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**Children's Concept of Understanding:  
Its Role in Comprehension Monitoring**

**By**

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**A thesis submitted in conformity with the requirements  
For the degree of Master of Arts  
Department of Human Development and Applied Psychology  
Ontario Institute for Studies in Education of the  
University of Toronto**

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**Children's Concept of Understanding: It's Role in Comprehension Monitoring**  
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**Abstract**

Research in the area of comprehension monitoring shows that children often fail to monitor their own comprehension. This study hypothesizes that what these poor monitors may lack is a concept of understanding. A concept of understanding is argued to involve aspects of information and information transfer. Thus subjects were tested on their ability to judge information adequacy, assess information perspective, ascribe understanding and describe the purpose of discourse. Children ages 3 to 7 years were tested for comprehension monitoring ability as well as for a concept of understanding. Most tests showed a substantial increase in performance on measures of a concept of understanding and of comprehension monitoring at around age five. The two types of tasks were highly related in that high monitors were consistently superior in measures of understanding understanding. The results show that comprehension monitoring can be explained by the acquisition of a concept of understanding.

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## Chapter 1: Introduction

Long ago around 250 BC in Syracuse, King Hieron II gave as material for a crown, a measured quantity of gold to a goldsmith. King Hieron admired the produced crown but was nagged by suspicions that the goldsmith had alloyed some of his gold, used the alloyed gold for the crown and had kept a quantity of pure gold for himself. The suspicions so took away from Hieron's enjoyment of the crown that he called in the thinker of the family, Archimedes, to tackle the problem. However, it was a problem that the mathematics of the day could not solve without reforming the crown into a bar so Archimedes left Hieron and began trying to think of an alternate solution to the problem. Archimedes still had no solution some time later as he lowered himself into a relaxing bath. Perhaps with half a mind to reprimand his servant, Archimedes watched as water spilled over the side of the over-full tub as he settled into the bath. Suddenly, Archimedes saw the solution to the problem and gave the famous shout, "*Eureka!*"--I've got it! What did Archimedes have? Well, two amounts of gold of equal masses will displace the same amount of water even if their shapes are entirely different. The solution to the problem of the crown: measure the amount of water displaced by the crown and by a bar of gold of equal mass; if the amounts are equal then the goldsmith will be exonerated. Rumour has it that the test was carried out and the goldsmith was proven guilty.

This story is a classic example of a moment of understanding--what some might call a flash of insight. What is that flash? What happens to us when suddenly we understand something? Think again of Archimedes calling out "*eureka*" or of your own *eureka*s. What let you or Archimedes say, "I have it;" what quality existed that enabled you to say that you understood?

### ***What is Understanding?***

Thorngate (1995) would say that the person who has that flash also experiences an emotion and that emotion is called, understanding. Understanding is also described by Thorngate not as a cognition, but rather as a release from the tension created by curiosity. Perhaps this different construction of understanding reflects a different approach to the subject. Thorngate speaks of understanding as a resulting feeling and not as a cognitive process. This study advances the idea

that understanding is both a process and a result. Understanding has many levels, not all of which involve emotion, included among them: symbol recognition (e.g. "chair" is the symbol for the object), grammar recognition (e.g. interrogatives) and meaning making (understanding). Each of these facets of understanding involves both procedure and result as well as an emotion. Emotions require an awareness of physiological responses--they must be *felt*. A rapidly beating heart, for example, might indicate that one is (feeling) nervous. One cannot have an emotion without awareness. A rapidly beating heart that goes unnoticed by the individual cannot be termed nervousness. It may be argued that understanding can occur even in the absence of recognition that understanding has occurred; think, for example, of the automatic nature of reading. The decoding involved in incidental reading is an example of understanding that does not involve flashes of insight, emotion or perhaps even recognition. That is not to say, however, that understanding does not involve emotion. It could be suggested that the feeling aroused when one thinks one has misunderstood leads to corrective measures such as re-reading or requests for clarification and then causes a corresponding emotion that assures the individual of his or her comprehension.

It is difficult to define understanding. First, the difficulty stems from the fact that there are degrees or levels of understanding. I think Rosenberg said it well when he noted, "[Understanding], for example, has too many parts to be readily enumerated or their interrelationships are too involved to be easily grasped at once" (Rosenberg, 1981, p.31). It is possible, for instance, to understand only a portion of something. A clear example of this can be found in the oft repeated response I received from adults after reading them an ambiguous story about eating holes (the hole in the centre of a donut); time after time, when asked if they understood the story, the adults often replied, "I understand the story, but it doesn't make sense." This response exemplifies some of the divisions that exist within understanding; in this case, the two different levels of 1) getting the words and sentences and of 2) getting the meaning or the text as a whole.

Second, understand may apply to both events as well as to expressions. For example, I understand both how an automobile engine works and I understand what a sentence means or what another person means by a statement. Thus, there are several ways to understand. First, one might understand in an academic way as in demonstrating that one understands the rules of a game by

keeping score. Second, one might understand in an empathic way as in “wearing another’s moccasins.” Third, one might understand in an active way as in being able to construct a model aeroplane from diagrams. These different ways to talk about and demonstrate understanding contribute to the difficulty of defining the term well. All of these kinds of understanding, however, have a common attribute and that is that each one involves the feeling of an agreement about the communication of specific information. It is this aspect of understanding that is central to the concept of understanding examined in this study.

Finally, understanding can apply to self or other. For example, on a grammatical level, the verb *To Understand* is transitive: it transmits the action of the subject to a direct object. In other words, one must always be referring to someone about something when one says, for example, “I understand you” or “He understands physics.” One can understand one’s self in the same way that one can understand others. Indeed, understanding is reaching an accord with others on what was intended or meant by a message. This notion of an accord is fundamental to a concept of understanding.

It may be argued that in order to monitor one’s own or another’s understanding or misunderstanding, one must have a concept of understanding. Central to this concept is knowledge of the causes of misunderstanding. These causes of misunderstanding tend to centre on aspects of information such as ambiguity (not enough information), deception (wrong information), forgetfulness (lost information) and inconsistencies (conflicting information). Second, one must have some idea of perspective: point-of-view (what information is available), bias (how is the information being filtered?), what information is known/not known and what information must be known for a successful understanding. Finally, understanding is purpose driven—one must have an idea of the purpose if one is to judge that one has understood. In some contexts a partial message may be understood if the listener has already grasped most of the necessary facts. Thus, I suggest that the concept of understanding involves an understanding of information adequacy, perspective taking, meaning making and intention of discourse.

Philosophers on understanding:

How does one know when one understands something correctly and what is it that enables this sort of judgement to be made? Until recently, philosophers were interested in knowledge not in understanding. Interestingly, Descartes' seventeenth century model of the Cartesian mind never thinks, "I know that I understand." Descartes explains the cognitive component of belief and of error formation but fails to address the meta-cognitive component of comprehension monitoring and error detection.

Not long after Descartes, Locke (1689) gives an expanded account of the cognitive component of understanding in his book *On the Conduct of the Understanding*. Locke was an empiricist; he believed that knowledge was derived from experience. At birth the mind is a *tabula rasa* and concepts or ideas develop as the mind encounters the world via the senses and then ponders the new information. It is not enough, points out Locke, to cram ourselves with information and declare ourselves knowledgeable. Instead, one must ruminate the information, "chew them over again" in order to have real understanding (Locke, 1706, p. 73, §20). For Locke, one must have ideas and then be able to explain not only these ideas but also the terms used to describe them. Today, we would call these "ideas" that Locke refers to "concepts." For example, Locke discusses as "ideas" what modern researchers would term a "concept of colour" when he notes that a child who is exposed to only black or white would have no ideas of scarlet or green as an adult (Locke, 1689). Locke subdivides these ideas into five qualities: 1) clear and obscure, 2) distinct and confused, 3) real and fantastical, 4) true and false or right and wrong, 5) adequate and inadequate. These qualities of ideas are particularly relevant to the definition of understanding used in this study because they reflect the qualities of information transfer that are enveloped by a concept of understanding (including understanding communication failure or the perspective of others). Locke, however, was more concerned with knowledge than with understanding.

In the mid-eighteenth century, Emmanuel Kant introduced Transcendental Philosophy which first raised understanding into the central philosophical problem. For Kant, the principles of reality were to be discovered by the study of the processes of thought. Kant believed that pure concepts of understanding contained nothing from sensation; instead, pure knowledge was found in the mind and not in objects (Wolff, R.P., 1963, p. 213). When Kant speaks of concepts of understanding, he refers not to the metacognitive notion of a concept of understanding as described in this paper; instead, he refers to *the mind* coming to bear upon the world via translated and categorized sensation such that an understanding of the world and its objects is formed that is purely cognitive and separated from the sensory manifold. Therefore, for Kant, people have to “make sense” of stimuli rather than merely respond to them--people must understand. Kant looks to the cognitive as a confirmation of the objective experience in his philosophy of understanding.

The nineteenth century brought new philosophers and new ways of thinking about understanding. John Dewey (1986, original 1854-1952), one example, was a pragmatist. Under pragmatism, understanding becomes distinguished from memory. Understanding is multi-leveled; for example, one might understand the words of a given proposition yet not understand the meaning of that same proposition; Dewey alludes to these as different levels of understanding. For example, Dewey notes that in discourse, it is necessary for those involved to understand the propositions but fulfilling this condition does not guarantee that the propositions will have validity when applied to the given problem. Just as Locke felt that understanding meant getting the meaning from the words, Dewey believes that understanding enables one to formulate propositions that are not only sensible (meaningful) but are also valid (practical or applicable). To earlier theorists (i.e., before Kant), such a distinction appears to have been unavailable.

Shortly after Dewey was developing pragmatism, Ludwig Wittgenstein was expounding his own philosophy of language. When speaking of thought, Wittgenstein noted, “Thought does not strike us as mysterious while we are thinking, but only when we say, as it were retrospectively: ‘How was that possible?’” (Wittgenstein, L. 1963, §428, p. 127e). He goes on to note: “We speak of understanding a sentence in the sense in which it can be replaced by another which says the same;

but also in the sense in which it cannot be replaced by any other . . . . These kinds of use of "understanding" make up its meaning, make up my concept of understanding" (Wittgenstein, L., 1963 §531-532, p. 143e). Wittgenstein makes two points here that are important to this study: first, he expresses the notion of metacognition in that he discusses thinking about thinking and second, he speaks of a concept of understanding. In this study, a concept of understanding is viewed as knowing about information adequacy, perspective taking, meaning making and intention of discourse. Unlike the philosophers discussed earlier, Wittgenstein considers not only thinking but also thinking about thinking. Wittgenstein, acknowledges the multi-tiered nature of understanding; furthermore, Wittgenstein denotes understanding as a concept.

Finally, Gilbert Ryle also alludes to the multi-tiered nature of understanding when he notes, "Though there is no way of specifying how many or what sub-tests must be satisfied for a person to qualify as having perfectly understood the argument, this does not imply that no finite set of sub-tests is ever enough" (Ryle G., 1949, p. 170). The fact that Ryle makes the distinction between getting the words and getting the meaning provides further support for this view of understanding. Furthermore, Ryle also supports the introspective nature of understanding by describing deductions as being tested by "silent soliloquy." For Ryle, understanding means not only knowing but also knowing *how*.

Over time we have seen several aspects of understanding come under the consideration of philosophers. When we began our examination of thought, understanding is treated most often as a noun, "The Understanding," which is more or less a synonym for "mind" and makes grand reference to all thought and logic. As we move towards current day, understanding is most often talked of in three ways: 1) as a verb, "To understand," 2) as a portion of brain function and 3) as one's "making sense," something one does. In this study, understanding is also viewed as a composite. Understanding is an "achievement" verb, that is, one must grasp the given meaning when one does "understand" otherwise one has just misunderstood. However, of more interest to me than understanding as an achievement accompanied by a feeling of understanding is the feelings normally activated when one thinks one does not understand. It is this negative feeling, I argue, which provokes comprehension monitoring. In this thesis, I argue that as children acquire a concept of

understanding, they come to experience the emotions related to understanding or misunderstanding. The acquisition of the concept of understanding is then reflected in their comprehension monitoring skills. Specifically, a concept of understanding is present when: 1) understanding is an understanding of something 2) it is applied to both self and other and 3) understanding involves a feeling typically of comprehension or incomprehension. Children possessing this concept are expected to engage in comprehension monitoring, that is, tests of their comprehension more so than those who do not.

## **Chapter 2: Related Research**

### ***Review of the Literature***

This thesis looks at the link between comprehension monitoring and a concept of understanding. Although these two terms have similarities they are quite different and these differences are as follows: First, comprehension monitoring is a skill one applies to oneself whereas a concept of understanding can be applied to self as well as to others. Second, comprehension monitoring involves checking one's own understanding; it is provoked, I suggest, by the feeling of misunderstanding and not provoked when one has a feeling of understanding. Finally, successful comprehension monitoring will employ corrective strategies. It is the availability of a concept of understanding that enables such feelings, monitoring and correction to occur, I shall argue. This section will examine the research in both the area of comprehension monitoring and the area of the concept of understanding. Finally, this previous research will be summarized and a link between comprehension monitoring and understanding will provide the basis for the hypothesis of this study.

### ***Comprehension Monitoring—A Skill Applied to the Self***

There is a maxim that loosely reads, "There is no learning without correction." Undoubtedly, this statement can be both supported and disputed, but that exercise is of less interest than recognizing what the maxim acknowledges about the learning process. Specifically, this maxim indicates that correction is a fundamental step in learning. In fact, it may be argued that it is self-correction that most influences the learning process. Self-correction is a meta-cognitive skill; it is the part of comprehension monitoring that allows one to seek solutions to problems and failures of understanding. The ability to recognize errors, confusions and misunderstandings in communication that may be, for example, person-to-person or author to reader is invaluable to a learner as it provokes, I shall argue, comprehension monitoring.

Comprehension monitoring is a step in the process of making sure that incoming information makes sense to oneself. One may read several pages and then turn back as many pages after realizing that one has almost no idea what has been read. That recognition of incomprehension and the strategies used to remedy it exemplify comprehension monitoring. My suggestion is that the recognition of misunderstanding is an identifiable feeling.

### Comprehension Monitoring Studies

Comprehension monitoring is a metacognitive process affected by person, strategy and task variables (Wagner, 1983, p. 328). A failure to monitor comprehension was first described by Markman (1979). She found that children in grades three through six did not spontaneously monitor their comprehension though they had the ability to carry out many of the processes involved such as retaining in memory and drawing relative inferences. Markman advanced the hypothesis that because of processing demands children fail to monitor their comprehension. Markman employed an error-detection paradigm in which the subject reads or hears ambiguous or incomprehensible information and is asked to evaluate the given information for clarity and comprehensibility. To encourage reporting of errors, Markman's subjects were taken on as "consultants" who are informed about and are asked to help fix or find the errors in the study materials. For example, in a study utilizing inconsistent information within texts, the researcher explained to her subjects that she was trying to write stories for kids and needed their help to make sure that the stories were clear and easy for children to understand. In such cases the children frequently fail to detect anomalies in texts.

In a study of children in grades 3, 5 and 6, Markman (1979) utilized explicit and implicit inconsistencies in stories read to the subjects. An explicit inconsistency in a text about fish is as follows: *It is so dark at the bottom of the ocean that fish cannot see colours. Some fish at the bottom of the ocean can see the colour of their food; that is how they know what to eat.* An implicit inconsistency for the same story is the following: *It is so dark at the bottom of the ocean that fish cannot see colours. Some fish at the bottom of the ocean know food by its colour. They will only eat red fungus.* Children in this study commented on the stories quite freely but failed to detect the

inconsistency in most cases. The implicit condition was significantly more difficult than the explicit condition for the subjects however performance in both conditions was poor for all of the subjects. Having children repeat the inconsistent sentences as they were read made no significant improvement in performance however sixth graders did improve when told to find the error while third graders' performance did not. Essentially, despite carefully processing texts for a specific purpose, children may not detect inconsistencies automatically. As stated earlier, a concept of understanding involves understanding of the intention of the discourse (i.e. to convey information sensibly). When Markman's subjects were told the story had a problem, they were, in a sense, reminded to pay attention to the intention of the discourse. This reminder enabled the older subjects to improve their performance on the task. It could be argued that when younger children perform poorly on this task they do so because they have not acquired a concept of understanding and may not know the intention of discourse.

Another study that demonstrates children's unreliable comprehension monitoring skills was conducted by Schmidt and her associates (1984). Two clue sentences described the protagonist playing a game of hide and go seek and one clue sentence hinted that the protagonist was playing baseball. The misleading clue sentence was either the first or the last of the three clue sentences. Subjects were asked to make an inference as to the game being played based on the clue sentences and to report any discrepancies. Children of all ages would make inferences but only the older children would report discrepancies leading the researchers to conclude, like Markman, that the processing underlying comprehension monitoring changed with development. It appears that young children do not have a framework for understanding the impact of text inconsistencies. It may be that rather than failing to understand the impact of the inconsistency, subjects simply do not have the concepts necessary to *detect* the inconsistency. Perhaps the developmental changes which Schmidt and her colleagues proposed are reflections of the acquisition of a theory or concept of understanding. In this way, when children acquire a concept of understanding, they become aware of the causes of misunderstanding. They then become more aware of the necessity for repair strategies when these causes (i.e. inconsistent information) occur.

More recently, Ruffman (1995) utilized a two-story method with eight year-olds where subjects were read a consistent story and an inconsistent story and then asked which made more sense. Varied story lengths along with probe questions ensured that processing demands such as memory were not an influence in the subjects' performances. Ruffman found that children of this age were not significantly able to discriminate between the two stories and answer correctly which story made more sense. However, when asked if the story would make sense to another child, the subjects reported inconsistencies in the text with greater frequency. This result suggests that children are predisposed to derive a single conclusion from a text but when forced to consider another's interpretation the children may follow the actual text more closely and notice the inconsistencies. It may be argued that this test is more likely a test of a concept of understanding rather than a test of comprehension monitoring because it forces the subject to look at the causes of misunderstanding and to demonstrate knowledge about them. This task gets at skills required for a concept of understanding. Comprehension monitoring, however, traditionally was about monitoring one's own understanding and employing corrective strategies when necessary. Many of the subjects in Ruffman's study failed to initiate this remediation despite seeming better able to assess another's understanding. Ruffman's results suggest that they are more likely to recognize a problem when asked about another's understanding than about their own. They may have the feeling of misunderstanding but recognizing the problem may depend on having the concept.

Most studies of children's comprehension monitoring show a developmental effect where younger children are less expert than older children at monitoring their own comprehension (e.g., Markman, 1979, Ackerman, 1981, Schmidt, Schmidt & Tomalis 1984, Beal & Flavell 1984, Ruffman, 1995). However, there is no real consensus among researchers regarding the exact acquisition age of comprehension monitoring skills. Some studies show that even adults perform well below ceiling on tests of comprehension monitoring skills. For example, Baker (1979) used Markman's error-detection paradigm in a study of adults. Subjects read six flawed passages in preparation for a "discussion." The adults in this study reported only 38 percent of the confusions and most of these confusions were main point rather than story detail confusions. The results showed that college students also have difficulty monitoring their comprehension of texts containing confusions such as

inconsistencies, unclear references and violations of connectives (i.e. replacing “therefore” with “however”). However, this result might underestimate the comprehension monitoring skills of adults because retrospective reports by the subjects revealed that the failure to report the confusions was often due to the subjects' unconscious use of repair strategies. These retrospective reports reveal some very interesting aspects about comprehension monitoring: First, it appears that for adults, comprehension monitoring can be circumnavigated—particularly with regards to the use of repair strategies which were often done subconsciously. Also these results show that it is useful to know not only if subjects detect errors but also how subjects are interpreting the information and for what purpose they are reading the passage. For example, many of the subjects in this study were attempting to gain general understandings and were not concerned with reporting errors.

Other studies demonstrate that children as young as three years are able to detect and resolve a variety of comprehension problems (e.g., Revelle, Wellman & Karabenick, 1985). A variety of hypotheses have been posed to explain these age differences.

#### *Possible Explanation for Poor Comprehension Monitoring*

Some researchers suggest that processing demands account for the developmental difference seen in comprehension monitoring skills. In support of this claim, Markman, (1979) reduced the processing demands for the subjects in her study by having them act out or view an enactment of faulty instructions in one condition. The results of this manipulation showed that when the processing demands are reduced, children demonstrate an improvement in their comprehension monitoring skills. It is also possible, however, that the change in task from cognition-based to action-based changed the nature of the subject's monitoring so that the better performance actually reflects a different kind of self-monitoring from comprehension monitoring. Comprehension monitoring is for the self; it is a metacognitive checking mechanism for comprehension, for checking our understanding not for checking our actions. That is, asking for clarification before trying to carry out a faulty request is comprehension monitoring whereas attempting to carry out a faulty request and then realizing that one cannot comply is another thing altogether.

Schmidt and her collaborators (1984) also provide evidence connecting processing demands and comprehension monitoring but from a developmental perspective. Their model suggests that integrative processing skills are required for comprehension monitoring and that improvement in these skills corresponds to increases in comprehension monitoring ability. The general idea is that in order to monitor one's comprehension of written text one must integrate and remember sentences then check incoming sentences for consistency as well as make new inferences or reorganize schemes from the new information. By varying the placement of an anomalous clue within a story, the researchers were able to assess if the subjects were integrating the sentences into story schemes. The results of the study provide evidence for three stages of development in integrative processing: 1) independent treatment of related sentences within a story, 2) intrastory integration without reorganization of incorrect schemes and 3) intrastory integration with reorganization of schemes when sufficient inconsistent information is present. Yet all of the stages would seem to presuppose that the reader already had a concept of understanding.

Further support for the hypothesis that processing limitations explain children's difficulty with comprehension monitoring tasks is found in studies which show that children tend to notice empirical inconsistencies more easily than logical inconsistencies in texts (e.g., Markman, 1979, Baker 1984a,b c.f. Ruffman, 1995). Empirical inconsistencies refer to parts of the text which deviate from the child's common world knowledge while a logical inconsistency would be a proposition in the text that deviates from another proposition in the text. Logical inconsistencies require integration of the sentences of the text in order to be detected, whereas deviations from factual knowledge do not require the integration of two new propositions; instead, the deviant proposition in the text is compared to factual knowledge that is readily available to the child. Certainly, in this case, there is evidence to support the claim that comprehension monitoring is easier in some contexts. It is not clear that a concept of understanding is involved in rejecting the false claims in the simplest tasks as the concept of understanding is arguably a metarepresentational concept.

In relation to processing limitations, Markman (1979) proposes that awareness of comprehension failure is also affected by the kind of standard against which comprehension is evaluated. For example, one might check an excerpted sentence for veracity, completeness and

logic without also checking these qualities in relation to the full communication i.e. the whole text. A sentence that is inconsistent or incongruous with the whole communication might be complete and meet truth requirements when evaluated separate from the whole communication. In short, when evaluation is action based, such as fulfilling a goal from instructions, then it is easier to apply a standard for evaluation than when the evaluation is more abstract and involves making inferences between propositions and related knowledge. Only in this later case would a concept of understanding be relevant.

This proposition could be related to the results of an experiment by Zabrocky and Ratner (1986) which used on- and off-line measures of comprehension evaluation while also measuring look-backs during reading to measure comprehension regulation. The researchers found that all subjects spent more time reading text inconsistencies but only older children actually looked back through the text as a way to resolve text confusions. Furthermore, the older subjects were more likely than the younger subjects to report incongruent texts as not making sense. These results show that all of the subjects had the ability to detect that there was a communication problem but that the older subjects were more likely to attempt to resolve the inconsistency or to report the inconsistent texts. Perhaps, like the subjects in Markman's (1979) experiment, the subjects who fail to report text inconsistencies fail to do so because they are unaware of the role of the message/text in causing communication failure.

The possibility that children are electing to guess rather than monitor the message for ambiguity was examined in a study by Reid (1990). In this study, one group of children were educated about the inadequacy of guessing before the comprehension monitoring task was administered while the control group was not. The results showed no improvement in the experimental group's performance over the control group. Therefore, a propensity to guess rather than evaluate information cannot account for children's difficulty with these tasks either. Instead, the need for metacognitions about understanding seems a possible explanation.

While comprehension monitoring research has focused on a "text" and its properties, Olson and his colleagues have approached the same topic from the perspective of the theory of mind, asking what a child understands of what another person would think or know in various contexts.

Thus Torrance and Olson have examined the relation between comprehension monitoring and the ability to make the say/mean distinction. The say/mean distinction refers to a set of concepts for representing language and meaning, primarily the concepts of what a text says as opposed to the interpretations one may make of that text (Torrance and Olson, 1987). Using this paradigm, Bonitatibus (1988) found that children who could monitor their comprehension attended to the literal meaning of a referential message whereas children who failed to monitor their comprehension did not. In this study one half of the subjects were told what a speaker would want to ask for before the speaker made the request. In some cases the request did not specify the desired object adequately. Successful comprehension monitors, therefore, were better able than their counterparts to note that a speaker's words could be an inadequate expression of the speaker's intention. Basically, good comprehension monitors were able to see that a request failed to identify a unique referent even when they were aware that the speaker had intended to identify a specific referent and would respond based on what was said as opposed to what they knew was meant. Poor comprehension monitors, however, would ignore the faulty request and respond based on their knowledge of or belief about what had been meant by the request. Essentially, poor comprehension monitors seem insensitive to the role of the message in causing communication failure.

Such studies suggest that recognition of a failure to understand and that recognizing when another would understand are related and that both are a reflection of a meta-cognitive judgement rather than merely one of information processing. Meta-cognitive judgements in turn may depend on a concept of understanding.

### **Concept of Understanding—A Skill Applied to the Self and to Others**

A great deal of research has focused on children's understanding of aspects of the mind such as beliefs and desires. So-called "Theory of Mind" research (see for example, Wellman, 1990 & Astington, Harris & Olson, 1988) has shown that children acquire concepts of beliefs, for example, long after they maintain beliefs of their own. Researchers have found that a reliable way of demonstrating this acquisition is to have children ascribe the beliefs being examined to others (Lewis

& Mitchell, 1994). The idea is that in order to ascribe a belief (to continue with the example) to someone else, one must first have a concept of what a belief is. In the same way, it should be possible to see if children have a concept of understanding by seeing if they can ascribe states of understanding to others. In his article on understanding, Nickerson (1985) points out that a common thread in all ways of defining understanding is knowledge. Understanding is an interaction that involves reaching an accord; it is the sharing of knowledge. For this reason, it should be possible to show that children have a concept of understanding by having them select and judge the information required to reach an accord with another person on a familiar subject. My purpose is to test the hypothesis that children who fail to successfully monitor self-comprehension (or incomprehension) will be the same children who fail to recognise the conditions for misunderstanding others.

### *Message Adequacy*

#### *The role of deception:*

One of the main tasks used to diagnose comprehension monitoring is that of recognizing that a text is ambiguous. A related field of research is that of recognizing that a simple request is ambiguous. Ackerman (1981) gave kindergarten and grade two children referential communications that were either ambiguous, partially ambiguous or adequate about a display of four familiar objects that varied on some descriptive level (e.g. size, colour, detail). In the first (deception) condition, the subjects were told that they would play a game called "Guess who said it" and subjects were asked to indicate either a picture of "Selfish Steven" (whom they were told would try to fool them), or a picture of "Nice Nancy" (whom they were told would be helpful) as having been the speaker of the referential communication. In a second more explicit (performative) condition, subjects listened to a referential communication and were told to select Selfish Steven as the speaker of the communication if more than one referent could be chosen and to select Nice Nancy as the speaker if only one referent could be chosen. Essentially, the task remained the same over conditions but the instructions varied so that the subject's expectations of the speakers were more salient in condition one. Kindergarten children made correct speaker assignments more frequently in the deception condition than in the

second, performative, condition while grade two children made speaker assignments equally well in each condition. These results show that when told they cannot trust the speaker, five year-olds are more likely to attend to and respond to the speaker's exact words. That is, if they know the speaker is a liar they listen more carefully. Older children, however, were able to assess the request as ambiguous even when they were not alerted to the potential that one of the speakers would try to fool them.

This ability to assess message adequacy for self and others is hypothesized as part of a concept of understanding. While comprehension monitoring examines how well incoming information is being understood, my claim is that a concept of understanding in self and others involves recognizing the causes of misunderstanding. In this study, a concept of understanding which enables accurate judgements of understanding for self and for others is said to predict monitoring. This concept allows one to recognize that when the referential communication is ambiguous there is more than one possible referent. Furthermore, I would argue that one simply could not monitor one's comprehension effectively without first having a concept of understanding. Essentially, acquisition of the concept imparts awareness of misunderstanding which in turn, sparks the corresponding emotion and elicits and informs comprehension monitoring.

*The role of speaker's communicative intention:*

Ackerman's (1981) findings do not preclude the notion of a concept of understanding. Indeed, the findings beg the question of why children often automatically overlook the ambiguity of the message. Instead, children evaluated message accuracy only when they were made explicitly aware of the degree of the speaker's trustworthiness. Perhaps this question can be explained by examining a concept of understanding. A concept of understanding involves not only self (i.e., judging one's own understanding) but also other as in having an understanding. Inherent to having and understanding is the assumption of agreement between participants. Therefore, evaluation of message adequacy may be related to a concept of understanding.

Similar to Ackerman's (1981) finding that kindergarten children fail to note the ambiguity of a communication, Beal and Flavell (1984) found that access to the speaker's communicative intent

overwhelmed grade one children's ability to recognise that a statement can be ambiguous. Beal and Flavell (1984) pre-trained grades one and two students on the distinction between the message and what the speaker meant. Next, subjects were shown a picture of a girl, introduced as Sheri, and were told that she had picked one of three possible referents and had made up a clue to help the subject pick the same referent. One half of the subjects were told which referent Sheri had picked in addition to receiving the clue. The subjects were then asked if the clue could refer to each one of the referents in turn. Finally, subjects were asked if they knew for sure or had to guess which referent Sheri meant from her clue. The results show that when grade one subjects were informed of Sheri's intent they failed to recognise the ambiguity of the clue even when more than one referent could be selected by the listener. When uninformed of the speaker's intent, however, grade one subjects performed near ceiling in their evaluation of the ambiguity. It is interesting to note that in normal conversation, children's failure to distinguish between intention and literal meaning may not hinder their understanding; although given the limited information the listener is able to make a mental correction based on knowledge of the speaker's intention and continue to follow the conversation successfully. The first-graders that insist that the ambiguous referential communication has only one referent—the referent they know the speaker intends—are acting in this way. However, Beal & Flavell's (1984) subjects do not recognise that they are making a mental correction based on their knowledge of the speaker's intention. The subjects aren't making meta-cognitive judgements--they are unaware of their own compensation. The young subjects in Beal & Flavell's (1984) study accommodate an imperfect speaker when they know the speaker's intention but subsequently, fail to note that the communication is flawed. It is possible that once these children develop meta-cognitions, that is a concept of understanding, then we may expect that they will anticipate possible misunderstanding; similarly, they will be able to understand cases in which communication goes wrong and perhaps recognize the causes and ways or repairing them.

### *Communication Maxims*

Recognition of ambiguity has been interpreted as the violation of one of Grice's communication maxims. Surian and Job (1987) found that first-grade children violate communication

maxims in some conditions. For example, one communication maxim is the Maxim of Quantity which states that the speaker a) should be as informative as is required by purposes of exchange and b) should not make his/her contribution more informative than is required (Surian and Job, 1987, p.370). In Surian and Job's (1987) study, subjects were shown four pictures of happy clowns. In three of the pictures the clown held a uniquely coloured flower and in one picture had no flower. The subjects were asked to describe one of the pictures of a clown with a flower before proceeding. Next, when asked to choose the happy clown, grade one through three students preferred choosing the referent they had described earlier in response to the potentially ambiguous referential communication over comparing each of the referents to the communication and choosing the one of best fit (the clown with no flower). In this case, the Maxim of Antecedent is favoured over the more correct use of the Maxim of Quantity. These subjects are embellishing the information they take from the statement with information they gained earlier. To these subjects, the clown that is unique is the one that they described earlier. When they are given a referential communication that could, in fact, describe any of four items, the subjects utilize their earlier experience to make a selection. In some ways, this reliance on earlier information is a sensible and valid strategy. Using the information enables the subjects to respond to the communication in an appropriate way: giving a referent when asked to choose one. In fact, the subjects might even be said to be fulfilling the rule that a referential communication indicates the referent in a unique way in that they are inserting information that makes the discourse coherent. Unfortunately, the subjects are simultaneously responding inappropriately because their embellishment of the communicated information changes the nature of the communication. They fail to note the possible misinterpretations of the utterance. It is precisely this sort of transformation that is avoided when one has a concept of understanding. Specifically, one learns to employ a more appropriate strategy centred upon information such as seeking more or clarification of information from the speaker. A concept of understanding relies upon knowledge of the possibility of understanding or misunderstanding.

## Summary

The research to date has revealed several aspects of comprehension monitoring and comprehension monitoring research techniques. Comprehension monitoring is a process is said to become automatic in much the same way that reading becomes automatic (Baker, 1979). Also, comprehension monitoring skills seem to appear in developmental stages of information integration (Schmidt et al, 1984). Although information processing demands have some effect on comprehension monitoring ability, they cannot completely account for the problems experienced by children with this task (Ruffman, 1995). The problem of comprehension monitoring, therefore, remains uncertain although, there is room in what is known about comprehension monitoring so far for a link to be established between comprehension monitoring and a concept of understanding.

The basic comprehension monitoring research paradigm is an error detection paradigm with the subject acting as a "consultant." This technique taps comprehension monitoring skills and children have demonstrated their comfort with the consulting role (i.e. Markman, 1979). It is clear, however, that the subject and the experimenter must have the same purpose in mind when reading a text for these experiments because errors can go unreported if the subjects feel they are unimportant to their purpose or if they apply a remediation strategy to the error.

Little research has been done on children's concept of understanding; however, there has been research on aspects of others' understanding of a message. Research thus far indicates that preschool children accommodate and embellish inadequate messages but are not aware that they are doing so (Beal and Flavell, 1984; Surian and Job, 1987). These children do not seem to have metacognitions about their understanding and as a result do not seek clarification of flawed communications especially if they have access to the speaker's intention. By age six or seven, they become more conscious of ambiguity and possible misinterpretation.

The message adequacy paradigm in which the subject assesses an ambiguous request may be a more suitable measure of a concept of understanding than of comprehension. An ambiguous request such as, "Bring the red ball," when there are two red balls is still a comprehensible and grammatically correct sentence. The flaw of the sentence is detected when the corresponding action

is considered. Thus, the individual who specifies the ambiguity as problematic has in fact detected the responsibility of the speaker to provide complete information. This act is arguably indicative of a concept of understanding more so than of monitoring one's own comprehension. A concept of understanding can be assessed by the message adequacy task because it can be applied to both the self and another.

The research has shown some similarities between comprehension monitoring and a concept of understanding particularly with regards to information assessment. The difference between the two, however, is quite significant. Comprehension monitoring is specifically related to assessment of one's own understanding of incoming information such as texts or requests. A concept of understanding, on the other hand, involves an assessment of the information itself in relation to both self and other. The individual evaluates the quality of the message (or information) and the ability for that message to be understood by oneself or by another. Perhaps it is the concept of understanding that explains the individual's comprehension monitoring skills. Thus through this concept, the individual learns to recognize and subsequently attempt appropriate remediation strategies to comprehension dilemmas.

### Hypothesis

Comprehension monitoring requires that children consider ideas and evidence and meta-represent their own position towards that information. In order to "monitor" at some level one must not only understand but also know that one does (or does not) understand and why. A body of research (Baker, 1979, Markman, 1979, Schmidt, Schmidt & Tomalis, 1984, Ruffman, 1995) gives evidence that children are poor monitors of their own comprehension. This thesis advances the hypothesis that what these poor monitors may lack is a concept of understanding and misunderstanding. In other words, although children may understand much of the information from the world around them, they may lack the meta-representational framework from which they can evaluate, measure or monitor their understanding. The goal of this thesis is to examine the role of children's acquisition of a concept of understanding on their ability to monitor their own cognition.

## **Chapter 3: The Study**

### ***Hypothesis***

The hypothesis stated at the outset of this study is as follows:

1. Children's performance on concept of understanding tasks will predict comprehension monitoring performance.

### ***Research Questions***

This study addresses the following questions: (1) is there a relationship between comprehension monitoring and aspects of a concept of understanding?; (2) do children perform differently on tests of a concept of understanding at different ages?; and (3) At what age do children seem to acquire a concept of understanding?

I expect that (1) there will be a relationship between comprehension monitoring and tests of a concept of understanding and that good comprehension monitoring skills will be a function of acquisition of a concept of understanding; (2) there will be a developmental trend in tasks measuring a concept of understanding and that the age at which subjects pass these tasks will be fairly uniform and (3) children will demonstrate acquisition of a concept of understanding between ages three and seven.

### ***Method***

#### **Participants**

One hundred and twenty male and female subjects drawn from schools and day care centres in the Barrie area and ranging in age from 3 years to 7 years participated in the study. All participants returned informed consent forms bearing and indicating parental consent and after completing the tasks or participation, received a sticker as an incentive and reward for participation in the experiment. Any participant unable to demonstrate colour knowledge or fluency in English was excluded from the experiment.

### **Apparatus**

Sony Walkman model number: WM F-17 and Sony microphone was used to record answers to communication-purpose task.

### **Procedure & Design**

Subjects were not only told they are helping a "big kid" with her homework and that they would be asked to listen to stories, watch puppets and answer some questions, but also, that they would receive a sticker in appreciation for their help. All subjects were tested individually on every task in the procedure and were tested in two areas: first, for various aspects of a concept of understanding: understanding of information adequacy, perspective taking and ascription of understanding and second, for comprehension monitoring skills using materials established by Markman & Gorin (1981) and by Baker (1984). The first three concept of understanding tasks were presented in a counterbalanced order. The comprehension monitoring task which was followed by a probe question about the purpose of communication was always presented last. Each sub-task was counterbalanced within the task. Each age group received the same treatment order.

The analysis examines performance on the tasks by age and by level of comprehension monitoring performance (high or low). These two kinds of groups (age and comprehension monitoring level) formed the independent variables. The dependent variables are performance on the concept of understanding tasks (perspective taking, information adequacy). Chi square analysis formed the bulk of the analysis along with analysis of variance.

### **Tasks and Materials**

#### ***Measures of Comprehension***

##### ***Comprehension Monitoring Task:***

A standard comprehension monitoring task which entailed three related stories based on or reproduced from a study Linda Baker (1984) were used. Each story is printed at the bottom third of

an 8 1/2 inch by 11 inch sheet of paper and the top two thirds contain a colour illustration of the story protagonist. The following instructions were spoken to each subject at the beginning of the task:

*I'm going to read you some stories. Some of my stories might have mistakes in them. I'd like you to help me make sure the stories will be easy for little kids to understand by telling me if you hear anything that doesn't make sense or sounds wrong. Please stop me anytime while I'm reading if you think something is wrong with the story or if you think something should be changed.*

The sheets were placed in clear plastic protective coverings. Each story contains an "error" and is written as follows:

### *Jill's Story*

There once was a girl named Jill. Jill was tall and had brown curly welkins<sup>a</sup>. One day on her way to school, Jill saw a rabbit in Farmer Tom's garden. Jill told her friends at school about the rabbit.

### *Farmer Tom's Garden*

This is Farmer Tom. Every spring, Farmer Tom plants seeds in his garden. This year Farmer Tom is going to grow tomatoes, ice cream cones<sup>b</sup> and carrots. Farmer Tom watches his garden everyday to make sure the rabbits do not eat his food.

### *Albert the Pretty Rabbit*

Once there was a rabbit named Albert. He had dark brown fur that was soft as could be<sup>c</sup>. He was very fluffy and had a beautiful tail. All the other rabbits wished they had Albert's snow white fur<sup>c</sup>. Albert liked to eat in Farmer Tom's garden. Albert was lucky he never got caught.

Each subject was asked to act as a "consultant" who, because they knew little kids better than the experimenter did, would help the experimenter check to see if the stories read aloud were "good" for younger children. When subjects reported an error they were asked:

*What is wrong with that part of the story? What do you think it should say instead?*

When subjects failed to report an error by the end of the story they were asked:

*Do you think that story is OK for kids? Did you hear any mistakes in it?*

At the end of each story, subjects who reported errors were asked:

*Was there anything else about the story that needed fixing?*

All of the subjects' responses were recorded on paper by the experimenter.

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<sup>a</sup> nonsense word

<sup>b</sup> prior knowledge violation

<sup>c</sup> internal inconsistency

## Measures of a Concept of Understanding

### Communication Purpose Probe:

All subjects were asked at the completion of the comprehension monitoring task:

*"Why do people talk to each other? What is talking for?"*

Children hesitant to answer were prompted with:

*"Why do you think we use words?"*

Also, children who responded, "Because they are friends" were further prompted with:

*"Well, if they are friends why don't they just hug? What do they use words for?"*

Children's responses were recorded on cassette tape as well as manually.

### Perspective-Taking Task:

In this task, subjects must give directions that are appropriate to the puppet's sensory perspective. Perspective can limit or change the information available to an individual. For example "Choose the blue ball" may not be an adequate direction to an individual who has colour-blindness. The purpose of this task is to

Ball	Sensory Quality			
	Hard	Soft	Quiet	Noisy
1		✓		✓
2	✓			✓
3	✓		✓	
4		✓	✓	

TABLE 1: BALL MATRIX

see if subjects consider the perspective of another when giving directions. The task uses four objects which vary in two visual aspects (colour and sheen) for the visual description task; and four objects which vary in auditory and tactile aspects (softness, noise production) for the non-visual description task such that each sensory aspect will be represented twice within the array of four objects but also such that each object will be uniquely described by indicating not one but two sensory aspects (e.g. soft and noisy or red and shiny). For example, (see also table 1) in the non-visual task, four balls identical in size and colour make up the array where ball one was hard and contains a bell that makes noise when shaken (H & N), ball two is soft and does not produce noise (S & Q), ball three is soft and

noise-producing (S & N) and ball four is hard and quiet when shaken (see Appendix A). Additional materials are a Big Bird hand puppet, a blindfold for the puppet and memory aids for the target object of the array. The tasks proceeded as follows:

First, in order to acquaint subjects with the task a practice exercise was carried out first:

For the Visual Description Task Subjects were told:

*I am going to show you a picture of each of these things. See how each one of these matches? This is the plain blue bottle, which one matches it, this one is the sparkly red bottle . . .? One of the things is special, let's make it this one, it is the blue sparkly bottle. Now, watch Big Bird and tell me if he picks up the special one.*

For the Non-visual Description Task subjects were told:

*I have four balls [then subject touches and hears a description of each ball which they are asked to repeat]. I am going to use this card with the arrow to point to one of the balls. The arrow will point to the special ball; that is this one it is hard and noisy and if you need to remember which ball is special then you just have to find the one with the arrow pointing to it.*

For each task when subjects gave a correct rejection they were told:

*That's right, Big Bird chose the wrong object. Which one should the Big Bird have chosen?*

Or if subjects made an incorrect acceptance they were told:

*Hmm, let me see (look at picture/arrow). No, the puppet should have chosen the \_\_\_\_\_.*

This step was continued until the subject made a correct rejection and then chose the correct object.

The two experimental sub-tasks then proceeded as follows:

**1) Visual Description Task:**

*I'm going to show just you a picture of the objects again and I want you help the puppet pick the right object by describing it. You must not point to it but use words instead. Why don't you sit on your hands so that you remember not to point.*

**2) Non-visual Description Task:**

*Here is the special one (subject feels ball, repeats a description and then the arrow is placed). Now, let's get Big Bird again but first I'm going to cover his eyes so that he can't see (Big Bird then declares that he can not see). Can you use words again to describe the object to Big Bird so that he can pick the special object?*

***Information Adequacy Task:***

Two hand-puppets of familiar children's, television show characters as well as a two-dimensional "toy cupboard" made from a cardboard back (12 inches by 12 inches) and four construction paper doors (two blue and two red) such that there were two large doors (5.5 inches by 7.25 inches) of differing colours and two small doors (5.5 inches by 4.0 inches) of differing colours. Each large door is placed above the small door of the other colour (e.g. the large red door is above the small blue door). The large cupboards have an illustrated upper shelf of toys. An illustration of a helicopter on a 3 inches by 5 inches index card fits into the small cupboard or onto the lower shelf of the large cupboard such that it is not visible once the door is closed (see Appendix B). The information adequacy task proceeded as follows:

Before beginning, the experimenter made sure that the subject had a clear understanding of colour and of size. (e.g. This is a big blue door . . . ). The task was done three times—one for each condition. In each test Barney plays with the helicopter and puts it away. Next Baby Bop enters and asks Barney where the Helicopter is so she can play with it. The subject is told not to tell Baby Bop where the helicopter is but instead to listen to what Barney says and decide if he tells Baby Bop enough so that she can find the helicopter the first time she looks for it. The child always knows the true location. The three possible responses from Barney are:

- 1) Correct information: (e.g.)It is in the BIG BLUE cupboard.
- 2) Inadequate information: It is in the BLUE cupboard.
- 3) Mistake or Deceive: It is in the SMALL RED cupboard.

After Barney gave his answer the subject was asked:

- 1) *Did Barney say enough for Baby Bop to understand where to find the helicopter, for sure, the first time she looks for it?*
- 2) *Where is the helicopter?*
- 3) *Where did Barney say to look for it, what words did he say?*

**Ascription of understanding task:**

Two stories printed sentence by sentence on the back of index cards measuring 3 inches by 5 inches with a relevant illustration on the opposite side will be used (see Appendix C). Each story contains an ambiguity (lexical or referential). The tasks proceeded as follows:

**Referent Ambiguity Protocol**

**Red Shoes**

**READ& SHOW TEXT:** This is Sally and John, they are dressed for a party.  
**SHOW PICTURE:** *(Sally and John in party clothes but no shoes)*  
**READ & SHOW TEXT:** Sally has two pairs of red shoes. One pair is for parties and the other pair is for basketball.  
**SHOW PICTURE:** *(Shoes)*  
**READ & SHOW TEXT:** Sally answers a knock at the door and finds her friend Mary. Mary asks to use Sally's basketball shoes.  
**SHOW PICTURE:** *(Mary with basketball at door with Sally)*  
**READ& SHOW TEXT:** Sally asks John to bring down her red shoes.  
**SHOW PICTURE:** *(Sally calling to John who is still upstairs)*

**1)ASK:** Do you understand what it meant when I said "Sally asks John to bring down her red shoes"? If "**yes**" go to (2)

**Tell and illustrate meaning using picture of shoes.**

**1b)ASK:** Do you understand what Sally meant when I said "Sally asks John to bring down her red shoes"? If "**no**" repeat explanation and question.

**2)ASK:** What did it mean when I said, "Sally asks John to bring down her red shoes"? **Listen then say:** "It meant that Sally wanted her basketball shoes to give to Mary."

**3)ASK:** Will John think Sally wants her party shoes or her basketball shoes?

**4)ASK:** Are choice from previous question what Sally wants when she asks John to bring down her red shoes?

**4b)If "no" ask:** What does Sally want?

### *Lexical Ambiguity Protocol*

**READ& SHOW TEXT:**           **This is Jim**  
**SHOW PICTURE:**               *(Picture of Jim)*  
**READ & SHOW TEXT:**       Jim saw an old, giant elephant.  
**SHOW PICTURE:**               *(Jim looking at an elephant)*  
**READ & SHOW TEXT:**       Jim touched the rough trunk.

**1)ASK:**           Do you understand what it meant when I said "Jim touched the rough trunk"?  
          If "yes" go to (2)

**Tell and illustrate meaning using picture of elephant.**

**1b)ASK:**       Do you understand what it meant when I said "Jim touched the rough trunk"? If "no"  
          **repeat explanation and question.**

**2)ASK:**       What did it mean when I said, "Jim touched the rough trunk"? **Listen then say:** "it  
          meant that John touched the part of the elephant called a trunk; his long nose.

**SHOW PICTURE:**               *(Jim touching the elephant's trunk)*

**3)Say:**       Let's change the story right here (pointing to middle picture) so that instead of seeing  
          an elephant, Jim sees an old giant tree. Let's pretend that we are reading it to  
          another child like you so now the story goes like this . . . (re-read story stopping at  
          question 1 and ask the following:)

**4)ASK:**       What will this other child understand it to mean when we say "Jim touched the rough  
          trunk"?

**5)ASK:**       Will the other child think it is a tree trunk or an elephant's trunk that Jim touches?

**6)ASK:**       What did Jim touch the first time we read the story?

**7)ASK:**       What will this picture show Jim touching when we turn it over?

**SHOW PICTURE:**               *(Jim touching the elephant's trunk)*

## Chapter 4: Results

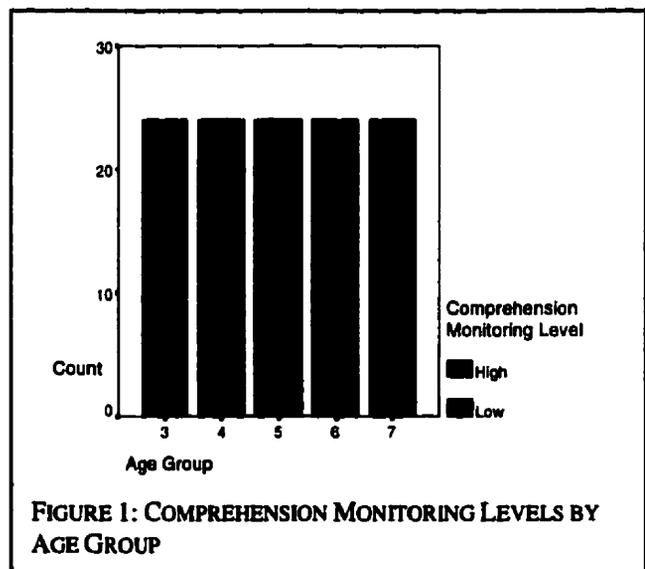
As noted earlier, subjects were divided in two ways for analysis of each task: 1) by age and 2) by level of comprehension monitoring (high and low, please see below). Five age groups (ages 3 through 7) were formed. Each group was assessed on a task by task basis as well as by overall performance on the concept of understanding tasks.

### Comprehension Monitoring Task

This task was the three-story task involving Jill, Albert the pretty rabbit and Farmer Tom. For this study, subjects were considered to have monitored their comprehension in a story if they were able to correctly identify the target problem in the story (i.e., "You can't *grow* ice cream cones!"). The subject may have suggested other editorial changes (i.e. "It should be Old MacDonald, not Farmer Tom") but were scored as having passed the test only if they identified the target problem. Results for each comprehension monitoring task by age are shown in Figure 1.

### *Comprehension Monitoring Levels:*

Comprehension monitoring level was determined from performance on the comprehension monitoring task such that subjects who did monitor their comprehension at least once were designated as having high comprehension monitoring skills while subjects who failed to monitor their comprehension on any occasion were designated as having low comprehension monitoring skills. See Figure 2 for a breakdown of these two groups by age.



Number of Correct Concept of Understanding Tasks for each Age Group

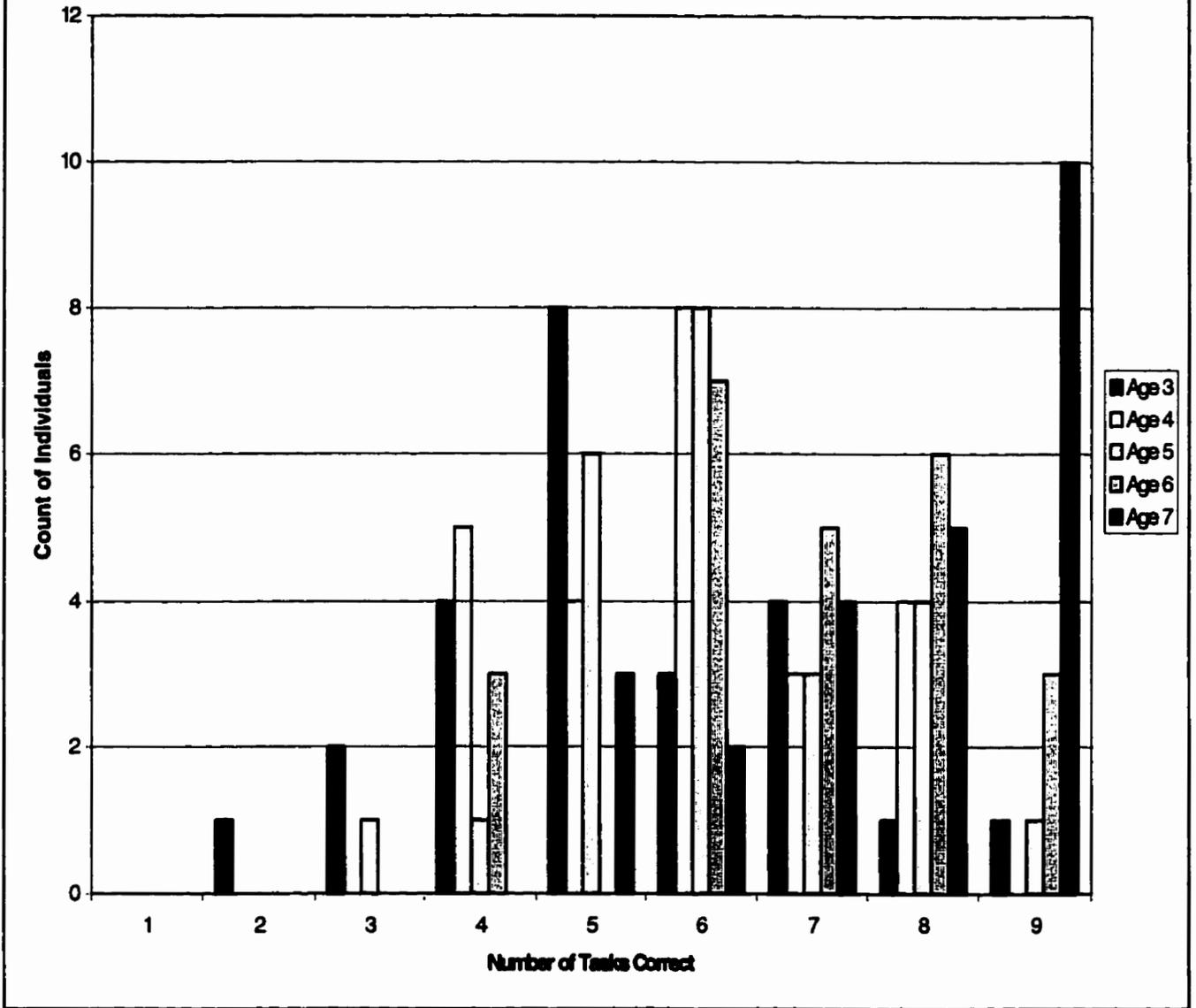


FIGURE 2: NUMBER OF CORRECT UNDERSTANDING TASKS FOR EACH AGE GROUP.

**Information Adequacy Task**

This task required subjects to listen to an exchange between Baby Bop who wanted to know where to find a specific toy and Barney who had put the toy away with the subject's help. Barney's description of where to find the toy was heard by the subject who subsequently judged the description's adequacy. An adequate description would correctly identify both the size and colour of the cupboard (complete information) and an inadequate description would fail to describe correctly one or both of these details (partial or wrong information). Table 2 shows the results for the two levels of comprehension monitoring for each level of information adequacy.

	Adequate Info.		Wrong Info.		Partial Info.	
	Low	High	Low	High	Low	High
Incorrect Judgement	2.4%	2.5%	26.8%	10.1%	75.6%	49.2%
Correct Judgement	97.6%	97.5%	73.2%	89.9%	24.4%	64.6%
Chi-square Test	NS		p<.017		p<.001	
Fisher's Exact Test	NS		p<.03		P<.001	

TABLE 2: INFORMATION ADEQUACY JUDGEMENTS BY HIGH AND LOW SKILLED COMPREHENSION MONITORS.

***Complete Information:***

Nearly all of the subjects, regardless of comprehension monitoring level and age, were able to judge that answers having complete information were adequate. There were no significant differences between the two comprehension monitoring groups.

***Wrong Information:***

A chi-square analysis of high and low comprehension monitors show a significant difference in mean performance (Pearson  $\chi^2=5.651$ ,  $p<.017$ ; Fisher's Exact  $p<.032$ ) such that subjects who judged correctly the message adequacy tended to also have better comprehension monitoring skills (89% vs. 73%). A developmental trend could also be seen. The results of the analysis by age group showed that older subjects were better able than younger subjects to recognize that the directions supplied by the Barney puppet were not correct (i.e. saying that the toy was in the small blue cupboard rather than the large red cupboard). Further exact analysis was carried out because more than 20% of the cells in the chi square analysis had an expected count of less than five. Because age is a linear variable, a Mantel-Haenszel statistic of performance on the wrong information task was carried out with the results showing that age is significant at the .01 level.

***Partial Information:***

This task required subjects to judge the adequacy of a description that correctly described the colour of the door to open but failed to specify the size of the correct door. A chi-square analysis shows a strongly significant difference between performance by skilled and less skilled comprehension monitors ( $\chi^2=17.424$ ,  $p<.001$ ; Fisher's exact  $p<.001$ ) judging that the information was inadequate. There is also a strongly significant difference in performance by age group (see Table 3 and Figure 3).

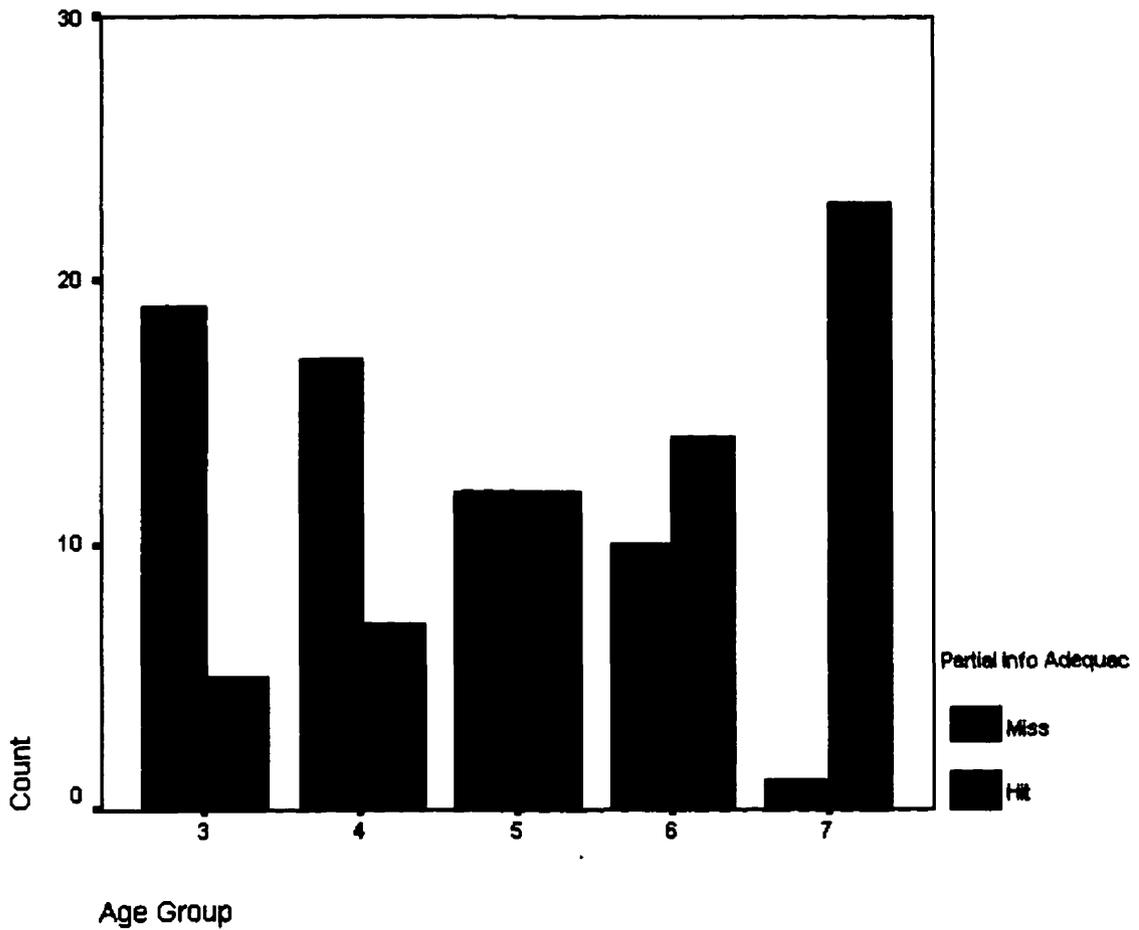


FIGURE 3: PARTIAL INFORMATION ADEQUACY JUDGEMENTS BY AGE GROUP

	Age Group					Total
	3	4	5	6	7	
Miss	19	17	12	10	1	59
Hit	5	7	12	14	23	61
Total	24	24	24	24	24	120

TABLE 3: PARTIAL INFORMATION ADEQUACY JUDGEMENTS BY AGE GROUP.

### **Ascription of Understanding Task**

This task required subjects to listen to two stories, one containing a referential ambiguity where red shoes are requested when there are two known types of red shoes (party and basketball) and one containing a lexical ambiguity where both a tree trunk and an elephant's trunk are interchanged. At different points in the story the subject is asked to judge both his or her own understanding (self-ascription) of the ambiguity as well as another child's understanding of the ambiguity (other-ascription).

#### ***Self-ascription of Understanding Judgements:***

In the referential ambiguity story, self-ascription was judged by the subject's response to the first question: "Do you understand what it meant when I said "Sally asks John to bring down her red shoes"?" Subjects who said, "no" were marked as having ascribed their own understanding as were subjects who said "yes" and then demonstrated that understanding by answering "what did it mean?" correctly (e.g., "It meant she wanted basketball shoes for her friend.").

In the lexical ambiguity story, self-ascription of understanding was said to have occurred when subjects answered the first question, " Do you understand what it meant when I said "Jim touched the rough trunk"?" in the following ways: a) answering, "no" or b) answering, "yes" and then saying after question two, "He touched the elephant's nose/trunk."

#### ***Other-ascription of Understanding Judgements:***

Ascription of understanding to others in the referential ambiguity story was judged from the subject's response to the question, " Will John think Sally wants her party shoes or her basketball shoes?" Correct responses were that John would think Sally wanted her basketball shoes or both pairs of shoes.

In the lexical ambiguity task, ascription of understanding to others was demonstrated if the subject indicated that another child would think Jim was touching a tree trunk when asked, Will the other child think it is a tree trunk or an elephant's trunk that Jim touches?

Table 4 shows that subjects in each level of comprehension monitoring skill performed equally well on several aspects of this task: self-ascription and other-ascription of understanding of

CM level	Lexical Self-Ascription		Lexical Other-Ascription		Referential Self-Ascription		Referential Other-Ascription	
	Low	High	Low	High	Low	High	Low	High
Incorrect Judgement	22.0%	21.5%	26.8%	24.1%	34.1%	31.6%	53.7%	32.9%
Correct Judgement	78.0%	78.5%	73.2%	75.9%	65.9%	68.4%	46.3%	67.1%
Chi-square Test	NS		NS		NS		p<.028	
Fisher's Exact Test	NS		NS		NS		P<.032	

TABLE 4: ASCRIPTIONS OF UNDERSTANDING BY HIGH AND LOW SKILLED COMPREHENSION MONITORS.

lexical ambiguities as well as self-ascription of referential ambiguity. The same trend occurred across age groups for self-ascription of understanding of ambiguities although the referential self-ascription task proved more difficult for subjects than the lexical self-ascription task. Interestingly, high and low comprehension monitoring skill level groups did perform differently on other-ascription of understanding of referential ambiguity ( $\chi^2=4.841$   $p < .028$ , Fisher's exact  $p < .032$ ) with high

Age	Lexical Other-Ascription					Referential Other-Ascription				
	3	4	5	6	7	3	4	5	6	7
Incorrect Judgement	25.0%	45.8%	37.5%	8.3%	8.3%	54.2%	58.3%	37.5%	37.5%	12.5%
Correct Judgement	75%	54.2%	62.5%	91.7%	91.7%	45.8%	41.7%	62.5%	62.5%	87.5%
Chi-square Test	p< .005					p< .01				

TABLE 5: OTHER-ASCRIPTIONS OF UNDERSTANDING BY AGE GROUP.

comprehension monitoring skill level subjects out-performing low comprehension monitoring skill level subjects. Furthermore, as is shown in Table 5, analysis of performance on other-ascription by age

group shows that performance improved with age for both the lexical task and the referential ambiguity task.

**Perspective Taking Task**

This task required subjects to give adequate directions for selecting a specific object to a puppet participant in two situations: one where the puppet

was sighted and the other when the puppet was blindfolded. Performance in both conditions was significantly related to age. These scores are shown in

Tables 6 & 7. When subjects had the same perspective as the puppet cohort (i.e., sighted), they were able to form adequate verbal directions (i.e. the sparkly blue bottle) to a

specified object at a rate better than chance regardless of their comprehension monitoring level. However, as is shown in Table 8, when subjects had a perspective that

differed from the puppet's perspective (i.e., subject sighted and puppet blindfolded), their performance was significantly related to their comprehension monitoring

ability. Subjects in the high comprehension monitoring skill level were better able to give adequate directions (i.e. the soft noisy ball) than those in the lower comprehension

monitoring ability group (Pearson  $\chi^2=4.483$ ,  $p<.034$ , Fisher's Exact  $p<.054$ ).

	Age				
	3	4	5	6	7
Miss	17	13	17	19	22
Hit	7	11	7	5	2
Mantel-Haenszel statistic = 5.409, $p<.02$					

TABLE 6: VISUAL PERSPECTIVE TAKING BY AGE GROUP

	Age				
	3	4	5	6	7
Miss	20	14	10	10	6
Hit	4	10	14	14	18
Mantel-Haenszel statistic = 16.924, $p<.0001$					

TABLE 7: NON-VISUAL PERSPECTIVE TAKING BY AGE GROUP

	CM Level		
	Low	High	Total
Miss	26	34	60
Hit	15	45	60
Chi square = 4.483, $p<.03$			
Fisher's Exact $p<.054$			

TABLE 8: NON-VISUAL PERSPECTIVE TAKING FOR COMPREHENSION MONITORING LEVEL

**Communication Purpose Task**

This task probed children's understanding of what communication is for. Children's responses were separated into the following categories: no response, emotion-based (e.g. responding, "Because they are nice/love each other."), information-based (e.g. responding, "To tell/know/respond/ask/understand/communicate something."), social-based (e.g. responding, "Because they are friends."), needs-based (e.g. responding, "To get help/food."), and action-based, (e.g. responding, "Because they can/need to/want to/are human."). Children could respond in more than one category if they made more than one statement but a single statement such as, "They need to tell that a robber is there," would be categorized as a need statement rather than as an information and a need statement. The mean response for each category across age is shown in Figure 4.

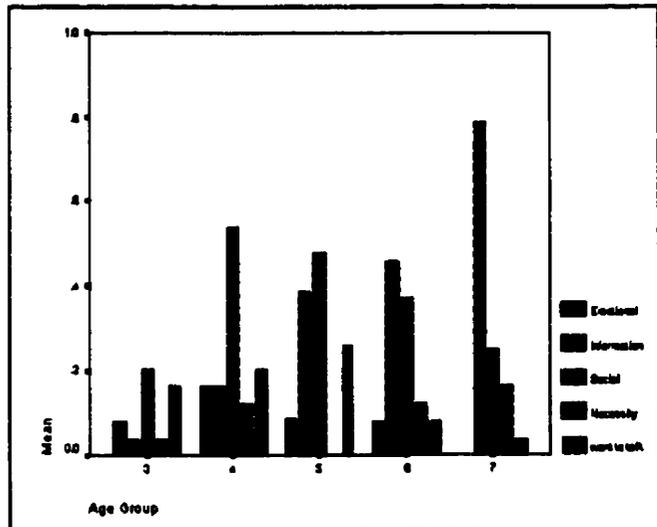


FIGURE 4: MEAN RESPONSE CATEGORIES FOR PURPOSE OF COMMUNICATION TASK

	Age				
	3	4	5	6	7
Emotional	2	4	2	2	0
Necessity	1	3	0	3	4
Social	5	13	11	9	6
Want to	4	5	6	2	1
Information	1	4	10	11	19

TABLE 9: PURPOSE OF COMMUNICATION RESPONSE COUNTS BY AGE

The frequency for each response category by age can be seen in Table 9 and by comprehension monitoring level in Table 10. The information statement (e.g. "Because they want to tell somebody something.") was the only category to be significantly related to age ( $\chi^2=13.893$ ,

	Comprehension Monitoring Level	
	Low (n=41)	High (n=79)
Emotional	4	6
Necessity	3	8
Social	14	30
Want to	4	14
Information	6	39

TABLE 10: PURPOSE OF COMMUNICATION RESPONSE COUNTS BY COMPREHENSION MONITORING LEVEL

	Information Response		Total
	Not Given	Given	
Low	35	6	41
High	40	39	79
Total	75	35	120
Chi Square	=13.893, p<.001		
Mantel-Haenszel	=13.777, p<.001		

p<.001 & a Mantel-Haenszel statistic =13.777, p<.001). The crosstabulation for this comparison can be seen in Table 11.

### Analysis of Variance

A one-way analysis of variance shows a significant difference (p<.01) between the average number of tasks performed correctly for good and poor comprehension monitors. These results are shown in Table 12.

		Sum of Squares	df	Mean Square	F	Sig.
# Correct Und. Tasks	Between Groups	35.680	1	35.680	14.120	.0001
	Within Groups	298.186	118	2.527		
<b>Total</b>		<b>333.867</b>	<b>119</b>			

TABLE 12: ONEWAY ANOVA FOR NUMBER OF CORRECT UNDERSTANDING TASKS BY EACH COMPREHENSION MONITORING GROUP LEVEL.

## ***Discussion***

### **Comprehension Monitoring Task**

The comprehension monitoring task consisted of three flawed stories about Jill, Albert the pretty rabbit and Farmer Tom. This task, which employs the subject as consultant, is a standard comprehension monitoring task. Subjects in this experiment commented freely upon the texts and did not seem generally reluctant to give feedback about the stories to the experimenter. Thus, failure to demonstrate comprehension monitoring by any subject was not likely the result of discomfort with reporting errors to the researcher. The great increase in comprehension monitoring ability from age five to six is suggestive of a developmental change in comprehension monitoring ability and could be indicative of the acquisition of a concept of understanding.

### **Information Adequacy Task**

Recall that a concept of understanding involves an understanding of adequacy of information for the listener. This task was designed to see how well the subject could judge the adequacy of the information contained in a communication in three different conditions: complete information, partial information and deceptive information. In this task, the subjects are aware of all of the required information but each acts as a "bystander" to judge the communication. This position gives the subject the unique position of potential speaker and potential listener. In other words, the subjects are able to mentally form an answer to the question, "Where is the helicopter?" and then to assess the given answer against not only their own representation of the answer but also their knowledge of whether a listener would understand that location on the basis of the message.

Nearly all of the subjects, regardless of comprehension monitoring level, were able to judge that answers having complete information were adequate. This result is not surprising considering that, presuming the subject had an accurate memory of the object's location (and all of the subjects did), complete information would not violate either the child's mental representation of an answer or the child's knowledge of the object's location. Instead, the subject's knowledge of the target object's location would be confirmed. A propensity to judge all answers as adequate could also yield this

result; however, as will be discussed later, subject judgements of wrong and partial information indicate that subjects made real judgements and did not favour a positive judgement of the communication.

Evidence that the subjects were indeed judging the communication's adequacy can be found in the analysis of responses to descriptions having wrong information. Subjects at both comprehension monitoring skill levels were able to correctly judge that the description given was inadequate at levels greater than chance. This good performance by both comprehension monitoring skill levels is in keeping with the fact that wrong information would be a complete violation of the subject's knowledge of the object location and as a result the inadequacy of the instructions would be more salient. The relationship between performance and level of comprehension monitoring, however, was still significant. Indicating that high monitoring subjects were more likely to reject false messages.

Perhaps the best measure of how well subjects assess the adequacy of a communication is through seeing how well the subjects assess descriptions having partial information (e.g. answering "Look behind the blue door," when there are two blue doors). Partial information, unlike complete or wrong information, does not completely agree with or completely disagree with the subject's knowledge of the target object's location. Instead, partial information matches the subject's knowledge to a certain extent but fails to indicate to a listener sufficient information for him to understand. Subjects must address the question of whether or not the listener will know where to find the toy from the description alone. This test is therefore a better test of subjects understanding of knowledge and beliefs about information and its relation to understanding. An analysis of the performance on the adequacy judgements of communications having partial information show that skilled comprehension monitors were better able to make the adequacy judgement than less skilled comprehension monitors.

This task is similar to one part of the Beal and Flavell (1984) task described earlier in which the child, knowing the true location, had to judge whether a message appropriately conveyed that information to a listener. Beal and Flavell found that by age seven children could make correct judgements. They also found, however that subjects younger than seven were able to judge

this is that the child can judge adequacy on the basis of his own feelings of non-comprehension rather than on possessing the concept of understanding.

The results from these information adequacy judgement tasks (shown in Tables 2 & 3) show that comprehension monitoring skills are related to knowledge of what quantity of information is necessary in a communication in order to reach an accord. The subjects found it difficult to correctly assess descriptions that correctly identified the door colour but failed to specify the size of the door and therefore failed to identify the referent uniquely. This result with partially informative communications suggests that the test is indeed tapping a skill that requires more mental work from the individual than simply mentally matching the response to their own mental representation and looking for fit. The majority of subjects demonstrated that they could reliably distinguish between what was said and what was meant through their good performance in the wrong information condition in which the description incorrectly described the colour and size of the toy chest door that concealed the desired toy. Also, in this same condition, subjects demonstrated that they could hold two descriptive aspects in mind and compare them to two aspects described by the speaker. Essentially, the subjects know how to examine the description for accuracy. Something, however, goes awry when the subject hears a description that is partially correct (i.e. the blue door when there are two blue doors). This result is in keeping with Robinson and Whittaker's (1985) suggestion that young subjects did not know that a referential communication must describe the referent uniquely and seemed to be ignorant about ambiguity. This is the competence I identify as having a concept of understanding.

#### *Ascription of Understanding*

The lexical and referential ambiguity tasks were designed to see how well subjects could judge their own as well as another's understanding of a communication based on the available information. Unlike the adequacy judgement discussed earlier, in this task the focus is less on the communication than on the listener's understandings about that communication. For example, in the lexical ambiguity story, the prose suggests that the character Jim is touching an elephant's trunk and indeed, he is. However, the experimenter and subject change the story so that instead of the

expected elephant's trunk, Jim is touching a tree trunk. It is at this point that the subject is asked what another child will expect Jim to be touching based on the beginning of the story. Although the subject knows that Jim is touching a tree trunk the correct answer is that another child will believe he will touch an elephant's trunk. In order to perform successfully on this task, the subjects must utilize changing contextual information yet be aware of to whom the different bits of information is available. Subjects in each level of comprehension monitoring skill level performed equally well on the self-ascription and other-ascription of understanding of lexical ambiguities in that they were able to recognize for themselves as well for others that lexical ambiguity (i.e. tree trunk vs. elephant's trunk) could lead to misunderstanding. In the same way, regardless of comprehension monitoring level, most subjects were able to see that changing context changed the nature of Sally's request for red shoes (self-ascription of understanding of referential ambiguity). However, high and low comprehension monitoring skill level groups did perform differently on other-ascription of understanding of referential ambiguity (i.e. knowing that John will bring the wrong pair of shoes to Sally because he is not aware that the context for her needing shoes has changed from getting ready for the party to loaning sports shoes to a friend). In this case, those skilled at monitoring their comprehension also proved better able to judge which individuals had access to relevant information and which did not. Poor monitors said he would bring the basketball shoes. Other-ascription of understanding of lexical ambiguity and of referent ambiguity showed a relationship to age. The biggest shift forward in subject's performance occurred about age five or six.

Referential ambiguities are more difficult for children than lexical ambiguities perhaps because of the nature of the referents. With lexical ambiguities, the two possible referents are completely different except in the way they are denoted. For example, a tree trunk and an elephant's trunk are quite dissimilar as objects despite both being elongated and, hence, similarly called trunks. Children seem to find this shift as likely to lead to misunderstanding. The referential ambiguity task may have been more difficult because the story never explicitly said that John went up to get the party shoes. That had to be inferred and younger subjects failed to make that inference. What makes the difference in performance is the subject's ability to track the contextual information as well as track which individuals have access to this contextual information (e.g.: what are the shoes

needed for and who knows this fact?). It is this tracking of information that is likely a building block of a concept of understanding.

### **Perspective Taking:**

The perspective-taking, ball and bottle, task required the subject to give verbal descriptions or directions as opposed to non-verbal descriptions such as pointing to a puppet. The difficulty in this task was not in the demand for a verbal description along with the restriction on pointing but rather was in accessing another's perspective when it differs from one's own perspective (i.e. subject sighted and puppet blind-folded). It is interesting to note that the perspective of the cohort was always accessible to the subject in that the subject could take the blind-folded perspective by closing his or her eyes. The results show however, that this ability to take another's perspective was not a simple task for the subjects and was related to comprehension monitoring level.

Having a concept of understanding involves being able to access another's perspective. Certainly, part of being able to communicate effectively is understanding what information is available to others. This act of perspective taking is hypothesized to be a component of a concept of understanding. The results of the perspective-taking task show that children have difficulty with this task when they do not share the perspective of the individual they are giving directions to and that performance on this task is related to level of comprehension monitoring. Thus the hypothesis that the kind of knowledge gained through a concept of understanding is also the kind of knowledge required to monitor one's comprehension effectively is further supported.

### **Purpose of Communication**

This thesis argues that knowledge of causes of misunderstanding are central to a concept of understanding and that these causes centre on aspects of information (see last paragraph of introduction). It is not surprising therefore to find that older children who, presumably have acquired a concept of understanding, also report information-statements as being the purpose of communication not only more frequently than younger children but also more frequently than for any other category.

Consistent with a concept of understanding being a predictor of comprehension monitoring, skilled comprehension monitors also reported information statements as the purpose of communication more often than less skilled comprehension monitors.

## **Chapter 5: Conclusions**

### ***General Discussion***

The Theory of Mind tradition measures concepts by having subjects ascribe that concept to another individual. This study also looked to the subject's ascription of understanding to another as a way to measure the concept of understanding. The results on which tasks do show a relation between the ascription of understanding and age and suggest that this acquisition may occur around six years (see Table 5).

Other proposed measures of the concept of understanding show transitions at about five years. It is interesting to note that it is at five years that the purpose of communication is described as providing information with substantially increased frequency. I believe that a concept of understanding is in many ways a concept of information as expressed through the concepts of understanding. One's understanding evolves as one learns to assess and convey information, which in turn enables one to monitor information one is trying to comprehend.

Comprehension monitoring rose out of the Information Processing tradition while a concept of understanding is rooted in the Theory of Mind tradition. It seems however, that these two things are linked and can be explained in the same way. I propose that the link is based in how the individual thinks about, conveys and understands information. These three things are the building blocks of a concept of understanding and appear to be the basis for comprehension monitoring. As the individual's approach to information is transformed by the acquisition of a concept of understanding then they will also begin to acquire the tools with which to judge and if necessary seek to repair incoming information.

### ***Conclusion and Potential Significance***

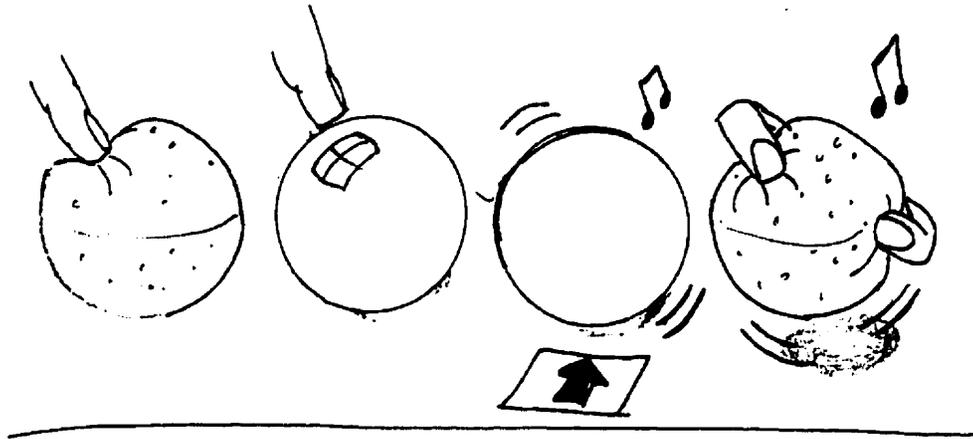
Children's acquisition of a concept of understanding and comprehension monitoring are related such that monitoring can be accounted for by performance on concept of understanding tasks. Comprehension monitoring is important to learning and if we can understand better what

concepts allow it to appear, we should be able to enhance learning. The concept of understanding may play just such a role.

### ***Future Research or Applications***

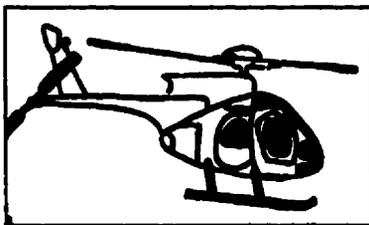
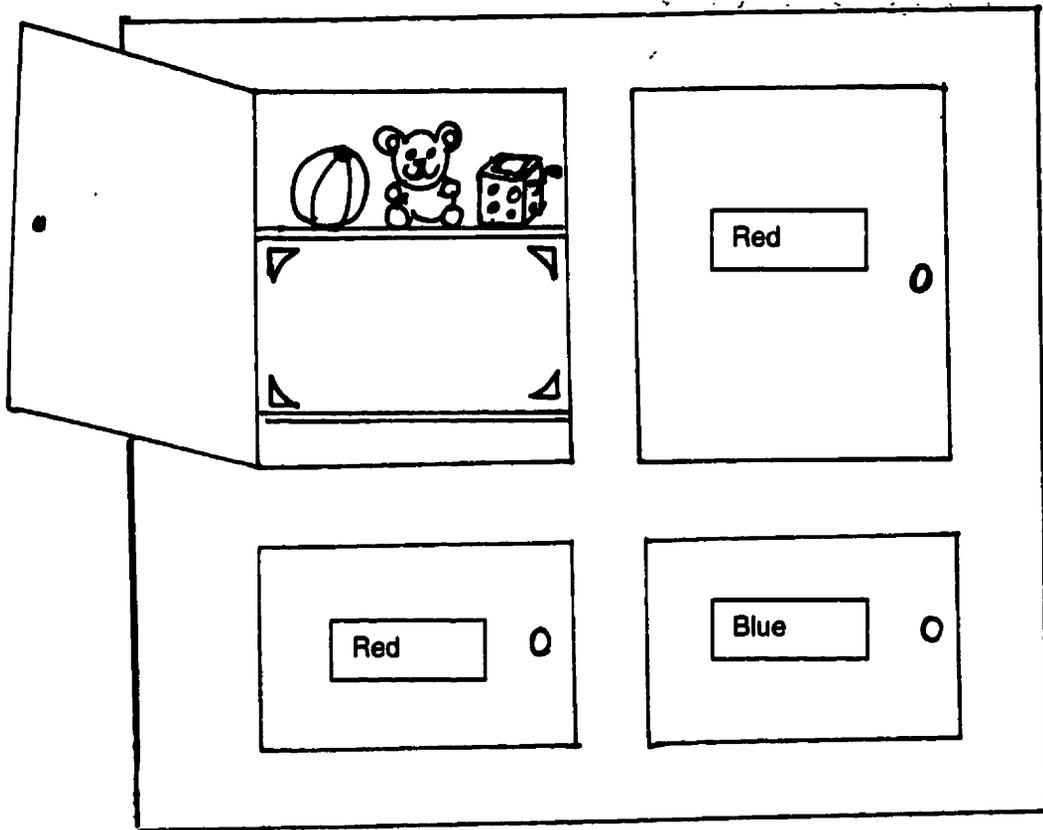
Clearly, judgements about information became the most significant aspect of communication competence, a competence manifold in the oldest children in this study. It would be interesting to examine this understanding in terms of how it impacts the way children learn. Teachers could be encouraged to help children judge and describe their own and others' understandings in order to develop a robust concept of understanding in the hope that such competence would influence the way they attacked all language and text.

## Appendix A: Non-visual Perspective Taking Materials



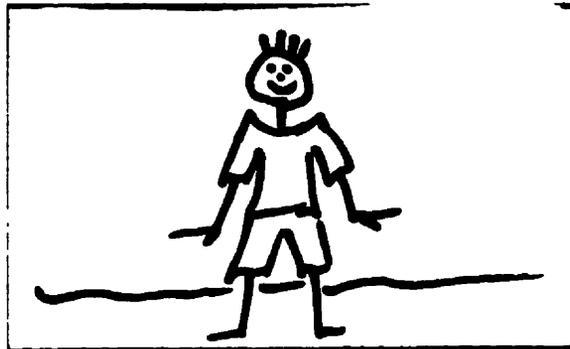
Four balls the same size and colour but differing in hardness and noise-production were used such that no two balls were alike. The pointer acted as a reminder for the subject.

## Appendix B: Information Adequacy Materials

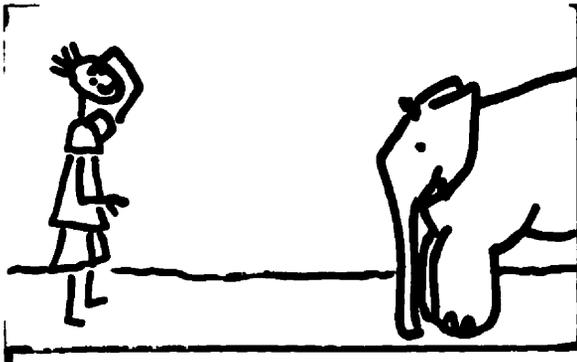


The Helicopter was placed into the toy cupboard by the subject and the Barney puppet then the door was closed.

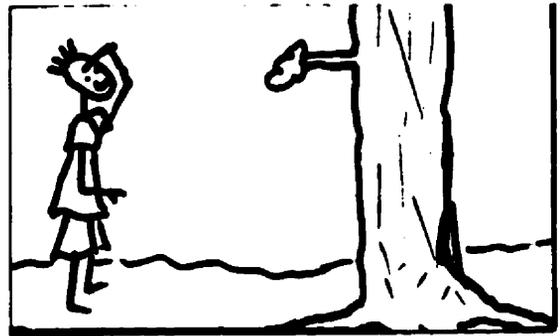
## Appendix C: Lexical Ambiguity Materials



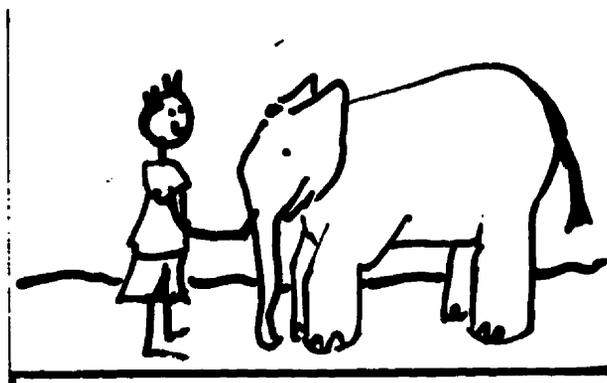
**This is Jim.**



**Jim saw an old, giant elephant.**



**Jim saw an old, giant tree.**



**Jim touched the rough trunk.**

## Works Cited

- Ackerman, Brian P. (1981). Performative bias in children's interpretations of ambiguous referential communications. *Child Development*, 52, 1224-1230.
- Astington, J.W., Harris, P.L. & Olson D.R. (1988). *Developing Theories of Mind*. NY: Cambridge UP.
- Baker, Linda (1979). Comprehension monitoring: identifying and coping with text confusions. *Journal of Reading Behavior*, XI, 4, 365-374.
- Baker, Linda (1984). Children's effective use of multiple standards for evaluating their comprehension. *J. of Educational Psychology*, 76(4), 588-597.
- Baker, Linda & Anderson, Richard I. (1982). Effects of inconsistent information on text processing: evidence for comprehension monitoring. *Reading Research Quarterly*, 17(2) 281-294.
- Beal, Carol R. & Flavell, John H. (1984). Development of the ability to distinguish communicative intention and literal message meaning. *Child Development*, 55, 920-928.
- Bonitatibus, G. (1988). Comprehension monitoring and the apprehension of literal meaning. *Child Development*, 59, 60-70.
- Dewey, John (1986). *The Later Works, 1854-1952*. Vol. 12, (Jo Ann Boydston Ed.) Edwardsville: Southern Illinois UP.
- Lewis, Charlie & Mitchell, Peter. (1994). Children's early understanding of mind: origins and development. In C. Lewis and P. Mitchell (Eds.) *Critical Issues in Children's Early Understanding of Mind*. Hillsdale, NJ: LEA. Pp.2-3.
- Locke, John. (1689). *An Essay Concerning Human Understanding*, 25<sup>th</sup> edition, London: Thomas Davison, Whitefriars.
- Locke, John. (1706). *Of the Conduct of the Understanding*. (Francis W. Garforth Ed.) NY: Teachers College Press.
- Markman, Ellen M. (1979). Realizing that you don't understand: elementary school children's awareness of inconsistencies. *Child Development*, 50, 643-655.
- Markman, Ellen M. & Gorin, Linda. (1981). Children's ability to adjust their standards for evaluating comprehension. *J. of Educational Psychology*, 13(3), 320-325.
- Nickerson, Raymond S. (1985) Understanding understanding. *American Journal of Education*. Feb. 1985, 201-239.
- Reid, Luc. (1990). Young children's difficulty with ambiguous messages: guessing strategy or comprehension monitoring deficiency? *J. of Genetic Psychology*, 151(3), 317-328.
- Revelle, Glenda L., Wellman, Henry M. & Karabenick Julie D. (1985). Comprehension monitoring in preschool children. *Child Development*, 56(3), 654-663.
- Robinson E.J. & Whittaker, S.J. (1985). Children's responses to ambiguous messages and their understanding of ambiguity. *Developmental Psychology*, 21, 3, 446-454.

- Rosenberg, Jay F. (1981). In Herman Parret & Jacques Bouveresse (Eds.) *Meaning and Understanding*. NY: de Gruyter.
- Ruffman, Ted. (1995). Reassessing comprehension monitoring skills. to appear in C. Cornoldi & J. Oakhill (Eds.), *Children With Reading Comprehension Difficulties: Process and Interventions*. Hillsdale, NJ: Erlbaum.
- Ryle, Gilbert. (1949). *The Concept of Mind*. Chicago: University of Chicago Press.
- Schmidt, Constance R., Schmidt, Stephen R. & Tornalis, Susan M. (1984). Children's constructive processing and monitoring of stories containing anomalous information. *Child Development*, 55, 2056-2071.
- Surian, Luca & Job, Remo (1987). Children's use of conversational rules in a referential communication task. *Journal of Psycholinguistic Research*, 16, 4, 369-381.
- Thorngate, Warren (1995). Contested concepts: do the best theories always win? [Review of the book *Conceptual Revolution*] *Contemporary Psychology*, 39, 4, 383-384
- Torrance, Nancy & Olson, David R. (1987). Development of the metalanguage and the acquisition of literacy: a progress report. *Interchange*, 18(1/2), 136-146.
- Wagoner, Shirley M. (1983). Comprehension monitoring: what it is and what we know about it. *Reading Research Quarterly*, 18(3), 328-346.
- Weilman, Henry M. (1990). *The Child's Theory of Mind*. MA: MIT Press.
- Wittgenstein, Ludwig. (1963). *Philosophical Investigations*. (G.E.M. Anscombe Trans.). Oxford: Basil Blackwell.
- Wolff, Robert P. (1963). *Kant's Theory of Mental Activity: A Commentary on Transcendental Analytic of the Critique of Pure Reason*. Cambridge: Harvard UP.
- Zabucky, K. & Ratner, H.H. (1986). Children's comprehension monitoring and recall of inconsistent stories. *Child Development*, 57, 1401-1418.