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# The Development of Children's Knowledge about Inner Speech

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Two studies demonstrated that preschool children have little knowledge and awareness of inner speech. Study 1 showed that, in contrast to 6- to 7-year-olds and adults, 4-year-olds usually did not infer that a person silently engaged in such intrinsically verbal mental activities as reading, counting, or recalling items from a shopping list was saying things to herself. They also tended to deny that covert speech is a possible human activity. Study 2 demonstrated that 4- and 5-year-olds are much poorer than adults at detecting their own inner speech. Children seem to acquire this sort of knowledge and awareness during the early school years, perhaps through experiencing their own inner speech while reading, writing, adding, and subtracting.

## INTRODUCTION

Research on the development of children's naive theory of mind or folk psychology has shown that they are in possession of some impressive basic knowledge about the mental world by the age of 4 or 5 years (Astington, 1993; Bartsch & Wellman, 1995; Lewis & Mitchell, 1994; Perner, 1991; Wellman & Gelman, 1992). Most important, they show by their performance on false-belief, appearance-reality, Level 2 perspective-taking, and other tasks that they have acquired something akin to a mental-representational conception of the mind. Thus, they understand that people act on the basis of their beliefs, even when those beliefs are false, and that how things seem or appear may vary with the perceiver's perspective and may also differ from how things really are.

However, studies have also revealed a number of major limitations on preschoolers' theory-of-mind competencies. For example, Flavell, Green, and Flavell (1993, 1995, 1996) have shown that older preschoolers lack important knowledge and abilities concerning their own and other people's ongoing mental activities. They are largely unaware of the fact that people experience a flow of ideation (William James's *stream of consciousness*) even when not engaged in cognitive tasks. Even more surprising, preschoolers may fail to assume that anything is going on in the minds of people who are engaged in such obviously (to us) cognitive activities as looking, listening, reading, and talking. Children of this age are also very poor introspectors of their own mental activity, frequently failing to report experimentally induced mental content that children of 7 or 8 years of age find very easy to report. Finally, unpublished research by Flavell, Green, and Flavell indicates that older preschoolers lack a clear understanding of the differences in mental activity and mental experience between being conscious (awake) and being unconscious (in a deep, dreamless sleep).

The main purpose of the present studies was to assess preschoolers' knowledge of inner speech or verbal thought, a very important and frequently occurring form of mental activity. There are several reasons why preschoolers might be largely unaware even of the existence of internal verbal events.

1. Several lines of evidence suggest that preschoolers may engage in less inner speech or verbal thought than older children and adults, at least in task situations. First, there is now considerable research support for Vygotsky's (1962) well-known claim that children's private, self-directed speech tends to become more covert—more "inner"—during the elementary school years (Diaz & Berk, 1992). Second, research on the development of memory strategies has shown a similar increase during this same age period in children's tendency to covertly rehearse stimulus names (Flavell, Miller, & Miller, 1993, chap. 6). Finally, children are generally thought to become more reflective as they grow older, and much of that increased reflection would undoubtedly be verbal in nature. This is not to suggest that preschoolers do not engage in inner speech at all but only to suggest that they may engage in it less or differently than their elders. On the contrary, they must be doing some kind of covert verbal encoding whenever they produce or comprehend speech (Hitch, Halliday, Schaafstal, & Heffernan, 1991). There is also experimental evidence that preschoolers subvocalize. In memory studies using electromyography or other methods, researchers have shown that preschoolers may subvocalize the names of the to-be-remembered items when the items are first presented even though, unlike older children, they may not continue to rehearse them subsequently (Garrity, 1975; Hitch, Halliday, Dodd, & Littler, 1989; Hitch et al., 1991; Hulme, Sil-

vester, Smith, & Muir, 1986; Locke & Fehr, 1970). They will definitely subvocalize words when the memory items are words rather than depicted objects (Hitch et al., 1989, 1991). Other studies have demonstrated that 5-year-olds can be successfully trained to engage in covert as well as overt verbal rehearsal in recall tasks (Johnston & Conning, 1990; Johnston, Johnson, & Gray, 1987).

2. Preschoolers' limited introspection skills should reduce the likelihood of their being consciously aware of whatever inner speech or verbal thought they do engage in.

3. Their extensive experience with overt talking coupled with their inexperience with silent reading might lead them to assume that speech could not be speech if it were not overt. If so, the very notion of inner, soundless speech might be almost unthinkable for them.

4. Just as preschoolers may believe that an activity could not be simultaneously linguistic and covert, as just proposed, so also might they believe that an activity could not be simultaneously linguistic and intellectual. That is, although they know that there are certain acts called thinking and certain acts called talking, they may not realize that the two can coexist in the same act in the form of verbal thinking.

## STUDY 1

Two hypotheses were tested in this study. The main one (*inner-speech* hypothesis) was that 4-year-olds would have relatively little knowledge about inner speech and would show this lack of knowledge in two ways. First, they would be less likely than older children and adults to believe that it is possible for people to talk to themselves silently, "up in their heads." Second, they were also predicted to be less likely than older participants to infer the presence of inner speech in an experimenter who was engaged in a mental activity that would clearly require it, for example, silently trying to recall items on a shopping list. Similar tests were made of a secondary hypothesis derived from speculation 4 above, namely, that 4-year-olds would be less likely than older persons to believe that an individual who is talking aloud could also be thinking at the same time (*simultaneous-talk-and-think* hypothesis).

### Method

#### Participants

The participants consisted of 20 4-year-olds, 20 6- to 7-year-olds, and 20 adults. The younger children were drawn from a university laboratory preschool and were mostly from middle-class families. Half were males and half females, and their mean age was 4 years 8 months (*range* = 4 years 2 months to 4 years 11 months). The older children were drawn from two private elementary schools and were of similar SES. Eleven were female and nine male, and their mean age was 7 years 1 month (*range* = 6 years 3 months to 7 years 10 months). The adult group consisted of 13 female and 7 male college students. Two female experimenters, hereafter referred to as E1 and E2, tested all of the participants.

#### Procedure

*Training and pretest.* To insure that the younger children were willing to answer questions with both "yes" and "no" answers, participants were asked four training questions about the possibility of both mental and physical activities. Feedback was given for these four questions. Three additional questions about thinking and talking (questions 3, 6, and 7) provided tests of our hypotheses. No feedback was given for these three questions. E1 began the testing session by saying, "You know, [participant's name], people *can* do lots of different things, can't they? They *can* drive cars, they *can* smile, they *can* sing songs. There are also things people can*not* do. They can*not* fly like a bird, they can*not* walk through walls, and they can*not* talk as loud as thunder. Now I'm going to ask you some questions about what people *can* and can*not* do."

1. Can a person eat ice cream? That's right/ Actually a person *can* do that.
2. Can a person stand on one foot all day long? That's right/ Actually a person can*not* do that.
3. Can a person say the words to a story up in his head, without moving his lips? OK.
4. At the very same tiny minute, can a person feel happy, sad, and mad, all at once? That's right/ Actually a person can*not* do that.
5. Can a person have dreams? That's right/ Actually a person *can* do that.
6. Can a person tell himself things or talk to himself up in his head? OK.
7. When a person is talking out loud, can he be thinking at the same time? OK.

Questions 6 and 7 were asked in counterbalanced order, and the other five questions were asked in the order shown.

*Main tasks.* Four tasks followed the pretest: two, blocked together, in which E2 sat silently while think-

ing (Silent) and two, also blocked together, in which she muttered continuously while thinking (Talk). The order of the tasks within the blocks was counterbalanced. Half the participants in each age group received the Silent tasks first, and half received the Talk tasks first.

In one of the Silent tasks (Store), E2 said, "You know, E1, this morning my friend asked me to buy some things for her at the grocery store. I didn't write down what she asked for." E1 responded, "Uh oh. Well, E2, try to remember all the things she asked you to buy." E2 said, "Hmm. This is going to take some time. Give me a few minutes." She then turned her back to the participant and E1 and said, "It's hard to remember exactly what she said." E1 paused a few seconds and then asked, "Right now, is E2 thinking, up in her head, or not? That's right/ Actually she *is* thinking. Is she just thinking, up in her head, or is she also saying things to herself, up in her head?" If participants answered, "Also saying things," E1 asked, "What is she talking about, up in her head?" If they answered, "Just thinking," E2 asked, "What is she thinking about, up in her head?" In this and all the other tasks, the choices within the test questions were counterbalanced across participants. In the other Silent task (Bicycle), E2 silently planned how she would tell her husband about some damage she had accidentally caused to his bicycle.

In one of the Talk tasks (Books), E1 said, "E2, I know you read lots of good books last year. Try to remember your three favorite books." E2 said, "Hmm, this is going to take some time. Give me a few minutes." She turned her back to E1 and the participant, while continuing to talk: "It's hard to remember exactly what I read. What was the name of that book I read about farming? It was the name of a place. Hmm." With E2 continuing to mutter audibly in this fashion, E1 asked, "Right now, is E2 talking or not? That's right, she *is* talking. Is she just talking or is she also thinking, up in her head?" As in the Silent tasks, participants were then asked for the content of E2's talking if they responded "Just talking," or the content of her thinking if they responded "Also thinking." In the other Talk task (Doctor), E2 continued to mutter aloud as she wrestled with the problem of what she would say to her sick son to persuade him to go see the doctor.

*Additional tasks.* The testing session ended with the administration, in random order, of two additional Silent tasks and one additional Talk task that we thought might be easier for young children than the four main ones. The Silent tasks concerned E2's covert verbal activity ("also saying things to herself, up in her head?") while silently counting an array of objects (Count) or while silently reading a story book (Read). At the end of the Read task a more direct question was asked: "She's still reading. Is she saying any story words to herself right now, or not?" Preschoolers have had some experience with the intrinsically verbal activities of counting and reading, and, even if they haven't done them silently themselves, they have certainly observed others doing them silently. They might, therefore, have had the experience of hearing numbers and other words in their heads in these situations and therefore be more willing to admit that E2 was talking to herself. In the additional Talk task (Shoe), E2 reported that she felt something inside her shoe and then repeatedly said, "I wonder what it can be. I can't imagine what it is." We thought the repeated use of "wonder" and "imagine" might help the 4-year-olds realize that E2 must be thinking as well as talking.

**Table 1 Percentage of Correct Responses to Tests of the Inner-Speech Hypothesis in Study 1**

| | Age | | |
|---|---|---|---|
| Test | 4 Years | 6–7 Years | Adult |
| Question 3 | 20* | 65 | 90* |
| Question 6 | 45 | 95* | 100* |
| Store | 35 | 55 | 85* |
| Bicycle | 25* | 65 | 75* |
| Count | 30 | 80* | 100* |
| Read | 30 | 90* | 95* |

*Note:* Percentages significantly ($p < .05$) larger or smaller than chance expectations of 50% according to the binomial table are marked with an asterisk.

## Results and Discussion

Table 1 shows how each age group responded to the six tests of the inner-speech hypothesis: the two initial questions about whether it would be possible for a person to engage in inner speech; following these, the two main Silent tasks concerning E2's inner speech; and last, the two additional, supposedly easier Silent tasks. The data from all six tests strongly support the hypothesis that 4-year-olds have little knowledge or awareness of inner speech. On none of these tests did the 4-year-old participants show above-chance (50%) correct responding and on two (Question 3, Bicycle) they performed significantly worse than chance. Thus, only a minority of these preschoolers said that a person could say the words to a story up in his head without moving his lips (Question 3) or could tell himself things or talk to himself up in his head (Question 6). Similarly, fewer

**Table 2 Percentage of Correct Responses to Tests of the Simultaneous-Talk-and-Think Hypothesis in Study 1**

| | Age | | |
|---|---|---|---|
| Test | 4 Years | 6–7 Years | Adult |
| Question 7 | 15* | 60 | 100* |
| Books | 60 | 90* | 100* |
| Doctor | 65 | 95* | 100* |
| Shoe | 55 | 80* | 100* |

*Note:* Percentages significantly ($p < .05$) larger or smaller than chance expectations of 50% according to the binomial table are marked with an asterisk.

than one-third of them said that E2 was saying things to herself while trying to silently recall her shopping list (Store), silently plan a persuasive message (Bicycle), silently count an array of objects (Count), or silently read a book (Read). To our surprise, they proved to be no more likely to infer inner speech when E2 was silently counting and reading than in the other two Silent tasks, despite the obviously verbal nature of these two activities. Recall that at the end of the Read task participants were asked an even more direct and specific question about inner speech: "She's still reading. Is she saying any story words to herself right now, or not?" Only six of the 20 4-year-olds said that she was, whereas 19 6- to 7-year-olds and 19 adults did so ($p < .001$, Fisher exact test).

There was also clear improvement with age on each of these tests. Chi-square or Fisher tests were carried out on the six rows of Table 1, and all of these age trends were statistically significant. If one accepts correct responding to at least five of these six tests as a criterion of awareness of inner speech, then 1 4-year-old, 11 6- to 7-year-olds, and 16 adults showed this awareness: $\chi^2(2) = 23.44, p < .001$. If the criterion is relaxed to at least four of six responses correct, the numbers per group become 4, 14, and 20: $\chi^2(2) = 28.13, p < .001$. It appears, then, that whereas few of the 4-year-olds gave evidence of this awareness, more than half of the 6- to 7-year-olds did. Some adult participants responded "could be" rather than "yes" to some of the Main tasks. We decided to be conservative and score these responses as incorrect. Had we scored them as correct, however, the adults' Store and Bicycle percentages correct would have risen to 100% and 85%, respectively, making the age differences even more marked.

As Table 2 shows, the secondary, simultaneous-talk-and-think hypothesis was also supported by the data. On none of the four tests of this hypothesis did the 4-year-olds respond significantly better than would be expected by chance, and on one (Question 7) they performed significantly worse. Only three of the 20 4-year-olds (15%) appeared to believe that a person could be thinking at the same time he or she was talking out loud (Question 3). Likewise, only 55%–65% said that E2 was also thinking while verbally puzzling aloud over various problems (Books, Doctor, Shoe tasks). As with the Silent tasks, the Talk task that we thought would be the easiest of the three because of E2's repeated use of "wonder" and "imagine" (Shoe) did not prove to be any easier than the other two. These results together with those of the Read task are reminiscent of Flavell et al.'s (1995, Study 7) finding that preschoolers often fail to ascribe concurrent mental activity to a person who is talking or reading.

There was also a clear improvement with age on these four measures. Chi-square or Fisher tests of the four rows in Table 2 showed significant age trends in each case. The numbers of participants per age group responding correctly to all four tests were 1, 11, and 20 from youngest to oldest group, $\chi^2(2) = 36.30, p < .001$. Lowering the criterion to three or more tests correct, the corresponding figures were 8, 16, and 20, $\chi^2(2) = 19.09, p < .001$. In addition, on those tasks in which 4-year-olds did correctly say that E2 was thinking as well as talking, they responded incorrectly 25% of the time when subsequently asked what she was thinking about, whereas the older participants never did. This suggests that some of the younger children's correct responses may not have been based on the knowledge under study. Thus, similar to what was found with the inner-speech measures, only a few of the 4-year-olds but more than half of the 6- to 7-year-olds gave clear evidence of knowing that people may think while talking.

Finally, a 3 (age) × 2 (task: Silent versus Talk) × 2 (order: Silent tasks first versus Talk tasks first) mixed ANOVA performed on responses to the four main tasks yielded significant main effects for age, $F(2, 54) = 8.51, p < .001$, for task, $F(1, 54) = 22.01, p < .001$, and for order, $F(1, 54) = 9.90, p < .01$, plus a significant age × order interaction, $F(2, 54) = 5.63, p < .01$. The two main Talk tasks (Books, Doctor) proved to be significantly easier than the two main Silent tasks (Store, Bicycle). One possible reason for this might have been that there were more available clues that E2 was thinking while talking aloud (e.g., she was obviously wrestling with a problem) than that she was talking silently while thinking. Another reasonable possibility is that children of this age are more aware that people think than that they talk covertly. As to the significant age × order interaction, this was because the 10 4-year-olds who received the Talk tasks before the Silent tasks performed better on both

types of tasks than the 10 who received the Silent tasks first. However, the former subgroup also performed better on the three pretest questions (3, 6, and 7) that preceded the Talk and Silent tasks, suggesting that the order effect may have been just a sampling error.

## STUDY 2

As suggested in the introduction (point 2), young children may be unaware of the existence of inner speech in part because their limited introspective skills tend to prevent them from noticing its presence on those occasions when they engage in it themselves. Study 2 was designed to test the hypothesis that they have considerable difficulty in noticing their own inner speech. Preschool children and adults were given four silent (no-talking-aloud) thinking tasks, two designed to engender inner speech and two designed to engender visual imagery. Immediately following each task participants were asked if they had solved it by subvocalizing or by visualizing. The prediction was that, in contrast to the adults, the preschoolers would be poor at recognizing which type of processing they had just done on each task.

### Method

#### Participants

The participants consisted of 18 4-year-olds, 18 young 5-year-olds, and 18 adults, drawn from the same sources as the participants in Study 1. The 4-year-old group consisted of 10 girls and 8 boys; their mean age was 4 years 7 months (*range* = 4 years 5 months to 4 years 11 months). The 5-year-old group comprised 8 girls and 10 boys, mean age of 5 years 2 months (*range* = 5 years 0 months to 5 years 5 months). The adults were 11 female and 7 male college students. Two additional 4-year-olds and four 5-year-olds failed the introductory practice task and thus were not included in the study. One experimenter (male) tested all the participants.

#### Procedure

The participants were first given a practice task to acquaint them with the procedure. On the pretext of keeping their thinking secret from a puppet, they were encouraged to think about their teacher's name silently, up in their heads. Then the puppet was put in a box so he could not hear and the participants were asked what name they had just been thinking of, and then whether they had thought of it by forming a picture of it in their head or by saying it to themselves in their head. No corrective feedback was provided in the case of incorrect answers to these questions. If a child was unable to think about the teacher's name without saying it out loud, the task was repeated using a friend's name instead. If a child responded incorrectly a second time, he or she was dropped from the study.

Four tasks of the same general sort followed, two Verbal and two Visual. In one of the Verbal tasks (Name), participants were asked to think silently about how their name sounds. They were then asked how they had thought about it: "Did you say your name to yourself in your head, or did you have a picture of your name in your head?" In the other Verbal task (Age) they thought silently about how old they were and then were asked a similar two-choice question. In one Visual task (House) they thought silently about how their house looked and then were asked whether, while doing so, they had had a picture of their house in their head or had said "house" to themselves in their head. In the other Visual task (Face) they thought silently about their mother's face and were asked a similar question. If a child said an answer aloud prematurely or indicated that he or she was unable to perform the requested task, then a back-up task was administered. Three 4-year-olds and one 5-year-old needed to be given a total of two back-up tasks each, all of which they were able to perform. The order of the four tasks and the order of options within each question ("say" versus "picture") were determined randomly for each participant, with each age group sharing the same set of random orders.

**Table 3 Percentage of Correct Responses to Verbal and Visual Tasks in Study 2**

| | Age | | |
|---|---|---|---|
| Test | 4 Years | 5 Years | Adult |
| Verbal, name | 40 | 55 | 78* |
| Verbal, age | 55 | 55 | 72 |
| Visual, house | 50 | 78* | 100* |
| Visual, face | 61 | 83* | 100* |

*Note:* Percentages significantly ($p < .05$) larger or smaller than chance expectations of 50% according to the binomial table are marked with an asterisk.

### Results and Discussion

Table 3 shows how the participants in each age group performed on the two Verbal and the two Vi-

sual tasks. A 3 (age) × 2 (task: Verbal versus Visual) mixed ANOVA performed on responses to these tasks yielded as significant effects only a main effect for age, $F(2, 51) = 10.20$, $p < .001$, and for task, $F(1, 51) = 8.77$, $p < .01$. Tukey tests showed that the adults performed significantly ($p < .05$) better than the 4-year-olds on both Verbal and Visual tasks; no other pairwise age comparisons were significant. One 4-year-old, 5 5-year-olds, and 11 adults chose "correctly," as we defined correctness, on all four tasks: $\chi^2(2) = 13.05$, $p < .01$. Related $t$ tests showed that the adults and the 5-year-olds, but not the 4-year-olds, performed significantly better on the Visual tasks than on the Verbal ones: for the adults, $t(17) = 3.00$, $p < .01$; for the 5-year-olds, $t(17) = 2.30$, $p < .05$.

It is apparent from Table 3 and the foregoing analyses that, consistent with our hypothesis, the 4-year-olds gave no evidence of knowing when they had just verbalized rather than visualized and when they had just done the opposite. In contrast, Table 3 shows that the adults usually reported having verbalized rather than visualized on the Verbal tasks (the 72% in Table 3 is near-significantly ($p < .10$) better than chance) and always reported having visualized rather than verbalized on the Visual ones. The performance of the 5-year-olds was intermediate. Like the 4-year-olds, they did not report verbalization significantly more often than visualization on the Verbal tasks. Like the adults, however, they did usually report having visualized on the Visual tasks. Finally, recall that all participants were given a Verbal practice task at the beginning of the testing session. The age trend for that task was quite similar to that for the two subsequent Verbal tasks: 60%, 50%, and 83% from youngest to oldest age group.

We were surprised that even a minority of the adults reported having thought of their name and their age via imagery rather than via inner speech on the Verbal tasks, whereas they never did the opposite on the Visual tasks. Perhaps we should not have been wholly surprised. Being skilled readers, the adults could have visualized the letters forming their name and the digits representing their age rather than, or in addition to, saying them to themselves. Indeed, three adults claimed to have both verbalized and visualized on one of their two Verbal tasks. This strategy would obviously have been much less available to preliterate preschoolers; even if a precocious few could have visualized the written version of their *own* name and age, surely none would have been able to visualize the written version of their *teacher's* name. In contrast, subvocalizing "house" and "face" on the Visual tasks would seem useless and therefore much less likely to occur. Another possibility is that some participants may have experienced the sound of their name and their age as something heard internally rather than something said internally, that is, as acoustic imagery rather than inner speech. If so, this could also have depressed the number of verbalization choices on the Verbal tasks.

The age trend for the Visual tasks shown in Table 3 is consistent with a recent finding by Estes and Buchanan (1993). These investigators gave 4-, 5-, 6-, and 20-year-old participants extensive experience with a computer game in which Shepard-type mental rotation could be a useful solution procedure. They found an increase with age in the percentage of participants whose reaction time patterns indicated that they were, in fact, using this visualization strategy. More to the present point, they also found a marked increase with age in the percentage of these "rotators" who, when questioned, showed some awareness that they had been mentally rotating the stimulus. Similar to what was found in the present study, awareness was rare in the 4-year-old group, fairly common among the 5-year-olds, and very common among the 6-year-olds and adults. Likewise, Estes, Wellman, and Woolley (1989) found that preschoolers were usually able to "make a picture in your head" of familiar objects and also visualize movements or transformations of these objects, for example, visualizing the opening and closing of a pair of imaged scissors. These results support Harris's (1995, p. 100) recent conjecture that children may be able to introspect mental imagery somewhat earlier and more easily than they can introspect other kinds of mental processes.

As Table 3 shows, on the Verbal tasks the child participants did not report having said their name and age to themselves more often than would be expected by chance. Could that be because they did not, in fact, subvocalize these words and therefore had nothing to report? We think that this is extremely unlikely. The children generally seemed to understand the tasks and seemed to be trying to think about what they had been asked to think about. Indeed, even if they had not tried to, it seems likely that the task instruction alone (e.g., "I want you to think about how your name sounds") would have automatically triggered some mental attention to whatever they were asked to think about. If this is true, it is hard then to imagine how they could have silently thought about how their name sounds and how old they are without verbalizing these words to some extent. For preliterate thinkers, especially, there appears to be no other feasible way to represent them. We believe, rather,

that their chance level of performance was due to their failure to notice or remember their covert verbalizations.

## GENERAL DISCUSSION

The results of these two studies indicate that preschool children's knowledge of inner speech is extremely limited. Study 1 showed that preschool participants tend not to infer the presence of inner speech in another person who is silently trying to solve a verbal problem, even though the person's solution efforts would necessarily require verbalization. Indeed, the majority of Study 1 preschoolers apparently did not believe that people can talk to themselves or say words covertly; that is, they seemed unaware that such an activity as inner speech is even possible. Likewise, they showed little understanding that people can also be thinking while talking aloud, even when the people are obviously talking their way through a problem. The latter finding also suggests that they would have little awareness of the possibility of covert verbal thought. Study 2 showed that preschoolers also tend to be very poor at detecting the presence of inner speech in themselves when they are engaged in a task that elicits such speech. This result is consistent with other recent findings (Flavell et al., 1995) of poor introspective abilities in children of this age. Gopnik (1993) and Wimmer and Hartl (1991) have presented arguments and evidence against the traditional Cartesian assumption that the human mind is transparent to itself. The Study 2 results, together with those of Flavell et al. (1995), offer additional evidence that this assumption is wrong, at least in the case of young children.

It might be argued that the complexity of the questions they were asked rather than their lack of knowledge about inner speech was primarily responsible for the preschoolers' poor performance on our tasks. However, there are several facts that make this seem an unlikely explanation of our results. First, recall that only 6 of the 20 4-year-olds (30%) in Study 1 correctly answered the direct question asked at the end of the Read task ("Is she saying any story words to herself right now, or not?"), even though it is structurally simpler than the other questions. Second, all 20 of the Study 1 4-year-olds correctly said yes in response to control questions 1 and 5 and no in response to control questions 2 and 4. These questions are not, on average, structurally simpler than test questions 3, 6, and 7 (compare the complexity of 4 with that of 3 and 6, for instance), and yet the 4-year-olds found them much easier than the test questions (Table 1). In addition, their perfect performance on the four control questions shows that they were quite willing to answer questions either affirmatively or negatively, depending upon the content of the question. Third, in one of Flavell et al.'s studies (1995, p. 46), 20 4-year-olds were asked two control questions very similar in structure to those employed in the Main and Additional tasks of Study 1. For example, one was: "——— [E2's name] is holding a crayon, isn't she? Is she just holding the crayon or is she holding the pencil too?" For one of these questions, E2 was seen holding just the first-named of the two objects; for the other, she was seen holding both. Despite the structural complexity of these questions, all 20 4-year-olds answered both correctly. This suggests that it was the content rather than the structure of our questions that made them difficult for our preschool participants. One could also object that the preschoolers might not understand the "up in her head" phrase in the Study 1 inner-speech questions, but they had just agreed that E2 was "thinking, up in her head." Because of this priming, together with the finding that children of this age usually do understand that thinking is a silent activity carried on inside one's head (Flavell et al., 1995), the general meaning of "activity X, up in her head" should have been clear to them. If it was in fact clear to them, then it is hard to see why they would deny that E2 was "also saying things to herself, up in her head" unless they simply did not believe that she was. Finally, if the 4-year-olds in Study 1 really possessed significant knowledge about inner speech one would think that at least one of our six questions would have liberated it. As Table 1 shows, however, none of these questions were correctly answered by more than a minority of the 4-year-olds. These arguments and evidence, together with those cited previously, support the conclusion that children of this age really do lack knowledge and awareness of inner speech.

When do children begin to acquire such knowledge and awareness? There is evidence that they make considerable progress during the early elementary school years. In Study 1, 6- to 7-year-olds proved to be more aware than 4-year-olds of the existence of inner speech and also more able to infer its presence in another person. Flavell et al. (1995, Studies 12 and 13) found that 7- to 8-year-olds were considerably better than 5-year-olds at reporting their recent thoughts, at least some of which were verbal in nature. Siegler and his co-workers (Siegler, 1996) have found that early elementary school children are able to report quite accurately the strategies they use

when adding, subtracting, telling time, and memorizing number sequences. These strategies include such inner-speech processes as covert counting and verbal rehearsal. It is reasonable to think that experience in elementary school would foster awareness of inner speech. Reading, writing, and arithmetic—the basic staples of primary grade education—all require considerable private speech on the part of the learner. Furthermore, the speech becomes progressively covert with increasing practice and expertise. This is as true for the speech involved in these activities as it is for the self-regulatory speech studied by the Vygotskyans. One can easily imagine children initially noticing that they talk aloud or half-aloud to themselves as they add and subtract numbers and read and write words, and later noticing that they still talk to themselves, but now often covertly, as they become more skilled at these activities. Recall in this connection that the 6- to 7-year-olds in Study 1 performed significantly above chance only on the Count and Read Silent tasks, the ones that entailed these school activities. As they become increasingly aware of the existence of inner speech as a cognitive activity and increasingly able to notice its occurrence when they engage in it, they should come to realize that it occurs frequently and can take many forms: rehearsing the past or planning the future, verbal problem solving, daydreaming and fantasizing, worrying and obsessing, and so forth. And with this realization, they will have learned a lot about what people's inner lives are like.

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## REFERENCES

Astington, J. W. (1993). *The child's discovery of the mind.* Cambridge, MA: Harvard University Press.

Bartsch, K., & Wellman, H. M. (1995). *Children talk about the mind.* New York: Oxford University Press.

Diaz, R. M., & Berk, L. E. (1992). *Private speech: From social interaction to self-regulation.* Hillsdale, NJ: Erlbaum.

Estes, D., & Buchanan, L. (1993, March). *Mental rotation and metacognition in early childhood.* Paper presented at the meeting of the Society for Research in Child Development, New Orleans.

Estes, D., Wellman, H. M., & Woolley, J. P. (1989). Children's understanding of mental phenomena. In H. Reese (Ed.), *Advances in child development and behavior* (Vol. 22). New York: Academic.

Flavell, J. H., Green, F. L., & Flavell, E. R. (1993). Children's understanding of the stream of consciousness. *Child Development, 64,* 387–398.

Flavell, J. H., Green, F. L., & Flavell, E. R. (1995). Young children's knowledge about thinking. *Monographs of the Society for Research in Child Development, 60*(1, Serial No. 243).

Flavell, J. H., Green, F. L., & Flavell, E. R. (1996). The development of children's knowledge about attentional focus. *Developmental Psychology, 31,* 706–712.

Flavell, J. H., Miller, P. H., & Miller, S. A. (1993). *Cognitive development* (3d ed.). Englewood Cliffs, NJ: Prentice-Hall.

Garrity, L. I. (1975). An electromyographical study of subvocal speech and recall in preschool children. *Developmental Psychology, 11,* 274–281.

Gopnik, A. (1993). How we know our minds: The illusion of first-person knowledge of intentionality. *Behavioral and Brain Sciences, 16,* 1–14.

Harris, P. L. (1995). Commentary. *Monographs of the Society for Research in Child Development, 60*(1, Serial No. 243).

Hitch, G. J., Halliday, M. S., Dodd, A., & Littler, J. E. (1989). Development of rehearsal in short-term memory: Differences between pictorial and spoken stimuli. *British Journal of Developmental Psychology, 7,* 347–362.

Hitch, G. J., Halliday, M. S., Schaafstal, A. M., & Heffernan, T. M. (1991). Speech, "inner speech," and the development of short-term memory: Effects of picture-labeling on recall. *Journal of Experimental Child Psychology, 51,* 220–234.

Hulme, C., Silvester, J., Smith, S., & Muir, C. (1986). The effects of word length on memory for pictures: Evidence for speech coding in young children. *Journal of Experimental Child Psychology, 41,* 61–75.

Johnston, R. S., & Conning, A. (1990). The effects of overt and covert rehearsal on the emergence of the phonological similarity effect in 5-year-old children. *British Journal of Developmental Psychology, 8,* 411–418.

Johnston, R. S., Johnson, C., & Gray, C. (1987). The emergence of the word length effect in young children: The effects of overt and covert rehearsal. *British Journal of Developmental Psychology, 5,* 243–248.

Lewis, C., & Mitchell, P. (Eds.). (1994). *Children's early understanding of mind: Origins and development.* Hillsdale, NJ: Erlbaum.

Locke, J. L., & Fehr, F. S. (1970). Young children's use of

the speech code in a recall task. *Journal of Experimental Child Psychology, 10,* 367–373.

Perner, J. (1991). *Understanding the representational mind.* Cambridge, MA: MIT Press.

Siegler, R. S. (1996). *Emerging minds: The process of change in children's thinking.* New York: Oxford University Press.

Vygotsky, L. S. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Wellman, H. M., & Gelman, S. A. (1992). Cognitive development: Foundational theories of core domains. In M. R. Rosenzweig & L. W. Porter (Eds.), *Annual review of psychology.* Palo Alto, CA: Annual Reviews.

Wimmer, H., & Hartl, M. (1991). Against the Cartesian view on mind: Young children's difficulty with own false beliefs. *British Journal of Developmental Psychology, 9,* 125–138.