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# *Children's Minds*

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## *The Ability to “Decenter”*

*I spent that first day picking holes in paper, then went home in a smoldering temper.*

*“What’s the matter, Love? Didn’t he like it at school, then?”*

*“They never gave me the present.”*

*“Present? What present?”*

*“They said they’d give me a present.”*

*“Well, now, I’m sure they didn’t.”*

*“They did! They said: ‘You’re Laurie Lee, aren’t you? Well just you sit there for the present.’ I sat there all day but I never got it. I ain’t going back there again.”*

*(Laurie Lee)*

We laugh at this misunderstanding for at least two reasons: because of the shock that comes from the sudden recognition of ambiguity where normally we would see none; and because the child’s interpretation touches us by revealing the inadequacy of his expectations, the naïveté of his open and hopeful mind.

The obvious first way to look at this episode is to say that the child did not understand the adult. Yet it is clear on a very little reflection that the adult also failed, at a deeper level, in understanding the child—in placing himself imaginatively at the child’s point of view.

This is not to criticize the teacher who spoke these words to Laurie Lee. We cannot stop to reflect on every word we utter as we hurry through a day.

Nevertheless this teacher was behaving, however understandably, in a way that psychologists would call "egocentric." Used in this way, the word does not mean "selfish," but it does mean, in a precise sense, "self-centered." It refers to the act of looking out on the world from one's own position in it, literally or metaphorically, and failing to realize how the same world, seen from a different stance, would appear—or what meaning the same words, heard and interpreted by a different brain with a different store of previous knowledge and experience, would carry.

Laurie Lee did not know that school is not a place where one normally gets presents. The teacher did know this, and she forgot that he did not. She knew it so well that it probably never entered her head that anyone else might fail to know it. The better you know something, the more risk there is of behaving egocentrically in relation to your knowledge. Thus the greater the gap between teacher and learner the harder teaching becomes, in this respect at least.

Also, Laurie Lee probably had no knowledge at all of the other, idiomatic, adult meaning of the words "for the present." So he did not even have an alternative interpretation to consider. In this respect too the teacher forgot about the size of the gap between them. She acted from her own self-center. She failed to "decenter" and consider imaginatively what her words would be likely to mean to a small child.

We all have a very strong tendency to "act from the center" in this sort of way. Yet we are highly skilled at decentering also, otherwise communication would fail completely much more often than it does. If there were someone who was quite unable to take account of the point of view of another person, then he would be a very poor communicator. For a conversa-

tion to go smoothly, each participant needs to try to understand what the other knows already, does not know, needs to know for his purposes, wants to know for his pleasure.

It has been claimed that children under the age of six or seven are very bad at communicating, precisely for the reason that they are bad at decentering—or that they are highly "egocentric."

This claim has been made most forcibly by Jean Piaget, and it has been backed by much supporting evidence. He has made it central to his theorizing about the capacities of children in the preschool and early school years. He has constructed such a far-reaching and closely woven net of argument, binding together so many different features of the development of behavior, that it is hard to believe he could be wrong.

Yet there is now powerful evidence that in this respect he is wrong.

In recent years Piaget has collected most of his data by devising tasks for children to do and then observing their behavior when they deal with the task, questioning them about it, noting what they say. One of the best known of these tasks is concerned with the ability to take account of someone else's point of view in the literal sense—that is, to recognize what someone else will see who is looking at the same thing as oneself but from the other side.

For this task, a three-dimensional object or set of objects is needed. Piaget uses a model of three mountains. (See *The Child's Conception of Space* by Piaget and Inhelder.) The mountains are distinguished from one another by color and by such features as snow on one, a house on the top of another, a red cross at the summit of the third.

The child sits at one side of the table on which this model is

placed. The experimenter then produces a little doll and puts the doll at some other position around the table. The problem for the child is: what does the doll see?

It would clearly be hard for the child to give a verbal description ("He sees a house on top of the mountain on his right . . ." etc.) for that description would have to be of considerable complexity. So in one version of the task the child is given a set of ten pictures of the model taken from different angles, and he is asked to choose the one which shows what the doll sees. In another version he is given three cardboard "mountains" and he is asked to arrange them so that they represent what would be seen in a snapshot taken from the doll's position. Children up to the age of around eight, or even nine, cannot as a rule do this successfully; and there is a powerful tendency among children below the age of six or seven to choose the picture—or build the model—which represents their own point of view—exactly what they themselves see.

Piaget takes this to indicate that they are unable to "decenter" in imagination. He points out that in one sense they know perfectly well that the appearance of a thing changes when you walk around it. And yet he maintains that they are bound by what he calls "the egocentric illusion" as soon as they are called upon to form a mental representation of some view which they have not actually seen. They "really imagine that the doll's perspective is the same as their own" (p. 220). They all think the doll sees the mountains only as they look from the child's position. What the child lacks is held to be the ability to see his own momentary viewpoint as one of a set of possible viewpoints, and to coordinate these possibilities into a single coherent system, so that he understands the ways in which the different perspectives relate to one another.

We are urged by Piaget to believe that the child's behavior in this situation gives us a deep insight into the nature of his world. This world is held to be one that is composed largely of

"false absolutes." That is to say, the child does not appreciate that what he sees is relative to his own position; he takes it to represent absolute truth or reality—the world as it really is. Notice that this implies a world marked by extreme discontinuity. Any change in position means abrupt change in the world and a sharp break with the past. And indeed Piaget believes that this is how it is for the young child: that he lives in the state of the moment, not bothering himself with how things were just previously, with the relation of one state to those which come before or after it. His world is like a film run slowly, as Piaget says elsewhere.

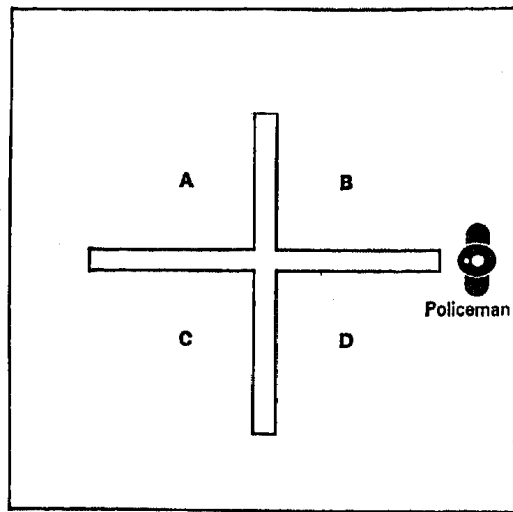
This is by no means to say that Piaget thinks the child has no memory of the earlier "stills." The issue for Piaget is how the momentary states are linked, or fail to be linked, in the child's mind. The issue is how well the child can deal conceptually with the transitions between them.

All this has far-reaching implications for the child's ability to think and reason, and we shall come back to these implications later. But first let us consider how children perform on a task which is in some ways very like the "mountains" task and in other extremely important ways very different.

This task was devised by Martin Hughes. In its simplest form, it makes use of two "walls" intersecting to form a cross, and two small dolls, representing respectively a policeman and a little boy. Seen from above, the layout (before the boy doll is put in position) appears on page 14.

In the studies which Hughes conducted the policeman was placed initially as in the diagram so that he could see the areas marked B and D, while the areas A and C were hidden from him by the wall.

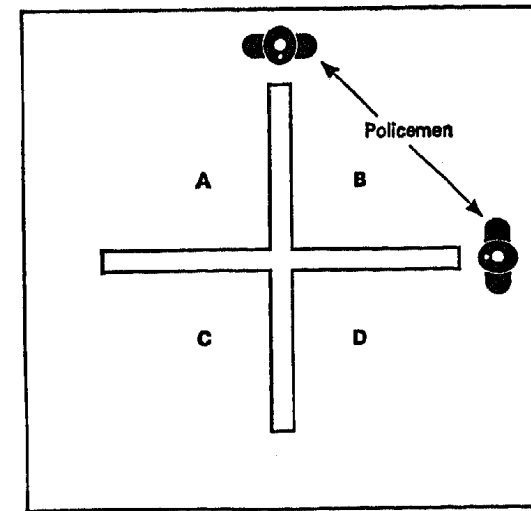
The child was then introduced to the task very carefully, in ways that were designed to give him every chance of understanding the situation fully and grasping what was being asked of him. First, Hughes put the boy doll in section A and



asked if the policeman could see the boy there. The question was repeated for sections B, C, and D in turn. Next the policeman was placed on the opposite side, facing the wall that divides A from C, and the child was asked to "hide the doll so that the policeman can't see him." If the child made any mistakes at these preliminary stages, his error was pointed out to him, and the question was repeated until the correct answer was given. But very few mistakes were made.

Then the test proper began. And now the task was made more complex. Another policeman was produced and the two were positioned as shown on page 15.

The child was told to hide the boy from both policemen, a result which could only be achieved by the consideration and coordination of two different points of view. This was repeated three times, so that each time a different section was left as the only hiding place.



The results were dramatic. When thirty children between the ages of three-and-a-half and five years were given this task, 90 per cent of their responses were correct. And even the ten youngest children, whose average age was only three years nine months, achieved a success rate of 88 per cent.

Hughes then went on to further trials, using more complex arrangements of walls, with as many as five or six sections, and introducing a third policeman. The three-year-olds had more trouble with this, but they still got over 60 per cent of the trials correct. The four-year-olds could still succeed at the 90-per-cent level.

It seems to be impossible to reconcile these findings with Piaget's claim that children under the age of seven are very bad at appreciating the point of view of some other person in the literal sense of being unable to figure out what that other person can see. However, though Hughes' findings cannot be

reconciled with Piaget's *claim*, some way must be found of reconciling them with Piaget's *findings*—for these are not suspect. Research by other investigators has fully confirmed that, if children are given the Piaget "mountains" task, they do indeed have extreme difficulty with it—but not, it now seems, for the reason Piaget suggests. For what reason, then?

One must obviously consider the differences between the two tasks—and these are many. One difference which Hughes noted is that the "policemen" task, while it certainly involves the coordination of points of view, merely requires the child to figure out whether an object will be visible and does not require him to deal with left-right reversals and so on. That is, he must decide *what* can be seen but not exactly *how* it will appear. Now it is perfectly clear that the calculation of how something will look from a given position when the scene is fairly complex will give pause to many an adult. But this hardly seems to explain why young children, in tackling the "mountains" task, so frequently choose their own point of view instead of a different, though wrong, one. When this fact is considered along with Hughes' findings, it is difficult to avoid the conclusion that the children who make "egocentric" responses to the "mountains" problem do not fully understand what they are supposed to do.\*

By contrast it is quite evident that, in the "policemen" problem, a situation has been found which *makes sense* to the child. Hughes was very careful about introducing the tasks in ways that would help the children to understand the nature of the problem, but in fact his precautions were largely unnecessary: the children seemed to grasp the situation at once. We have then to ask why this was so easy for them.

\* In another study, Hughes used a simplified version of the "mountains" task and found that it was possible, by taking great care over the way in which the problem was introduced, to get a high proportion of correct responses from preschool children. So this lends further support to the view that Piaget's subjects did not understand.

Notice that we cannot appeal to direct actual experience: few, if any, of these children had ever tried to hide from a policeman. But we *can* appeal to the generalization of experience: they know what it is to try to hide. Also they know what it is to be naughty and to want to evade the consequences. So they can easily conceive that a boy might want to hide from a policeman if he had been a bad boy; for in this case it would be the job of the policeman to catch him and the consequences of being caught would be undesirable.

The point is that the *motives* and *intentions* of the characters are entirely comprehensible, even to a child of three. The task requires the child to act in ways which are in line with certain very basic human purposes and interactions (escape and pursuit)—it makes *human sense*. Thus it is not at all hard to convey to the child what he is supposed to do: he apprehends it instantly. It then turns out that neither is it hard for him to do it. In other words, in this context he shows none of the difficulty in "decentering" which Piaget ascribes to him.

In respect of being humanly comprehensible, the "mountains" task is at the opposite extreme. Within this task itself, there is no play of interpersonal motives of such a kind as to make it instantly intelligible. (There is the question of the experimenter's motives in asking the child to do it and of the child's motives in responding, but that is quite another matter.)

Thus the "mountains" task is *abstract* in a psychologically very important sense: in the sense that it is abstracted from all basic human purposes and feelings and endeavors. It is totally cold-blooded. In the veins of three-year-olds, the blood still runs warm.

This is in no way meant to suggest that the ability to deal, in cold blood, with problems of an abstract and formal nature is

unimportant. It is immensely important. Much that is distinctively human and highly to be valued depends upon it. And young children are bad at it.

The more highly one values this activity the more important it then becomes to try to understand the true nature of the difficulty to which it gives rise. For the better we understand this, the more readily we should be able to help children to overcome it.

One obstacle that stands in the way of better understanding is that those who study such topics are, for the most part, accustomed to abstract and formal modes of thought to the point where they find it hard to appreciate that degrees of abstractness which present no kind of difficulty to them may render a task senseless and bewildering to a child. In other words, the research worker, like Laurie Lee's teacher, may often fail to decenter.

It may seem now that we have reached the curious position of claiming (a) that children are not egocentric, and (b) that sophisticated adults are. Not so, however. What is being claimed is that we are all egocentric through the whole of our lives in some situations and very well able to decenter in others. Piaget would not disagree with the claim that egocentrism is never wholly overcome. The dispute with him is only about the extent—and the developmental significance—of egocentrism in early childhood. I want to argue that the difference between child and adult in this respect is less than he supposes; and then to argue further that the critical differences lie elsewhere.

In the course of trying to reconcile Hughes' findings with Piaget's I suggested that Hughes' task is easy for the child to grasp because it makes human sense. It rests on an understanding of the interaction of two complementary intentions of

a very basic kind: the intention to escape and the intention to pursue and capture. Now it is worth observing that the appreciation of such a complementary pair of intentions, however simple and elementary, calls already for an ability to decenter that is not concerned with the literal understanding of another point of view: not with what another person *sees* from a given standpoint, but with what he is feeling or planning to do. Hughes' task, though designed primarily to test the former, also rests upon the latter. And what I have been suggesting is that the latter is a very fundamental human skill.

The question of the origins of this skill takes us right back to infancy, at which time Piaget believes that the most profound egocentrism reigns. He holds that initially the child is not capable of making any distinction between himself and what is not himself, that he cannot draw the boundary which later, most of the time, is so obvious and so firm.

This is a degree or two more extreme than simply attributing to the rest of existence your own point of view; for if you deny existence to the rest of existence you evidently deny it any point of view at all. But by the same token you deny it to yourself. The whole notion of "point of view" ceases to apply.

Piaget calls this early egocentrism "*complete and unconscious*" (my italics). If the child is in this state then he is not aware of himself, any more than he is aware of other people and things. Awareness grows as differentiation grows.

It is quite reasonable to wonder how Piaget or anyone else knows what a very young infant is aware of. Certainly the infant cannot tell us directly. So the only possibility is to try to make inferences from the way he behaves.

The central piece of evidence from which Piaget argues is this: if you let a child of five or six months play with a small toy and you then cover the toy with a box or a cloth while the child is watching you, the child will most commonly make no attempt to lift the cover and get at the toy again. This will be true

even if the child has shown much interest in the toy and even if you know from other evidence that his control of hand and arm movements is quite good enough for him to manage the reaching and grasping that would be needed.

So why does he not do his best to get the toy back again? Piaget argues that he does not do this for the interesting reason that the toy has ceased to exist for him: at this stage out of sight really *is* out of mind.

An adult normally thinks of the world as a place where objects endure in their own right, whether or not he sees them. Their existence is independent of his. Some philosophers have questioned this notion and its bases, but for most of us, most of the time, it is a quite unchallenged assumption, continually guiding our behavior. If we see a box being placed over an object, we know that the object is still there. If someone were to take away the box and show us that the object had vanished, we would be considerably surprised and we would have to invoke trickery or magic.

So if a child does not believe that the object is still there inside the box, if he has not developed what has come to be called the "object concept," then his notion of the world must be very different from our own. But so it would be if he had not distinguished himself from the rest of the universe. You cannot think of a universe of stable enduring things, moving around in space and time, unless you have made the critical distinction between self and not-self by which you award the things their independence—and at the same time achieve your own.

Thus Piaget uses the child's failure to search for a vanished object as evidence for a state of profound early egocentrism. And at first sight it seems like strong evidence indeed. But there are various difficulties for his conclusion, and a substantial one is this: if the reason why the child does not search is, because he totally lacks the concept of the permanence of ob-

jects, then the precise way in which an object is made to vanish from his sight should not make any difference to his response. If the world for him is just a series of pictures that come and go (which is what the lack of the object concept would seem to imply), then, no matter what causes the object to vanish, the child will not try to get it back. However, this does not appear to be true. The manner of disappearance does matter.

One way of causing an object to disappear from human eyes is to remove all light from it. And it is possible with modern infrared television cameras to photograph events that occur in total darkness. So an object can be made to vanish simply by switching off the lights in a blacked-out room, and the child's behavior can then still be observed. This experiment has been carried out by Tom Bower and Jennifer Wishart, and they report that in these circumstances children quickly reach out in the appropriate direction to find their toy again. Thus Piaget's claims about egocentrism are once again challenged.

In this instance, there is still a good deal of debate about what the right explanation will finally prove to be, and there is much ongoing research. But Bower offers an interesting and well-supported account which proposes that it is with the notions of location and movement that the child's initial difficulties lie. (See *A Primer of Infant Development*.) On this view of the matter, what the young infant lacks is the knowledge that objects *move* and that this fact makes it possible for the same object to appear in different places or for different objects to appear in the same place, either one after the other or one inside the other. But by the age of five months, some notion of movement is present and the understanding that object X can go from place A to place B is established. Thereafter the child continues to have many difficulties of the kind Piaget describes, but they arise from the fact that he has yet to develop a full appreciation of spatial relations such as *on*, *in*, *in*

front of, and behind.\* They do not derive from the complete lack of a notion of a world of "other things."

Among the "other things" in the universe, there is one group specially important for a human baby, whether or not he is aware of the fact, and that is the group of other persons. Now one consequence of a belief in profound early egocentrism has to be the belief that the baby is quite unaware of the special significance of other people. And he certainly must be incapable of genuinely social behavior—incapable of any response to persons as persons, of any communication with them, of any apprehension of their intentions. The overwhelming impression which the adult gets of being in touch, humanly speaking, with the baby must be illusory.

Piaget goes so far as to allow that, by seven or eight months, the child does show by the very look on his face that people keenly interest him. But to be consistent Piaget must go on, as indeed he does go on, to say that in the child's mind there is still no contrast in principle between another person and the rest of the universe. (See *The Child's Construction of Reality*.)

If, on the other hand, we do not accept that the baby is wholly bound in egocentrism, we are free to allow that his interest in other people is as genuine as it appears to be, and that some kinds of personal interaction are at least possible at an early stage: that some sort of genuine two-way communication may be going on. But is it? There is a certain risk here of believing something because we want to believe it. It is emotionally more satisfying for most adults to think that the young baby who smiles at them is already a person than to think that the smiles and gestures and vocalizings are largely reflexive, that they are merely blind behavior patterns devoid

\*We are not talking here about the understanding of these words, but of the relationships to which they refer.

of personal meaning. So there is need for caution. Yet many workers who have closely observed the interactions of mothers and young babies are now convinced that the impression of personal response from a baby is by no means illusory and that communicative strivings begin within the first few months of life. Thus Jerome Bruner presents evidence which supports the view that adult and infant can very soon come to a sharing of attention and a communication of intention, and he takes this early "mutuality" to be the essential starting point for the learning of language. (See "The ontogenesis of speech acts.") Kindred findings and arguments come from Colwyn Trevarthen, who claims that evidence from films of more than 100 exchanges between mothers and their infants of two or three months of age forces us to conclude that a complex form of mutual understanding develops even at this age. Trevarthen believes that this kind of early interpersonal responsiveness is the source from which the whole of human intelligence springs.

Certainly, once the child begins to speak, the existence of communicative strivings cannot be doubted; and it would appear to ordinary observation as if the capacity for mutual exchange develops very rapidly thereafter. Yet even here the question of egocentrism arises.

Start again here:

It was indeed in the course of discussing his observations of the speech of preschool children that Piaget first proposed egocentrism as an explanatory concept, claiming that much of the time when the young child speaks he "does not attempt to place himself at the point of view of his hearer." (See *The Language and Thought of the Child*.)

Once again, however, later work has made it necessary to call in question not the claim that the child sometimes fails to do this, but certainly any suggestion that he cannot. Michael Maratsos reports a study in which young children were asked to communicate about a set of toys to an adult who was either

herself looking at the toys or who had closed her eyes and covered them with her hand. (Actually she was cheating by peeping through!) The task for the child was to let the adult know which toy was to be put in a car that was then to be run down a hill; and sometimes—for instance, when there were two identical objects in different positions—this put a considerable strain on the children's linguistic resources. It was not easy for them to produce descriptions like: "the one that is nearest to the car." So, very reasonably, when the adult could see, the children for the most part dealt with such problems simply by pointing. But when they believed she could not see, they tried to give verbal descriptions even though they could not manage these well. As Maratsos puts it, they showed high sensitivity to the listener's state. Maratsos explains the fact that some other investigators have not reported so much sensitivity of this kind in young children by pointing out that he himself used a very simple task—one which the children could readily understand.

Peter Lloyd, in a study that raised the same kind of issue, used a task involving a talking toy panda, presented to the children as a creature who "could not speak very well" and who would therefore need their help when he tried to communicate. (The panda's voice actually came from an adult hidden in a soundproof cubicle with a one-way vision screen.) The children gave help with obvious pleasure and most of them showed themselves to be sensitive to the panda's incompetence, making allowance for it in their dealings with him.

Lloyd found that, though the children would try to help the panda, they were not so ready to signal when they themselves needed help. They were not given to indicating that a message which they had received was inadequate. They did not often spontaneously ask for more information. But many of them proved to be able to do this quite competently if they were explicitly encouraged to tell the panda whenever he did not say

enough. All in all, there was little indication of the existence of egocentrism as a serious barrier to communication.

The general conclusion seems unavoidable: preschool children are not nearly so limited in their ability to "decenter," or appreciate someone else's point of view, as Piaget has for many years maintained.

The abandonment of belief in pronounced childhood egocentrism has far-reaching implications. But its significance will be better understood if it is seen in the light of recent evidence and arguments about the ways in which children learn to use and understand language. So it is to a consideration of this that we now turn.

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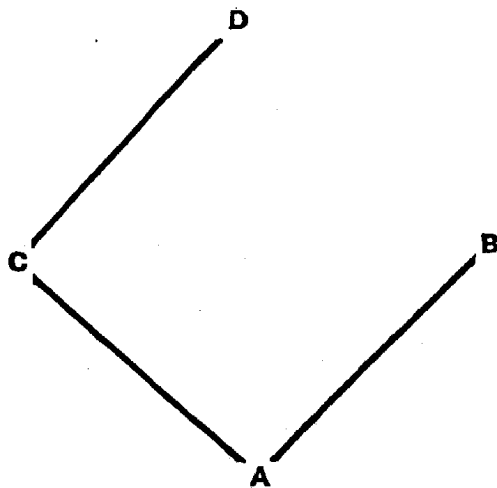
*What Is and What Must Be*

Piaget has not been alone in claiming that young children are incapable of inferences which, to an adult, seem elementary. From a type of psychological theory utterly opposed to his own, precisely the same conclusion has been drawn. One of the most eminent of the associationist—or behaviorist—psychologists, Clark Hull, claimed that the essence of reasoning lies in the putting together of two “behavior segments” in some novel way, never actually performed before, so as to reach a goal. Serious objections can be raised to this way of defining reasoning but let us accept it for the moment and look at what happens if we study children’s thinking in a way guided by the Hullian conception.

When Hull spoke of the joining of two “behavior segments” he spoke against a background of studies of rats learning to run mazes—studies of a kind so popular with the behaviorists. A “behavior segment” was then exemplified by the running from one point in the maze to another.

The claim was as follows. Suppose you arrange the maze as in the diagram on page 48. Now suppose that a rat learns to run from A to B to get a small reward; and from A to C to get an equally small reward; and from C to D to get a much bigger reward (all of these bits of learning taking place on separate

occasions). If you then place him at Point A and he chooses the path  $A \rightarrow C \rightarrow D$ , instead of the path  $A \rightarrow B$ , he must be *reasoning* that you can get to D that way, for he has never actually *been* from A to D that way before.



Of course, there is a 50/50 chance of taking that road randomly, with no reasoning at all. But if a large number of rats were all to take it, that would be evidence of rodent reasoning.

In fact this evidence has not been obtained. Rats don't, apparently, figure things out in this way.

More strangely, evidence has been obtained which makes it look as if children under the age of seven don't either.

Two followers of Clark Hull, Howard and Tracy Kendler, devised a test for children that was explicitly based on Hullian principles. However, it did not involve running a maze. Instead the children were given the task of learning to operate a machine so as to get a toy. In order to succeed they had to go through a two-stage maze. The stages consisted merely of pressing the correct one of two buttons to get a marble; and of inserting a marble into a small hole to release the toy.

The Kendlers found that the children could learn the separate bits readily enough. Given the task of getting a marble by

pressing the button they could get the marble; given the task of getting a toy when a marble was handed to them, they could use the marble. (All they had to do was put it in a hole.) But they do not for the most part "integrate," to use the Kendlers' terminology. They did not press the button to get the marble and then proceed without further help to use the marble to get the toy. So the Kendlers concluded that they were incapable, like the rats, of deductive reasoning. This work was done in the 1960s. No wonder Chomsky could so readily convince people of the need to postulate a highly specific device for the acquisition of language.

On the other hand, the Kendlers' results are bound to seem deeply puzzling to anyone who has watched children playing in a nursery or listened to their conversation, and who really brings the two kinds of data together in his mind.

Here is a striking example of the kind of reasoning of which children seem to be capable if one observes their spontaneous behavior, by contrast with their behavior when they are being tested.

This exchange happened to be tape-recorded, so it can be quoted very accurately. It took place shortly after the death of Donald Campbell when he was trying to break the world water speed record, and some months after a visit by a research worker called Robin Campbell to the school where the conversation took place. The speakers were a little girl of five and another research worker.

CHILD: "Is that Mr. Campbell who came here—*dead*?" (Dramatic stress on the word 'dead'.)

RESEARCH WORKER: "No, I'm quite sure he isn't dead."  
(Much surprised.)

CHILD: "Well, there must be two Mr. Campbells then, because Mr. Campbell's dead, under the water."

This child has put together, if not two "behavior segments," two quite distinct pieces of information: *Mr. Campbell who*

came here is not dead and Mr. Campbell is dead, and has drawn a valid conclusion, which she states as a necessary consequence: "... there must be two Mr. Campbells then ...". Her reasoning involves the understanding that the existence of a living person is incompatible with the death of that same person. So if Mr. Campbell is dead and Mr. Campbell is alive, there simply must be two of them!

How can it be that children of five are capable of reasoning like this, yet can fail to "integrate" two very simple bits of separately learned behavior in a task such as the Kendlers used?

The mystery at first appears to deepen when we learn, from Michael Cole and his colleagues, that adults in an African culture apparently cannot do the Kendlers' task either. But it lessens, on the other hand, when we learn that a task was devised which was strictly analogous to the Kendlers' one but much easier for the African adults to handle.

Instead of the button-pressing machine, Cole used a locked box and two differently colored matchboxes, one of which contained a key that would open the box. Notice that there are still two behavior segments ("open the right matchbox to get the key" and "use the key to open the box") so the task seems formally to be the same. But psychologically it is quite different. Now the subject is dealing not with a strange machine but with familiar meaningful objects; and it is clear to him what he is meant to do. It then turns out that the difficulty of "integration" is greatly reduced.

Recent work by Simon Hewson is of great interest here for it shows that, for young children too, the difficulty lies not in the inferential processes which the task demands, but in certain perplexing features of the apparatus and the procedure. When these are changed in ways which do not at all affect the inferential nature of the problem, then five-year-old children solve the problem as well as college students did in the Kendlers' own experiments.

Hewson made two crucial changes. First, he replaced the button-pressing mechanism in the side panels by drawers in these panels which the child could open and shut. This took away the mystery from the first stage of training. Then he helped the child to understand that there was no 'magic' about the specific marble which, during the second stage of training, the experimenter handed to him so that he could pop it in the hole and get the reward. A child understands nothing, after all, about how a marble put into a hole can open a little door. How is he to know that any other marble of similar size will do just as well? Yet he must assume this if he is to solve the problem. Hewson made the functional equivalence of different marbles clear by playing a 'swapping game' with the children.

These two modifications together produced a jump in success rates from 30 per cent to 90 per cent for four-year-olds. For three-year-olds, for reasons that are still in need of clarification, no improvement—rather a slight drop in performance—resulted from the change.

We may conclude, then, that children experience very real difficulty when faced with the Kendler apparatus; but this difficulty cannot be taken as proof that they are incapable of deductive reasoning.

With this conclusion in mind, let us see now how children behave in a very different type of situation.

It is highly informative to listen to the comments children make and the questions they ask when they listen to stories. In this situation a rich harvest of evidence of reasoning may be reaped.

Here are a few examples:

"What a lot of things he's taking! He wouldn't have . . . he's only got two hands and he wouldn't have space for his two hands to carry all these things."

Margaret Donaldson

(Premises: 1. Peter has more to carry than two hands can carry; 2. Peter has only two hands. Conclusion: It is not possible for Peter to carry all that he is represented as carrying. Implied criticism of the story.)

"She must have eaten all her food on the other day."

(Premises: 1. Houses normally have food in them; 2. This house has no food. Conclusion: The food must have been all eaten up.)

"But how can it be [that they are getting married]? You have to have a man too." (The book contains an illustration of a wedding in which the man looks rather like a woman. The child thinks it is a picture of two women.)

(Premises: 1. You need a man for a wedding; 2. There is no man in the picture. Conclusion: It can't be a wedding.)

"I think you have missed a page. You didn't say that he cut out the leather."

(Premises: 1. There is a page on which the story tells of cutting out leather; 2. No reference has been made to cutting out leather. Conclusion: A page has been missed.)

CHILD: "You're not looking."

TEACHER: "Pardon?"

CHILD: "Why are you not reading it?"

TEACHER: "Because I know it."

(Premises: 1. When you read a book you look at it; 2. The teacher is not looking at the book. Conclusion: She is not reading the book.)

It is impossible to take account of this evidence and at the same time to maintain that children under the age of six or seven are incapable of reasoning deductively. So if sometimes—as in certain experimental situations—they do not ap-

pear to reason deductively, we must look more closely at what is happening. If we cannot get children to reason when we contrive experiments, whereas we can observe them reasoning spontaneously, then we must ask why.

It turns out, however, that in spite of the findings of Piaget and the Kendlers and some others, it is not impossible to get children to reason in the contrived circumstances of an experiment. It is harder but it is not impossible.

Barbara Wallington conducted a series of experiments where the task was to find a toy in one—or more than one—of a set of boxes which might or might not have stars on the lids. She designed her studies with great care and a desire to give children every chance to grasp what it was that she wanted to them. The results were revealing.

The children were given information which they could use to guide their search. For instance, they might be told: "If there is a star on the box, then there is a wee animal in the box," or: "If there is no star, then there is a wee animal in the box." After hearing a statement of this kind, they were asked to predict which boxes would contain a toy and to check whether they were right.

The pattern of the children's choices and the nature of their answers when they were asked why they had made the choices showed very clearly that many of them were engaging in processes of strict reasoning in the sense that they were using the experimenter's statement as a basis from which to deduce conclusions. They very rarely drew all the conclusions which would be judged correct by the canons of traditional formal logic—but neither did a group of adults to whom the same task was given. The older children (and "older" in this case means between four years three months and four years eleven months) frequently responded in just the same way as the adults, taking "if there is a star . . ." to mean "if *and only if* there is a star . . ." and reasoning accordingly. Some of the children were also able to give explanations very like those of

the adults, using such expressions as: *it must be, it has to be*. Here are two examples, by way of illustration: "When there's no star, there's supposed to be a wee animal in the box." "It must be in there [box with no star] if it's not in there [starred box]." In this last case the given statement had been: "If there is a star, then there is no wee animal."

Notice that these justifications were made after the children had indicated which boxes they were choosing but before they had been allowed to open them.

From children under four years, such responses as these were relatively uncommon. But even the youngest children did not behave randomly. They tended to have systematic search strategies, even if these were as primitive and unrelated to the experimenter's words as starting with a box at one end and working along the row.

Further evidence that, even in experimental situations, children can sometimes give proof of their ability to reason is now being obtained. Peter Bryant and Paul Harris have each independently looked at the child's ability to engage in the kind of inference which is concerned with transitive relations such as "equal to" or "greater than." (This is yet another form of inference which Piaget regards as criterial for operational thought and which, therefore, according to his theory, is not normally to be found in children under age seven.) To illustrate the findings of Bryant and of Harris we shall look at two studies—one by each of them—on the child's ability to compare the size of two objects by means of some intermediary—which means in effect that the intermediary is serving as a measuring instrument.

Harris and his colleagues showed four-year-old children two strips of paper placed about three feet apart. The strips differed by about a quarter of an inch—too small a difference to be perceptible. Thus when the children were asked which strip was longer, approximately half their judgments were

correct, this being, of course, the result that would be expected by chance alone. Then a third strip of paper, equal in length to one of the other two, was produced; and it was briefly placed alongside each of the others in turn. The question was then repeated. And now most of the children gave the correct answer. This seems to show clearly that they were capable of understanding measurement, which is to say that they were able to make inferences of the form: if A equals B and if B is longer than C, then A must be longer than C.

Bryant and Kopytynska have reached conclusions similar to those of Harris about the ability of young children to make measurements. They used simple but ingenious equipment to show that, though young children often do not spontaneously measure things which they can compare visually, they do frequently use a measuring instrument when visual comparison is impossible. They gave their subjects two black wooden blocks, each with a hole in it, and asked them to find out whether one of the holes was deeper than the other. It was quite impossible to see the bottom of the holes. Between the two blocks, the experimenters had placed a wooden stick which the child could use as a measuring instrument if he chose to do so. Even in conditions where no mention of the stick was made, many children used the stick as a means of solving the problem.

Let us take stock. From the evidence we have been considering, the main points to emerge are these:

1. Children are not at any stage as egocentric as Piaget has claimed. For all human beings, the taking of another point of view requires a certain effort, and the difficulty is bound to vary from one situation to another in many complex ways. But

the gap between children and adults is not so great in this respect as has recently been widely believed.

2. Children are not so limited in ability to reason deductively as Piaget—and others—have claimed. This ability shows itself most markedly in some aspects of their spontaneous behavior—and we have seen that it reveals itself with great clarity in the comments they make while listening to stories. But it can be demonstrated also in the contrived situation of an experiment from about the age of four, if not sooner, even though many experiments have failed to elicit it. At least from age four, then, we must again acknowledge that the supposed gap between children and adults is less than many people have claimed.

3. A child's ability to learn language is indeed something at which we may wonder. But his language-learning skills are not isolated from the rest of his mental growth. There is no reason to suppose that he is born with an "acquisition device" which enables him to structure and make sense of the language he hears while failing to structure and make sense of the other features of his environment. On the contrary it now looks as though he first makes sense of situations (and perhaps especially those involving human intention) and then uses *this* kind of understanding to help him to make sense of what is said to him.

It appears, then, that the theories about the growth of language and thinking which have been most influential over recent years are, in important respects, ill-founded. This does *not* mean that these theories are wrong in their entirety.

Nor should we conclude that, because children turn out to be in some respects closer to adults than has been supposed, they are really just like them after all. It may simply be that we have to look for the differences elsewhere.