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EFFECTS OF ACTIVE PLAY AND PASSIVE OBSERVATION ON PROBLEM SOLVING IN FOUR-YEAR-OLD CHILDREN

BY

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A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

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TO MY PARENTS

-- RAYMOND AND IDA LEUNG --

WITH LOVE

ABSTRACT

Object play is widely considered a primary medium through which children develop cognitive skills. In an attempt to examine the relative importance of different types of play experience and selected play components on children´s subsequent approach to problem solving, 31 four-year-olds (19 boys, 12 girls) were matched on sex and PPVT-R raw score, and were then assigned to one of three treatment groups. Seven triplets (5 male, 2 female) and five pairs (2 male, 3 female) of children were formed. Children in each group were exposed to a different type of experience relative to task-relevant materials (active play, passive observation of play, and no involvement) and subsequently given a lure-retrieval task. The solution to this task involved the joining of the two longest sticks with a block to produce a tool to retrieve a lure. Subjects were compared on their problem-solving performance as measured by solution time and score on hints.

Correlations between solution time and the specific object play components obtained in Cheyne and Rubin´s (1983) study were replicated in this study. Examination of additional components in play indicated that problem solution was enhanced not only by frequent use of long double-stick construction, but also by double-stick constructions with any stick length. Problem-solving performance of the three groups of children were not significantly different. However, a Treatment x Sex interaction was noted among children in the active and passive groups; passive girls spent more time and tended to require more assistance to task solution than active girls, active boys, and passive boys. Factors which may have contributed to this finding are discussed.

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CHAPTER I

INTRODUCTION

The underlying assumption of this study is that children´s development of cognitive abilities and skills is depended upon and influenced by their past experiences. The contributions of several forms of prior experience with objects to children´s subsequent approach to solving problems have been investigated. Among the forms of prior experience that are reported in the literature are active play, training, observation of an experimenter´s demonstration, and no prior opportunity to play with the objects. However, the effect of passive observation of a video playback of a peer´s play on problem solving has not been explored.

Most play theorists consider object play as functional and universal. Among nonhuman primates, it has long been established that prior tool use contributes to later solving a lure-retrieval task. In contrast, it was not until the past decade that research was done with human subjects in this area. The correlation between object manipulation and problem solving was well documented, yet the actual functions of the prior play experience is still in need of further study.

Although a general or global link between object play and problem solving has been demonstrated, it remains to be clarified what the specific elements in play are that enhance problem solving. Thus far, little research has been done which relates specific components of play with sticks and blocks with outcome measures of problem-solving proficiency.

The present study attempted to examine the effect of different modes of prior experience with objects on problem solving with specific attention to the components of object play that correlate with problem-solving performance. The two major objectives of this study were: (a) to explore whether problem-solving abilities of children with prior play experience with task objects differ from those of children with mere passive observation of peer´s object manipulation and from those without play opportunities with task objects, and (b) to gain some insight into the role of play components in the solution of problem. From knowledge of various aspects of the play situation, such as the structure of play, the nature of the materials, and the types of play behaviours, it is hoped problem solving by preschool children may be promoted.

CHAPTER II

REVIEW OF LITERATURE

Origin of Play Theories and Research

Children's play has been the subject of attention for a long time, though, until recently, it is noted more for its theories than for its scientific accumulations of data (Herron and Sutton-Smith, 1971). The "classical" theories of the surplus energy, the preexercise, and the recapitulations (Berlyne, 1969; Ellis, 1973; Gilmore, 1971; Levy, 1978; Millar, 1968; Rubin, 1982) are considered to be the sources of many of the research ideas ascribed to the contemporary theorists.

One of the earliest theoretical speculations about the significance of play is attributed to both F. Schiller (1875) and Spencer (1873), although their beliefs that play was essentially "letting off" of surplus energy could be traced back to Ancient Greek philosophy and the Aristotelian concept of catharsis (Mitchel and Mason, 1948). F. Schiller (1954) defined play as "the aimless expenditure of exuberant energy" left over once the primary needs were met. Since the young were freed from the responsibility for their own survival, they were considered to possess a total energy surplus which was depleted through play.

In comparing F. Schiller's views with contemporary issues on play, Rubin (1982) discovered two points of interest. For one, F. Schiller´s argument that play was the medium through which the child could transform and transcend reality thereby gaining new symbolic representations of the world was very much similar to the theoretical speculations of Piaget (1962), Singer (1973) and Vygotsky (1976) among others. For another, F. Schiller´s category of "Überfluss" or material superfluity, which could lead to physical play, resembled Bühler´s (1928) and Piaget´s (1962) category of functional play. In addition, F. Schiller´s category of aesthetic superfluity, which was culminated in dramatic or symbolic play (Lieberman, 1977), could also be found in Piaget´s (1962) Play, Dreams, and Imitation in Childhood. Rubin further pointed out that Piaget´s categories of play, which were later elaborated by Smilansky (1968), that is, functional, constructive, and dramatic play, were actually derived from Bühler´s (1928) definitions of "Funktions-spiele", "Konstruktionsspiele", and "Fiktionsspiele", respectively.

In his writings, Spencer (1873) postulated that play was the activities stimulated by replenished nerve cells and carried on without regard to much life-supporting endeavours or ulterior benefit. Perhaps Spencer´s most relevent contribution to present-day play theory was the distinction he made between different types of play--(a) the superfluous activity of the sensorimotor apparatus; (b) artistic-aesthetic play; (c) the higher coordinating powers of games, and (d) mimicry. According to Rubin (1982), Spencer´s first two categories of play could be identified with Bühler´s (1928) categories of "Funktionsspiele" and "Fiktionsspiele", as well as Piaget´s (1962) categories of practice and symbolic play. Similarly, the latter two categories strongly resemble Piaget´s categories of games with rules and imitation.

Groos´ (1898, 1901) preexercise theory of play was the next classical theory that has bearing on contemporary play research. To Groos, play was a product of emerging instincts; through the elaboration of undeveloped instinctual impulses, play resulted in the emergence of intelligent, nonreflective behaviors. Interestingly, Groos believed that playing children were more gratified with the processes rather than with the outcomes of their behaviors. A connection of this view could be identified with the works of White (1959) and those researchers concerned with effectance or mastery motivation (Harter, 1978, 1980; Harter and Zigler, 1974; Morgan, 1983; Messer, Rachford, MaCarthy, and Yarrow, 1983; Vietze, 1983; Yarrow and Messer, 1983).

Groos (1901) also proposed a category system for understanding the types and functions of children´s play. The category of socionomic play, which included fighting and chasing, and imitative, social and family games, was speculated to assist in the development of interpersonal skills, a hypothesis adopted by contemporary investigators in looking at the causal effects of fantasy and dramatic play (Rubin and Pepler, 1980; Singer, 1973; Smilansky, 1968).

The third classical theory that has significant influence on contemporary play research was Hall´s (1920) recapitulation theory of play. The major tenet of Hall´s writing was that the history of humankind could be progressively recapitulated during childhood play. Thus, children´s play was suggested to weaken the instincts derived from earlier epochs thereby allowing the development of more complex forms of activity typical of modern civilizations. This view was closely related to the present-day psychoanalytic belief that play served a cathartic role in normal development in providing a means to release, and subsequently weaken childhood tensions, anxieties, and aggressive impulses.

Having established a sense of theoretical continuity in the field of children´s play, the present study specifically focuses upon Groos´ contention that play provides a source for children to develop problem-solving skills and tests it empirically.

In this context, literature pertinent to an examination of the functions of play in problem solving among children can be divided into three major sections: first, a review of the theoretical arguments about the value of playful behavior; second, literature relating specifically to object play findings; and third, a discussion of problem-solving tasks.

Theoretical Basis of Play

A review of the play theories indicates four basic ways in which play contributes to the development of problem-solving skills: (a) play as exploration; (b) play as experimentation; (c) play as practice; and (d) play as symbolic thinking. The theories related to each of the mechanisms will be examined in order to specify the ways in which they explain the effects of play on problem solving.

Play as Exploration

A controversy exists throughout the literature about the distinction between exploration of and play with objects, and whether exploration is a form of play (Hutt, 1970; Weisler & McCall, 1976). The present study does not aim to define play, but rather, to look at components of play as they relate to problem solving.

Hutt (1970, 1982) distinguishes exploration as a stimulus referent and play as a response referent. When a child is confronted with a novel object, the primary focus of play may be discovery of its stimulus characteristics and thus exploration may serve as an agent posing the question: "What is this and what can it do?" (Berlyne, 1965; Hutt, 1970, 1982) and applies to this mechanism of play as exploration. On the other hand, the child may focus his or her play on response qualities of the object, thus serving as an agent posing the question: "What can I do with this object?" (Hutt, 1970, 1982; Sylva, 1974) and relates to the next mechanism of play as experimentation.

Exploration involves visual investigation, active examination, manipulation and prolonged attention to the object and activities (Berlyne, 1965; Hutt, 1982; Piaget, 1962). It has been well documented that through exploration of novel objects, a child develops a better knowledge of the nature-characteristics of objects (Weisler and McCall, 1976). Thus exploration would likely contribute to subsequent problem-solving with the same objects by providing the child with an understanding of the objects beforehand.

Play as Experimentation

Once the child has discovered the properties of an object or mastered a skill, he or she starts to experiment actively with the object or skill. This experimentation in play most likely leads to variability (Sutton-Smith, 1975) and flexibility (Bruner, 1973) in the child's responses.

Experimentation in plays, which involves exploration or discovery of the interactive characteristics of stimulus and response, has been viewed as an activity one level higher than exploration of an object. Hutt (1970, 1982) uses the term "diversive exploration" when the child begins to try out different combinations of response to stimulus characteristics. Unlike the exploration in which the child examines the properties of an object, diversive exploration allows the child to find out different ways of using the object. According to Hutt (1970, 1982), diversive exploration is characterized by a more relaxed and varied approach to the objects of play. In addition, it contains trial and error and the chance combinations of responses (Piaget, 1962) and is a form of "variation-seeking" with an object and a child's own behaviors (Sutton-Smith, 1975). Bruner (1973) addresses the experimental mechanism in play as combinatorial flexibility "that would, under functional pressure, never be tried" (p. 38). Hence, experimentation in play would likely be beneficial by attaining a broad repertoire of skills and responses and perhaps a flexible set that can be used to more effectively solve a divergent problem.

Play as Practice

The third manner in which play contributes to development is by the assimilation nature of play activities. P.H. Schiller (1976) argues that simple discovery of principles with object in play is not sufficient for implementation in problem contexts. There is also need for newly attained principles and actions to be consolidated through repetition. To illustrate, P.H. Schiller stated

> My chimpanzees learned (the principle of joining sticks) rapidly....but they played a lot with the double stick before incorporating it into the problem solution.... Repetition condenses the chain, to a unified skill pattern (p. 237).

Thus, for P.H. Schiller (1976), both discovery of principle and its subsequent assimilation in play are seen to be important precursors of problem solving.

Similarly, play serves a major adoptive role within the framework of Piaget's theory. To Piaget (1962), play prevents the newly learned abilities, both physical and mental, from being lost due to disuse. Since such abilities are likely to receive the most attention when "reality" receives very little, play fixes and retains the new skills and responses. Therefore, on the basis of Piaget´s (1962) theory, if play behaviors were to be prevented somehow, then not very many skills and concepts would remain available to the child.

In short, through practice, play fosters the assimilation and consolidation of newly acquired principles and skills. This repertoire of abilities can be evoked in subsequent problem-solving attempts.

Play as Symbolic Thinking

The role of play in facilitating transformation from concrete to abstract thought has been the focus of several theoretical models (Piaget, 1962; Smilansky, 1968; Vygotsky, 1976). Piaget (1962) proposes that the transition is from sensorimotor schemes to conceptual schemes. Representation occurs in play when a symbol (signifier) takes on the meaning of an object (signified). According to Piaget (1962), the meanings of symbols are developed, in part, through assimilation, the dominant element in play. Thus, the symbolic representations that are produced in play form part of the process through which a child develops abstract thinking.

Vygotsky (1976) further explains the way in which the transition from concrete to abstract thinking takes place.

He purports that thought is separated from an object when the child is engaging in play. For example, a stick becomes a horse. The mechanism that leads to such transition is that the stick "becomes a pivot for severing the meaning of horse from a real horse" (p. 546). Vygotsky (1976) notes that it is only in play that young children´s thoughts are freed from real-life situational constraints.

In brief, symbolic play involves using one object to signify another and is, therefore, an elementary form of representational thought. In play, the child´s thought can be moved away from the concrete into the abstract at an age when he or she may be otherwise incapable of abstract thought. Such an ability to consider objects in more abstract terms facilitates divergent problem solving which requires the child to deduce a variety of free associations (Pepler, 1982).

In sum, the theories that address the functions of play on development suggest that play may be beneficial to problem solving by enabling the child to explore and learn about the properties of the object, to experiment and generate different responses with the object, to practice and retain the new abilities, and to improve on symbolic thinking.

Empirical Findings of Play

Insights in the functions of object play have been obtained from research with nonhuman primates as well as children. Among studies with primates (Bruner, 1972; Candland, French and Johnson, 1978; Groos, 1898; P.H. Schiller, 1952; Van Lawick-Goodall, 1970, 1976 a, 1976 b), P.H. Schiller (1952), for example, discovered a perfect correlation between amount of object manipulation and success in tool use in a cross-age, cross-specific comparision of primates. Some researchers have found that deprivation of object play opportunities most likely resulted in severely limited tool use and problem-solving capacity in chimpanzees (Bernstein, 1962; Birch, 1945 a, 1945 b; Jackson, 1942; Menzel, Davenport, & Roger, 1970; P.H. Schiller, 1952). Despite the bulk of speculations and works on the function of play activity with objects, only recently have empirical studies begun to document the role of object play in children. In general, three major areas of interest can be identified in this research area: (a) the influence of play materials; (b) the effect of prior experiences; and (c) the specific components in play that facilitate problem solving.

Play Materials

Studies on object play generally distinguish between convergent and divergent materials (Dansky & Silverman, 1973, 1975; Li, 1978; Pepler, 1979; Pepler & Ross, 1981; Smith & Dutton, 1979; Sylva, Bruner & Genova, 1976). Convergent play materials refer to those that tend to direct play toward a single solution; while divergent play materials are those that facilitate a variety of play activities.

Play materials in the studies of Pepler (1979) and

Pepler & Ross (1981), could be used by the children either convergently, as pieces to a puzzle, or divergently, as play blocks. When confronted by a problem in which a salient cue was irrelevant, it was found that the three- and four-year-olds who played with convergent materials tended to persist with a reasonable but inappropriate strategy. This observation is similar to Luchins´ (1942) concept of set. According to Luchins´ explanation, subjects who worked out problems with a single equation for solution, acquired a particular technique or set to handle the problem in a certain way. This set carried over to subsequent problems despite the fact that an easier solution is available.

On the other hand, in the same studies, the children who played with divergent materials did not use strategies as consistently in solving convergent problems as children who had played with convergent materials. Instead, these children had a higher proportion of trial-and-error moves, which suggested that they might have had a more flexible approach to solving a puzzle with a less salient strategy. This effect is similar to the findings of Sylva et al. (1976) and Smith and Dutton (1979) who reported that three- to five-year-old children who played with materials in a divergent manner were more flexible or innovative in their use of strategies to solve a convergent problem.

Unlike the poorer performance of those children who played with convergent materials on the divergent-thinking tasks, the effects of divergent play on divergent problem solving also indicated greater flexibility in problem solving by the children with divergent play (Pepler, 1979; Pepler & Ross, 1981). The results were consistent with those of other studies done by Dansky and Silverman (1973, 1975) and Li (1978). In general, children who had divergent play experiences were more imaginative in their responses to divergent problems, giving more unique responses to divergent-thinking tasks, than children who had convergent play or no play experiences.

Taken together, the comparison of the effects of play with convergent and divergent materials on problem solving suggested that the effects of convergent play experiences were very specific, whereby children in the convergent play group tended to use the strategies whether or not they were appropriate. On the contrary, play with divergent materials appeared to transfer much more generally. Even though the divergent problem-solving tasks were not similar to the divergent play experience, the children who had played with the divergent materials were more flexible and unique in their responses. The flexibility elicited by playing with divergent materials seemed to transfer to the convergent tasks; in particular, the divergent play group appeared to be more flexible in the abandonment of ineffective strategies as they sought problem solutions.

Prior Experiences

Various experiences prior to presentation of the problem contributed differently in their effects in shaping problem-solving abilities. On the whole, the treatment conditions used among studies can be grouped into three types: (a) active play manipulation; (b) active nonplay manipulation; and (c) passive nonplay observation. The first type of prior experience was a period of free play with objects. The second type, termed imitation or training, involved subjects' observation of the experimenter's demonstration of different operations and subjects' repetition of the procedure. The third type of prior experience consisted of an observation only in which the child's role was to watch the experimenter perform a principle required for the task. In general, active play was found to be more task-enhancing than the other nonplay experiences. However, no research has been done using a passive play observation whereby the child watches modelling of a peer instead of an adult, and the observation involves free play rather than demonstration of a prescribed activity. The efficacy of such a prior experience as preparation for problem solving is yet to be understood.

Sylva, Bruner, & Genova (1976) compared the effect of free play to a no-treatment condition. Though children with play experience were superior in task performance to children with no treatment, the superiority of the play group over the observe-principle group was less clear. The authors reported that children in the play group required fewer hints, displayed more goal-directed responses, and were categorized as "learners" more frequently (that is, moving from simple to complex means) as compared to children in the observe-principle condition. Nonetheless, upon further examination, it was found that nine out of the 15 successful children in the observe-principle group solved the problem on their first attempt, whereas only three of the 14 in the play group did so, and therefore, did not require any hints, did not need more than one goal-directed response, and were not categorized as "learners", although they had clearly learned the solution (Cheyne, 1982; Pepler & Ross, 1981).

Vandenberg (1981) and Smith and Dutton (1979) have extended the research of Sylva et al. (1976). Vandenberg (1981) used tasks of varied difficulty with children of a larger age range. Differences in task performance were similar to those obtained previously. In this instance, children who had prior play experience solved the problem more readily than those receiving instructions. However, this difference was found only with the task of similar complexity but not for the simpler task which demand less probing toward the solution. Smith and Dutton (1979) extended the play versus training paradigm to direct and innovative problem solving. On the task of joining two sticks together with a block, children with training experience directly relevant to the task performed as well as children with play opportunity, and both were superior to a control group. On a more complex task of joining three sticks together, which had not been directly taught to the two-stick-joining training group, the children with play experience needed fewer hints and were faster in solving the problem than those with training or no experience, indicating that play experience may be beneficial for a task which requires innovative use of prior experience.

The aforementioned superiority of the play experience over training and no experience on a convergent problem-solving task corresponds to Dansky & Silverman´s (1973) findings on a divergent problem-solving task. In their studies, free-play experience with everyday objects, such as paper clips or corks, resulted in the suggestion of more possible uses of these or other objects than did a nonplayful experience in which children watched the experimenter do things with the objects and then repeated the actions themselves.

In Sylva´s (1974, 1977) study, five groups of three- to five-year-old children were contrasted on their problem-solving proficiency. The author reported that children in both free play and observation of experimenter´s demonstration of solution principle conditions performed better than those in the other three conditions, namely, children without any prior experience, children observing the experimenter did the same actions as the yoked free play children, and children doing the same actions of their yoke mates themselves under training. Moreover, the children with play opportunity had a slight but significant advantage over those observing the solution principle in that those children who did need help to solve the problem needed fewer hints to do so. Sylva´s findings were similar to those of Zammarelli

& Bolton (1977), who examined mathematical concept learning in 10- to 12-year-olds and concluded that "play with a specially designed toy can lead to a greater understanding of the rules embodied in a mathematical concept and a better memory for such rules than can be provided by observation..." (p. 160) of the same materials without the opportunity to manipulate them.

Play Components

At least as far back as Groos (1898, 1901), it had been speculated that one of the potential functions of play is to provide the organism with specific skills for a variety of life tasks. Both Birch (1945 b) and P.H. Schiller (1952) provided strong evidence that fairly specific skills and principles, with regard to sticks and other objects as tools, are learned by primates in unconstrained, playful object manipulation. Most researchers in the field have attempted to observe and record the behaviors of the children during play and have suggested that play impacts on problem-solving proficiency, nevertheless, they have not clearly identified the specific elements in play that facilitate problem solving. Not until recently has there been evidence from research with children suggesting that task-specific skills may be built up in the context of object play (Cheyne & Rubin, 1983; Darvill, 1981; Pepler & Ross, 1981; Vandenberg, 1981).

In an attempt to test for the effect of configurational richness on subsequent problem solving, Sylva, Bruner, &

Genova (1976) concluded from the correlation between test scores of children in the play group and their yoke mates, that configurational richness affected task performance. Since Sylva et al. (1976) had not assessed nor attempted to define configurational richness, Vandenberg (1980, 1981) criticized this conclusion. However, Cheyne (1982) noted that in her unpublished dissertation, Sylva did precisely define configurational richness and directly related it to task performance. Sylva (1974) defined poor configurations as involving less than five single clampings and rich configurations as those involving more than four single clampings or at least one double-stick clamping. She found that children in the play group who made rich configurations were more likely to be spontaneous solvers than children who made poor configurations. In addition, she reported that this relation also held for children under the yoked control conditions, namely, training and watching an adult modelling, but not as powerfully as for the children under the play condition.

Although Vandenberg (1981) was not able to replicate Sylva´s (1974) findings, in more recent work, it was found that the greater the variety of stick configurations during play, the shorter the time for solution (Cheyne and Rubin, 1983). This correlation was obtained for a measure very similar to that used by Sylva (1974). Evidence was less strong for a measure similar to that used by Vandenberg (1981), whose measure corresponded to the computation of the average number of elements per construction in Cheyne and Rubin's (1983) study.

Pepler (1979) and Pepler and Ross (1981) found measures of flexibility and fantasy effective in predicting skill at solving divergent but not convergent tasks. In the former case, there were multiple problem solutions; whereas in the latter, there was but a single task solution. This finding helps to explain Cheyne and Rubin's (1983) failure to find consistent significant correlations between flexibility of play construction, fantasy play constructions, and problem-solving skill. In Cheyne and Rubin's (1983) study, the children were presented with divergent play materials and tested with a convergent problem-solving task. The non-significant relation between flexibility, fantasy, and time for solution may be due to the nature of the problem presented to the children which did not require the flexibility and fantasy components of play.

Vandenberg (1981) examined the performance of certain components of problem solution during play, which he labeled "task specifics". Vandenberg predicted that the use of task specifics in play would become more helpful as the difficulty of the problem increases. Interestingly, Vandenberg reported the opposite effect, that is, the use of task specifics in play predicted the solution of a simple problem better than a difficult problem. In contrast, the clearest and most consistent finding in Cheyne & Rubin's (1983) study was that children who appeared to discover the long-stick extension principle during play were better able to solve a lure-retrieval problem than were their counterparts who did not discover the principle. It is interesting to note that these differences, once again, can be reconciled by a simple comparison between Vandenberg's (1981) and Cheyne and Rubin's (1983) definitions. The particular task specific that Vandenberg observed to predict performance on his simple problem was directly analogous to Cheyne and Rubin's "use of the principle" construction, which involved the exact construction necessary for subsequent problem solution. Alternately, the task specific that Vandenberg observed in the play session prior to the presentation of the difficult problem was analogous to Cheyne and Rubin's measure of "number of joins". Given both sets of data, it was suggested that the potency of the task specific discovered in play becomes greater with increasing resemblance to the central principle required for problem solution, regardless of task difficulty.

The findings of these correlational studies have been confirmed by Darvill (1981), who manipulated the performance or nonperformance of task specifics by altering the characteristics of the materials. Darvill found that children who were permitted to play with sticks and blocks that precluded stick/block joins performed more poorly on the lure-retrieval problem than did children who played with materials that allowed such joins. Thus, it would appear that the discovery or performance of the principle in play does have an impact on problem-solving skill.

Problem Solving Tasks

Attempts to define thinking in general or problem solving in particular appear most clearly in the works of Humphrey (1951), Johnson (1955), Maltzman (1955), Ray (1955), Russell (1956), Underwood (1952), Van de Geer (1957), and Vinacke (1952). In general, the defining characteristics most frequently mentioned for thinking are the integration and organization of prior experience, and for problem solving the dimension of discovery of correct response. Play studies in which problem-solving tasks were used generally fall into either of two major classes: convergent problem solving, for which there is one and only one solution, and divergent thinking, for which there is no single correct solution but a variety of possible solutions. The following review will focus mainly on the nature of convergent tasks and the direction of their association with play.

Past research has shown that play is beneficial to solving convergent problems. Most of the studies used modifications of the classic stick problem described by Hobhouse (1901) and Köhler (1931). In brief, the problems involve the retrieval of a lure placed out of reach, which can be solved by joining two sticks to form an extended tool. Köhler´s (1931) work, in particular, inspired considerable research using this paradigm. This research was adopted to investigate problem-solving skills of infants and young children (Alpert, 1972; Brainard, 1930; Ling, 1946; Matheson, 1931; Menzel et al., 1970; Richardson, 1932, 1934). These studies, by and large, focused on the problem-solving skills per se and often described in great detail the children's behavior in the problem situation. Not until recently has the Köhler (1931) paradigm been reintroduced for children by Sylva (1974, 1977; Sylva et al., 1976). However, the focus of Sylva's investigations was not on problem solving per se, but on the prior play activity with materials relevant to problem solution.

In Köhler's (1931) study, when a banana was placed beyond reach, the chimpanzee, Sultan, grabbed a stick and used it as a rake. If the sticks in the cage were too short to reach the banana, Sultan joined two sticks together, thereby constructing a tool long enough to reach the goal. Köhler attributed Sultan's success at both the single- and double-stick problems to sudden insights into the functional relations inherent in the problem situation. In other words, Köhler saw no need to study the relation between problem solving and prior experience because of his claim that the solution derived from the perceptual present.

On the other hand, Birch (1945 b) argued that insight such as Sultan's depended on the animal's prior experience with sticks. Birch experimented with six young chimpanzees by presenting them the single-stick-as-rake problem. Records of these chimpanzees indicated that only one of them, Jojo, had ever been seen manipulating sticks. When confronted with an attractive lure outside the cage, Jojo immediately seized a nearby stick and used it effectively as a rake. Only one other chimpanzee solved the problem, and this animal´s solution occurred after he "accidentally" touched the banana with a stick and noticed it moved towards him. The remaining four chimps in Birch´s experiment spent thirty minutes in frustrated attempts to get the banana. Following the initial presentation of the problem, all the chimps were provided with sticks in the home cage and were seen manipulating the sticks for three days. When tested again, all six chimps solved the stick problem within twenty seconds. Thus, it appears that prior experience with sticks led to problem solution, whereas lack of it was most often associated with failure and frustration.

Similarly, research with children has shown that when the training session related directly to the task of joining two sticks together, the play and training groups were equivalent in their problem-solving performances, and both were superior to a nonplay group (Smith & Dutton, 1979; Sylva, 1977; Sylva et al., 1976; Vandenberg, 1981). Nonetheless, Smith and Dutton (1979) further showed that on a more complex task of joining three sticks together, which had not been directly taught to the training group, children with play experience performed better than both children with training and nonplay opportunities, indicating that play experience may be beneficial for a task which needs "innovative transfer".

Hence, given the data of Birch (1945 b) with chimpanzees and those of the studies with children, it seems unlikely that the act of insight in problem solving (Köhler, 1931) leads to the discovery of a previously unknown principle. Rather, as Cheyne and Rubin (1983) suggested, insight may be better conceptualized as the discovery that a previously known principle will serve as a solution to a problem.

Thus far, the major thrust of research has focused on the general relation between object play and problem-solving tasks. Little research has been done to relate success in problem solving to specific components of object play. Of the few studies dealing with specific play behaviors, Cheyne and Rubin (1983) found the discovery of the solution principle and the quality of combinatorial activity during play were significantly related to problem-solving solution time. Unfortunately, the authors employed only one group of subjects. In another study, Sylva (1974) found that the complexity of play constructions was positively related to problem-solving skill. Again, Sylva's play sample was small and varied widely with regard to age. Since the lure-retrieval problem is highly age sensitive (Cheyne and Rubin, 1983; Sylva, 1977; Vandenberg, 1981) and since Sylva did not control for this age variable, her findings were considered highly tentative. In other words, further studies relating specific behaviors that occur during play with measures of problem-solving proficiency tend to require a comparison group and a control for age.

CHAPTER III

STATEMENT OF PROBLEM

Children´s experience with task relevant objects has been shown to facilitate later solution of problems. However, it has also been demonstrated that the effectiveness of prior play experience varies with the type of involvement the child has had with the objects. In general, it has been found that active manipulation in a free play situation is most effective in promoting problem solving. What is more, it is important to note that problem solving is not automatically fostered by the lack of structure in a free-play situation, but that it is the discovery of the solution principle during play that contributes to solving single solution problems.

In all, the two major factors which determine the constructiveness of play experiences are: (a) the type of involvement with objects and (b) the components of play behavior displayed. In Cheyne and Rubin´s (1983) study, the latter factor has been dealt with systematically through analysis of the various object play components. These investigators found that discovery of the solution principle during free play increased the frequency of correct solutions in a convergent problem, namely, a lure-retrieval task. However, the authors did not investigate the effect that different types of involvement have on problem solution. All of their subjects were given the same type of play experience.

In this investigation, Cheyne and Rubin´s (1983) study was replicated with the additional variable of type of involvement in play. The major question explored was: "What are the effects of active manipulation of objects, passive observation of object manipulation, and no opportunity to manipulate the objects on convergent problem solving?" It was hypothesized that children given opportunities to play with the task objects would (a) perform significantly faster and (b) require significantly less assistance on a lure-retrieval task than those who observed a peer´s play and those who had no play experiences with the objects. In addition, correlations between the measures of different play components and problem-solving scores were examined.

The independent variable in this study was the type of involvement with task objects, namely, (a) active manipulation, (b) observational experience, and (c) no manipulation. Children in the active manipulation (experimental) group were given the opportunity to actively play with the blocks and sticks. Two sets of peers, matched with the active subjects on sex and PPVT-R raw score, constituted the comparison and the control groups. The former group of children were allowed to passively watch their matched peers at play from videotapes, while the latter group was asked to play with non-task materials only.

The dependent variables in this study were: (a) the measures of specific object play components scored according to Cheyne and Rubin´s (1983) categories, (b) the time to solution and (c) the score on hints obtained on the problem-solving task.

CHAPTER IV

METHOD

Research Design

This study used a matched subject design with three types of treatment relative to task-related materials, namely, active manipulation, passive observation, and no involvement. The dependent variable was performance in problem solving using solution time as an index of proficiency and a score on hints as an index of the amount of assistance required.

Description of Sample

The study sample included 31 normal preschool children (19 boys and 12 girls). The subjects were obtained by contact with parents through two preschools and three day care centres[1] serving university students and personnel, and through referral by parents of children participating in these centres.

Unlike Cheyne and Rubin's (1983) study, in which the mean age of the children was 56 months (SD = 4.00 months), a younger age group was employed in the present study. Since past research done by Smith and Dutton (1979) had ascertained that the lure-retrieval task was too hard for many 36-month-olds, but too easy for many 60-month-olds, children in the intermediary age were chosen in this study. Ages of the current sample ranged from 44 to 52 months. The mean age

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[1] The participating centres were the Campus Day Care Centre, the Education Nursery School, the Family Studies Nursery School, the Playcare Centre, and the Univillage Student Daycare.

was 48 months (SD = 2.00 months) at the time of experimental testing.

Testing Materials

Peabody Picture Vocabulary Test-Revised

The Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn and Dunn, 1981) is a picture game designed "to provide an estimate of a subject´s verbal intelligence through measuring his hearing vocabulary" (Dunn, 1959, p. 25). Form L of the PPVT-R was individually administered to each child. The test, from which a raw score was derived, was used to match subjects that were then randomly assigned to one of the three treatment groups.

Play Materials

Play materials for the active manipulation condition consisted of a set of nine wooden sticks, three of which were 26 cm long, three 19 cm, and three 12 cm, and five 4.3 x 4.3 x 4.3 cm wooden blocks. In each face of a block there was a hole into which the sticks could be fitted.

For the control condition, play materials included six picture puzzles preselected to represent six levels of difficulty from easy to hard. Each of the puzzles was fitted together in a 23 x 29.5 cm frame. In the order of presentation, the puzzles were: The Postman (Sifo, 11 pieces), Humpty Dumpty (Playskool, 12 pieces), Little Bo Peep (Playskool, 16 pieces), Giraffe (Judy, 19 pieces), Dog (Sifo, 25 pieces), and Big Bird and Little Bird (Playskool, 13 pieces).

Task Materials

A lure-retrieval task was used to obtain the dependent measures on problem solving. This task included two wooden sticks 26 cm long, two 19 cm, and two 12 cm and, one 4.3 x 4.3 x 4.3 cm wooden block, and a transparent box, measuring 13.5 x 20.0 x 26.5 cm. The door on the front of the box was hinged at the bottom. A latch at the top could be released by pushing a stick through a hole directly in front of the latch. When unlatched, the door automatically dropped to a horizontal position. The box was placed on a blanket which could be folded back to cover the entire box during the treatment phase. Three 4 cm long pencil toppers in the form of Garfield or Odie were used as lures to be retrieved from the inside of the box. The small toys were kept inside a 11 x 17 cm bag until they were introduced.

Other Materials

In addition to the play and task materials, other equipment included a stopwatch mounted at the top of a clip-board and an elongated table, 68 x 198 cm, which was taped with two sets of measurement along the experimenter´s side: (a) 152 one-cm-intervals and (b) marks indicating the lengths of average children´s arms plus the extension tool, as well as the distance at which the box was to be placed.

Procedure

Request for Participation

Directors of the university-affiliated nursery and day care centres were contacted by the experimenter who explained the nature of the study to them. If the directors expressed an interest in the study, they were asked to send letters to the parents of children, which explained the study and invited participation of their child (see Appendix A). The parents were advised to indicate willingness by returning the consent form to the experimenter (see Appendix A) in the enclosed self-addressed, stamped envelope. Of the 102 letters circulated, there were 21 consents, 13 nonacceptances, and no response from 67 parents.

Ten additional subjects were obtained through referrals from participating parents. At the time of the first session, parents were asked if they knew any relatives, friends or neighbours with children of the defined age range. If so, the experimenter provided the referring parents with letters and consent forms to be distributed.

Upon receiving the completed consent forms, those parents who had granted consent were contacted by telephone. The purposes of this phone call were to answer any questions they might have and to make appointments for the initial session.

Sessions

The study entailed two sessions: (a) the administration of the PPVT-R and (b) the experimental session. The PPVT-R was given no more than 30 days before the experimental testing. Test administration for the two separate sessions were arranged at times convenient to the parents and children involved. For both sessions, all subjects were tested individually for approximately 15 minutes each.

Mental Assessment. The PPVT-R (Form L) was administered either in the child's home or at the day care centre which the child was then attending. The purposes of conducting this test were (a) to obtain a raw score on the PPVT-R of each child and (b) to allow the experimenter to develop rapport with the child. A time was arranged for the experimental testing session.

The subjects were then grouped into pairs (one in active manipulation and one in passive observation), or possibly triplets (one assigned to each of the three treatments), in accordance with the following matching criteria listed in order of priority:

1. Sex. The sex of members of each set was the same.

2. PPVT-R raw score. The raw scores of members of each set could not differ more than six points of one another. Those children with the closest match on scores were grouped together.

3. Randomization. A child was placed under the active experimental condition if no match was found at the time. The next child to come, who was of the same sex and within the defined score range as the active child, was given the passive treatment. If two sex- and score-matched children were available, they were randomly assigned into the passive and control conditions.

Seven triplets (5 male and 2 female) and five pairs (2 male and 3 female) of children were formed. The means and standard deviations for PPVT-R raw scores of subjects under the three treatment conditions are shown in Table 1. The raw scores of the triplets did not differ significantly from each other, $t(6) = 1.121$, p = NS, $t(6) = 0.628$, p = NS, $t(6) = 0.576$, p = NS, nor did those of the pairs, $t(11) = 1.38$, p = NS. Of all sets of three, there were four instances of random assignment into the passive and control treatment conditions.

Experimental Testing. The experimental session was conducted in the Child Development Lab in the Department of Family Studies at the University of Manitoba (see Appendix B) The session involved two phases: (a) administration of the assigned treatment and (b) presentation of the lure-retrieval task.

In the first phase, each child was brought to the Child Development Lab by a parent who stayed in the room during the entire session. The child was seated at a child-size table with the experimenter seated at his/her right side. The parent sat to the left side of the child. The child was given a short while to become familiar with the environment. In the meantime, he/she was allowed to read a story book while the experimenter described the general procedure to the parent. The parent was asked about the child´s previous toy experience, i.e., whether the child had lego or tinker toys and how frequently the child played with them. The parent was also requested not to encourage interaction nor to use words like "Good", "Fine" during the session. In the event

Table 1

Means and Standard Deviations for PPVT-R Raw Scores of Subjects under Active, Passive, and Control Treatment Conditions

Treatment Conditions	*n*	PPVT - R Raw Score Mean	*SD*
Triplets			
Active	7	41.86	12.42
Passive	7	40.29	9.41
Control	7	41.00	10.80
Pairs			
Active	12	43.33	11.65
Passive	12	41.92	9.70

Note. Triplets: Active vs Passive $t(6) = 1.121$, p = *NS*.
Passive vs Control $t(6) = 0.628$, p = *NS*.
Active vs Control $t(6) = 0.576$, p = *NS*.
Pairs: Active vs Passive $t(11) = 1.38$, p = *NS*.

that the child turned to either the parent or the experimenter, they simply redirected the child back to the task.

Following instructions to the parent, children in each of the three groups were treated with a different type of experience for eight minutes. If the child was in the active experimental condition, he/she was offered a set of nine wooden sticks and five wooden blocks. The experimenter pointed out that the sticks were of different lengths and then demonstrated the insertion of one 19 cm stick into one of the holes in a block. The child was told: "You can play with all these toys while I do some writing." As soon as the experimenter ended her instructions and the child touched an object, i.e., began to play, the experimenter started timing with a stopwatch. The entire period of play was videotaped.

During free play, when the child looked up, paused, or refused to play, statements such as the following were given: "You can play some more", "Try some more", "It´s all right to play some more", and "I still have some writing to do, you can play longer." To control for the biasing effects of experimenter expectancies, any qualitative statement about the child´s behaviors or utterances, such as "Good", "That´s right", "Fine", "That is a good try", or "That´s a girl/boy," were not used during free play. In the event of a child showing a construction to the experimenter and/or naming it, the experimenter responded by saying: "I see. You can do some more." The child was allowed eight minutes of free play with the materials, and was then presented the lure-retrieval task.

If the child was in the passive observation condition, he/she was asked to watch on a TV monitor, the videotaped play session of his/her matched peer. At the moments when the passive child looked away from the screen, the experimenter redirected the child back by patting him/her on the shoulder and then pointed towards the screen, saying "Watch". If the child felt uneasy while watching the videotape, the mother was asked either to move closer or to seat the child on her lap. The videotape was followed by the lure-retrieval task.

For children in the control condition, the same procedural format was followed as for the active condition except that six picture puzzles were presented instead of the sticks and blocks. These puzzles were introduced one at a time, in the order of increasing levels of difficulty. If the child asked for help, the experimenter replied: "Try another piece" or "You do it. This is your game." If the child terminated the play by gesturing or vocalizing, the experimenter gave the child a new puzzle and remarked: "That was a difficult one. Let´s try another." After eight minutes of puzzle play, the experimenter interrupted by saying: "I´ve finished my writing already. Let´s play a game. I´ll let you finish this puzzle after you play this game," and then presented the lure-retrieval task.

In phase two, i.e. the lure-retrieval task, all the play materials or the TV monitor were put away before its presentation. To increase the goal-directedness of the passive child, the experimenter asked the child to do the task first and promised free play with sticks and blocks afterward. To ensure that every child was properly seated, the experimenter pushed the child´s chair further into the table before removing the blanket to uncover the lure-retrieval task box. At this point, the experimenter showed the children in the passive and control conditions that the sticks were of three different lengths and demonstrated the joining of a 19 cm stick and the block. The experimenter, then, moved the block and sticks to her side of the table and placed the bag with the toppers 75 cm from the child´s end of the table and told the child to stay on the chair and reach out to get the bag. When the child extended his/her arm, the experimenter checked the point of reach against the marks on the masking tape. The experimenter then opened the bag, took out the three small toys and placed them on the table right in front of the child. The child was asked to select either the Odie or the Garfield pencil topper. After the child made his/her choice, the experimenter removed the bag and the other two toys, and told the child: "You can keep Garfield/ Odie if you can get it out of that box." The child was allowed to hold the toy while the experimenter demonstrated how to work the box. In doing so, the experimenter moved the transparent box sideways so the child could see as the experimenter poked her index finger through the hole, saying: "Look. When I push the latch, the door will open." The experimenter then closed the door, took the toy from the child and put it inside the box. Thus, the mechanism for opening the box was demonstrated once more though without verbal description. The experimenter, by reference to the second set of markings on the tape, placed the box on the table in front of the child at a distance which was equivalent to the length of the child´s arm plus the extension tool. The child was given the following instructions:

> Now, what I want you to do is to think of a way to get Garfield/Odie out of the box. You can use any of these (pointing to sticks and block) if you want. But, one thing, you cannot get out of your chair to reach Garfield/Odie. You have to stay on your chair. Do you understand?

If the child indicated he/she did not understand, the instructions were repeated. If the child understood, the experimenter instructed: "You can start now" and began timing at this point. The solution to this problem involved the joining of the two longest sticks by means of a block, releasing the latch on the box, and raking in the lure.

A time limit of seven minutes was permitted for solution. All the subjects were able to complete the task within this time, since hints (see Table 2) were given either at one-minute intervals or when the subject stopped working

Table 2

Task Strategies and Hints

Highest Strategy Used	Hint
1. Does nothing OR reaches with hand but without using any element (i.e., sticks and block).	1. "Have you used everything you can think of that might help you get Garfield/Odie out of the box?"
2. Using block only OR using one or more sticks only.	2. "Can you think of a way you can use the stick/block[1] to help you get Garfield/Odie out?"
3. Using the block and one stick only (may or may not be joined together).	3. "Can you think of a way that you can use both the block and the sticks to help you get Garfield/Odie out?"
4. Joining sticks together other than the two long sticks OR using both block and sticks but without joining of the two longest sticks.	4. "You could join the two long sticks together with the block and make a longer stick. Then, you get Garfield/Odie out."
5. Join sticks together but not the double-long-stick extension.	5. "I will hold this stick (26-cm long). Can you put the block into the end of it? Now pick up the other long stick and join that to the end of the other one. Now, you get Garfield/Odie out."
6. Makes the appropriate tool, but does not recognize how to use it to solve problem.	6. "See, you have a very long stick here (show length). You can lift the stick up and push it through this hole to open the door (demonstrate)."

[1] If the child used either the block or stick, the hint would suggest using the other element.

on the task, i.e., was off task[1], for more than 20 seconds. The first five hints of this series which are of increasing direction and helpfulness were adopted from Cheyne and Rubin (1983, p. 579). A sixth hint was added for those cases in which the appropriate extension tool was made, but had not been used in the solution of the problem within one minute; the prompt was "See, you have a very long stick here (show length). You can lift the stick up and push it through this hole to open the door (demonstrate)." Hints were given in sequence, but appropriate to what the subject had already done. Giving the last hint virtually was equivalent to solving the problem for the child.

During the task, redirecting statements were given under the following conditions: (a) that information leading to the solution was not given; (b) that no reinforcement was given; and (c) that the tone and expression be natural. Given the above criteria, statements that did not provide information regarding the solution to the task and which were non-reinforcing are indicated below. Each of these statements were given relative to the type of off-task behavior the child showed and were given only if the child showed one of these off-task behaviors. In the event that the child turned to the experimenter, the appropriate responses were "Think", "Think of a way", "Try and see if it (i.e., the way) works", or "This is your game. You have to do it." If the child was

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[1] The child was considered off-task when he/she was not on-task. On-task referred to the time in which the child was attending to or looking at the task materials.

shy, self-conscious and hesitant to try, the experimenter said: "This is just a game. You can play with it." If the child did not remain seated, the statement used was "Remember to stay on your chair." If the child played with the task materials instead of working at the task, the experimenter (a) reminded the child to look at the lure in the box and (b) promised free play with the same toys after the game.

The active play of all experimental subjects and the problem-solving performances of the three subject groups were videotaped. The video camera, recorder, and monitor were set up in the room behind a curtain at all times except for the first eight minutes of the passive observation sessions, during which the monitor was moved to the front of the table. For each set of subjects, the experimental subjects were tested first so that the entire videotaped period of their free play could subsequently be shown to his/her passive observation peer.

Data Collection

All data were recorded live during the experimental sessions and were further verified from the video recordings after every session. For the active play condition, data were recorded right after the experimenter finished her instructions and the child touched the materials for a period of eight minutes. The experimenter recorded the subject´s verbalizations and dramatic play activities, and also recorded, diagramatically, all structures constructed in the form of a running record (see Appendix C for the record sheet and an illustration). A structure was defined as an independent construction of sticks and blocks; minimal structure consisted of two elements, namely, a stick and a block.

A child´s construction was considered a structure if: (a) the child was off-task for more than seven seconds; (b) the child added one or more elements of a fallen segment or segments to the remaining part; in the process of reassembling, a new or different configuration resulted; (c) the child added one or more elements to a construction which he/she named differently or denoted in play that it was a different representation; (d) the child dismantled majority of elements from construction(s) and started a new round of building; and (e) the child put aside one or more structures, then made a new one from remaining materials. On the other hand, a child´s construction was not considered a structure if: (a) segment(s) of a construction fell out, which was then shattered or to which the child had not added element(s); and (b) when part of a structure fell away, the part remaining of the structure was not regarded as a new structure. In every case, any element that dropped or broke off was included as part of the structure, whereas those elements which the child pulled out during constructing were not counted unless the child labelled the construction before any element was taken out.

Scoring

From the records and diagrams, a number of object play measures (see Table 3) were subsequently scored. Object play was defined as behaviors and strategies engaged in by a child, which were related to the materials presented. The types of play components considered were adopted from the same set of measures used by Cheyne and Rubin (1983) and were defined as in the following manner. In examining the discovery and practice of extension through joining, as well as the assimilation of this skill, the number of joins, i.e., total number of insertions of sticks into blocks, made by the child during play was measured. Discovery of solution principle, which referred to whether or not the child showed the long stick/block/long stick extension, was recorded. Occurrences of symmetrically double-stick connections were also noted for long sticks, for middle length and for short sticks, taking each block as a referent point, and were coded as the use of principle.

To look at the combinatorial complexity of play, a measure of construction complexity was obtained by subtracting the frequency of simple constructions from the frequency of complex constructions. Simple constructions composed either of one stick and one block, one stick and two blocks, two sticks and one block, or two blocks and two sticks. All of the multiple stick-block constructions were considered as complex. Also, the average number of elements, i.e., sticks and blocks, used for building was noted as another index of complexity.

To score the flexibility in play, average number of

Table 3

Object Play Measures

(1) Number of joins (i.e., total number of insertions of sticks into blocks).

(2) Discovery of solution principle (i.e., whether the child gave evidence of discovering the long stick/block/ long stick principle during play).

(3) Use of principle (i.e., frequency of symmetrical double-stick constructions for long sticks, for short and for intermediate length sticks, taking each block as a referent point).

(4) Construction complexity (i.e., frequency of simple constructions was substracted from frequency of complex constructions).[a]

(5) Elements/Construction (i.e., average number of elements [blocks and sticks] per construction).

(6) Operations (i.e., average number of different operations or procedures engaged in by the child).[b]

(7) Dimensional flexibility (i.e., number of joins per block)

(8) Fantasy constructions (i.e., number of child´s actions or utterances indicating some representational activity with regard to each structure).

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[a] Simple constructions (i.e., one stick and one block,
one stick and two blocks,
two sticks and one block,
two sticks and two blocks).
Complex constructions (i.e., multiple stick-block constructions).

[b] The operations are (a) stacking or lining up blocks/sticks; (b) inserting sticks into blocks to form one or more one-dimensional configurations, i.e., length only; (c) seriating sticks; (d) grouping sticks by size; (e) inserting sticks into blocks to form a two-dimensional configuration, i.e., length and width; and (f) inserting sticks into blocks to form a three-dimensional configuration, i.e., length, width, and height.

different <u>operations</u> or procedures used by the child was computed. The operations were (a) stacking or lining up blocks/sticks; the elements had to be lined on the table; and a minimum of three sticks/blocks were required; (b) inserting sticks into blocks to form one or more one-dimensional configurations, i.e., length only; (c) seriating sticks; a minimum of three sticks in a seriated order were necessary; (d) grouping sticks by size; a minimum of three sticks were needed; (e) inserting sticks into blocks to form a two-dimensional configuration, i.e., length and width; and (f) inserting sticks into blocks to form a three-dimensional configuration, i.e., length, width, and height. A child´s operations scores were based on the frequency of occurrences (a) of each operation category and (b) across all operations. A measure of <u>dimensional flexibility</u> was recorded by calculating the number of joins per block.

Creativity in play was also determined. A measure of <u>fantasy constructions</u> was used to indicate the number of child´s actions or utterances which contained make-believe representation with regard to the play materials. In play, the child could make movements with the objects, e.g., moving a train through a tunnel; utter pretend non-speech sounds, e.g., imitating the sound of a rooster, or humming different musical notes while beating with a stick; or engage in pretend speech, e.g., naming the structure "a tap", asking the adult "What have I made? Guess," etc.

Two distinctive measures were obtained from the lure-retrieval task (see Appendix D). First, the time for solution was noted which referred to the time passed between the end of the experimenter's instructions and the point at which the subject extended the appropriate tool towards the box with arm fully stretched. The computation of solution time did not include the time required to release the latch and rake the lure, for as Cheyne and Rubin (1983) had stated, all subjects could get the lure with the tool, yet due to differences in coordination and dexterity, subjects varied in the time to unlatch the door and retrieve the lure.

Second, the number and level of hints were recorded to indicate the amount of help needed. The procedure for scoring was adopted from the method described by Vandenberg (1981). In general, weights were alloted to every hint and points were given to the hints which were not needed. According to Vandenberg (1981), the successive increments of direction disclosed were equal for the first five hints. Hence, one to five points were assigned to each of the first five hints respectively. For the sixth hint, the entire solution was revealed, and accordingly, the amount of additional direction obtained from this hint was greater than the incremental direction disclosed by one of the other hints. Thus, the sixth hint was given a higher weighting of nine points. To illustrate, a child who required no hint received a perfect score of 24, a score of 19 if hints 2 and 3 were needed, and a score of 17 if hints 2 and 5 were needed. In this case, a higher score signified better task performance and less assistance required.

In addition to solution time and score on hints, constructions made after each hint were also recorded. This additional information provided an indication of whether or not the child showed progress with increasing prompts.

Reliability

Hints given during a lure-retrieval task are contingent upon the subject's response, therefore inter- and intra-observer reliabilities were not obtained on score on hints. Reliabilities for object play and task measures are presented in Table 4. Interobserver agreements obtained between the experimenter and a trained observer were determined at the midpoint and upon completion of data collection. Intraobserver reliabilities were also obtained at the end of data collection. Both inter- and intra-observer agreements were calculated using the formula:

$$\text{percentage of agreement} = \frac{\text{number of elements agree}}{\text{number of elements agree} + \text{number of elements disagree}} \times 100\ \%.$$

The interobserver reliabilities judged from the videotaped of 12 subjects' records ranged from 94% to 100%. Intraobserver reliability based on six subjects was 100% for each of the measures.

Data Analysis

Subjects were compared on their problem-solving performance as measured by solution time and the score on hints. For the matched triplets, solution time and score on

Table 4

Inter- and Intra-Observer Reliabilities

Obtained at Midpoint and at End of Data Collection

Reliability	Measures	Midpoint	End
Interobserver	number of different structures made during play	94%	95%
	solution time[a]	100%	100%
	number of different structures made after each hint	100%	100%
Intraobserver	number of different structures made during play	---	100%
	solution time[a]	---	100%
	number of different structures made after each hint	---	100%

Note. Intraobserver reliability checks were not performed at the midpoint of data collection.

[a] The minimum level of accuracy required for reliability judgements on solution time was one second.

hints were analyzed separately using a one-way analysis of variance with repeated measures on treatment (Active x Passive x Control). For the matched pairs, these measures were analyzed by means of a two-way analysis of variance with the trial factor of treatment (Active x Passive) and the grouping factor of sex. Differences in amount of previous toy experience were examined in a similar manner for both the matched triplets and pairs (Dixon et al., 1981).

To compare the results of the present study with those of Cheyne and Rubin (1983), the same analyses as they did were employed. Thus, the Pearson product-moment correlation coefficient was used to obtain correlations between solution time and the object play variables for the group that was similar to Cheyne and Rubin's, namely, the active experimental subjects ($n = 12$).

Further examination of our data included (a) Pearson product-moment correlation coefficients of previous toy experience, chronological age and PPVT-R raw score with task performance measures across the total number of subjects ($N = 31$) and (b) two-way repeated measures analyses of solution time, score on hints, and previous toy experience with active and passive groups using a median split of the various object play measures.

In general, the accepted level of probability in this study is $p < 0.05$. However, nonsignificant tendencies at the $p < 0.10$ level are also reported.

CHAPTER V

RESULTS

Results of this study are presented in five sections. First, correlations relative to Cheyne and Rubin's (1983) findings are reported. Secondly, results of analyses for the major hypotheses between the three treatment groups are presented. Thirdly, results of analyses for the major hypotheses between the active and passive groups only are then given. Next, differences in task performances of active and passive children relative to each of the object play measures are described. In the last section, correlations between subject characteristics and task performances are also given.

Comparisons with Study by Cheyne and Rubin (1983)

The present study was in part a replication of Cheyne and Rubin's (1983) study. Only the children who received object play experiences, namely, the active experimental group ($\underline{n}$ = 12), were comparable to those in Cheyne and Rubin's sample ($\underline{N}$ = 140), hence, the following comparisons are based on data of these two groups exclusively. The means and standard deviations for solution time and each of the object play variables obtained in both studies are shown in Table 5. Though tests of significance could not be carried out, several observations of the results of these two studies are of interest. As may be noted in the table, although children of the present study are generally younger and score comparably lower on the PPVT-R than the children in Cheyne

Table 5

Means and Standard Deviations for Major Dependent Variables Obtained by Cheyne and Rubin (1983) and in the Current Study

Dependent Variable	Cheyne and Rubin´s Study				Present Study	
	Girls		Boys		Girls + Boys	
	M	*SD*	*M*	*SD*	*M*	*SD*
	(*n* = 76)		(*n* = 64)		(*n* = 12)	
Solution time	223.61	119.54	188.14	132.23	168.92	73.60
No. of Joins	14.74	6.06	13.35	5.52	32.67	12.20
Use of Principle -Short	1.37	1.34	1.46	1.23	0.83	1.12
Use of Principle -Inter.	0.88	0.98	0.78	0.91	0.75	1.22
Use of Principle -Long	1.18	1.46	1.00	1.11	0.75	1.06
Construction Complexity	6.76	4.71	10.43	2.72	18.33	5.96
Elements/ Construction	8.09	3.03	8.65	3.07	5.29	2.24
Operations	2.53	1.19	1.82	1.02	2.91	1.29
Dimensional Flexibility	2.67	1.23	3.13	1.17	2.28	0.85
Fantasy Constructions	1.71	2.25	2.50	2.32	4.00	4.31
PPVT-R Age Equivalent (mos)	68.23	15.15	68.98	14.80	49.58	8.36
CA (mos)	57.04	4.49	56.02	4.25	48.33	2.74

Note. Inter. = Intermediate; CA = Chronological age.

and Rubin's study, our subjects tend to spend less time in problem solution and build more complex constructions during play. In contrast, across the three stick lengths, our children use the extension principle less frequently than Cheyne and Rubin's subjects.

Correlations between solution time and object play variables for both studies are presented in Table 6. The pattern of significant correlations achieved in the two studies is similar. The two play components that correlated negatively with solution time in Cheyne and Rubin's study are also evident in our results, namely, the use of the appropriate long stick extension principle during play, $\underline{r}(10) = -0.53$, $\underline{p} < .10$, and the index of construction complexity, $\underline{r}(10) = -0.52$, $\underline{p} < .10$. Though Cheyne and Rubin indicate that they examined the relationships between the use of intermediate and short stick extension principle with solution time, they report only that these correlations were not significant. Our correlations on these variables are likewise not significant though there is a negative tendency indicated for the use of extension principle with short sticks with time to solution, $\underline{r}(10) = -0.52$, $\underline{p} < .10$.

In addition to the measures of object play used by Cheyne and Rubin, we derived a weighted score on use of principle as follow: a weighting of 3 for long, 2 for the intermediate, and 1 for short stick extension. The weighted score derived in this manner correlated negatively with solution time, $\underline{r}(10) = -0.61$, $\underline{p} < .05$. Similar to Cheyne

Table 6

Correlations Between Solution Time and Object Play Variables: Active Experimental Group

Variable	Cheyne and Rubin´s Study (1983) Solution Time (N = 140)	Present Study (1984) Solution Time (n = 12)
No. of Joins	-0.11	-0.28
Discovery of Solution Principle	---	-0.44
Use of Principle -Long	-0.27 ††	-0.53 †
Use of Principle -Intermediate	---	-0.34
Use of Principle -Short	---	-0.52 †
Use of Principle -Weighted Score	---	-0.61 ††
Construction Complexity	-0.29 ††	-0.52 †
Elements/Construction	-0.15	-0.37
Operations	-0.02	-0.10
Dimensional Flexibility	-0.06	-0.05
Fantasy Constructions	-0.01	0.31

Note. In Cheyne and Rubin´s study, correlations between solution time and discovery of solution principle, use of principle-intermediate and -short were not reported, and correlation between solution time and use of principle-weighted score was not examined.

†$p < .10$. ††$p < .05$.

and Rubin´s results, solution time is not associated with other object play measures, including the number of joins, the average number of elements per construction, the total number of operations, dimensional flexibility and fantasy constructions.

In all, our results show a similar pattern of associations of object play variables with lure-retrieval solution time. However, our data further indicate that frequent use of symmetrical extensions of any stick length tends to be a better predictor of time to solution on a lure-retrieval task.

Between Groups Comparisons: Active, Passive, and Control

The means and standard deviations for solution time, score on hints, and previous toy experience of the active, passive, and control subjects are shown in Table 7. In general, the active children score higher on task performance and have had more previous toy experience than the passive and control children. However, one-way analyses of variance indicate no differences among the three treatment groups in solution time, $F(2, 18) = 0.93$, p = NS, hints score, $F(2, 18) = 1.21$, p = NS, and previous toy experience, $F(2, 18) = 0.32$, p = NS.

Between Groups Comparisons: Active and Passive[1]

In Table 8, the means and standard deviations for

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[1] In addition to the five sets of matched pairs, subjects in the active and passive conditions among the seven sets of matched triplets were also included, yielding a total number of 12 sets.

Table 7

Means and Standard Deviations for Solution Time, Score on Hints, and Previous Toy Experience Between the Sets of Triplets

Treatment Groups	n	Solution Time M	Solution Time SD	Score on Hints M	Score on Hints SD	Previous Toy Experience M	Previous Toy Experience SD
Active	7	153.14	77.01	16.00	4.97	5.57	2.30
Passive	7	221.86	118.66	11.43	6.35	4.57	1.40
Control	7	178.57	85.98	13.86	5.11	5.14	3.02

Table 8

Means and Standard Deviations for Solution Time, Score on Hints, and Previous Toy Experience of Boys and Girls Between the Sets of Pairs

Treatment Groups	n	Solution Time		Score on Hints		Previous Toy Experience	
		M	SD	M	SD	M	SD
Active	12	168.9	73.60	15.0	4.90	5.5	1.83
Boys	7	196.7	80.98	14.3	5.31	5.7	2.36
Girls	5	130.0	42.61	16.0	4.64	5.2	0.84
Passive	12	218.7	108.99	11.8	5.72	4.8	1.47
Boys	7	171.7	87.89	13.9	4.26	5.3	1.50
Girls	5	284.4	108.73	8.8	6.65	4.2	1.30

Note. Comparisons of Ms for Treatment x Sex interaction on solution time:

Active girls vs Passive girls $t(10) = 2.96$, $p < .02$.

Active boys vs Passive girls $t(10) = 1.81$, $p < .10$.

Passive boys vs Passive girls $t(10) = 2.33$, $p < .05$.

solution time, hints score, and previous toy experience are presented for boys and girls and for active and passive groups. The children in the active group have generally had more experience with toys, and tend to spend less time and require less assistance to correctly solve the lure-retrieval task than their passive peers.

Results of two-way analyses of variance with sex as the grouping factor and treatment group as the trial factor on the dependent variables are given in Table 9. On solution time, a Treatment x Sex interaction is noted, $F(1, 10) = 6.88$, $p < .05$. Multiple comparisons using t tests show that passive girls require more time to task solution than active girls, $t(10) = 2.96$, $p < .02$, active boys, $t(10) = 1.813$, $p < .10$, and passive boys, $t(10) = 2.33$, $p < .05$. Although no differences on the main effect of sex are found, active children tend to use less time in task solution than the passive children, $F(1, 10) = 3.58$, $p < .10$. Analyses of the scores on hints indicate a tendency for children in the active condition to score higher than those in the passive condition, $F(1, 10) = 4.51$, $p < .06$, and also a slight trend for a Treatment x Sex interaction, $F(1, 10) = 3.55$, $p < .10$. Further analyses pinpoint that the score on hints tends to be lower for the passive girls as compared to the active boys, $t(10) = 2.161$, $p < .10$, active girls, $t(10) = 2.624$, $p < .05$, and passive boys, $t(10) = 1.99$, $p < .10$. On the other hand, for both sexes, previous toy experience in the active and passive groups are found to be similar.

Table 9

Between Sex and Group Comparisons (Active and Passive) on Solution Time, Score on Hints, and Previous Toy Experience

Dependent Measures	F - Value		
	Sex	Treatment Group	Interaction
Solution Time	0.43	3.58 †	6.88 †††
Score on Hints	0.46	4.51 ††	3.55 †
Previous Toy Experience	2.01	0.79	0.13

† $p < .10$. †† $p < .06$. ††† $p < .05$.

To ensure the significant Treatment x Sex interaction effect on solution time is purely due to the impact of the different modes of prior involvement with task objects but not to other variables such as previous toy experience, chronological age (CA) and PPVT-R raw scores, a two-way analysis of covariance was performed, using each of the other variables as covariates. The independent measures are treatment group and sex, while the dependent variable is solution time. It is found that the significance of the interaction effect still stands even when holding constant the effects of previous toy experience, $F(1, 9) = 6.04$, $p < .05$, CA, $F(1, 9) = 9.03$, $p < .05$, and PPVT-R raw score, $F(1, 9) = 6.08$, $p < .05$.

<u>Explanation of Object Play Measures on Task Solution</u>

To test for differences in problem-solving performance in relation to the object play variables, solution time and hints scores of the children in the active and passive groups are divided into high and low relative to the median of each object play measures. F-ratios of two-way repeated measures analyses (see Table 10) reveal that all object play components to which both groups of children are exposed do not significantly affect their subsequent performances in problem solving, except for two measures. First, on the measure of use of the short-stick extension principle, an interaction effect is present, $F(1, 10) = 8.48$, $p < .05$. The means for the hints score of children in both active and passive groups on this particular measure are presented

Table 10

Between Group Comparisons (Active and Passive) With Object Play Measures and Task Performance

Source	F - Value	
	Solution Time	Score on Hints
No. of Joins	1.17	0.52
Treatment Group	1.37	2.48
Interaction	0.66	0.00
Discovery of Solution Principle	4.74 +	3.32 +
Treatment Group	1.38	2.72
Interaction	0.69	0.95
Use of Principle-Long	2.27	2.64
Treatment Group	1.37	2.55
Interaction	0.60	0.28
Use of Principle-Intermediate	1.30	0.34
Treatment Group	1.30	2.48
Interaction	0.07	0.00
Use of Principle-Short	2.98	2.64
Treatment Group	1.63	4.59 +
Interaction	2.67	8.48 ++
Use of Principle-Weighted Score	0.95	0.90
Treatment Group	1.29	2.53
Interaction	0.00	0.20
Construction Complexity	0.19	0.42
Treatment Group	1.39	2.49
Interaction	0.80	0.04
Elements Per Construction	0.19	0.42
Treatment Group	1.39	2.49
Interaction	0.80	0.04
Operations	0.08	0.86
Treatment Group	1.30	2.39
Interaction	0.05	0.11
Dimensional Flexibility	0.19	0.42
Treatment Group	1.39	2.49
Interaction	0.80	0.04
Fantasy Constructions	0.07	0.00
Treatment Group	1.30	2.49
Interaction	0.05	0.01

+$p < .10$. ++$p < .05$.

in Table 11; children with active play and frequent use of short-stick extension are shown to have the highest mean on score on hints. Further comparisons of these means using *t* tests indicate that active children who use the short-stick extension principle frequently during play score higher on hints than their passive matched peers, $t(10) = 3.576$, $p < .01$, as well as those active and passive children with low frequency in use of short-stick extension, $t(10) = 3.73$, $p < .01$ and $t(10) = 3.184$, $p < .01$ respectively. Furthermore, children in the active group tend to have higher scores on hints ($M = 15.00$) than those in the passive group ($M = 11.75$) no matter how many times they make the extension with short sticks, $F(1, 10) = 4.59$, $p < .10$.

Secondly, on the measure of discovery of the solution principle, there are tendencies for those children who discover the appropriate extension principle to have a shorter solution time ($M = 162.08$s) and a higher score on hints ($M = 15.33$) compared to those who did not discover the principle ($M = 225.50$s and $M = 11.42$ respectively), $F(1, 10) = 4.74$, $p < .10$ and $F(1, 10) = 3.32$, $p < .10$ respectively.

Relationship of Subject Characteristics to Task Performances

The scores on hints and solution time that the entire sample ($N = 31$) achieved during problem solving show no relation to their previous toy experience, chronological age or PPVT-R raw score. There is a tendency, though, for more previous toy experience to be associated with higher scores on hints, $r(29) = 0.33$, $p < .10$.

Table 11

Means for Score on Hints of Active and Passive Children on Use of Principle - Short

Treatment Groups	*n*	Mean Frequency of Use of Short-Stick Principle	
		Above Median	Below Median
Active	12	19.00	11.00
Passive	12	11.33	12.17

Note. Comparisons of *M*s for Frequency of Use x Treatment interaction:

Above-Active vs Above-Passive $t(10) = 3.576$, $p < .01$.

Above-Active vs Below-Active $t(10) = 3.730$, $p < .01$.

Above-Active vs Below-Passive $t(10) = 3.184$, $p < .01$.

None of the other comparisons of means were significant.

CHAPTER VI

DISCUSSION AND CONCLUSION

The present study attempted to examine the influence of object play on cognitive development. The specific focus was on the effects of different types of prior experience and selected play components on children´s subsequent approach to a lure-retrieval problem.

As expected, manipulation of sticks and blocks does not, by itself, lead to problem solution, but certain components of object play appear to be associated. There were tendencies indicating that the discovery of the correct extension principle and the use of the long-stick extension in play did enhance problem solving. These findings are consistent with those of Cheyne and Rubin (1983). In addition, it was observed that problem solution was not only improved by frequent use of long double-stick construction, but also by double-stick construction with any stick length.

Hence, Cheyne and Rubin´s argument that the discovery and the use of the symmetrical long-stick construction influence problem solving is supported by our results. As well, our data also suggest that there are preliminary steps in the learning of the extension principle. As pointed out in the review of literature, these steps include exploration of the properties of novel objects, experimentation with different ways of using the objects, as well as practice of the newly acquired strategies and skills. The specific steps involved in the free play of our active children were experimentation and practice following the experimenter's demonstration of the relevant characteristics of the sticks and blocks. Similar to Cheyne and Rubin's results, the long-stick extension principle tended to correlate with solution time. The correlation was even stronger when all attempts at double-stick construction were examined relative to solution time, suggesting that more opportunities to experiment and practise different responses with the objects benefit problem solving. Recognition of these preliminary steps in learning problem solution is consistent with the contentions of Piaget (1962) and P.H. Schiller (1976) that simple discovery is not sufficient for implementation in problem contexts. To them, play is essentially an assimilative process that takes place gradually and thereby promotes the consolidation of newly learned principles and actions through repetition. More specifically, using a differentiation analogous to that of Tulving and Pearlstone (1966), it seems that discovery makes the principle available but assimilative activity makes it accessible.

In addition to replication of Cheyne and Rubin's study, we were interested in exploring possible differential effects that the type of prior play experience may have on solution of the lure-retrieval task. In comparing the sets of pairs, our results indicated a tendency for the girls to benefit more from prior active manipulation of task-related materials than the boys. However, it is uncertain whether this result can be directly attributable to a differential effect of the type of prior experience on problem solving of boys and girls. Some further exploratory analyses and observation that may contribute to an explanation follows.

In the literature, though sex differences have not been notable in studies using the present paradigm, past research generally suggests a modest superiority of boys in the lure-retrieval problem solving (Sylva, 1977). Cheyne and Rubin (1983) and Rubin et al. (1983) interpret this trend by saying that boys are more likely to play with "constructive materials" and past experiences with these materials foster problem solving. However, the girls in the active group had a similar level of previous toy experiences as the boys (see Table 8). When past toy experience of our children was held constant, the Treatment x Sex interaction still remained suggesting that such previous experiences did not affect solution time in a differential manner.

Additional information was collected with regard to the experimenter's impression on each child's involvement in the eight minutes of pre-task experience. Children in the active and control conditions tended to be more involved in their assigned treatments, whereas those given the observational experience were generally less attentive. It is, therefore, possible that watching a peer's free play on a TV monitor may not be sufficiently interesting to capture the children's attention. On the other hand, even with less attentiveness to the matched peers' play, the time to solution of the lure task for active and passive boys did not differ though it did for the girls. It was also observed that, on presentation of the lure-retrieval task, some children initially engaged in exploratory rather than solution-directed behaviour. However, this initial exploratory approach was not characteristic of any one group.

Yet, Smith and Dutton (1979) and Sylva (1977) have reported that training or observation experience of adult demonstration of the relevant solution principle does increase problem-solving efficiency. It was expected that, if adult modelling was effective, peer modelling should likewise be effective. Though our results show that the observation experience benefits the boys more than the girls, further refinement of the method for data collection is suggested.

The selection of a peer rather than an adult model was based on the assumption that a modelled behaviour is more likely to be imitated if it is presented (a) by a peer and (b) in a manner corresponding to the child's level of development. Hence, the matched subject design was employed to assign children into groups. Given this approach, the treatment received by the passive children was contingent upon the type of play engaged in by the active match. However, as indicated by the means in Table 11, though the children who used the short-stick extension more frequently during free play scored significantly higher than those who used it less frequently, their matched passive peers did not score comparably higher. Whether the lower performance of these passive subjects results from lack of attentiveness during TV watching or to ineffectiveness of passive observation per se cannot be concluded without specific measures of attentiveness to the peer modelling.

Hence, in future studies, there is a need to monitor the attentiveness of the child while watching a peer at play and to note specifically which play components, in particular double-stick extensions, the child observed. Since the frequency of double-stick extension in active play was associated with reduced solution time, this component of play would appear to be critical to learning from observation of a peer´s play.

It is notable that though our children were younger than Cheyne and Rubin´s, and obtained correspondingly lower age equivalents on the PPVT-R, they spent less time in problem solving than Cheyne and Rubin´s older sample. This difference may be related to one of our prompting criteria for redirecting off-task behaviours which Cheyne and Rubin did not include. In our study, as in Cheyne and Rubin´s, hints were given at one-minute intervals and at a level which was appropriate to what the child had constructed at that moment. However, in addition to Cheyne and Rubin´s procedure, we gave a prompt after every 20 seconds of persistant off-task behaviour. Thus, we may have moved the child along to the solution more quickly than Cheyne and Rubin had done. Furthermore, the substantial correlation of solution time with score on hints, $\underline{r}(29) = -.87$, $\underline{p} < .01$, strongly suggests that the prompting procedure may have affected time for solution and, hence, caused our children to look more proficient in problem solving than Cheyne and Rubin's. However, because all subjects in this study received the same prompting procedure, this effect across treatment groups was accordingly similar and, therefore, differences in solution time and score on hints among our children were not confounded.

In comparing the three groups of children, no significant differences were found in their problem-solving abilities, and the hypotheses on better solution time and hints scores of the active children as compared to the other two groups were not supported. Indeed, the rationale for selection of a restricted age range and for matched subject sets was to minimize variability associated with developmental level. Despite these attempts to control for extraneous factors, the variability of the dependent measures was considerable. For further research it is suggested that measures of the attentiveness of passive subjects be obtained which could contribute to explaining at least one source of variability and possibly partialling it out from the dependent measures.

On the other hand, the difference in performance of the active and passive subjects, particularly evident among the girls, may be associated with different motivational conditions. Subjects in Cheyne and Rubin's study were given the same experience prior to the presentation of the task, accordingly, their motivation during task solution would likely be similar. On the contrary, the nature of the pre-task experience was different among our three groups and these various treatments may have led children to approach the task in different manners. When confronted with the problem, the active children were observed as being eager to begin and continue in their efforts to solve the problem. In contrast, children in the passive condition were prone to go off-task after several unsuccessful attempts at task solution. Therefore, it seems likely that the differences in the type of task involvement may have contributed to the wide variability in problem-solving scores and need to be controlled in future research.

It may be well to also note that the object play experience of the active children was divergent in nature, while the puzzle play experience of the control children was essentially convergent. In recent research children provided with convergent play experience used a higher proportion of strategy-based moves in solving convergent tasks, while those with divergent play experience used a greater proportion of trial-and-error moves (Pepler, 1979; Pepler and Ross, 1981). In contrast to the divergent play experience of the active children, the control children in the present study, though not given a chance to play with task-relevant objects, were given puzzles which provided a convergent type of experience. This experience may have helped them in solving the convergent task in lure retrieval. Similar to past research in which control conditions involved no play experience with materials of any sort, the puzzle play provided for the control children in this study also did not affect task solution. However, delineation of the possible impact of a variety of objects, which can be divergent or convergent, task related or non-task related, on subsequent solving of a problem may be worth considering.

In summary, the present study demonstrated that there are beneficial, immediate effects of object play. Specifically, and most relevant following upon Cheyne and Rubin's study, is the refinement of the concept of discovery of the solution principle required for the lure-retrieval task; discovery of the solution principle is not restricted to the immediate configuration required for solution, such as long-stick extension, but also includes similar constructions which incorporate the underlying principle required for solving the problem. It is hoped that if our data are verified by further research, long-term effects of cumulative play experience with objects can be understood. Play experience could, then, be made an effective instrument for promoting children's problem-solving abilities by systematically relating the type of experience and the components of play to the desired learning effects.

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APPENDICES

A. LETTER AND CONSENT FORM TO PARENTS

B. DIAGRAM OF CHILD DEVELOPMENT LAB

C. RECORD SHEET FOR OBJECT PLAY AND AN ILLUSTRATION

D. RECORD SHEET FOR TASK

APPENDIX A

LETTER AND CONSENT FORM TO PARENTS

THE UNIVERSITY OF MANITOBA

FACULTY OF HUMAN ECOLOGY
Department of Family Studies

Winnipeg, Manitoba
Canada R3T 2N2

(204) 474-9225

Date

Dear Parents,

I am a graduate student in the Department of Family Studies working under the supervision of Dr. L. Brockman. We are interested in learning how children's play with simple toys helps them solve a simple problem. At this time, we wish to observe children who are between 44 to 52 months of age. The Director of the child care program your child attends or attended during the past year has kindly accepted to send this letter of invitation to all parents whose children are within this age range. If your child is, or will be, of this age between __________ and __________, we invite you to consider participating in this research with your child.

If you choose to participate, I will meet with your child on two occasions for approximately one-half hour each. The first session may take place either in your home or possibly the day care centre your child is then attending, whichever is more convenient for you. For the second session, I will ask that you come with your child to the Child Development Laboratory in the Human Ecology Building at the University of Manitoba at a time that is convenient for you. The reason for this is that videotape equipment will be used. For this session, some children will be randomly selected to play with simple toys, and others to view the videotaped play of another child. After the data has been taken from the videotape, the entire tape will be erased.

If you are interested in participating with your child, kindly complete the enclosed form and return it as soon as possible. Following receipt of your form, I will telephone you to arrange times that are convenient for you for the two separate sessions.

Should you have any questions, feel free to contact me at 269-3419 or 474-8344, or my supervisor, Dr. Lois Brockman at 474-9225.

Thank you in advance for your cooperation and your interest in this research.

Yours sincerely,

Maggie Leung Wong

MLW/deb

THE UNIVERSITY OF MANITOBA

FACULTY OF HUMAN ECOLOGY
Department of Family Studies

Winnipeg, Manitoba
Canada R3T 2N2

(204) 474-9225

Study of Object Play and Problem Solving in Children

Conducted by Maggie Leung Wong under the supervision of Dr. Lois Brockman

Kindly check one of the following:

_____ We are willing to allow our child to participate in your research.

_____ We would prefer that our child did not participate in your research.

My child's name is ____________________

My child's birthdate is ____________________
Month/Day/Year

I understand that a portion of the videotaping may be shown to another child and the parent as a part of this research. I also understand that all information obtained in this study will be kept confidential.

____
Signature of parent

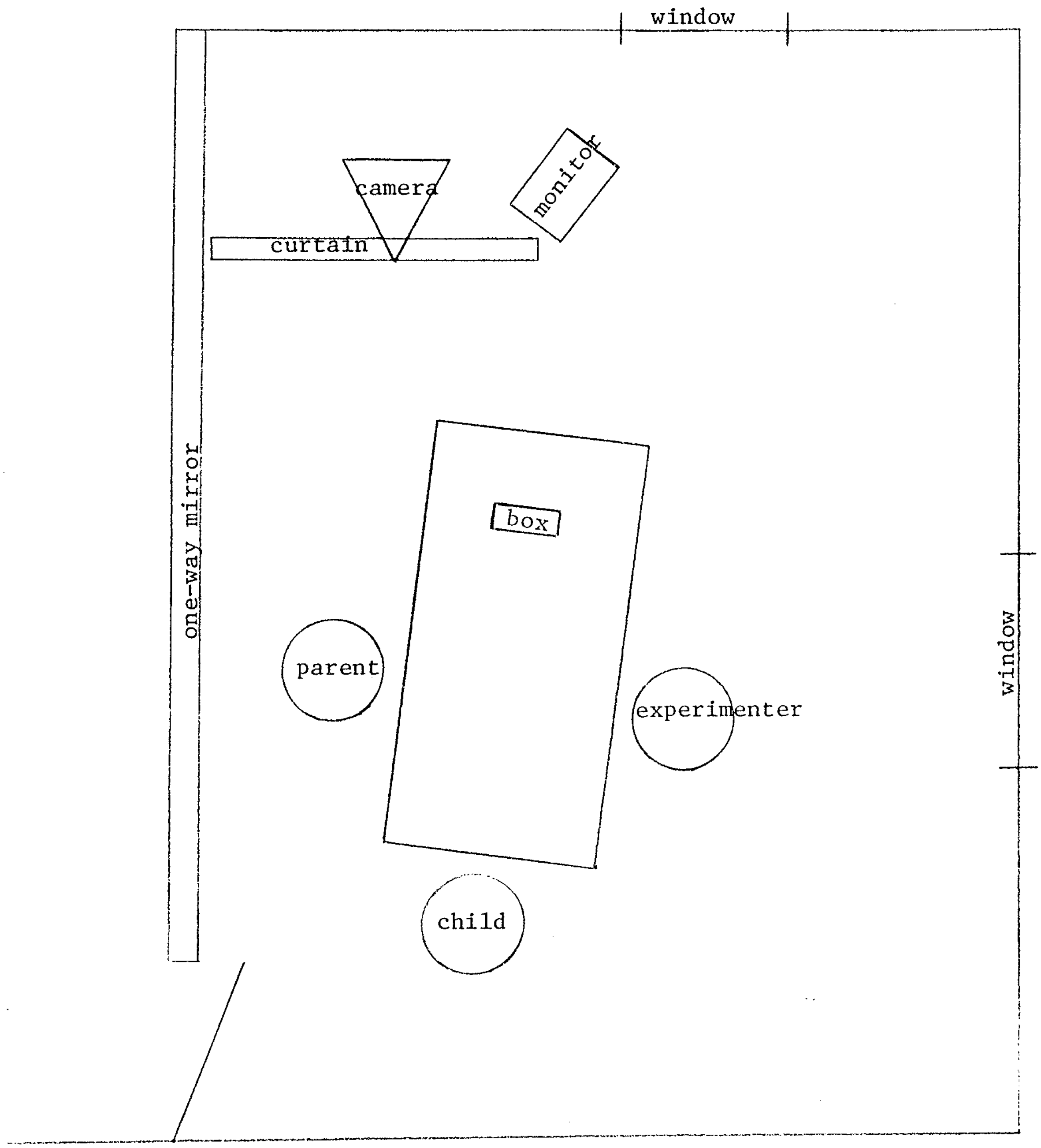
____
Date

____
Telephone Number

APPENDIX B

DIAGRAM OF CHILD DEVELOPMENT LAB

DIAGRAM OF CHILD DEVELOPMENT LAB



APPENDIX C

RECORD SHEET FOR OBJECT PLAY AND AN ILLUSTRATION

CHILD CODE: ______________________

TAPE NUMBER: ______________________

TESTING DATE: ______________________

	2	3
	5	6
	8	9

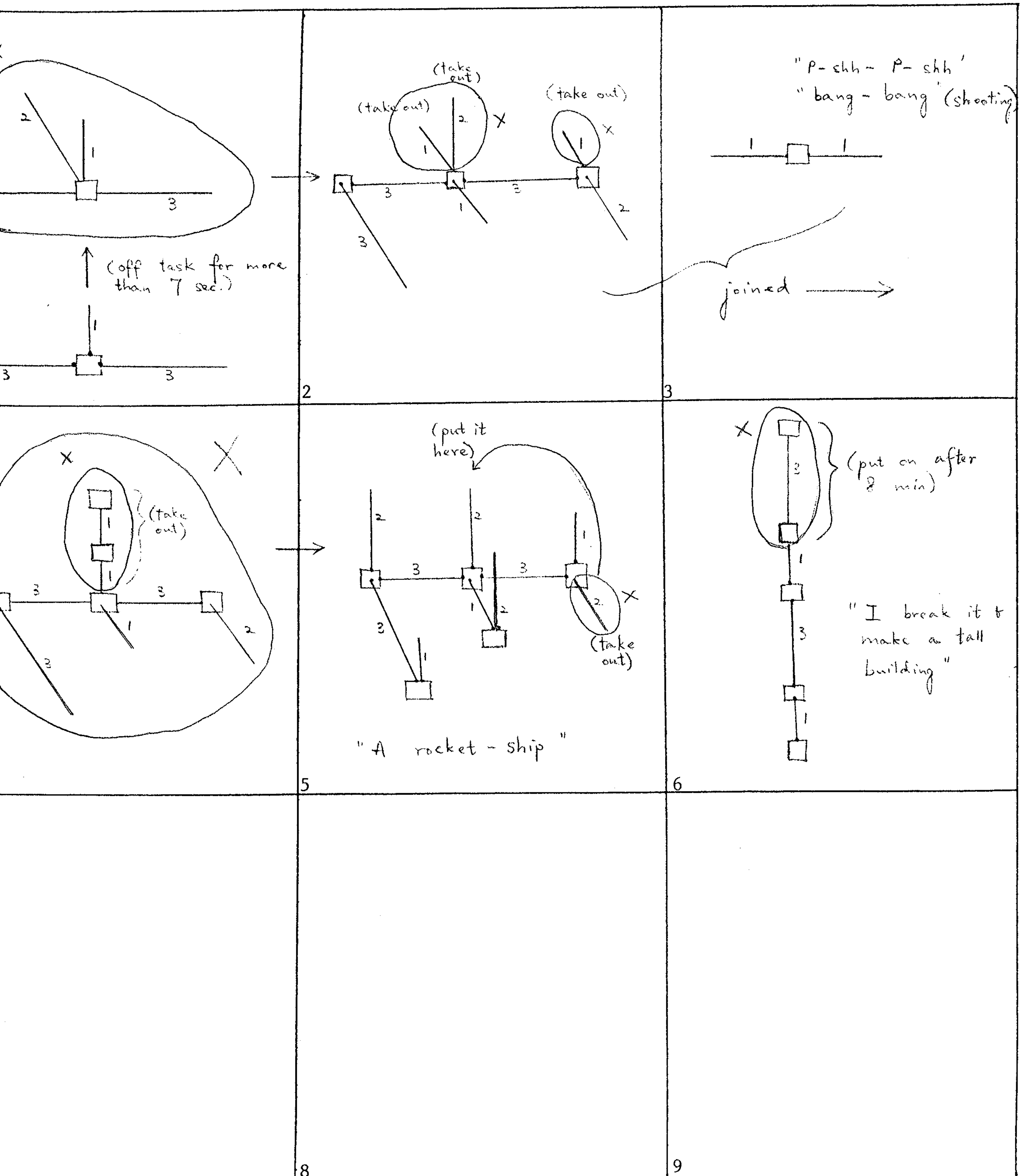
✓ lego (fair)

few tinker (very little)

CHILD CODE: RS # 16

TAPE NUMBER: Tape # 4

TESTING DATE: August 9, 1984 (10:30 am)



APPENDIX D

RECORD SHEET FOR TASK

CHILD CODE: ____________________

TAPE NUMBER: ____________________

TESTING DATE: ____________________

TASK: Solution Time ____________________

Number and Level of Hints ____/____/____/____/____/____