Cognitive Development, 5, 1–27 (1990)

Developmental Changes in Young Children's Knowledge About the Mind

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In this article we propose an account of the early development of children's knowledge about the mind and report two studies designed to test a part of it. According to this "connections-representations" account, young children begin their discovery of the mental world by learning that they and other people have internal experiences or mental states that connect them cognitively to external objects and events—experiences such as seeing them, hearing them, and wanting them. Later, they realize that the same object can be seriously (other than in pretense) mentally represented in different, seemingly contradictory ways: for example, as A in appearance, B in reality, C according to their perceptual or conceptual perspective, and D according to another person's. The results of both studies confirmed the prediction that 3-year-olds would perform well on appearance-reality and perceptual perspective-taking tasks requiring only an understanding of cognitive connections, but perform poorly on tasks requiring an understanding of seemingly-contrary-to-fact mental representations. To illustrate, children of this age had little difficulty determining that they could hear but could not see a noise-making object located on the experimenter's side of a barrier, and that the experimenter could see it (connections-level tasks). In contrast, they were largely unable to say, for instance, that a toy bear held behind a large elephant mask and emitting a cat sound looked like an elephant, sounded like a cat, and really was a toy bear (representations-level tasks)—even though the experimenter had actually told them previously what it looked like, sounded like, and really was. The article concludes with speculations about the possible origins of connections and representations knowledge and observations about the significance of these acquisitions for the child's development.

The development of young children's ideas about the mind has recently become a lively area of scientific inquiry. Researchers have been studying such interesting topics as: (a) young children's understanding of percepts, beliefs, intentions,

This research was supported by NIMH Grant MH 40687. We are grateful to the children, teachers, and parents of Bing School of Stanford whose cooperation made these studies possible. We also wish to thank Louis J. Moses for his useful criticisms of a previous draft of this article.

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Manuscript received May 10, 1989; revision accepted August 17, 1989

emotions, and other mental states; (b) their ability to infer the perceptual, conceptual, and affective perspectives of others; and (c) their grasp of the distinctions between real and mental, real and pretend, real and apparent (the appearance-reality distinction), what is said and what is meant, and what is seen and how that which is seen is mentally represented (Astington, Harris, & Olson, 1988; Harris, 1989; Saarni & Harris, 1989). Moreover, there seems to be a growing sense that many of these acquisitions may be linked developmentally, despite their apparent diversity and heterogeneity. Some develop at about the same age and appear to reflect the same newly acquired insight into the nature of mind. Some emerge in fixed sequence, suggesting an orderly developmental succession of such insights.

There have been a number of recent attempts to describe and explain the course of development in this area (e.g., Chandler & Boyes, 1982; Flavell, 1988; Forguson & Gopnik, 1988; Harris, 1989; Leslie, 1988; Perner, 1988, 1989; Pillow, 1988; Taylor, 1988; Wellman, 1987, 1988, in press; Wellman & Bartsch, 1988; Wimmer, Hogrefe, & Sodian, 1988). In this article we first propose a "connections-representations" account of the early phases of this development and then report two studies designed to test a part of it. This account is based both on a recent elaboration (Flavell, 1988) of our earlier theoretical distinction between Level 1 and Level 2 knowledge about visual perception (Flavell, 1978; Flavell, Everett, Croft, & Flavell, 1981) and on these recent theoretical efforts by others. It does not represent a new theory, but rather a combination of elements from previous theories.

According to this account, by approximately 3 years of age most children have learned that they and other people can be related epistemically or *cognitively connected* (Flavell, 1988) to things in the external world in a variety of different ways. An example of a cognitive connection is seeing something. Children of this age know that they can become cognitively connected to something by seeing it; they also understand that they may not see it—that they may not be connected to it in this way at a given moment. They further understand that they may be cognitively connected, or not connected, to things in many other ways as well. That is, they understand at least roughly what it is to do most of the following: hear or not hear something, taste it, smell it, feel it by touching it, know it, think of or about it, guess it, dream of or about it, picture or imagine it, pretend with it, want it, hope for it, intend to do something with it, and have specific feelings and emotions regarding it—like it, fear it, be angry at it, and so on. This account does not claim that all such cognitive connections are understood equally early or equally well nor does it explain developmental décalages among them. It only suggests that some knowledge about most such connections is an early acquisition.

We also credit 3-year-olds with some understanding that: (a) cognitive connections can change over time; (b) they are largely independent of one another;

(c) their own connections are independent of those of other people; and (d) connections entail inner, subjective experiences. As examples of (a), they are capable of realizing that they dreamt of X last night but are not dreaming of it now, and that they see Y now but did not see it a minute ago. As examples of (b), they understand that they can hear something either with or without also seeing it, think about it with or without perceiving it simultaneously, and so forth. To illustrate (c), they are capable of recognizing that another person may perceive, guess, want, dislike, and so forth, something that they do not or vice-versa; thus, contrary to Piaget and others, we believe that their conception of these connections is fundamentally nonegocentric rather than egocentric. As to (d), recent research (e.g., Dunn, Bretherton, & Munn, 1987; Wellman, 1988; Wellman & Estes, 1986) suggests—also contrary to traditional views—that young children can distinguish to some extent between the subjective acts and experiences of seeing, feeling, and so forth, something and that objective something itself. That is, it seems likely that they tend to interpret perceptions, feelings, and the like mentalistically rather than behavioristically—as experiences that take place inside themselves and others. When they see another child cry, for instance, they are likely to assume that the child is experiencing unpleasant inner feelings, just as they do when they cry. Similarly, when they see a person look at or listen to something, they are likely to represent that person as having the phenomenological experience of seeing or hearing it (Novey, 1975).

Despite these impressive developmental accomplishments, children of this age still have only a limited understanding of *mental representations* (Flavell, 1988). They believe tacitly, as adults generally do, that each object or event in the world has only one nature—one "way that it is"—at any given point in time. It cannot be two or more very different, mutually contradictory and incompatible things at the same time; rather, it can only be one thing—namely, how it "is" (with "is" not differentiated in their thinking from "seems to them at that moment"). Unlike adults, however, they do not clearly understand yet that people may for one reason or another "seriously" represent that thing very differently from the way it "is" (seems to them), that is, describe it very differently other than when pretending, joking, dreaming, lying, or the like (cf. Perner, 1988). Young children do not clearly understand that it is possible to seriously represent (model, depict, construe, etc.) a single thing with its single nature in several different ways—ways that would be mutually contradictory if they described the object itself rather than people's mental representations of it. Thus, they do not see clearly that even though something may actually be only one thing or one way out there in the world at any given moment, it can actually be more than one thing or one way up here in our heads, in our mental representations of it. Consequently, they will tend to reject as simply wrong or incomprehensible any description of something that seems to them to contradict "the way it is at that moment." In particular, they will tend to do so even when

that description is generated by a seriously held but incorrect mental representation of the thing, for example, a belief that is false because based on inadequate evidence.

This account suggests, therefore, that children of this age are to some degree cognizant of cognitive connections to things, but not of the fact that things can seriously be represented mentally in very different ways. How might such children respond to tasks or situations that require cognizance of apparently contradictory mental representations? The tasks we have used to assess children's understanding of the appearance-reality distinction provide one illustration (e.g., Flavell, 1986; Flavell, Flavell, & Green, 1983; Flavell, Green, & Flavell, 1986). Following brief pretraining on the meaning of the appearance-reality distinction and of the words used to express it ("looks like" versus "really and truly"), we present the child with, say, a sponge that looks like a rock. After the children have manipulated this fake rock, we ask the appearance and reality questions. The appearance question is: "When you look at this with your eyes right now, does it *look like* a rock or does it *look like* a sponge?" The reality question is: "What is this really and truly—is it *really* and *truly* a sponge or is it *really* and *truly* a rock?" Order of questions and of options within questions are counterbalanced or randomized. Suppose that, after manipulating it but just prior to the two questions, they decide the object is a sponge, not a rock. For them, therefore, it "is" just one thing—a sponge. We then ask them our two questions. Adults interpret these questions as questions about the two very different, incompatible-seeming ways this one object can be represented mentally, namely, as a rock in its visual appearance and as a sponge in its enduring reality (texture, compressibility, function, etc.). We mentally tag each representation for the cognitive perspective or stance that gave rise to it—for its epistemic credentials, so to speak. In this case, we tag one as "what it looks like it is" and the other as "what it really is." However, because young children lack adequate understanding of mental representations they should tend to interpret the two questions simply as two differently worded requests for the object's single-identity-in-the-world and should therefore give the same answer to both questions—"sponge." If they had decided instead that the object was a rock, they should, of course, answer "rock" to both questions. Our studies show that 3-year-olds tend to perform poorly on simple appearance-reality tasks such as the one using the sponge-rock. Moreover, consistent with the process analysis just given, by far their most common error pattern is to give the same answer to both questions.

Children of this age have also been shown to have difficulty with other tasks that appear to require an understanding of contrasting mental representations. For example, they have trouble understanding false belief and changes in belief (Astington & Gopnik, 1988; Forguson & Gopnik, 1988; Gopnik & Astington, 1988; Hogrefe, Wimmer, & Perner, 1986; Johnson & Maratsos, 1977; Moses & Flavell, in press; Perner, 1988; Perner, Leekam, & Wimmer, 1987; Wimmer et al., 1988; Wimmer & Perner, 1983). These studies show that if a 3-year-old

subject and another person initially think X is the case, and then the subject, but not the other person, subsequently discovers that Y rather than X is really the case, the subject will incorrectly assert that: (a) The other person also thinks Y; (b) the subject himself or herself had also initially thought Y, prior to learning the truth. Again, the idea that someone could *seriously* (i.e., other than in pretend play or fantasy) represent something as being other than it "is" is poorly understood at this age. Similarly, they also perform poorly on so-called Level 2 visual perspective-taking tasks (e.g., Flavell et al., 1981). For example, they have difficulty understanding that a depicted turtle which they view in normal, right-side-up orientation or "standing on his feet" appears upside down or "lying on his back" to another person who views it from the opposite side of the table. Again, the problem seems to be a failure to differentiate how something "is" (seems to them) from how people might experience or represent it. For them, "what is there" is a turtle standing on its feet, and therefore it makes no sense to attribute to another person a mental representation of it as a turtle lying on its back. In addition, there is correlational evidence that the same young children who perform well (or poorly) on appearance-reality tasks likewise perform well (or poorly) on false belief tasks and Level 2 visual perspective-taking tasks (Flavell et al., 1986; Gopnik & Astington, 1988). This evidence is at least consistent with the possibility that an improved understanding of contrasting mental representations mediates good performance on all three tasks.

Young children also have difficulty with several other tasks that would seem to require this same understanding (Flavell, 1988). In early word learning children are often reluctant to accept a second name for an object, for example, "cat" for the animal they know only as "kitty" (Clark, 1987; Markman, 1984). Perhaps the new name is interpreted as a claim that the animal is something other than a kitty. They have trouble with hypothetical statements, especially about how things might have been in the past (Kuczaj, 1981). Perhaps past hypotheticals like Kuczaj's "What would have happened if your mommy drank some coffee last night?" (it having just been established that she had not really done so) are hard for them to interpret properly because they are construed simply as incorrect descriptions of a previous, known reality. They find it difficult to understand scale models (DeLoache, in press), perhaps because these models have to be construed as representations of what they model in addition to being construed as objects in their own right. Finally, Piaget long ago showed that they have trouble seriating objects by size and in understanding that such series are transitive (Flavell, 1963, p. 193). Piaget attributed the difficulty to their failure to conceive of each object in the series as being simultaneously both smaller than its neighbor on one side and larger than its neighbor on the other side. A partial cause of this failure might be their inability to understand how an object could be thought of as "smaller" if they had just encoded it as "larger" (thus, "larger" is what it "is"), or "larger" if they had just encoded it as "smaller."

If young children have the difficulties just described, why should they not also

have problems with such mental states as knowing, thinking of or about, guessing, dreaming, imagining, pretending, hoping or fearing that, and so forth—states that we have classified as cognitive connections? We believe that alternative descriptions of reality tend to be easier for young children to interpret correctly as reflecting alternative mental representations if (a) the description is recognized by them as laying no claim to truth (as in dreaming, imagining, and pretending), or if (b) there is as yet no known reality with which the description can conflict (as in guessing, hoping or fearing that, and hypotheticals regarding a future as contrasted with a past state of affairs). Perner (1989) cites two recent studies that seem to support claim (a). In one experimental condition, 3-year-olds said "chocolate" when asked what was in a closed chocolate box, and then discovered that it actually contained a toy car rather than chocolate. When subsequently asked what they had previously said was in the box, most of them incorrectly said "car." In another condition, subjects of the same age knew from the outset that the chocolate box contained a car and were asked to tell a puppet "something silly," namely, that there was chocolate in the box. When asked subsequently what they previously had said was in the box, most of these subjects correctly said "chocolate." In contrast, 4-year-old subjects recalled correctly both previous assertions. These results suggest that, consistent with our claim, the 3-year-olds could understand and reconstruct their nonserious, pretend-play-like misrepresentation of the box's contents but not their serious, false-belief-induced misrepresentation. Similarly, 3-year-olds have been shown to understand the nonserious pretend-real distinction better than the serious apparent-real distinction (Flavell, Flavell, & Green, 1987; Woolley & Wellman, in press). Perhaps nonserious contrary-to-fact representations are easier for young children to understand than serious ones because the former are experienced so frequently in their everyday private and social pretend play. As to claim (b), Wellman and Bartsch (1988) have shown that 3-year-olds seem to understand and accept that another person whose belief is different from their own will act in accordance with his or her belief rather than with theirs, provided that the real state of affairs is not yet known by either. If it is known to them but not the person, they are likely to think that the person will act in accordance with that known reality rather than with the person's false belief. Likewise, mental representations that do not portray a reality wholly different from and contradictory to that which the child recognizes should pose few problems (as in thinking of or about something, and the other, previously cited connections of perceiving, wanting, intending, and having specific feelings and emotions regarding something). For the same reason, children may understand true beliefs, which accord with the child's reality, better than false ones, which do not, although opinion is currently divided on this point (cf. e.g., Forguson & Gopnik, 1988; Wellman & Bartsch, 1988). Finally, the idea of someone not knowing a reality the child knows might be construed by the child as the person denying that reality (and thus be hard to understand) or it might be construed as the person simply not

being cognitively connected to it, analogous to not seeing it (and thus be easy to understand). Correspondingly, some studies show that attributing lack of knowledge is easier than attributing false belief (Hogrefe, Wimmer, & Perner, 1986; Leslie & Frith, 1988) and some show the two to be about equally difficult (Flavell, Flavell, Green, & Moses, in press); both are clearly more difficult than attributing not seeing (Leslie & Frith, 1988). More generally, our account suggests that young children find alternative mental states easier to credit to the degree that they are construed merely as someone's mental relation or internal reaction to something (see it, not hear it, want it, like it, fear it, etc.) and harder to the degree that they are construed as someone's serious claim that the something is something else entirely. For example, if another person obviously dislikes something (X) the child likes, the child could accept this fact and perhaps even credit the person, thereby, with a somewhat different "mental representation" of X than the child's own, for example, that X is unpleasant-tasting (Flavell et al., in press). The child could do this because the attributed representation still portrays the X as an X, not as a Y or a Z. Thus, our account suggests that a number of factors may affect a young child's ability to think about or "metarepresent" mental representations in specific situations: whether the representation in question is serious or nonserious (e.g., pretense), whether or not its truth-falsity has been determined, how much it differs from the child's own, and how obvious it is made to the child that it is an internal mental state rather than a state of the external world.[1]

In marked contrast, 3-year-olds appear to have little difficulty with tasks that seem to require only knowledge about cognitive connections. There is considerable evidence that they can manage easily so-called Level 1 visual perspective-taking problems (e.g., Flavell, 1978; Flavell et al., 1981; Flavell, Shipstead, & Croft, 1978, 1980; Lempers, Flavell, & Flavell, 1977; Masangkay et al., 1974; Yaniv & Shatz, 1988). In Level 2 problems the issue is *how* an object that both the child and another person view from different positions *looks* or appears to the other person, for example, right side up versus upside down, or as this sort of object or that. In Level 1 problems the question is only *what* object the other person *sees* from his or her viewing position. There is no issue in these latter problems of how the other person experiences or represents that object, but only of whether the person is or is not connected visually to it. There is also a little evidence that 3-year-olds understand that at any given moment an observer can be cognitively connected to an object in one way but not in another (Yaniv & Shatz, 1988), for example, be able to hear but not see the object. The present

[1] Although we believe the foregoing account of young children's difficulties in understanding the representational process is on the right track, we are not sure it will prove to be more adequate than its close cousins in the recent literature. For example, a rather similar conceptualization by Perner (1988, in preparation) seems more parsimonious than ours and may explain the available data just about as well. All that we really feel sure of at this point is that no one has got the story exactly right yet!

studies were designed to provide more and better evidence on this question. As to other cognitive connections, Wellman and Woolley (in press) have recently shown that even 2-year-olds have some understanding of people's desires. They also cite work by others suggesting at least some early awareness that people have emotions, goals, motives, and intentions. Consistent with the present developmental account, they hypothesize that children initially acquire a "desire psychology" and only later a "belief-desire psychology" that allows them to understand false belief and the like.

Most of the previous evidence showing that children understand cognitive connections before seemingly-contrary-to-fact mental representations has come from different studies involving different samples of children. This developmental claim would obviously be strengthened considerably if it could be shown that the same 3-year-olds who find representations tasks hard find connections tasks easy. Our early studies of Level 1 versus Level 2 perspective-taking had this design (Flavell et al., 1981; Masangkay et al., 1974). In those studies we predicted and found that, for example, 3-year-olds who could correctly infer what depicted objects another person seated opposite could and could not see (Level 1 tasks), could not correctly infer how depicted objects, that both they and the other person saw, looked from the other person's perspective (Level 2 tasks). Similarly, Wellman and Woolley (in press) have shown that the same 2-year-olds who can reason about desires cannot reason about beliefs. In addition, there is recent evidence (Leslie & Frith, 1988) that older autistic children find Level 1 tasks easy but have great difficulties with tasks requiring an understanding of mental representation.

We followed this within-subject design in the present studies, and also used a new set of tasks to test our developmental claim. The representations and connections versions of each task were designed to be similar, in that both versions required the children to distinguish among their present visual experience, their present auditory experience, and what was really the case; thus, the specific cognitive connections studied were those of seeing and hearing. In the representations versions, this meant being able to say what object a visible, noise-emitting stimulus looked like, sounded like, and really was. In the connections versions, it meant being able to say whether an object was visible, audible, and physically present. For example, in the connections task used in the first study, the experimenter (Frances Green) held, for instance, a bell out of sight behind a screen and asked the children if at that moment they saw it, if they heard it (the bell sounded), and if there was a bell there; they were also asked if the experimenter saw it (Level 1 perspective-taking). For the representations version, after appropriate pretraining she put on, for example, a dog mask, stepped behind a screen so only the mask was visible, and asked the children if she presently looked like Francie, if she sounded like Francie (as she talked normally), and if she really was Francie; thus they were questioned about her visual appearance, auditory appearance, and real identity. They were also asked the same questions

substituting "a dog" for "Francie."[2] We predicted that the children would perform well on the connections task but poorly on the representations task, because only the representations task required them to understand that a single object could be simultaneously represented as two different objects: dog in visual appearance, Francie in auditory appearance and in reality. These representations tasks also required them to differentiate between two different appearances, one visual (dog) and one auditory (Francie), and thereby constituted a novel, within-person Level 2 perspective-taking task, different from the customary between-persons variety.

Thus, the connections tasks included three types of Level 1 or Level 1-like contrasts: (a) within-person perspective-taking (the subject hears the bell but does not see it); (b) appearance-reality (the subject does not see the bell but the bell is really there nevertheless; thus a novel, Level 1-like appearance-reality task, in which the "appearance" is identified with the object's perceptibility-imperceptibility and the "reality" with its presence-absence);[3] and (c) between-persons perspective-taking (the subject sees the bell but the experimenter does not). The representations tasks included two types of Level 2 contrasts: (a) within-person perspective-taking (the stimulus is representable both as Francie in auditory appearance and as a dog in visual appearance from the child's point of view); and (b) appearance-reality (the experimenter presently looks like a dog but really and truly is Francie).

The concept of within-person perspective-taking is a new one, so far as we know, as is that of perceptibility-presence construed as an early form of the appearance-reality distinction. The use of auditory appearance questions in the representations tasks also provided a novel benefit from an assessment standpoint. One could always argue that the visual appearance and reality questions used in previous appearance-reality research are potentially confusable: "looks like an X" could be construed as "probably is an X," and "really is an X" might be read as "really resembles visually or appears to be, an X."[4] On the

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[2] In both studies, the visual appearances were less realistic than the auditory ones. For example, a masked Francie obviously looked less like a real, live dog than she sounded like herself. As will be shown, however, this did not seem to have made the visual appearance questions any harder than the auditory appearance ones (see Tables 2 and 4).

[3] We are indebted to Elizabeth Spelke for the idea that this might be construed as a Level 1 appearance-reality task. Its analogy with representations-level appearance-reality tasks is not perfect, because although the hidden bell is not perceptible, nothing in the perceptual display suggests positively that there is not or could not be one behind the screen.

[4] However, Flavell, Green, Wahl, and Flavell (1987) showed in two studies that removing all possible semantic ambiguities from the reality question did not help 3-year-olds answer it correctly: A white cardboard stimulus was held behind a blue filter, a pre-cut piece was detached from the center of the stimulus while it was still behind the filter, that (white) piece and an identical blue piece were then placed on the table, and the child was simply asked which of the two was the piece the experimenter had just removed from the stimulus—an unambiguous reality question, surely. This

other hand, the only reasonable interpretation of "sounds like an X" in the present context would likely be some variation of "is making a sound like the sound an X usually makes," and this interpretation would in fact yield the correct answer to all our auditory-appearance questions. Therefore, auditory-appearance questions should be particularly clear in meaning, and not easily confused with either visual-appearance or reality questions on purely semantic grounds. If, nevertheless, 3-year-olds still fail to answer them correctly, one would be inclined to look to conceptual rather than linguistic limitations for an explanation.

We also wanted to compare subjects' performance on these novel connections and representations tasks with performance on the kinds of representations-level appearance-reality tasks used in our previous research. Consequently, at the end of the experimental session we administered two such tasks involving real versus apparent object identity, tasks similar to the rock-sponge task described previously. We predicted that, consistent with our connections-representations account, 3-year-old subjects would find the connections tasks easy but the representations tasks—both novel and non-novel—hard.

STUDY 1

Method

Subjects. The subjects were 20 nursery school children (13 girls, 7 boys) drawn from middle class families. They ranged in age from 2 years, 4 months to 3 years, eight months with a mean of 3 years, 1 month. Four additional children were excluded because of attentional difficulties, inadequate linguistic ability, or refusal to complete the procedure. The same female experimenter tested all subjects in both studies.

Procedure. Each subject was given three novel connections tasks and three novel representations tasks. The tasks were alternated systematically with half of the subjects beginning with a connections task followed by a representations task, and half the reverse. At the end of the session the experimenter gave two appearance-reality tasks of the sort used in previous studies (thus, non-novel representations tasks). Prior to each subject's first novel representations task he or she was given the following brief pretraining. To insure that all subjects would recognize her name, the experimenter said, "Did I tell you what my name is? My name is Francie. Is my name Mary? No. Is my name Francie? That's right, my name is Francie." Next, prototypical sounds made by each animal in the

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question proved to be as hard or harder than the usual, more abstract and wordy reality question ("Is it really and truly . . . ?"). It is evidence such as this that leads us to believe that young children's difficulties with appearance-reality and other representations tasks are more conceptual than linguistic.

representations tasks were played on a cassette tape. Prior to each sound, the experimenter said "This is what a (dog, rabbit, elephant) sounds like." Finally, brief pretraining on an appearance-reality contrast was given. The experimenter placed a ghost costume, for example, a white handkerchief with black felt eyes, over her hand saying, "I'll put this over my hand. Right now it *looks like* a ghost. Is this *really* a ghost or *really* just my hand? (13 of the children said "hand," 7 said "ghost.") That's right (actually), it's *really* just my hand."

Connections Tasks. Four questions were given in randomized orders for each of the following stimuli: a baby rattle, a drum, and bells. The procedure was identical for each of the tasks and will be illustrated using the drum. "Here is a drum." The drum was sounded and then placed behind a white cardboard barrier out of the child's view; the Level 1 perspective-taking question (4) was the only task in which the child but not the experimenter saw the object. The test questions and their correct answers were: (1) "Look. Do you *see* the drum right now?" (no); (2) "Listen. Do you *hear* the drum right now?" (The drum was sounded for this question only.) (yes); (3) "Do I have a drum over here?" (yes); and (4) (The drum was moved to the child's side of the barrier.) "How about me. Do I (point to self) *see* the drum right now?" (no) The ordering of the three stimuli was randomized for each subject.

Representations Tasks. Three animal disguises were worn by the experimenter and six questions were asked about each disguise. The disguises were an elephant, a rabbit, and a dog. The procedure is illustrated for the elephant disguise. "I have an elephant mask to show you. See the trunk. Is it okay if I put this on?" The experimenter did so and then stepped behind a screen which occluded all but the mask. Half of the subjects were given three questions with "elephant" as a choice followed by the same ordering of the same questions with "Francie" as a choice, and half the reverse. The same ordering of choices was preserved for each subject for his or her other two representations tasks although question orders were varied on each task. The questions and their correct answers were: (1) "Look at me. Do I *look* like an elephant (Francie) right now?" (yes, no); (2) "Listen to me talking. (The experimenter talked normally for both response options.) Do I *sound* like an elephant (Francie) right now?" (no, yes); and (3) "Am I *really* an elephant (Francie)?" (no, yes). The ordering of the three tasks was randomized for each subject.

Non-Novel Representations Tasks. Two tasks contrasting just visual appearance with reality were given in counter-balanced order at the end of the session. Ordering of the questions was determined randomly and ordering of choices within questions varied unsystematically. A pen which appears to be a tube of toothpaste was shown to the child. The experimenter said, "Here is something you can write with. (The experimenter wrote, then squeezed the

tube.) There's no toothpaste in here. Want to try it?" After the child wrote, the experimenter replaced the cap, thereby covering up the pen point, and asked, "When you *look* at this *right now*, does it *look like* a pen or does it *look like* toothpaste?" and "Is this *really and truly* a pen or is it *really and truly* toothpaste?" The second stimulus was a box which appears to contain dog food when viewed from the front but actually contains popcorn. The experimenter first showed the child the back of the box which had been cut away and covered with a clear transparency to show its contents. "See what's in this box." If the child did not say spontaneously "popcorn" the experimenter provided the label. The box was reversed and the experimenter asked, "When you *look* at this box *right now*, does it *look like* there's dog food in here or does it *look like* there's popcorn in here?" and "Is there *really and truly* dog food in here or is there *really and truly* popcorn in here?"

Results and Discussion

As predicted, the children performed very well on the connections tasks. Table 1 shows that 18–20 of the 20 subjects correctly answered the *see*, *hear*, and *here* (object presence, or reality) questions and that almost as many (15–16) correctly answered the *experimenter see* (connections-level perspective-taking) questions. (This apparent difference in difficulty between the perspective-taking and the other questions was not observed in Study 2 and therefore we are not inclined to make much of it.) Nine children answered all 12 questions correctly. Fourteen answered all 3 trios of *see*, *hear*, and *here* questions correctly and 4 more answered 2 of the 3 trios correctly; in all, 85% of the 60 trios of answers were correct. These results are consistent with those of Yaniv and Shatz (1988), who also found that children of this age could usually differentiate between what would be visible and what would be audible to a doll observer. Similarly, Pillow and Flavell (1985) found that 3-year-olds could report accurately that they saw one object but not another when the latter was hidden behind the former. The present findings, therefore, provide additional evidence for the view that even very young children understand that their own perceptual connections/ nonconnections are both independent of one another and independent of other people's. In the conditions of this study, children as young as 2½ proved capable of discriminating between what they could see, what they could hear, what was physically present although not

Table 1. Percentage of Subjects Answering Each Question Correctly on Connections Tasks in Study 1

	Question			
Task	**See**	**Hear**	**Here**	**E See**
Rattle	95	95	95	80
Drum	95	95	95	75
Bells	100	95	90	80

Table 2. Percentage of Subjects Answering Each Question Correctly on Representations Tasks in Study 1

	Question					
	Francie Choice			Animal Choice		
Task	Look	Sound	Really	Look	Sound	Really
Elephant	50	65	75	65	55	50
Rabbit	50	80	75	70	55	45
Dog	55	65	70	75	35	35
	Look	Really				
Box	55	55				
Toothpaste	45	75				

perceptible (Piagetian object permanence, essentially), and what another person could see from a perspective different from their own.

The data also confirmed the prediction that these same children would perform much more poorly on the representations tasks, both novel and non-novel. Correct performance on the novel Elephant, Rabbit, and Dog task questions ranged from 35% to 80% (Table 2) with a mean of 59%, not significantly better than would be expected by chance (50%). In contrast to the connections results just reported, no child performed perfectly on the representations-level counterparts (*look like*, *sound like*, and *really*) of the connections-level *see*, *hear*, and *here* questions; in fact, only one child performed perfectly on as many as 4 of the 6 trios of questions. In all, only 13% of the 120 trios of answers were correct, as contrasted with 85% of the connections trios. We had expected that the children might do better on the *look like* and especially, the *sound like* questions than on the *really* questions, because the intended meaning of the former questions was signaled more explicitly by the experimenter ("Look at me . . . ," "Listen to me talking . . .") and because, as noted previously, *sounds like* questions seem to have a single, clear meaning not readily confusable with those of the other two questions. In fact, however, the 3 questions proved to be about equally difficult for them; the mean percentages were 61%, 59%, and 57% respectively. This finding is consistent with our view that the children's problems with these questions would be primarily conceptual rather than linguistic.[5] Performance on the

[5] We also believe that this conceptual problem consists in not knowing how the task display can be diversely represented mentally rather than in not knowing what is actually there physically. They "knew" what was going on in a concrete Gibsonian sense but could not conceptualize the different ways it could be represented. We assume that the subjects knew perfectly well at the gut level that the animate creature before them was always Francie, and never a *real* elephant, rabbit, or dog. To illustrate, after having just said that Francie looked like, sounded like, and really was a rabbit, one child heard a sound and exclaimed, "Hey Francie, there's someone knocking at the door." Had the children thought she had really metamorphosed into an animal, they most probably would have voted down the study with their feet!

non-novel appearance-reality tasks (Box, Toothpaste) was similarly poor. Only 1 child got all 4 questions right; 6 others got 3 right. Only 18% of the 40 pairs of answers were correct.

As in our previous studies, by far the most common error pattern on the non-novel appearance-reality tasks (94% of the not-fully-correct pairs of answers) was to give the same answer to both questions—either the appearance (40% of these same-answer pairs) or the reality (60%). The same pattern was present in the novel representations tasks, but less strongly. Of the 120 trios of *look like, sound like,* and *really* questions asked, all three questions of 68% of them were answered the same way—either all affirmatively (65% of the same-answer trios) or all negatively (35%). (This preference for "yes" answers over "no" answers may explain the difference between Francie choices and Animal choices in Table 2: questions calling for "yes" answers were answered correctly more often than those calling for "no" answers.) Within these 120 trios the percentages of pairs of questions that were answered the same way were 77% for the *look like-sound like* pairs, 79% for the *look like-really* pairs, and 81% for the *sound like-really* pairs. The interpretation of this pattern suggested by the connections-representations account is that these young, connections-level children had difficulty understanding that the very same stimulus could be represented as two different, mutually contradictory things, for example, as toothpaste and pen, or as Francie and elephant. Consequently, they tended to give the same yes or no answer to the two or three different questions asked about each stimulus, an answer probably dictated, in most cases, by whichever characterization of the stimulus was cognitively salient for them on that trial. Notice that the same-answer pattern could not reflect a generalized, across-tasks perseverative tendency or yes bias, because no such pattern was observed on the connections tasks. Whether or not this interpretation of the children's dominant error pattern is correct, the data do strongly suggest that, as predicted, they could not respond discriminatively and correctly to what seemed like clear and straightforward questions about an object's visually given apparent identity, its auditorily given apparent identity, and its real identity.

STUDY 2

Study 2 was intended to be a better controlled comparative assessment of young 3-year-olds' understanding of a visual "appearance," an auditory "appearance," and a "reality" at connections versus representations levels. Several changes were made. We modified our connections level tasks in an attempt to demonstrate more directly that children of this age understand that they can be connected to an object in one sense modality but not another, for example, hear an object but not see it, or the converse. We removed two confounds present in the representations tasks of the previous study. In Study 1, the auditory appearance and reality were confounded; that is, the experimenter both sounded

like and really was Francie. In addition, the experimenter sounded like Francie as she asked the visual appearance question. These problems were avoided in Study 2 by using a toy animal rather than a person as the reality. This animal was then disguised to look like a second animal and made to sound like a third. For example, on one representations task a toy bear looked like an elephant when masked and placed behind a barrier and sounded like a cat when a tape recording was activated. We also introduced a control task in which each representations question was asked about a different object rather than all three being asked about the same object. We did not expect many children to err on this control task because, unlike the experimental task, it did not require understanding that the selfsame object can be represented as being different, mutually contradictory things. We also hoped the control task would show both that a question with three response options was manageable for young subjects and that memory for concealed objects was not the primary source of children's errors in responding to the reality questions of the representations task. Finally, in Study 2 we clarified the meaning of the questions and provided training by demonstrating explicitly the correct responses to all of the tasks before administering any of them. We predicted that the children would still perform more poorly on representations tasks than on connections tasks, despite this considerable assistance.

Method

Subjects. The subjects were 24 nursery school children (15 boys, 9 girls) drawn from middle-class families. They ranged in age from 2 years, 5 months to 3 years, 11 months with a mean of 3 years, 4 months. One additional child was excluded from the study because of attentional difficulties.

Procedure. Subjects were trained on three connections tasks either before (half the sample) or after (the other half) having been trained on three representations tasks and a control task. They were then tested for their ability to solve these same tasks, administered in that same order.

Connections Tasks. Auditory and visual appearance questions and a Level 1 perspective-taking question were asked for each of three stimulus presentation conditions. In each condition these three questions were first asked with reference to a set of bells and then asked again with reference to a drum. The presentation conditions were counterbalanced across subjects and orders of questions were individually randomized. In Condition 1, *Visible, Not Sounding*, the stimulus (e.g., drum) was placed in view of the child but not sounded as both the auditory and the visual appearance questions were asked. The drum was obscured from the experimenter's view, but not the child's, by placing it in front of the barrier when the Level 1 perspective-taking question was asked. In Condition 2, *Invisible, Sounding*, the drum was sounded while all three questions were

asked and was always obscured from the child's but not the experimenter's view. In Condition 3, *Invisible, Not Sounding*, the drum was neither sounded nor visible to the child as the two appearance questions were asked. For the Level 1 perspective-taking question, the drum was moved to the child's side of the barrier. This condition included a fourth question concerning object presence (reality) when the drum was not visible to the child. The form of the test questions in all three conditions was the same as in Study 1, for example, "Listen, Do you *hear* the drum right now?"

To illustrate the nature of the prior training for these tasks, for Condition 3 the experimenter said, "Here are some bells." The bells were sounded and placed behind a white cardboard barrier. The experimenter then gave the following facts in randomized order: "Look. You don't *see* the bells right now. Listen, you don't *hear* the bells right now. I have some bells over here. (Bells are moved to child's side of barrier.) I don't *see* the bells right now." Training proceeded in a similar fashion for the other two stimulus presentation conditions, again with one rather than two stimuli used for each to shorten the procedure. Bells were the stimuli used for a subject's first training experience, the drum for his second, and bells again for the third.

Representations Tasks. Three representations and one control task were given as a block in individually determined randomized orders. Orders of questions and choices within questions were also randomized. The stimuli for the three representations tasks were: (a) a stuffed toy bear, an elephant mask, and the sound of a cat; (b) a stuffed toy dog, a Big Bird mask, and the sound of a cow; (c) a stuffed toy Mother Goose (termed a duck by the experimenter), a Miss Piggy mask, and the sound of a dog. To illustrate the training procedure, a toy animal (bear) was presented to the child. "Here is something. He's going to put on a mask and stand behind this wall." The experimenter put a mask (elephant) in front of the animal's face, took it away again, then replaced it and held the disguised toy behind a white barrier so that only the mask was visible. The child was next shown a small cassette tape recorder. "I'll turn this on so he can talk." The recorder was activated (cat sound) and placed behind the barrier. Animal sounds had been recorded on individual endless-loop TDK tapes and each sound was continued as all three question types were demonstrated (or tested). The experimenter gave the following facts in randomized orders: "This animal I am holding in my hand is *really* a toy bear. Look at him (experimenter points to the mask). Right now, he *looks like* an elephant. Listen to him. Right now, he *sounds like* a cat." When subsequent testing occurred, the toy animal, mask, and tape recorder were presented as in training. The test questions were: "What is this animal I am holding in my hand *really*, a toy cat, a toy elephant, or a toy bear?"; "Look at him (experimenter points to mask). Right now does he *look like* a bear, an elephant, or a cat?"; and "Listen to him. Right now does he

sound like an elephant, a cat, or a bear?" Response options for the other two tasks were (toy) duck, pig, and dog, and (toy) dog, bird, and cow. For the duck task, the references to the animal were feminine.

Although these representation tasks are of course unusual, we did several things to make their task demands as clear as possible. First, the reality questions always included the word "toy," since the objects were in fact *toy* animals. Second, the masks worn by the toy animals were human-sized rather than sized to the dimensions of the animals, in order to avoid giving children the impression that we were creating a different toy creature with the use of the mask. Finally, and most important, we told the children explicitly what each stimulus looked like, sounded like, and really was before asking them; this was done as an extra effort to make the intended meaning of the questions as clear as possible.

Control Task. For the control task three stimuli were introduced individually and placed in three separate locations. First, a toy bird was placed adjacent to the wall. "Here is something. I'll put it here." Next, the small tape recorder playing the sound of a horse was activated and left in the subject's view. "Here is something else. I'll turn it on." Finally, a toy Dumbo elephant was introduced. "Here is something else. I'll put him behind this wall." The elephant was placed behind the barrier, made to briefly reappear, then replaced behind the barrier such that it was not visible to the child. In training, the following facts were given in randomized order. "There is *really* a toy elephant behind this wall (the experimenter pointed and briefly displayed the animal). Look at this (the experimenter pointed to the bird). It *looks like* a bird. Listen to that (experimenter pointed to the tape recorder). It *sounds like* a horse." In subsequent testing the stimuli were introduced in the same fashion. The questions were: "What animal do I *really* have behind this wall, a toy horse, a toy elephant, or a toy bird?"; "Look at that. Does it *look like* a horse, a bird, or an elephant?"; and "Listen to that. Does it *sound like* a bird, a horse, or an elephant?" The experimenter pointed to each of the three locations as the questions were asked. Questions and orders of choices within questions were randomized.

Results and Discussion

As Table 3 shows, the children performed very well on the connections tasks—those that required Level 1 perspective-taking (*E* see) as well as those that did not. Of the 24 subjects, 18 answered correctly all 20 questions and 4 others answered correctly all but 2 or 3; 44 of the 48 trios (92%) of *see, hear,* and *here* answers in Condition 3 were fully correct. These findings closely replicate those of Study 1 and thus provide additional support for the claim that by age 3 children understand readily that their perceptual connections can be independent of one another and of other people's. Also consistent with both prediction and

Table 3. Percentage of Subjects Answering Each Question Correctly on Connections Tasks in Study 2

Condition	Question			
	See	Hear	Here	E See
1 (visible, not sounding)	100	90	—	92
2 (invisible, sounding)	94	96	—	96
3 (invisible, not sounding)	96	92	100	94

Note. Each entry is the mean percentage for two trials.

Study 1 results is the finding that the children coped considerably less well with the representations tasks than with the connections ones. As Table 4 shows, the percentages of correct responses to the three-option representations questions ranged from 46% to 67% with a mean of 55%. This level of performance is not significantly better than what would be expected by chance (33%): $t(23) = 1.00$, n.s. As in Study 1, the three types of questions did not differ significantly in difficulty: $F(2,46) = 1.01$, n.s. Again, what seemed from a linguistic point of view to be very clear and unambiguous auditory appearance questions did not prove to be any easier for the children to answer correctly than the visual appearance and reality questions. Only 3 of the 24 subjects answered all 9 questions correctly, only 3 more correctly answered as many as 6 out of 9, and only 16 (22%) of the 72 trios of *look*, *sound*, and *really* answers were fully correct. This is clearly very poor performance, especially given the fact that during training the experimenter had actually *told* the children the answers to all the questions they were asked subsequently during testing.

In contrast, the children did much better on the Control task than would be expected by chance: $t(23) = 6.71$, $p < .01$ (see Table 4). Their near-ceiling performance on the Control *really* question shows that their poor performance on the Bear, Dog, and Duck *really* questions could not be due to an inability to remember what animal the experimenter had hidden behind the mask. Likewise, their good performance on the Control questions suggests that their poor showing on the other questions could not be due to a general inability to cope with three-

Table 4. Percentage of Subjects Answering Each Question Correctly on Representations Tasks in Study 2

Task	Question		
	Look	Sound	Really
Bear	58	62	46
Dog	54	54	46
Duck	67	62	50
Control	100	79	92

option questions. This conclusion is also supported by a small study we ran after Study 2 was completed. In that study, the experimenter trained and tested 9 additional 3-year-olds on the Study 2 representations and control tasks. However, this time she asked open-ended questions instead of three-choice questions: for example, "Listen to him. Right now what does he *sound like?*" If the child did not respond to one of these open-ended questions, the experimenter supplied the three choices. We compared the performance of these 9 children with that of 9 same-aged subjects from Study 2. The performance of the two groups proved to be almost identical: mean correct performance for the 9 Study 2, three-choice subjects was 54% and 89% for the representations and control questions respectively; the corresponding percentages for the 9 subjects given open-ended questions were 58% and 85%. If anything, the open-ended questions were probably less child-friendly than the three-option ones, inasmuch as some children would not even answer some open-ended questions until the experimenter supplied the three possible choices.

Recall that in Study 1, as in our previous studies, the dominant error pattern on each representations task was to give the same answer to the different questions. Contrary to expectation, this error pattern was not dominant in this study. Subjects gave the same answer to all three questions on only 11 (15%) of the 72 possible occasions. Similarly, this pattern occurred only once (4% of possible occurrences) in the small study that used open-ended questions. On the other hand, subjects gave three different answers on 25 occasions (35%), 16 of them fully correct and 9 of them not. In general, which answer they gave to which question seemed to be a largely random matter. Why this departure from previous results? We do not know but can suggest a plausible explanation. Everything in the task situation pushed strongly for response variability rather than the response consistency that the children would, by hypothesis, have favored if left to their own devices. Three times during the initial training the experimenter presented three different stimuli (the whole body of one animal, the mask of a second, and the sound of a third) and gave each one a different name. Then, three times during the subsequent testing she presented the same three stimuli, asked for their names, and (for Study 2 subjects) provided the same three names as possible choices. Thus, the training and testing procedures may have disrupted the children's preferred strategy; it may have taught them that, for reasons they did not understand, response variability rather than consistency was appropriate, even though it obviously did not teach them to match correctly descriptions of visual appearances, auditory appearances, and realities with their referents. It is also possible, of course, that the simultaneous presence of a visible animal mask, a nonvisible animal, an audible animal sound, and the experimenter asking them to choose among three animal names may have constituted an information-processing overload that contributed to their difficulties. This said, it is worth remembering that they did not actually perform any more poorly on the Study 2 three-option representation-tasks than on the two-option ones of Study 1 and

many previous studies; it is rather that their response patterns did not take the usual form of giving the same answer to the different questions. It might be argued that the Study 2 representations tasks are just so unusual that even older preschoolers would find them incomprehensible. However, in pilot testing we administered them to 5 children ranging in age from 3 years, 5 months to 3 years, 10 months, and 3 of the 5 performed perfectly or near-perfectly on them. Although we have not actually tested any, it seems very likely that older children would have little difficulty with them.

GENERAL DISCUSSION

The connections-representations account claims that children acquire some basic knowledge about the mind during the first 3 years of life. In particular, they discover important facts about what we have termed *cognitive connections:* what many of the different kinds of cognitive connections are; that they can change over time; that they are largely independent of one another; that their own connections are essentially independent of those of other people; and that connections entail inner, subjective experiences. However, according to this account, they do not yet know very much about the diverse and potentially conflicting *mental representations* that the forming of these connections may engender in self and others. They do not easily understand that a single object or event in the world can be seriously (nonplayfully) represented in people's minds as several different, mutually contradictory things. As a consequence, the mental representations referred to by such expressions like "It looks like an A from here," "It looks like a B from where you are," "It sounds like it is a C," and "I (you) believe it is a D" tend to be terra incognita for them.

Two studies tested the prediction from this account that 3-year-olds should perform well on tasks requiring only knowledge of cognitive connections but poorly on similar tasks that require knowledge of conflicting mental representations. The predicted pattern was observed in both studies. The children performed very well on connections-level versions of appearance-reality tasks (perceptibility versus presence), within-person perspective-taking tasks (same person, different sense modalities), and between-person perspective-taking tasks (different people, same sense modality). In these tasks they demonstrated impressive abilities to indicate, discriminatively and correctly, that they saw an object but did not hear it, that they heard it but did not see it, that they neither saw it nor heard it, that the object was still there even when it was neither visible nor audible, and that the experimenter could see it when they could not and vice-versa. It is no mean feat for children this young to be able to deny that they see something that, although nonvisible, is making noises right in front of them, and to deny nonegocentrically that another person sees something which is compellingly visible to them.

In sharp contrast, these same children performed very poorly on the representations-level counterparts of these connections-level appearance-reality and with-

in-person perspective-taking tasks. They had great difficulties discriminating between what an object looked like it was and what it sounded like it was, and discriminating between these appearances and what it really was. They had these difficulties whether asked yes-no, two-option, three-option, or open-ended questions; whether the reality was a real person or a toy animal; whether the task situation afforded two alternative mental representations or three; whether the tasks were novel, visual-plus-auditory-appearances ones or of the visual-appearance-only variety used in many previous studies; and even whether or not the correct responses to the tasks had been given to them previously by the experimenter. It was also interesting to observe that they had just as much difficulty distinguishing conceptually between two appearances that were directly perceptible (auditory versus visual, in the within-person Level 2 perspective-taking contrasts) as they did between these appearances and a nonperceptible reality (in the appearance-reality contrasts). In Study 1 but not Study 2, they also showed their incomprehension by tending to give the same answer to the different questions, as if construing them as requesting the single identity label they themselves had assigned to the stimulus during that particular task. Although the children's failure to profit from the experimenter's demonstration of correct responses might seem surprising, it too is consistent with previous findings. That is, previous efforts to train 3-year-olds to solve representations-level appearance-reality tasks (Flavell, Green & Flavell, 1986; Taylor & Hart, in press) and between-persons perspective-taking tasks (Flavell et al., 1981) have also not succeeded. We conclude, then, that 3-year-olds find a variety of representations tasks harder than connections ones, not because the latter's questions are ambiguous or unclear, but because these tasks require an understanding of mental representations that they have not developed yet.

How might children acquire these connections and representations competencies? Our data do not speak to this question, obviously, but we offer the following speculations for whatever they may be worth. As regards the former, it is easy to imagine everyday experiences that could help them realize that their own cognitive connections can be independent of one another and of other people's (and that the same is true for other people), provided they are cognitively mature enough to learn from these experiences (cf. Johnson, 1988). For example, they frequently hear things without or before seeing them, and can easily create and manipulate playfully such discrepancies by opening and closing their eyes while listening to an object, blocking their ears while looking at it, and so forth. Similarly, their elders often have occasion to tell them that they, the children, see (hear, feel, taste, smell, etc.) things that the elders are not presently in a position to see and vice-versa, and also may often work such perspectival differences into showing and hiding games. Finally, the ability to distinguish between an object's momentary perceptibility-imperceptibility and its physical presence (which we conceive to be a connections-level forerunner of the appearance-reality distinction) is obviously rooted in the Piagetian concept of object permanence. Recent research by

Baillargeon (1987) shows that infants as young as 3–4 months of age act as if they know at some level that an object occluded by a screen still exists behind the screen. Indeed, this and other basic knowledge about objects currently looks like it might turn out to be largely innate, contrary to what Piaget and almost everyone else once thought (Spelke, 1988). Older infants give even better evidence that they distinguish between object perceptibility and object presence by actively searching for objects that disappear from their sight. Bushnell (1981) has used virtual objects created by parabolic mirrors to show that older infants also assume that what appears visually to be an object really will turn out to be a solid object when they try to grasp it. Thus, infants seem to assume that whereas perceptibility implies presence (the case of virtual objects), nonperceptibility does not necessarily imply nonpresence (the case of object permanence). It seems likely that this elementary form of the appearance-reality distinction begins to become a possible object of conscious reflection somewhere around 2–2 ½ years of age, extrapolating from evidence about related developments (e.g., Lempers, Flavell, & Flavell, 1977; Novey, 1975; Smiley & Huttenlocher, 1989). The following interchange recorded by the mother of a 25-month-old girl illustrates this newfound metacognitive capability:

Mother: Do you have a bowl of cereal?
Child: Yes (looking at mother, not down at bowl).
Mother: Can you see it?
Child: (giggles, still doesn't look down) No can see it!
Mother: You can't?
Child: (looking down). Yes. See it.

It is possible that young children first become aware of visual and other cognitive connections—and of the mental world in general—in part by noticing such matches and mismatches between subjective experiences and objective reality.

What about the subsequent transition from only understanding connections to also understanding representations? We can suggest some possibilities here as well (Flavell, 1988; Flavell, Flavell & Green, 1987; see also Gopnik, in press; Wellman, 1985). An age-dependent increase in information-processing capacity might make the transition possible, as Halford (1987) has suggested recently. Children might find it easier to at least consider the possibility that the same thing could be represented mentally in different ways as it becomes easier for them to hold two or more such representations in mind at the same time. Consistent with this possibility, Flavell, Green, Wahl, and Flavell (1987) found that 3-year-olds perform better on color appearance-reality tasks if visual evidence of the object's real color remains available during questioning. For instance, they are more likely to say that a white object held behind a green filter is really and truly white if the white handles used to hold the object extend out laterally beyond the edges of the filter, and therefore, still appear white rather than green to them. The handles may aid by helping the child keep in mind what the object's natural color

is. On the other hand, such capacity increases could scarcely be a sufficient cause of the transition. For example, 3-year-olds who assert that, say, a white object behind a red filter both looks red and really is red are usually well aware that the object will look white again when the filter is removed (Flavell, Green, & Flavell, 1986; Flavell, Green, Wahl, & Flavell, 1987). Thus, even when both real and apparent color seem to be available to them cognitively, 3-year-olds will often refuse to attribute both to the object at any one point in time. In fact, even 5-year-olds will often given an appearance answer to a reality question if the question specifies the present reality, for example, "*Right now, for real,* is this object blue (apparent color) or white (real color)?" (Flavell, Flavell, & Green, in press). Recall also evidence from the Control task in Study 2 that the children could remember what animal had been hidden behind the wall.

Young children also have experiences that seemingly could help them learn about mental representations, again assuming that they are cognitively ready to profit from them. In their pretend play they have repeated experiences representing things as other than what they really are and observing their playmates do the same. Perhaps these play experiences help sensitize children to the possibility of nonplayful conflicting representations in other situations (Flavell, Flavell, & Green, 1987). Similarly, they learn other relevant-seeming contrasts between reality and something else—real versus toy, real versus depicted, real versus fake, and real versus apparent (Woolley & Wellman, in press). Gopnik (in press) has suggested that noticing changes in their own beliefs over time, as new information comes their way, may also help. That is, noticing that one's mental representation of something has changed even though the something itself has not, might be a developmentally formative experience for the prepared mind; it is the conceptual equivalent of walking around a visual display and noting how different it looks from different perspectives. In addition, other people frequently must make salient to the child differences between the child's mental model of reality (e.g., beliefs about it) and their own or those of others. The child says a toy is his; his playmate strenuously objects, saying that it is hers, not his. The child says something is good; someone else says it is bad. Many parents often call young children's false beliefs and other cognitive missteps to their attention, point out differences between different people's perspectives, and otherwise help them realize that the same thing can be mentally represented in more than one way. There is evidence that children hear a lot of talk about mental events from parents and older siblings from an early age (Dunn, Bretherton, & Munn, 1987). Finally, as Gopnik (in press) has argued cogently, a theory of mind that includes no concepts of conflicting mental representations should inevitably lead children who hold this theory to make many wrong predictions about other people's behavior. For example, they should default habitually to the prediction that another person will act in accordance with his or her own beliefs and expectations, not the person's own. According to Piaget's equilibration model, a theory of that kind would be particularly ripe for developmental change.

Here as elsewhere in cognitive development, however, a complete explana-

tion will have to specify the developmental role of innate and maturing capabilities within the child as well as potentially formative experiences. Recall that autistic children seem to possess something akin to Level 1 visual perspective-taking abilities but little else in this general area, despite the fact that these formative experiences are presumably also available to them (Baron-Cohen, 1988; Leslie & Frith, 1988). They clearly lack whatever basic capabilities are needed to benefit from these experiences. Similarly both the formal research evidence (Flavell, 1988) and our informal testing experience give us the strong intuition that many normal 2½–3-year-olds are simply not "ready" to understand appearance-reality, false belief, and Level 2 visual perspective-taking tasks, and that no training or experience would suffice to help them until some as yet unknown cognitive capabilities have matured.

Whatever the origins of these metacognitive acquisitions, there is no denying their importance for the child's development. The simple fact is that, without them, the child could not develop into anything like a normal person. A child with no knowledge of conflicting mental representations would be incapable of reflecting on either his or her own or other people's perspectives. "Opinion," "belief," "point of view," "impression," "appearance," "deception," "judgment," "inference," and "prejudice," are only a few of the many important concepts that could have little meaning for such a child. And a child who lacked knowledge of cognitive connections as well as mental representations could not even conceive of him- or herself or others as conscious, experiencing subjects who perceive, want, intend, feel, and so on. Such a child could hardly be said to have a concept of self or person at all. Although the mind could be considered a "knowledge domain," knowledge of it is much more than mere "domain-specific knowledge." Rather, it is what Carey (1985) aptly terms "a tool of wide application," one that opens the doors to human selfhood and social life. It is probably for this reason that the child's acquisition of knowledge about the mind is currently regarded by many developmental psychologists as among the most significant, both theoretically and ecologically, in all of human cognitive development. And because it is co-extensive with what has variously been termed metacognition, social cognition, naive theory of mind, and folk psychology, it should also be of considerable interest to social psychologists, cognitive psychologists, philosophers, educators, and the lay public (Astington et al., 1988).

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