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COGNITIVE DEVELOPMENT ◆289

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INTRODUCTION

A number of trends are discernible in the recent literature on cognitive development. The thought processes of the adolescent are no longer ignored: Falmagne (38), Osherson (109, 110), and Neimark (105) have done much to rejuvenate interest in the nature of formal operational thought focusing attention on the question of whether Piaget's account of logical thought is correct. The elderly have emerged as an important research population (e.g. 124, 133) with the recognition that the phenomena that emerge during the loss of intellectual function are every bit as central to our understanding of cognitive development as are the phenomena that emerge during the acquisition of intellectual function. There has been an explosion of research on the acquisition of reading skills (54, 123), and the development of memory (e.g. 16, 41, 62, 125). The last 2 years have also witnessed the emergence of research on the relation between the development of hemispheric lateralization of function and cognitive development (154). Cognitive styles are now being considered in terms of the information-processing demands therein (157). And attention has focused on the role of early cognitive development and communication skill in relation to language acquisition (5, 7, 20, 21, 60, 136). To report carefully on these diverse trends one needs to know a fair amount of logic, linguistics, philosophy, and physiology. So one might characterize the last 2 years as the years that forced the cognitive developmentalist to master a number of other disciplines in order to keep up with the literature. A particularly salient case in point is the journal of *Human Development* wherein one finds many a paper on the dialectical theory of development. The reader who has studied Hegel and Marx is at a decided advantage.

The need to know much about other disciplines led me to think of reneging on my agreement to write this review. Were it not for yet one further trend that has taken hold in cognitive development, I might have done so. I refer to a shift in emphasis away from the view that the preschooler is cognitively incompetent to one that grants the preschooler at least some competence. This shift comes about in part because of the emergence of researchers committed to the view that cognitive development is *not* an all-or-none process (147) and in part from the argument that the preschooler simply must have more competence than earlier research has re-

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vealed (43, 44). In any event, the case can now be made that the preschooler's cognitive capacities have been underestimated. In what follows, I briefly review the traditional accounts of the preschooler's capacities. I then take up the evidence that preschoolers have more cognitive capacity than traditional accounts have granted them. I conclude by discussing my reasons for applauding the focus on what preschoolers can do as much as on what they cannot do.[1]

FOCUS ON THE PRESCHOOLER

The Traditional View

When viewed through the eyes of many a cognitive developmentalist, the child of 5 years or younger is remarkably inept. On several standard tests of cognition his performance departs widely from that of the adult. A few years later, at the age of 7 or 8, the child's performance on these same tasks parallels adult performance. A particularly salient example is the Piagetian number conservation task. In this task the child is typically shown two rows of objects, e.g. 10 red checkers and 10 blue checkers. The two rows are arranged one above the other so that there is an obvious one-one correspondence between items in each row and so that the rows are equal in length and density. The child is asked whether there are as many chips or checkers in one row as there are in the other row. He usually replies that there are—be he a 5-year-old or an 8-year-old. However, when the experimenter spreads out the red chips and thereby destroys the perceptual salience of the one-one correspondence the younger children now say the longer row contains more chips. Young children seem to believe that one can increase the number of things in an array simply by spreading the array out over a larger area. It is this failure to conserve number that led Piaget (117) to conclude that the young child lacks a concept of number.

It is not just the conservation task that makes the preschooler appear cognitively inept. He seems to not be able to handle hierarchical classification. He cannot keep straight which is the superordinate class and which the subordinate, particularly when it comes to quantitative questions. If one shows the preschooler a picture of some flowers, say six roses and two daisies, and asks, "Are there more flowers or more roses?" the child responds, "More roses" (73).

When asked to describe an object in such a way as to enable another person to identify which of several objects the speaker is referring to, the preschooler gives egocentric descriptions, descriptions that represent idiosyncratic reactions to the object and are therefore of little help to a listener (81). Consider the 5-year-old who describes a random shape pattern as "mommy's hat." It is hardly an informative message to the listener who is a stranger to the child. Such explanations lend support to Piaget's (115) characterization of the young child as one who is unable to select messages that take his listener's point of view and needs into account.

There is a long list of further ineptitudes. The preschooler does not treat colors as belonging to the same dimension (78), cannot, on his own, generate mediators

[1]I do not ignore completely the other trends identified. Also, I have cited reviews that cover these trends wherever they are available.

when memorizing (40), cannot deal with part-whole relations (34), does not readily ignore irrelevant information (53), and so on. See White (152) for further examples of where preschoolers fail to pass simple cognitive tests.

The list of cognitive shortcomings in the preschooler is long, well documented, and ever growing. And these contribute to the theoretical accounts of the preschooler. Depending on our theoretical bias, we might say he is perception-bound and unable to think logically (117) or symbolically (22); we might say he fails to use the second signal system (85); that he has a "primitive" mind (150); that he thinks associatively but not cognitively (75, 152); that he is unable to form sg-rg mediators (78); that he lacks concrete operations (73), etc.

Before turning to the evidence on what the preschooler can do, it is well to draw attention to a general feature of the evidence used by those who give the impression of a cognitively inept preschooler. There is an overriding tendency to treat the preschooler's cognitive capacities, or lack thereof, in the light of those possessed by the older child. Children of different ages are given the *same* task—a task that is assumed to be particularly well suited for testing a given capacity. The child who passes the test is said to "have" that capacity and the child who fails the test is said to lack the capacity. There is an implicit assumption that the task in question is *the* test of the capacity in question. A review of the recent findings as to what young children can do does much to challenge this assumption. For it is when new tasks are used, standard tests are modified, or training is introduced that we begin to get a glimpse of what the young child can do. That new tests or modifications of the standard tests are needed underscores the fact that preschoolers as compared to older children differ in their ability to negotiate a particular cognitive domain. This cannot be denied. But to the extent that a modification in procedure makes it possible to see what the young child *can* do, we can then consider task differences with a view to determining what might underly the young child's difficulty with the standard tasks. And from there we can begin to determine what it is that develops.

Some, Albeit Not Complete, Early Cognitive Capacity

I hold that recent work supports the view that the preschooler possesses some cognitive capacities, capacities that might be less complex than, or even different from, those of the older child, but which are nevertheless very real. In what follows I marshal evidence for this view by summarizing research on a variety of topics. The focus is on the preschooler. Yet on occasion I include studies of somewhat older children. This is done particularly when there is a report of a child of a given age doing something that previous work suggests he should be unable to do, or when a study with older children supports an interpretation of the younger child's abilities and/or inabilities.[2]

[2]Investigators of language acquisition have almost always been concerned with what young children can do. Accordingly, recent research on language acquisition is not highlighted in this review. I aim to pull together the findings of what young children can do in the cases where they have been assumed to be pretty much incompetent.

Quantitative Invariance Concepts

Many investigators of the young child's understanding of quantity have conducted conservation training studies in order to test hypotheses about what the young child must learn before he can be granted a concept of number, length, etc. See Beilin (8) for an excellent review. I suggest that those studies that have yielded positive training effects can be viewed as studies in support of the claim that the young child who participated in the training knew something about quantity to begin with—this despite the fact that he failed a host of conservation pretests. More generally, I advance the thesis that in many cases training studies can be viewed as procedures for uncovering a capacity, as opposed to procedures for establishing a capacity from scratch.

The view that training makes manifest a preexisting understanding of quantity seems inescapable when one considers a particular class of conservation training studies, those that involve modeling techniques. Botvin & Murray (13) provided black children in the first grade who failed to conserve mass, weight, amount, and number one of two kinds of modeling conditions. In the first condition, two nonconservers and three conservers participated in a roundtable discussion. The discussion opened with the experimenter asking each child to answer mass- and weight-conservation questions. The experimenter then left as the group proceeded to discuss their different answers and reach an agreement. A second group of nonconservers watched the opening proceedings of the roundtable, thereby having an opportunity to hear conflicting answers, but did not participate in a discussion. There was no differential effect of the two experimental conditions. Both groups showed a dramatic amount of specific (weight and mass) and nonspecific (number and amount) transfer. And Miller & Brownell (102) allow us to rule out the possibility that conservers are, in general, better at winning arguments. Further, Botvin & Murray's comparison of explanations given by the original conservers and the newly trained conservers makes it clear that the latter did not simply mimic what they had heard. The original conservers were inclined to give more compensation and reversibility explanations than were the trained conservers. The latter focused on the fact that nothing had been added or subtracted or that a particular transformation was irrelevant. Botvin & Murray take this result to mean that the initial understanding of conservation is different from a later understanding of conservation. The idea is that the conserver first recognizes the role of relevant (addition-subtraction) and irrelevant transformations (e.g. displacement) in conservation, an hypothesis which I agree with and to which I will return. But first I highlight the ease with which Botvin & Murray trained conservation. A brief discussion, or actually an opportunity to hear conservers and nonconservers give conflicting answers, suffices to make the nonconserver a conserver. How could this be unless the nonconserver already knew something about the rules regarding quantitative invariance? Parenthetically I note a similar argument has been made regarding Hornblum & Overton's (69) study of the conservation skills of the elderly. The elderly seem to fail on tests of conservation. But a small amount of feedback alters the behavior and does so very

rapidly. Hornblum & Overton appeal to the competence-performance distinction to interpret their elderly subjects' erratic behavior.

We turn now to the question of whether the evidence supports the idea that despite a failure on a conservation task, the young child does have some understanding of quantitative invariance. Experiments employing modifications of the Piagetian number conservation task and concluding that the young child does in fact have a number invariance scheme (23, 96) have been subject to strong criticism. Hunt (71) shows that the Mehler & Bever (96) results are very susceptible to experimenter bias. The experimenter who is told that the 2-year-old will do well is the one who comes closest to replicating the finding regarding the 2-year-old as a precocious conserver. Katz & Beilin (77) quarrel with Bryant's (23) evidence regarding the young child's ability to judge equivalence on the basis of one-one correspondence and then conserve—although it must be noted that they did not run the very condition upon which Bryant bases much of his argument, this being one where there were no perceptual cues in conflict with the cue of one-one correspondence.

It seems reasonable to conclude that efforts to show that the young child has an invariance scheme for number as revealed by procedures that closely resemble the Piagetian paradigm are on shaky ground. But it is not clear that the Piagetian task or variants of it are the *only* tests of the young child's invariance scheme for number. Work from my laboratory employing a quite different paradigm shows that young children do possess a number invariance scheme. Children between the ages of 2½ and 5 years treat unexpected changes in the numerosity of a set—changes that are produced by the surreptitious addition or subtraction of one or more items—as changes that are relevant to number. They not only recognize the resulting change; they tell us what must have happened, i.e. that somehow an item was either removed or added. On the other hand, when the experimenter surreptitiously lengthens or shortens a row or changes the color or identity of items in a row, the children notice the changes but say that they are irrelevant to number. They correctly insist that the number has remained unchanged even though perceptual properties of the expected set have not. See Gelman (49) for a review of these "magic" studies. Such findings lead to the conclusion that preschoolers possess an invariance scheme for number, a scheme which organizes the real world manipulations that can be performed on a set of objects into ones that are relevant to number and ones that are not. Recall the Botvin & Murray results showing that trained conservers appealed to addition/subtraction versus irrelevant transformations in their explanations. I suggest this is as it should be. The nonconserver organizes transformations into those that are relevant and those that are irrelevant to number, and this conceptual organization is appealed to when the nonconserver is first converted to a conserver.

I should make clear that I am not claiming the exact same abilities for the young child as for the older child, the child who immediately passes the conservation test. The young child's knowledge is certainly not as complex as the older child's. For one thing, the young child's ability to negotiate numerical tasks seems limited to those that employ small sets ($n = 2$–5 items). Research by a variety of investigators supports the view that the young child's skill with small sets is much advanced over his skill with larger sets (4, 27, 132). Second, the young child has great difficulty using a one-one correspondence rule to arrive at judgments about the equivalence or nonequivalence of set sizes. He seems most inclined to make decisions about equivalence on the basis of an ability to count the items (49). And finally, it appears that the young child reasons about those numerosities for which he is able to obtain a specific numerical representation but resists reasoning about numerosities that he cannot accurately represent (48, 50).

What emerges then is a view that the young child needs to arrive at a specific representation of the numerosity in a set before he applies his number invariance scheme. Skill at abstracting the numerosity will then interact with his inclination to reveal his ability to reason about number. The older child seems willing to make judgements of equivalence on the basis of one-one correspondence without considering the exact number of items and then proceed to consider the effect of transformations without regard to any specific numerosity. A related position is advanced by Ginsburg (55), Klahr & Wallace (79, 80), and Schaeffer et al (132).

I think that Piaget's (119) recent discussion of the relationship between the role of correspondences and transformations in the development of the child's understanding of conservation will prove to be consistent with the foregoing views. His earlier treatment of conservation focused on the role of transformations. Now Piaget has turned his attention to the conditions that a child must recognize before he can deal with transformations. He must first discover the correspondences between two states in order to make comparisons and this "has to precede any transformations, any working of changes on these fixed states." I see here a concern for the way children compare quantities as well as a concern for their understanding of transformations. Moreover, there is an account of what children do know about quantity before they can pass the standard conservation test. First, the child can determine correspondences without being able to apply the rules of transformations. Second, the use of transformations relies on the use of correspondences. Finally, the child understands the system of transformations as it generally applies to quantities.

Miller and her colleagues (100, 101) show a strong correlation between the child's tendency to focus on and conserve number. They also find that conditions that make one-one correspondence salient increase the young child's tendency to conserve, provided that the set sizes are small. Such findings lend support to the hypothesis that the child's skill at abstracting a representation of numerosity is related to his success on a conservation task. Work by Silverman, Vanderhorst & Eull (142) leads to a similar conclusion regarding length conservation.

Research of the last 2 years provides some clues as to what is and what is not related to success on the conservation test. Brainerd (15) fails to show a relationship between the child's understanding of compensation and success on a liquid conservation task. Holland & Palermo (68) found it relatively easy to teach 4- and 5-year-olds to use the terms "more" and "less" correctly. Yet there was no relationship between success on the more-less training and ability to conserve (cf 143). A clever study by Rybash, Roodin & Sullivan (130) provides some evidence for the conclusion that children fail a liquid conservation test because they forget something about the initial status of the arrays.

In sum, the evidence supports the view that young children do know something about quantity and that there are conditions under which they can and do reason about quantity. Further, there appears to be an interaction between the young child's skill at estimating quantity and his ability to reason about it as assessed by "magic" tasks and conservation tasks.

Classification Abilities

A reading of Piaget or Vygotsky gives the clear impression that young children have considerable difficulty using a consistent criterion in sorting stimuli that vary along several dimensions. What's more, they seem unable to deal with hierarchical classification schemes and, in general, display decidedly limited classification abilities. Recent work by Rosch (128) and Markman (91) leads to the conclusion that there are some sets of stimuli that young children can classify with ease.

Rosch provides evidence for the position that, of the many levels of abstraction we are able to impose on objects, there is a preferred *basic level* of abstraction that humans impose on the world. The bias toward the basic level occurs in part because there is a basic structure of stimuli in the real world. Given that real-world attributes like feathers and wings do not occur in random combination, Rosch suggests that there will be a basic level of cognitive categorization that reflects such real world correlations. But the view is *not* that the real world is simply "out there" in category bins that are waiting to be picked up by the mind. The way we interact with the world helps constrain further the form of a basic level of categorization. Given information-processing constraints, the basic level of classification should be one that provides information with the least amount of cognitive effort. If so, a basic level of cognition can be defined as the level at which objects share the most humanly relevant attributes in common. Since humans interact with objects via consistent motor programs (e.g. chairs are to sit on, flowers are to pick) common motor programs might likewise be expected to form part of the operational definition of the basic level of cognitive categories.

When adult subjects are asked to list attributes and provide descriptions of movement routines that can be named at three levels (e.g. city-bus, bus, vehicle), they indeed behave as if there is a basic level for forming abstractions about subjects. Objects that form basic level categories are said to have a large set of attributes in common whereas objects that are lumped together in the more abstract superordinate categories have few, if any, attributes in common. For example, members of the basic level category of *chair* have seats, legs, and backs but it is difficult to identify the attributes that are shared by members of the superordinate category *furniture*. Basic level objects share common movement schemas (e.g. chairs are sat on) whereas superordinates do not (what action does one perform with respect to furniture—other than buy it or rearrange it?).

Rosch seems to be offering us a definition of a "natural" category, this being one that involves basic objects. If such categories are natural, then we might expect young children to have little difficulty sorting objects that form basic categories. To determine whether basic objects are more readily categorized by children, Rosch et al (128) compared the ability of children to sort basic level objects with their ability to sort objects on the basis of superordinates. In one experiment, subjects were kindergarteners, first-graders, third-graders, and fifth-graders. Stimulus materials were color photographs of *clothing* (shoes, socks, shirts, pants), *furniture* (tables, chairs, beds, dressers), *people's faces* (men, women, young girls, infants), and *vehicles* (cars, trains, motorcyles, airplanes). (Underlined items were superordinates, items in parentheses were basic.) Subjects in the superordinate condition were given one picture each of the four different objects representing each of the four categories. Subjects in the basic sorting condition received four pictorial examples of one basic object in each of the four superordinate categories.

The results are straightforward. Only half of the kindergarten and first-grade subjects used the superordinate criteria. As in previous studies, it was the older children who consistently used such criteria. In contrast, there were *no* developmental differences in the ability to use basic categories, this because almost all subjects sorted consistently on the basis of basic categories. A second experiment suggests that 3-year-olds would do about as well (i.e. nearly perfectly) on the basic sorting task. Using a simplified (i.e. oddity) sorting task, Rosch was unable to detect any developmental trend from 3 years of age up to adulthood when subjects were required to identify likes at the basic level.

These results call into question the widely held assumption that preschoolers have unusual difficulty sorting complex materials on the basis of consistent criteria. Some criteria are readily available, others are not. The question focuses attention on the problem of the superordinate and leads us to consider why it is elusive to the young child. Part of the story is told by Markman & Siebert (91).

Markman draws a distinction between *classes* and *collections* and the types of concepts they characterize. Several criteria are used to highlight the difference between classes and collections. These are: (*a*) the way in which membership is determined; (*b*) the nature of the part-whole relationship involved; (*c*) the internal organization of concepts; and (*d*) the nature of the whole that is represented by classes and collections. Before proceeding it is necessary to point out that much of the work on the development of classification skills deals with the kinds of concepts that can be described by a class model. Here concepts are defined in terms of intentional and extensional aspects. The intentional aspect involves the defining criteria of a class; the extensional aspect involves the instances that meet the defining criteria. The typical classification study might present a child with, say, a picture of a robin, a turkey, a sparrow; a bicycle, a car, a bus; a tulip, a rose, and a petunia. The child's job is to place all birds in one pile, all vehicles in another, and all flowers in yet another. In other words, he is to determine that there are three different intentional definitions and that each of these contain three instances, i.e. extensions.

Indeed the foregoing set of stimuli represent classes. It is possible to consider each object independently and determine its class membership by considering it in terms of its defining properties. But to determine whether an object is a member of a collection, one needs to know something about its relationship to other objects. Consider the concept of family and consider a child. Is a child a member of the collection we call a family? That depends on whether the child has a parent (or some other relative). Likewise husband and wife do not constitute a family unless they have children or other relations. The example of family serves to highlight the general determining characteristic of collections: the relationship between objects is crucial. A bunch of stones is a bunch of stones only if there is close spatial proximity between the stones; likewise a bunch of grapes. In short, an object by itself cannot be judged to be a member of a collection; it can, in contrast, be judged to be a member of a class.

Part-whole relations are not the same for classes and collections. In the case of classes the subordinate is included in the superordinate. Thus roses are flowers. But in the case of collections, it makes little sense to say that a subclass of members are also members of the superordinate. Children are not families. Once this distinction is pointed out, it is easy to move to the last two distinctions between classes and collections. Collections seem to have a tighter internal organization and their members adhere together to form a whole more readily than do the members of a class. The organization of members of classes is imposed more by the formal structure of a class and the whole is an abstraction. The parts of an object, e.g. foot, hand, eyes, and head of a body must be organized in a certain way if there is to be a percept of a particular object; in a similar way the part of a collection must be organized in a certain way.

These considerations about the nature of collections led Markman & Seibert to suggest a continuum of part-whole relationships; with objects the part-whole relation is tighter than with collections, and collections in turn involve a stronger relation of parts to whole than do classes. In one test of this hypothesis, kindergarten and first-grade children were given different versions of the class-inclusion problems described in the introduction. Children included in the study failed the Piagetian task. Half of these children were asked collection questions; half class questions. The same materials were used in both conditions. As an illustration consider the collection versus class questions regarding red and blue blocks arranged in a pile. Children in the collection condition were asked whether the one who owned the blue blocks or the one who owned the pile of blocks would have more blocks to play with. Children in the control (class) condition were asked whether someone who owned the blue blocks or someone who owned the blocks would have more blocks to play with; i.e. they were given the standard class-inclusion question. Children tested with the modified (collection) questions did much better than those tested with standard (class) questions. A subsequent experiment rules out the possibility that the advantage derived from the fact that the nouns used to describe collections were singular collective nouns. A third experiment failed to show an advantage of objects over collections with regard to part-whole questions. Children did as well on the collection questions as they did on the object questions, a result which led Markman & Seibert to suggest that collections form "psychological units which are as coherent as objects." Whether or not this is the case, we now have some insight into the child's difficulty with standard class-inclusion tasks: the stimuli that are typically used are organized in the mind of the adult who can impose abstract formal rules on the stimuli. Perhaps the child is less inclined to define the organization in this particular way and so when given stimuli that must be so organized, he does rather poorly. Or he may not be able to access this particular level of organization.

Both Fodor (43) and Rozin (129) suggest that cognitive development may involve the development of the ability to use certain computational routines and/or the outputs of such routines in a variety of domains. That is, the basic computational systems required to perform certain feats of reasoning may be at work only in restricted stimulus domains—presumably because these systems were evolved for species-specific purposes. According to Rozin, the evolution of general purpose intelligence involves the evolution of more general access to computational processes that originally served specialized behavioral purposes. We are all familiar with the argument that the use of language involves a system that is hierarchically integrated. One could maintain that the young child's comprehension of words and related concepts involves the implicit use of hierarchical structure that is yet to be accessed for use in other domains.

Some support for the idea that the young child's problem with a classification task involves an accessing difficulty comes from several studies on the nature of the young child's semantic representations. When children are asked to name objects that are like a designate, they respond with items that are within a given taxonomic category (106). Steinberg & Anderson (145) conclude on the basis of first-graders' responses to retrieval cues that some of their concepts are represented by class-inclusion hierarchies. A child was first shown a set of familiar pictures. He then had to recall the name of the pictured object he was most reminded of when given a set of retrieval cues. The retrieval cues mapped onto a tree-like, class-inclusion structure. Since probabilities of recalling the picture were related to predictions based on the semantic distance between the target and cue, the data support the conclusion that class-inclusion hierarchies can serve as the basis for retrieval. A similar line of reasoning contributed to the design of an experiment by Harris (65), who studied the inclusion relationship with regard to semantic memory. The subjects in his experiments, aged 4½ to 6 years, were required to answer questions about a nonsense word, e.g. mib, which was assigned to a category name, e.g. man, bird, flower, or drink. This was done after the child was first asked questions about each of the category names, questions that were generated from a consideration of a class-inclusion model. After children described a man as one who eats food, lacks wings, and is alive, they were then told a mib was a man and asked similar questions. On the basis of the children's responses about the attributes of bird, man, drink, and flower Harris concludes that their knowledge of such attributes is indeed hierarchically organized. Further, he takes their ability to use this hierarchy to answer questions about mibs that were at various times a bird, a man, etc as some evidence for their ability to make inferences based on the hierarchy. Most recently, Mansfield (89) used a false recognition technique to demonstrate the availability of superordinate-subordinate relations to 5-year-old subjects. The recognition technique was adopted to limit the problems young children might encounter when retrieving stored information. Thus a variety of recent studies converge on the view that young children can respond on the basis of hierarchical representations. I should note an apparently contradictory result. McCauley, Weil & Sperber (94) obtain evidence of kindergarten children responding on the basis of associations that cut across categories rather than category membership. Thus they behaved as if *dog* and *bone* were more similar than *dog* and *lion*. McCauley et al used differences in response time to name two pictures, differences which need not be taken to reflect differences in ability. Instead they may reflect a preference for doing something one way as opposed to another way [cf Nelson (105a)]. Of course, it need not be the case that reaction time data will fail to correlate with other dependent measures. Mansfield's results stand as a clear example to the contrary. But there is always the possibility that they will, and one is well advised to include an additional dependent measure as a check.

If we assume that young children can and do on some occasions respond on the basis of hierarchical representations, what can we make of their failure to do so in standard classification tasks? Harris suggests that a distinction should be made between the spontaneous deployment of rules and their availability, a suggestion that is consistent with Rozin's general account of cognitive development.

We return now to the way children perform on classification tasks. Rosch and Markman show how important it is to consider the definition of stimuli as well as the nature of the structural relations between stimuli in any discussion of the young child's classification abilities. It would follow that attempts to give children stimuli that they can organize in their own way or see as salient might yield evidence of children doing better on standard classification tasks. The evidence supports such a conclusion. Odom, Astor & Cunningham (107) show that when children aged 4 to 6 years old are tested with the two of three dimensions that are most salient to them they do better on a matrix classification task than when tested with a combination of one salient and one nonsalient dimension. And Carson & Abrahamson (26) find that the class-inclusion skills of children in grades one to four depend on the extent to which exemplars are good examples of a category. Following Rosch, these authors note that some examples of a category are better exemplars than others. Horses and dogs are good exemplars of the animal category, flies and bees are not. When children are shown horses and dogs and asked the class-inclusion question, e.g. are there more horses or animals, they perform better than when shown horses and flies or dogs and bees. Isen and co-workers (74) suggested that they could increase the saliency of a superordinate class by showing children an additional superordinate class. The manipulation succeeded in that performance was improved in such conditions. Westman & Youssef (151) suggest that the reported failure of kindergarten children to use commonality of category membership (e.g. 103) in free recall learning may be due to the fact that they have been given too many exemplars of a particular category. If so, kindergarten children should do better at learning many categories with few members than few categories with many members. This is precisely what happens. Worden (156) reports a similar effect with second graders as compared to fifth graders; her younger group clusters their output as well as does the older group; the source of differences is in the number of items included in each chunk.

But it is not just characteristics of the stimuli that affect the quality of a young child's performance on classification tasks. In some cases the way the study is designed can influence the quality of observed behavior. Worden (155) suggests that her subjects were better able to show an ability to organize material because they were given an opportunity to do the organizing. And they were required to meet a criterion of two consistent sorts. Odom et al (107) gave their subjects repeated trials and found a significant decrease in matrix classification errors over trials. "This strongly suggests that repeated presentations may be required to obtain a valid assessment of a young child's cognitive ability to classify multiplicatively" (p. 762). Indeed, ponder the fact that many of the early studies of classification behavior involved but one or two trials.

Finally, it seems that in some cases the young child brings to the task a strategy that will interfere with his being able to do what the experimenter wants him to do. Wilkinson's (153) work on class-inclusion provides an excellent case in point. Wilkinson asks whether it might not be that the young child compares the number of items in different groups by counting (see above for supporting evidence). Counting involves tagging each object in an array once and only once. This in turn necessitates a step-by-step partitioning of the counted items from the to-be-counted items. Once counted an item cannot be returned to the to-be-counted category. But this is precisely what the young child who compares quantities by counting would be forced to do in the class-inclusion task. He is asked: "Which is more, the flowers or the roses?" But roses, having already been counted, cannot be recounted without violating a principle of enumeration—count each item once and only once. What to do? Count the other subset. Wilkinson presents excellent evidence in support of this argument and ends up focusing on the need for detailed analyses of the component skills involved in tests of cognitive development.

We take it to be obvious by now that the young child can hardly be characterized as entirely incapable of sorting materials by consistent criteria, of using class-inclusion rules, of combining classes, etc. We have suggested a number of variables that have conspired together to mask what classification capacities might be given to the young child. What is called for is just what Wilkinson suggests—a very careful analysis of the component skills that go together to make up flexible classification abilities (cf 2, 80).

The Young Child's Sensitivity to Order and Causal Relationships

ORDER The traditional view of the young child is of a child who cannot keep straight the order of events let alone be able to order more than two events in temporal succession (118); he cannot impose order on a set of stimuli even when the stimuli dictate an order as in the case of a series of sticks of graded lengths (73); he cannot repeat a story in a way that honors the way it was told, and he seems perfectly satisfied with the idea that causes and effects can take place in such a way as to allow a reversal of their order (46, 118), etc. Perhaps the most striking result of the last 2 years is how far from true this traditional view is. Research resulting from projects on a variety of different topics done in a variety of different ways converge on one very clear theme: order in events and arrays is a very salient feature for the preschool-aged child.

Perhaps the simplest case of an order is that which defines a more-less relationship between two stimuli, be they different in length, numerosity, etc. A variety of investigators (14, 23, 25, 36, 141) have demonstrated preschoolers' succeeding on discrimination tasks that correlate the presence of reward with the stimulus that represents more or less. Siegel (141) shows children as young as 3 being able to choose which of two arrays is more or less numerous when the arrays represent the number combinations of two through nine. Bullock & Gelman (25) report children as young as 2½ transferring an initial order comparison to their choice of winner when shown two new sets representing novel numerosities. Thus children trained that a three-item set is the "winner" and a one-item set is the "loser" choose a four-item set over a three-item set when they first encounter the new sets. Thus, young children can do more than recognize an order relation that holds between two sets; they can compare two ordered sets and make judgments about a common order relation.

Those familiar with the Piagetian literature might choose to be unimpressed with the above findings. After all, for Piaget the question is whether young children can seriate a set of stimuli and what's more whether they can make transitivity judgments. Again the answer is clearly, yes. The reader is probably familiar with the Bryant & Trabasso (24) study wherein the subjects were children (aged 4 to 6 years) who typically fail Piaget's test of transitive inference. In this task the child is shown two of the possible pairings of three sticks of different lengths, e.g. AB (with A > B), and BC (with B > C). He is then asked to determine which of the pair AC is longer without the opportunity to do so by inspection. For Piaget, failure on such tasks reflects the young child's inability to logically add the relations A > B and B > C to come up with the inference that A > C. Bryant & Trabasso wondered if the child's difficulty might not be more of a problem in memory than logical inference. Accordingly, they put their subjects through a memory training phase—a procedure we review here because it is used extensively in the elegant series of studies conducted subsequently by Trabasso and his colleagues (147).

In the Bryant & Trabasso study, children were shown pairs from a set of five sticks (A, B, C, D, E) and taught by means of a discrimination-learning technique which of a pair was the "longer" (or "shorter"). To start, the child was trained on the AB pair, then the BC, CD, and DE pairs. Subsequently, they were shown random pairs of the sticks and required to relearn a series of discriminations. There are two features of the training that are noteworthy. First, the children never saw the actual length of the sticks; the bottoms of each pair of sticks were hidden in a box and their tops protruded to the same height. Thus the children had to learn to associate the different colors with different relative lengths. Second, training required children to respond to "which is longer" and "which is shorter" questions—a feature which it now seems served to highlight the comparative relations (127). Following training, the children were tested *without* feedback on all 10 possible pairs of the training stimuli. And, as in training, the children had to rely on the color of the sticks when choosing one as longer or shorter. The test of the child's ability is best illustrated by the way he responded on the BD comparison and the critical adjacent pairs of

BC and DC. Children were *not* trained on the BD comparison. Further, during training the terms of this pair as well as the middle term C were as often the "longer" as the "shorter" stick in an array. The percent correct responses on the BD comparison was considerably above chance (ranging from 78% to 92%). Further success on the critical test pair was highly correlated with a child's ability to remember the values of the relevant adjacent pairs, BC and CD. The latter result provides the major source of evidence for support of the Bryant-Trabasso hypothesis.

Note that here again we are confronted with a training study that seems to have uncovered an ability presumed absent in the young child. The reader who objects by noting how extensive the training was should consult a recent study by Timmons & Smothergill (146), who worked with kindergarten children who did very poorly on tasks requiring them to seriate six values of brightness or length. These children were given same-different judgment trials on either or both dimensions; no feedback was provided. Still this no-feedback training experience facilitated seriation performance.

De Boysson-Bardies & O'Regan (31) attempted to account for the results of Bryant & Trabasso in the following way: During training the child learns to label sticks in each pair as longer or shorter and then labels sticks within the pair as big or little. Since sticks B, C, and D will be assigned inconsistent labels, the child will retain no consistent labels for B, C, and D. In contrast, sticks A and E retain the consistent labels big or little. Then, the argument continues, those sticks without labels which are paired with A or E (B and D, respectively) can be compared noninferentially. Harris & Bassett (66) designed a study to test this tortuous account and could find no evidence in favor of it. Well, then, perhaps the children constructed linear images of the arrays and simply "read off" their answers. It indeed seems to be that this is what the children did; but adults confronted with the same task do likewise (147). In fact, children and adults alike construct such linear representations when confronted with a wide variety of ordered materials representing height, weight, happiness, or even niceness (126). Trabasso (147) summarizes the series of studies by suggesting that there are no qualitative differences between children and adults as regards the way they solve such problems. He targets linguistic difficulties as a major source of difficulties confronting the young child.

Work on the young child's understanding and use of temporal terms provides further evidence for my conclusion that order in events is a salient property for young children. On the basis of his own work, as well as that done by others, Beilin (7) concludes that young children do, under some conditions, see events as being ordered in a sequence. This, Beilin proposes, facilitates their acquisition of terms like *before/after, first/last, this, then,* and *that.* However, such terms are not always understood. Sentences that involve their use in a way that departs from the natural sequence of referred-to events, e.g. "before you go to the store, visit your grandmother," are difficult for the young child. This, Beilin suggests, reflects the limited number of cognitive operations available to the young child. The argument is that young children's thought processes lack reversibility, a fact which makes it exceedingly difficult for them to impose order on information that itself is not ordered or is incongruent with naturally occuring orders. However, from Trabasso's work we see that young children can impose order on a set of events that are not presented in a systematic order. It may be that young children do not do so spontaneously. After all, Trabasso's studies all involve an extensive training component. Brown's (18) research provides some insight into the extent to which young children can, without benefit of instruction, impose order on a sequence of events that violate expectations that might be based on the temporal flow of events.

Brown's work makes it clear that the young child's ability to impose order on events that are not ordered is far from an all-or-none matter. Consider a case where the preschooler had little difficulty. Three- and four-year-olds were given the task of remembering the sequence in which as many as seven items of clothing were placed on a clothesline (19). To start they were first asked to dress a doll in the same way they dressed themselves in the morning. This allowed Brown to obtain information on the child's own ideas about the order in which clothes are put on. Children were asked to remember sequences that were either logical (i.e. congruent with the child's order) or arbitrary. Performance was excellent in both conditions. Having to remember an arbitrary order did not present difficulty in this situation. In a second task, children were shown a series of four pictures. Two-thirds of them represented an ordered sequence, one-third depicted unrelated events. Half of the ordered sequences were shown in an order congruent with the ordering that could be imposed on them, the other half were shown in a scrambled order. Memory was excellent for the ordered presentation of the orderable pictures, even when the recall test was delayed. Immediate recall of the random sequences was likewise excellent but fell off as testing was delayed. The absence of any order that could be imposed on the stimuli did not make it impossible for the children to recall the experimental order; it did interfere with long-term storage of such an order. Of interest is the kind of error made on the recall of scrambled arrays. Children did not find it easy to remember the scrambled order, apparently because they had difficulty ignoring the inherent order that could be imposed on such stimuli, for their "errors" included many reorderings of the input stimuli in accord with the inherent order. This latter finding leads to the conclusion that young children can impose order on events that have an inherent ordering even if it is disguised by scrambling. At least this seems to be true when the events are pictured simultaneously.

But what if the events are not presented simultaneously or the child must find order where none exists? Here it seems the young child is at a disadvantage compared to the child of primary school age. He does not do as well at recalling the sequence in which he saw pictures one at a time (19). He needs the aid of a narrative that imposes order on the successive pictures. And if he is not provided such aid, he does not do it spontaneously. If required to work with more than one ordered set of materials, this too is a problem. Young children can remember the path of animals through a jungle when required to trace the path forward; however, they have great difficulty providing the backwards path—even when given extra training at initial input on the forward order (18). They mix up the order of events in a story when retelling it, even when it can be shown by recognition and/or reproduction tasks that they have such information available (17). So the picture emerging from this research is one of a young child who is indeed sensitive to order and even able to construct orders—provided the task demands are limited and/or the child has had some suitable training.

Why do increases in task demands, especially ones that require the child to retrieve information in a way that deviates from the way it is stored, impair performance? Brown argues that it is because the young child has yet to achieve a level of thought that is characterized by operational reversibility. And this may very well be the case. A related interpretation is that the young child's competence is fragile and not well enough established to permit him to cope with unfamiliar stimuli or the demands imposed by complex tasks. Whatever the ultimate theoretical account, one thing cannot be denied; the young child's ability to deal with ordered events is less than trivial. It cannot be explained away. Indeed the discovery of a sensitivity to order makes sense of the ease with which the young child approaches the learning of sequenced materials such as count words (50) or language.

CAUSALITY Since young children are able to keep track of ordered events and remember them in order, it seems odd to think of them as being insensitive to the order rule regarding cause and effect. Yet Shultz & Mendelson (139) conclude that 3-year-olds tend to attribute causality to an event that *follows* a particular effect. By contrast, the children 6 years of age or more behave as if they assume that causes precede effects. Kuhn & Phelps (82) likewise report young children indifferent to the order of cause and effect. The results reported by Shultz & Mendelson seem consistent with Piaget's (116) account of the young child's conception of physical causality. The young child is said to associate phenomena on the basis of contiguity without a concern about a possible mechanism and whether the inferred association is reasonable or complete. Such a child might very well believe that causes can follow effects. But is this characterization correct? Is it true that young children are precausal? Or might there be alternative accounts of the evidence advanced in support of this view? I think so.

Consider what Piaget had children talk about—what causes the wind and rain, why rivers flow, how bicycles and other machines work, etc. It is the rare preschooler who has had an opportunity to learn about such events and the working of machines. And perhaps in the absence of a knowledge base the child cannot help but give answers that are animistic and lacking reference to a potential mechanism. In the case of machines, the child might not realize that the experimenter wants the child to posit a mechanism. Koslowski (unpublished communication) makes such a point in her discussion of the young child's account of the workings of a bicycle. The child might say he thinks the pedals are responsible for the bicycle's movement because he takes the question to be one about causal agent and not one about force. It should be possible to show that young children can be reasonable about their choice of possible causes, that they do assume that a mechanism of some kind relates cause to effect, that they do recognize that causes precede effects, etc, provided care is taken to use events the child might know about. Should such evidence be forthcoming, then we can conclude that the child's account of things he does not know about is more a result of an effort to cope with the situation than a basic precausal attitude.

Berzonsky (9) showed that the child's familiarity with a topic does influence the quality of his causal accounts. Explanations similar to ones Piaget classifies as precausal were forthcoming when the child was questioned about remote events, e.g. why does the moon change shape. But children responded to questions about familiar events—e.g. the flying of kites and the malfunctioning of familiar objects such as the flattening of a tire—with physical mechanical explanations. My own work on the child's understanding of number provides a clear case in point. Almost all children who were confronted with an unexpected change in number were able to provide adequate explanations, i.e. ones involving an assumption that there must have been an addition or subtraction. These children behaved as if they assumed unexpected changes derive from an antecedent cause—even if they did not witness one. Koslowski reaches a similar conclusion in her work. She showed preschoolers an apparatus that involved a bolt passing through a closed box and ringing a bell. Using a series of indirect questions, she observes that the vast majority of children behave as if they recognize that the connecting mechanism was contained in the box. Mendelson & Shultz (98) report a shift in response type depending on whether children (aged 4½ to 7 years) saw how the dropping of a marble into one box could produce a bell ringing inside another box. The model of how this could happen consisted of running a tube from the base of the marble box to the top of the bell box. The children never witnessed the marble going through the tube. Children who saw the tubing tended to ignore as a potential cause an event that occurred inconsistently but nevertheless in close temporal proximity to the bell's ringing. In contrast children who did not see the model indicated that the event which was closest in time to the bell's ringing was the cause—despite the fact that this event did not occur consistently. Clearly, when the child could imagine a reason for the delay between cause and effect, he behaved reasonably. Otherwise he did not.

Merry Bullock and I have just completed a study which shows 4- and 5-year-olds choosing a "reasonable" versus an "unreasonable" event as potential cause. The children were first shown a box with a plexiglass front. At the left of the box were two handles: one could start a ball rolling down an incline; the other switched on flashing lights at a rate designed to give the appearance that a single light was moving down an incline (phi phenomena). After an initial play period with this box, the children encountered what was, from our point of view, the events of interest. The child watched the light and ball each traverse a path to the end of the box and appear to disappear into another box. The light and ball events were coterminus. Three seconds later a jack jumped out of this second box. The child was given the opportunity to "make jack jump" and questioned as to what happened. Despite no initial tendency to choose to play with the ball-handle more than the light-handle, children behaved as if the ball had to be responsible for jack's jumping. I see this as evidence for their ability to choose a reasonable as opposed to an unreasonable cause. A mechanical jack-in-the-box is likely to work by some impact mechanism. A rolling ball can obviously cause an impact; a moving light is a less obvious candidate.

Mendelson & Shultz obtain evidence like ours when they provide children with information that can be used to make inferences about the events that intervene between an initial and final event. Our children quite probably knew something about jack-in-the-boxes. Such results lend additional support to the idea that a young child's success at causal explanation depends heavily on his knowledge about the events in question. What begins to emerge is a view of the young child who is hardly precausal. His ability to reveal a basic understanding that events have causes will surely develop as he acquires knowledge. If he does not know enough to determine the nature of a mechanism, he might very well behave as if causes can follow their effects. But one must be very cautious about arriving at a conclusion that the young child fundamentally believes that this is so. I suggest this is unlikely given the recent findings. And when these findings are considered against the backdrop of research which shows how salient order is to young children, it is particularly hard to continue to assume that children are indifferent to the order in which cause and effect occur.

Brown (18) points out how some of her findings go against the view that young children are so cognitively immature as to be unable to exploit causal relationships. As already indicated, her young subjects were better at recalling stories that contained logical or causal links—especially when input order was consistent with the assumption that causes precede effects. Brown's work on the relative ease of tracing consequences from causes or vice versa makes it clear that it is quite a simple matter to interfere with the young child's ability to order cause and effects. It is not just the type of material (familiar or unfamiliar) that is critical. For example, kindergarten children are better at selecting pictures that complete a representation of a causal sequence than they are at selecting ones that start a sequence.

In the case of causal reasoning, I believe too little is yet known about the young child's capacity, and therefore I think it premature to venture a hypothesis as to its developmental course. But enough is known to encourage investigators to venture where few have since Piaget did his pioneering work on this topic.

Perspective-Taking Abilities

Tradition has told us that the preschooler is egocentric; he cannot adopt the perspectives of others or take his listener's needs and capacities into account and adjust his messages accordingly. In 1973 Marilyn Shatz and I reviewed the available evidence in this regard (138). We suggested that tasks designed to assess nonegocentric behavior confound the child's cognitive developmental status with the question at hand. Consider the Krauss & Glucksberg (81) task where a child has to describe objects so that another child who is placed behind a barrier can identify which one of the same five objects the speaker is describing. The objects to-be-described are abstract geometric forms. For the speaker to succeed in this task he has to assign a label to each novel shape so that the label uniquely identifies each shape. And to do this he has to identify distinctive features. But young children have difficulty with distinctive feature tasks (53). And so one can predict that children would have difficulty meeting the criterion of the Krauss & Glucksberg task because the speaker could not, on his own, label the objects distinctively—never mind whether he had to communicate or not. A similar criticism can be made about some of Piaget's work (115). He asked children to reproduce explanations about physical events involving

the working of water taps and syringes. But Piaget's own work suggests that young children lack the ability to represent physical events with respect to causality, or more probably, to talk coherently about causality. So what if they fail to honor the experimenter's explanation? They probably did not understand what they heard. And even if they did, they might have had difficulty retrieving the explanation from memory (18). Surely we all look egocentric when we try to explain something we do not quite understand or cannot remember exactly.

Thus a child might look egocentric because he lacks knowledge or memorial skills and not because he lacks an intent to communicate or is unable to take his listener's needs into account. Likewise, task difficulty might stand in the way of determining whether the young children can take account of the visual perspective of others. There is considerable evidence to support the view that task difficulty is a crucial variable. Many of the variables that contribute to the relative difficulty of perspective-taking tasks are reviewed by Shantz (134) and Glucksberg, Krauss & Higgins (58). These papers deal mostly with elementary school children. Here I focus on those recent studies which shed some light on the preschooler's perspective-taking abilities.

It is not obvious as to how one goes about suiting tasks to children of the age we know so little about, but some guesses can be made. In a communication task, it seems only fair to ask children to talk about what they might know. And one should choose a response that the child is likely to be able to make. These considerations led Shatz & Gelman (138) to ask 4-year-olds to talk about the workings of a toy or let them choose a topic. We indexed communication skill in terms of the child's tendency to adjust the complexity of his syntax when talking to listeners of different ages. Why syntactic measures? Because 4-year-olds have a remarkably rich repetoire of syntactic constructions, and it is therefore *possible* for them to select among these when talking to different listeners. Not that they necessarily will. It's just that they could, should they be so inclined, modify messages as they confront listeners with different needs. As it turns out, when 4-year-olds talk to 2-year-olds about the workings of a toy, they generally use short and simple utterances. With peers and adults they use longer and more complex utterances. Much the same result holds when the child is allowed to choose the topic of conversation.

But does the child who adjusts the length and complexity of his utterances select different messages for different listeners? And if so, are these appropriate selections? In the main, the answer is yes to both questions. Gelman & Shatz (51) find that the 4-year-old's speech to a 2-year-old serves different functions and contains somewhat different messages than does his speech to adults. Speech to 2-year-olds serves to "show and tell," to direct, focus, and monitor attention; speech to adults includes talk about the child's own thoughts and seeks information, clarification, or support from the adult. Adult-directed speech also marks the child's recognition of the fact that he may not be correct about his assertions. The adult is treated as one who is in a position to offer advice, to challenge, and the like. It seems quite clear that the messages are selected to match the needs and capacities of the listener.

On the basis of this later work, we conclude that preschoolers are not always egocentric communicators. Further, there is the implication that the young child has representations of others—representations that involve such variables as cognitive capacity, age, linguistic level, and attentional constraints. And it appears that these representations help to guide the child's choice of responses. But do we grant too much? After all, our subjects talked in the presence of their listeners who may have provided subtle feedback cues. And it is possible that the child's ability to take his listeners' capacities into account is confined to the syntactic domain. The questions then are: Can preschoolers represent individuals other than themselves when those individuals are not present? Do such representations control response selection along dimensions other than syntactic ones? How readily can one demonstrate that preschoolers can take the needs of others into account?

As regards the role of the presence or absence of the listener, Sacks & Devin (131) had preschool children talk to dolls who were identified as babies, 2-year-olds, etc. They report results much like Shatz & Gelman obtained. So the child's ability to adjust his messages is not tied to feedback that is given by a listener. Two unpublished studies, one by Shatz (135) and one by Markman (90), show young children dealing with and/or representing the capacities of others who are not physically present. These studies also provide evidence regarding the generality of nonegocentric abilities.

Shatz (135) asked 4- and 5-year-old children to help her make decisions about toys that were to be given to either a 2-year-old or someone their age. Depending on which condition they were in, they were shown a *picture* of either a 2-year-old or a 4-year-old boy in order to test whether they could make appropriate choices for others when they had no direct feedback from the recipient. The stimuli consisted of four toys: two that were deemed appropriate for 2-year-olds and two deemed appropriate for 4-year-olds. Subjects who chose presents for 2-year-olds picked significantly more 2-year-old toys than expected by chance. Likewise "peer condition" subjects chose 4-year-old toys. An analysis of the toy-choice justifications showed that the children rarely gave inappropriate or egocentric ones such as "I like it." Instead children tended to refer to the cognitive and/or affective predispositions of the receiver as illustrated by the following explanation: "I didn't pick this (the number-letter board) because he (the 2-year-old) can't read."

Markman (90) had 5-year-olds make predictions about their own capacity to remember or to perform motor tasks. The memory monitoring task—adopted from Flavell, Friedrich's & Hoyt (42)—required a child to indicate whether or not he would be able to remember a given number of pictures. At first the child saw one picture and was asked if he could remember it; then two pictures and asked if he could remember them, and so on until ten pictures had been shown. Having completed the self-prediction task, the child was asked to make predictions as to how well a 2-year-old and a teenager would do on the same task. There were also motor-skill prediction tasks. In one the child had to predict how far he, a 2-year-old, or a teenager could jump. As the experimenter moved stepwise away from the child, the child had to answer about his (or someone else's) capacity to jump that far. A child's predictions about his own abilities tended to fall between predictions about abilities of 2-year-olds and teenagers. But it was not just that the child knew that 2-year-olds were worse off and teenagers better off than he. The children made

differential predictions about the memorial and motoric skills of 2-year-olds. Most 2-year-olds were judged to be able to handle the motor tasks at some level, but 2-year-olds were usually viewed as creatures who generally could not *remember* a thing. A kindergarten child is unlikely to have read developmental texts on the normative capacities of 2-year-olds. Yet he correctly judges the subject to be more advanced motorically than cognitively.

Markman and Shatz provide some clues as to what preschoolers know about those younger than they. Further studies provide additional support for the position that preschoolers are not completely egocentric. Borke (11) presented 3- and 4-year-old children with tasks that were modeled after Piaget & Inhelder's (120) mountain experiment but designed to include stimuli that young children could readily discriminate to make it easier for the child to respond. It has been shown that older children do better on perspective-taking tasks if they can rotate a display to illustrate their perspective judgments rather than having to match the perspective with one of several shown in pictures (67, 72). Borke reasoned that the same should hold for still younger children and therefore had them rotate a copy of the test display. The test displays varied in terms of how much one might expect a young child to know about the stimuli. One display consisted of a lake with a sailboat on it, a house and miniature animals. Another display contained eight different groupings of people or animals in natural settings, e.g. a dog and a doghouse. The third display was a replica of Piaget and Inhelder's mountain task. The experiment involved having a dog named Grover move around the test display. The child indicated what Grover could see by rotating a replica of the test display. All subjects did well at predicting Grover's perspective. Although they made more errors on the mountain display, they did better than might be expected: 42% and 67% of the 3- and 4-year-olds' respective responses were accurate. Here again we see the effect of varying task complexity both in terms of stimulus and response demands. Similar results obtain for the young child's ability to provide nonegocentric referents. Systematic variations in stimulus complexity (70) and process demands (47, 122) produce systematic differences in the child's ability to do well at selecting a nonegocentric referent.

When simple tasks are used it appears that young children can make inferences about what another individual might or might not know depending on the circumstances. Marvin, Greenberg & Mossler (93) show children as young as 4 able to recognize that a secret is shared by those who saw the event in question but *not* by one who had his eyes closed and could not see the event. The same investigators (104) involved preschool children in a task that required them to recognize that information available to them was not available to their mothers so as to be able to answer questions on what their mothers might know. The child first watched a movie of a boy sitting at a table; the sound track revealed the boy's desire for cookies. Then the child's mother entered the room and watched the same movie but the sound track was turned off. Finally the experimenter asked the child whether his mother knew that a boy was sitting at a table and that the boy wanted cookies. Since the mother did not hear the sound track, the nonegocentric child should answer "yes" to the table question and "no" to the cookie question. I for one am impressed with the fact that 4- and 5-year-olds could meet this criterion of nonegocentric behavior. It is not *that* easy a task.

The list of evidence regarding the ability of preschoolers continues. Meissner & Apthorp (97) find that black preschoolers of low socioeconomic status do very well at adjusting their communications depending on whether their listener is blindfolded or not. Again, the task is easy; this time the children had to indicate a choice of toys. They resisted pointing when paired with a blindfolded listener. Menig-Peterson (99) shows 3- and 4-year-olds adjusting their speech to a teacher to take into account what the teacher could not know about the topic. Thus children who talked with one adult about a variety of topics told the teacher different things about that conversation depending on whether the teacher was or was not present during the initial session.

Lempers, Flavell & Flavell (83) show very young children passing a wide range of visual perspective-taking tasks. We review here but one of the many tasks that very young children did well on—the *Show Card Pictures* task. Children ranging in age from 1 to 3 years were handed, one at a time, black and white photographs of familiar objects. The face side of the photograph was always shown; some right side up and some upside down. They were then asked to show the pictures to an observer (usually the child's mother) who was seated across from and facing the child. An egocentric child might be expected to "show" the back of the one picture; the nonegocentric child should make some effort to turn the picture toward the observer, thereby depriving himself of a view of the picture. All 2½- and 3-year-old children oriented the pictures to face their observers and most placed them right side up. Only the very youngest children showed any sign of being unwilling to turn the backside of the pictures toward themselves. However, not even these children adopted the obviously egocentric strategy of continuing to look at the picture themselves while showing a blank view to their observer. Instead they tended to place the picture on a horizontal between themselves and the observer. Lempers et al suggest that their youngest subjects may not have been able to deprive themselves of a view of what they show. But they go on to point out that even the youngest children were able to produce a percept that someone else could see. So it can hardly be said that the very young children were egocentric in this task.

It is apparent that task difficulty plays a major role in determining the young child's success at perspective-taking abilities. We might expect children who have an opportunity to practice some or all of the component skills of the various tasks to do better on perspective-taking tests than children who do not have a comparable opportunity. Genesee, Tucker & Lambert (52) provide some evidence here. They asked whether English-speaking Canadian children who were learning to speak French might develop a greater sensitivity to listeners' needs. In the experimental tasks children in kindergarten, grade one, and grade two were asked to explain a board game to a classmate who was either blindfolded or not blindfolded. The testing was in English. The greater was a child's immersion in Francophone settings, the greater was his sensitivity to the special needs of blindfolded listeners. Using a comparable task, Bearison & Cassel (5) report a communication-skill advantage for children from person-oriented as opposed to status-oriented families. These studies

provide some clues as to the nature of the experiences that contribute to the ability to adjust communications. Priddle & Rubin (121) were able to modify the spatial perspective-taking skill of preschoolers by having them move around three-dimensional displays and thereby assume different positions. Thus, although the evidence is limited, it nevertheless supports our initial conjecture about the potential role of experience in perspective-taking tasks.

What emerges from a review of the preschooler's perspective-taking abilities? It seems that there is a clear case for the position that the preschooler can and does take the perspectives of others into account. But how do we reconcile recent findings with the earlier data that suggest the opposite? First, it no longer seems appropriate to characterize the thought of preschoolers as egocentric. Such a global characterization is contradicted by the evidence at hand, evidence which leads me to conclude that the very young child typically attempts to take his listeners' perspectives into account. If the task is simple enough—where simple refers variously to the use of responses that are well developed, stimuli that are suited to the child's interest, stimuli the child can process, instructions the child can understand—then the young child's nonegocentric abilities will show through. If, on the other hand, the child has to deal with just-learned materials, just-acquired responses, emerging concepts or not-yet-developed concepts, or unavailable strategies, the coordinated demands of the task will surely overload his processing capacities, and, likely as not, lead him to fail. By such a view, perspective-taking abilities become better and better with experience, the acquisition of knowledge in a variety of domains, and sheer practice. It is not an ability that is first absent and then present. It is an ability that continues to develop into adulthood. Hopefully, most readers have improved their abilities to deliver colloquia, lectures, and seminars in a way that is suited to the needs of the audience in question.

Second, the available data make it difficult to hold to a theoretical view that yokes the development of nonegocentric behaviors with the development of concrete operations. It is a safe bet that the children who participated in the studies reviewed above would fail Piagetian tests of conservation, seriation, etc. Add to this the fact that children who are old enough to pass the Piagetian tests of concrete operations will in a variety of settings do rather poorly on referential-communication tasks [see (58) for instances] as well as visual perspective-taking tasks (120). Such findings are consistent with the view that perspective-taking abilities develop as the component skills of a task are mastered. They are not consistent with a stage-theoretic view that appeals to the notion of emerging logico-mathematical abilities. As more and more evidence becomes available on the nature and development of perspective-taking abilities, I venture to guess that the traditional stage-like view of nonegocentric performances will fall by the wayside. Indeed, Shatz's (137) recent theoretical account of what contributes to the growth of perspective-taking would seem to render the traditional stage account of nonegocentric behavior superfluous.

More Evidence

The above sections provide much evidence that preschoolers succeed on many tests of cognitive capacity. There are many further indications that the field has moved toward being as much concerned for what the young child can do as what he cannot do. A variety of investigators have been concerned with abilities that seem to stand at the interface of perceptual and cognitive skills. Perhaps it is because of the traditional view that the preschooler has many a perceptual ability that these investigators include preschoolers in their designs and, what's more, give the impression of being open to the possibility that these younger subjects will do well, at least under some conditions. Here are further examples of their abilities: Kindergarten children can detect symmetry in patterns (12). Children as young as 5 can do more than recognize differences in orientation (23, 144). If orientation is represented in a meaningful display, they can store such information (87). Likewise, the same-aged children can recall the spatial location of a particular picture (149). Although preschoolers may in some cases fail to respond to depth cues in a picture (63), there are conditions under which even 2-year-olds are capable of detecting depth in a two-dimensional picture (108). And when care is taken to provide children with a task they can negotiate, 5-year-olds do seem quite capable of mentally rotating their images of a teddy-bear (92).

Several teams of investigators are pursuing an in-depth study of the child's developing concept of space (1, 140). The focus is on what the preschooler can do as well as what he cannot. Acredolo, Pick & Olsen (1) took children of different ages on a walk through familiar and unfamiliar halls of buildings. During the walk the experimenter would drop a keyring and at the end of the walk ask the child to return to the place of the lost object. If the space in question had a landmark (a chair), young children did as well as older children at finding their way back to the position in question. Likewise, they were able to locate a lost object in a playground that was both familiar and well-dotted with objects that could serve as landmarks. The young child's ability to locate an object in an undifferentiated space was not particularly good—although it did improve when the child was told in advance to try and remember a particular sight so as to be able to return to it. Such findings are consistent with the Siegel & White (140) hypothesis that young children are able to learn landmarks. And as Acredolo et al note, they lend support to Piaget & Inhelder's (120) hypothesis about the shift from a reliance on topological relations to the inclusion of Euclidean relations in the establishment of spatial representations. That young children are able to deal with specific landmarks is of particular interest in view of Nelson's (106) hypothesis about the nature of the preschooler's knowledge of his world. The idea is that the young child organizes events in his life into scripts that spell out the order in which events occur and the way objects enter into the staging of the events. Since these are events that take place in space, the script analysis would be implausible if children could not notice and remember landmarks.

The script analysis of preschool behavior has a special quality that is seldom encountered in writings about the preschooler. It deals directly with the abilities of the young child rather than treating the preschooler only in comparison to older children. Whether the notion of script proves to be useful remains to be seen. But I find it refreshing to see an effort to capture what it is the young child must know and to deal with the child at his own level. There are other signs in the literature

of a developing interest in the need to know more about preschoolers. Fein (39) studies the pretend behavior of 2-year-olds under conditions which maximize its occurrence. Doing this allows her to learn about the objects that serve as acceptable substitutes. Goodson & Greenfield (59) consider play behavior in a somewhat different vein. The question is whether young children assemble toys in a rule-governed fashion. The answer is yes. A variety of studies are converging on the conclusion that young children do well at recalling and understanding stories that are well structured (e.g. 64, 88). And Perlmutter & Myers (114) thought it reasonable to assume that preschoolers would know that certain objects are color-specific and that others are not. And indeed, when young children were shown black and white drawings of a variety of objects they could match the color of color-specific objects, e.g. bananas. In contrast, their color matches for objects that are not color specific, e.g. socks, were random; the children apparently knew that such objects have no particular color.

I assume that there are some readers who remain unimpressed with the preschooler's cognitive abilities. Perhaps it is well to end this review with a summary of the few studies that have considered the boldest hypothesis to date—i.e. that preschoolers can make inferences. Macnamara, Baker & Olson (86) addressed the question of whether 4-year-olds are able to draw inferences by focusing on the way children answered questions involving the verbs *pretend, forget,* and *know.* The children were first told stories, each of which ended with a sentence containing one of the target verbs. For example, one story began with a description of the two toys with which Mary-Jane and Dick usually played. It continued with the children deciding to play with just one of the toys at their next encounter. There is no mention of which toy was selected for their next play session. The story ends with a statement that Mary-Jane forgot to bring the ball. The subject is then asked a series of questions. In order to answer the questions correctly, which they often did, the child had to deal with the presuppositions and implications given by the story as in "Was Mary-Jane supposed to bring the ball?" and "Was Dick disappointed?", respectively.

Pea (113) has succeeded at assessing the extent to which children between the ages of 1½ and 3 years assign the correct truth-functional value to a variety of sentence types, including true-affirmatives, false-affirmatives, false-negatives, and true-negatives. This involves comparing a child's responses to each of these types of utterances. For example, children typically say "yes" in response to a true-affirmative (e.g. "That is a ball," about a ball). In contrast, they couple an oppositional "yes" with the stimulus word in question in a false-negative and thus say "yes, ball" in response to "That is not a ball." The ability to agree with true-affirmatives and oppose false-negatives begins to show at 24 months of age and is clearly noted by 30 months of age.

These studies on the young child's use of presuppositions, implications, and truth-functional definitions are in some ways the most startling of all the ongoing research on the preschooler's cognitive capacities. It is certainly too early to accept Macnamara's suggestion that the account of such abilities will require an appeal to something akin to formal operations. Although 5-year-olds are able to make some

inferences as to where they did not lose an object, they are unable to limit their search to that area in which they must have lost the object (33). Further, the ability to deal with context-free logical statements is a relatively late development (111). And then the tendency of even 6- and 7-year-old children to store relationships that are implied in a sentence appears to be rather limited (112). They gain almost no recall advantage from cues that are implicit words in the original sentence. Thus the child who has to recall "His mother baked a birthday cake" does not seem to benefit from the cue *oven.* This is true despite the fact that even younger children can state the implied agent when explicitly asked to do so. So once again we see a case where the child might have the ability in question but fail to use it in a related task. This is hardly the kind of behavior that characterizes the formal-operational child who generates hypotheses on his own.

But if one hesitates to grant formal-operational thought to the child who can on some occasions think inferentially there is the problem of how to characterize such abilities. Further, there is the question of why such abilities surface at one time and not at another. In the next section, I suggest that part of the young child's problem is centered in his failure to understand the rules of the experimenter's game. The effect of this is a child who cannot help but "fail" even if he has the requisite ability to "pass."

THE RULES OF THE EXPERIMENTER'S GAME

When we as researchers design a task, we have in mind a set of assumptions as to how one should approach the task in order to succeed. In the case of the Paris & Lindauer experiment (112), the child who can infer the unstated agent should do so at the time he commits a sentence to memory. Otherwise he runs the danger of not being able to benefit from cue words that are the implicit agents. But consider the young child's viewpoint. Why should he be concerned with the unstated? He is unlikely to have had any comparable tests, and he is probably just beginning his history as a testee. Consequently, he is unlikely to have learned to try to figure out what it is the experimenter is after. Paris & Lindauer advance a similar account and provide supporting evidence. On the assumption that young children who participated in their earlier studies failed to realize that they should pay attention to the nature of unstated agents, they developed an ingenious sentence presentation procedure that forced children to note these agents. This involved having the children act out the actions described in sentences. Consider the sentences "The man shot the robber in the leg" versus "The man shot the robber in the leg with a gun." The former leaves the agent *gun* unstated, the latter makes explicit reference to it. Yet the child who can infer the instrument cannot help but invent a pretend gun to carry out the task of acting out. Thus, if a child executes actions that use the implied instrument, the experimenter has succeeded in getting the child to note the variable of interest. What is impressive about the Paris & Lindauer manipulation is that it accomplished more than having the child represent implicit instruments. Children did as well at recalling implicitly cued sentences as they did at recalling explicitly cued ones. The authors conclude that participants in the initial studies did not understand the task demands.

The idea that failure on a task may flow from a misunderstanding of what the experimenter is up to can be applied to a wide variety of studies. And the last 2 years have witnessed the publication of a number of variations on this theme. Girgus, Coran & Fraenkel (56) show that the well-known developmental function for the Müller-Lyer illusion *disappears* after 2½ minutes of testing and viewing. Why? They conclude that young children start out with different strategies. In particular they start out thinking that they should include the arrows when judging relative length.

Estes (37) suggests that young children are not likely to assume on a priori grounds that the same stimulus will produce reward trial after trial. Indeed, she suggests that they probably assume to the contrary. Her example of a child who finishes one bowl of ice cream and looks to another for more ice cream is both charming and compelling. The child who comes to a simple discrimination experiment with such a view can be expected to have difficulty at the start of an experiment. To test this hypothesis, Estes compared learning under two conditions of reinforcement. In one, the reward and the stimulus cueing reward were physically inseparable as when the "reward" was a happy face drawn on the underside of the card on which the to-be-learned +SΔ was drawn. In the other, a token was placed under the positive stimulus. As predicted, 4- to 6-year-old children made considerably fewer errors when the reward was physically inseparable from the +SΔ.

Several researchers have suggested that children who participate in transfer experiments may not realize that they are to apply information gained in the training phase to their transfer decisions. Cole (28) has shown that preschoolers treat the initial phase of learning differently than they treat the transfer. Bullock & Gelman (25) report on two problems they encountered in interpreting transfer data. Children between the ages of 2½ and 4 were first given a one-item versus two-item discrimination task. Half the children were told that the one-term array was the "winner"; half were told that the two-item array was the "winner." From the experimenter's point of view this constituted a more-less comparison. To determine whether children could transfer the more-less distinction to another set they gave children a three- versus four-item transfer task. They note that apparently many of their "older" children were confused by the question of which array was then *the* winner. These children often said that neither was the winner, an observation which in point of fact was correct. The children hesitated to choose the *best possible* choice until asked to do so. When asked to do this, they went on to choose the one that honored the relation they were reinforced for during training. The variation in the question served to tell the children that they were to make a judgment of similarity and not identity. A somewhat different problem arose regarding the interpretation of the transfer responses of the 2-year-olds. These youngest subjects responded at random, a result which could be taken to reveal an inability to use a numerical ordering relation. But it turns out that the 2-year-old's problem was knowing to apply the knowledge gained during training to the new stimuli. On the hunch that this might be the case, Bullock & Gelman ran a subsequent study where they left the training arrays on the testing table. The arrays were covered, thus a positive transfer result could not be taken as evidence favoring a memory-deficit account of the original study. Apparently, the presence of the old, covered arrays was enough to clue the children that they were to apply information gained from those original displays to the new displays presented during transfer. Thus, young children may not interpret the questions as expected, and they may not realize that they are expected to relate an acquisition task to a transfer task. In short, they may not see the experiment as the experimenter hopes they will.

The problem of instructions is highlighted in a study by Blank (10). She notes that many experiments involve asking children *why* or *how* questions. And most experiments report young children disinclined to answer such questions, giving the impression that it is virtually impossible to elicit verbalizations from preschoolers that are interpretable. But consider Blank's hypothesis that preschoolers take *why* questions to be requests for a motive and *how* questions to be requests for a statement about their capacity. In contrast, adults interpret such questions to be requests for a listing of the characteristics of a object that controlled his choices. Thus a preschooler will answer "I like it" and an adult will answer "The red one" when explaining discrimination choices. Add to this Blank's suggestion that preschoolers are disinclined to state the obvious (cf 113). It is only older children and adults who seem inclined to violate this rule of conversation (61) when confronted with an experimental setting. If indeed the young child has yet to recognize that it is permissible to state the obvious in the context of an experiment, a counterintuitive prediction follows. They will better be able to explain their choice when the stimuli in question are out of view. The results of an experiment designed to test both hypotheses are impressive. Of the 32 children asked why (or how) questions, almost all of them gave the commonly noted irrelevant explanations. In contrast, almost half the children gave interpretable explanations in response to a "which one" question. Further, the children who gave these explanations were predominantly in the out-of-view testing condition. Children in the *in-view* condition were content to simply point, seemingly seeing no need to describe what was visible!

The idea that the preschooler and the adult experimenter may interpret instructions in two different ways plays a central role in the Glucksberg, Hay & Danks (57) study of the 2½-year-old's understanding of *same* and *different*. In this case it appears that our error has been in presuppositions about how even adults will respond. Donaldson & Wales (32) have shown that 2-year-olds respond *as if they think same* and *different* mean the same thing. When asked to hand the experimenter an object that is the same as an exemplar, they choose one from the same class of objects. They do likewise when asked to hand the experimenter an object that is different from the exemplar. Glucksberg et al suggest that this is perfectly sensible in the context in which the questions are posed. When an adult holds up a hammer and requests a different one, might his listener not interpret this as a request for another hammer (that is not broken, perhaps)? At least, Princeton undergraduates are so inclined, demonstrating the plausibility of an adult assuming that "give me a different one" in the context of an exemplar means "give me another one like x." When a 2½-year-old's comprehension of *same* and *different* is tested with more specific requests, e.g. "give me one that's the same color as this bead" or "give me one that's a different color than this bead," they no longer behave the same way to both requests. Indeed, they behave as if they understand perfectly well that *same* and *different* mean different things. When asked the same-different

questions in the original form posed by Donaldson & Wales, they treat the two terms in a similar fashion, but now it seems because they, like adults, interpret words in context.

Lest I give the impression that the young child's tendency to interpret instructions in context is the same as the adult's, it is important to counter such a claim. Actually, it is beginning to emerge that the young child is more inclined to depend on context than adults. Over and over again one reads the need to exercise caution in designing the context of an experiment and instructions therein to be sure that the context matches what is implied by the questions and experimental design. Indeed, all that I have said in this section could be so interpreted. And then there are the various experiments that show a systematic effect of varying the context on what the child will say or how he will behave (e.g. 45, 76, 95, 107, 149). See Erickson & Shultz (35) for a related argument. The question for further research is: What contributes to the ability to stand back from the immediate pull of a context? Older children and adults clearly resist this pull better than preschoolers.

There is yet another issue, one that is difficult to categorize or even label appropriately. I speak of the problem of engaging the child in the task at hand. Surely most readers are now familiar with what was said by Adam (one of the subjects in Roger Brown's study of language acquisition) in response to a question designed to test Adam's linguistic prowess. And surely most readers would like to be able to penetrate beyond Adam's tendency to say "Pop go weasel," instead of repeating a model's sentence. The problem is how to do so. Lloyd & Donaldson (84) suggest that young children are more likely to respond in a way that reflects what they really think if they have to answer to someone less able than themselves. On this assumption, children's true/false judgments were elicited by a "talking" panda bear. Lloyd & Donaldson do not mention failure to elicit similar data with an adult as questioner. Yet I assume that they moved to the panda because of such an earlier failure. At least, this assumption squares with the steps that led me and my students to a similar method. Merry Bullock discovered that she could render an uncooperative 2-year-old most cooperative if she engaged the child in a three-way conversation with herself and a puppet. We too had the sense that the use of a puppet had the effect of making the child think he was more knowledgeable than the puppet. And this in turn led us to give young children the clear impression that we too were unsure of what constituted an answer. This is readily done by simply telling the child that we do not know and need help. I suspect that there is more to the story as to why such status mitigating devices work to engage the young child. First, 5-year-old children appear to treat them with a somewhat jaundiced view. One has the impression of a 5-year-old thinking how silly that adult is in carrying on a conversation with a puppet—although this is not always the case. Secondly, young children will tell their parents what they know (51). So at the very least there is a factor of learning about the situations in which a strange adult can be given such information. If the very young child talks readily to a doll or a puppet who says novel things, it may be because he typically "converses" with such playmates.

It would help us in our search for the nature of early cognitive development if we had more insight into the many subtle factors that influence a child's willingness to talk about what he knows. The young child who makes distinctions about those who are and are not knowledgeable and those who are and are not appropriate audiences for them is already a child who shows some evidence of understanding perspectives. As we uncover tasks that engage the young child so as to make it possible for one to test him, we simultaneously learn something of the young child's representation of the world around him. Likewise we gain insight into the nature of the difficulties the young child has. Bullock & Gelman's follow-up study does more than reveal an ability of 2½-year-olds to make more-less judgments in the numerical domain. It also suggests that part of cognitive development involves learning when to transfer (cf 3). A similar argument motivates the design of cross-cultural studies of cognition conducted by Cole and his associates (29, 30), who convincingly contend that we will best understand what is common between and what distinguishes the thought processes of different cultures as we uncover the task and context variables that block success, where success is defined from the experimenter's point of view. It is not just a matter of methodological concern that should motivate the search for the answer as to what constitutes the child's definition of the experimenter's "game." When we know how to ask the questions, design the tasks, and engage the preschooler, we will know much more about the nature of early cognitive development.

CONCLUSION: WHY STUDY EARLY COGNITIVE DEVELOPMENT?

I began with the suggestion that it is a good thing that many in the field of cognitive development have moved to investigate what the preschooler can do as well as what he cannot do. Why? Recall that the traditional account of how the younger child differed from his older cohort was given in terms of capacity the *younger child lacked.* My objection to this is based on many considerations. First, the characterization of the child's cognitive structure in terms of what it lacks derives in most cases from a very limited experimental investigation of a particular ability. The characterization, for example, of the child as lacking number-invariance rules rested on the child's ability to perform satisfactorily on a single task, the number-conservation task. This task is certainly a test for the presence of number-invariance rules. It is difficult to imagine how a child could pass without such rules. But a failure to pass this test cannot *by itself* be taken as proof that the child lacks number-invariance rules. Failure on a single test should not be accepted as proof of the null hypothesis. Any nontrivial cognitive structure will by definition play a role in a variety of contents. Thus our first misgiving about the traditional view is methodological in nature. The child is said to lack cognitive principles of broad significance simply because he fails a particular task involving these principles.

Our second concern is with the nature of theorizing that flows from inadequately supported assumptions about what the child lacks. Let us for the moment accept the view that the preschooler is cognitively inept. Such a view makes life difficult for the theorist who is interested in describing the process of cognitive growth from the preschool years through to middle childhood. For we are forced to work with all-or-none descriptive statements about cognitive development. This in effect means

we could be caught up in a never-ending guessing game of whence came a particular ability.

Then there is the fact that the focus on deficiencies belies the commitment to a developmental approach. Among those who call themselves developmentalists, I doubt there is anyone who has not been asked to defend the developmental approach. The typical answers involve the view that we will not understand the end product unless we watch its evolution. Indeed, some argue, our understanding of the end product might be altered if we knew its developmental course. It seems inconsistent to argue on these grounds for research comparing children and adults while ignoring the need to compare preschoolers and school-aged children.

Finally, I contend that the decision as to which of the many potential relationships holds between the development of a particular capacity from one point in time to another rests ultimately with the data. Above I summarize the evidence against the view that the disappearance of egocentrism is yoked to the emergence of logico-mathematical abilities. The account of the acquisition of number concepts may very well require a stage theoretic framework. But it begins to look as if the account of communication skills will not. Indeed, as I see the recent findings on what preschoolers can do, it becomes difficult to hold to any theory that links all of the cognitive advances of middle childhood to one grand theory.

I end with one caution about interpreting the evidence summarized in this review. Yes, there are conditions under which young children reveal some capacities they were thought to lack. Yet it still is true that they fail the many traditional tasks we use. The question is, why do they succeed in some cases but not others? Why is a particular capacity so fragile? To answer this most important question we will need to make more extensive use of research designs that compare *and* contrast rather than merely compare *or* contrast.

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