript submitted for publication, 1980. (b)

Bruya, L. D., & Buchanan, H. E. The effect of changing structural complexity on the observed motor behavior of preschool-age children. In C. B. Corbin (Ed.), AAHPER research consortium symposium papers: Teaching behavior and sport history (Vol. 1, book 1). Washington, D. C.: American Alliance for Health, Physical Education, and Recreation Publications, 1978. (a)

Bruya, L. D., & Buchanan, H. E. Structural complexity and observed motor behavior of pre-school age children during play (NTSU 35779). Denton, Tx.: North Texas State University, Division of Physical Education, 1978. (b)

Bruya, L. D., & Buchanan, H. E. Complexity in an outdoor play environment. In C. Gabbard (Ed.), Texas A&M conference on motor development and movement experiences of children. College Station, Tx.: Texas A&M Press, 1979.

Caplan, F., & Caplan, T. The power of play. Garden City, N. Y.: Anchor Press/Doubleday, 1973.

Dattner, R. Design for play. Cambridge, Mass.: M.I.T. Press, 1969.

Ellis, M. J. Why people play. Englewood Cliffs, N. J. Prentice-Hall, 1973.

Ellis, M. J., & Scholtz, G. J. L. Activity and play of children. Englewood Cliffs, N. J.: Prentice-Hall, 1978.

Erickson, E. Childhood and society. New York: Norton, 1950.

Erickson, E. Play and actuality. In M. W. Piers (Ed.), Play and development. New York: Norton, 1972.

Espenschade, A. S., & Eckert, H. M. Motor development (2nd ed.). Columbus: Charles E. Merrill, 1980.

Fiske, D. W., & Maddi, S. R. A conceptual framework. In D. W. Fiske & S. R. Maddi (Eds.), Functions of varied experience. Homewood, Ill.: Dorsey Press, 1961.

Fowler, C. L. How complexity of motor tasks affects preschool children's perceptions of enjoyment, difficulty, and performance. Unpublished manuscript, 1979.

Freud, S. Beyond the pleasure principle (4th ed.). New York: Liveright, 1950.

Freud, S. On creativity and the unconscious. New York: Harper and Row, 1958.

Freud, S. The ego and the id. New York: Norton, 1960.

Frost, J. L., & Klein, B. L. Children's play and playgrounds. Boston: Allyn and Bacon, 1979.

Gramza, A. F., Corush, J., & Ellis, M. J. Children's play on trestles differing in complexity: A study of play equipment design. Journal of Leisure Research, 1972, 4, 303-311.

Hall, R. V., & Fox, R. G. Changing criterion designs: An alternate applied behavior analysis procedure. In B. C. Etzel, J. M. LeBlanc, & D. M. Baer (Eds.), New developments in behavioral research: Theory, method, and application. New York: Lawrence Erlbaum Associates, 1977.

Hewes, J. Build your own playground! A sourcebook of play sculptures, designs, and concepts from the work of Jay Beckwith. Boston: Houghton Mifflin Co., 1975.

Hutt, C. Exploration and play in children. In J. S. Bruner, A. Jolly, & K. Sylva (Eds.), Play--Its role in development and evolution. New York: Basic Books, 1976.

Johnson, M. W. The effect on behavior of variation in the amount of play equipment. Child Development, 1935, 6 (1), 56-58.

Kando, T. M., & Summers, W. C. The impact of work on leisure: Toward a paradigm and research strategy. Pacific Sociological Review, 1971, 14(2), 310-327.

Kazdin, A. E. Methodological and assessment considerations in evaluating reinforcement programs in applied settings. Journal of Applied Behavior Analysis, 1973, 6, 517-531.

Kerlinger, F. N. Foundations of behavioral research (2nd ed.). New York: Holt, Rinehart, & Winston, 1973.

Levy, J. Play behavior. New York: John Wiley & Sons, 1978.

McClenaghan, B. A., & Gallahue, D. L. Fundamental movement: A developmental and remedial approach. Philadelphia: W. B. Saunders, 1978.

McGraw, M. G. Growth: A study of Johnny and Jimmy. New York: D. Appleton-Century, 1935.

Millar, S. The psychology of play. Baltimore: Penguin Books, 1968.

Miller, P. L. Creative outdoor play areas. Englewood Cliffs, N. J.: Prentice-Hall, 1972.

Munsinger, H., Kessen, W., & Kessen, M. L. Age and uncertainty: Development of variations in preference for variability. Journal of Experimental Child Psychology, 1964, 1(1), 1-15.

Piaget, J. Play, dreams and imitation in childhood. New York: Norton, 1962.

Piaget, J. Mastery play. In J. S. Bruner, A. Jolly, & K. Sylva (Eds.), Play--Its role in development and evolution. New York: Basic Books, 1976.

Plantinga, J. H. A creative alternative to swingsets: Guidelines for planning and designing creative playgrounds. Eugene, Oregon: University of Oregon Center of Leisure Studies, 1977.

Roberts, J. M., & Sutton-Smith, B. Child training and game involvement. Ethnology, 1962, 1(2), 166-185.

Scholtz, G. J. L., & Ellis, M. J. Novelty, complexity, and play. Paper presented at the International Seminar on Play in Physical Education and Sport, Wingate Institute, Israel, April, 1975. (a)

Scholtz, G. J. L., & Ellis, M. J. Repeated exposure to objects and peers in a play setting. Journal of Experimental Child Psychology, 1975, 19, 445-455. (b)

Shaw, L. G. The playground: The child's creative learning space (MH 20743-04A1). Gainesville, Florida: The Bureau of Research, College of Architecture, University of Florida, 1976.

Simpson, N. B. Historical perspectives of play environments. In C. B. Corbin (Ed.), AAHPER research consortium symposium papers: Teaching behavior and sport history (Vol. 1, book 1). Washington, D. C.: American Alliance for Health, Physical Education, and Recreation, 1978.

Stone, J. G. Play and playgrounds. Washington, D. C.: National Association for the Education of Young Children, 1970.

Sutton-Smith, B., Roberts, J. M., & Kozelka, R. M. Game involvement in adults. The Journal of Social Psychology, 1963, 60, 15-30.

Vitz, P. C. Preference for different amounts of visual complexity. Behavioral Science, 1966, 11(2), 105-114.

Wade, M. G., & Ellis, M. J. Measurement of free range activity in children as modified by social and environmental complexity. The American Journal of Clinical Nutrition, 1971, 24, 1457-1460.

Weilbacher, R. M. A comparison of kindergarten girls' social and motor behavior in a static play environment and in a dynamic play environment. Unpublished doctoral dissertation, The Ohio State University, 1980.

Witt, P. A., & Bishop, D. W. Situational antecedents to leisure behavior. Journal of Leisure Research, 1970, 2(1), 64-77.