THE EFFECT OF A CHANGE IN PERCEPTUAL VERBS
ON INTELLECTUAL REALISM ERRORS
IN APPEARANCE-REALITY TASKS

by

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B.Ed., The University of Alberta, 1975

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS

in
THE FACULTY OF GRADUATE STUDIES
(Department of Educational Psychology and Special Education)

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA
September, 1988

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ABSTRACT

Pillow & Flavell (1985) argue that the phrase 'look like' increases the tendency of young children to commit intellectual realism errors. The present study followed their procedures with the Block Arrays (which includes the Hidden Block task) and, in addition, included the Identity task from a previous appearance-reality study by Flavell, Flavell & Green (1983). Forty-two three- and four-year-old preschoolers were presented with a variety of block arrays (Block Arrays task) and realistic-looking fake objects (Identity task) to observe. The subjects were tested on all of the stimulus items in one task before being tested on the second one. Half the subjects received the Block Arrays task first, half received the Identity task first. After the presentation of each array or object, the subject was asked a test question about its appearance while looking at it through a viewing tube. In the Look Like Condition, the test question included the words 'look like' and in the See Condition, the verb 'see' was used instead of 'look like'. If the subjects made any errors in the first condition (Look Like), they then received the second condition (See). No difference was found in the childrens' performance in the Hidden Block task but there was a difference in their performance in the Identity task. However, this difference cannot be attributed solely to the two wordings but rather to some interaction of task type and condition. Further analysis of the Look Like Condition revealed an Age-by-Task interaction in which the threes and fours performed differently in each task. A significant main effect for each of Task and Gender was also found in the Look Like Condition.
TABLE OF CONTENTS

ABSTRACT .............................................................................................................. ii
LIST OF TABLES ..................................................................................................... vi
LIST OF FIGURES ................................................................................................. vii
ACKNOWLEDGEMENTS ......................................................................................... viii
Chapter

I. INTRODUCTION .............................................................................................. 1
   Background ....................................................................................................... 1
   The Appearance-Reality (A-R) Distinction ..................................................... 1
   Phenomenism & Intellectual Realism .............................................................. 2
   Children's Difficulties With The A-R Distinction ......................................... 3
   Mental Representation And The A-R Distinction .......................................... 4
   The A-R Distinction and Theory of Mind ...................................................... 5
   Theory of Mind ............................................................................................... 6
   Manipulation of Perceptual Verbs ................................................................. 8

II. LITERATURE REVIEW ................................................................................... 9
   Introduction ..................................................................................................... 9
   Theory Of Mind .............................................................................................. 10
   The Appearance-Reality (A-R) Distinction .................................................. 12
   Pretend Play and the A-R Distinction ........................................................... 15
   Appearance-Reality Difficulties - Real Or Apparent? .................................... 16
   The Role of Perceptual Verbs ....................................................................... 19
   Perception ...................................................................................................... 20
   See .................................................................................................................. 21
   Look Like ........................................................................................................ 23
   Statement of the Problem ............................................................................. 24
      Hypotheses ................................................................................................. 25

III. METHODOLOGY .......................................................................................... 26
   Introduction ..................................................................................................... 26
   Subjects .......................................................................................................... 26
   Materials ......................................................................................................... 27
   Tasks and Procedure ...................................................................................... 27
      Hidden Block Task ..................................................................................... 27
   Identity Task .................................................................................................. 29
   Probe ............................................................................................................... 31
LIST OF TABLES

Table 1 - Subjects Per Cell ................................................. 34
Table 2 - Means and Standard Deviations for Task Order .............. 36
Table 3 - Means and Standard Deviations for the Hidden Block Task 37
Table 4 - Analysis of the Hidden Block Task for Age and Condition Effects 37
Table 5 - Means and Standard Deviations for the Identity Task ........ 38
Table 6 - Analysis of the Identity Task for Age and Condition Effects 38
Table 7 - Means and Standard Deviations for the Look Like Condition .... 39
Table 8 - Analysis of the Look Like Condition for Age and Task Effects 40
Table 9 - Means and Standard Deviations for the See Condition ........ 42
Table 10 - Analysis of the See Condition for Age and Task Effects .... 42
Table 11 - Means and Standard Deviations for Task and Condition ...... 43
Table 12 - Repeated Measures ANOVA for Age, Task and Condition .... 44
Table 13 - Means and Standard Deviations for the Look Like Condition .... 46
Table 14 - Analysis of the Look Like Condition for Age, Gender and Task Effects 46
LIST OF FIGURES

Figure 1 - Hidden Block Array ........................................... 28
Figure 2 - Graph of Age-By-Task Interaction for the Look Like Condition ........................................... 41
Figure 3 - Graph of Task-By-Condition Interaction ........................................... 45
Figure 4 - One-Block Visible Array ........................................... 63
Figure 5 - Two-Block Visible Array ........................................... 63
ACKNOWLEDGEMENTS

I would like to acknowledge those who have been instrumental in the production of this thesis. First, I want to thank my advisor Dr. Rita Watson who not only gave me scope but also wisely pulled in the reins when necessary. I learned much from her dedication to integrity in research. I thank Dr. Harold Ratzlaff for his gentle probing and eye for detail. He was a continual source of encouragement. To Dr. Ken Reeder I owe thanks for the enthusiasm with which he received my first tentative proposal and for his continued support as I completed the thesis. To all of them I acknowledge, with gratitude, the many hours of time and effort spent on my behalf.

Much appreciation goes to the staff in ERSC, particularly Stewart Seidel, who worked tirelessly with me despite a busy schedule while I labored to produce this document.

Lastly, I would like to thank my husband, Todd, who stood by me through the ebbs and flows of the writing of a thesis. His unconditional love and support gave me the courage to keep going.
Chapter I
INTRODUCTION

Background

It is not only recently that scientists have studied appearance in relation to reality. The Greeks also attempted to gain an understanding of physical reality as distinct from its appearance (Morris, 1987). Morris states that to understand an object's reality requires that one separate its properties from one's perceptions. Distinguishing between the appearance of an object or situation and the real state of affairs implies a simultaneous holding of seemingly contradictory images. Flavell and his associates consider this representational complexity to be difficult for young children up to four years of age to overcome (Flavell, Flavell & Green, 1983; Taylor & Flavell, 1984; Pillow & Flavell, 1985; Flavell, Green & Flavell, 1986).

The Appearance-Reality (A-R) Distinction

The development of the ability to distinguish between the apparent and the real state of affairs has been systematically studied by Flavell and others in recent years. Understanding that appearances may be deceiving and could be misrepresentative of reality is considered by Flavell (1986) to be "ecologically significant". Consider the situations that occur everyday which require the knowledge of that distinction, situations in which available information is either insufficient or misleading causing us to accept outward appearance as the truth. The distortion of reality may be unintentional (a partially obstructed object) or quite deliberate (magic tricks). Examples of these distortions abound; mirages, the apparent distortion of a rod in water, optical illusions, sleight of hand and movie stunts are but a few.
Because the occurrence of appearance-reality distortions is pervasive in society, the ability to be able to make the distinction between the two seems to be necessary to an ordered life. Flavell suggests that it is highly likely that "the development of knowledge about the distinction between appearance and reality is ... a universal development in human beings" (Flavell et al., 1983, p. 96). In a cross-cultural replication of one of Flavell's studies, Chinese 3- to 5-year-olds in the People's Republic of China demonstrated similar error patterns, age changes and levels of performance as American 3- to 5-year-olds (Flavell, Zhang, Zou, Dong & Qui, 1983) thus supporting his hypothesis.

In Flavell et al. (1983) two types of 'errors', phenomenism and intellectual realism, were examined together for the first time, although previous researchers had studied them separately (Braine & Shanks, 1965a, 1965b; Piaget & Inhelder, 1969; Freeman & Janikoun, 1972; Liben & Belknap, 1981). Flavell considers the two errors to be related cognitive immaturities, reflecting problems with the appearance-reality distinction. He sees phenomenism as cognitive 'undershoot' and intellectual realism as cognitive 'overshoot'.

Phenomenism and Intellectual Realism

Phenomenism is the tendency of children to focus on the surface appearance of an object or what is perceptually salient rather than on the underlying reality of the object (Flavell, 1977). For example, young children may insist that a candle which looks like an apple is an apple even though they have been able to determine that it really is a candle made of wax. Braine & Shanks (1965), early researchers of phenomenistic responding, found that children reported how an object appeared instead of how it truly was. For the purposes of their study, Flavell et al. (1983) operationally defined phenomenism in the following way. Phenomenism is the giving of an appearance answer to both appearance and reality questions about an object.
Intellectual realism, on the other hand, is the tendency of children to look beyond the perceptual field and to focus on what is known or cognitively salient about the object(s) at hand (Luquet, 1927). Freeman and Janikoun (1972) found that children will often draw a cup and its handle when directed to draw what they "see" even though the cup's handle is not in view. Pillow & Flavell (1985) defined intellectual realism as "children's tendency to respond to requests for perceptual reports by indicating what they know about an object or array, rather than strictly what they can see from their present perspective" (p. 664). In the present study this latter definition of intellectual realism will be adopted.

Children's Difficulties with the A-R Distinction

Flavell and his colleagues have devised various tasks designed to investigate the nature of the development of the A-R distinction (Flavell, Flavell & Green, 1983; Flavell, Zhang, Zou, Dong & Qi, 1983; Taylor & Flavell, 1984; Pillow & Flavell, 1985; Flavell, Green & Flavell, 1986). As an example of the type of tasks used, children three to five years old were shown a piece of sponge painted to resemble a rock and allowed to handle it in order to discover its real identity. Then the researcher asked them two questions: "What is this really, really? Is it really, really a rock or really, really a piece of sponge?" (reality question) and, "Does it look like a rock or does it look like a piece of sponge?" (appearance question). They discovered that young children of about three years had difficulty making the distinction between appearance and reality. They would often say that the sponge was really a rock or that it looked like a sponge.

Joseph Campione, in his commentary accompanying the Monograph published by Flavell, Green and Flavell (1986), describes their work as "extremely clever manipulations designed to induce young children to demonstrate whatever appearance-reality or perspective-taking competence they may have" (p. 79). In this series of studies, Flavell et al. left few stones unturned in an attempt to determine just what knowledge and skills 3-year-olds do or do not have about the A-R distinction.
Their manipulations included experiments to test possible memory problems, using more familiar objects, embedding tasks in more familiar contexts, reducing information-processing requirements, and the use of more extensive pretraining. They concluded that 3-year-olds indeed seem not to have acquired the ability to make these distinctions and, according to a very recent article, that "young children's difficulties with the AR distinction are nontrivial, deep-seated, genuinely intellectual ones" (Flavell, in press, p. 5).

**Mental Representation and the A-R Distinction**

Why is the ability to distinguish reality from appearance difficult for young children even when the tasks are simplified as much as possible? According to Flavell (1986), the demands of the tasks require that the child accept that the same object at any point in time can be represented in two mutually exclusive ways in regard to its identity and its property. However, this representative complexity is not easy for a 3-year-old to deal with. Young children of this age, it seems, have trouble reconciling these disparate images suggesting that they really do not understand the nature of their own mental representations. They tend to assume that things in the world have one reality and do not understand that this reality can be mentally represented in various ways. If children view objects as having only one reality, then they can have only one characterization which describes that object. Adults on the other hand "easily resolve the seeming contradiction by identifying one representation of its property or identity with its present appearance and the other with its reality" (Flavell, 1986, p. 422). Flavell then, attributes children's difficulties to their lack of an adequate understanding of the subjectivity of mental representation. This has been challenged by various researchers who believe that the difficulty lies not in the ability to distinguish between appearance and reality but in other cognitively-related areas.

Olson & Astington (1987) argue that children cannot make the distinction unless they are motivated by a knowledge of their own beliefs which mediate their 'seeing' of
an object. Wimmer, Hogrefe & Sodian (in press) suggest that young children have an inadequate understanding of their own informational accesses as origins of knowledge and belief which leads to their failure in making the distinction between appearance and reality. They theorize a second stage in children's cognitive development beginning in the fourth and fifth years wherein children become able to take into account the origins of their knowledge in their understanding of the world. Although each of these theories sheds a different light upon the problem none of them alone sufficiently explain children's difficulty with the A-R distinction.

The A-R Distinction and Theory of Mind

The recent return to the study of the development of children's minds and the variables that affect cognitive growth has stimulated much research in diverse areas - philosophy, psychology, linguistics and artificial intelligence are a few. Some of the work have concentrated on when and how young children become aware of their own and others' thoughts or mental representations. How does the appearance-reality distinction fit into this larger framework of research?

Part of the evidence for a developing theory of mind is the ability of a child to understand the subjectivity of mental representations. This marks the ability not only to think about people, events and objects but also to separate these thoughts from the actual object or event. Its development includes increasing skills in representing one's own and others' thoughts and beliefs and eventually to engage in recursive thinking. The A-R distinction is, according to Flavell (1986), enabled by the ability to hold in mind (to represent) at the same time what seems to be contradictory information about an object or state of affairs, and to be aware that a contradiction exists. Thus a child's awareness of 'contradictory' mental representations is central to the ability to distinguish between what something looks like and its real identity. There must exist the ability to choose between the appearance and the reality of an object.
simultaneously represented in mind. The next section discusses the development of a child's theory of mind, of which the appearance-reality distinction is but a part.

Theory of Mind

The study of the mind and the nature of human knowledge, from which stem numerous epistemological issues still being investigated today, finds its origins in the introspective musings and writings of the ancient Greek philosophers. Psychology however, during the twentieth century, turned its back on introspective speculations, moving toward what was considered to be the more 'respectable' platform of empirical testing. The rebirth of cognitive science in the last three or four decades hails the resurrection of the study of the mind with a difference; rather than depending solely upon introspection, "cognitive scientists are fully wedded to the use of empirical methods for testing their theories and their hypotheses" (Gardner, 1985, p. 5). The study of mental states has become acceptable and, as Chandler (1988) states, "with the advent of the modern cognitive revolution, it has once again become fashionable to think of the actions of human beings as being guided by systems of personal beliefs" (p. 7).

Premack and Woodruff (1978) stated that humans not only possess mental states such as personal beliefs but that they act in accordance with them and can impute these states to themselves and others, an indication, they claim, that they have a 'theory of mind'. Chandler (1988) suggests that "to have a theory of mind is to hold to a special sort of explanatory framework that interprets intentional behaviors as a partial consequence of the particular beliefs to which those whose actions are in question subscribe" (p. 2). What Premack & Woodruff and Chandler are saying is that a person who possesses a theory of mind is aware that s/he is experiencing a mental state of one kind or another (believing, thinking, wanting, remembering, etc.) and recognizes that others also experience mental states. Thus, as Chandler (1988) states
it, one must "draw a careful distinction between the simple having of beliefs and the more complex matter of appreciating that such beliefs are actually had" (p. 2).

He goes on to give this example. Infants often hold up their arms because they want to be picked up. Do they do so because they think that this action automatically results in their being picked up? Or is it that the children believe that raised arms conveys a message to the adult who in turn believes that they desire to be picked up? If the latter is truly the case, such children would be acting in accordance with their belief about another's belief. They could be said to possess a theory of mind.

How does one acquire a theory of mind? When does it begin to develop? What is its developmental scheme? These and other questions are currently being posed in cognitive psychology from a variety of perspectives: explication of internal states (Bretherton & Beeghly, 1982); false belief (Wimmer & Perner, 1983); real and apparent emotion (Harris, Donnelly, Guz & Pitt-Watson, 1986), moral development (Wimmer, Gruber & Perner, 1984), pretense and representation in infancy (Leslie, in press), and the appearance-reality distinction (Flavell, Flavell & Green, 1983).

There is controversy about whether the ability to explicitly represent mental states of self and others is a prerequisite to the possession of a theory of mind (Pylyshyn, 1978; Chandler, 1988; Bretherton & Beeghly, 1982). This affects at what time in a child's cognitive development one can consider that a theory of mind emerges. Wimmer & Perner (1983) suggest that this does not occur until sometime around four or five years of age according to their measure of a child's theory of mind. Other research findings support the claim that the beginnings of a theory of mind emerges much earlier than at first suspected (Leslie, in press; Bretherton, McNew & Beeghly-Smith, 1981). Although he has no empirical evidence to support his views, Chandler (1988) speaks out strongly against those who claim that children younger than four years cannot be described as having any theory of mind and suggests that such claimants are seriously underestimating young children's competence.
Manipulation of Perceptual Verbs

Of particular interest to the present study is the manipulation used by Pillow and Flavell (1985) in testing for intellectual realism errors on hidden block arrays. They examined the effect of a change in perceptual verbs used in the test question on the number of errors young children made. They were concerned that the expression 'look like' was possibly ambiguous conveying the meaning "What do you think this is?" rather than "What does this appear to be?". Their procedure included substituting the word 'see' for 'look like' in the test question on follow-up trials. The question became "Do you see just an X (orange) block or do you see an X (orange) block and a Y (blue) block?" rather than "Does this look like just an X block or does this look like an X block and a Y block?" This change resulted in substantial improvements in correct responses for some of the children.

These improvements suggest that use of the 'see' wording instead of the 'look like' wording does indeed reduce the number of intellectual errors. The authors felt that the subjects not only noticed a subtle change in wording, but also gave it weight and responded very differently as a consequence" (p. 668). However, it is not clear why young children would respond differently to these two perceptual verbs. No analyses were carried out to confirm the significance of their findings.

It would be valuable to determine whether the results are replicable over time and with a different population. It would also be interesting to test whether a similar differential response would be elicited if a different task was used. In order to accomplish this, the present study was designed to apply the procedures from Pillow & Flavell (1985) to their Hidden Block task and also to the Identity task taken from the Flavell et al. (1983) study.
Chapter II
LITERATURE REVIEW

Introduction

It appears that a knowledge of the distinction between appearance and reality is characteristic of most adults but not characteristic of young children, aged three or younger (Flavell, 1986). It also seems to be a universal development which crosses cultural borders (Flavell, Zhang, Zou, Dong & Qui, 1983). This ability requires that one be able to distinguish between the perceptually salient characteristics of an object and its permanent, immutable identity or property. In other words, it is an awareness and understanding of the distinction between what something appears to be to the senses at any given moment in time and its real identity. For example, understanding that a glass of milk covered with a piece of orange-colored plastic remains a glass of milk and is not transformed into a glass of kool-aid, or that the milk's color remains white and has not suddenly become orange (Taylor & Flavell, 1984). It is important to understand this ability in the context of cognitive development as a whole, and particularly, that segment of research which explores children's developing theory of mind.

There is evidence to suggest that between the second and sixth years of a child's life there is a transitional period wherein emerges the ability to consider one's own mental states and those of others (Miscione, Marvin, O'Brien & Greenberg, 1978; Wimmer & Perner, 1983; Flavell, Flavell & Green, 1983; Leslie, in press). Topics such as children's understanding of false beliefs, the emergence of pretend play, perspective-taking (perceptual and affective), and children's ability to distinguish
between appearance and reality, are being investigated in the search for a clearer understanding of the development of children's minds. Diverse as the research may be, researchers are discovering that there are some underlying similarities. "A number of them (cognitive acquisitions) seem to develop around the same age and may be mediated by the same insights into the nature of mind" (Flavell, 1988).

In attempting to synthesize and summarize current cognitive research, Flavell (1988) has proposed two stages of development in children's theory of mind. The first stage he conceptualizes as 'cognitive connections', the knowledge that one can become connected to things in the world through one's senses (seeing, hearing, touching) or through mental states of one sort or another (imagining, wanting, liking). The second stage, mental representations, is the developing ability of children to represent something or someone in different ways, to understand that their representations are subjective and not connected to the world. This second stage, according to Flavell, is important to children's ability to make the distinction between appearance and reality, the topic of this research.

In this chapter, literature pertaining to the thesis topic will be reviewed and presented in the following way. First, theories about the development of a theory of mind will be discussed. Second, literature relevant to the appearance-reality distinction and perceptual verbs as they apply to this study will be examined. Finally, the problem and hypotheses to be investigated will be presented.

Theory of Mind

Differentiating between subjective, internal states and external behavior broadly defines a theory of mind. The issue here is whether a person understands that although mental states can be related to external events or behavior, they are independent of them. Does one hold to a set of beliefs and stand in relation to them so that subsequent actions are predicated upon those beliefs? If one can predict another person's behavior based on one's thoughts and beliefs about the other's beliefs; if one
understands that they can 'see' the Queen of England without 'knowing' that she is the Queen; if one can be aware that an object may appear to be one thing but in reality be something else altogether, this suggests that a person does indeed possess a theory of mind (Premack & Woodruff, 1978; Wellman, 1985; Chandler, 1988).

Several questions loom large in the research of those whose interests lie in the study of this area of cognitive development. What truly characterizes a person who possesses a theory of mind? When does it first appear in the cognitive development of a child? At what age is it fully developed? What is the course of its development and how can it be described? Those who are presently engaged in the study of cognitive development disagree about the evidence for a theory of mind and its emergence. The following literature attempts to define the boundaries of the development of a theory of mind.

Wellman (1985) has elucidated a description of his conception of the child's theory of mind and its development. He outlines five general classes of knowledge that people develop about their own and others' mental states:

1. Existence. Knowing that mental processes exist, that people possess minds.
2. Distinct processes. The ability to distinguish several different cognitive processes, understanding that they have distinctive features.
3. Variables. Understanding that there can be various factors, including other mental states which affect a person's focal mental state and/or mental performance.
4. Integration. This is the opposite of distinct processes, that is, integration is the awareness that several mental processes may have similar aspects which unify them as components of a larger activity.
5. Cognitive monitoring. The ability to 'read' their own mental state or monitor cognitive processes. This is metacognition, understanding and utilizing information about cognition.
Wellman acknowledges that these categories are not exhaustive and suggests that there is probably overlap between them, but he feels that they do "present a useful scheme for selectively reviewing and organizing our knowledge of children's conceptions of cognition" (p. 171). Although this is congruent in part with other less well-articulated theories, he does not address the aspect of attribution of beliefs to others which is integral to other definitions of a theory of mind (Premack & Woodruff, 1978; Chandler, 1988).

Premack and Woodruff (1978) state that a theory of mind means "that the individual imputes mental states to himself and to others" (p. 515) and that this is a system of inference which can be used to make predictions about others' behavior. Chandler too considers the interpretation of intentional behaviors an integral part of this theory.

The Appearance-Reality (A-R) Distinction

Young children of about three years who are unable to distinguish between appearance and reality make either or both of two types of 'errors'. They commit either phenomenism errors or intellectual realism errors (Flavell, Flavell, & Green, 1983) as described in Chapter One. However, prior to the Flavell et al. (1983) study these two types of errors had been examined independently. Phenomenistic responding has been noted in studies which investigated the possibility that a command of the A-R distinction is a precursor for Piagetian conservation (Braine & Shanks, 1965a, 1965b; DeVries, 1969; King, 1971; Langer & Strauss, 1972). Piaget observed that young children tend to focus or centrate on what is most perceptually salient rather than the underlying reality. Children who are confused in this direction claim that an object truly is what it appears to be. In the Braine & Shanks (1965a) study, young preschoolers claimed that partially submerged sticks were really bent when they only appeared that way in the water.

Others have examined intellectual realism (Luquet, 1927; Freeman & Janikoun, 1972) and discovered that children tend to report all that they know rather than only
what they see. These studies required children to report what they knew through drawings. Other studies asked for verbal reports or the matching of pictorial representations to the actual objects (Liben & Belknap, 1972; Pillow & Flavell, 1985). Freeman & Janikoun (1972) allowed children five to nine years old to examine and identify a mug. The mug was then placed 4 feet from the child with the handle invisible from his/her perspective. Then the child was asked to "draw exactly what you can see from where you are sitting". They found that children up to seven years included the handle in their drawings. Since the handle is a defining characteristic of the cup, it is reasonable to assume that the child's mental image of the cup included a handle. This explains the tendency to include the handle even though no handle was visible.

Social perspective-taking research has also revealed children's inability to separate private knowledge of an event from ignorance on the part of another viewer (Chandler, 1973). Here too, children tended to ascribe to 'ignorant' onlookers the knowledge that they themselves were privy to by describing the action or reaction of the onlooker consistent with their own privileged information.

In Flavell et al. (1983) phenomenism and intellectual realism were for the first time investigated as related cognitive immaturities. As defined in that study, phenomenism errors occur when a child reports only the appearance of an object when asked about its reality. On the other hand, intellectual realism errors occur if a child reports reality when asked about its appearance. In a series of tasks, children aged three to five years were tested on their ability to distinguish between the appearance of an object or action and its true identity or property after they had seen the transformation from appearance to reality or reality to appearance of the object. In one task the subject was presented with a white index card and the child was asked to identify its color. Then a sheet of pink plastic was placed in front of the card to make it appear pink. The child was asked two questions: "Is this really, really pink or is it really, really white?" and "When you look at this with your eyes right now, does it look like it's pink or does it
look like it's white?" Some children answered 'white' to both questions, some children answered 'pink', and others answered both questions correctly. In further experiments of the same study, new tasks involving hidden objects, actions and shapes were added to determine whether the same pattern of errors would arise. Several conclusions were made concerning the results:

1. Although the appearance-reality (A-R) distinction is present as early as age three it is still unstable at this point.

2. There is improvement through the early childhood years but older preschoolers still do not reach ceiling performance.

3. Errors are not random. Rather they tend to be systematic: children report only appearance for both appearance and reality questions or only reality for both questions. However, the same child can and does make both kinds of errors on different tasks.

4. Task type influences the types of errors that are made. If the task requires a distinction between the appearance or reality of a property there is a greater likelihood that phenomenonism errors will occur. Intellectual realism errors occur more frequently, however, for tasks which require a distinction between real and apparent identity.

Thus it seems that young children are not necessarily phenomenists or realists but rather, their understanding of the relation between reality and appearance is unstable. A crucial question to ask at this point is just why 2-year-olds are able to engage in pretend play (Leslie, in press) but at the age of three consistently confuse the appearance and reality of an object even when both have been demonstrated for them to see. It appears that these two skills include the same ability to understand the subjectivity of mental representations.
Pretend Play and the A-R Distinction

Pretend play emerges in the second year of a child's life and is considered to be an "early manifestation of the ability to understand mental states - a primitive form of 'theory of mind'" (Leslie, in press). It is a gradual development (Watson & Jackowitz, 1984) throughout the preschool years whose emergence appears prior to that of the A-R distinction. By the age of three a child can easily distinguish between real and pretend identities (Bretherton, 1984). If one considers the cognitive requirements for pretend play it can be seen that children must be able to distinguish between reality and the deliberate distortion of reality in their mind. In order to be able to pretend children must divorce the actual state of affairs (object) from their own fantasies (thoughts) yet hold both representations in mind at the same time. For instance, a child who uses a banana as a 'telephone receiver' does not really believe that the banana is a receiver. However, in pretend play, the banana is acted upon as if it truly were a receiver.

As cited in Olson & Astington (1987), it has been shown that children as young as three years can differentiate between mental events such as pretending and real events (Wellman & Estes, 1984) and also use mental verbs like think and pretend (Shatz, Wellman & Silber, 1983).

Apparently it is easier for 3-year-olds to reflect upon the pretend-real distinction than the apparent-real distinction (Flavell, Flavell & Green, in press). They tested the pretend-real (P-R) and the A-R distinction using similar or identical tasks from previous A-R testing and discovered that 3-year-old children performed significantly better on pretend versus appearance questions. Beyond this, they performed significantly better on the same reality questions in the P-R tasks than in the A-R tasks. However, even though there was marked improvement, the average correct performance was less than 70% of the tasks suggesting that the early development of pretense may be
"necessary and facilitative but not sufficient" for the A-R distinction (Flavell, 1986, p. 422).

**Appearance-Reality Difficulties - Real or Apparent?**

Since the 1983 study, Flavell and others have manipulated several variables to determine whether young children really lack competence with the A-R distinction (Taylor & Flavell, 1984; Flavell, Green & Flavell, 1986). They wondered whether the tasks or the wording of the questions inhibited the subjects from revealing what they implicitly knew, thus significantly underestimating their capabilities. They tried making the tasks easier and teaching A-R knowledge, but all their results suggested that young children's difficulties with the A-R distinction are very real. Flavell thought that perhaps they were responding to the two questions (appearance and reality) as if they were just differently worded versions of the same request.

This account is similar to that of Wimmer & Perner (1983) who investigated whether young children could accurately represent another person's definite belief which differed from the true state of affairs known to the subject. Is a child able to hold in mind two differing perspectives at the same time and further, to represent them both? In one experiment 4- to 9-year-old subjects were told two stories. The first story is about Maxi who puts a piece of chocolate in a blue cupboard (X). While Maxi is absent Mother moves the chocolate from the blue cupboard and places it in the green cupboard (Y). Maxi comes back to find the chocolate while Mother is out. The subjects are aware of two things: Y is true yet Maxi still believes, albeit falsely, that X is the case. The subjects are then asked to predict where Maxi would look. Most of the 4- to 5-year-olds pointed incorrectly at Y, yet the performance of the 6- to 9-year-olds was almost perfect. Based on their results Wimmer and Perner concluded that children six years and older could deal with conflicting beliefs in two persons and make accurate predictions of another person's behavior based on their own
knowledge of false beliefs. Wimmer and Perner consider this ability to be a new cognitive skill emerging between the ages of four and six years.

Coincidentally, the A-R literature also shows that around the age of four, children begin to be able to make much more accurate distinctions between what something appears to be and what it really is. Understanding that one has been deceived by appearances is really knowing that one holds a false belief about an object or event. It may be that the understanding of false beliefs facilitates the understanding of the appearance-reality distinction or they may merely be parallel cognitive developments. There are other accounts which attempt to explain why children experience difficulty with the distinction between appearance and reality.

Olson & Astington (1987) claimed that the problem lies with young children's inability to ascribe beliefs to themselves and others. Children cannot take into account their beliefs about an object when they say that they see something. Thus, although what children see is mediated by their belief about the object(s) under scrutiny, they cannot make use of a concept of belief to explain what they see. If Bob doesn't understand that the 'rock' he sees today may appear to him as a sponge tomorrow or as a sponge to Jack today, he has not separated his (or Jack's) belief about the object from the object itself. Yet the problem is not just the separation of belief from reality but a separation of two distinct beliefs about one reality. Olson & Astington's explanation does not account for the fact that young children continue to experience difficulty even when they are told what an object appears to be and are allowed to manipulate the object to determine its identity. Thus knowledge (and beliefs) imparted verbally and by touch seems insufficient to clarify their confusion.

Wimmer, Hogrefe & Sodian (1988) suggest that this is exactly where the problem lies. Mental representations of an object originate from our perceptions; therefore the inability to relate perceptual information to our beliefs about the representations will cause confusion about the object. They suggest that young children up to about age
four do not understand the sources of their knowledge and beliefs. For example, given a sponge rock to examine, young children cannot somehow relate their belief about the 'sponge-ness' of the object to information attained through touch; nor can they relate their belief about the 'rock-ness' of the object to the act of looking. It is only beginning at age four or five that children are able to take into account the origins of their knowledge in their understanding of the world.

Can it be that despite specific reference to "looking" in the A-R studies children continue to be so unaware of the origins of their belief about the objects? As Wimmer et al. put it, children's "failure to understand the origins of their own representations must be truly profound" (p. 34). Perhaps children simply do not tag separate conceptualizations of reality and appearance with their belief(s) about a particular object as adults might do. Hence John may not conceive of the 'sponge' belief as the appearance of the object. Neither might he conceive of the 'rock' belief as the reality of the object. This does not mean that he does not know where these beliefs originate, only that they are not coupled to his beliefs about appearance and reality. This may explain why children who erred, made both intellectual realism and phenomenism errors. Flavell (1986) suggests much the same thing. He states it this way:

I have suggested some cognitive competencies that may variously be facilitative, necessary, or sufficient for a beginning understanding of the appearance-reality distinction. One competency hypothesized to be sufficient or nearly sufficient is an increased cognizance of subjectivity and mental representation; this competency may allow children to construe an illusory stimulus as simultaneously possessing two seemingly incompatible properties or identities - one identified with its appearance and the other with its reality. (p. 423)

Three different accounts have been examined in regard to the source of children's difficulty with the A-R distinction, yet none of them adequately answer the questions raised about this difficulty. Much research yet needs to be done before we will understand with clarity the structure of children's cognition. Responsible research
requires that task demands not only be congruent with the research question but also clearly understood by the subject. In his address to the American Psychological Association in 1985, Flavell (1986) remarked that "if there is one lesson to be learned from the recent history of the field of cognitive development, it is that the cognitive capabilities of young children are often seriously underestimated by the tasks developmentalists initially devised to assess those capabilities" (p. 420). A goal of the present study is to give another push to the curtain which blocks our view of young children's ability to distinguish between appearance and reality.

The Role of Perceptual Verbs

The manipulation by Pillow & Flavell (1985) will be examined in depth as a prelude to the specific purpose of this study. They investigated the effect of a change in perceptual verbs on subjects' tendency to commit intellectual realism errors on hidden block tasks. Intellectual realism is defined in the study as the "tendency of young children to indicate incorrectly all that is present in an object array when asked to indicate only what they can see of it from a particular perspective" (p. 664).

The authors hypothesized that the expression 'look like' may increase the tendency of young children to respond with realism answers because it is ambiguous and could lead to misinterpretation of task demands. The ambiguity, they contend, lies in the vague meaning of the expression 'look like'. If a young child is asked, "What does this (object) look like?", the response might include not only the perceptual characteristics of the object but also what the child believes or expects to be the case. Thus, the question "Does this 'look like' an X or does it 'look like' an X and a Y?" could be taken to mean, "Do you think there is just an X here or do you think there is an X and a Y here?" The subject might also interpret the question as a request for the identity of the object. Therefore the authors modified the test question so that the verb 'see' was used in a follow-up question.
The subjects watched through a viewing tube while the experimenter set up three types of block arrays. The tube was used to stress the act of looking. There were visible one-block arrays, visible two-block arrays in which both blocks were visible and hidden two-block arrays in which one block was seen but then hidden behind a larger one. The instructions directed the subjects to "look at what you see through here (viewing tube)". In testing for the effects of the two wordings, test questions using 'look like' were used first. All subjects who made three or more intellectual realism errors were presented with more trials in which the 'see' wording was used. For example, "Do you see just a blue block, or do you see a blue block and a red block?", instead of, "Does this look like just a blue block or does this look like a blue block and a red block?" Of the eight subjects who were given the follow-up trials only one showed no improvement. The average improvement for the rest was 3.13 correct responses in which two subjects who had a previous score of 0 scored 6 out of 6.

This substantial improvement indicates that subjects responded noticeably differently to the change in wording. Why they did so is not clear. Is 'see' a better substitute for 'look like'? Possibly this improvement was due to the more directive nature of the word 'see'. Pillow and Flavell did not explain why the new wording produced the contrasting results they reported. A look at the problem of perception and some of the literature surrounding the verb 'to see' and the expression 'look like' may illuminate the problems associated with the use of these perceptual verbs.

**Perception**

Paradoxically, although our knowledge about the world is dependent upon what we gather through our senses, it is also true that what we perceive is very much affected by what we know. The top-down theory of perceptual processing states that accumulated beliefs influence the interpretation of the objects of perception (Goldman, 1986). What we perceive either is mediated by or leads to particular beliefs about the perceived object (Heil, 1983). We do not just experience the visual sensation of
seeing; rather, what we believe about the object colors our perception of it and further, what we see may lead us to certain beliefs about that object. Percept, after all, is a representation of the world and thus potentially represents what we believe about the world. Most people, children included, assume that what something appears to be is what it really is, or at least, that something has only one "way-that-it-is" in the world (Flavell, 1988). The disassociation of an object's appearance from its identity requires an awareness of the subjectivity of appearance and an ability, learned or not, to engage in "compensatory belief" (Heil, 1983). That is to say, we learn to allow for the conditions that might cause us to misperceive an object. Thus a child confronted with a deceptive object might pass off the deception as its true identity without being aware of and compensating for the discrepancy.

There is a dearth of literature dealing with verb analysis which examines the expression 'look like' and even less which compares and contrasts this against the verb 'see'. A brief examination of these verbs will provide a better base of understanding about what we may be trying to extract from young children.

See

The verb 'to see' is complex and can occur in a wide variety of constructions (Warnock, 1965; Miller & Johnson-Laird, 1976). However, Miller and Johnson-Laird reduce the list to three main senses of 'see' (p. 585):

1) to perceive with the eye
2) to have a mental image of; visualize
3) to understand; comprehend

Each of these senses can be integrated with specific theories from philosophical and psychological perspectives on perception. To perceive with the eye is the physical act of seeing, the cognitive connection (Flavell, 1988) which informs us about the world. Looking at a chair with unobstructed vision and healthy eyes is an example of physical seeing. This kind of seeing can be devoid of knowledge or understanding
about the object; it can be devoid of any recognition of what that object is (Warnock, 1976; Miller & Johnson-Laird, 1976; Olson & Astington, 1987). A young child can see a tool in the garage and have no conception about its identity or its function, but he still sees it, albeit nonepistemically (Dretske, 1969).

Visualization is of course the mental representation of the object of our seeing, that which can be subject to mental manipulation and which is separate from objective reality. This has been identified as the central problem of young children's difficulty with the A-R distinction (Flavell, 1986). If children cannot understand that they can have more than one representation of their father, for example, then they cannot perceive of their father being their father and the President of a country simultaneously. He is either one or the other, not both.

To understand as one sees is what Dretske (1969) coined epistemic or informed seeing and can involve judgments such as identifying, describing, and classifying. In order to state that one sees a ball, one must know, or at least believe, that it is a ball and be able to differentiate balls from non-balls. One must also have a one-to-one correspondence between the actual object and the label for a ball. 'See', it seems, refers one back to one's own perceptual state and is a call to make some sort of judgment about objects or perspectives based on mental representations of them (epistemic seeing). If this is true, then for the block arrays, children should have greater difficulty answering correctly with the 'see' wording than the 'look like' wording in the hidden arrays because they already knew that there was a small block behind the large block. Because young children tend to report all that they know (mental image) rather than just what they see, they should have performed much worse with the 'see' wording. However the results obtained fly in the face of this kind of logic. It appears that 'see' in this type of task induces nonepistemic seeing of the kind which allows children to disregard previous knowledge about the arrays.
Look Like

The expression 'look like' can be interpreted in various ways. For example, "What does this look like?" can mean:

1. What does this resemble (remind me of)? or
2. What do I think this is? (what is it supposed to be?) or
3. What fanciful thing can my imagination conjure up that this might be like? (eg. cloud formations shaped like animals, faces, etc.)

Therefore it may be quite unclear even to adults what might be required to answer the question. Even more confusing is what a child of three or four might construe 'look like' to mean. Do young children really understand that the question "Does this look like a _____?" is a request for the appearance of an object or group of objects? In previous work with young children, Flavell used a pretraining procedure to teach them the meanings of 'look like' and 'really, really' and the difference between the two (Flavell et al., 1983). Unfortunately the procedure used no probes in order to determine from the children themselves exactly what they understood the terms to mean. They only watched passively while the experimenter told them what they saw, what it looked like and what it really was. It is entirely possible that very young children have an inadequate understanding of 'look like' or that they have a different understanding of it than adults. Generally, adults say that something looks like something else because they have reason to believe that what they are 'seeing' is not what it appears to be (Vesey, 1965). Because there has been so little investigation of 'look like', it is very difficult to ascertain just what factors come into play to cause the kind of problems young children encounter with the A-R distinction when this expression is used.

On the whole, we are inadequately informed about these two perceptual verbs. However, we cannot ignore the improvement shown by the children, remarkable considering that Flavell was unable to 'teach' subjects to distinguish between
appearance and reality in previous studies even though the training procedures were made as directive as possible. Pillow and Flavell, themselves, acknowledged that "the results of this study do not allow the conclusion that all cases of intellectual realism are purely artifactual or that young children have no difficulty differentiating between knowledge of an object or scene and its momentary appearance" (p. 670). They used quite a small sample size (n = 19) and the number of children who completed the 'see' condition was even smaller (n = 8). This made it difficult to determine whether their results truly supported their hypotheses. A follow-up study is necessary which attempts to replicate their results with a different sample to test whether their findings can be generalized to a similar population.

Statement of the Problem

The present study uses Pillow and Flavell's (1985) procedure with the hidden block arrays and extends the new wording to the Identity task used in the Flavell et al. (1983) study. This new task requires the subject to examine a realistic-looking fake object and to identify its appearance. The purpose of using these particular tasks is two-fold. First, it is desirable to test whether the original results with the hidden blocks can be replicated. Second, to test whether the results are generalizable to other task contexts. Since young children tend to commit intellectual realism errors on Identity tasks, the change in perceptual verbs has a potentially similar effect on the number of errors committed by young children. Having included the Identity task in the study, it would be prudent to mention the difficulties that might be embedded within this type of task.

The Identity task is quite different in nature to the Hidden Block task. In the latter task, the deception was simply a matter of hiding one block behind the other. In the former task, the deception lies inherent within the object itself. In other words, the appearance and reality of the object are concurrently present and presumably available to the subject. Thus the aspect of epistemic seeing (seeing and knowing),
could be a confounding factor when the 'see' wording is used. For example, consider a silk flower. To answer the 'look like' question seems relatively straightforward. It does look like a flower. However, to answer the 'see' question is more complicated. What does one see when one looks at a silk flower? Most adults would probably say, "I see silk that looks very much like a flower", or "I see a flower that is made of silk" because they know what it really is. How a child would answer that question is part of this investigation.

The following question will be examined:

"Does the wording of test questions affect children's ability to distinguish between appearance and reality as measured by Hidden Block and Identity tasks?"

**Hypotheses**

The following hypotheses will be addressed:

1. The use of the perceptual verb 'see' instead of 'look like' will result in a decrease in intellectual realism errors in the Hidden Block task.
2. The use of the perceptual verb 'see' instead of 'look like will result in a decrease in intellectual realism errors in the Identity task.
Chapter III
METHODOLOGY

In this experiment the same procedures and pattern of questioning that Pillow and Flavell designed for their block arrays task was used in an attempt to replicate their results with a different sample of subjects and a new task. Of the appearance-reality tasks used in previous research, the Identity task from Experiment two of Flavell et al. (1983) tended to elicit intellectual realism errors (identifying what is known about the object(s) rather than what appears to be). Because this was true of both the Hidden Block task and the Identity task, it was assumed that both tasks measure the same variable and that they could justifiably be considered repeated measures. It is possible that applying the change in perceptual verbs for the 'look like' question to the Identity task may also affect the pattern of intellectual realism errors made by young children. Therefore this task was added to the study to test whether the results will generalize to a different task type.

Subjects

Flavell (personal communication, January, 1988) indicated that the population from which he collected his original sample in the Pillow & Flavell (1985) study was the Laboratory Preschool of Stanford University, California. In order to replicate their sample as closely as possible in this study, 42 preschool children were sampled from the population of 3- and 4-year-olds attending the University of British Columbia Child Study Centre. The age range of the 19 three-year-olds was 3 years, 5 months to 3 years, 11 months with a mean age of 3 years, 8 months. The age range of the 23 four-
year-olds was 4 years, 2 months to 4 years, 10 months with a mean age of 4 years, 7 months. There were equal numbers of girls and boys (21 each).

The children were from middle- to upper middle-class, two-parent homes and were tested with the approval of their parents. Of the children whose parents consented to their child's involvement, only those who agreed to cooperate with the researcher were tested. In all, sixty letters of permission were distributed to parents. Of those, eight parents either did not respond or responded negatively. Out of a pool of 52 subjects whose parents consented to their involvement, 10 were excluded for the following reasons. Four turned 5 years of age prior to testing, two refused to accompany the researcher, three failed to complete the testing, and one child was unable to be tested because he was blind.

Materials

Five small 2-inch square colored plastic blocks and five large 6-inch square cardboard boxes covered with construction paper were used in the Hidden Block task. The blocks, both large and small, were of various colors.

The Identity task comprised a sponge rock, a white plastic egg in a glass egg cup, a wooden apple with a leather stem, two silk carnations, red and white, in a glass vase, a rubber chocolate chip cookie fridge magnet and a rubber bun.

A viewing tube, 15 cm in diameter, made of manilla tag and covered with colored construction paper, was used by the children to look at the objects on the table. Two manilla tag handles were attached to opposite sides of the tube for ease in handling.

A small portable cassette tape recorder and a PZ (Pressure Zone) Microphone were used to tape the testing session and the Probe at the end of the session.

Tasks and Procedure (see also Appendix A)

1a. Hidden Block Task

This task tested the ability of the subject to respond only to what can be seen rather than what is known. In this task a small block of one color was placed on the table first
while the child watched and then a larger block of another color was placed in front of it so that the small block was obstructed from the child's view as shown in Figure 1. Different combinations of colors were used for each trial.

Figure 1. Hidden block array

1b. Procedure

The subjects watched through a viewing tube while the researcher arranged each block array. These arrays were randomly assigned to the subjects. The researcher said, "Take a good look through here (the tube)." Then the test question was asked.

Look Like (LL) Condition: (X and Y represent the colors of the blocks)

"When you look through here right now, does this look like just an X block (large block) or does this look like an X block and a Y block (small hidden block)?"

If the subject gave one or more incorrect answers to the 'look like' question (LL Condition) during the viewing of the six hidden block arrays, another six hidden block arrays were presented using the 'see' question (See Condition). Those who scored perfectly in the LL Condition did not receive the See Condition. The reasoning behind this procedure was based on the assumption that the See Condition would reduce intellectual realism errors. If this is true, there would be no reason for using the See Condition if in the Look Like Condition no realism errors were committed. The
decision to use a cut-off point of one or more errors differed slightly from the procedure used by Pillow & Flavell (1985). Their cut-off point for eligibility in the See Condition was three or more errors. In the present study, a decision was made to lower the cut-off point in an attempt to increase the number of subjects who experienced both Conditions. This procedure was used both for the Hidden Block task and the Identity task.

See Condition:
"When you look through here right now, do you see just an X block (large block), or do you see an X block and a Y block (small hidden block)?"

2a. Identity Task

This task was designed to determine whether the subject could differentiate between the permanent, immutable identity of an object and its appearance. The stimuli comprised six realistic-looking fake objects (sponge rock, wooden apple, plastic egg, silk flowers, rubber bun and rubber egg).

2b. Procedure

The order of the stimulus items was randomly assigned to each subject. Each object was handed to the subject to encourage them to examine it more closely. No information was given to the subject, verbally or otherwise, about the object. It was then taken away and placed at a distance of about 1m from the child after which the experimenter gave the viewing tube to the child and said: "Take a good look through here." A test question was asked following each of the objects' presentation.
Look Like Condition:
"When you look through here right now, does this look like a (rock; egg; apple; some flowers; cookie; bun) or does it look like a (sponge; piece of plastic; piece of wood; some silk; piece of rubber; piece of rubber)?"

If the subject made any errors on the six tasks then the same tasks were presented again in a different order followed by the second question with the 'see' wording. Any subject who answered all the LL Condition questions correctly were exempted from the See Condition.

See Condition:
"When you look through here right now, do you see a (rock; egg; apple; some flowers; cookie; bun) or do you see a (sponge; piece of plastic; piece of wood; some silk; piece of rubber; piece of rubber)?"

Originally, the See Condition of each task was to follow immediately the LL Condition, provided that the subject failed to receive a perfect score on the LL Condition. However, administering the See Condition right after the LL Condition in the Block Array task would have meant that some of the subjects saw 18 block arrays consecutively. Some of the younger subjects became restless even after several arrays, so a decision was made to administer the LL Condition of each task before continuing to the See Condition, if necessary. This added variety to the presentation and was successful in reducing the numbers of subjects who may have dropped out due to boredom. The subjects received the tasks in one of two orders:

Order A. (22 subjects)
1. Visible and hidden block task (LL Condition)
2. Identity task (LL Condition)
3. Hidden block task (See Condition)
4. Identity task (See Condition) or

Order B. (20 subjects)

1. Identity task (LL Condition)
2. Visible and hidden block task (LL Condition)
3. Identity task (See Condition)
4. Hidden block task (See Condition)

The See Condition was conducted only if the subject made one or more errors in the LL Condition. These orders were randomly assigned to the subjects.

The tasks were administered to individual children during a 20-minute session which was audiotaped. Task order was randomly assigned so that half of all the children regardless of age received the Hidden Block task first and half received the Identity task first. The 'look like' wording only was used throughout the first administration of both tasks. Children with any errors on the hidden block arrays or identity tasks were tested again using the 'see' wording. The order of arrays or items within each task type was randomly assigned to the subjects.

Probe

A probe was included after the tasks in order to gather some information about young children's understanding of the expression 'look like' and the perceptual verb 'see'. This information was used to aid in the interpretation of the results. Following the administration of all the tasks each child was interviewed briefly about the verbs used in the test questions. This part of the session was also audiotaped. The probes were worded as follows:

1. When I say, "What do you see?" what does the word 'see' mean to you?
2. When I say, "What does this look like?" what does 'look like' mean to you?
Design of the Study

Age, gender, task and condition were the independent variables, each having two levels. The dependent variable was the number of correct identifications of the appearance of the stimulus objects for each condition.

The study is most effectively portrayed by a 2 X 2 X 2 X 2 (age X gender X task X condition) fixed effects, fully crossed design with repeated measures on the latter two factors (see Table 1 in Chapter IV). However, not all factors were analyzed simultaneously.

Data Preparation and Entry

The audiotapes of the testing sessions were transcribed and the protocols were scored according to the number of correct responses to each of the questions for each task. For a correct identification the item was scored as 1. For an incorrect identification the item was scored as 0. Each subject was given an identity number and the data for all tasks were then recorded on Fortran coding sheets. From these sheets the data were entered onto the University of British Columbia mainframe computer and double-checked for accuracy. A total of 3 errors were made out of a possible 1512 entries giving an error-rate of about 0.2%. These three errors were corrected.

Analysis

In order to address the hypotheses stated in Chapter 2, two repeated measures analyses were conducted using the Biomedical Program (BMDP) 2V on the Amdahl V6 mainframe computer at the University of British Columbia Computing Science Center. 2V performs, amongst other analyses, analysis of variance for fixed effects models and for repeated measures. It will accommodate data sets in which there are unequal n as in the case of this study. The program was run for two grouping factors (age and gender) and two within factors (task and condition) although not all factors
were analyzed simultaneously. Besides these two analyses, several post hoc analyses were also conducted. The analyses are noted below.

A. In order to determine whether task order affected the scores two independent t-tests were conducted to test for any order effect of the tasks.

B. Analyses pertinent to the hypotheses

1. Hypothesis 1:

   A 2 X 2 (Age-by-Condition) ANOVA for one grouping factor and one within factor, with repeated measures on the second factor, was conducted on the data for both conditions in the Hidden Block task.

2. Hypothesis 2:

   A 2 X 2 (Age-by-Condition) repeated measures ANOVA for one grouping factor and one within factor, was conducted on the data for both conditions in the Identity task.

C. Post hoc analyses

1. A 2 X 2 (Age-by-Task) repeated measures ANOVA for one grouping factor and one within factor was conducted on the data for the Look Like Condition in both tasks.

2. A 2 X 2 (Age-by-Task) repeated measures ANOVA for one grouping factor and one within factor was conducted on the data for the See Condition in both tasks.

3. A 2 X 2 X 2 (Age-by-Task-by-Condition) repeated measures ANOVA for one grouping factor and two within factors, was conducted on the data for both conditions in both tasks.

D. The next analysis was performed to test for possible gender effects.

2. A 2 X 2 X 2 (Age by Gender by Task) repeated measures ANOVA for two grouping factors and one within factor was conducted on the data for the Look Like Condition in both tasks.

In Chapter 4 the results of these analyses will be presented.
Chapter IV

RESULTS

Table 1 presents the number of 3- and 4-year-old girls and boys tested for each of the tasks and conditions in this study.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Subjects Per Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hidden Block Task</td>
</tr>
<tr>
<td></td>
<td>*LL Cond.</td>
</tr>
<tr>
<td>3-yr-old</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>4-yr-old</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
</tr>
</tbody>
</table>

* Look Like Condition has been abbreviated to LL Condition.

Table 2 shows that, of the 19 three-year-olds, 9 were girls and 10 were boys. Of the 23 four-year-olds, 12 were female and 11 were male. Thus there were 21 girls and 21 boys involved in the study. All of the subjects received the LL Condition but fewer subjects received the See Condition given that only those who scored less than perfectly in the first condition proceeded to the second condition. In the case of the Hidden Block task 63% of the three-year-olds received the See Condition, compared
to 31% of the four-year-olds. For the Identity task, 63% of the three-year-olds received the second condition whereas 83% of the four-year-olds received this condition.

Some gender differences appear when the percentages of boys are compared to those of the girls. In the Hidden Block task, 67% of the girls were administered the See Condition while only 24% of the boys received it. However, these gender differences are not as apparent in the Identity task where 71% of the girls and 76% of the boys received the See Condition. Gender differences will be discussed in more detail in Chapter V.

The analysis that follows was conducted to determine whether there might be any confounding effects upon the results by task order.

Independent $t$-tests for Task Order Effect

20 subjects received the Block Array task first and 22 received the Identity task first. In order to determine whether scores were affected by task order, the mean number of correct answers were computed within each task order in the LL Condition as seen in Table 2. The means for the Hidden Block task were further compared using two independent $t$-tests with a relaxed alpha of .20 to protect against committing a Type II error. The mean scores of the two task orders for the three-year-olds were compared and the analysis yielded a $t$-score which was less than $t$-critical. The same was done for the means of the four-year-olds and again, the $t$-score was less than $t$-critical at the .20 level of significance. Therefore it was assumed that any difference in mean scores is not attributable to task order.
Table 2
Means and Standard Deviations for Task Order in the Look Like Condition

<table>
<thead>
<tr>
<th>Subjects</th>
<th>n</th>
<th>Order</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-yr. olds</td>
<td>9</td>
<td>H/l*</td>
<td>3.22</td>
<td>2.28</td>
<td>3.89</td>
<td>2.20</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>l/H**</td>
<td>4.40</td>
<td>2.07</td>
<td>4.20</td>
<td>2.35</td>
</tr>
<tr>
<td>4-yr. olds</td>
<td>12</td>
<td>H/l</td>
<td>5.36</td>
<td>1.50</td>
<td>3.09</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>l/H</td>
<td>3.40</td>
<td>2.37</td>
<td>4.40</td>
<td>2.07</td>
</tr>
</tbody>
</table>

* H/l (Hidden Block task first, then Identity task)
** I/H (Identity task first, then Hidden Block task)

Results of the Analyses

1. Hypothesis 1

The first hypothesis predicted that the See Condition would elicit fewer intellectual realism errors than the Look Like Condition for the Hidden Block task. Thus, if this hypothesis is supported, the scores for the See Condition should be higher than those for the LL Condition. A 2 X 2 (Age-by-Condition) ANOVA with repeated measures on the second factor was performed on the data for the Hidden Block task. Table 3 shows the means and standard deviations of the correct responses for the subjects in this analysis, all who received both conditions. None of the subjects who obtained perfect scores in the LL Condition were included. Table 4 presents the summary of the repeated measures ANOVA.
Table 3  
Means and Standard Deviations for Subjects in Both Conditions of the Hidden Block Task

<table>
<thead>
<tr>
<th>Subjects</th>
<th>n</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-yr.-olds</td>
<td>12</td>
<td>2.08</td>
<td>1.98</td>
<td>2.00</td>
<td>2.80</td>
</tr>
<tr>
<td>4-yr.-olds</td>
<td>7</td>
<td>3.14</td>
<td>2.04</td>
<td>1.57</td>
<td>2.37</td>
</tr>
</tbody>
</table>

Table 4  
Summary of Repeated Measures ANOVA for the Hidden Block Task

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (A)</td>
<td>1</td>
<td>0.88</td>
<td>0.11</td>
</tr>
<tr>
<td>Residual</td>
<td>17</td>
<td>7.89</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition (C)</td>
<td>1</td>
<td>6.05</td>
<td>1.93</td>
</tr>
<tr>
<td>CA</td>
<td>1</td>
<td>4.89</td>
<td>1.56</td>
</tr>
<tr>
<td>Residual</td>
<td>17</td>
<td>3.14</td>
<td></td>
</tr>
</tbody>
</table>

The analysis reported in Table 4 yielded no main effect for Age or Condition and no interaction effect. Thus the hypothesis that the see wording would elicit fewer intellectual realism errors than the look like wording seems to be without support in the Hidden Block task. The null hypothesis that the means for the two conditions are not different is tenable.
2. Hypothesis 2

The second hypothesis stated that fewer intellectual realism errors would occur with the See Condition than with the Look Like Condition for the Identity task. Table 5 presents the means and standard deviations for the group of subjects who received both conditions. The corresponding results for the 2 X 2 (Age-by-Condition) repeated measures ANOVA are summarized in Table 6.

### Table 5
Means and Standard Deviations For Subjects in Both Conditions of the Identity Task

<table>
<thead>
<tr>
<th>Subjects</th>
<th>n</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Look Like Condition</td>
<td></td>
<td>See Condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-yr.-olds</td>
<td>12</td>
<td>3.83</td>
<td>1.75</td>
<td>4.58</td>
<td>1.83</td>
</tr>
<tr>
<td>4-yr.-olds</td>
<td>19</td>
<td>2.74</td>
<td>1.97</td>
<td>3.74</td>
<td>2.16</td>
</tr>
</tbody>
</table>

### Table 6
Summary of Repeated Measures ANOVA for the Identity Task

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (A)</td>
<td>1</td>
<td>13.88</td>
<td>2.74</td>
</tr>
<tr>
<td>Residual</td>
<td>29</td>
<td>5.06</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition (C)</td>
<td>1</td>
<td>11.26</td>
<td>4.23*</td>
</tr>
<tr>
<td>CA</td>
<td>1</td>
<td>0.23</td>
<td>0.09</td>
</tr>
<tr>
<td>Residual</td>
<td>29</td>
<td>2.66</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05
As shown in Table 6, a significant main effect was found for Condition \( F(1,29) = 4.23, p < .05 \). There was no significant effect due to Age and no significant interaction between Age and Condition. The significant main effect for Condition confirms the hypothesis that the 'see' wording decreases the number of intellectual realism errors in the Identity task. The null hypothesis that there is no difference in means for the two conditions is rejected.

The next few analyses were performed in order to tease out any further factors which may account for differences in the performance of the subjects.

Post Hoc Analyses

1. ANOVA for Age and Task Effects in the Look Like Condition

Table 7 presents the means and standard deviations for this analysis; the corresponding summary of the repeated measures ANOVA follows in Table 8.

| Table 7 |
|-----------------|-----------------|
| Means and Standard Deviations for Age and Task in the Look Like Condition |

<table>
<thead>
<tr>
<th>Subjects</th>
<th>n</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-yr.-olds</td>
<td>19</td>
<td>3.47</td>
<td>2.43</td>
<td>4.47</td>
<td>1.68</td>
</tr>
<tr>
<td>4-yr.-olds</td>
<td>23</td>
<td>4.96</td>
<td>1.74</td>
<td>3.30</td>
<td>2.18</td>
</tr>
</tbody>
</table>
Further examination revealed the presence of a significant Task-by-Age interaction \( [F (1, 40) = 10.71, \ p < .01] \) suggesting that the two age groups reacted differently to the tasks. This interaction is shown in Figure 2. As can be seen, the four-year-olds performed better than the three-year-olds on the Hidden Block task but worse than the three-year-olds on the Identity task.
2. ANOVA for Age and Task Effects in the See Condition

Because a Task-by-Age interaction was found in the previous analysis of the LL Condition, a 2 X 2 (Age-by-Task) repeated measures ANOVA was conducted to determine whether a similar interaction would also be revealed in the See Condition. The number of subjects included in this analysis was substantially reduced from the analysis on the LL Condition for two reasons. First, as explained earlier, fewer subjects received the See Condition than the LL Condition. Second, only those subjects who received the second condition for both tasks were included. That is, if any subjects received the See Condition on one task but not the other, then they were excluded from the analysis. Tables 9 and 10 present the respective means and
standard deviations of the subjects and the corresponding results of the repeated measures analysis of variance.

Table 9
Means and Standard Deviations for Age and Task in the See Condition

<table>
<thead>
<tr>
<th></th>
<th>Hidden Block Task</th>
<th>Identity Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects</td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td>3-yr.-olds</td>
<td>8</td>
<td>2.25</td>
</tr>
<tr>
<td>4-yr.-olds</td>
<td>7</td>
<td>1.57</td>
</tr>
</tbody>
</table>

Table 10
Summary of Repeated Measures ANOVA for Age and Task Effects in the See Condition

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age(A)</td>
<td>1</td>
<td>1.45</td>
<td>0.22</td>
</tr>
<tr>
<td>Residual</td>
<td>14</td>
<td>6.67</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task (T)</td>
<td>1</td>
<td>70.88</td>
<td>16.00*</td>
</tr>
<tr>
<td>TA</td>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Residual</td>
<td>14</td>
<td>4.43</td>
<td></td>
</tr>
</tbody>
</table>

*p < .01

As can be seen in Table 10, no significant Task-by-Age interaction was found in this condition. Rather, a significant main effect for Task, \( [F (1,14) = 16, \ p < .05] \), was revealed. This analysis suggests that the two tasks are significantly different from each
other. This main effect was not found in the analysis of the data for the Look Like Condition. However, this finding, together with the discovery of a significant main effect for Condition on the Identity task suggests that there is a Task-by-Condition interaction. The next analysis explores the possibility that this interaction may be significant.

3. ANOVA for Age, Task and Condition Effects

In order to test for the possibility of a Task-by-Condition interaction, a 2 X 2 X 2 (Age-by-Task-by-Condition) repeated measures ANOVA was performed on the data. As with the previous analysis the number of eligible subjects were 15. The means and standard deviations are contained in Table 11 followed in Table 12 by the summary results for the corresponding ANOVA.

<table>
<thead>
<tr>
<th>Table 11</th>
<th>Means and Standard Deviations For Age, Task and Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hidden Block Task</td>
</tr>
<tr>
<td></td>
<td>L.L. See</td>
</tr>
<tr>
<td>Subjects</td>
<td>n  Mean  S.D.  Mean  S.D.</td>
</tr>
<tr>
<td>3-yr.-olds</td>
<td>8  2.38  1.85  2.25  2.87</td>
</tr>
<tr>
<td>4-yr.-olds</td>
<td>7  3.14  2.04  1.57  2.37</td>
</tr>
<tr>
<td>Total</td>
<td>15  2.73  1.91  2.20  2.57</td>
</tr>
</tbody>
</table>
As shown in Table 12, the results of this analysis reveal a significant main effect for Task, \( F(1,13) = 5.57, \ p < .05 \), and a significant Task-by-Condition interaction, \( F(1,13) = 10.55, \ p < .01 \). The main effect for Task is not entirely surprising since this effect had already been detected in a previous analysis (see Table 10). However, that analysis included only the See Condition whereas the present analysis included both conditions. The presence of a significant Task-by-Condition interaction is confirmed in this analysis. Figure 3 illustrates this interaction.
4. ANOVA for Age, Gender and Task Effects in the Look Like Condition

Previous work done in the area of the appearance-reality distinction did not examine the effects of gender on the dependent variable. It was decided to examine this variable along with age and task for possible main effects and interactions, therefore a 2 X 2 X 2 (Age-by-Gender-by-Task) repeated measures ANOVA was performed on the data. The means and standard deviations of the subjects in the analysis are shown in Table 13. Table 14 presents the results of this analysis.
### Table 13
**Means and Standard Deviations for Age, Gender and Task in the Look Like Condition**

<table>
<thead>
<tr>
<th></th>
<th>Hidden Block Task</th>
<th></th>
<th>Identity Task</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td><strong>3-yr.-old</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>9</td>
<td>3.00</td>
<td>2.29</td>
<td>4.11</td>
</tr>
<tr>
<td>Boys</td>
<td>10</td>
<td>3.90</td>
<td>2.60</td>
<td>4.80</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>3.47</td>
<td>2.43</td>
<td>4.47</td>
</tr>
<tr>
<td><strong>4-yr.-old</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>12</td>
<td>4.08</td>
<td>2.07</td>
<td>2.83</td>
</tr>
<tr>
<td>Boys</td>
<td>11</td>
<td>5.91</td>
<td>0.30</td>
<td>3.82</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>4.96</td>
<td>1.74</td>
<td>3.30</td>
</tr>
</tbody>
</table>

### Table 14
**Summary of Repeated Measures ANOVA For Age, Gender and Task Effects In the Look Like Condition**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age(A)</td>
<td>1</td>
<td>0.90</td>
<td>0.21</td>
</tr>
<tr>
<td>Gender(G)</td>
<td>1</td>
<td>25.11</td>
<td>5.82*</td>
</tr>
<tr>
<td>AG</td>
<td>1</td>
<td>1.94</td>
<td>0.45</td>
</tr>
<tr>
<td>Residual</td>
<td>38</td>
<td>4.13</td>
<td></td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task(T)</td>
<td>1</td>
<td>2.29</td>
<td>0.65</td>
</tr>
<tr>
<td>TA</td>
<td>1</td>
<td>37.17</td>
<td>10.50**</td>
</tr>
<tr>
<td>TG</td>
<td>1</td>
<td>1.44</td>
<td>0.41</td>
</tr>
<tr>
<td>TAG</td>
<td>1</td>
<td>0.51</td>
<td>0.15</td>
</tr>
<tr>
<td>Residual</td>
<td>38</td>
<td>3.54</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05  ** p < .01
As can be seen from Table 14, the analysis revealed a significant main effect for gender, \( F(1,38) = 5.82, \ p < .05 \). An examination of the means for the boys reveals that in both tasks they performed better than the girls. There were no other significant effects due to gender.

The significant Task-by-Age interaction, \( F(1,38) = 10.50, \ p < .01 \), corresponds to the same interaction found in Table 8 for this condition and displayed in the graph in Figure 2.

The results reported in this chapter will be discussed in Chapter 5 together with suggestions for further research.
Chapter V
DISCUSSION

Introduction
The purpose of this study was to examine the effect of changing the perceptual verb in a test question on the number of intellectual realism errors committed by young children. It was hypothesized that the use of 'see' in the test questions rather than 'look like' would reduce the number of intellectual realism errors in the two tasks used in the study. The results of the analyses reported in Chapter 4 are discussed in this chapter followed by the limitations of the study and further research possibilities.

Discussion of the Results
Hypothesis 1
This hypothesis predicted that a change in perceptual verbs would reduce the number of intellectual realism errors committed by young children in the hidden block arrays. The results of the ANOVA do not support this hypothesis. Indeed, only 4 subjects showed any improvement in score (average increase, 2.75), whereas 8 subjects' scores fell (average decrease, 2.88) and 7 subjects' scores showed no change across conditions. None of the four-year-olds showed any improvement. This runs contrary to the results obtained by Pillow & Flavell (1985) in which, out of 8 subjects who received the See Condition, 7 showed improved scores (average increase, 3.13) and 1 score remained the same across both conditions.

Perhaps the subjects in this study interpreted both questions as one and the same question. This is supported by the statements of some of the subjects as they answered the 'see' question. They would answer, "It looks like..." even though the
question was, "What do you see?" Another possible explanation is that with several of the children it became apparent that they thought we were playing a memory game. Some answered this way: Researcher - "Does this look like just a green block... (child - "just a green block") ...or does this look like a green block and a black block?"... (child changes mind - "a green block and a black block"). It seemed these children thought they were supposed to recall as much as they saw and even prompts from the researcher to watch carefully and listen to the question did not make any difference to their response. One child said, "You were hiding the green one...you're hiding them". A four-year-old said, "...if they're behind each other you can't really see them", then immediately said, "I can see them, but it's a little hard". Then she moved so she could see both of them. This particular subject scored 3 in the LL Condition and 0 in the See Condition.

Hypothesis 2

The second hypothesis predicted that the number of intellectual realism errors would decrease with the use of the 'see' wording in the Identity task. The repeated measures ANOVA supports this hypothesis, revealing a significant main effect for Condition. This is in contrast to the lack of a significant Condition effect for the Hidden Block task. It seems that in the Identity task, subjects did respond differentially to the two perceptual verbs. Of the 31 subjects who received the See Condition, 14 showed increased scores (average increase, 3.07), 5 showed decreased scores (average decrease, 2.40), and 12 experienced no change in scores across condition.

Why did the change in perceptual verbs make a difference in the Identity task? Unfortunately the information gleaned from the Probe used at the end of the testing session did not produce much insight about the way young children interpret the two perceptual verbs. However, there were a great number of spontaneous comments made by the children as they looked at and handled the objects which may help explain the results. A perusal of these comments suggests that the children were
much more reflective about the stimulus objects in the Identity task than in the Hidden Block task. Most of the comments in the Identity task were made in the Look Like Condition when they were handling the objects. These statements fell into several categories:

a) statements identifying the object's appearance (eg. "egg, it's a egg"; "this is a doughnut"; "a cookie")

b) statements identifying the 'fakeness' of the objects (eg. "this isn't real"; "a pretend rock"; "flower, they're not wet at all because they're plastic")

c) statements explaining why an object was not real (eg. "it's made of wood"; "you can't eat it"; "that doesn't feel like a real egg"; "they don't smell like flowers")

d) statements contrasting what the object looked like with what it was (eg. "pretend apple, but it's wood"; "this is a fake egg...it looks like a real egg"; "it looks like a cookie but it has a magnet on the back of it, so it's a piece of plastic")

e) statements contrasting the look of the objects against the information gained by examination of them (eg. "it looks like a rock...it feels like a sponge"; "they don't smell like flowers...they just look like two flowers")

Categories b) and c) contained by far the largest number of statements suggesting that, as a whole, the children had a pretty good idea what the objects were made of and that they were not real. If this is true, then the 'look like' wording must truly be confusing because 31 subjects performed less than perfectly and more than 50% of them made 3 or more errors. One would have expected that the children would have performed much better than this given their understanding of the nature of the objects. The fact that the subjects performed better with the 'see' wording confirms the hypothesis that the use of this perceptual verb does decrease the number of intellectual realism errors.

It would, however, be inappropriate to explain the difference solely in terms of the children's differential interpretation of the two verbs. If this was a viable explanation
then a significant main effect for Condition should have been found for the Hidden Block task also but it was not. It seems that other confounding factors exist which play a role in the interpretation of these inconsistent results.

Here, it would be fitting to bring into the picture the results of two post hoc analyses which examine these confounding factors. They are the ANOVAs which are reported in Tables 10 and 12.

**Task Effects in the See Condition**

The ANOVA for Age and Task effects in the See Condition revealed a significant main effect for Task (Table 10). As mentioned in Chapter II, the two tasks are unique and distinct. The Hidden Block task is quite straightforward in which appearance and reality are manipulable and separate. In the Identity task, appearance and reality are contained in one object which could lead to confusion about the appearance or reality of the object. Previous research in which these two tasks were used (Flavell et al., 1983) also revealed significant main effects for task so it was not unreasonable to expect the same in this study. An examination of Table 9 in Chapter IV shows that the subjects performed better on the Identity task than on the Hidden Block task with a mean difference of 2.63 points. However, this significant main effect was found in the See Condition and not in the Look Like Condition suggesting that the difference between means in the See Condition cannot be attributed solely to task differences.

**Task-By-Condition Interaction**

Significant main effects were found for Task in the See Condition but not the Look Like Condition and similarly found for Condition in the Identity task but not the Hidden Block task, which suggests that a Task-by-Condition interaction was present. The summary in Table 12 revealed that, indeed, this Task-by-Condition interaction was significant. This interaction informs us that neither the Task nor the Condition effect alone accounts for the variances that are seen in the performance of the subjects.
Thus, the decrease in the number of intellectual realism errors in the Identity task is probably due to an interaction between the task and the wording.

Age-By-Task Interaction in the Look Like Condition

The Age-by-Task interaction graphed in Figure 4 shows that the three-year-olds performed better in the Look Like Condition of the Identity task than the Hidden Block task. The four-year-olds performed better on the Hidden Block task than the Identity task.

Flavell et al. (1983) also discovered that their four-year-olds performed better on Hidden tasks than their three-year-olds. This task is similar to the Hidden Block task except that different materials were used and the test question was slightly different. Suggestions have previously been made in this chapter about why younger children may have performed poorly on the Hidden Block task. Better performance by the three-year-olds on the Identity task is somewhat puzzling. One might have expected that if they had trouble with the Hidden Block task, they would have experienced equal if not greater difficulty with the Identity task because the former task seems more straightforward than the latter task as discussed in Chapter II.

Comments by the three-year-olds indicated that they knew that the objects were not real but what seems to have happened was that when they verbalized the object's appearance, even comments like "a pretend rock", this seemed to fix it in their minds. When the researcher asked the test question, the object appearance, having recently been verbalized, was easily accessible in short-term memory. Also, very few comments included mention of the object's material (identity) so that when the researcher used words like wood, plastic, rubber or silk, they did not strike a responsive chord. This may explain why the younger group performed as well as they did on the Identity task.

The four-year-olds experienced little difficulty with the Hidden Block task. Even the ones who made errors performed fairly well, with only two subjects making more than
three errors. However, they performed much more poorly on the Identity task. In this task the comments of the four-year-olds included many more instances where the object's material (e.g. sponge, wood) was mentioned. They were more cognizant of the fact that appearance and reality were contained in the object at the same time but seemingly could not sort out their understanding of the object in relation to the test question. Some of them even made a point of answering the test question with appearance and reality answers. For example, in reply to the question, "Does this look like an apple or does it look like a piece of wood, one child said, "..piece of wood apple". For the plastic egg, another child responded, "..both of them; an egg and a plastic". Thus they were confusing their knowledge of the object identity with a request for the appearance of the object, seemingly true cases of intellectual realism.

Gender Effects in the Look Like Condition

In this study significant gender differences show up in the Look Like Condition as revealed in Table 16. Why the boys performed better than the girls overall is not altogether clear and is not informed by past research in this area. Sanders & Pinhey (1983) describe demand characteristics as experimental situations wherein "...experimental subjects act as they believe the experimenter wants them to..."(p. 170). Borg & Gall (1983) suggest that subjects "are likely to use cues present in the environment to come to conclusions as to what the experiment is attempting to achieve, what is expected of them as subjects in the experiment, and what the researcher hopes to find" (p. 218). It may be that girls are more susceptible to this than boys. In this study, the researcher found that more girls than boys asked how they were doing and wanted to know whether their answers were right. Also more girls changed their answers if they somehow sensed that their first answer was not correct. More girls than boys responded with the first option of the test question, then with the second option when it was stated. This may possibly account for the poor performance of the girls, especially on the Hidden Block task.
Limitations of the Study

In this study three- and four-year-old subjects, both boys and girls, were tested. They came from middle- to upper middle-class homes and in all cases both parents reside at home. Most of the fathers and about 30% of the mothers are professionals. Most of the parents are highly motivated and aware and expect a great deal from the school and their children.

The children all attend the University of British Columbia Child Study Centre preschool where the head teachers hold Bachelor's or Master's degrees in Early Childhood Education. All teaching assistants have at least a Bachelor's degree in Education and usually some teaching experience and are presently working towards a Master's or Doctoral degree. Thus the level of education of the teachers and assistants at this preschool is generally much higher than that of a regular preschool. The philosophy of the school is based on current research and there is a high level of involvement by the parents. It is probably safe to assume that this population of preschool children differs from the regular population of preschool children and that the generalizability of the study is limited to those children who have similar backgrounds and educational experience.

Because of the special nature of this group of children, there were risks in reaching ceiling effects on the test items. This did occur with the four-year-old boys on the Hidden Block task. Out of 12 boys tested, only one did not perform perfectly on the LL Condition. This reduced quite substantially the number of four-year-olds who received the See Condition. Overall, this affected the n of some of the analyses so that the power of the test for differences in means was reduced. It was hoped, in this study, that reducing the cut-off point for moving on to the See Condition from 3 errors to 1 error would increase the number of subjects in the second condition. However, only 45% (compared to 42% in the Pillow & Flavell study) received the second condition partly because there was missing data on some of the subjects for the See Condition.
This too contributed to the reduced numbers of analyzable scores. These numbers could have been increased by having every child receive the See Condition regardless of their performance in the LL Condition. This would not have affected the testing procedure in light of the desire to replicate Pillow & Flavell (1985) as closely as possible.

**Conclusions**

In summary, the results of this study lend some support to the hypothesis that the use of the perceptual verb 'see' rather than the phrase 'look like' reduces the number of intellectual realism errors committed by young children. However, the effect of this change in perceptual verbs was influenced by task type such that there was a significant effect due to the change only in the Identity task. The results also suggest that age is a determining factor in how children react to the two different tasks. Three-year-olds performed better on the Identity task than the Hidden Block task whereas four-year-olds tended to perform better on the Hidden Block task than the Identity task. Finally, boys tend to perform better on these tasks than girls regardless of age or task.

As in many studies, this study has raised more questions than it answers. The following section lists some ideas for further investigation that have arisen from the present study.

**Suggestions For Further Research**

1. Modifications to the study:
   
a. Increase the number of subjects in the second condition by testing all of the subjects regardless of their performance on the first condition.

b. Test the effect of the order of appearance and reality answers given in the test question. For example, subjects in one group would hear the test question worded so that the appearance answer occurred first. The second group of subjects would hear the test question worded so that the reality answer occurred first.
2. Compare the performance of a group of average preschoolers to the performance of a select group of youngsters similar to the ones in this study.

3. Conduct the study again, but besides the appearance question include the reality question used in previous appearance-reality studies.

4. Develop a method for analyzing the comments of the children to provide a better base of support for interpretation and to gain more insight into what is actually happening in the minds of the subjects.
REFERENCES


Braine, M. D. & Shanks, B. L. (1965). The conservation of a shape property and a proposal about the origin of the conservations. Canadian Journal of Psychology, 19, 197-207. (b)


APPENDIX A - A Note About the Visible Arrays
A Note About the Visible Arrays

An explanation is required here in regard to the visible array scores. Pillow & Flavell (1985) used the visible array scores as a comparison with the hidden array scores for pictorial or verbal response. It was felt necessary to replicate the procedure of the 1985 study carefully including the visible arrays so that a comparison of results concerning the perceptual verbs could be made. However, the present study does not require this kind of comparison and its hypotheses are limited to the hidden block arrays. Since the scores for the visible arrays were not important to the original hypotheses or the post hoc analyses of this study, they have not been included in the main body of this thesis nor were they analyzed.

The visible arrays are described and illustrated below.

i) Three one-block visible arrays - Figure 4 shows this configuration in which a single small block was placed on the table in front of the child.

![Figure 4. One-block visible array](image)

ii) Three two-block visible arrays - as can be seen in Figure 5, a small block of one color was placed on top of a large block of another color. Different combinations of colors were used for each trial.

![Figure 5. Two-block visible array](image)

These block arrays were administered along with the hidden block arrays in random order.

The procedure used for the visible arrays was as follows: The subjects watched through a viewing tube while the researcher arranged each block array. The researcher said, "Take a good look through here (the tube)" and then asked the test question.
Test question:
Look Like Condition (X and Y represent the colors of the blocks)
i. (one-block visible)
"When you look through here right now, does this look like just an X block (small block) or does this look like an X block and another block?"
ii. (two-block visible)
"When you look through here right now, does this look like just an X block (small block) or does this look like an X block and a Y block (large block)?"
(the See Condition was not conducted on any of the visible arrays).
APPENDIX B: Sample Protocols
Name ___________________________     ID ________

Birthdate _________________________     Age ________

Date _______________________________

I. APPEARANCE-REALITY TASKS

A. Identity Task

Condition 1:
1. sponge rock    4. silk flower
2. rubber egg    5. rubber cookie
3. wood apple    6. rubber bun

Condition 2:
1. rubber bun    4. wood apple
2. silk flower    5. sponge rock
3. rubber cookie    6. rubber egg

B. Hidden-Objects Task

Condition 1:
1. V - y / black    7. V - green
3. V - r    9. V - o / y
5. V - g / p    11. V - blue

Condition 2:
1. g / o    4. g / y
2. o / p    5. r / p
3. blue / black    6. y / blue

C. Probe:
1. When I say, "What does this look like?", what does 'look like' mean to you? ________

                                                                                           
                                                                                           
2. When I say, "What do you see?", what does 'see' mean to you? ________

                                                                                           
                                                                                           
Name ___________________________   ID ________
Birthdate ___________________________   Age ________
Date ________________________________

II.

**APPEARANCE-REALITY TASKS**

A. Block Arrays Task (V - Visible; H - Hidden)

<table>
<thead>
<tr>
<th>Condition 1:</th>
<th></th>
<th>Condition 2:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. V-y/black</td>
<td>7. V-g</td>
<td>1. g/o</td>
<td>4. g/y</td>
</tr>
<tr>
<td>4. H-y/o</td>
<td>10. H-g/black</td>
<td>4. g/y</td>
<td></td>
</tr>
<tr>
<td>5. V-g/p</td>
<td>11. V-blue</td>
<td>5. r/p</td>
<td></td>
</tr>
</tbody>
</table>

B. Identity Task

<table>
<thead>
<tr>
<th>Condition 1:</th>
<th></th>
<th>Condition 2:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. sponge rock</td>
<td>4. silk flower</td>
<td>1. rubber bun</td>
<td></td>
</tr>
<tr>
<td>2. rubber egg</td>
<td>5. rubber cookie</td>
<td>2. silk flower</td>
<td></td>
</tr>
<tr>
<td>3. wood apple</td>
<td>6. rubber bun</td>
<td>3. rubber cookie</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition 2:</th>
<th></th>
<th>C. Probe:</th>
<th></th>
</tr>
</thead>
</table>
| 1. rubber bun               | 4. wood apple        | 1. When I say, "What does this look like?", what does 'look like' mean to you? ________
| 2. silk flower              | 5. sponge rock       | ___________________________________________________________
| 3. rubber cookie            | 6. rubber egg        | ___________________________________________________________

2. When I say, "What do you see?", what does 'see' mean to you? ____________________

_________________________________________________________

_________________________________________________________