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The Development of Children's Knowledge About Attentional Focus

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Children of 4, 6, and 8 years of age were tested for their understanding that a person who is mentally focused on one thing will be devoting little or no simultaneous attention or thought to another, totally irrelevant thing. For example, while one is busy trying to recognize the people in a group photograph or recall the movies one has seen recently, one will likely not also be thinking about the photograph's drab frame in the first case or one's piano in the second. Whereas most of the 6- and 8-year-olds demonstrated an understanding that task-oriented thought and attention are selectively focused in this way, most of the 4-year-olds showed no such understanding.

The development of children's knowledge about the mind is currently receiving a great deal of study (see, e.g., reviews by Astington, 1993; Moses & Chandler, 1992; Perner, 1991; Wellman, 1990; Wellman & Gelman, 1992). Most of this research has focused on children's knowledge about mental *states,* such as beliefs, knowledge, desires, emotions, and intentions. For example, there have been many studies of young children's developing understanding of false beliefs. Less research has been done on their understanding of mental *activities,* that is, the mental things we could be said to do rather than have (D'Andrade, 1987).

However, recent studies by Flavell, Green, and Flavell (1993, 1995) have identified some of the things that preschool children do and do not know about the activity of thinking, construed in the broad and nonspecific sense of just mentally attending to or thinking of something. They seem to understand that thinking is an internal, mental activity that can refer to either real or imaginary objects or events. Indeed, by the end of infancy, children probably have some minimal understanding that people mentally attend to things (e.g., Baldwin & Moses, 1994; Baron-Cohen, 1993). They are also capable in some circumstances of distinguishing thinking from perceiving, talking, acting, and knowing—psychological activities with which it frequently cooccurs. Finally, they can sometimes infer that a person is thinking if provided with very clear and salient situational or behavioral cues: for example, when the person has just been presented with a problem and looks reflective.

On the other hand, Flavell et al. (1995) found that preschoolers tend to be generally poor at determining both when a person (self or other) is thinking and what the person is and is not thinking about. They do not realize that conscious individuals are experiencing a virtually constant flow of mental content of one sort or another—William James's "stream of consciousness" (1890)—even when behaviorally and perceptually unengaged with the external world, as when just sitting quietly with no perceptual stimulation. More surprising, preschoolers do not even automatically assume that a person who is doing something that would be regarded as cognitive—looking, listening, reading, or talking, for instance—is engaged in mental activity while doing it. Moreover, when they do infer that a person is thinking, they tend to be poor at inferring the content of the person's thought, even when the clues to its content are obvious and unequivocal. They also have very limited introspective skills. That is, they are poor at recalling or reconstructing what they as well as others have just been thinking about, or even recognizing that they had just been thinking, even in situations designed to make accurate introspection very easy.

In three of Flavell et al.'s (1995) studies (Studies 4, 6, and 10), 4-year-olds also revealed a curious limitation in their understanding of how thought or attention is deployed. For example, after having established that a person was currently thinking about one thing, they would often say that the person was also simultaneously thinking about some other, unrelated thing. To illustrate, in two studies, children watched an experimenter search for and eventually find a missing object (X). Once found, it was no longer of concern to the experimenter and was therefore removed from sight. The experimenter was then presented with another interesting object (Y) and became wholly absorbed in examining it. After having established that she was now thinking about Y, 4-year-olds were asked if she were also thinking about X. One half or more of the children said that she was. In another study, two line drawings were constructed with thought bubbles appearing above a character's head. One contained six asterisks to represent individual thoughts and the other contained only one. Children 4 and 5 years of age were asked: "If somebody is thinking for just a teeny short bit of time, for just a second, does their head look like this (one-asterisk bubble), with just one thought, or does it look like this (six-asterisk bubble), with lots of different thoughts happening all at the same time?" The order of the two choices was counterbalanced. Whereas 90% of the 5-year-olds said the person would have only one thought, only 60% of the 4-year-olds did, a choice pattern not significantly different from chance expectation.

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These results suggest that 4-year-olds may conceive of the mind as more analogous to a lamp than a flashlight: That is, they may think that it is capable of radiating attention or thought in many directions at once, rather than in only one direction at a time.

These findings are consistent with those of previous studies of the development of children's knowledge about attention (Fabricius & Schwanenflugel, 1994; Miller, 1985; Pillow, 1988, 1989). Previous work suggests that there is an increase with age during the preschool and elementary school years in roughly the following intuitions about attention (cf. Pillow, 1989). Attention is selective and limited. If one tries to attend fully to one thing, one will normally not be very aware of other things (unless the other things are very attention-getting, in which case attention to the target will suffer correspondingly). For example, Pillow (1989) tested preschool and elementary school children's understanding that trying to comprehend verbal input in one ear (a story or block-building instructions) would result in failure to comprehend an incidental story presented to the other ear. He found that "whereas most 4-year-olds demonstrated little understanding of selective listening, some 5-year-olds, most 6-year-olds, and nearly all 8-year-olds understood that attending selectively to one event may diminish the information one obtains about other events" (Pillow, 1989, p. 441).

The purpose of the present study was to obtain more systematic evidence than Flavell et al. (1995) had concerning the development of the intuition that one normally focuses one's thought or attention on just one thing at a time. Previous studies by Pillow (1989) and others have measured this intuition somewhat indirectly, by inquiring whether children of different ages think that a person will *comprehend* or *learn about* nontarget as well as target objects. In this study we ask directly whether children believe that a person will *think about* or *pay attention to* nontargets as well as targets. The two approaches could yield different results. Young children seem not to understand clearly that thought or attention are necessary first steps in achieving comprehension and learning (Fabricius & Schwanenflugel, 1994; Flavell et al., 1995; Pillow, 1989, in press). Consequently, they could wrongly assume that a person would comprehend or learn about nontargets as well as targets, as previous research suggests they do, and yet not also wrongly assume that the person would attend to or think about nontargets as well as targets. In most tasks used to assess their knowledge of attention, children are told that the person's job is to focus on the target. It would not be surprising, therefore, if they assumed that the person would follow instructions and attend only to targets and yet, understanding little about the processes of comprehension and learning and how they are mediated by attention, see no reason to think that nontargets would not be comprehended or learned.

The research strategy in the first four tasks—the main tasks in this study—was to direct a second experimenter's mental attention to one of two adjacent objects by asking her a question about that object. Both objects were visible to her at the time the test questions were asked. Four-, 6-, and 8-year-olds were first asked whether or not this experimenter was attending to, or thinking about, anything while focused on the target object. If the response was yes, children were asked to volunteer the content. If the correct content was specified, children were queried about whether she was also thinking about or attending to the nontarget object. Next, we asked children to rate the degree of attention devoted to each object that had been mentioned. Finally, we asked each child whether the experimenter currently sees the target and the nontarget, regardless of whether they had been mentioned previously. The addition of this question allowed us to find out whether children distinguished between attending to or thinking about a visible object and seeing it.

Two additional tasks were also given following the four main tasks. They differed from the main tasks only in that mental attention was directed to nonpresent objects, and, consequently, the *see* questions were omitted. These tasks were included to provide additional, convergent evidence of children's understanding or lack of understanding of attentional focus.

Half of the children in each age group were given questions for all six tasks using only *thinking-about* wording, and the other half were given questions using only *paying-attention-to* wording. Our purpose in using these alternative wordings was to give children their best chance to demonstrate competence: If one expression did not convey the intended meaning to children of a given age, the other might. In pretraining, we used both terms. An additional measure we took to clarify the meaning of the test questions was to structure the initial phrase of the first question in the same way for both wordings: We began both wordings with the phrase, "Is there anything on her mind right now, . . . ?"

Method

Sample

Three groups of children were tested with 20 in each group. The mean ages for the children were 4 years 6 months (range = 4 years to 4 years 9 months), 6 years 6 months (range = 5 years 11 months to 7 years 2 months), and 8 years 7 months (range = 8 years 1 month to 9 years). The younger group consisted of an equal number of girls and boys. The two older groups each consisted of 9 girls and 11 boys. Three additional children were excluded from the study, 2 because of experimenter error, and 1 because his English was not proficient. The younger children were drawn from a university laboratory preschool. The older children were enrolled in first and third grades in a neighboring community. The children in the study were mostly from middle-class backgrounds. Two female experimenters tested all of the children.

Procedure

Pretraining. We began with some introductory comments as to what the brain or mind is used for and then gave children some imagery exercises during which we repeatedly used the terms *think* and *attend to*. The exercises were based in part on those developed by Betts (1909). The first experimenter (E1) said, "I have a brain or a mind in my head (she pointed to her temple) and you have a brain or a mind in your head. What do you use your brain or mind for? Good. What else? Minds do many different things. Here are some of the things. We use our minds to imagine things, to pay attention to things, to think about things, to remember, and even for letting us know how we are feeling—happy, sad, or even mad." She continued, "Let's try using our minds for a little while. First I'll ask Ellie (Experimenter 2 or E2) to take a turn. Ellie, close your eyes and imagine a dog. Make a picture of a dog in your mind. Pay attention to that dog. What color is he? Good. Now (child's name), your turn. Make a picture in your mind as we go along. Close your eyes if you want to (most children had already done so spontaneously). Imagine or picture a dog. Now pay attention to the

color he is. What color is he? Now think about that dog becoming a different color. Pay attention to the color he is now. What color is he now? Good. Can you think about a cat coming next to the dog? Pay attention to what size the cat is. Is he a little cat or a big cat? Good. Now, can you imagine the dog chasing the cat? Think about where the cat is going to hide. Can you imagine the cat running up a tree?" E1 concluded the pretraining by saying, "Okay, that was kind of fun to use our minds that way, wasn't it? We used our minds to imagine that cat and dog, to think about what they were doing, and to pay attention to special things about them. Now I'll show some things to you and to Ellie and then I'll ask you some questions about Ellie."

Main tasks. E2 was seated directly opposite E1, with the child to E1's left. The two test objects were displayed such that both were continuously visible for both E2 and the child. The orders of the four tasks were individually randomized, and within each age group the 10 children given the attention-to wording and the 10 given the thinking-about wording had identical orders. The procedure is illustrated for the *pins* task. The child was shown an attractive small box that contained three decorative pins. E1 said, "I put some pins in this nice box. Let's show them to Ellie." E2 was asked, "Ellie, which of these pins should I give to my mother for her birthday?" E2 responded, "Just a second," and continued to stare at the pins. She did not touch them. A fixed sequence of questions followed: "Is there anything on Ellie's mind right now, is she thinking about (paying attention to) anything?" followed by "What is she thinking about (paying attention to)?" if the child said yes. If the child did not correctly specify the target, no further thinking-about or attention-to questions were asked. If the child did correctly specify it, the next question was, "Is she also thinking about (paying attention to) the box?" We then asked about the target, "Is she thinking a little or a lot about the pins (paying a little or a lot of attention to the pins)?" The very same question was asked about the box (nontarget) if the child had previously said E2 was thinking about or attending to it. All children were then asked two *see* questions, in the following order: "Does Ellie see the pins right now? Does she also see the box?" Finally, E1 concluded the task by asking E2, "Which is best for my mom, Ellie?" and E2 responded, "I choose this one."

The structure of the remaining three tasks was identical to that of the pins task. In the *buttons* task, the child and E2 were shown a shirt with a button missing. E1 held approximately a dozen buttons in her hand (none of them matching the lost button) and said, "Ellie, this shirt lost a button . . . is there a button here that looks just like the other buttons on the shirt?" As before, E2 said, "Give me a second," and scrutinized the buttons. The questions were exactly as before, the target was the buttons, and the nontarget was E1's hand that was holding the buttons. The task was concluded by E2 asserting she had not found a proper match.

In the *moose* task, the test stimulus was a stuffed moose doll. The moose was on skis and carried ski poles. He wore a red and white striped scarf and red sunglasses. E1 said, "Ellie, a friend gave me this moose. How many red stripes are on his scarf?" E2 replied, "Give me a minute." The nontarget was the sunglasses on the moose. At the end of the task, E2 was asked how many stripes there were and E2 responded appropriately.

In the *picture* task, the target was a 5 × 7 in. (12.7 × 17.7 cm) group photograph of 22 adults and children, and the nontarget was its rather unattractive black picture frame. E1 first showed the picture only to the child, saying quietly, "I put this picture of my family in this black picture frame (E1 pointed to the frame). Let's show the picture to Ellie. Ellie, are there some people in this picture that you know?" At the end of the task E1 asked, "Were there some people that you knew?" and E2 responded appropriately.

Additional tasks. The purpose of these two tasks was to assess children's understanding of mental focus with respect to perceptually absent stimuli, thus avoiding any possible confusion for the child between seeing an object and attending to it mentally. Accordingly, these two tasks did not include physically present objects. Instead E1 asked E2 a question, and as E2 considered the response she stared at an opposite wall. In the *groceries* task, E1 asked, "Ellie, I'm going to the grocery store today. Can I buy you any food while I am there?" As before, Ellie said, "Give me a minute." Children were then given the same sequence of questions as in the main tasks, except that no *see* questions were asked. The target object in this task was the food and the nontarget her bicycle ("Is she also thinking about/paying attention to her bicycle?") The task ended with E2 enumerating three or four food items she needed. In the *movies* task, E2 was asked, "Ellie, did you go to any good movies last month?" "Yes, lots of them," she responded. E1 asked, "How many movies did you see?" The nontarget for this task was her piano. The task was concluded by E2 saying how many movies she saw. The order of the two additional tasks was counterbalanced.

Results

Table 1 shows the percentage of children at each age level responding correctly to the various questions on the four main tasks. Recall that children were not asked the second question about what E2 was attending to or thinking about on a given task if they had not just said she was attending to or thinking about something in answer to the initial, open-ended question. Likewise, they were then not questioned about attention to the nontarget if they had not indicated the target in response to this second question. Consequently, some of the data in Table 1 are expressed in two ways. The percentages in parentheses represent the total number of correct responses to a given question, summed over tasks and children within an age group, divided by the total number of times that question actually got asked in that age group. Percentages not in parentheses have the same numerator but the denominator is always 80, that is, the total number of times that question could potentially have been asked (20 children × 4 tasks). We first carried out 3 (age) × 2 (question wording: thinking about vs. paying attention to) analyses of variance (ANOVAs) on children's scores for each question (1 point for each correct response; range = 0–4); thus, these analyses, henceforth referred to as *regular analyses*, applied to the percentages that are not in parentheses in Table 1. Question wording did not prove to be a significant main effect in any of these analyses; that is, children generally performed no better or worse whether the questions were framed in terms of what E2 was paying attention to or what she was thinking about. Consequently, the ANOVAs subsequently performed on the data shown in parentheses in Table 1 included only the age variable. These latter, henceforth referred to as *special analyses*, were based on the percentage correct responses of only those children who were questioned on a particular measure on at least one task; as a consequence, the sample size varied from analysis to analysis. In both the regular and the special analyses, we further analyzed significant main effects for age by using Tukey tests for significant pairwise differences between age groups.

As the first row of Table 1 shows, there was an increase with age in children's tendency to affirm, in response to E1's initial question, that E2 was thinking about (or paying attention to) something, $F(2, 54) = 4.56$, $p < .05$, with 4-year-olds significantly different from 8-year-olds by Tukey test. The same was true for correct identification of the target (pins, etc.) as the object of E2's thought (second row of Table 1): for regular anal-

Table 1
Percentage of Correct Responses to Questions on Main Tasks

Response	Age		
	4 years	6 years	8 years
Think or attend to something	75	90	99
Think or attend to target	63 (83)	90 (99)	99 (100)
Denies think or attend to nontarget	5 (8)	39 (43)	61 (62)
Denies, or more attention to target	15 (24)	80 (83)	95 (96)
See target	95	91	99
See nontarget	94	90	95

Note. The percentages in parentheses are based only on those children who were asked the question. The percentages not in parentheses are based on all children (see text).

ysis (based on all children), $F(2, 54) = 9.23$, $p < .001$, with 4-year-olds significantly different from both 6- and 8-year-olds; and for special analysis (of the data in parentheses, based only on children who were asked the test questions), $F(2, 54) = 4.74$, $p < .01$, with 4-year-olds significantly different from 8-year-olds. These results are consistent with Flavell et al.'s (1995) findings that 4-year-olds often have difficulty inferring that a person is thinking and, when they do infer it, correctly inferring the object of the person's thought from the available evidence.

The most important results of the study are shown in rows 3 and 4 of Table 1. Row 3 shows that there was a dramatic increase with age in the tendency to deny that E2 was also thinking about or paying attention to the nontarget object (box, etc.), located next to the target object and clearly in E2's line of regard: for regular analysis, $F(2, 54) = 15.92$, $p < .001$, with 4-year-olds significantly different from both older groups. Similarly, for the special analysis, $F(2, 52) = 8.30$, $p < .001$, with 4-year-olds significantly different from both older groups. It would of course not be unreasonable to believe that E2 might be thinking about or (especially) paying attention to the nontarget a little bit—because it was visible after all—but definitely less so than to the target. In fact, many cognitive psychologists would probably argue that it is the better answer. Row 4 shows the percentage of children who, on a given task, either attributed no attention or thought to the nontarget (the row 3 pattern) or, instead, attributed a little to the nontarget and a lot to the target. Using this more liberal scoring increased the percentages of correct responses, especially in the two older groups, but left the overall age trend basically unchanged: for regular analysis, $F(2, 54) = 57.87$, $p < .001$, with 4-year-olds significantly different from both older groups; and for special analysis, the results were the same, $F(2, 52) = 45.50$, $p < .001$, with 4-year-olds significantly different from both older groups. The percentages of response patterns of this latter, "little–lot" type, using as the denominator the total number of times the two questions were asked (thus, a special rather than a regular analysis), were 20%, 92%, and 90%, from youngest to oldest group. Thus, if the older children attributed some attention or thought to the nontarget, they almost always attributed more to the target, whereas this was not true for the 4-year-olds. The numbers of children correct on three of the four tasks by the more conservative, row 3 criterion were 0, 5, and 11 (from youngest to oldest group), and by the more liberal, row 4 criterion, 0, 14, and 20. Both results are significant, $\chi^2(2, N = 60) = 15.51$, $p < .001$ for the first, and $\chi^2(2, N = 60) = 42.90$, $p < .001$ for the second. The latter result shows that not one of the twenty 4-year-olds said even fairly consistently that E2 thought about or attended to the target more than to the nontarget, whereas all of the 8-year-olds did. The only significant Age × Question Wording interaction occurred on the regular analysis of the row 4 data; $F(2, 54) = 3.75$, $p < .05$. This was caused by the 6-year-olds' being correct more often by this liberal criterion when E1 used the think-about wording (93%) than when she used the pay-attention-to wording (68%). This may reflect a greater inclination, which accords with our own intuitions, to equate perception with attention than to equate it with thought. This could lead to a greater tendency to say that E2 might be allotting some attention to an obviously visible target than to say that she might be giving some thought to it.

Finally, it is apparent from the last two rows of Table 1 that children of all ages tended to say that E2 saw the nontarget as well as the target, whether or not they had previously said she was thinking about it or paying attention to it. What appeared to increase with age, rather, was the understanding that one can be seeing something and yet not be thinking about it or attending to it. For example, the numbers of children asserting on at least three of the four tasks that E2 saw the nontarget but did not attend to or think about it were 0, 4, and 10, from youngest to oldest group, $\chi^2(2, N = 60) = 11.20$, $p < .01$. Nevertheless, a few children seemed to think that E2 would not see the nontarget when focusing on the target. "Cuz when you are looking at one thing then it's hard to look at the other," one 6-year-old's explanation, may actually reflect some beginning understanding of attentional limitations.

Table 2 shows the percentage of children in each group responding correctly to the questions on the two additional tasks given at the end of the testing session. As in the main tasks, there was an increase with age in the recognition that E2 was thinking about or attending to something (row 1), $F(2, 54) = 5.46$, $p < .01$, with 4-year-olds significantly different from 8-year-olds. There was also a near-significant ($p < .06$) main effect for question wording, with children tending to perform a little better when hearing the thinking wording (93%) than when hearing the attention wording (80%). Again, this may reflect an understandably greater tendency to equate attend with see than to equate think with see; recall that E2 had nothing to look at in

Table 2
Percentage of Correct Responses to Questions on Additional Tasks

Response	Age		
	4 years	6 years	8 years
Think or attend to something	73	88	100
Think or attend to target	68 (93)	80 (91)	100 (100)
Denies think or attend to nontarget	18 (26)	70 (88)	100 (100)

Note. The percentages in parentheses were based only on those children who were asked the question. The percentages not in parentheses are based on all children (see text).

these additional tasks and so might not be thought to be paying attention to anything. Unlike in the main tasks, however, the percentages in parentheses in row 2 show that, on those occasions when 4-year-olds did agree that E2 was attending to or thinking about something, they were as good as the older children at correctly giving responses relating to identifying the correct content categories (food, movies); unlike the older children, however, they often guessed specific instances of these categories (e.g., "broccoli" rather than just naming the categories themselves, e.g., "food").

In marked contrast, the 4-year-olds were once again much likelier than the older children to say that E2 was also paying attention to or thinking about an object (bicycle, piano) totally unrelated to the target and not previously mentioned: for regular analysis, $F(2, 54) = 32.90$, $p < .001$, with all three groups significantly different from one another by Tukey test; for special analysis, $F(2, 50) = 26.65$, $p < .001$, with 4-year-olds significantly different from both older groups. We did not credit the little–lot response pattern as being correct on these tasks because it was not plausible that E2 would be devoting any thought or mental attention at all to the nontarget objects; it did not occur very often in any case. As would be expected from Table 2, the numbers of children responding correctly to all questions on both of these probe tasks showed a very striking increase with age: 2, 13, and 20 from youngest to oldest group, $\chi^2(2, N = 60) = 33.87$, $p < .001$. Finally, and also not surprisingly, children of all ages found it easier to deny that E2 was thinking about or attending to the nontargets on the additional tasks, where they were not visible, than on the main tasks, where they were, $F(1, 57) = 32.59$, $p < .001$.

The three age groups seemed different from one another in a number of ways. The 4-year-olds tended to respond quickly, with little apparent indecision or uncertainty, indiscriminately attributing attention or thought to nontargets and targets alike. They often tried to figure out which specific object in the target set E2 was focused on (e.g., saying "this pin" rather than "the pins" or, as noted earlier, "broccoli" rather than "food" on the additional tasks); moreover, they would sometimes seem loathe to credit her with any thought or attention if they did not succeed in identifying a specific object. This may reflect the tendency noted by Flavell et al. (1995) in children of this age to identify thinking with final cognitive outcomes or products (e.g., problem solutions) rather than with the cognitive processes leading up to them.

The 8-year-olds seemed to have a very good, almost adultlike grasp of the issues posed by our tasks. As many adults would also probably do, they often hesitated before answering the questions about the nontargets on the main tasks, trying to decide whether or not to attribute any of E2's attention or thought to them. If they did decide to attribute some, they often spontaneously qualified their attribution by saying "maybe a little bit," "hardly at all," "not too much," and so forth. On the additional tasks, in contrast, they tended to find the nontarget questions trivially easy. In fact, there was a great deal of giggling and smirking when those questions were asked, as if the whole idea that E2 might also be thinking about or paying attention to her bike or piano struck them as very funny.

Although the 6-year-olds definitely seemed closer to the 8-year-olds than to the 4-year-olds in their understanding of attention deployment, there were still some differences between these two older groups. The 6-year-olds were more likely than the 8-year-olds to say that E2 was attending to or thinking about the nontarget, nonsignificantly so on the main tasks but significantly so on the additional tasks (the third row of Tables 1 and 2); moreover, when they did say so, they were less likely spontaneously to hedge their answers by saying a "little bit." They also seemed generally less confident of their answers concerning nontargets than the 8-year-olds, even on the easier additional tasks. At the same time, they were the only group to improve their performance significantly over tasks. That is, they were more likely to deny that E2 was thinking about or paying attention to the nontarget on their last two main tasks than on their first two, $t(19) = 2.52$, $p < .05$. This result, plus their quite good overall performance on the six tasks, suggests some understanding in this age group of the selective, focused nature of thought and attention.

Discussion

The results of this study suggest that children's knowledge about attentional focus increases considerably between 4 to 8 years of age. The 4-year-olds showed little understanding that a person who was preoccupied with one set of visible objects for some task purpose (e.g., trying to identify the people in a group photograph) would be paying little or no attention to an inconspicuous, task-irrelevant object that also happened to be in her visual field (in this task, the frame around the photograph). Even more striking, they did not even seem to understand that a person who was preoccupied with a set of physically absent objects or events (e.g., trying to remember how many good movies she had seen recently) would not also be thinking about or attending to some totally unrelated absent object (e.g., her piano); as noted previously, Flavell et al. (1995) also obtained a similar finding with preschool children. We do not believe the 4-year-olds actively assumed that the person was attending to the nontargets as well as the targets prior to the experimenter raising the possibility in her question, even in the case of the visible nontargets in the main tasks (this would clearly be impossible in the case of nonvisible and not-previously mentioned nontargets in the probe tasks). Rather, because of insufficient

knowledge of how attention works, they did not realize that she was not attending to them when the question was raised.

It is of course possible that our 4-year-olds performed poorly because we did a poor job of communicating the meaning of the task questions to them. That does not seem a very likely possibility, however. In the pretraining, we had them attend to imagined objects and described what they were doing using the same expressions ("pay attention to" and "think about") that were subsequently used in testing. In addition, we guarded against the possibility that they might understand one of these expressions but not the other by testing half of the group using one expression and the other half using the other. This possibility did not materialize: Both subgroups performed equally poorly. One might also imagine that their poor performance reflects some sort of general yea-saying bias in answering yes–no questions. This also seems unlikely. Of the 20 four-year-olds, 13 responded negatively on at least one yes–no question during the testing session. Flavell, Green, and Flavell (1993, 1995) have also obtained evidence against such a bias in their research on related tasks. Perhaps a more specific yea-saying bias could have been operative in the case of the additional tasks, the ones that involved nonpresent objects. Possibly the 4-year-olds inferred that E1 would not have asked whether E2 was thinking about such seemingly irrelevant objects as her bicycle and piano unless she really was for some unknown reason. Although this is a possibility, it does not seem to be a very likely one. For one thing, it is not clear why only the youngest, most intellectually immature children would have made such an inference. In any case, this possibility could not explain the 4-year-olds' similar responses to the main tasks' yes–no questions, because those questions were not at all strange or pragmatically anomalous. Finally, the 4-year-olds also displayed little understanding of attentional focus in responding to the little–lot questions concerning the amount of E2's attention to the targets and nontargets, despite the fact that these were not yes–no questions. Although factors unrelated to their knowledge about attentional focus certainly could have contributed to the very poor performance of the 4-year-olds shown in Tables 1 and 2, it is hard for us to believe that they could explain all of it.

In contrast, the 8-year-olds showed considerable knowledge of attentional focus. Most important, they clearly understood that the person would be devoting little or no thought or attention to the visible nontargets (e.g., the picture frame) and none at all to the unrelated objects (e.g., the piano). Their spontaneously given hedges when asked about the visible nontargets ("maybe a little bit," etc.) further show that they understood that there can be amounts or degrees of attention—that attention is not an all-or-none affair. Although they often allowed for some attention to the visible nontargets, as just noted, they also often denied that the visible nontargets received any. Of the 20 eight-year-olds, 15 denied it on at least one of the four main tasks. Thus, in addition to showing some understanding of the focused, selective nature of attention, they also showed by these denials some grasp of the distinction between perception and attention; that is, they realized that one could see something but not pay attention to or think about it. One 8-year-old articulated this distinction quite clearly when answering an attention-to-nontarget question: "Not really, but she does *see* it." Although the 6-year-olds in this study seemed less clear and confident about these matters than the 8-year-olds, they still showed almost as much understanding as the 8-year-olds and definitely more than the 4-year-olds. These developmental results are consistent with those of previous investigations (Fabricius & Schwanenflugel, 1994; Flavell et al., 1995; Flavell, Miller, & Miller, 1993, pp. 200–201); Miller, 1985; Pillow, 1988, 1989) in suggesting that children are acquiring a basic understanding of attention during the late preschool and early elementary school years. For a brief discussion of the utility of such understanding, see Pillow (1988, p. 45).

In the introduction, we speculated that 4-year-olds may implicitly conceive of the mind as more like a lamp than a flashlight, that is, as a device that can radiate attention and thought in all directions at once rather than in only one direction at a time. Assuming that this were true, why might they have such a conception? One possibility is that they overestimate their own and other people's mental abilities generally and fail to recognize their limitations. Consistent with this is the evidence from metamemory studies that preschoolers regularly overestimate their memory span (Flavell, Miller, & Miller, 1993, p. 256). Perhaps their apparent overestimation of attentional capacity is just another instance of this general insensitivity to cognitive limitations.

Another possibility is that they think of the mind more in analogy to the ears than the eyes as regards capacity for simultaneous, multidirectional processing. By 4 years of age, they well know that a person sees at a given moment only what is in his or her field of vision at that moment, and that one must reorient one's eyes if one wants to see other things (Flavell, Miller, & Miller, 1993, pp. 196–201). Like a flashlight, one's gaze illuminates only one small region of space at a time. In contrast, they know that one can hear noises coming from different directions at the same time without moving one's ears, much as an immobile lamp simultaneously illuminates everything in its immediate surround. It seems reasonable to imagine that children's earliest conception of the mind might be more earlike than eyelike in this regard, given their experiences with its operation. They could notice that a person need not move his or her head to change from one object of thought to another. They could also notice that different thoughts commonly follow one another in quick succession even if they do not occur literally simultaneously and often do so without any deliberate mental reorientation on the thinker's part (very often in the case of young children, who undoubtedly do less deliberate thinking than their elders). Viewed in this way, it is perhaps not surprising that a child who knows full well that a person cannot see in many directions at once might accept the possibility that a person could be thinking about or paying attention to many things at the same time.

What might cause children to improve their understanding of attentional focus and attentional limitations as they grow older? We do not know but can suggest two possibilities. First, as they move into the middle childhood years, children become better able to monitor their own ongoing mental events, perhaps in part as a consequence of school experiences that foster introspection (Flavell et al., 1995, chap. 5). This improved ability to introspect would provide them with more opportunities to notice what they have and have not been attending to and to notice that they can attend to only a very limited number of things at

any given moment. Second, they also begin to develop a conception of the mind as being active and constructive (Chandler & Boyes, 1982; Fabricius & Schwanenflugel, 1994; Pillow, 1989, in press; Wellman, 1990). This should entail a growing realization that attending to things is an active, sometimes effortful process that consumes mental resources rather than a passive process of receiving all the information that is available. Realizing more clearly that attending is something individuals do rather than something that just happens might help promote the idea of attentional limitations, because children already know that one cannot do many things at once.

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