THE UNIVERSITY OF MANITOBA

THE EFFECT OF EXTENDED EXPLORATION ON COMPETENCE DURING A MASTERY MOTIVATION SESSION AMONG 18-MONTH-OLD CHILDREN

BY

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To My Parents
Sterling and Barbara Lyon

ABSTRACT

The effect of additional exploration on competence was investigated by examining differences in performance on three mastery motivation tasks between two groups of 18-month-old children. A difference score was derived from performance measures taken during a pre-test and post-test in the mastery motivation session. Additional measures obtained during the mastery motivation session included duration of on-task behaviour, most prominent type of exploration, and quality of exploration. Overall competence was obtained from the Bayley Scales of Infant Development (BSID).

Thirty-six 18-month-old children participated in the study. Children were randomly assigned to either an experimental or control group. The BSID was administered to the child during a home visit. Subsequent to this, the child was given three tasks: problem solving (mazes), fine motor (pegs), and form discrimination (forms) during a taped laboratory session.

Results indicated that the initial competence level was higher for the experimental than the control group. Contrary to what was expected, the control group showed a greater increment in competence than did the experimental group on the mastery tasks. Analysis of exploratory behaviour and on-task times revealed no significant group

differences.

Analyses of task differences indicated a greater increment in competence, longer on-task times, and a higher type of exploratory behaviour on the maze than on the peg and form tasks.

Suggestions for further research include developing a procedure that is child-based rather than time-based, and finding a cleaner method of separating indices of competence from indices of mastery motivation. Child behaviour during a mastery session should be transcribed to include the type of behaviour, and the sequence of behaviour.

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CHAPTER I

History of Theories of Motivation

The evolution of motivation theories has been strongly influenced by trends evident in the field of psychology as a whole. Bolles (1975) suggests that "motivation seems to be neither a fact of experience nor a fact of behaviour, but rather an idea or concept we introduce when we undertake to explain behaviour". Generally speaking, theories of motivation appear to fall into two broad categories reflecting either an intrinsic or an extrinsic orientation. Theories with an extrinsic orientation, such as the mechanistic drive-reduction theory proposed by Hull (1943), reflect the belief that motivating agencies (known as drives) are governed by rewards external to the organism. Theories based on the concept of intrinsic motivation, on the other hand, have been conceptualized in an attempt to account for behaviours that appear to be energized by forces intrinsic to the organism. One of the behaviours identified as an indicator of intrinsic motivation is exploration. In his critical paper, Motivation Reconsidered: the concept of competence, Robert White (1959) attempts to provide a new direction in motivation theory by challenging proponents of drive theories as well as those of instinct theories including Freud's. The purpose of this literature review is to outline the relevant theories that have led to the development of White's concept of motivation and the importance that exploration has played as a factor to be explained in the motivational literature. Influences upon the direction of study in the area of motivation can be traced as far back as the late 1800's. In his work, Descent of Man (1896), Darwin presented a theory of continuity between man and animal that changed the history of psychology (Weiner, 1973). The importance of Darwin's work to the development of psychological theory has been summarized by Atkinson (1964). He pointed out three premises evident in Darwin's theory that influenced the course of psychology: the affirmation of intelligence in animals; acknowledgement of individual differences in an organism's capability (i.e., the notion of "survival of the fittest"); and acceptance of continuity between man and animal which, in turn provided justification for the idea that man is guided by instincts.

Instinct as an explanation of behaviour marked the beginning of an era in the study of motivation. Two prominent theorists that adopted the instinct doctrine were Sigmund Freud and William McDougall. Freud (1915) postulated that all behaviour and all other psychological functioning was determined by instinctual drives and thus that every perception, thought, feeling, and action discharged excitation that ultimately stems from the instinctual drives (Baldwin, 1980), the two basic of which he identifies as Eros (life) and Thanatos (death). The life instinct was expressed in sexual behaviors and the death instinct in hostile behaviors.

McDougall (1908), on the other hand, postulated that instincts were responsible for all behaviour (Weiner, 1973) and developed an elaborate instinct theory. For McDougall, motivation became a universal principle for behaviour. Implicit in the theory is the idea that if there were no instincts, man would lie inert (Bolles, 1975). He believed that instincts have cognitive, affective and conative components and are directed toward particular end states (Weiner, 1973).

An alternate concept evolved from the homeostatic theories of Lange (1873) and James (1890), namely, Woodworth's (1918) concept of drive. For Woodworth, two problems needed to be addressed, firstly, how a thing is done (mechanism) and secondly, what induces us to do it (drive). Woodworth's concept of drive was derived in part from McDougall's work, however he departed from McDougall on the idea of the universality of instincts as motivating agents (Bolles, 1975). Woodworth instead postulated that a mechanism is capable of producing its own drive if it is continually aroused. From this premise, it follows that behaviours may be intrinsically motivated (Deci, 1975).

One of the most significant drive theories to emerge is Hull's (1943) theory of drive-reduction. Based on the experimental evidence from conditioning reported by behaviourists such as Pavlov (1927), Hull attempted to construct a theory that would account for broad trends in behaviour. This new approach was the first in behaviourism that elaborated on motivation specifically

Hull's theory concentrated on habit formation (learning) and activation of habits (motivation) (Deci, 1975). Hull postulated that drives are generalized motivators which activate behaviour but do not direct behaviour. In reducing drive, specific behaviours are reinforced and associations are established which indicate that learning has occurred. Through repetition of reinforcing behaviour, habits form and are strengthened (Bolles, 1975). Thus, through Hull's work, motivating agencies (drives) were introduced into the mainstream of stimulus-response associationism (Bolles, 1974).

The concept of drive, however, was not accepted in the entire psychological community. Cognitive theorists offered another approach based on the assertion that humans process information and on this basis, make choices about the behaviour in which they engage (Weiner, 1973).

Among cognitive theorists, Tolman (1932) suggested a cognitive approach to the study of motivation. He contended that the mechanistic approach of stimulus-response association was not flexible enough to explain behaviour (Bolles, 1974) for behaviour is purposive or best defined in terms of its goals and consequences.

Fundamentally, Tolman's approach focusses on behavioural ends that are fixed, but behavioural means that are variable. To reach an end-point behaviour is not guided by instinct or reinforcement alone, but also by environmental conditions, previous training, means-end relationships, and competing instincts (Bolles, 1975). Thus for Tolman, an organism's expectation of the success of the outcome is the source of motivation for behaviour. In contrast to Hull's theory, in which external drives activate behaviour, Tolman suggests an intrinsic motive, namely, "expectation of success" to account for behaviour.

Another cognitive model of motivation was proposed by Kurt Lewin (1936). He viewed behaviour as driven by tensions and moved by forces that are directed by positive and negative valences and are addressed to goals. Actions can then be explained on the grounds that we perceive particular ways and means of discharging certain tensions. Activities perceived as making possible the release of tension attract (positive valence), whereas activities perceived as increasing tension repel (negative valence) (Bolles, 1974; 1975).

Motivation, as an area of study, had now expanded to include both mechanistic theories such as Hull, and cognitive theories of Tolman and Lewin. New concepts including curiosity and exploration were also introduced into motivation research and affected its direction during the early 1950's. At that time two factors fostered an interest in the study of exploration: firstly, the recognition that a good portion of an organism's behaviour was characterized not by the behaviours that served to maintain biological well-being, but by tendencies to explore, investigate and seek out new forms of stimulation; and secondly, the concern that any theory of behaviour that neglected exploratory and curiosity behaviours would be severely deficient (Fowler, 1965).

At this time investigation of exploratory behaviour flourished. Pertinent highlights of research in this area will be reviewed before returning to the research in motivation as it develops to mastery motivation.

Studies of Exploratory Behaviour

Exploratory behaviour has no clearly defined place in infant development literature. The inability to define exploration has led to the inclusion of many and varied behaviours under the term exploration and there is also difficulty in determining the differences between exploration and play (Weisler & McCall, 1976).

Early research in exploration was investigated within the drive-reduction models by researchers such as Berlyne (1950). However, some disenchantment with the adequacy of the drive-reduction theory for explaining exploratory behaviour soon became evident (Harlow, Harlow & Meyer, 1950; Harlow, 1953; Montgomery, 1953; Montgomery, 1954; Berlyne, 1950).

Harlow et al. (1950) in their study of rhesus monkeys found that, over a series of test sessions, the monkeys showed increased ability in working with mechanical puzzles without the presence of food as a reward. They suggested that solving a puzzle correctly, in itself seemed to be satisfying and reinforcing to the monkeys. Harlow (1953) rejected the notion that the manipulatory behaviour of this kind had any connection with an animal's physiological motives and suggested that exploration be considered as an autonomous drive (Bolles, 1975).

At the same time, Montgomery (1953) was also arguing that exploration could not be adequately explained by homeostatic drives. He reported that exploration decreased in rats when they were made hungry and that they continued to explore even when satiated. From this research he also concluded that exploratory behaviours were dependent on an autonomous drive (Bolles, 1975). Montgomery (1954), and later, Myers & Miller (1954), and Zimbardo & Miller (1958) gathered support for the hypothesis that the chance to explore a novel environment and effect change on the environment is a reinforcing agent (White, 1959).

While Harlow and Montgomery were suggesting that exploration be considered as a drive rather than an activity energized by a drive, Berlyne was attempting another approach. Initially he built a conceptual model for exploratory behaviour that was designed to "fit" better with the drive-reduction theory (Berlyne, 1950). He viewed exploration as a consummatory response for a source of drive he called curiosity. The antecedent condition necessary for the development of a curiosity drive was identified as novel stimulation. Berlyne assumed that any behaviour that led to exploration would be reinforced and, further, that continuous exposure to the novel stimulation would result in the reduction of the curiosity drive (Bolles, 1975). Later on, Berlyne (1960) suggested that an optimal level of stimulation within the organism regulated exploratory behaviour. Hence, a novel stimulus engenders uncertainty that raises arousal but when the stimulus is explored, the arousal level is decreased. As a consequence, an organism was thought to try and keep arousal producing stimuli near an optimal level of arousal; large deviations from this level were seen as aversive (Rubenstein, 1984).

Another conceptualization of optimal level of stimulation was developed through the work of Leuba (1955) and Hebb (1955) and reflected the belief that both decreases and increases in drive (arousal) could be reinforcing depending on the organism's momentary level of stimulation and arousal (Fowler, 1965). Fiske and Maddi (1961) elaborated on this concept with their proposal that activation is fed by all sources of variation (novelty, complexity, incongruity) so as to maintain an optimal level of arousal.

Berlyne (1960) was also one of the first to attempt to define curiosity and exploratory behaviours. He classified exploration into two types: specific and diversive. Berlyne proposed that specific exploratory behaviour occurs when an animal is disturbed by a lack of information. Diversive exploratory behaviour occurs when an animal seeks out stimulation that offers something like an optimum amount of novelty, complexity, change, variety, or surprisingness.

The definition of exploration that Berlyne offered provided a guide to researchers to consider the salient features, aspects and properties of the stimuli that evoked exploratory tendencies (Fowler, 1965). Indeed the study of exploration encompasses studies of visual attention, studies of visually directed reaching, preference for novelty, preference for complexity, secondary circular reaction, and institutional apathy (Rubenstein, 1984). Weisler and McCall (1976) have provided an extensive review of research on these facets of exploration.

A new thrust to the area of exploration was initiated through the examination of predictability of infant scales. McCall and his associates (1973, 1977) examined test results from the Bayley and Fels longitudinal studies and concluded that intelligence could not be represented as a single, linear score because some of the ability domains involve changes in the characteristic of behaviours as the develops and thus the characteristics of behaviours from stage to stage tend to be discontinuous.

McCall (1974) examined exploration, play and manipulation in a series of five studies focussing on the effect of stimulus differences and novelty on length of time the child manipulated the toy, and the qualitative diversity of infants' free play with commercial toys using cross-situational and cross-age stabilities. Results indicated that there was a developmental progression from raw sensory-perceptual feedback to a gradually increasing influence of perceptual cognitive skills that was reflected in richer play behaviour and behaviour more appropriate to the available toys (McCall, 1974).

From this approach came several studies in the area of exploration that attempted to identify the developmental stages of exploration (Fenson, Kagan, Kearsley, & Zelazo, 1977; Largo & Howard, 1979; Fenson & Ramsay, 1980; Belsky & Most, 1981). It was felt that a greater understanding of the development of exploration and play in children would provide insights in the course of early cognitive development. In all of these studies, the development of exploration followed a similar path from simple manipulation and mouthing, to exploration of unique properties of objects, to pretense play involving more complex and cognitively demanding behaviour (Belsky & Most, 1981). It was also noted that the developmental changes seemed to mirror the changes in cognitive development.

To elaborate on this, Fenson and Ramsay (1980) examined the relationship between imitation and spontaneous production of action sequences in play behaviour to examine the relationship relative to the level of functioning of the child. Results indicated that a child's imitative level closely resembled that of their spontaneous functioning thus providing support for Piaget's suggestion that a child's ability to imitate would not greatly exceed their level of understanding.

Researchers in the area of exploration and cognitive functioning have also examined the effect of exploration and play on problem-solving. Kopp and Vaughan (1982) examined a measure of sustained attention taken during the first year of life to explore its utility as a factor in predicting cognitive competence as measured by Bayley Scales, Gesell schedules and Piagetian cognitive tests. Results indicated that sustained attention contributed significantly to prediction of performance on the Bayley and Gesell but not on the Piagetian based scales.

Smith and Dutton (1979) examined play and training in problem-solving with 4-year-old children. The children were given play and training opportunities to determine differences in performance between those who were allowed a short time to explore materials followed by either a play opportunity or training experience before the problem tasks and those with no additional task experience. Two sets of problem tasks were examined, one being less complex than the other. For the first task the child was required to retrieve and then open a box with a marble in it. The child was given three sets of sticks of differing length and a block with holes in each face that the sticks fit into. The child had to select the appropriate set of sticks and then join them by using the block to retrieve the box. For the more complex task, the box was further from the child and the child had to connect three sticks using two blocks to retrieve and open the box. On the less complex task, children with training experience directly relevant to the task performed as well as children with play opportunity. On the more complex task, children who had play opportunities were faster than those with training in solving the task and needed fewer hints. The authors suggest that the free-play opportunities were more relevant to task performance on the complex task than training because the second task required a greater degree of innovative or flexible thinking. Both sets of children did better than control children without additional task experience.

Krantz and Scarth (1979) examined the direction of the effect of adult assistance on preschooler's task persistence. The effects of teacher proximity, use of verbal reinforcement, and prompting procedures were experimentally compared for their effects upon the child's tendency to persist in self-selected manipulative tasks. Subjects included two groups of preschoolers, the younger group ranging in age from 28 to 54 months and the older group from 45 to 56 months. The child's on-task behaviour was timed by an observer while the examiner applied the experimental treatments. The treatments included: proximity where the examiner simply joined the child to observe; proximity reinforcement where the examiner joined the child and verbally reinforced him/her; proximity prompting where the examiner joined the child, asked questions and offered suggestions to extend the child's persistence; proximity reinforcement prompting where the examiner joined the child, asked questions, offered suggestions and provided verbal reinforcement for manipulative behaviour; and nonintervention where the observer merely timed the child's on-task behaviours. Results suggested that, in most instances, an adult's efforts to increase the task persistence of preschoolers can be augmented by a combined application of proximity, verbal reinforcement, and prompting procedures.

Cheyne and Rubin (1983) attempted to relate specific skills evidenced in the activity of play to performance on problem-solving tasks. Subjects were 76 girls and 64 boys with a mean age of 56 months. The children were allowed to play for eight minutes with a number of varying sized sticks and blocks with four holes drilled into each of them. Following this the children were presented with six sticks, a block and the problem of retrieving an object that they had chosen that was placed in a transparent box and out of reach. The child was then told to try to solve the problem of getting the object. Measures obtained included the number of joins, whether the child gave evidence of discovering the solution, measures of configural richness in construction, the number of different procedures engaged in by the child, and the number of joins per block, and the proficiency as measured by solution time. Results suggested that the children who discovered the long-stick principle were better able to solve lure-retrieval problems that required the use of this principle than those who did not discover the principle. Configuration richness was negatively correlated with problem solving proficiency suggesting that the organizational or patterning features of object play may be relevant for problem-solving.

Early research on exploratory behaviour was strongly influenced by the drive theorists, however, there was some difficulty in accounting for exploration using that model. Researchers such as Berlyne (1960) have attempted to provide a definition of exploration in an effort to further clarify the study of exploratory behaviours. Cognitive theorists such as McCall (1974) have examined exploratory behaviours in relationship to the development of cognitive functioning in infancy. There has been extensive research in an attempt to outline the development of exploration and also the effect of exploration of materials on problem-solving skills.

From this point, the motivation theories that lead to the development of mastery motivation concepts will be examined.

Theories Leading to Effectance Motivation

As previously mentioned, the study of motivation was broadening to include theories that moved beyond drive and instinct theory. Researchers such as McClelland, Atkinson, Clark, and Lowell (1953) elaborated on the Tolman-Lewin model in the area of achievement motivation within their affective arousal model. The premise behind this model was that affect is the basis of motivation - that it precedes behaviour, energizes, and directs behaviour (Deci, 1975). Like Tolman, McClelland and Atkinson proposed that one's beliefs about the likelihood of achieving a goal is a mediating variable between the perception of a stimulus and the resultant achievement behaviour (Weiner, 1973). They believed that achievement behaviours were the result of a conflict situation. They assumed that one's past experience provided cues that were associated with competition against a standard of excellence. This standard of excellence reflected one's expectation of success or fear of failure. Behaviour was determined by the relative strengths of the expectancy of success and the expectancy of failure as the individual approached a goal.

To reiterate the apparent discontent with drive and instinct theories has led theorists to reconsider these traditional approaches to the study of motivation. This new approach to motivation reflects the belief that an organism actively seeks out stimulation and is motivated to explore the environment and have an impact on their surroundings (Yarrow & Messer, 1984). Early research in exploratory behaviour identified exploration as being a separate and distinct drive. From there the concept of curiosity developed (Berlyne, 1960) and the idea of an optimal level of stimulation. McClelland and Atkinson have drawn from the work of Tolman and Lewin in introducing an affective component to account for human behaviour. Woodworth's (1958) behaviour primacy theory reflects a move away from his original concept of drive toward one that includes intrinsically motivated behaviour. He viewed humans as being in continual interaction with their environment and themselves (Deci, 1975).

Another theorist that has elaborated on this belief of the human as an active organism and the existence of intrinsically motivated behaviour is Robert White (1959) in his paper, <u>Motivation reconsidered: the concept of competence</u>.

Introduction of the Concept of Effectance Motivation

Robert White (1959) introduced the concepts of competence and effectance motivation as a challenge to the drive-reduction and psychoanalytic instinct theory's of Hull and Freud, respectively. White's central argument was that "the motivation needed to attain competence cannot be wholly derived from sources of energy currently conceptualized as drives or instincts (p. 162). White presented evidence from both animal and human studies indicating that behaviours such as exploration, curiosity, play, and one's attempt to deal effectively with one's environment could not be adequately explained by drive-reduction, secondary reinforcement, or anxiety-reduction (Harter, 1978).

White considered competence, defined as an organism's capacity to interact effectively with its environment (White, 1959), as having a motivational component. This motivational component, known as effectance motivation, urges an organism toward competence in dealing with the environment and is satisfied by a feeling of efficacy. Effectance motivation, therefore, is an intrinsic motivation; the gratification being the inherent pleasure produced when dealing competently with the environment.

In developing his concept of motivation, White refers to Woodworth's (1958) behaviour-primacy theory. Woodworth observed that many behaviours seemed directed toward dealing with the environment without the arousal of any organic need (White, 1959). This concept is similar to White's competence.

White has also been influenced by Jean Piaget (1952). While Piaget does not address the concept of motivation specifically, it is implicit in his writings on the development of cognitive structures known as schemata (Deci, 1975). The process of adaptation, a central element of Piaget's theory, reflects the belief that there is a dynamic interaction between the infant and environment (Yarrow & Messer, 1984). White has expanded on this notion of an active, seeking infant, in contrast to the homeostatic theories of the behaviourists.

For White, the effectance motive is manifested in exploration, curiosity, mastery and striving for an optimal level of stimulation and further, the behaviour is directed, selective, and persistent (Yarrow & Messer, 1984). White also suggests that effectance motivation is undifferentiated in the very young, but becomes distinguishable later as separate motives of cognizance, construction mastery, and achievement. The effectance motive, however, remains as the basis for these separate motives (White, 1959).

While White did provide a new impetus to the study of motivation, he did not provide a theory, model, nor operational concept of effectance motivation. The processes that Hunt suggests provides a bridge between White's theory of competence and the beginnings of mastery motivation in infancy (Yarrow & Messer, 1984).

Hunt's (1963) view of intrinsic motivation was heavily influenced by Piaget's (1952) theory of cognitive development. Hunt's theory was based on a discrepancy hypothesis and he assumed that incongruity was a generic instigator for behaviour and that there was an optimal degree of discrepancy from the familiar (Ulvund, 1980). Hunt suggested that purposive behaviour begins when infants orient to and inspect objects. Then as the behavioural repertoires of the infant increase, new means of exploration (through manipulation) are employed to learn about the environment. Exploratory manipulation leads to active attempts at influencing the environment and eliciting feedback from other people. It is through this exploration that a child develops an expectancy that things can be recognizable. When a novel stimuli appears, the child visually attends to it, then inspects and explores it until the stimuli has been fully explored and mastered (Morgan & Harmon, 1983). Like White, Hunt's view presupposed that infants have an innate motivation to master and have an effect of their environment (Harmon, Morgan & Glicken, 1984).

The broad conceptualizations of White's competence and effectance motivation have provided others with the opportunity to elaborate and further define this motivational construct. Three others whose concepts are similar to White's include Wenar, Heckhausen, and Harter. Wenar (1976) described an executive competence that has roots in White's definition of competence, especially as it appears in infancy. He defines executive competence as the "ability to initiate and sustain locomotor, manipulative, and visually regarding activities at a given level of complexity and intensity, and with a given degree of self-sufficiency (p. 191)."

Heckhausen (1977, 1981) has elaborated on a concept of achievement motivation that shares many similarities with effectance motivation. Heckhausen's achievement motive presupposes 1) that individuals intend, by their own activities, to produce an outcome that is evaluated according to some standard of excellence; 2) that there is a gradual differentiation of the internal attribution of competence into the concepts of ability and effort; and 3) that an action cannot be motivated by desires to achieve unless the outcome of the action is perceived to be influenced by internal factors (Heckhausen, 1981). While Wenar and Heckhausen have drawn from White's work in developing motivational theories similar to effectance motivation, it is Susan Harter who expanded on and attempted to operationalize White's concept of effectance motivation.

Development of the Concept of Effectance Motivation

Susan Harter's preliminary work on effectance motivation led her to consider the development of a model. Harter's model evolved from a series of studies of school-aged children that examined intrinsic versus extrinsic motivation, developmental differences, and dimensions and pleasure aspects of effectance motivation. Effectance motivation, as conceptualized by Harter, "impels the child to engage in mastery attempts". If these attempts are successful, that is, if they result in competent performance, the child experiences feelings of efficacy or inherent pleasure (Harter, 1981). Using this conceptualization, Harter proposed a general framework to examine the structure of effectance motivation and the content of the components across different developmental levels. Harter suggested that a model should consider various factors including: 1) components of the motive system within a developmental framework, 2) the effects of failure as well as successes, 3) refinement of the concept of intrinsic pleasure to include "optimal degree of challenge", 4) the role of socializing agents and the function of rewards, 5) the influence of reinforcement over time on a child's ability to internalize a self-reward system and set of mastery goals, 6) the relative strength of intrinsic vs extrinsic motivational orientation, and 7) the correlation of motivational constructs.

Empirical evidence from her previous research provided a basis for the inclusion of such variables and components. For example, Harter and Zigler (1974) attempted to validate four dimensions of effectance motivation (response variations, curiosity for novel stimuli, mastery for the sake of competence, and preference for challenging tasks) by including subjects who were expected to differ in effectance motivation, namely, normal and retarded children. Drawing on Zigler's (1971) assumption that retarded children have less effectance motivation than normal children, Harter and Zigler predicted that on tasks designed to tap components of effectance motivation more directly, normal children would demonstrate greater effectance motivation than retarded children matched on mental age (Harter & Zigler, 1971). The four tasks used were a box maze (response variation), pictorial curiosity (curiosity of novel stimuli), graduated pegs (mastery for the sake of competence), and puzzle preference (preference for challenging tasks). The findings indicated that the group effects for each of the four tasks were significant, thus supporting the prediction that normals demonstrated more effectance motivation than did the retarded groups.

In Harter's (1975) study of the developmental differences in effectance motivation, she investigated one component of effectance motivation, mastery motivation, and an extrinsic motivator, that of social reinforcement. The children (4- and 10-year-olds) were presented with color discrimination tasks in an attempt to measure the strength of mastery motivation and social approval for the two age groups. Mastery motivation was defined as being the desire to solve cognitively challenging problems for the sake of discovering the solution and need for social approval was inferred from the responsiveness to the social environment. The major motivational measure considered was the amount of time the subjects chose to play the game.

The results indicated that older children were motivated to produce a successful outcome in the form of the correct answer as suggested by longer playing time on unsolvable versus solvable tasks independent of adult praise, in contrast to the younger group who played extremely long on both ($p < .001$). Results for the social condition did not reveal the expected result that a significant difference would be found for the younger group in favour of social reinforcement. The younger groups spent considerably more trials than the older group on the tasks once having learned the problem ($p < .001$) suggesting that the younger children manifested motivation in the continued production of interesting stimuli.

Harter suggests that there are two types of mastery motivation that can be identified in the older child: the intrinsic need to produce an effect on one's environment and the desire to solve problems for the sake of being correct (Harter, 1975a). Further work on effectance motivation and need for approval in older children (Harter, 1975b) helped to elaborate the relationship between those variables and socially desirable responsiveness. The hypothesis in this study was that among older children, mastery motivation (the desire to solve cognitively challenging problems for the gratification inherent in successful problem solving) is stronger than the desire for praise and approval. Mastery motivation was measured as the amount of time the children chose to spend on one of two discrimination problems, a challenging (unsolvable) or a solvable task. To assess the role of praise or approval, there were two conditions used, a social-reinforcement condition and an experimenter-absent condition. A social desirability scale developed by Crandall, Crandall, and Katkovsky (1965) was used to measure the tendency to give socially desirable responses. It was predicted that mastery motivation would be of primary importance to the low-scoring children, whereas with high-scoring children, mastery motivation would be secondary.

Results indicated that there was longer playing time on the unsolvable task than the solvable task ($\underline{p} < .001$), but that the task difference was only significant for the low scorers ($p < .05$). High scorers showed a longer playing time in the social-reinforcement condition than the experimenter absent condition ($p < .05$). As suggested by the results, the study presented evidence that mastery motivation (as measured by the amount of playing time) is strongest in children who tend to score low on socially desirable responses scale.

Harter also investigated the response of pleasure to aspects of mastery motivation, notably cognitive challenge (1971, 1974, 1978), social reinforcement and task difficulty (1977). Initial studies indicated that children smile more upon successful completion of a task. The more recent studies indicate a positive curvilinear relationship between smiling and difficulty level for correctly solved items. Lowest and highest levels of difficulty produced less pleasure than an optimal level of difficulty (Harter, 1978).

Harter's work has contributed a more differentiated concept of effectance motivation and has highlighted the importance of social factors (Yarrow & Messer, 1983), but there has been little effort to focus on the behavioural phenomena described as motivational (Vietze, 1983). In contrast to Harter's work with older preschoolers and school-aged children, the research of Leon Yarrow and his associates has focussed on the development and validation of measures of mastery motivation in infancy (Morgan, 1983). The focus from this point on will relate to infants and toddlers, where effectance motivation is called mastery motivation.

Mastery Motivation in Infants and Toddlers

Yarrow's group began taking an interest in mastery motivation following a study on relations between parameters of the environment and the Bayley Scales of Infant Development (Yarrow, Rubenstein, Pederson & Jankowski, 1972). The results indicated differing degrees of relationship among separate aspects of development and a strong interdependence of cognitive, motor and motivational functions. Among these, the cognitive-motivational activities appeared to indicate the earliest manifestations of attempts to master and obtain feedback from the environment (Yarrow & Messer, 1983). Mastery motivation is the term adopted by this group to describe this intrinsic motive to control the environment, to master skills, and to be effective (Morgan & Harmon, 1984; Messer, Rachford, McCarthy, & Yarrow, 1983). In attempting to determine behaviours and to develop measures which best reflect mastery motivation, several approaches, as described in the following studies, were taken by the Yarrow group. These included studies of measures of mastery motivation and their relationship to cognitive ability, semi-longitudinal studies where they examined the predictive validity of mastery motivation indices, and studies of mastery motivation measures in groups of children recognized as being different in rate of development such as Down's Syndrome and normal children.

Jennings, Harmon, Morgan, Gaiter, and Yarrow (1979) examined the relationship of exploration to persistence and cognitive functioning in one-year-old children. They felt that spontaneous exploration was the most appropriate index of White's construct of effectance motivation. The study involved three sessions: free play, mastery, and administration of the Bayley Scales of Infant Development (BSID). In the free play session, quantitative and qualitative measures of exploration included total exploratory play, producing effects, practicing emerging skills, continuity of play and cognitively mature play. The mastery session included 11 tasks designed to reflect effect production, practicing emerging skills and problem solving. Persistence was the percentage of time an infant engaged in task-directed behaviours. Among exploratory measures taken during free play, the only correlation found was a positive one between total exploration and continuity of play. This suggests that the exploratory measures indicated four different aspects of exploration. In examining the relationship of free play measures with persistence, the results suggested that the quantitative measures of exploration (total exploratory play, producing effects, practicing emerging skills) did not relate to persistence or ability (BSID). However, the qualitative measures of exploration (continuity of play and cognitively mature play) did relate to persistence and ability (BSID). Specifically, infants with higher continuity scores in free play successfully completed more persistence tasks and persisted longer on problem-solving tasks. Infants who engaged in more cognitively mature play were more persistent on structured mastery tasks, and repeated problems more spontaneously. Cognitively mature play was also positively related to measures of cognitive ability.

Yarrow, Morgan, Jennings, Harmon, and Gaiter (1982) studied 13-month-old children's persistence at tasks as it relates to cognitive functioning and environmental conditions. Considerations governing the choice of tasks were that they be interesting to one-year-olds and that they provide an opportunity to observe individual variability in task-directed behaviours. The 11 tasks were of three types: tasks that provide an opportunity to secure feedback, combinatorial tasks that involve practicing skills, and barrier tasks. Initially the measures of mastery included latency to task involvement, persistence, exploration of materials, variety of approaches, frequency of solution, variety of effects produced, latency to first solution, affect, and competence, however the analyses were only reported on persistence at tasks, competence, and affect.

They found that persistence was significantly related to the competence measure on mastery tasks, ($r = .69$, $p < .01$). There was a significant correlation between the Bayley MDI and persistence ($r = .48$, $p < .01$), but that there was only a negligible correlation between the Bayley PDI and persistence. As expected, the competence measure was also significantly correlated with the Bayley MDI and PDI. Measures of goal-directedness (persistence) at 6 months were related to the Bayley problem solving cluster at 13 months, ($r = .42$, $p < .05$), and competence on mastery tasks at 13 months ($r = .45$, $p < .05$). This relationship between persistence at 6 months and competence at 13 months suggests that early cognitive development and mastery motivation are closely linked. Further, the results suggested that there may be a reciprocal relationship between persistence and competence in infancy.

To refine and elaborate on this study, Yarrow, McQuiston, MacTurk, McCarthy, Klein, and Vietze (1983) did a follow up study with data from children at 6 and 12 months of age. Using the same components in tasks (effect production, practicing sensorimotor skills, and problem solving), they looked at six measures of mastery motivation: latency to involvement, visual attention, exploratory behaviour, persistence on task-related or goal-directed behaviour, and positive affect.

Results showed a significant relationship between all measures of mastery motivation at 6 months except positive affect. The intercorrelations at 12 months were similar to those at 6 months. The cross-age relationships between mastery motivation measures suggested that a child's developmental level and the nature of the task interact to influence the level of mastery behaviour. These relationships were interpreted as representations of theoretically meaningful transformations in mastery behavior based on the assumption of a hierarchical arrangement of the components (Yarrow & Messer, 1984). As in the previous study, support was shown for a reciprocal relationship between mastery motivation and later competence. One measure of mastery motivation, exploratory behaviour, at 6 months was significantly related to the MDI at 12 months, $r = .32$, $p < .01$). There were also significant correlations between measures of the mastery component, practicing emerging skills, at 6 months and the 12 month MDI. Results also indicated that the MDI and PDI at 6 months were significantly related to overall measures of mastery suggesting a bi-directional relationship between mastery motivation and competence.

Following this, Messer, McCarthy, McQuiston, MacTurk, Yarrow, and Vietze (1983) studied the relationship of mastery behaviour and competence (BSID) at 6 and 12 months and competence at 30 months (McCarthy Scales). The tasks were divided into three groups: effect production, practicing sensorimotor skills, and problem solving. The tasks were different for the 6 and 12 month age groups but the structure of the tasks and the procedure was the same. The mastery variables in this study reflected five levels of task involvement: looking, peripheral exploration, general exploration, task-directed exploration, and goal-directed exploration. Results showed a higher correlation between less directed forms of task involvement and the McCarthy Scales at 6 months. At 12 months, a negative correlation between less directed forms of task involvement and the McCarthy Scales, and a positive correlation between goal directed attempts and the McCarthy Scales was found. These findings suggest a transformation of mastery behaviour at 6 and 12 months. The way an infant attempts to master the environment (as evidenced by level of task involvement) appears to be a better predictor of later competence than the infants level of competence. Sex differences were also reported, girls generally had stronger correlations at both 6 and 12 months.

Further support for the classification of mastery behaviour into task involvement came from Messer, Rachford, McCarthy and Yarrow, (1983) in their study of the structure of mastery behaviour at 30 months. In this study, mastery motivation was conceptualized as proportion of time that infants spent at the five levels of task involvement. The levels of task involvement were no engagement, low engagement, simple engagement, active engagement, and problem engagement. The detailed codes of the child's behaviour was then subjected to cluster analysis to indentify the behaviours that could be considered similar. The mastery tasks were chosen to be interesting to the children and to present them with challenging problems. The McCarthy Scales were also administered. Principle components analysis indicated that children tended to structure their behaviour similarly across the six tasks even though the tasks had differing characteristics. Cluster analysis resulted in the identification of four clusters of task related behaviour: persistence cluster, task cluster, manipulation cluster, and absence cluster. The cluster analysis provided support for the classification of mastery levels based on task engagement. Correlations between the engagement levels and the clusters indicated that the two variables containing the highest level of task involvement were highly positively correlated as were the two variables that contained the lowest level of task involvement. Also, the other correlations between these four variables were strongly negative. The intermediate levels of class engagement did not closely correspond to any one cluster, however there was a different pattern of correlations for each level suggesting that each level represented a distinct level of task engagement. Levels of task engagement were more strongly related to the competence levels on the McCarthy Scales than were the behavior clusters.

MacTurk and Yarrow (1983) examined the transition of mastery behaviours in an attempt to reach some conclusions as to the strategies children use in the approach and mastery of objects. This study also attempted to further examine the relationship between mastery motivation and competence. A series of twelve mastery tasks were administered to non-delayed 6-month-old children and 8- and 12-month-old Down Syndrome infants matched for sex and the Bayley Scales of Infant Development (BSID) mental scale. The mastery behaviours developed were representative of a hierarchy and included the categories of look, explore, goal-directed behaviours (persist), success, and social/off-task. In contrast to earlier studies of measures of motivation where a highly motivated child spent longer times engaged in goal directed behaviours, this study focussed on the more motivated child as one who displayed a well-organized progression of behavioural transitions. This distinction was seen as being similar to Hutt's distinction between specific (exploration) and diversive (play) activities. Results indicated that the two groups adopted similar strategies in mastery attempts, where goal-directed behaviours were an important part of a child's repertoire. The differences occurred when considering the manner in which tasks were approached.

Looking was the hub of behaviour for Down's infants, whereas non-delayed infants behaviour revolved around social behaviors. Correlational analysis of mastery behaviors and BSID scores suggested that the connection between task persistence and the achievement of success serves as a link between motivation and competence, in other words, the child's ability to perceive a relationship between persistence and success may serve to motivate the child. The authors also suggest that this finding served to support Lewis and Goldberg's (1969) generalized expectancy theory. Children who displayed evidence that task persistence resulted in success were also the ones who had higher Bayley raw scores.

Vietze, McCarthy, McQuiston, MacTurk, and Yarrow (1983) examined exploration and attention in Down's Syndrome to determine whether the developmental examination of the tasks would be similar to non-delayed children. Three groups of children at 6 months, 8 months, and 12 months of (chronological) age were presented with 12 toys in two sessions. The toys were classified into three groups: effect production, sensorimotor skills, and problem solving. Five dependent measures were developed to measure behaviour: visual attention alone, exploratory behaviour, task and goal-directed behaviour (mastery), off-task behaviour, and social behaviour. The Bayley Scales of Infant Development (BSID) were also administered to all three groups. Results indicated that the only consistent difference amongst the three age groups was for looking, which was highest at 6 months of age, gradually declining at 8 months and lowest at 1 year. Exploratory behaviour showed a general tendency to increase with age, but was only significant on sensorimotor and problem-solving tasks. Mastery behaviour also showed a tendency to increase across age groups, but this was only significant for effect-production tasks. Off-task behaviour decreased across the three age groups, but was only significant for problem-solving tasks. At 6 months there were no significant correlations of exploratory measures with the BSID. At 8 months there was limited significance of exploratory behaviours with the BSID. At 12 months, there was a significant positive relation between mastery behaviours and the BSID mental scale, and mastery behaviour and the BSID motor scale for sensorimotor skills and problem solving tasks. The authors suggest that the progression in organization of exploratory behaviour in Down's Syndrome is similar to non-delayed children. Down's children tend to look more than normal children, and normal children engage in mastery behaviour more than Down's, however Down's children seem to explore in the same way as normal children.

MacTurk, Vietze, McCarthy, and Yarrow (1985) elaborated on the sequence of exploratory behaviour in

Down's Syndrome and normal children. Children from the two groups were matched on BSID scores. The mean chronological ages were 9.2 months (Down Syndrome group) and 6 months (non-delayed group). Children were observed in three sessions, one to administer the BSID, and two exploratory behaviour sessions. Exploratory behaviour was divided into six levels: 0- looking, 1- minimal contact, 2- basic active exploration, 3- involved task related behaviours, 4- goal-directed behaviour, and 5- successful completion of task. Off-task and social behaviours were also recorded. After data collection, the levels were pooled so that 1 and 2 became Explore, and 3 and 4 became persist. Results showed that there was a significant difference in the behaviour (F = 82.06, $p < .001$) and a significant group x behaviour interaction (F = 6.78, $p < .01$). There was no significant main effect for group. An examination of the transition from one behaviour to another indicated that the two groups did not differ in total amounts of behaviour but in the distribution of the behaviour. Where look was the hub of the behaviour organization for the Down's Syndrome group, social was hub for the non-delayed group. For the non-delayed group, Look, Social and Success all tended to be followed by Persist, whereas the Down's Syndrome group tended to return to Look after Explore, Off-task and Social. The author's suggest this may be reflect a difference in CNS integrity.

Through their research, the Yarrow group has refined and elaborated on the concept of mastery motivation. The expression of mastery motivation is observed in the task-directed behaviour during the presentation of a set of tasks. These researchers have developed mastery motivation measures that can be divided into three categories: indices of mastery motivation; causality pleasure and; indices of competence (Morgan & Harmon,1984; Yarrow & Messer, 1983). They consider the primary measure of mastery motivation to be persistence, i.e., the amount of time the child engages in task-directed behavior (Morgan & Harmon, 1984; Yarrow & Messer, 1983). Causality pleasure has also been coded on the assumption that it may be indicative of the feelings about being confronted with a challenging situation (Morgan & Jacobs, 1981; Morgan & Harmon, 1984; Yarrow & Messer, 1984). The indices of competence reflect the successful completion of the task by the child.

The Yarrow group has also utilized several tasks in the study of mastery motivation which were selected relative to the developing skills of the child. In developmental order these skills include: producing effects with objects, practicing emerging skills, and problem-solving (Yarrow & Messer, 1984). Morgan and Harmon (1984) have provided a categorization of the variety of tasks in a developmental framework. The categories reflect a hierarchical organization relative to the difficulty and appropriateness of the tasks at different age levels.

Following the lead of Leon Yarrow and his associates, researchers at the University of Colorado have also been examining the developmental aspects of mastery motivation in infancy and early childhood (Harmon, Morgan, & Glicken, 1984; Morgan & Harmon, 1984; Morgan & Jacobs, 1981, Harmon, Pipp & Morgan, 1984). Their work has also included the introduction of mother's perception of mastery motivation and studies of differences in development of competence in infants with known differences that affect mother-infant interaction (such as preterm and full-term) that could enhance or impede mastery motivation.

Morgan and Jacobs (1981) outlined their assessment of mastery motivation for 2-year olds. Their long term objective was to develop a standardized test for the assessment of mastery motivation for 9- to 36-month-old children. The general procedure involved the introduction of four types of tasks: cause and effect, combinatorial toys (pegs and rings), barrier problems, and combinatorial toys (shapes) to children in the presence of their mother. Interaction between the child and experimenter was kept to a minimum. The children were given two timed trials during a session. Between the trials the experimenter provided demonstration of the use of the toy. During the session, the experimenter coded motivation codes (not task directed behaviours, and task directed behaviours), competence (successes), and causality affect. From the procedure, five types of scores were derived: persistence, competence, causality pleasure, self-initiated mastery motivation, and preference for challenging tasks. Their results suggested that persistence appeared to be the best measure of mastery motivation, while competence appeared to be a meaningful measure of the child's performance level.

Morgan and Harmon (1984) provided a review of the research carried on by the Yarrow group and the University of Colorado in the area of mastery motivation in infants and toddlers. Again, a key objective was to develop a standardized procedure and tasks for assessment of mastery motivation in children 12- to 36-months of age. Their summary suggested that mastery motivation was best assessed by using a test-like approach as opposed to a free play session. In a test-like situation, more types of task-directed behaviour associated with mastery motivation were observed. The procedure used in most of the studies under review involved the demonstration of the tasks, followed by an opportunity for the child to play with the task for a period of time with minimal involvement from the experimenter or mother. There was a developmental progression in the types of tasks appropriate for different age levels beginning with exploration/curiosity, followed by practicing emerging skills, completing a multi-part task, and mastery for the sake of competence.

Harmon, Morgan, and Glicken (1984) reviewed research on the issue of continuity and discontinuity in childhood in the domains of affective and cognitive/motivational development (mastery motivation). Free play, structured tasks, and maternal reports were used to assess aspects of mastery motivation. In the free play situation, children at 12, 15, and 18 months of age were examined and rated for specific types of behaviour. The variables included activity level, the number of different objects with which the child played, high level play, continuity of high level play, social use of objects, proximity and contact to mother, and interest in mother. Results indicated developmental trends in infants free play behaviour. There was a continuous increase in activity level over the age periods, however there were differential uses of activity level at 15 and 18 months. At 15 months, infants used activity as a means of exploring inanimate objects, whereas at 18 months, activity level was used as a means of gaining proximity, contact and social interaction with their mothers. The results also suggested a shift in both the quantitative and qualitative aspects of play. From 12 to 15 months there was an increase in play variables to more conventional use of toys, more combinatorial play, and an increase in social play. There was no increase from 15 to 18 months. There was also a significant change in social interest of the mother from 15 to 18 months, but not from 12 to 15 months.

The free play scoring system was also used to study play behaviour in abused/neglected infants. The play behaviour of the previous sample was used as a comparison. Results indicated that the abused infants were more likely to actively explore, but in a less persistent, more disorganized fashion. In contrast, neglected infants showed more motor retardation and lack of interest in the toys. Studies involving low birthweight pre-term infants indicated that these children were less active than fullterms and explored the room less, however while their proximity to mother was greater, they showed less direct interest in her.

Mastery motivation was assessed during structured sessions using three types of toys: those providing the opportunity to produce feedback, those requiring circumvention of a barrier/ obstacle, and combinatorial toys. The measures of mastery motivation were divided into the three categories of indices of mastery motivation, causality pleasure, and indices of competence. A review of 13 studies of infants from 6 months to 4 1/2 years of age seem to indicate a discontinuity in mastery task behaviour between 6 months and 1 year of age. There appears to be a shift from more general exploration to focused mastery attempts. This has led the authors to conceptualize that there is a developmental progression in mastery behavior from exploration and producing effects on the environment to more task-directed behaviour. Data from a questionnaire developed to measure "Mothers Observation of Mastery Motivation" (MOMM) provided confirmation of this discontinuity in development at around 9 months of age (Morgan, Harmon, & Jennings, 1983). Results using the authors' mastery motivation measures on risk infants indicated that preterm infants were slower to solve tasks and showed fewer instances of solution behaviour. Further, these infants were less likely to show task directed behaviour (persistence) and more likely to only explore or manipulate the toy. This supported the authors' hypothesis that preterm infants were less persistent at tasks as a result of greater initiative on the mother's part during the first year of life. Further support was gathered through an intervention program for medium risk infants at 12 months of age. The program goals were to involve the mother in defining the style of her infant, learn appropriate interaction techniques, and help her anticipate the next developmental step for her infant. Results indicated that intervention infants were more task directed, demonstrated more causality pleasure, were quicker to solve the task and demonstrated more solution behaviour than non-intervention infants.

Harmon, Pipp, and Morgan (1984) also investigated mastery motivation in low birthweight preterm and fullterm infants 12 months of age. Infants were tested in a structured laboratory session that consisted of a mastery motivation situation, object permanence, and developmental testing using the Bayley Scales of Infant Development. Variables that were derived from scores included interest in experimenter, mother or other, affective behaviour, latency measures, and task behaviour scored using a hierarchical system of behaviours that included off-task, passive interest, active exploration and task-directed behaviour. Results indicated that fullterm infants demonstrated significantly more solution behaviour and were more likely to repeat the appropriate use of the toy than preterm infants. They were also quicker in solving the task and showed more positive affect with solution. Preterm infants displayed significantly more active exploration of the task suggesting less cognitively advanced methods of interaction with the toys. There were significant differences between the two groups on the Bayley MDI, where fullterm infants showed higher scores. The data was then re-analyzed using the MDI scores as a covariate. Results indicated significant differences for the positive affect with solution, and marginally significant differences for the measures of active manipulation and latency to solution. A second study reported on mastery motivation in medium risk infants at 12 months corrected age and again at 24 months corrected age. Half of the infants received a family oriented intervention program throughout the infant's first year of life, the other half were seen at 6 and 12 months of age for assessment only. Results at 12 months indicated that intervention infants were more task-directed, demonstrated more causality pleasure, were quicker to solve tasks and demonstrated more types of solution behaviour than non-intervention infants. At 24 months, the intervention showed higher mean scores on the mastery motivation measures, but the differences were no longer significant.

Yarrow and his associates have expanded the study of mastery motivation to include the period of infancy. They have provided direction to the continued study of the interrelationships between developmental competence and motivation. One of the problems identified for future research has been the ability to identify the relevant dimensions of both cognitive and motivational areas of functioning (Yarrow & Messer, 1984). Three criteria in developing the mastery motivation tasks for this group of researchers includes: that the task should be interesting, that the task should take some time to complete, and that the task should be optimally challenging relative to the child's own developmental level (Brockman, Morgan, & Harmon, 1984). The tasks have also been chosen in an attempt to reflect a hierarchical organization with respect to developmental difficulty. The development of this hierarchy reflects the belief of the Yarrow group that at different ages mastery motivation is manifested by different developmental behaviours and includes: exploration/curiosity tasks (5 months and older), persistence tasks (9-15 months), encompassing effect production tasks, combinatorial tasks, means-end tasks, completing a multipart task, and preference for challenging tasks (3 years and older). Using this approach, researchers have included a variety of tasks with a number of different solutions in their study of mastery motivation. While this approach has advantages in controlling for fatigue, there are also disadvantages. One of these is that the definition of achievement on the task (the goal) does not remain constant from task to task, or from developmental level to level. This results in a confound where the researcher is in fact defining the goal from task to task. An alternative approach is to incorporate the first two criteria suggested by the Yarrow group and add to it the need for a common goal. Using these new criteria, a set of means-end mastery tasks has been developed where the goal remains constant but the complexity of the task increases to reflect differences in developmental competence.

The Colorado researchers have expanded on the work of Yarrow and his associates in the area of mastery motivation. This group has attempted to develop standardized measures and procedures in the area of mastery motivation to further the understanding of the link between competence and motivation (Morgan & Jacobs, 1981). Morgan and Jacobs (1981) have suggested that persistence (amount of task-directed behaviour) is the most meaningful measure of mastery motivation, and Morgan and Harmon (1984) have suggested that mastery motivation is best assessed using a test-like approach. The procedure suggested allows a child to work as independently as possible at the task materials for two trials, but the length of time that the child is allowed to continue is determined by the examiner. Given that the persistence measure is the primary measure of mastery motivation, it would appear that the examiner may be interrupting the session at a time where the child may still be involved with the task. A more appropriate procedure may be to allow the children to continue at a task up to a point where they indicate they are no longer interested in the task.

Both the Yarrow group and the researchers in Colorado have attempted to organize mastery behaviour in a hierarchical manner where simple exploration of a toy is considered a less cognitively mature way of interaction with the toy than task-directed behaviour. This organizational hierarchy reflects a normative developmental progression beginning at simple exploration of tasks and producing effects to more task-directed behaviours such a combinatorial skills and problem solving (Yarrow, et al., 1983; MacTurk & Yarrow, 1984; MacTurk, et al., 1985). Research has also been done in an attempt to elaborate on the developmental heirarchy as researchers try to identify the behavioural transitions of children as they work on mastery tasks (MacTurk, et al., 1985). This kind of research reflects a new interest in the area of mastery motivation, that of the mastery behaviour of individual children.

Statement of Problem

The extensive research in the area exploratory behaviour has presented challenges to theorists in the study of motivation. Early work on exploration and curiosity reflected the attempts to incorporate these behaviours in a mechanistic framework such as Hull's drive-reduction theory. Most notably, Berlyne (1966) proposed the idea of an "optimal level of stimulation" within an individual that regulates exploratory behaviour. Atkinson & McClelland (1953) also included a concept of arousal or activation in which tension disequilibrium was seen as motivating exploration (Rubenstein, 1984). More recently, researchers in the area of mastery motivation have also recognized the relevance of exploration to the

the development of competence.

The impetus for inclusion of exploration in mastery motivation research derives from White's reconsideration of motivation. His concept of effectance motivation implies exploratory behaviour. White conceptualizes this motivational component of effectance as urging a child to interact effectively with the environment, which is evident in exploratory play. Despite this fact, researchers in the area of mastery motivation have focussed on persistence as the principal variable in the development of competence (Yarrow & Messer, 1984) and have hypothesized that persistence will predict competence. Exploratory behaviour has typically been researched as a correlate to persistence.

Concurrently, researchers of exploration have also identified the importance of exploration and play to problem-solving (Smith & Dutton, 1979; Kopp & Vaughn, 1982; Cheyne & Rubin, 1983) where free play and training experiences have all led to greater competence on tasks. Similarily, through his comprehensive examination of infant test data, McCall (1974) observed that infant behaviour develops in a discontinuous manner and that each developmental increment is preceded by increased organization of exploratory behaviours.

As suggested by Weisler and McCall (1976), researchers have had difficulty defining exploration. However, in the area of mastery motivation, there has been an attempt at identifying a developmental hierarchy of mastery behaviours (MacTurk & Yarrow, 1983). These include increasingly task-specific behaviours similar to those generally described as exploratory.

Another challenge in the study of mastery motivation has been to obtain separate measures of mastery motivation and competence. Generally, persistence is measured while the child is demonstrating competence on a task. Furthermore, the child is only allowed to work with task materials for a pre-defined maximum time of 60 seconds during the first trial, and 90 seconds on the second trial (Morgan & Jacobs, 1981). In this study, the highest level of competence was separated procedurally from indicators of mastery motivation. As well, the period of persistence was extended through the use of prompts to allow for a longer period of exploration.

The objective of this study is to examine the effect of an extended period of exploration on competence during three mastery motivation tasks. The main independent variable is the opportunity to continue to explore the mastery motivation tasks and task materials after competence has been demonstrated. The dependent variable is the change in competence level following the period of exploration. The hypothesis for this study is that an increased period of exploration of tasks results in increased competence on those tasks.

As well, the following questions will be explored:

a) Is the increase in competence related to on-task time during the mastery motivation session?

b) Is the type of exploration related to task competence and an increase in competence?

c) Is increased competence related to a combined effect of on-task time and exploration?

d) Is an increase in competence following exploration related to the child's developmental level?

CHAPTER II

METHOD

Subjects

Thirty-six children, 18 boys and 18 girls, were tested at 18 months of age (M = 18 months, SD = 9.4 days). The children were identified through several sources of referral. Parents of children attending the Child Development Laboratories and Nursery School of the Department of Family Studies, University of Manitoba, or individuals associated with the faculty, students, and parents of participating children were asked whether they or friends of theirs who had infants of the required age might be interested in participating in this project. For those interested, a consent form and covering letter were mailed to the parent (See Appendix A). Children included in the study were generally from upper middle and middle class families. Two of the 36 children were from single-parent families and for three, their first language was not English. These children were tested by two of the three examiners who were bilingual in the respective children's first language.

Research Design

A pre-post test design with between factors of sex (2) and treatment (2) and a within factor of task (3) was used. The children were randomly assigned to either an experimental or control group, with an equal number of boys and girls in each group. The order of presentation of the three mastery tasks (Appendix B), was counterbalanced across subjects within each of the experimental and control groups.

Testing Materials

Mastery Motivation Apparatus

The basic apparatus used for all three tasks was a box (34.5 x 34.5 x 11.5 cm) with an automatic feedback mechanism designed to release in a manner similar to the jack-in-the-box (Brockman, 1977). (Also see Appendix B.) Templates corresponding to tasks and levels of difficulty within tasks could be inserted into this apparatus. When the child completed a template, a toy was automatically released from the covered hatch located at the centre top of the task box relative to the child's position. This enabled the child to recognize that the end of the trial had been achieved.

Mastery Motivation Tasks

Three mastery tasks each designed to measure a single ability at increasing levels of difficulty included problem solving (mazes), fine motor ability (pegs), and discrimination (forms).

Mazes. The maze task was a downward adaptation of Brockman's slotted mazes (1977) and consisted of six interchangeable templates and a non-removable stylus. (See

Appendix C for maze patterns.) The results of the Brockman study indicated that additional templates with less complex mazes were needed for 18-month-olds. Hence the slotted mazes were adapted to include a half-Y-turn, Y-turn, and T-turn, as well as the original straight alley (training maze) and mazes with 2- and 5- choice points (See Appendix C.)

Pegs. The templates for the peg task were developed relative to the norms for the appropriate age level as indicated by infant tests. The task consisted of five interchangeable templates representing increasing difficulty. The template sequence was one large round hole (2.5cm, training template), three round holes (2.5 cm), six round holes (1 cm), six square holes (1 cm) and six rectangular holes (1 x 3 cm). (See Appendix C.)

Forms

Design for templates of the form discrimination task was also based on the norms and developmental sequences of the infant tests. The task consisted of five templates with an increasing number of differently shaped holes. Corresponding three-dimensional forms could be dropped into the appropriate holes in the templates (Appendix C). The first template (training) consisted of one round hole into which a 2.5 cm cylinder could be dropped. For each successive template, an additional form of equal surface area as the cylinder was included in the following order:

square, triangle, ellipse and rectangle. Also, the position of a single form was changed from template to template. The template of the highest level of difficulty included all five forms.

<u>Treatment</u>

A session consisted of two phases. Phase 1 included periods of competence, mastery motivation, and extended exploration (treatment). Phase 2 included a period of mastery motivation, and extended exploration (Figure 1). The treatment was initiated for a child in the experimental group after the second instance of being off-task, i.e., not looking at the task or task materials, for three successive seconds, twice during the mastery motivation period in Phase 1.

The period of exploration was extended through the use of a series of prompts designed to encourage the child to explore the task materials further and to include increased degrees of modelling by the examiner. The delivery of prompts was governed by the child's off-task times. In order, the treatment prompts were (a) the examiner giving a verbal prompt, "Can you make the cow jump?", accompanied by a clap of the hands to draw the child's attention to the goal of the task, (b) the examiner pointing to the next portion of the task to be completed and giving a verbal prompt, and (c) the examiner modelling the completion of the task with the statement, "See how it works?". The last

PHASE ONE - BASELINE		TREATMENT			
Competence	Mastery Motivation				
Highest template on task on which two trials were successfully completed	Subsequent template until child has been off-task twice for 3 seconds	Experimental Group (continues)	Prompt 1 non-directive verbal command	Prompt 2 directive, task-specific command	Prompt 3 demonstration of task completion
		Control Group (discontinue: trip hatch)			

PHASE TWO -				
		Exploratory Period		
Phase one competence (one trial only)	two 3-sec. off-task periods	prompt 1 same as treatment	prompt 2 same as treatment	prompt 3 same as treatment
Phase one competence (one trial only)	two 3-sec. off-task periods	prompt 1 same as treatment	prompt 2 same as treatment	prompt 3 same as treatment

Figure 1. Time line indicating phases and sequencing of periods within phases for a session.

two prompts were adapted in a form relevant to each specific task, i.e., the examiner moved the stylus to the next choice point or up to the goal for the maze task, pointed to the next hole or inserted the remaining pegs for the peg task, and pointed to the next open slot or dropped the remaining forms into the slots for the form task. Children in the control group were not given an extended opportunity to explore, and the examiner did not model the solution to the task. Instead, the hatch was tripped at the point where the treatment period began for the experimental children.

Procedure

Upon receiving the signed consent forms, parents were contacted by telephone to arrange appointments for a home and a lab visit.

Home Visit

An examiner and assistant visited the child's home not less than one day and not more than four days before the lab visit to familiarize the child with the examiner and to administer the Bayley Scales of Infant Development (BSID) (Appendix D). As part of a larger project examining other aspects of mastery motivation, the mother was also requested to complete two questionnaires, the Mother's Observation of Mastery Motivation Questionnaire (MOMM) and a Toy Referent Questionnaire. These questionnaires were completed while the examiner administered the BSID.

Lab Visit

The mother and child were greeted at the entrance of the testing room in the Department of Family Studies at the University of Manitoba. Upon entering, the child was given a warm-up toy and seated at a child-sized table. The examiner sat in front and to the left-hand side of the child, and the mother behind and to the child's right. The general procedure was described to the mother and she was asked to redirect the child back to the task if s/he turned to her. The entire session was videotaped.

At the beginning of each task, the examiner gave at least one demonstration of the training template and then asked the child to try it. If a child refused a task, the next task was presented and the refused task was re-presented as the last task. This occurred only once, when a child refused the maze task upon initial presentation.

The session was paced by the responses of the child. Specifically, the child's off-task times indicated the giving of prompts or the tripping the hatch by the examiner. Only one prompt was given each time a child went off task. The camera person, who was seated behind a curtain and out of sight of the child, monitored the off-task times and signalled them to the examiner. If a child simply glanced to the examiner, the examiner responded with a neutral expression or reciprocated the child's smile. If the child turned to the mother, she responded with a verbal cue as she had been instructed at the outset of the session, i.e., "You can do some more."

A minimum of two training trials and then two trials per template were given until a child went off-task for a minimum of three seconds. At this point, the examiner gave a verbal prompt "Where's the cow?". When a child went off-task a second time for at least three seconds, the procedure for children in the experimental and control groups differed, marking the beginning of the treatment period. For the experimental group, a second verbal prompt, "You find the cow," was given and the experimental treatment (as described above) was initiated. For the control group, the hatch was tripped by the examiner to end the trial.

Following the completion of Phase 1 for both groups, the tasks were removed from the table and the children were offered a 'snack' of juice and crackers. This provided the children with a break between the two presentations of the tasks. The average break time was 6 minutes, 22 seconds, with a range of 2 minutes, 20 seconds to 12 minutes, 50 seconds.

Phase 2 was initiated with presentation of the highest template on which the child had completed two trials during Phase 1. Each task was presented in the same order as during Phase 1. During this phase, all children were given only one trial per template and both the experimental and control groups were allowed to continue to the end of all five prompts.

Upon completion of the tasks, the mothers were invited to view the videotape. The examiner thanked the mother and child for their participation and offered to send a copy of the summary of results upon completion of the study.

Data Transcription, Coding, and Derived Measures

Two general categories of measures, child's behaviour and time, were transcribed from the time-coded videotapes. (See Appendix E for code sheet.) Data for the behavioural measures included competence, exploratory behaviour, and increase in competence. (See Table 1 for measures related to each component.) On-task time was obtained during periods of competence, mastery motivation, treatment and exploration.

Performance Measures

Competence. Measures of competence were obtained from two sources: a) the BSID and b) the mastery motivation tasks. The BSID mental (MDI) and motor scale (PDI) raw scores were used to determine the child's overall level of development. Two forms of competence measures were obtained from the mastery motivation tasks: 1) at a global level, the highest template of each task which was successfully completed on two trials during Phase 1

Table 1

Summary of Variables and Measures

Variable	How Derived	Measure
Competence:		
a) general competence	Bayley Scales of Infant Development (BSID)	Mental Scale raw score Motor Scale raw score
b) competence on mastery motivation tasks	1) global: Template number for a task 2) specific: total number successes on a task	Highest level template completed on two successive trials of a task Performance Score = $\frac{\text{elemental successes}}{\text{possible elements}}$
Difference Score:	i) Task performance score at 2nd prompt during mastery motivation Phase 1 ii) Highest task performance score during Phase 2	Difference Score = ii) minus i)
Goal-Directed Exploration:		
a) during competence	i) Number of competence trials where goal-directed exploration is prominent ii) Number of competence trials	Ratio of Goal-Directed Exploration = i) / ii)
b) during mastery motivation period (persistence) (treatment)	i) Number of prompts where goal-directed exploration is prominent ii) Number of prompts given during mastery motivation	Ratio of Goal-Directed Exploration = i) / ii)
c) during assessment of learning	i) Number of prompts where goal-directed exploration is prominent ii) Number of prompts given during exploration period	Ratio of Goal-Directed Exploration = i) / ii)
On-task:		
a) during competence period	i) Amount of on-task time across two trials ii) on- + off-task time	Ratio competence on-task = i) / ii)
b) during mastery motivation period (persistence)	i) Amount of on-task time beyond competence to the second prompt ii) on- + off-task time during persistence period	Ratio Persistence on-task = i) / ii)
c) during treatment period (exploration)	i) Amount of on-task time from beyond the second prompt to the fifth prompt ii) on- + off-task time during treatment period	Ratio Exploration on-task = i) / ii)

(competence score) and 2) at a specific level, the total number of elements across all the templates completed on a task. This competence measure was designed, using weightings, to reflect the incremental contribution of each elemental success relative to the number of possible completions in any given task. A ratio of achieved to possible elements was then used as the child's performance score (Table 2).

The elements the child completed on each task were coded separately and then added together at the second prompt which marked the end of the mastery motivation period of Phase 1 and again for the highest template during Phase 2. The specific weightings assigned to the elements are described below.

Maze Task. The elements considered for the maze task were vertical legs, horizontal legs and choice-points. Vertical legs are any slots that require a child to use a vertical movement of the arm to move the stylus toward the goal. Horizontal legs are any slots that require the child to use a horizontal movement of the arm to move the stylus toward the goal. Choice-points refer to the points in the maze where the child must choose between continuing in one direction or changing to another in attempting to reach the goal.

The choice points were given a value of 0.5; the vertical legs a value of 1.0; and the horizontal legs a value of 1.5 each time one occurred in a template. The horizontal legs were given a higher value because items on some infant tests suggest that a vertical movement of the arm is less difficult than a horizontal movement of the arm. By adding the elements present in each template, the templates were given numerical values (Table 2).

Peg Task

The elements considered for the peg task were the size and shape of the pegs. The different shapes used, namely round,square, and rectangular, reflected a sequential order commonly found in infant tests. On a logical, but arbitrary basis, each large round shape was given a value of 1.0, each small round shape a value of 2.0, each square shape a value of 2.5, and each rectangular shape was given a value of 2.5. Template values were derived by adding the elements present in a template. (See Table 2.)

Form Task

The elements considered for the form task were the shapes of the forms and the corresponding holes. The shapes used were a circle, square, triangle, ellipse and rectangle. With the assumption that children learn forms in the order indicated, each round shape was given a value of 1.0, each square shape a value of 1.5, each triangle a value of 2.0, each ellipse a value of 2.5, and the rectangle received a value of 3. By adding the elements in a template, the template value was determined. (See Table 2.)

Table 2

Summary of Weightings and Ratios (Performance Score) Reflecting the Incremental Complexity of Templates across the Tasks

	Template Weightings		
Template	Maze	Peg	Form
1	1	1	1
2	2	3	2.5
3	2.5	9	4.5
4	3	12	7
5	4.5	15	10
6	10	--	--
Total	23	40	25
	Performance Score		
1	0.04	0.03	0.04
2	0.13	0.10	0.14
3	0.24	0.33	0.32
4	0.37	0.63	0.60
5	0.57	1.00	1.00
6	1.00	----	----

Increment in Competence (Difference Score)

The effect of extended exploration on competence was assumed to be evident in a higher level of competence on Phase 2. Hence, Phase 1 performance scores (from mastery motivation period) were subtracted from Phase 2. The difference between the two performance scores yielded a difference score which was used as the primary data. A positive score, therefore, meant that performance during the assessment of learning was higher than during Phase 1 (pretest). The rationale behind this was that the performance up to the point of the second prompt in Phase 1 best reflected the child's level of competence before the introduction of the treatment period to the experimental group.

Exploratory Behaviour

Assuming that the type of exploratory behaviour may have a differential effect on the development of competence (Messer, McCarthy, McQuiston, MacTurk, Yarrow & Vietze, 1983; MacTurk & Yarrow, 1983; MacTurk, Vietze, McCarthy, & Yarrow, 1985), exploratory behaviour was coded into two categories, namely, goal-directed exploration and non-goal-directed exploration. These categories were thought to reflect the type of hierarchical organization of exploratory behaviour conceptualized by MacTurk & Yarrow, (1983) and MacTurk, et al., (1985). Behaviours in the goal-directed category reflected the type of manipulation necessary to achieve the goal, or a purposeful attempt at reaching the identified goal. Behaviours in the non-goal directed category reflected on-task exploration that could not lead to the successful completion of the task. Due to the varying characteristics of each task, behaviours were operationally defined within each category relative to each particular task. (See Table 3 for description of task specific forms of these behaviours.)

These types of exploratory behaviour were coded each time they occurred during competence, mastery motivation, and treatment in Phase 1, and mastery motivation and exploratory period in Phase 2. Within each period, the data was further divided by the points at which the different prompts were given. In this way it was possible to determine the number of times that goal-directed exploration was most prominent from prompt to prompt. Data on the proportion of time goal-directed behaviour was most prominent was obtained separately for competence, mastery motivation, and treatment (experimental group only) during Phase 1, and mastery motivation, and extended exploration during Phase 2 by dividing the sum of goal-directed exploration being most prominent across the prompts by the total number of prompts in a period.

An additional measure of exploration based on the hierarchy of types of exploratory behaviour described by MacTurk, et al. (1985), was developed using an ordinal

Table 3

Summary of Exploratory Behaviour Specific to Each Task

	Task		
Exploration	Maze	Peg	Form
Goal-Directed	- pushing stylus up/down back/forth on leg - moving stylus in/out of cul-de-sac	- placing pegs in holes - placing pegs in in/out of holes - failed attempts to put pegs in	- manipulating forms to fit into slots - trying various slots with the forms or forms forms to slots
Non-Goal Directed	- fingering slot where stylus sits - tapping/banging task box - lifting up template - mouthing stylus - looking at template - feeling template with hands	- stacking pegs - putting finger in hole - holding/twirling pegs - taking pegs back and forth from box to template - banging/sliding pegs together or on template - mouthing pegs - handing/showing pegs to adult - looking at template - feeling template with hands	- stacking forms - putting finger in slot - holding/manipulating forms - taking forms back and forth from box to template - banging/sliding/rolling forms together or on template - mouthing forms - handing/showing forms to adult - looking at template - feeling template with hands
Refusal/ Off-Task	- pushing task away - leaving chair and walking around - playing with objects other than task - looking at adult	- pushing task away - leaving chair and walking around - playing with objects other than task - looking at adult - throwing pegs	- pushing task away - leaving chair and walking around - playing with objects other than task - looking at adult - throwing forms

scale. The underlying continuum was based on the assumption that general exploration is at a lower level than goal-directed exploration. The scale reflects two components: level of exploration and duration. The two levels of exploration examined were goal-directed and non-goal directed behaviour. The levels with the component duration were high and low proportion of on-task time where the mean proportion on-task time of all the children at each respective period was considered as the break-point. The resulting scale which ranged from 1 to 4 included:

1. non-goal directed exploration with below mean on-task.
2. non-goal-directed exploration with above mean on-task
3. goal-directed exploration with below mean on-task
4. goal-directed exploration with above mean on-task

This scale was used during the mastery motivation and treatment periods in Phase 1.

On-task Time

In keeping with the definition of persistence adopted by Morgan and Jennings (1981), on-task durations were obtained from the time-coded videotape for the competence, mastery motivation and treatment periods (Phase 1), and the mastery motivation and exploration periods (Phase 2).

In addition, the on-task time plus the off-task time, relating to each of these periods was recorded. A proportion of on-task time was then derived. The proportion on-task time for the period from the beginning of the template to the point at which the second prompt was given in mastery motivation Phase 1 and again in Phase 2, was defined as persistence. This measure reflects the uninterrupted involvement of the child with the task which is consistent with persistence as it is defined by Morgan and Harmon, (1984).

CHAPTER III

RESULTS

The objective of this study was to investigate the effect of additional exploration of task materials on children's performance on three different mastery tasks. The coding reliabilities are reported first. A description of the children's performance on the tasks before treatment follows, and then the analysis of the performance level of the experimental and control groups following treatment is presented. Other variables associated with performance level are also examined.

Differences in experimental and control group performance were generally analyzed using three-way analyses of variance. Analyses of variance were also used to consider other variables that may have influenced the child's performance on the tasks. Intercoder reliability of behavioural measures taken from the videotapes of nine subjects (Appendix F) range from 83% (total task time for mazes and forms, and the type of exploration most prominent for forms) to 100% (performance level for pegs and forms).

Analyses of variance of procedural variables indicated no effect of the order of task presentation on competence level, persistence measures, or the difference score. However, an examiner effect was observed for persistence on the maze task, $\underline{F}$ $(2,28) = 3.70$, $\underline{p} < .05$ where children tested by NL were on-task longer. An Examiner x Phase interaction effect on the maze task, F (2,28) = 3.53, p < .05 indicated that the on-task behaviour during persistence in Phase 1 was greater than on-task during Phase 2 for two of the examiners (MB and AF) but less for NL. An examiner effect was also found for the difference score F (2,33) = .08, p < .05. Children tested by NL obtained higher difference scores than those tested by AF and MB.

Analyses of sex differences indicated a higher level of competence for boys (M = 2.63) than girls (M = 2.13), F (1,32) = 5.73, p < .02. The boys were also more persistent than the girls on the maze, F (1,29) = 12.23, p < .01 and form tasks, F (1,32) = 8.79, p < .01. However, no significant sex differences were found for either the difference score or type of exploration most prominent. Because boys and girls differed on competence level and persistence, subsequent analyses of variance included sex as a factor.

Child's Task Performance

Competence

Prior to treatment, the competence score summed across tasks was higher for the experimental group than the control group, F (1,32) = 4.16, p < .05, (see Table 4). Boys had a higher initial competence level than girls, F (1,29) = 12.23, p < .02. There were significant differences in competence score between the three tasks

Table 4

Mean Competence Score of Experimental and Control Children on Mastery Motivation Tasks

	Group					
	Experimental (N= 18)		Control (N= 18)		Experimental + Control (N= 36)	
Task	Mean	SD	Mean	SD	Mean	SD
Maze	3.6	1.15	2.2	0.65	2.9	1.14
Pegs	2.7	0.96	2.7	0.96	2.7	0.94
Forms	1.5	0.86	1.6	0.71	1.5	0.77

where the maze ($\underline{M}$ = 2.89) and pegs ($\underline{M}$ = 2.72) were significantly higher than the forms ($\underline{M}$ = 1.53), $\underline{F}$ (2,64) = 35.20, $\underline{p}$ < .001. The Group x Task interaction effect, $\underline{F}$ (2,64) = 9.87, $\underline{p}$ < .001 indicated that the difference between the groups was only present for the maze task.

Further analysis indicated differences in performance among the three tasks for both the experimental and control groups (Table 4). For the experimental group, the mean competence score was significantly different for the three tasks, $\underline{F}$ (2,34) = 30.40, $\underline{p}$ < .01. Post-hoc tests indicated that the mean score on the maze task (3.56) was significantly higher than either the peg task (2.72), or the form task (1.50), $\underline{p}$ < .01, and the peg task competence score was also significantly higher than the form task, $\underline{p}$ < .01. There was also a significant task difference found for the control group, $\underline{F}$ (2,34) = 13.98, $\underline{p}$ < .001. Post-hoc tests indicated that the peg task score (2.72) was significantly higher than both the maze task (2.22), $\underline{p}$ < .05 and the form task (1.56),$\underline{p}$ < .01. The maze task score was also significantly higher than the form task, $\underline{p}$ < .01.

Difference Score

A summary of difference score means and standard deviations for the experimental and control groups is given in Table 5. Contrary to what was expected, the experimental group had a lower score ($\underline{M}$ = .011) than the control group ($\underline{M}$ = .073), $\underline{F}$ (1,32) = 4.32, $\underline{p}$ < .05. There

Table 5

Mean Increment in Competence (Difference Score) From Phase 1 to Phase 2 for Experimental and Control Groups on Mastery Motivation Tasks

	Group					
	Experimental		Control		Experimental + Control	
Task	Mean	SD	Mean	SD	Mean	SD
Maze	.024	.154	.158	.167	.088	.172
Pegs	.009	.102	-.020	.213	-.005	.165
Forms	-.002	.144	.082	.182	.044	.172

were no differences between sex or task, and there were no interactions.

On-task Time Analysis

In Table 6, means and standard deviations of proportion on-task are presented for each task.

On-task Time during Competence Period

During competence, the proportion of on-task time of the experimental and control groups did not differ. However, there was a significant difference between tasks, $\underline{F}$ (2,64) = 10.54, $\underline{p}$ < .001 where the proportion of on-task time was greatest for the forms, then the pegs, lowest for the mazes.

On-task Time during Mastery Motivation Period

On-task time during the mastery motivation period (persistence) did not differ for sex, group in Phases 1 and 2, but was significantly different among tasks. On-task times were equivalent for the peg and form tasks and lower for the maze task in Phase 1, $\underline{F}$ (2,64) = 14.21, $\underline{p}$ <.001, and similarly for Phase 2, $\underline{F}$ (2,52) = 4.02, $\underline{p}$ <.02. There was a Sex x Task interaction for Phase 2 only, $\underline{F}$ (2,52) = 7.40, $\underline{p}$ < .01. The on-task for females was greatest for the pegs, followed by the forms and mazes, whereas on-task for males was greatest for forms, followed by mazes, and then pegs.

The tasks were analyzed separately to examine differences between sex, group and phase. There were no differences between the groups on any of the tasks,

Table 6

Proportion of On-Task Time During Phase 1 and Phase 2 for Experimental and Control Groups on Mastery Motivation Tasks

	Groups					
	Experimental		Control		Experimental +Control	
Task	Mean	SD	Mean	SD	Mean	SD
MAZES						
Phase 1:						
Competence	0.80	0.20	0.84	0.17	0.83	0.18
Persistence	0.55	0.12	0.61	0.15	0.58	0.14
Treatment	0.41	0.21	---	---	---	---
Phase 2						
Persistence	0.51	0.21	0.53	0.14	0.52	0.18
Exploration	0.27	0.18	0.30	0.20	0.28	0.19
PEGS						
Phase 1:						
Competence	0.93	0.07	0.93	0.06	0.93	0.07
Persistence	0.68	0.12	0.76	0.11	0.72	0.12
Treatment	0.61	0.18	---	---	---	---
Phase 2:						
Persistence	0.68	0.19	0.57	0.21	0.62	0.21
Exploration	0.40	0.24	0.42	0.21	0.41	0.22
FORMS						
Phase 1:						
Competence	0.91	0.12	0.97	0.04	0.94	0.09
Persistence	0.70	0.10	0.74	0.13	0.72	0.12
Treatment	0.46	0.21	---	---	---	---
Phase 2:						
Persistence	0.62	0.23	0.57	0.21	0.59	0.22
Exploration	0.42	0.21	0.37	0.21	0.40	0.21

however, there were differences found between the phases on the peg and form tasks. For the peg task, children were on-task more during Phase 1 than Phase 2, F (1,34) = 6.56, $p < .05$. There was a Group x Phase interaction, F (1,34) = 5.87, $p < .05$, where the decrease in mean proportion on-task from Phase 1 to Phase 2 was much greater for the control group (.76 to .57) than the experimental group (.68 to .67). On the form task, the boys (M = .72) were on-task longer than the girls (M = .59), F (1,30) = 8.19, $p < .01$. There was also a difference between the phases where persistence during Phase 1 was greater than Phase 2, F (1,30) = 12.49, $p < .01$.

Child's Exploratory Behaviour during Competence and Mastery Motivation

Results using the measure of proportion of goal-directed behaviour during on-task will be reported first, and then the exploration scale results will be presented.

There were no significant group differences found during competence or mastery motivation in Phase One, however, the control group was engaged in goal-directed exploration a greater proportion of the time than the experimental group during both periods (See Table 7). There was a significant task difference during mastery motivation, F (2,62) = 3.57,

$p < .05$, where the proportion of goal-directed behaviour was greatest for the maze task, followed by the form task and finally the peg task.

Analysis of variance of Phase 2 data indicated no significant difference between the experimental and control groups during mastery motivation, however the mean proportion of goal-directed exploration was greater for the experimental group than the control group (See Table 7).

Analysis of variance of the exploration scale for the mastery motivation period indicated no significant differences, however, as expected there was more goal-directedness and lower on-task for the mazes than the forms or pegs.

Child's Exploratory Behaviour during Treatment and Exploration

A Sex x Phase x Task analysis of the treatment period and the exploration period (experimental group only) indicated that the proportion of goal-directed exploration was greater during the treatment in Phase 1 than the exploratory period in Phase 2 (Table 7), $F(1,29) = 6.17$, $p < .02$.

Analysis of variance of proportion of goal-directed behaviour during the Phase 2 exploration indicated no significant difference in goal directed exploration between the experimental and control

Table 7

Proportion of Goal-Directed Behaviour Most Prominent While On-Task During Phase 1 and Phase 2 for Experimental and Control Groups

	Group					
	Experimental		Control		Experimental + Control	
Task	Mean	SD	Mean	SD	Mean	SD
MAZES						
Phase 1:						
Competence	.94	.24	NA[a]	NA[a]	.97	.17
Persistence	.65	.29	.69	.39	.67	.34
Treatment	.39	.32	---	---	---	---
Phase 2:						
Persistence	.50	.41	.40	.39	.45	.40
Exploration	.21	.24	.15	.17	.18	.21
PEGS						
Phase 1:						
Competence	.89	.32	.94	.24	.92	.28
Persistence	.42	.35	.42	.35	.42	.35
Treatment	.24	.28	---	---	---	---
Phase 2:						
Persistence	.28	.35	.19	.30	.24	.33
Exploration	.15	.24	.13	.26	.14	.24
FORMS						
Phase 1:						
Competence	.94	.24	NA[a]	NA[a]	.97	.17
Persistence	.50	.34	.69	.39	.60	.38
Treatment	.31	.29	---	---	---	---
Phase 2:						
Persistence	.28	.26	.32	.25	.30	.25
Exploration	.17	.24	.16	.21	.16	.22

NA[a]= data unavailable due to lack of variability in goal-directed behavior.

groups during the exploratory period in Phase 2, however the mean proportion of goal-directed exploration was greater for the experimental group than the control group (Table 7). There was a Sex x Group interaction, F (1,28) = 4.01, $p < .05$. Girls in the control group had a higher proportion of goal-directed exploration than those in the experimental group, but boys in the control group had lower proportion than those in the experimental group.

There was a significant difference between the treatment and exploratory periods for the maze task when analyzing the exploration scale. Goal-directed behaviour with less than mean on-task was characteristic of Phase 1 treatment, and non-goal directed with greater than mean on-task was characteristic of Phase 2 exploratory period, F (1,15) = 7.86, $p < .01$. There were no significant differences for either the peg or form tasks.

On-task Time during Treatment and Exploration

On-task time was greater during the treatment period than the exploration period, F (1,29)= 6.36, $p < .05$. A significant difference was also found between tasks F (2,58)= 5.31, $p < .01$ where the proportion on-task was greatest for the peg task, followed by the form task and finally the maze task (see Table 6).

During the exploratory period in Phase 2 there was a significant task difference, F (2,50) = 4.10, $p < .05$ where the mean on-task was greater for the pegs (.43), followed by the forms (.42) and finally the mazes (.30) (Table 6).

Relationship between Competence and the Difference Score

There was a positive correlation between the competence score on the pegs and the Bayley MDI, $r = .43$, $p < .01$, and the forms and the Bayley MDI, $r = .33$, $p < .05$. Correlations between the two competence measures (competence score and BSID raw scores) and the difference score are presented separately for the three mastery tasks in Table 8.

On the maze task there was a significant negative correlation between the Bayley PDI and the difference score, $r = -.49$, $p < .05$ for the experimental group. There were no significant correlations for the control group.

For the experimental group, there were significant negative correlations between the competence score and the difference score for the peg task, $r = -.46$, $p < .05$, and the form task, $r = -.67$, $p < .01$. There was also a negative correlation on the peg task for the control group, $r = -.72$, $p < .01$. There was a positive correlation for the competence

Table 8

Correlations of Difference Scores with the Competence Score and Bayley Scale Scores for Experimental and Control Groups

Task	Group: Experimental (n=18)	Control (n=18)	Experimental + Control (N=36)
MAZE			
Competence	-.41	.29	-.33*
Bayley MDI	-.04	.05	-.04
Bayley PDI	-.49*	.06	-.23
PEG			
Competence	-.46*	-.72**	-.60**
Bayley MDI	-.11	-.72**	-.48**
Bayley PDI	-.08	-.47*	-.31
FORM			
Competence	-.67**	.56**	-.03
Bayley MDI	-.02	.29	.12
Bayley PDI	-.28	.41	.07

* $p < .05$
** $p < .01$

score and the difference score on the form task, r = .56, $p < .01$.

The negative correlations between the competence score and the difference score suggest that the higher the competence level, the lower the difference score. The positive correlation for the control group on the form task may be an artifact due to the low initial scores on the task.

Relationship of Difference Score with Exploration

Correlations between the difference score and the proportion of goal-directed behaviour indicated no significant relationships for the experimental group. A positive relationship was found for the control group during mastery motivation Phase 1 on the maze task, r = .62, $p < .01$ and during competence on the peg task, r = .48, $p < .05$. (See Table 9.)

Relationship of Difference Score with On-task Measures

The relationship of difference scores with proportion of time on-task was examined for each of the mastery tasks during competence, mastery motivation (persistence), treatment and exploratory periods in Phases 1 and 2 (Table 10).

There were no significant correlations found with any of the on-task measures for either the experimental or control group on the maze task during Phase 1. During Phase 2, the difference score was

Table 9

Correlation of Difference Score with Proportion of Time Goal-Directed Exploration Most Prominent for Experimental and Control Groups

	Group					
	Experimental		Control		Experimental + Control	
Task	n	r	n	r	n	r
MAZES						
Phase 1:						
Competence	NA[a]		NA[a]		NA[a]	
Mastery Mot	17	-.39	18	.62**	35	.19
Treatment	17	.09	--	--	--	--
Phase 2:						
Mastery Mot	17	-.19	17	.02	34	-.14
Exploration	16	.14	15	.16	31	.08
PEGS						
Phase 1:						
Competence	18	-.04	18	.48*	36	.23
Mastery Mot	18	.12	18	-.16	36	-.07
Treatment	18	-.18	--	--	--	--
Phase 2:						
Mastery Mot	18	.12	18	.17	36	.15
Exploration	18	.26			36	-.02
FORMS						
Phase 1:						
Competence	18	.11	NA[a]		36	-.02
Mastery Mot	18	.05	18	.22	36	.20
Treatment	18	.23	--	--	--	--
Phase 2:						
Mastery Mot	16	-.20	18	.39	34	.18
Exploration	16	.28	17	.38	33	.30

* $p < .05$
** $p < .01$
NA[a] = data unavailable because of lack of variability in goal-directed behaviour.

Table 10

Correlation of Difference Score with Proportion On-task during Phase 1 and Phase 2 for Experimental and Control Groups

	Group					
	Experimental		Control		Experimental + Control	
Task	n	r	n	r	n	r
MAZES						
Phase 1:						
Competence	16	.41	15	.45	31	.49**
Persistence	16	-.21	15	.13	31	.06
Treatment	17	.08	--	--	--	--
Phase 2:						
Persistence	16	.26	15	.52*	31	.35
Exploration	16	.01	15	-.18	31	-.05
PEGS						
Phase 1:						
Competence	18	.10	18	.15	36	.12
Persistence	18	-.33	18	-.48*	36	-.42*
Treatment	18	-.39	--	--	--	--
Phase 2:						
Persistence	18	.19	18	.38	36	.32
Exploration	18	.11	18	.34	36	.23
FORMS						
Phase 1:						
Competence	16	.29	18	.03	34	.26
Persistence	16	.07	18	.26	34	.23
Treatment	18	.32	--	--	--	--
Phase 2:						
Persistence	16	-.09	18	.36	34	.12
Exploration	16	.62**	17	.29	33	.44**

* $p < .05$
** $p < .01$

significantly correlated with persistence for the control group, $r = .520$, $p < .05$, however there were no significant correlations for the experimental group.

On the peg task, the difference score was negatively correlated with persistence during Phase 1 for the control group, $r = -.480$, $p < .05$, and again, there were no significant correlations for the experimental group. During Phase 2, the difference score was not significantly correlated with any of the on-task measures

There were no significant correlations during Phase 1 on the form task, but during Phase 2, the exploratory period on-task was significantly correlated with the difference score for the experimental group, $r = .623$, $p < .01$.

<u>Relationship of Goal-directed Behavior to On-task Measures</u>

In Table 11 , correlations between the proportion of time goal-directed exploration was most prominent and proportion on-task are presented for the mastery tasks during competence, mastery motivation, treatment and exploratory periods in Phase 1 and Phase 2. Some of the data was unavailable due to a lack of variability in the proportion of goal-directed exploration.

Table 11

Correlation of Goal-Directed Behaviour with Proportion On-task During Phase 1 and Phase 2 for Experimental and Control Groups

	Group					
	Experimental		Control		Experimental + Control	
Task	*n*	*r*	*n*	*r*	*N*	*r*
MAZE						
Phase 1:						
Competence	17	.05	NA[a]	NA[a]	35	.05
Persistence	17	.26	18	.19	35	.21
Treatment	17	.61**	--	--	--	--
Phase 2:						
Persistence	16	.25	15	.26	31	.24
Exploration	16	.53*	15	.41	31	.45**
PEGS						
Phase 1:						
Competence	18	.45*	18	.29	36	.39*
Persistence	18	.39	18	.21	36	.29
Treatment	18	.05	--	--	--	--
Phase 2:						
Persistence	18	-.32	18	.22	36	-.02
Exploration	18	.52*	18	.08	36	.30
FORMS						
Phase 1:						
Competence	18	.37	NA[a]	NA[a]	36	.39*
Persistence	18	.30	18	.35	36	.37*
Treatment	18	.39	--	--	--	--
Phase 2:						
Persistence	16	.44	17	-.15	33	.14
Exploration	16	.27	17	.46*	33	.36*

* $p < .05$
** $p < .01$
NA[a] = data unavailable because of lack of variability in goal-directed behaviour.

During Phase 1 on the maze task, there was a significant positive relationship between goal-directed behaviour and on-task during treatment (experimental group only), $r = .61$, $p < .01$. There were no other relationships for the experimental or control groups during Phase 1. During Phase 2, there was a significant correlation between goal-directed behaviour and on-task during the exploratory period for the experimental group, $r = .53$, $p < .05$.

For the peg task, there was a significant correlation between goal-directed behaviour and on-task during competence for the experimental group, $r = .45$, $p < .05$, during Phase 1. There were no significant correlations for the control group. During Phase 2, there was a significant difference between goal-directed behaviour and on-task during exploration for the experimental group, $r = .52$, $p < .05$. There were no significant correlations for the control group.

On the form task, there were no significant correlations for the experimental or control groups during Phase 1. During Phase 2, goal-directed behaviour was significantly correlated with exploration, $r = .46$, $p < .05$ for the control group.

CHAPTER IV

DISCUSSION

The objective of this study was to investigate the effect of exploration on competence during the presentation of mastery motivation tasks. Researchers in the area of exploratory behaviour have indicated that free exploration of task materials can result in increased competence on problem-solving tasks (Cheyne & Rubin, 1983). The maze task used in the present study is a similar type of problem-solving task and results suggested that both the experimental and control groups showed the highest increase in competence on the mazes among the three tasks. The other two tasks, pegs and forms, require fine motor and discriminatory abilities, respectively. However, contrary to what was expected, the control group showed a higher increment of learning on all three tasks suggesting that this increase in competence on the maze task may be a task characteristic rather than a treatment effect. Given that the extended exploration had no apparent influence on increasing competence for the experimental group, other factors have been explored including initial competence, type of exploration, on-task time, and fatigue effects.

Influence of Initial Competence Level on the Difference Score

The competence level on the mastery motivation tasks measured abilities similar to the Bayley Scales of Infant Development as indicated by the significant correlation (.48) across the tasks (Fung, 1984). The initial competence level shown by the children may be a factor in deriving a valid difference score. When moving through the tasks from template to template the incremental gain as templates become more complex may not be equivalent. The relationship of initial competence and the difference score, though relatively tenuous, suggests that the higher the competence level, the less the increase in competence following the mastery motivation period. A positive correlation on the form task in which they proceeded through the fewest templates would appear to be consistent with this argument. If this interpretation is correct, then the elemental weightings should be reconsidered with the possibility of higher weighting of the more complex elements, and higher weighting of an element on a more complex template than the addition of the same element on a less complex template.

Influence of Type of Exploration on Difference Score

MacTurk, et al, (1985) have suggested that it is important to consider mastery behaviours in a hierarchical organization from relatively simple exploration to goal-directed behaviour. This parallels research on exploratory behaviours which are seen to follow a developmental sequence that is also related to cognitive development (McCall, 1974; Belsky and Most, 1981). For the current study, exploration was conceptualized as being either non-goal directed or goal-directed in an attempt to capture this concept of a hierarchical organization of behaviours. The results, although tentative, suggest that the control group was more goal-directed than the experimental group during Phase 1. An explanation for this can be found in the work by Berlyne (1960) that incorporates the concept of optimal level of stimulation in a drive-reduction model. This model suggests that when a need is satisfied, the drive is reduced. In the present study, continued prompting for the experimental group may have been perceived by the child as a negative reinforcer once the child had fulfilled the need to explore the task. These factors, in combination, were greater for the experimental than the control group.

The results also indicated some relationship between the difference score and goal-directed exploration for the control group on the maze task. These findings, although weak, are similar to the work by MacTurk and his associates of a hierarchical organization of behaviours. It is also interesting to note that the maze task was a problem-solving task which has been identified in the exploration research from as far back as Harlow (1950) as the kind of task that elicited the behaviours later identified by White (1959) as indicating effectance motivation. Similarly, research in the area of exploration indicates that the chance to explore results in greater competence on problem-solving tasks (Smith & Dutton, 1981; Cheyne & Rubin, 1983). On-task, but non-goal-directed behaviour did not appear to have any effect on the difference score.

Influence of On-task Time on the Difference Score

On-task time included goal-directed and task-directed behaviour which is not necessarily goal-directed. Persistence for Yarrow and his associates is defined as on-task behaviour which includes both goal-directed and non-goal directed, but task-directed behaviour. This is a measure of time during which the child is engaged in the task. Persistence is considered to be the main measure of mastery motivation and researchers have identified a positive relationship between persistence and competence on mastery motivation tasks (Yarrow, et al, 1982). In the present study, correlations of the difference score and on-task measures on the peg task were negatively related which suggests that the longer the child was on-task, the lower the difference score for both the experimental and control groups. The reason for this may relate to the differences in the nature of the task. In contrast to the maze task where there is only one manipulandum, the form, and in particular, the peg task consisted of a number of pieces which could be explored in non-goal defined ways such as stacking, lining and rolling. This provided the child with an opportunity to engage in other behaviours that would extend the on-task time but not necessarily lead to the discovery of the task solution as identified by the examiner. For MacTurk and his associates such non-goal-directed behaviour falls lower in the hierarchy. Although the concept of hierarchically organized exploratory behaviour would suggest that this non-goal-directed behaviour contributes to competence, the data from this study was not adequate to draw any conclusions of this nature.

Fatigue Effects

Though a fatigue effect was not obtained for order of presentation of tasks during Phase 1 or Phase 2, on-task times during Phase 2 were significantly lower than Phase 1. This suggests that there was a fatigue effect over the total session, but that across tasks during a phase there was not a differential effect. The reduced on-task times during Phase 2 may have been related to the break period between Phase 1 and Phase 2, although the length of the break times did not correlate with the difference score.

Characteristics of the Mastery Task

As described in the review of literature, the mastery motivation tasks used in the current study differed in some respects from those used in previous research (Morgan & Harmon, 1984). The major differences between the tasks used in this study with other research are that the task goal is common both within and across the mastery motivation tasks, the type of cognitive ability required to complete the task remains constant as the task becomes more difficult, and the goal is established by the examiner for the child.

The mastery motivation tasks were designed to measure three areas of ability: problem solving (mazes), fine motor (pegs), and form discrimination (forms). Results on competence level, on-task, and exploration measures indicated significant differences between the tasks suggesting that the tasks were measuring different abilities.

There is some indication that on the maze task, the children could readily identify the established goal, however, on the peg and form tasks, the established goal was not necessarily that which the child had identified as being the goal. This was due to the design of the tasks relative to the nature of the ability area being measured. On the maze task, there was virtually nothing for the child to work at other than the achievement of the goal, whereas the peg and form tasks offered an opportunity for the children to engage in behaviours that were not necessarily goal-directed even if the child was on-task. This is reflected in the significantly higher proportion of goal-directed exploration during periods of on-task for the mazes, even though the on-task times were significantly higher for the pegs and forms than for the mazes.

Results also indicated significant differences in the competence level on the three tasks where the form task was lower than the maze and pegs. It was evident that the children were often unable to succeed beyond the training template suggesting that the form task may require a level of cognitive and motor functioning that the children are just reaching at 18 months.

Evaluation of Procedure and Measures

The procedure was developed through the work of the Colorado group. Morgan and Harmon (1984) suggest that mastery motivation is best measured in a test-like situation where a child is independently engaged in a task. They have defined competence as success on tasks and mastery motivation as the time a child is task-directed. Their procedure suggests that a child be timed during a mastery session and allowed to work only a specified number of minutes. For the purposes of this study, the child was encouraged, through the use of prompts, to continue working on a task beyond competence to facilitate an opportunity to explore the tasks further. The procedure was developed in an attempt to have a child-paced session as opposed to a time-based session. However, it appears from the results that some of the same effects found using a time-based procedure were evident in the current study and that they were enhanced in the treatment group where the children responded less well. It may be necessary to use the child's behaviour as the indicatory that s/he is finished a task to determine the end of the task. This would be a qualitative rather than a quantitative (time-based) measure. It was evident during the session when a child began to become disinterested in a task. They would begin to fidget in the chair, turn away from the task, push the task box away, throw the task materials and shake their heads and say "no". Further research would benefit from identifying these behaviours so that the procedure would be child-driven right to the point that the child is finished with a task.

In addition to the child's refusal behaviour, it was observed that children began showing less interest in the task by becoming less task-directed and going off-task more frequently. This was also reflected in the proportion of goal-directed behaviour while on-task where the longer the child worked on the task, the less goal-directed they were. McCall (personal communication, 1984) has suggested that a child may experience feelings of efficacy associated with mastery motivation when working the hardest on the tasks. Further study on measures of mastery motivation could include the examination of off-task times relative to on-task time as relevant indicator of when children are finding themselves in a period of greatest difficulty with a task.

An attempt was also made to separate competence from mastery motivation so that the constructs could be measured as independently as possible. However, it is evident from the results on the competence level and difference score that this was not entirely successful. There was a significant difference in competence level where the experimental group had a higher level than the control group, however the difference score reflected greater increases in competence for the control group than the experimental group.

An explanation for these results may be found in a procedural difficulty in separating competence and mastery motivation. For the experimental group, a child was allowed to work on a task until all five prompts had been given. If a child worked beyond the second prompt but completed the task before the fifth prompt was given, then they were still allowed to carry on to the next trial. Thus the competence period for the experimental group could feasibly include trials where the child had worked to just before the final prompt was given. However, for the control group, this was not possible because a child was only allowed to work up to the second prompt before having the hatch released by the examiner. This resulted in the experimental group having an increased opportunity to explore the tasks during what was identified as a competence period. This suggests that the competence measure was being confounded with the mastery motivation measures.

In an attempt to clear up some of the confound between the competence and mastery motivation periods so as to get a cleaner competence measure, competence data was obtained from scores collected by Annie Fung (1984) on the same group of subjects. Re-analysis using these scores indicated no significant difference in competence level between the experimental and control groups, however, the experimental group still had a higher level than the control. The difference score was also re-analyzed using the Fung (1984) competence score to derive the Phase 1 Performance Score. Results indicated no significant differences, however, the control group still showed greater gains from Phase 1 to Phase 2 which is consistent with the findings of this study.

Analysis of Data

A difference score was used to determine increase in competence from Phase 1 to Phase 2. There is some controversy as to whether the gain score is a more accurate measure of change in performance than the use of analysis of covariance (Huck, Cormier, and Bounds, 1974). Because there was not the expected change in competence found, performance scores from Phase 1 and Phase 2 were also examined using Analyses of Covariance where the competence level before treatment was the covariate. These analyses yielded essentially the same results as obtained through the use of difference scores suggesting that the use of ANCOVA instead of the difference score would not have provided a stronger presentation of the results.

Conclusions

In conclusion, the results of this study did not indicate that an increased opportunity to explore task materials results in an increase in competence on tasks. This is contrary to research found in the exploration literature (Smith and Dutton, 1981; Cheyne and Rubin, 1983), however as discussed, procedural factors including the use of the prompting sequence, and the difficulty in separating indices of competence from indices of mastery motivation may have influenced the results.

While the results were not as expected, there were some important observations concerning the procedure that are particularly relevant to further research in the area of mastery motivation. The procedure in this study was designed so that the session was child-based rather than time-based. The use of a prompting sequence was not entirely successful in this application, however, it appears as though the use of child-based measures has merit. Further research should focus on refining the procedure so that the child's behaviour becomes the focus in determining the pace of the session.

While there were difficulties in separating competence from mastery motivation, again it seems worthwhile to consider the separation of these measures in further research to enable behaviours associated with each to be studied separately.

Finally, the measures of exploration used in this study were not fine enough to draw any solid conclusions concerning a hierarchy of exploration. A suggestion for further research would be to use computer equipment in the transcription of data from videotapes that can identify changes in behaviour in the order the changes happen for a more accurate description of child behaviour.

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APPENDICES

APPENDIX A

Letter to Parents

THE UNIVERSITY OF MANITOBA

FACULTY OF HUMAN ECOLOGY
Department of Family Studies

Winnipeg, Manitoba
Canada R3T 2N2

(204) 474-9225

January 20, 1984

Dear Parents:

As parents and as professionals working with children, we are mutually interested in supporting optimal development in our children. We want them to develop competencies that will enable them to live productive and fulfilling lives. In recent years researchers in the area of child development have been asking some very basic questions, not simply about child's level of development, but also about how a child indicates that s/he wants to work on developing skills and how our response affects his/her achievement of this goal.

In respect to this latter point, namely, how a very young child indicates s/he is working on and wants to learn skills, we have several tasks which are basically toys the children can play with, that indicate they may be appropriately used for continued research into how we can support a child's optimal development. To test these tasks for appropriateness and feasibility in this area of research, and to refine them for more effective use, we are inviting you with your child to participate in our current research project. For this project we will be focusing upon children who are 18 months of age.

If you choose to participate in our research project, the involvement of you and your child would include a visit by us to your home and a visit by you with your child to the Department of Family Studies at the University of Manitoba. The visit to your home will be approximately one hour. We will bring some toys with us that will assist us in becoming acquainted with your child. During this time we will ask you to respond to two short questionnaires.

Your visit with your child to the Child Development Laboratories of Family Studies will be approximately one-half hour. During this time we will give your child a series of three table games. We ask that you be with your child throughout the half-hour session. For the purpose of precise and accurate data collection, the entire session will be videotaped. In addition to myself, the only persons who will have access to

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these videotapes are my research assistants. If it is judged that segments of the videotape would be valuable to continued research in this area, I will contact you for permission to edit out and retain the specific segment. Except for specific permission obtained from you for edited retention of segments, all videotaped records will be erased after data has been recorded.

To protect your confidentiality, yours and your child's name will be deleted from all records and will be substituted by a nondescript code.

We have all seen how eager children, as young as infants, are to learn. We also know they need our help. As an educator, I am specifically interested in knowing when and how we can most effectively assist children in learning new skills and to support them in developing their potential. It is for this reason that I invite your cooperation and participation in this research project. We know you, as parents, are similarly interested and, therefore, we will certainly share the findings from this project with you upon its completion.

If you are willing to participate in this research project with your child, kindly indicate by signing the attached consent form and returning it in the enclosed, self-addressed envelope. If you agree to participate, one of my research assistants (Marie Betournay, Annie Fung, or Nancy Lyon) will telephone you several weeks in advance of your child's approaching 18 months of age to arrange times convenient to you for the home and lab visits.

Sincerely yours,

Lois M. Brockman
Professor of Human Development

LMB/dah

Enclosure

P.S. If you know of anyone whose child is turning 18 months between the months of January and April, 1984, and who may be interested in this project, could you please ask them to contact us at 474-9225.

CONSENT TO PARTICIPATE

I agree to participate with my child, ________________________, in the research project described in Dr. Brockman's cover letter. I understand that information obtained through this project will be respected as confidential. If, at any time following this consent, I wish to withdraw from the research project, I am free to do so.

My child's birthdate is ________________________________.
(month, day, year)

____
(signature of parent)

Date____________________________

Address ________________________

____

Phone Number ____________________

APPENDIX B

Presentation Order of the Mastery Motivation Tasks

Figure 1

Distribution of Presentation Orders of the Mastery Tasks

	PRESENTATION ORDER	EXPERIMENTAL		CONTROL	
		MALE	FEMALE	MALE	FEMALE
1	M - P - F				
2	P - F - M				
3	P - F - M				
4	F - P - M				
5	F - M - P				
6	M - P - F				
7	M - F - P				
8	P - M - F				
9	F - M - P				

APPENDIX C

Mastery Motivation Tasks

Figure 1. Diagram showing Task Box and Seating Arrangements During Lab Session

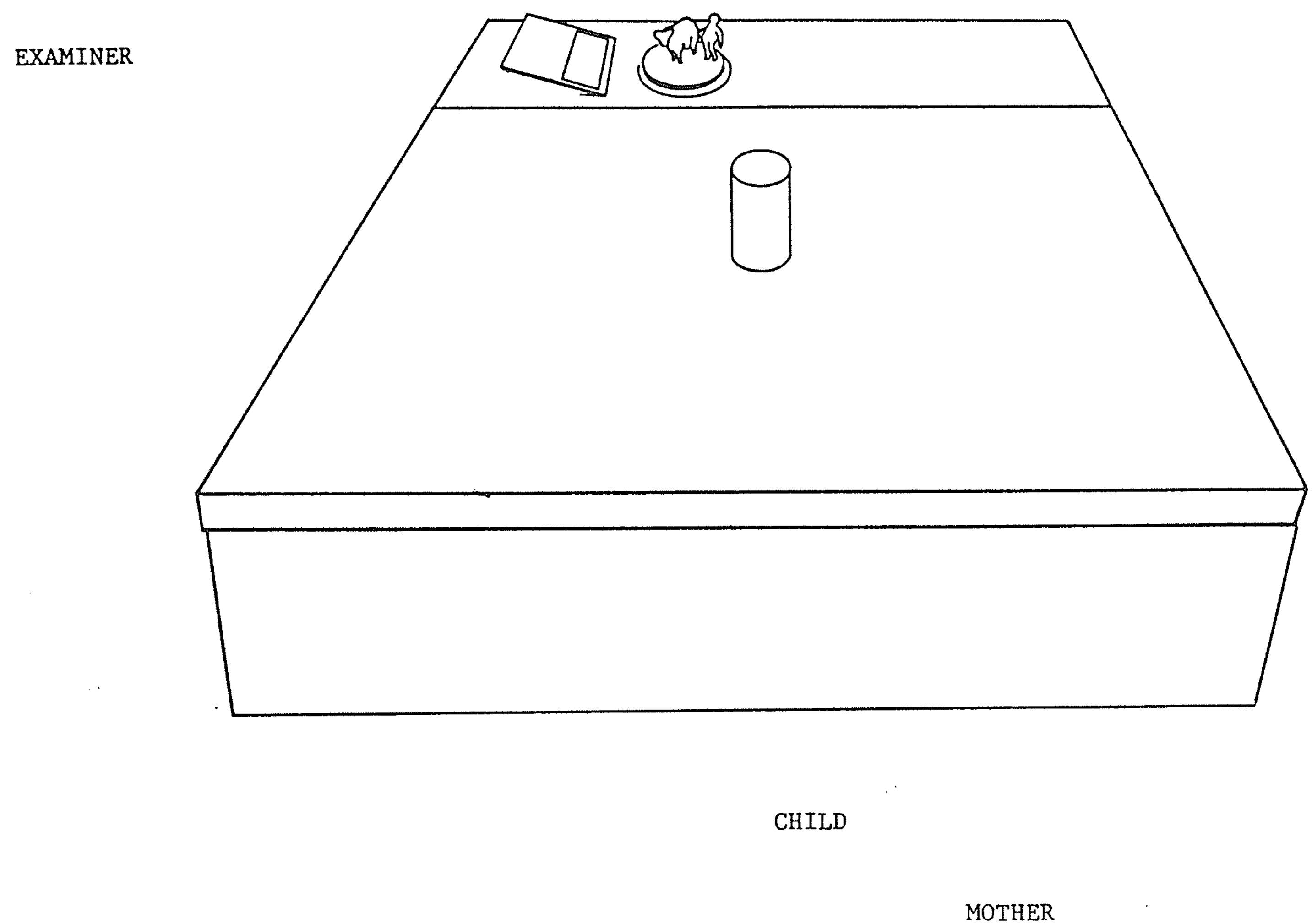
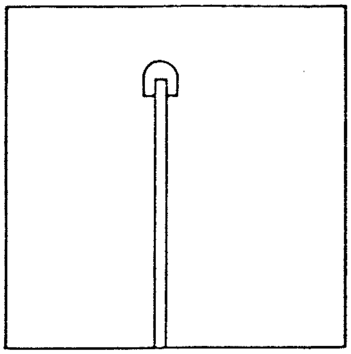
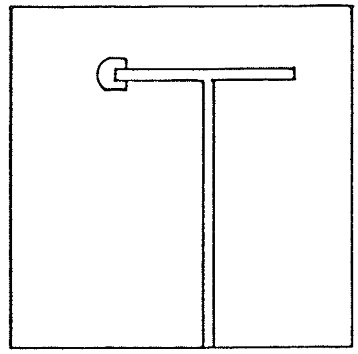


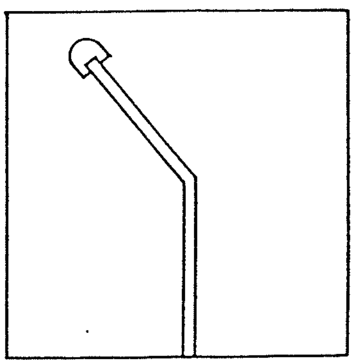
Figure 2. Maze Task



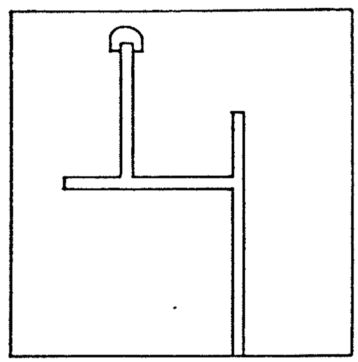
Training Maze



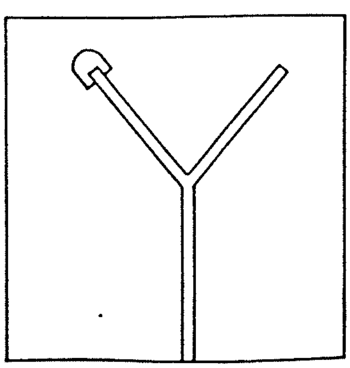
T-Maze



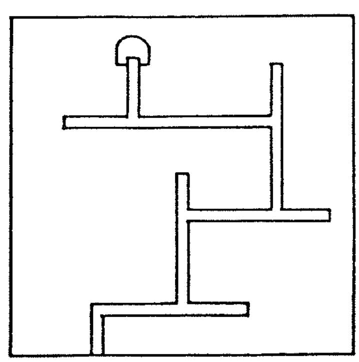
Half-Y Maze



2 Choice Points

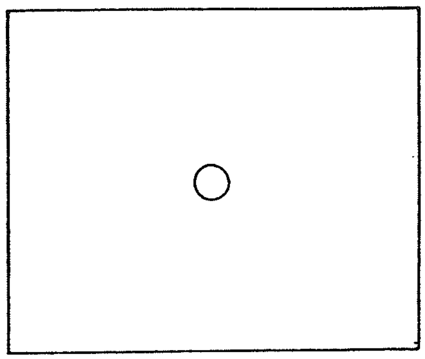


Y-Maze

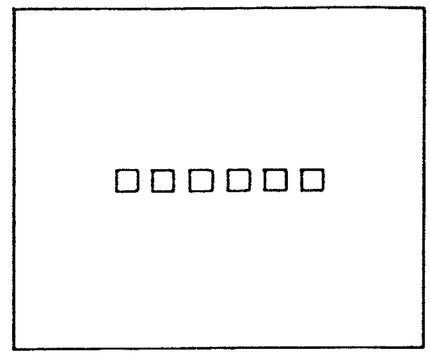


5 Choice Points

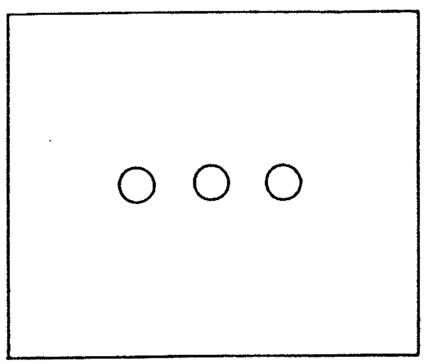
Figure 3. Peg Task



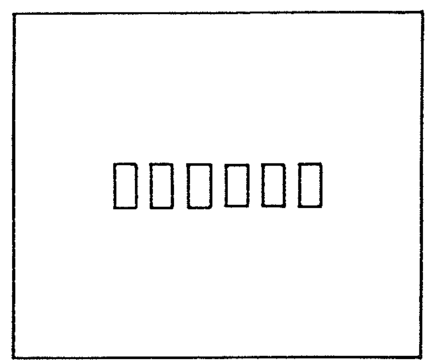
Training Template



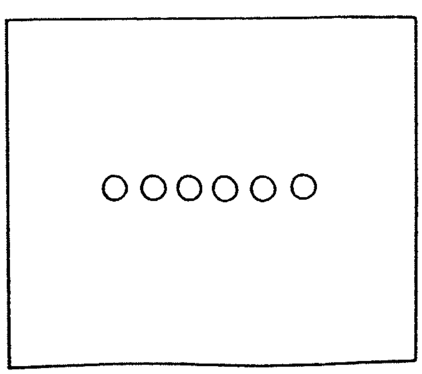
6 square holes



3 round holes

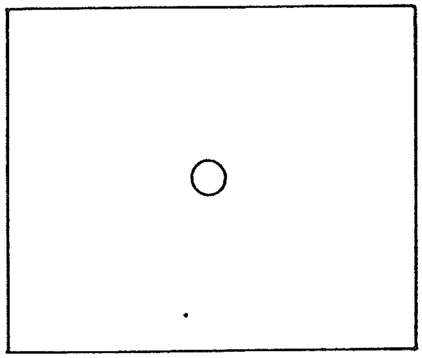


6 rectangular holes

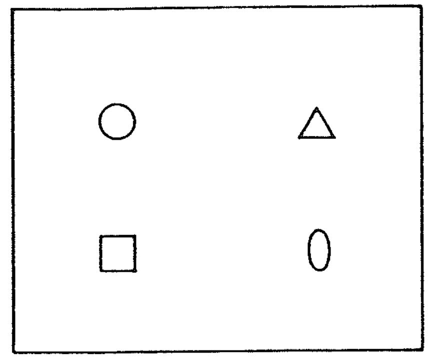


6 round holes

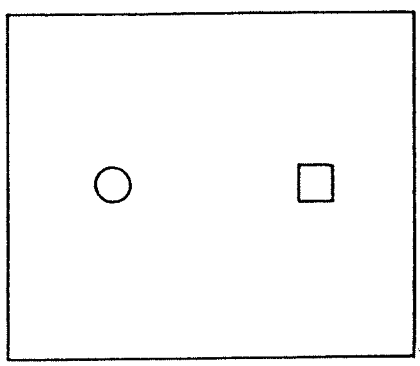
Figure 4. Form Discrimination Task



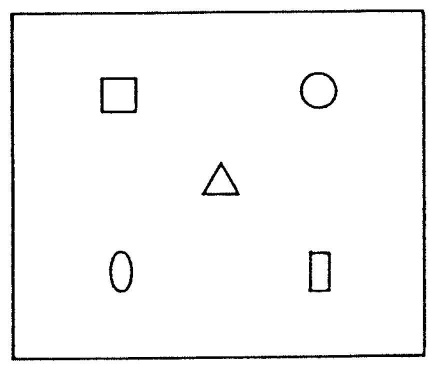
Training Template



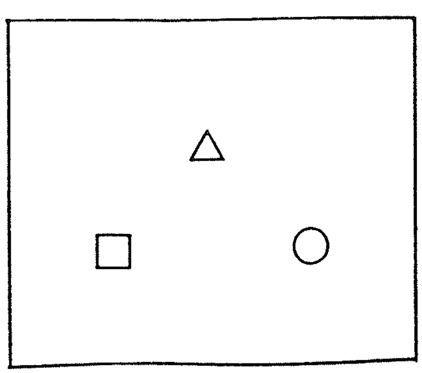
4 Forms



2 Forms



5 Forms



3 Forms

APPENDIX D

Bayley Scales of Infant Development

(Items from 14-25 month range)

H_1 = Cubes

Number of cubes

1) Tower = _____ (119, 143, 161)

2) Train = _____ (154)

3) Concept of on = _____ (162)

O = Pegs (118, 123, 134, 156)

	Trial #1	Trial #2	Trial #3
Time =	________	________	________

R = Blue Board (121, 129, 142, 155, 159, 160)

Round blocks placed in = _____

Square blocks placed in = _____

Time for task completion = _____

S = Pink Board (120, 137, 151)

○ □ △

Reversed _____

W = Broken Doll (133, 140, 153)

1) Mends marginally _____

2) Mends approximately _____

3) Mends exactly _____

M = Paper and Crayon (125, 135, 147, 157)

1) Imitate crayon stroke _____

2) Differentiates scribble from stroke _____

3) Imitates strokes _____

4) Folds paper _____

U = Doll

1) Follows directions (126)

Chair_____ Cub_____ Handkerchief _____

2) Points to parts on doll (128)

Hair_____ Eyes_____ Mouth_____

Ears_____ Hands_____ Nose _____

Feet_____

G^3 = Observe or ask mother for the following:

i) uses words to make wants known _____

ii) sentences of two words _____

V = Pictures (130, 132, 139, 141, 148, 149)

	Names	Points
Dog	_____	_____
Shoe	_____	_____
Cup	_____	_____
House	_____	_____
Clock	_____	_____
Flag	_____	_____
Star	_____	_____
Leaf	_____	_____
Purse	_____	_____
Book	_____	_____

T = Naming of objects (124, 138, 146)

Ball_____ Scissors_____ Cup_____

Watch_____ Pencil_____

X = Discrimination (144, 152)

Cup_____ Plate_____ Box_____

Y = Names Watch (145, 150)

5th picture_____ 3rd picture_____

4th picture_____ 2nd picture_____

Z = Prepositions (cups, cubes, chair)

On_____ In_____ Under_____

Attains toy with stick _____

Finds 2 objects (131)

Trial	1	2	3
Rabbit	_____	_____	_____
Ball	_____	_____	_____

Throw ball _____ _____ _____ (48)

K = (47, 57, 71)

1) stands up - rolls onto stomach _____

2) stands up - turns to one side _____

3) stands up - to sitting position _____

L = (49, 50)

1) walks sideways _____

2) walks backward _____

M = (51, 52, 58, 60)

	Alone	With Help
1) stand on right foot	_____	_____
2) stands on left foot	_____	_____

N = Stairs (53, 54, 64, 66)

	With Help	Both Feet (alone)
1) walks upstairs	_____	_____
2) walks downstairs	_____	_____

O = Walking Board (55, 56, 62, 67)

1) tries to stand on walking board

2) walks with one foot on walking board

3) walking board - stands with both feet

4) walking board - attempts grip

P = (59)

Jumps off floor - both feet _____

Q = Walking On Line (61, 65, 68)

1) walks on line - general direction _____

2) walks on tip toe - few steps _____

3) walks backward - ten feet _____

R = Jumps (63, 69)

1) jumps from bottom step _____

2) jumps from second step _____

APPENDIX E

Code Sheet for Data Transcription of Child's Behaviour from the Videotape

Figure 1.

CHILD CODE # TESTER TESTING DATE MAZE TASK ORDER PRESENTED

TRIAL START PHASE TEMPLATE NUMBER

END EXPERIMENTAL/CONTROL

PROMPT	TIME PROMPT GIVEN	TOTAL OFF-TASK TIME	ATTENTION FOCUSED DURING OFF-TASK	COMPLETED		EXPLORATION	COMMENTS
				TURNS	CUL DE SACS		
1							
2							
3							
4							
5							
TOTAL							

TRIAL START PHASE TEMPLATE NUMBER

END

PROMPT	TIME PROMPT GIVEN	TOTAL OFF-TASK TIME	ATTENTION FOCUSED DURING OFF-TASK	COMPLETED		EXPLORATION	COMMENTS
				TURNS	CUL DE SACS		
1							
2							
3							
4							
5							
TOTAL							

Figure 2.

CHILD CODE # TESTER TESTING DATE PEG TASK ORDER PRESENTED

TRIAL START PHASE TEMPLATE NUMBER

END EXPERIMENTAL/CONTROL

PROMPT	TIME PROMPT GIVEN	TOTAL OFF-TASK TIME	ATTENTION FOCUSED DURING OFF-TASK	POSITIONAL ORDER OF PEGS	(N) OF PEGS PLACED IN	EXPLORATION	COMMENTS
1							
2							
3							
4							
5							
TOTAL							

TRIAL START PHASE TEMPLATE NUMBER

END

PROMPT	TIME PROMPT GIVEN	TOTAL OFF-TASK TIME	ATTENTION FOCUSED DURING OFF-TASK	POSITIONAL ORDER OF PEGS	(N) OF PEGS PLACED IN	EXPLORATION	COMMENTS
1							
2							
3							
4							
5							
TOTAL							

Figure 3.

CHILD CODE # TESTER TESTING DATE FORM TASK ORDER PRESENTED

TRIAL START: PHASE TEMPLATE NUMBER

END EXPERIMENTAL / CONTROL

PROMPT	TIME PROMPT GIVEN	TOTAL OFF TASK TIME	ATTENTION FOCUSED DURING OFF-TASK	SEQUENCE OF FORMS IN SLOTS	EXPLORATION	COMMENTS
1						
2						
3						
4						
5						
TOTAL						

TRIAL START PHASE TEMPLATE NUMBER

END

PROMPT	TIME PROMPT GIVEN	TOTAL OFF-TASK TIME	ATTENTION FOCUSED DURING OFF-TASK	SEQUENCE OF FORMS IN SLOTS	EXPLORATION	COMMENTS
1						
2						
3						
4						
5						
TOTAL						

APPENDIX F

Interobserver Reliability on Child's Behaviour

Appendix F

Summary of Interobserver Reliability on Child's Behaviour

Behaviour Measures	aPercentage of Agreement
MAZES:	
Exploration most prominent	88
Total Task time by trial	83
Performance level by trial	93
PEGS:	
Exploration most prominent	94
Total Task time by trial	94
Performance level by trial	100
FORMS:	
Exploration most prominent	83
Total Task time by trial	83
Performance level by trial	100

[a] Percentage of Agreement = $\frac{\text{Number of Agreements}}{\text{Total Number of Agreements + Disagreement}}$