According to Piaget (1970), young children are often unable to detect the invariant or concealed realities that underlie perceptual appearances. My aim in this chapter is to demonstrate that children may actually know a good deal about how these realities do not correspond to appearances, and that their lack of success with the many tasks that Piaget and others have used to support the existence of conceptual limitations during an early preoperational stage of cognitive development can be reinterpreted through an explanation that focuses on language. My proposal is that children are both sophisticated and limited users of rules of conversation that promote effective communication: sophisticated when it comes to the use of conversational rules in everyday, natural talk, but limited in specialized settings that require knowledge of the purpose intended by speakers who have put aside rules in the conventional use of language.

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COMMUNICATION AND RULES OF CONVERSATION

When young children participate in everyday conversations, they often adjust their speech to suit the characteristics of the listener (Gelman & Shatz, 1977). They speak in less sophisticated ways to children younger than themselves and use more complicated forms of language when conversing with adults. Moreover, they are skilled in comprehending the motives of a speaker (Braine & Rumain, 1983). They assume that a speaker’s messages will be cooperatively motivated by brevity, sincerity, relevance, and clarity, conventions of communication that have been noted by philosophers of language. These are rational, systematic rules that constrain conversations.

In his account of speech conventions, Grice (1975, p. 45) maintains that a Cooperative Principle underlies effective communication: "Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged." To produce conversation in accordance with this principle, he lists four rules or maxims that may be described as the Maxims of (a) Quantity ("Speak no more or no less than is required"), (b) Quality ("Try to speak the truth and avoid falsehood"), (c) Relevance or Relation ("Be relevant and informative"), and (d) Manner ("Avoid obscurity and ambiguity"). These maxims can be called the conversational rules. 1

In conversations between adults, it is mutually understood that the rules may sometimes be explicitly flouted to create what Grice has termed conversational implicatures. These nonconventional forms of language are used, for example, when the rules contradict each other (e.g., when being relevant and informative would violate the quantity rule to be brief and speak no more than is required), when irony is intended through an uninformative statement of the obvious, or when there is a politely motivated desire to ensure through repeated questioning that the listener understands. Even in adult conversations, however, the listener is apt to be misled if a rule is quietly broken.

In experimental settings, contrary to the relevance and quantity rules, experimenters may pose questions to children in which the answer is obvious or repeated. Unlike older children and adults, young children may not appreciate that the purpose of departing from these rules is to establish the children’s understanding of concepts. They may inadvertently perceive an experimenter’s well-meaning questions as uninformative and irrelevant. Moreover, contrary to the quality and manner rules, children may perceive questions as insincere and deceptive, or an experimenter may unjustifiably assume that children share with

1 Although Grice’s account has been highly influential, many commentators (e.g., Brown & Levinson, 1987; Cohen, 1971; Sperber & Wilson, 1986) have pointed to more complex issues (that will not be dealt with here) in the study of the pragmatic use of language.
adults the meaning of certain key words. Because children’s conversational habits are based on an implicit understanding of the Cooperative Principle and the conventional use of conversational rules, in response to implicatures contained in unconventional forms of questioning, they may misinterpret the experimenter’s purpose or use of language. They may respond incorrectly not because they do not know the answer but because the conversational worlds of adults and children clash. In some cases, communication may be jeopardized by children’s perception that the experimenter is not even observing the basic principle that speakers cooperate with the listener.

Efforts have been made to investigate how children understand the nature and purpose of adults’ questions. The results indicate that children can be inadvertently led to give answers that do not reflect the depth of their understanding, and that they have a greater knowledge of the realities underlying perceptual appearances than Piaget and others estimated.

**PERCEPTION OF PURPOSE IN QUESTIONING: CONSERVATION OF NUMBER AS A STARTING POINT**

Sixty years ago, Piaget (1929) wrote about the difficulties of questioning children by using a “clinical method.” To diagnose their authentic reasoning abilities, his rule was to encourage “the flow of spontaneous tendencies,” and he advocated that “every symptom” of the child’s thought should be placed in its “mental context” (p. 4). Questions ideally should be asked in the manner and form of the spontaneous questions actually asked by children of the same age and younger. In efforts to avoid “systematic errors” inherent in the “pure experiment” in which children may give artificial responses, Piaget was particularly concerned with the effect of repeated questioning and lengthy interviewing. He sought to deal with this problem by presenting countersuggestions and by letting the child talk for a few minutes and later returning to the topic indirectly. He advocated that the interviewer probe the roots of the suspect answer and then ask the question in as many different ways as possible. But although he believed that “Suggestion may thus be avoided by means of patience and analysis,” Piaget (1929, pp. 27–28) did concede a “much more serious difficulty,” that of distinguishing from among the results of the examination the point to be regarded as the child’s original contribution and that due to previous adult influences.”

Piaget acknowledged but never clearly confronted this problem. In fact, a critical gulf in communication can occur even between adult speakers and listeners. Such a gulf is well shown in many humorous incidents, for example, in the Marx Brothers joke in which one man says to another, “Where can I get a hold of you?” and the response is, “I don’t know. I’m ticklish all over!” Cases of misunderstanding a speaker’s intent probably occur more frequently in commu-
communication with children. But these misunderstandings are also apt to be more subtle because children are less experienced in conversations. Compared with adults, children may be less likely to retort spontaneously in an effort to clarify a speaker’s intent and to offer repairs for improving communication. Consequently, their misunderstanding of the purpose underlying questions may go unnoticed, and they may not reveal the depth of their knowledge.

Although Piaget advocated using countersuggestions to probe for certainty in children’s answers, the children may not share the experimenter’s implicature in violating the quantity rule—to test through repeated questioning whether they believe in their answer, irrespective of whether the opposite is maintained by their peers in general. Instead, they may extract meaning from their personal knowledge of others and strain to import their own relevance to the speaker’s rule breaking. As Anne-Nelly Perret-Clermont has pointed out in chapter 3 of this volume, children’s responses to suggestions such as “Another child gave me a different answer. Do you agree?” may be tacitly based on the presumed answer to the question “Is he a dumb or smart kid?”, rather than referring to any child at all. Nevertheless, on the basis of conservation studies, Piaget often contended that young children center on the external perceptual aspects of transformations and ignore invariant features such as number. That is, in comparing the numbers of counters set out in parallel rows, they fail to take into account density as well as length and do not compensate by integrating information from two or more dimensions of a problem.

All the same, the issue of how children understand experimenters’ questions has not gone unnoticed. In an incisive pair of studies, Rose and Blank (1974) tested the hypothesis that nonconservation of number is influenced by the language context and that repetition of the question (e.g., “Are there the same number in both rows, or does one row have more?”) misleads children to change their answers and respond incorrectly. Asking only one question after the rows had been transformed produced more conservation responses in 6-year-olds compared with largely nonconservation responses in a standard two-question condition. This is similar to the effect we see in adult conversations where repeated questioning (e.g., “How are you?” Response: “OK.” Repeated question: “How are you?”) results in response switching or, perhaps in some cases, annoyance at having to repeat the answer. Yet Rose and Blank’s findings have met with equivocal support in replication studies (e.g., Neilson, Dockrell, & McKechnie, 1983; Samuel & Bryant, 1984) and, in any event, were largely restricted to 6-year-olds’ judgments of small numbers of items. To address this issue, we examined children’s appreciation of repeated questioning in two conservation of number experiments with children aged 4 to 6 years (Siegal, Waters, & Dinwiddy, 1988).

A total of 180 children participated in Experiment 1. Within each age group, half were randomly assigned to a one-question condition and half to a standard two-question condition. The task involved comparing numbers in two rows of 20
counters that had been rearranged by the experimenter. As predicted, the children tested under the one-question condition gave significantly more conservation judgments (78% in all) than did those tested under the standard condition (23%).

In Experiment 2, we further examined the hypothesis that children interpret repeated questioning as requiring an inconsistent pattern of responses. Children were shown puppets who acted as subjects in videotaped conservation experiments and were asked to give causal attributions for the puppets' responses in one-question and two-question conditions. According to our theory, if children interpret a repeated request as a cue to change responses, they should give "external" attributions for puppets' conservation judgments in the standard two-question condition and more "internal" attributions for conservation responses or non-conservation responses in the one-question condition.

The 32 4- to 6-year-olds in this second experiment were initially alerted to the possibility that choices are made to please others by instructions based on Asch's (1958) series of conformity experiments, together with two practice requests for justifications. The experimenter first read a story such as the following, in which the characters were the same sex as the subject:

Sally was playing with a few of her friends at kindergarten when the teacher came up to the children and showed them two blocks, one big and one small. The teacher asked each child to point to the biggest block. The first child pointed to the smaller block, and so did the others. Then it was Sally's turn. She pointed to the small block, too. Do you think that Sally pointed to the small block because (a) she really wanted to please the other children and be like them or because (b) she really thought that block was the biggest? (All the children chose a.)

The teacher showed the same blocks to another group of children who were playing with Louise and asked them to point to the smallest block. The first child pointed to the big block, and so did the others. Then it was Louise's turn. She pointed to the other block instead. Do you think Louise pointed to the small block because (a) she wanted to please the other children or because (b) she really thought it was the smallest block? (All the children chose b.)

So you see, sometimes people do things just to please others and sometimes they do things because they really think what they do is true.2

The children then viewed four videotaped segments depicting the responses of puppets on the conservation of number arrays used in the first study. The puppets were shown tested by an experimenter twice under one-question conditions and twice under standard conditions. For one segment in each condition, one

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puppet gave a conservation response and another a nonconservation one. The presentation order of the segments was systematically varied.

After viewing each segment, the children were asked if the puppet had responded "just to please the grown-up" or "the way the puppet really thought was true," representing external and internal attributions, respectively. For puppets' nonconservation responses in the standard condition, the percentage of external choices ("just to please the grown-up") was 69%, significantly above a chance level. The percentage of external choices was below chance level for conservation responses in the standard condition (25%) and for responses in the one-question condition (28%). For nonconservation responses in the one-question condition, the percentage of external choices was at a chance level of 44%.

Such experiments require qualifications. First, our conservation tasks departed somewhat from those Piaget (1952) originally used. Second, no necessary connection existed between children's own answers on conservation tasks and their attributions for others' responses. Third, in Experiment 1, a minority of children, especially 4-year-olds, did not conserve, and in Experiment 2, some did not give external attributions for others' nonconservation responses in one-question formats. Although repeated questioning may jeopardize children's performance on many tasks, asking only one question does not guarantee that all children will respond correctly.

Bearing these considerations in mind, we replicated our results in two subsequent experiments on conservation of length (Siegal et al., 1988, Experiments 3 and 4) that were in agreement with Rose and Blank's original findings. Children were often able to respond correctly, but they could be misled by an experimental context that departed from the conversational rules (in this case, the quantity rule: "Speak no more or no less than is required"). In turn, children may respond in a manner that does not reflect the depth of their knowledge, and a researcher may be misled to classify their thinking as still in the preoperational stage at which they do not understand the concept of invariance in number. In standard two-question conservation experiments, at least some children may change their answers because they are prompted to do so by repeated questioning. The majority of children in our experiments gave external causal attributions for nonconserving responses in the standard procedure. In contrast, they conserved and gave internal causal attributions in a one-question condition.

**CONVERSATIONAL RULES AND CHILDREN'S RESPONSES ON COGNITIVE TASKS**

It appears, then, that on standard Piagetian cognitive tasks such as number conservation, many young children do know the correct answer. However, they may interpret repeated questioning that violates the quantity rule as conveying the
message that their first response was not acceptable and should be switched. This scenario, characterized in Figure 1, raises issues about whether children's performance in experiments comes near to revealing what they know.

Are children certain of the right answer? Do those children who are certain respond incorrectly because of violations of the quantity and quality rules? As Gelman, Meck, and Merkin (1986) have suggested, children who are uncertain of the correct answer on cognitive tasks may be apt to respond inconsistently to repeated questioning. Because their responses may reflect a lack of experience or confidence in the answer, clarification of instructions should facilitate performance, especially in single-task conditions.

However, the suggestion that uncertain children are especially likely candidates to be swayed on tasks that contravene conversational rules is unlikely to be the whole story. A further explanation for poor performance is that, in some cases, children are certain of the answers but may not state their convictions because of violations of the quality rule (to be sincere and truthful).

For example, Perner, Leekam, and Wimmer (1986) have suggested that, because children know that the experimenter already knows the answer, they regard standard conservation questions as insincere. Their incorrect responses reflect an insufficient analysis of the experimenter's reason for asking the conservation question rather than an inability to conserve. When told to give a response after the first questioner is replaced by a second, naive experimenter who had not heard their previous answer and thus could not be insincere in asking the question a second time, the majority of 4- to 6-year-olds now conserve. Older children have a more advanced appreciation of intentions in conversations. They conserve in any event because they can understand the "second order epistemic intention" or, for that matter, the implicature contained in the experimenter's repeated questioning that he or she truly wants to know what the children know. To account for nonconservation, Perner and his co-workers substituted an inability in early childhood to understand the mind of the experimenter for the lack of a logical ability to disregard perceptual appearances.3

Do children respond incorrectly on "appearance-reality" tasks because of a conceptual limitation or because of violations of the quantity, quality, and relevance rules? A similar interpretation can be given for children's responses on tasks designed specifically to examine whether children can distinguish the real properties of objects from their appearances. In a series of intriguing studies by Flavell and his colleagues (e.g., Flavell, Flavell, & Green, 1983; Flavell, Green, & Flavell, 1986), 3-year-olds were often found to mistake appearances for reality (termed a phenomenism error) and reality for appearances (a realism error). On

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3This position may be too strong. Instead of an inability to understand the mind of the experimenter, it may simply be inexperience in knowing others' intentions (Siegal, 1991, chapter 4; Siegal & Sanderson, 1989).
appearance–reality (AR) color tasks, for example, they frequently committed phenomenism errors. When a white substance such as an egg was placed under a color filter, they might tell an experimenter that the egg was colored in both reality and appearance. Realism errors were especially common on “identity” AR tasks when, for example, children were shown a sponge that looked like a rock and were asked to indicate both the apparent and real identity of the object.

Flavell et al. (1986) reported that, even in highly familiar situations, many children have little or no understanding of the AR distinction. Accordingly, they do not possess a “dual-coding” mechanism to conceive of appearance and reality simultaneously and cannot keep one in mind while experiencing the other. Some investigators view this ability as a prerequisite for children to respond correctly on Piagetian conservation problems (Flavell et al., 1986, p. 1).

However, the evidence for Flavell and his colleagues’ assertion comes largely from studies involving direct and repeated questioning on multiple AR tasks. If meaning in conversations is guided by a “mental model” of the world (Johnson-Laird, 1983), children may perceive the questions on AR tasks to be similar and as part of a repeated sequence, even if the task materials are varied. Again, under repeated questioning, young children who are inexperienced in conversations may not share the implicature that the experimenter has violated the quantity rule.

Recently, we conducted two experiments in an attempt to reexamine the position that many young children do not appreciate the distinction between appearance and reality and are often phenomenists on color tasks in which they mistake appearance for reality (Siegal, Share, & Robinson, 1989). In Experiment 1, 48 3-year-olds were given a single AR. They were shown milk in a blue glass and asked, “What color is the milk really? Is it truly white or truly blue?” (reality question) and “When you look with your eyes right now, what color is the milk? Does it look white or look blue?” (appearance question). The order of the questions was alternated across subjects. Most accurately labeled the drink as white in reality and blue in appearance. In another phase of this experiment, the children were shown two glasses: cream in a clear glass that looked like milk and milk in a blue glass that looked like juice. They were told, “Here is some milk in a blue glass. It looks like juice but it is truly milk. Here is some cream in a clear glass. It looks like milk but isn’t really. If a friend came along to ask you for a glass of milk, which one would you give her? (reality question) Which one would the friend think was the milk?” (appearance question). For the most part, consistent with the results of the labeling phase, the children correctly made the inference that a child who thirsted for milk but was unaware of the contents of the glasses would erroneously select the cream (see Table 1).

In Experiment 2, a different sample of 48 3-year-olds was divided into two conditions: a single-task condition as in Experiment 1 and a multiple questioning task similar to that used by Flavell et al. (1986). Under a form of repeated questioning in the multiple-task condition, the children often mistook appearance
for reality, claiming that milk in a blue glass was blue in both appearance and reality. In addition, to examine the notion that repeated questioning on these types of tasks can impair cooperation in communication, each child in Experiment 2 was asked at the conclusion of the session, “Would you like to stop now or go on?” In the repeated questioning condition, 10 out of the 24 children expressed a desire to conclude the experiment when asked, versus only two who were tested in the single-task condition. As Grice (1975, p. 49) has suggested, speakers may regard certain conversational environments as so ineffectual for communication that they refuse to continue the dialogue and opt out of the Cooperative Principle altogether. Some children will do this in certain experimental settings, hoping that the session will be brought to a speedy conclusion.

In answering AR questions, children may commit phenomenism errors as a means of positively evaluating the effectiveness of the experimenter’s attempts at providing deceptive appearances, particularly on a series of tasks that is not apt to be perceived as very new or different. Especially during repeated questioning on AR color tasks, they may be induced to say that an apparent deception is so good that it is real; hence, milk is really and truly colored when placed under a colored filter. Children’s inexperience with the purpose of questions that contravene the quality rule, involve deception, and, hence, contain an element of insincerity renders this possibility a good one. A similar interpretation might be given for a realism pattern on object identity tasks. For example, should 3-year-olds evaluate a sponge that looks like a rock as a less than adequate facsimile, they could justifiably respond that the object both looks like a sponge and is a sponge in reality.

Although AR knowledge may be exceptionally advanced in food-related contexts (see, for example, Siegal & Share, 1990, Experiment 2), our findings

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**Table 1**

RESPONSES TO THE APPEARANCE AND REALITY QUESTIONS IN THE LABELING AND INFERENCE PHASES OF EXPERIMENT 1

<table>
<thead>
<tr>
<th>Response</th>
<th>Labeling phase</th>
<th></th>
<th>Inference phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Correct on both</td>
<td>85</td>
<td>41</td>
<td>71</td>
</tr>
<tr>
<td>Appearance answers to both questions (phenomenism)</td>
<td>8</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Reality answers to both questions (realism)</td>
<td>4</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Incorrect on both</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

suggest that earlier studies may have underestimated children's ability to detect the real properties of substances because these studies used procedures that violated the quality rule. Furthermore, AR tasks may not capture the hearts and minds of young children. Repeated questioning on tasks that involve deception may contravene not only the quantity rule but the quality and relevance rules as well. Children may reason that a quick finish will allow a return to more interesting, relevant, and informative activities.

**FURTHER IMPLICATIONS OF THE QUALITY RULE FOR COMMUNICATION**

To communicate effectively, a speaker must be sincere enough to maintain comparable sincerity on the part of the listener whose task it is to respond to questions seriously. Nevertheless, in some cognitive tasks, an experimenter may question children on a highly familiar topic in a deadpan fashion that involves a conversational implicature: The experimenter wants to determine what children know to the extent that, in his or her questioning, the quality rule prevails over the quantity and, possibly, the relevance rules. To understand the implicature, the children have to share the experimenter's intent. Otherwise, the experimenter's adherence to the quality rule in the face of other rule violations may lead children to give responses that are less than sincere. Conversely, there are experimental tasks in which the quantity and relevance rules prevail over the quality rule. Should children not recognize the experimenter's well-meaning use of insincerity and deception, their answers may again mask what they know.

*When children can be less sincere than the experimenter: Responses to questions about gender constancy.* Preschoolers sometimes interpret prolonged questioning on some tasks as seeking age-typical or “cute” answers, whereas older children who see themselves more as adults do not interpret questioning in this way. One example comes from research on children's concepts of gender. According to Kohlberg (1966), children's sex-role development is influenced by an understanding of gender concepts. Of special importance is the establishment of a stable concept of gender identity. This concept involves the stable and constant categorization of the self, despite superficial opposite-sex transformations in features such as dress. Once children have achieved a stable concept of gender, they know, for example, that a boy will remain a boy even if he wears girls' clothing or plays girls' games. They then seek out traditionally sex-appropriate activities and adopt sex-typed behaviors in efforts to live up to a self-definition as boys or girls.

Slaby and Frey's (1975) gender constancy interview has been widely used to test Kohlberg's cognitive-developmental account. The measure consists of 14
questions and counterquestions: nine questions on children’s knowledge of their “gender identity” (e.g., Are you a boy or a girl?), two questions on “gender stability” (e.g., When you were a little baby were you a boy or a girl? When you grow up will you be a mummy or a daddy?), and three questions on “gender consistency” (e.g., If you wore [opposite sex of subject] clothes would you be a boy or a girl? If you played [opposite sex of subject] games, would you be a girl or a boy?) The counterquestions are designed to probe the certainty of the subjects’ original responses (i.e., If you played [opposite sex of subject] games, would you be a [opposite sex of subject’s first response]?). Children seem to find the identity questions (given first) easier than the stability questions (given second), and find the consistency questions (given last) the most difficult.

However, gender constancy has been shown to be closely related to children’s conservation responses (Marcus & Overton, 1978). The sequence of questions and counterquestions in the gender-constancy interview, although not identical, is very similar in nature and may be perceived as repetitious. In the traditional conservation experiment, posttransformation questions are more difficult to answer than pretransformation ones, just as questions on gender consistency are more difficult than those on gender identity and stability. Therefore, the repetition of items and the completely obvious answers to at least the gender identity questions may provoke children to change their responses. Although intended to be sincere, the sequence of questions may seem progressively silly and, thus, to demand silly, insincere answers. According to this analysis, repetition should result in a lack of gender constancy on the more “difficult” or silly consistency items. If children are given the consistency items first, they should provide more gender-constant responses.

In one of my studies (Siegal & Robinson, 1987), the participants (30 boys and 30 girls) ranged in age from 42 to 54 months with a mean of 47.9 months. Robinson and I hypothesized that more gender-constant responses would be given when the interview questions were asked in reverse order. In addition, the children were asked to give causal attributions for the presence or absence of gender consistency in the responses of other children. The purpose of this addition was to supplement the group pattern of responses on the consistency items with justifications in the form of attribution choices. If the absence of consistency reflects a willingness to satisfy demand characteristics of the interview, more external attributions in terms of a desire to please an adult should be given for the absence than for the presence of gender consistency.

As predicted, the order in which the questions were asked had a significant effect on the children’s responses. Of the 30 children who were asked the gender consistency questions first (the reversed order condition), 23 (76.7%) gave gender-constant responses on both items involving clothes and games, compared with only 10 of the 30 children in the traditional order condition. Far more external attributions were given when the story character was de-
scribed as lacking gender constancy than when gender constancy was present in the character’s responses.

The age range of the children in this study was rather restricted compared with that in previous work, and interview responses may be independent of attributions because it is possible for children to maintain that peers hold genuine or false beliefs in gender consistency (or its absence) irrespective of their own beliefs. But despite these qualifications, the lack of gender constancy shown by children in the traditional interview format was influenced by the context in which the questions were posed. Our interpretation is that questions in the traditional format seem progressively silly to children and attract insincere responses instead of correct ones. Older children have more experience in conversation and recognize the intent underlying repeated questioning on matters that seem to have obvious answers. Thus they are more likely to respond sincerely and correctly.

When children can be more sincere than a well-meaning experimenter: Responses to questions about health and contamination. Another explanation for children’s performance on many cognitive tasks involves their naive approach to a situation in which the experimenter has put aside the quality rule in order to carry out a brief and relevant, well-meaning test of their knowledge.

For example, Rozin, Fallon, and Augustoni-Ziskind (1985; see also Rozin & Fallon, 1987, pp. 34–35) claimed that young children do not easily understand the invisible basis of contamination. In their study, an experimenter dropped items such as a used comb and a grasshopper into glasses of juice. In line with the results of an earlier interview study (Fallon, Rozin, & Pliner, 1984), a considerable number of their 4- to 6-year-old subjects were willing to drink the contaminated juice on request.

As Rozin and his colleagues (1985) have cautioned, however, the effects of social pressure on responses are difficult to evaluate. In this respect, rather than lacking a conceptual understanding of contamination, the children may simply have misinterpreted the procedural requirements of the situation. For example, they may know that a drink that has been in contact with a foreign object can be harmful, and they may reject the object as food. At the same time, they may not be aware that a grown-up might offer children a contaminated drink in an effort to test their understanding of the causes of illness; they would have no reason or experience to doubt that the experimenter’s presumed offer of an uncontaminated drink was sincere.

As part of a series of studies, we reexamined children’s knowledge of contamination (Siegal, 1988, Experiment 1). The participants were 120 children divided into three groups of 40. The mean ages in months, with ranges in parentheses, were Preschool, 59 (54 to 64); Grade 1, 69 (65 to 74); and Grade 3, 99 (90 to 103). The children were given three contamination situations in random order. In these situations, an insect, a comb, and a spoon were shown to fall
accidentally to the bottom of a glass of milk, just as a child (the same age and
gender as the subject) was about to drink it. The situations were illustrated with
a real dead cockroach, a comb, and a spoon. The spoon did not look dirty, but
its actual cleanliness was not specified. The comb, obviously used, had dandruff
clearly stuck to it. The cockroach was obviously authentic and could be readily
identified by all the children; it was used because pilot work suggested that using
insects such as flies and grasshoppers in similar conditions may not trigger Aus-
tralian adults’ judgments about contamination.

The children were required to indicate the likelihood that illness would
occur in children who drank the milk and to predict their own preventive health
behavior. They were asked questions before and after the experimenter removed
the object from the milk and placed it out of sight. The questions before removal
of the object were: “Would the child get sick if he/she drank some of the milk
with a _____ in it?” If yes, “A little or a lot?” Then they were asked, “Would
you want to drink milk that had a _____ in it if a grown-up told you that you
could?” The questions asked after the object was removed were: “Would the
child get sick if he/she drank some of the milk now that the _____ has been
taken out?” If yes, “A little or a lot?” The next question was, “Would you
want to drink milk that had a _____ taken out of it if a grown-up told you that
you could?”

Of 40 preschoolers, 39 said that they would not drink milk with a cock-
roach in it, and 34 said they would not drink the milk even when the cockroach
was removed. Most children claimed that drinking milk with a dirty comb in
it or milk from which a comb had been removed would make a child either a
little or a lot sick. The majority would not drink the milk themselves in either
of these two circumstances, and it appeared, although further study is needed
to investigate this possibility, that some of the few children who said that they
would drink milk containing a cockroach or dirty comb intended to shock the
experimenter (and in this way were less sincere than she was). Surprisingly,
13 of 40 preschoolers claimed that a child who drank milk with the spoon in
it would become very sick. Many of these spontaneously volunteered that they
would be afraid of swallowing the spoon! With the spoon removed, the number
decreased to 5.

These results, which came from an Australian sample, suggest that children
have a greater understanding of contamination than indicated by the American
studies of Rozin and his colleagues, and the discrepancy may be interpreted in
terms of differences in the degree of exposure of Australian and American children
to contaminants. Nevertheless, the hypothesis that Rozin’s subjects may have been
naive in assuming that an adult would not sincerely offer them a contaminated
drink is an intuitively appealing explanation for the superior performance shown
by the children in our study, who were simply asked to evaluate another’s truth-
fulness and then to predict their own health behavior. In this respect, we recently
reported that 3-year-olds in natural conversations regarded juice that had been in contact with a cockroach as not good to drink, even when the cockroach was removed without a trace (Siegal & Share, 1990).

**ARE YOUNG CHILDREN CONCEPTUALLY LIMITED OR CONVERSATIONALLY INEXPERIENCED? TOWARD THE ADJUDICATION OF ALTERNATIVE ACCOUNTS OF DEVELOPMENT**

This chapter has examined two general positions on cognitive development. In Piaget's (1952, 1970) analysis, children and adults share beliefs about the nature and purpose of experiments. Age differences in conservation answers, for example, are due to differences in the schema or "functional architecture" required to go beyond perceptual appearances in order to represent and use concepts such as invariance in number. In adapting to the environment, children later come to share the same capacity for representation as adults. According to the contrasting view, taking into account Grice's Cooperative Principle and the conversational rules, results from experiments on conservation, knowledge of the appearance-reality distinction, gender constancy, and concepts of health and contamination suggest that adults and children may differ to some extent not in their representation capacities but in their interpretation of the purpose and meaning of language. In Grice's terminology, the difference is in their experience with "logic in conversation." Consequently, children's beliefs about the realities underlying perceptual appearances—even if these turn out to be rather fragile—may actually be no different from those of adults. However, adults and children may differ in their beliefs about the purpose underlying repeated or other forms of unconventional questioning that contravene conversational rules. Therefore, children on many cognitive tasks may respond in a manner that seems to reflect conceptual limitations.

Rather than sharing the experimenter's purpose and implicatures in conversation, children may be uncertain of the answer to the task in the first place and may be induced to respond incorrectly through repeated questioning. Even if they are certain of the correct answer, they may give a wrong one because they do not recognize the experimenter's well-meaning use of insincerity and deception or because the question seems uninformative or irrelevant. Then there is the issue of semantic development that goes beyond the scope of this chapter and involves violations of the rule of manner, "Be clear and avoid obscurity." The experimenter's use of words may not yet map onto the child's experience (see Siegal, 1991, chapter 6, for a discussion). In fact, children may not disclose what they know on any task in which there has been a departure from a conversational rule and they do not yet share the meaning of adult implicatures. These are matters
that can be approached by examining the interaction between the explicitness of children’s knowledge and their conversational experience.

As Karmiloff-Smith (1986) suggests, it is useful to distinguish between knowledge that is consciously accessible (sometimes called explicit or declarative knowledge) and knowledge that can be implicitly represented in behavior (sometimes called procedural knowledge). For example, in language tasks, children can implicitly identify forms such as sentences, but they may not be able to respond to direct questions about these forms. Similarly, they may have a substantial implicit AR knowledge without possessing conscious access to the dual representational code that is necessary to respond to direct questions. Thus, if an experimenter’s goal is to examine the early capacity for representation through direct questioning, some children may be unable to access their knowledge and may confuse appearance and reality. By contrast, they may demonstrate a procedural or implicit knowledge if the experimenter examines their understanding as a means of obtaining a clear-cut goal, such as procuring uncontaminated nutrients.

Yet experimenters may seek explicit, declarative knowledge from children using methods that require still further explicit knowledge. In communication with adults, young children may initially operate under a mental model that does not represent departures from conversational rules. As Johnson-Laird (1983) proposed, in making inferences, listeners typically imagine a state of affairs based on the meaning of the premises. They then formulate an informative conclusion that corresponds to this state and search for alternative models to test the validity of the conclusion. Young children’s experience in communicating with adults often takes the form of a simple model: An A (adult) wants B (information). B can be obtained by asking C (child). The inference is simply that, by questioning C (and by C cooperatively supplying B), A acquires the desired B.

But what if this mental model is disturbed by repeated questioning on very similar tasks that contravene the quantity rule? Children may not construct a model based on an alternative state of affairs and an understanding of the implicature: A wants to be sure that C knows about B, and for this reason A uses prolonged techniques of questioning. Instead, they may operate on the basis of premises, such as that A believes that B can be found from C if C would change his or her mind, or that A was looking for a different B in the first place. Therefore, even if children have an explicit or declarative understanding of a problem, their knowledge may not be conveyed in response to techniques that require the construction of an alternative model of the task and the experimenter’s intent.

According to Johnson-Laird (1983, pp. 126–145), there are both implicit and explicit inferential abilities in interpreting discourse. Implicit inferences are based on a single mental model that processes information rapidly. Explicit inferences are required when the single or default model does not work and alternative models must be sought. Nevertheless, the use of unconventional or unfamiliar
language that requires the explicit construction of alternative mental models may conceal both an explicit and implicit knowledge of a subject area.

Of course there is more to cognitive development than the ability to share purposes and meanings in experimental contexts. Even if children do have this ability and possess an implicit representation that directs their attention to the relevant features of a problem, they may still lack the conceptual competence—the logico-mathematical knowledge and principles—to succeed fully. Only a skeletal understanding may be present. To ensure that a conceptual limitation in development is deep rather than superficial, it is necessary to rule out the interpretation of a clash between the conversational worlds of adults and children.

An approach that focuses on the language of the experiment harbors the possibility of discovering more capacity in early cognitive development than has often been envisioned. If this chapter has shown that conversational assumptions in forms of questioning must be made more explicit, it has achieved its purpose.

References


