6

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# Preschool Thought

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I find it noteworthy that this special issue has provided for a separate essay on preschool thought. Until very recently, almost all researchers of cognitive development have made a habit of contrasting the preschooler with the older child. Preschoolers have been characterized as lacking the classification abilities, communication skills, number concepts, order concepts, memorial skills, and a framework for reasoning about causal relationships between events that older children are granted. Indeed, had one written an essay on preschool thought five years ago, the conclusion might have been that preschoolers are remarkably ignorant. In this essay I review some of the evidence that has begun to pile up against the view that preschoolers are cognitively inept. I then consider why we failed to see what it is that preschoolers can do and possible misinterpretations of the recent findings.

It is commonplace to read about the egocentrism of preschool children. The idea is that the young child either is unable to take the perspective of another child or adult or, worse yet, believes his or her own perspective is the same as that of others. Such general statements derive support from a variety of studies. When asked to describe an abstract shape for another child, a preschooler will sometimes use private labels, for example, "mommy's hat" (Glucksberg, Krauss, & Weisberg, 1966). The child's talk in the presence of others often goes on without any attempt to coordinate this talk with that of other speakers; the child seems not to care who else is speaking, what they say, or whether he or she is being listened to. "He feels no desire to influence his listener nor to tell him anything; not unlike a certain type of drawing room conversation where everyone talks about himself and no one listens" (Piaget, 1955, p. 32). When asked to choose a picture that represents the view of a mountain seen by someone opposite the child, the child selects the representation that matches what the child sees (Piaget & Inhelder, 1956)!

In 1973, Marilyn Shatz and I reported on our studies of the speech used by 4-year-olds when they talked to 2-year-olds, peers, or adults. We found that our subjects generally used short and simple utterances when they described the workings of a toy to their 2-year-old listeners. In contrast, these same 4-year-old children used longer and more complex utterances when describing the same toy to their peers or adults (Shatz & Gelman, 1973). Was it possible that these children, who were presumed to be egocentric speakers by the research community at large, were adjusting their speech in accordance with their perception or conception of their listeners' different abilities and needs? As it turns out, yes. We (Gelman & Shatz, 1977) found that 4-year-olds' speech to a 2-year-old serves different functions and contains somewhat different messages than does their speech to adults. Speech to 2-year-olds serves to show and tell, to focus, direct, and monitor attention; speech to adults includes talk about the child's own thoughts and seeks information, support, or clarification from adults. Adult-directed speech also contains hedges about statements of fact, indicating that the child recognizes that he or she may be wrong and that the adult could challenge his or her statements. The children in our experiments were clearly taking the different needs and capacities of their listeners into account when talking to them. They hardly seem egocentric!

What about the claim that preschoolers think their visual perspective is the same as that of another person? Here again the presumed is contradicted. In an elegant series of experiments with 1–3-year-old children, Lempers, Flavell, and Flavell (1977) demonstrated over and over again that it is simply wrong to deny preschoolers an ability

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to distinguish their perspective from that of others. In the "show-toy task," 1½–3-year-old children showed toys to adults so that the front side was visible to the adult. This means they turned away from themselves the front of the toy and thereby deprived themselves of their original perspective. When asked to show pictures, almost all the 2- and 3-year-olds turned the front side to the adult and thereby ended up seeing the blank back of the picture. Still younger children showed the picture horizontally rather than egocentrically, that is, they did not simply hold the picture upright and thus show the back to their adult cohort in the task.

More recently, Flavell, Shipstead, and Croft (Note 1) dispelled the rumor that preschoolers believe that the closing of their own eyes deprives others of visual information about them. In fact, there is so much evidence now coming in about the perspective-taking abilities of preschoolers (for reviews, see Gelman, 1978; Shatz, 1978) that I find it hard to understand how I or anyone else ever held the belief that preschoolers are egocentric.

In retrospect one might argue that the perspective-taking abilities of preschoolers make sense. Young children do interact with others and they do talk. If they did not have any perspective-taking abilities, how could they ever communicate (cf. Fodor, 1972)? The argument might continue that we may have been wrong on the perspective-taking front, but surely we were correct in our characterization of other cognitive abilities. After all, number concepts seem much removed from the daily interactions of a preschooler. Besides, they constitute abstract ideas—the kind of ideas that everyone knows are very late in cognitive development. All of this may well be true; nevertheless, preschoolers know a great deal about the nature of number. I and my collaborators have shown that children as young as 2½ years honor the principles of counting and are able to use a counting algorithm to reason numerically, for example, to determine that an unexpected change in the numerical value of a set occurred because of surreptitiously performed addition or subtraction. (See Gelman & Gallistel, 1978, for a review of the arithmetic reasoning abilities of preschoolers.)

Successful counting involves the coordinated application of five principles (Gelman & Gallistel, 1978). These are as follows: (1) The one–one principle—each item in an array must be tagged with one and only one unique tag. (2) The stable-order principle—the tags assigned must be drawn from a stably ordered list. (3) The cardinal principle—the last tag used for a particular count serves to designate the cardinal number represented by the array. (4) The abstraction principle—any set of items may be collected together for a count. It does not matter whether they are identical, three-dimensional, imagined, or real, for in principle, any discrete set of materials can be represented as the contents of a set. (5) The order-irrelevance principle—the order in which a given object is tagged as one, two, three, and so on, is irrelevant as long as it is tagged but once and as long as the stable-order and cardinal principles are honored. Number words are arbitrary tags. The evidence clearly supports the conclusion that preschoolers honor these principles. They may not apply them perfectly, the set sizes to which they are applied may be limited, and their count lists may differ from the conventional list, but nevertheless the principles are used. Thus, a 2½-year-old may say "two, six" when counting a two-item array and "two, six, ten" when counting a three-item array (the one–one principle). The same child will use his or her own list over and over again (the stable-order principle) and, when asked how many items are present, will repeat the last tag in the list. In the present example, the child said "ten" when asked about the number represented by a three-item array (the cardinal principle).

The fact that young children invent their own lists suggests that the counting principles are guiding the search for appropriate tags. Such "errors" in counting are like the errors made by young language learners (e.g., "I runned"). In the latter case, such errors are taken to mean that the child's use of language is rule governed and that these rules come from the child; we are not likely to hear speakers of English using such words as *runned, footses, mouses, unthirsty,* and *two–six–ten*. We use similar logic to account for the presence of idiosyncratic count lists.

Further facts about the nature of counting in young children support the idea that some basic principles guide their acquisition of skill at counting. Children spontaneously self-correct their count errors, and perhaps more important, they are inclined to count without any request to do so. If we accept the idea that the counting principles are available to the child, the fact that young children count spontaneously without external motivation fits well. What's more, the self-generated practice trials make it possible for a child to develop skill at counting.

Still other cognitive domains exist for which it has been possible to reveal considerable capacity on the part of the young child. There are conditions under which preschoolers classify according to taxonomic categories (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), classify animate and inanimate objects separately (Keil, 1977; Carey, Note 2), and use hierarchical classifications (Keil, 1977; Mansfield, 1977; Markman & Siebert, 1976). They can be taught to use a rule of transitive inference (Trabasso, 1975). They can be shown to be sensitive to temporal order (Brown, 1976). They believe, as do adults, that causes precede their effects (Bullock & Gelman, 1979; Kun, 1978). They use rules to solve problems (Siegler, 1978), and so on. In short, they have considerable cognitive abilities. Why, then, has it taken us so long to see them? I think there are two related reasons.

First, we simply did not look. Indeed, we seemed to choose to ignore facts that were staring us in the face. Consider the case of counting prowess in the young child. It is now clear that preschoolers can and do count. But many of us, myself included, who researched number concepts in children started out with the view that preschoolers were restricted to the use of a perceptual mechanism for number abstraction. The idea was that their representation of number was governed by the same pattern-recognition abilities that are used to distinguish one object from another. Just as they distinguish "cowness" and "treeness," they presumably distinguished "twoness" and "threeness." I don't remember how many times I saw preschoolers counting in my various experiments before I finally recognized they were indeed able to count, no matter what our theories led us to believe. I do remember one 3-year-old telling me that he much preferred one task over another, that being the one in which it was possible to count! And it took us a while to recognize the ubiquitous tendency for 4-year-olds to talk down to 2-year-olds.

The failure to recognize facts that contradict existing theories is not unique to those who study cognitive development. Time and time again we read in the history of science of similar cases. It seems as if we have a general tendency to resist new facts if their recognition means giving up a theory without being able to come up with another that will account for the new as well as the old facts. I believe that we now know enough about the nature of the development of number concepts to be able to deal with the apparent contradictions between the new and old research findings. The young child seems unable to reason about number without reference to representations of specific numerosities, representations obtained by counting. With development, the child's reasoning moves from a dependence on specific representations to an algebraic stage in which specific representations of numerosity are no longer required. In the conservation task, the child has to make inferences about equivalence and nonequivalence on the basis of one-to-one correspondence. It matters not what the particular numbers of items in the two displays are. If they can be placed in one-to-one correspondence, then they are equal by definition. If we are correct, then the abilities we have uncovered can be seen as the beginning understanding of number. In this light their existence need not be seen as contradictory findings. Indeed, once one begins to talk about precursors of later cognitive abilities it is no longer unreasonable to start the search for those concepts and capacities the preschooler must have if he or she is to acquire complex cognitive abilities. We should expect to find domains in which they are quite competent—if only we look.

Recent work on the learning and memorial abilities of young children endorses my belief that there are many cases in which it will suffice to decide to look for competence in order for us to take note of it. As Carey (1978) pointed out, young children perform an incredible task by learning the lexicon of their native language. She estimated that 6-year-old children have mastered to some degree about 14,000 words. To do this, the children need to learn about nine new words a day from the time they start speaking until the time they reach their sixth birthday. This is truly a remarkable accomplishment. So what if the preschooler fails on a task that requires him or her to sort consistently by taxonomic category? The same child has to have some classification abilities in order to learn the lexicon so rapidly. To be sure, the child probably does not learn the full meaning of every new word the first time that word is heard. But as Carey showed, "One or a very few experiences with a new word can suffice for the child to enter it into his or her mental lexicon and to represent some of its syntactic and semantic features." Given this and the continued exposure to that word, it is then possible for a child to learn more about it and to reorganize his or her lexicon and the conceptual framework involved therein.

Nelson (1978) made it clear that young children readily learn the scripts that describe the class of events they encounter. Others (e.g., Mandler, in press) have shown young children to have excellent memories for stories—a fact that really should not surprise us, given the young child's interest in hearing stories.

Although some abilities are so pervasive that simply deciding to attend to them will make them evident, this is not true for a wide variety of cognitive skills, for example, reading and metacognitive skills. This brings me to the second reason for our failure, until recently, to acknowledge the cognitive capacities of preschoolers.

Many of the young child's cognitive abilities are well concealed and require the modification of old tasks or the development of new tasks for their revelation. I return to the question of early number concepts. Young children systematically fail Piaget's number conservation task. With this task, they behave as if they believe that the number of objects in a row changes when items are pushed together or spread apart. They thus begin by agreeing that two rows placed in one-to-one correspondence represent equal amounts; when they see one row lengthened, however, they deny the continued equivalence.

In an effort to control for a variety of variables that might have interfered with the child's possible belief in the invariance of the numerical value of a set despite the application of a lengthening transformation, my colleagues and I developed what we call "the magic task" (Gelman, 1972). The task involves two phases. The first establishes an expectancy for the continued presence of two sets of two given values, say, 3 and 2, despite the repeated covering and uncovering of those sets. To avoid reference to number or the use of ambiguous terms such as *more* or *less*, one of these displays is designated "the winner," and the other "the loser." These are covered and children have to find the winner and tell us why they have or have not done so once they uncover a display. As luck would have it, preschoolers decide on their own that numerical value is the determinant for winning and losing status. They thus establish an expectancy for two particular numerical values. Then, unbeknownst to the child, the second phase of the experiment begins when the experimenter surreptitiously alters one of the expected displays. Across different conditions and experiments, the changes involve addition, subtraction, displacement, change in color of the original objects, and even a change in identity of the original objects. Children who encounter a change in number produced by subtraction or addition say that the expected number has been violated, typically identify the number of elements present and the number that should be present, and make explicit reference to the transformation that must have been performed—even if they did not see it. In contrast, children who encounter the effects of irrelevant transformations say the number of elements is as expected despite the change in length of a display, or in the color, or in the identity of an element in that display.

According to the results of the magic task, preschoolers know full well that lengthening or shortening an array does not alter the numerical value of a display. Still, these same children fail the conservation task. But note how different these tasks are. In the conservation task the child has to judge equivalence on the basis of one-to-one correspondence, correctly interpret questions that are ambiguous, watch the transformation being performed, and then ignore the effect of that transformation. In the magic task the child need not make judgments of equivalence based on one-to-one correspondence, he or she need not (indeed cannot) see the transformation being performed, and there are no ambiguous terms to misinterpret. In other words, the magic task is a very stripped down version of the conservation task. Likewise, many other tasks that show preschoolers in a positive light have downgraded the complexity of the tasks that they fail, altered the instructions, changed the stimuli used, embedded the question of interest in games preschoolers play, provided extensive pretraining before testing on the target task—In short, in many cases it has been necessary to develop tasks and experimental settings to suit the preschool child (Gelman, 1978). This is easier said than done. Consider the magic game which *was* designed to meet our best guesses as to how to elicit the number-invariance rules honored by the young child.

Bullock and Gelman (1977) modified the magic task in order to determine whether preschoolers could compare two number pairs. In particular, the question was whether they would recognize that the number pair 1 and 2 was like 3 and 4 insofar as 1 and 3 were both "less" and 2 and 4 were both "more." Children between the ages of $2\frac{1}{2}$ and 4 were first shown one-item and two-item displays, and they established expectancies for a set of one and a set of two items. Half the children were told that the one-item array was the winner; half were told that the two-item array was the winner. From the experimenter's point of view this was also a more–less comparison task. To determine whether the $2\frac{1}{2}$–4-year-old children in the experiment knew this, we surreptitiously replaced the original displays with three-item and four-item displays and asked which of these was the winner. Many of the older children were confused by this question and said that neither was the winner—an observation which in point of fact was correct. When asked to make the best possible choice, the children then went on to choose the display that honored the relation they were reinforced for during the expectancy training. Apparently the children did not immediately realize that it was all right to make a judgment of similarity, given the fact that neither of the new displays was identifical to either of the original displays. Our variation in question format served to tell them that the transfer task called for a similarity judgment. My point here is that we started out with a task that was designed for young children and still we found that the task presented problems.

This example of the subtle ways in which a task can confound the assessment of those early cognitive abilities that are generally buried is not an isolated one. I have discussed others elsewhere (Gelman, 1978), and for me they are very sobering. They make it clear that in many cases, it takes more than a decision to look for early cognitive abilities. It is often exceedingly difficult to know how to design tasks so that they will be suitable for use with young children. I believe this derives in part from the fact that many of the preschoolers' cognitive abilities are fragile and as such are only evident under restricted conditions—at least compared with the conditions under which older children can apply their knowledge. This brings me to my next point.

Some might take the recent demonstrations of early cognitive abilities to mean that preschoolers are miniature adults as far as their cognitions are concerned. This is not what I want people to conclude, and should they so conclude it would not be in the best interests of either those who study cognitive development or the child. The fact remains that despite the recent demonstration of some complex cognitive abilities, young children fail a wide range of tasks that seem so simple for older children. I believe that many of the best insights into the nature of development will come from understanding exactly what conditions interfere with the use and accessibility of those capacities the young child does possess. These insights may also be of the greatest educational relevance. However, these insights can only come after we have uncovered the basic capacities that make cognitive growth a possibility.

What I do want people to realize is that we have been much too inclined to reach conclusions about what preschoolers cannot do, compared with what their older cohorts can do on a variety of tasks. We must cease to approach young children with only those tasks that are designed for older children. The time has come for us to turn our attention to what young children can do as well as to what they cannot do. Without a good description of what young children do know, it's going to be exceedingly difficult, if not impossible, to chart their course as they travel the path of cognitive development. What's worse, we run the serious risk of making unwarranted statements about the nature of preschool curricula. I have had people tell me that there is no point in teaching young children about numbers, since preschoolers cannot conserve numbers. This, I submit, is a non sequitur. The conservation task is but one index of numerical knowledge, and it is beginning to look like it is an index of a rather sophisticated knowledge.

My message is quite straightforward. We should study preschoolers in their own right and give up treating them as foils against which to describe the accomplishments of middle childhood. We have made some progress in recent years, but there is still plenty of room for those who are willing to take on the mind of the young child.

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