EGOCENTRISM IN PRESCHOOL CHILDREN.

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I hereby declare that this thesis has been composed entirely by myself and that the work reported here is my own.

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Contents

Abstract

This thesis is primarily an investigation of Piaget's claim that preschool children are egocentric, in the particular sense of being unable to calculate what another person can see (Piaget and Inhelder, 1956).

Chapter 1 outlines the general theoretical background to this investigation. It is argued that there is a conflict between Piaget's claim that young children are egocentric, or unable to take another person's point of view, and the idea, stemming from Dewey and Mead, that young children are from an early age involved in communication situations which require them to take another person's point of view. A historical review is presented of each of these two positions, and some specific areas of conflict are outlined.

Chapter 2 focuses on the specific ability of calculating what another person can see, and suggests that the preschool child's early interactions contain sequences in which this ability may be required. Two main kinds of sequence are considered: those involving reference, or the joint focusing of visual attention on features of the immediate environment, and those involving clearance, or the use of visual attention in initiating interactions. The evidence for the occurrence of these sequences is discussed.

Chapter 3 considers various experimental studies of the child's ability to calculate what another person can see in terms of the distinction between projective abilities (which involve merely calculating what another person is looking at) and perspective abilities (which involve calculating how it looks to the other person). Virtually all these studies support the findings of Piaget and Inhelder's mountain

task and suggest that children below 8 years do not have complex perspective abilities. Moreover, Piaget and Inhelder argue that their findings imply that preschool children cannot have simple projective and perspective abilities. It is suggested that Piaget and Inhelder's arguments are inadequate, and that a fuller investigation of preschool children's competences in this area is required.

Chapter 4 reports eight experiments which investigate these competences. In general these experiments demonstrate that even children as young as 3 years have considerable abilities in both the projective and perspective areas. In the projective area, the results of Experiment 1 show that 3- and 4-year old children can construct the line of sight between two dolls, and are aware that blocking this line of sight means that one doll can no longer see the other. Moreover the results of Experiments 7 and 8 show that children as young as 3 years perform well on tasks requiring them to coordinate 2 or 3 lines of sight. In the perspective area the results of Experiments 4, 5 and 6 show that 3- and 4-year old children can construct another person's view of a group of 3 dolls, and that they do this by using a two stage inferential strategy. However they will only use this strategy in certain specified conditions. The results of Experiments 2 and 3 suggest that many 4-year olds can calculate another person's view of a cup when this involves transformations in the front/back dimension.

Chapter 5 summarises these findings and draws some general conclusions. Primarily, these experiments show that children as young as 3 years can calculate what another person can see, and in this respect preschool children are by no means as egocentric as Piaget has claimed.

Moreover these findings have implications for the more general area of cognitive development, in terms of how cognitive tasks are presented to children; the strategies children may use in solving such tasks; the kinds of inferences preschool children can make; and the importance of considering cognitive abilities in social situations.

Chapter 1. Introduction and General Theoretical Background

1. Introduction

This thesis is primarily an investigation of Piaget's claim that young children are egocentric or unable to take another person's point of view (e.g. Piaget 1926, 1928; Piaget and Inhelder 1956). It is particularly concerned with one aspect of egocentrism: the question of whether or not young children are able to calculate what another person can see.

In Piaget's theory it is claimed that children below 7 or 8 years are unable to calculate what another person can see. The main evidence for this comes from the well known "mountain task" (Piaget and Inhelder 1956). In this task the child is seated before a model of three mountains and a doll is placed at various positions around the model. In a typical version of the task the child is then shown several pictures of the mountains, taken from different viewpoints, and he is asked to select first the picture showing his own view and then the picture showing the doll's view. Piaget and Inhelder found that most children below 8 years could correctly select their own view, but few could select the doll's view. A typical response found with the younger children (below 6 years) was that when asked to select the doll's view they simply selected their own view again.

This result is generally held to be a classic example of egocentrism. Children below 8 years at least are, quite literally, unable to take another person's point of view. Moreover, children below 6 years do not even seem to be aware that the other person

has a point of view distinct from their own. They seem to believe that the other person sees exactly what they themselves see.

Piagetian theory, then, holds that young children are unable to calculate what another person can see. However, a different approach to this question suggests a rather different answer. Observations of young children in their naturally occurring social interactions suggest that situations frequently occur which may require them to be able to calculate what another person can see. We will briefly outline two main kinds of situation here; these will be considered in more detail in Chapter 2.

First, it seems that very young children (below 3 years) may actively engage in directing or following another person's direction of gaze in order to achieve a common focusing of visual attention on some particular object or event in the immediate environment. This common focus may be achieved for its own sake, or for naming or requesting the name of an object, or as a prelude to talking about the object. This process will be considered under the general heading of reference.

The second kind of situation occurs when interactions are initiated. It seems that slightly older children (3 to 5 years) frequently engage in quite complex sequences of behaviour when initiating interactions, and these sequences often involve attracting the other person's visual attention before proceeding with the interaction. This process, which is called clearance by Goffman (1963), occurs even when the topic of the interaction or conversation lies outside the immediate environment.

Both of these processes seem to require the young child to be able to calculate what another person can see. Clearly there is a conflict here between this alternative approach and Piaget's theory. This thesis is essentially an attempt to resolve the conflict between these two positions.

This particular conflict is part of a much wider theoretical conflict between Piaget's theory of egocentrism and the idea that young children are from an early age involved in situations which require them to take another person's point of view. For the rest of this chapter we will be concerned with this more general conflict. We will first give a historical review of Piaget's concept of egocentrism, and then consider some aspects of the alternative theoretical position. Finally we will outline some areas of conflict between the two positions and suggest possible ways in which particular issues may be resolved.

2. Piaget's concept of egocentrism

Piaget introduced the concept of egocentrism in his first two books (Piaget 1926, 1928). The main theme of both these books is that young children below 7 or 8 years are predominantly egocentric, or unable to take another person's point of view. This is illustrated by three studies in particular: those of egocentric speech, communication skills, and relational terms.

Piaget's investigation of egocentric speech was primarily an attempt to obtain an objective measure of the egocentrism of thought. He recorded the spontaneous speech of children in a free situation and divided it into two major categories, egocentric speech and socialised speech. Egocentric speech occurs either when the child is

alone or when "he does not attempt to place himself at the point of view of his hearer" (Piaget, 1926, p.9.). Socialised speech occurs when the child does adopt the point of view of his hearer. Piaget found that for his small group of subjects the coefficient of egocentrism (the proportion of egocentric speech to total speech) was around 40-60% between 3 and 6 years, and decreased rapidly around 7 or 8 years.

One major problem with this account of egocentric speech is that it is not clear exactly what is meant by "not attempting to place himself at the point of view of his hearer". Piaget offers several different explanations of egocentric speech and socialised speech, but they are all expressed in mentalistic terms with few behavioural criteria. For example, during egocentric speech the child

> "... seems on this occasion to want to make himself understood; but on closer examination it will be seen that he cares very little who is listening to him ... and furthermore, that he does not care whether the person he addresses has really heard him or not. He believes someone is listening to him; that is all he wants."
> (Piaget, 1926, p.8.).

and

> "... He talks either for himself or for the pleasure of associating anyone who happens to be there with the activity of the moment."
> (ibid, p.9.).

and

"He is not speaking to anyone. He talks aloud to himself in front of others."
(ibid, p.18.).

and

"The child talks about himself, except in those cases where he does so during collaboration with his hearer ... and except in cases of dialogue. Dialogue, in our view, occurs when the child who has been spoken to in a proposition answers by talking about something that was treated of in this proposition."
(ibid. p.21.).

On the other hand, during socialised speech,

" ... the child talks not at random, but to specified persons and with the object of making them listen and understand."
(ibid. p.8.).

and

" ... the child really exchanges his thoughts with others ..."
(ibid. p.10.).

and

" ... the child actually makes his hearer listen and contrives to influence him, i.e. to tell him something."
(ibid. p.19.).

Not surprisingly, a variety of different interpretations of the

of egocentric speech were made by Piaget's readers (see, for example, McCarthy 1954). Piaget later claimed (e.g. Piaget 1959, p.267; Piaget and Inhelder 1969, p.61) that these readers had simply misunderstood what was quite clear. The selection which we have just given from Piaget's original account shows that Piaget himself must take a fair share of the blame for the subsequent misunderstandings.

Piaget also devised communication tasks where children were first told a story, or given an explanation of a mechanism such as a tap or a syringe, and were then asked to repeat the story or explanation to another child. Piaget found that children below 7 or 8 years showed considerable inadequacy in communicating. One common form of this inadequacy was a lack of clarity of reference. The younger children frequently used personal pronouns or demonstratives without indicating what they referred to, and they often completely omitted to name characters in the stories or parts of the mechanisms. Piaget claimed that this was due directly to egocentrism. The young child is unable to differentiate his own view from the other's, and so he believes that the other child already knows what he is talking about. Consequently he does not take the trouble to make himself clear.

> "If children fail to understand one another, it is because they think they do understand one another. The explainer believes from the start that the reproducer will grasp everything, will almost know beforehand all that should be known, and will

> interpret every subtlety ... it is obviously owing to this mentality that children do not take the trouble to talk convinced as they are that the other person knows as much or more than they do, and that he will immediately understand what is the matter. This mentality does not contradict the egocentric mentality. Both arise from the same belief of the child, the belief that he is the centre of the universe."
> (ibid, p.101.).

This explanation seems a poor attempt to explain the results of the communication tasks. Indeed, if what Piaget says here is true, then why do children "take the trouble to talk" at all?. The children do not fail the tasks because they don't talk. They do talk, but they make characteristic errors, particularly of reference. Piaget's explanation is incapable of explaining why they talk at all, or why they make these particular errors.

As part of his investigation of the child's ability to handle relational concepts, Piaget (1928) directly tested the child's comprehension of the terms "brother" and "sister". A typical finding was that a boy below 7 or 8 years would know that he had a brother, but would not know that he himself was his brother's brother. Piaget argued that the child's egocentrism prevented him from seeing himself from his brother's point of view, and thus realising the reciprocal nature of the relationship.

Piaget reported similar results for the terms "left" and "right". Below 7 or 8 years the child can identify his own left

and right hands, but cannot correctly identify the right and left hands of a person sitting opposite him. This, Piaget claims, involves taking the point of view of the other person, and so is impossible for the egocentric child.

These three studies, of egocentric speech, communication skills, and relational terms, are for Piaget the paradigm cases of egocentrism. They are the clearest examples he gives of the young child's inability to take another person's point of view. All the same, he tries to relate all the other studies in these two volumes to egocentrism. The argument he uses is that the egocentric child is unable to take another person's point of view, and so feels no need either to justify his thinking to others or to compare his thought with theirs. The egocentric child is unable to see his thought as itself an object of thought and so he cannot see the subjective and self-contradictory elements in his own thinking. As a consequence his thought is illogical, dominated by personal schemes and visual analogies. These properties are described by such terms as syncretism, juxtaposition, precausality and intellectual realism, and are illustrated by the other studies in the two volumes[1].

A final example of egocentrism from Piaget's early works is given by his study of children's conceptions of the rules of marbles (Piaget 1932). Piaget found that children below about 7 years knew at most only a small part of the rules, and this often differed from the parts that the other participants knew. Nevertheless all would play together at their own variation of the game, each believing he was playing to the same rules as the others. There was little conception of winning and losing.

Piaget claimed that to play to the rules involves subjecting one's own interpretation of the game to the more objective point of view outlined by the rules. The child below 7 or 8 years, being egocentric, is unable to do this.

There have been three major developments in Piaget's concept of egocentrism since these early formulations. First, Piaget developed other concepts to describe the major changes which occur in the child's thinking around 7 or 8 years (e.g. the groupings, concrete operations, reversibility), and egocentrism became closely related to these other concepts. Secondly egocentrism, in connection with the notion of decentering, became a higher order concept and was applied throughout development. Thirdly Piaget attempted around 1960 to "clarify" his position on egocentric speech but in so doing contradicted his earlier account. These three developments will be considered in turn.

In the late 1930s and 1940s Piaget started to express the properties of the young child's thought in terms that were more logical and mathematical, replacing the informal descriptive terms he had previously used, such as syncretism and juxtaposition. The logical, organised thinking which emerges around 7 or 8 years became known as concrete operational thought, and the child below 7 or 8 years was referred to as preoperational. The concrete operations are internalised general actions performed on specific elements in the real world (hence concrete) which are coordinated into organised systems, the logico-mathematical structure of which is expressed by the groupings. The operations are essentially reversible, in that each operation necessarily implies the reverse

operation. (For more details see Piaget 1950, Inhelder and Piaget 1964, Piaget and Inhelder 1969).

Concrete operational thought is also connected with the concept of decentering. This has two main senses here. First, Piaget often states that concrete operational thought is decentered in the general sense of being objective rather than subjective (e.g. Piaget 1950 p.73, Piaget and Inhelder 1969 pp.94-5). This objectivity is ensured by its not being confined to one particular point of view; it involves the coordination of several points of view. Here decentered thought is being directly contrasted with egocentrism. What is decentered is the whole cognitive system, and what it is decentered from is the personal viewpoint or ego.

In another sense, the decentering of concrete operational thought is connected with specific acts of attention and perception. Here it is directly contrasted with the notion of centering. The preoperational child tends to center or focus on only one aspect of an object or an event, and ignores other relevant features of the situation. A child who can decenter, on the other hand, can take account of, and is able to coordinate the results of, several centerings. Piaget often uses the concept of decentering in this second sense to explain performance on class inclusion tasks and conservation tasks (Piaget 1950 pp.130-3).

Piaget relates[2] each of these concepts in turn to egocentrism. The groupings, he argues, are essentially a system which coordinate viewpoints and so are incompatible with egocentrism (Piaget 1950 p.164). Similarly, egocentrism is incompatible with reversibility, for the simultaneous awareness of both an action and its reverse

action requires the ability to be aware of and coordinate more than one viewpoint (Piaget 1959 p.280). Finally, egocentrism is most closely related to decentering (Piaget 1950 p.142). Egocentric thought cannot be decentered, as it is tied to a single viewpoint, and an egocentric child cannot decenter, as he is tied to his own perception. The linking together of all these concepts is well illustrated by the following:

> "Now from the fact that a grouping gives us that form of equilibrium achieved by the coordination of actions at the time of their becoming completely decentered, it follows that we can measure intellectual egocentrism by the irreversibility of thought, and therefore by the absence of any groupings, and we can also determine the exact progress of reversibility by the gradual building up of such groupings ..."
>
> (Piaget 1959 p.281).

The linking up of these concepts has a very import effect on the concept of egocentrism. It ties egocentrism up much more closely with the formal structures of Piaget's theory, and in particular, via the notion of decentering, to the standard tests of preoperational thought such as class inclusion and conservation. At the same time it draws the emphasis away from the manifestations of egocentrism in the social and linguistic areas which were a crucial part of Piaget's early formulations of the concept. Thus, following on directly from the passage just quoted, Piaget continues:

> "... That is why, in our opinion, research which is based on evidence as fragile as egocentrism should be

> replaced by an analysis of the actual operational mechanism of action and thought i.e. of the inner source of intellectual development." (Piaget 1959 p.281)

Similar sentiments are expressed in the following passage:

> "The phenomenon itself (i.e. egocentrism) whose relative frequency at different development levels we had wanted to test, as well as its decline with age, has never been disputed because it has seldom been understood. When viewed in terms of a distorting centering on one's own action, and of subsequent decentering, this phenomenon proved much more significant in the study of actions themselves and of their interiorisation in the form of mental operations than in the field of language." (Piaget 1962 p.7).

This still seems to be the current Piagetian position, as Inhelder (pers. comm.) has recently confirmed. She again emphasises that the egocentrism of the preoperational child must be seen primarily in terms of the subsequent decentering leading to the grouping of operations. This, as we shall see later, is well illustrated by Piaget and Inhelder's explanation of the young child's performance on the mountain task.

The second major development in the concept of egocentrism was that, in conjunction with the concept of decentering, it became a higher order concept within Piaget's theory. This development was at first implicit in Piaget's extension of the concept to infancy and adolescence, and was later made explicit when he

used the concept to compare intellectual development with expansions in epistemology.

The egocentrism of infancy is illustrated by the neonate's complete inability to distinguish himself from the rest of the world (Piaget 1950 pp.113-4). A gradual decentering occurs over the first 18 months of life so that at the end of this period the infant can recognise himself as an object in a world made up of permanent objects, and containing some degree of causality (see Piaget 1952, 1954 for more details). The egocentrism of adolescence is connected with the appearance of formal operational thought. The principal feature of this level of thinking is its ability to organise logically not only statements about the real world (as in concrete operational thinking) but also hypothetical statements about other possible states of the world. The egocentrism of adolescence comes from an inability to differentiate these imagined possibilities from more realistic expectations of the world. It manifests itself in the form of an adolescent idealism, more or less unadapted to reality (see Inhelder and Piaget 1958, especially pp.345-6).

The extension of the concepts of egocentrism and decentering to the whole of intellectual development, and finally to epistemology, is illustrated by the following:

> "In the field of thinking, the whole history of science from geocentrism to the Copernican revolution, from the false absolutes of Aristotle's physics to the relativity of Galileo's principle of

inertia, and to Einstein's theory of relativity, shows that it has taken centuries to liberate us from the systematic errors, from the illusions caused by the immediate point of view as opposed to ' decentered' scientific thinking. And this liberation is far from complete.

"I coined the term 'cognitive egocentrism' (no doubt a bad choice) to express the idea that the progress of knowledge never proceeds by a mere addition of items or of new levels, as if richer knowledge were only a complement of the earlier meagre one: it requires also a perpetual reformulation of previous points of view by a process which moves backwards as well as forward, continually correcting both the initial systematic errors and those arising along the way. This corrective process seems to obey a well defined developmental law, the law of decentering ('decentration'). For science to shift from a geocentric to a helicentric perspective required a gigantic feat of decentering. But the same kind of process can be seen in the small child: my description notably favoured by Vygotsky, of the development of the notion 'brother' shows what an effort is required of a child who has a brother to understand that his brother also

has a brother, that this concept refers to a reciprocal relationship and not to an absolute property ...

"I have used the term egocentrism to designate the initial inability to decenter, to shift the given cognitive perspective ('manque de décentration'). It might have been better to say simply 'centrism', but since the initial centering of perspective is always relative to one's own position and action I said 'egocentrism' and pointed out that the unconscious egocentrism of thought to which I referred was quite unrelated to the common meaning of the term, hypertrophy of the consciousness of the self."

(Piaget, 1962, p.3-4).

The main implication of this extension of the concept of egocentrism is that there is no longer any particular stage of development at which the child can be said to be egocentric. Instead, he is egocentric, in some way or another at every developmental stage. Indeed, egocentrism occurs even in adulthood whenever "there are periods of mental inertia" (Piaget 1959 p.271), while on the epistemic level Piaget seems to be implying that, as long as man's knowledge of the universe is incomplete, there will always be egocentrism[3]. The appropriate question to ask now is not "is the child egocentric at this stage?" but "what form does his egocentrism take at this stage?". This second major development clearly ties up with the first; the egocentrism of the preoperational

child lies primarily in his lack of groupings.

However Piaget has not by any means abandoned his concept of egocentric speech, despite his attempts to draw attention away from it. The third major development in the concept of egocentrism is that Piaget recently tried to "clarify" his position on egocentric speech (Piaget 1959, 1962). The clarified position, though, is substantially different from the original account. For a start Piaget retracted the claim made in 1926 that the coefficient of egocentrism (the proportion of egocentric speech to total speech) is a valid measure of the egocentrism of thought. Instead he acknowledged the evidence (e.g. from Katz and Katz 1927, Buhler 1931, Isaacs 1933) that there is considerable variation in this coefficient. However, Piaget claimed that these variations can be explained by situational factors, such as the number of others present and their relationships to the child, the kind of activity going on, and whether the setting is home or school. Whether these factors alone can explain all the variations found in the coefficient of egocentrism is doubtful. Even after discounting those studies which have grossly misunderstood Piaget's concept of egocentrism, such as Fisher (1934) who simply recorded the number of sentences with "I" as the subject, it is certain that there are still sufficient differences in the subjective interpretations of Piaget's criteria for egocentric speech to make comparison between studies of little use (see McCarthy 1954).

Having retracted his claim about the coefficient of egocentrism, Piaget then proceeded to reformulate his position on egocentric speech.

"There is no reason to believe that cognitive egocentrism, marked by unconscious preferential focusing or by a lack of differentiation of viewpoints, has no application to the field of interpersonal relations, in particular those which are expressed in language. To take an example from adult life, every beginning instructor discovers sooner or later that his first lectures were incomprehensible because he was talking to himself, so to say, mindful only of his own point of view. He realises only gradually and with difficulty that it is not easy to place oneself in the shoes of students who do not yet know what he knows about the subject matter of the course." (ibid, p.5.)

Clearly this example of the lecturer is closer to Piaget's original study of communication between two children than to his observations on spontaneous speech, and indeed he goes on to say that the communication situation was originally the more important for him. (This is certainly not the impression one gets from the original account.) The communication situation, illustrated by the example of the lecturer, now becomes the model for egocentric speech. In this revised position, then, speech is egocentric when a child is trying to communicate with another person but failing to take into account their particular knowledge, attitudes, opinions, etc. which are relevant to the situation.

"As far as I know, I have never spoken of speech 'not meant for others'; this would have been

> misleading, for I have always recognized that the child thinks he is talking to others and is making himself understood. My view is simply that in egocentric speech the child talks for himself (in the sense in which a lecturer may speak 'for himself' alone, even though he naturally intends his words for the audience.)"
>
> (ibid, p.8.)

This later account of egocentric speech differs considerably from Piaget's original account. The emphasis here is on the child trying to cummunicate and failing, through not taking account of the other's point of view. This contradicts earlier statements such as

> "He feels no desire to influence his hearer nor tell him anything ..."
>
> (Piaget, 1926, p.9.)

Moreover Piaget's original account included under egocentric speech the category of monologue, or speech uttered when the child is alone. Again this is incompatible with the later position, where the emphasis is on the child's attempting to communicate to another person. Monologues cannot be considered as egocentric speech in the revised position.

There are then clear contradictions between Piaget's two accounts of egocentric speech. Furthermore it is not clear which version is favoured in current Piagetian theory. The most recent account of egocentric speech (Piaget and Inhelder, 1969, pp. 120-122) includes both versions simultaneously, without taking account of their differences.

One of the main conclusions that we want to draw from this review of Piaget's concept of egocentrism is that it is not easy to specify precisely what Piaget means when he claims that young children are egocentric or unable to take another person's point of view. This lack of precision occurs in several different places in his account of egocentrism. First, we have seen that Piaget's early account of egocentric speech was confusing and that his explanation of the results of the communication tasks in terms of egocentrism was inadequate. Secondly, we have pointed out that one of the main effects of linking up egocentrism with the other concepts of preoperational thought is that all standard tests of preoperational thought, such as class inclusion or conservation tasks, automatically become tests of egocentrism. Finally we have shown that there are contradictions between Piaget's original account of egocentric speech presented in 1926 and his revised account presented in 1959 and 1962.

3. Taking the other person's point of view in communication

We will now consider the theoretical position which appears at first sight to be in direct opposition to Piaget's theory of egocentrism. The essence of this opposing theoretical position is the idea that communication is fundamentally an interpersonal process for which the ability to "take another person's point of view" is a basic prerequisite. The direct implication of this basic idea is that, since young children do have a certain number of communication skills, then they must, to some extent at least, be able to "take another person's point of view".

Although this basic idea that communication involves taking another person's point of view has been put forward by several theorists, it has usually been expressed in a variety of different forms and has

never been worked out very extensively. As a consequence, there is no single comprehensive elaboration of this basic idea, but instead there is a variety of isolated accounts. We will now review some of the more important of these accounts.

The idea that communication involves taking another person's point of view is by no means new. It was stressed in particular by both Dewey and Mead. The following passage from Dewey (1925) is a good account of the basic ideas involved. Here Dewey not only deals with taking the other person's point of view, but connects this with the important distinction between "conventional" and "non-conventional" communication, and finally ends with a model account of what has since become known as "intersubjectivity".

> "A requests B to bring him something, to which A points, say a flower, There is an original mechanism by which B may react to A's movement in pointing. But natively such a reaction is to the movement, not to the pointing, not to the object pointed out. But B learns that the movement is a pointing; he responds to it not in itself, but as an index of something else. His response is transferred from A's direct movement to the object to which A points. Thus he does not merely execute the natural acts of looking or grasping which the movement might instigate on its own account. The motion of A attracts his gaze to the thing pointed to; then,

> instead of just transferring his response from A's movements to the native reaction he might make to the thing as a stimulus, he responds in a way which is a function of A's relationship, actual and potential, to the thing. The characteristic thing about B's understanding of A's movements is that he responds to the thing from the standpoint of A. He perceives the thing as it may function in A's experience, instead of just egocentrically. Similarly, A in making the request conceives the thing not only in its direct relationship to himself, but as a thing capable to being grasped and handled by B. He sees the thing as it may function in B's experience. Such is the essence and import of communication, signs and meaning. Something is literally made common in at least two different centres of behaviour. To understand is to anticipate together, it is to make a cross-reference which when acted upon, brings about a partaking in a common, inclusive, undertaking."
> (Dewey, 1925, pp.178-9, emphasis added in places)[4]

Mead (1934, 1947) also emphasised the process of taking another's point of view. In his theory, meaningful human communication

> "involves not only communication in the sense in which birds and animals communicate with each other, but also an arousal in the individual himself of

> the response which he is calling out in the other individual, a taking of the role of the other, a tendency to act as the other person acts." (Mead, 1947, p.183, emphasis added)

Despite their apparent similarities there are considerable differences between the positions of Dewey and Mead. Dewey seems to be suggesting that all conventional communication implicitly involves taking the other's point of view, and so this ability must be present in the young infant as soon as he speaks his first word or engages in his first conventional act of non-verbal communication. On Dewey's theory, then, infants of less than 12 months may be able to take another person's point of view. Mead, on the other hand, claims that only a certain type of communication involving what he calls significant symbols. This type of communication takes place only when the child has acquired the ability to internalise a variety of other points of view, a process which Mead calls the acquisition of the generalised other. Mead does not specify the age at which the generalised other is acquired, but he does say that before it can be acquired the child must pass through the "play stage" in which he externalises several roles at once in his dramatic play. This seems to put the age of acquisition of the generalised other at around 5 or 6 years, slightly before the age Piaget gives for the waning of preoperational egocentrism.

The kind of interpersonal approach to language typified by Dewey and Mead has been very much out of fashion lately. Since Chomsky (1957, 1965), the emphasis has been mainly on regarding language as an impersonal system of rules which an individual somehow

learns or acquires. Much attention has been paid to determining developmental levels of competence within the system, particularly by looking at the age at which certain structures (usually syntactic) are acquired. Little attention has been paid to the situational, and in particular to the interpersonal contexts in which such structures are used, although there are signs that more recent accounts (e.g. Bloom 1970) are beginning to take some of these factors into account.

Similarly, the various abilities and mechanisms which have been proposed to account for the young child's acquisition of language have also been very much detached from the actual interpersonal situations in which language is acquired and used. For instance in the early post-Chomsky period there was much discussion of a "Language Acquisition Device" (e.g. Chomsky 1965, McNeill 1970). This crude device was supposed to operate on the corpus of utterances that a young child heard and extract the underlying regularities in the corpus, thus providing the child with his "grammatical competence". However, there has been some realisation recently that grammatical competence is not enough. Campbell and Wales (1970) argue for the notion of "communicative competence" or "the ability to produce or understand utterances which are not so much grammatical but, more important, appropriate to the context in which they are made." (p.247) This point has been taken up by Ryan (1974):

> "The neglect of what has come to be known as 'communicative competence' is not only serious in itself, but has also led to a distorted view of the child's grammatical abilities. This distortion is seen most clearly in McNeill's (1966)

> exaggerated claims as regards the child's 'achievements' in acquiring syntax with such alleged speed. If the acquisition of syntex was seen in a broader developmental perspective as based on the child's pre-existing social, communicative, and verbal skills, it would not seem quite the 'mystery' that McNeill (1970) supposes it to be."
>
> (Ryan, 1974, p.185)

There have been a few attempts by psychologists recently to provide interpersonal models of communication (e.g. Flavell et al 1968, Argyle 1969, Marshall 1971). These three models, though, amount to little more than restatements of the fact that communication is an interpersonal process involving some kind of interpersonal skills ("role taking skills" in Flavell's terminology, and "social skills" in Argyle's). Indeed most of the more interesting recent accounts of the interpersonal aspects of language have come not from linguists, nor from psychologists, but from philosophers interested in ordinary language (e.g. Austin 1962a, Grice 1957, 1968, Searle 1969, Strawson 1964). Austin, for example, distinguished between the formal meaning of an utterance and its illocutionary force, or what the speaker is trying to bring about conventionally by his utterance. Thus the utterance "will you shut the door?", although formally an enquiry about what the hearer might do in the future, is in fact a request for immediate action. According to Austin, then, understanding an utterance involves not just knowing the meaning of the words, but also understanding what the speaker is trying to do with the utterance.

Also relevant here is Grice's theory of meaning. He proposed

(Grice 1957) that utterer's meaning, or what a speaker means by a given utterance on a specific occasion, is more basic than sentence meaning, or what the sentence conventionally means. He analyses the former as follows: a speaker means something by an utterance if the speaker intends to produce a certain effect in his audience by means of the audience's recognising his intention. This was later refined and extended by Strawson (1964) and Grice (1968) to include more levels of intention and recognition of intention. Thus a more complete analysis involves:

(1) the speaker's intention to produce a certain response in the audience;

(2) the speaker's intention that the audience should recognise the speaker's intention (1);

(3) the speaker's intention that this recognition of the speaker's intention (2) be the reason, or part of it, for the audience's response;

(4) the speaker's intention that the audience should recognise the speaker's intention (2).

These insights of Austin and Grice may have considerable relevance for the understanding of certain kinds of communication situation. Although all communication situations can be regarded as implicitly involving the recognition of another's intentions or the determination of what the other is trying to do with the utterance, there are some important kinds of situation which explicitly involve this kind of ability. Examples of these include occasions where the meaning of a word is being learnt or extended, or where there appears to be difficulty or failure in communication. These are all features

of the early language-learning situation where, as Bloom (1970) and Bruner (1973) among others have pointed out, both sides are continually trying to interpret each other's utterances and intentions against the background of the whole ongoing situational context. We will look at early language acquisition again shortly. For the time being we will merely point out that the theories of Grice and Austin may well be useful for specifying what is involved in "taking another person's point of view" in these situations.

Also relevant here, but in a much more general way, is Strawson's account of our concept of a person (Strawson 1959). Strawson's argument is essentially a critique of solipsism, the philosophical position that holds that one can deny that other people have conscious experience similar to one's own. Strawson argues that such a position is logically incoherent, because it is a necessary condition of ascribing states of consciousness to oneself that one should be prepared to ascribe them to other persons. Our concept of a person is of a type of entity to which both predicates ascribing states of consciousness and predicates ascribing physical characteristics are equally applicable, and this concept of a person is logically prior to that of an individual consciousness. Thus it is logically incoherent to claim that oneself is capable of consciousness while other persons are merely physical objects.

This brief summary does not do justice to what is a very complex argument. Moreover it should be pointed out that Strawson is arguing for the logical primacy of our concept of a person, and not for the developmental primacy. Nevertheless Strawson's argument is relevant here because it suggests that young children must be able

to identify, in some rudimentary form at least, other "centres of consciousness" before they can meaningfully identify their own states of consciousness. This basic recognition that other people have points of view is an essential precondition of being able to calculate what these other points of view are.

The few isolated theoretical insights reviewed in this section unfortunately do not add up to an adequate overall theory. Clearly there is a great need for a detailed interpersonal theory of communication which would incorporate these insights into a comprehensive overall account. Such a theory would, hopefully, provide an adequate account of the extent to which any communication situation involves taking another person's point of view. More importantly, it would break down this global term "taking another person's point of view" and specify instead precisely which of each person's perceptions, thoughts, feelings, desires, knowledge and intentions are relevant to the communication situation, and what specific abilities, in the form of recognising or calculating these perceptions, etc., are required for successful participation in the communication situation. It would be an even better theory if it could give an account of how an individual's level of competence in performing these recognitions and calculations actually imposes constraints on his performance in such situations. Clearly this is a vast, but necessary, undertaking.

4. Specific areas of conflict

In the last two sections we have reviewed two theoretical positions which appeared at first sight to be in direct opposition to each other: first, Piaget's theory that young children are

egocentric and unable to take another person's point of view and secondly, the position that communication is an interpersonal process for which the ability to take another person's point of view is a basic prerequisite. We pointed out that there was on the one hand a lack of precision in Piaget's theory of egocentrism, and on the other hand a lack of an adequate detailed account of the alternative theoretical position. The main conclusion to be drawn from these two reviews is that it is at present virtually impossible to specify which abilities in young children are being denied by Piaget's theory yet upheld by the opposing position.

This does not mean that the conflict between the two positions has evaporated. Instead it merely means that the two opposing positions have not yet joined battle. Moreover they will not do so until specific areas of conflict are outlined, each position making a precise statement of the specific skills and abilities claimed to be present or absent. Unless this is done, claims and counter-claims that young children are able or unable to take another person's point of view are of little avail. This section briefly outlines a few areas of possible conflict between the two opposing positions.

(a) Early language acquisition

This is currently becoming a very popular area of research, particularly among psychologists interested in the skills and abilities which infants bring to early language-learning situations (e.g. Bruner 1973, 1974 and Trevarthen 1974, in press). This research is beginning to focus on the interpersonal skills and

processes involved in early language acquisition but, hampered by the lack of an adequate theory, it has not yet made much progress towards specifying the precise skills and abilities required in these processes.

The lack of theoretical clarity in this area is well illustrated by the many different accounts of "intersubjectivity" being circulated at present. For example, Habermas (1970) regards intersubjectivity as being to do with whether speakers are talking about the same things, and is particularly concerned with the linguistic devices by which this is brought about. For Bruner (1973) intersubjectivity seems to cover not only the processes by which mother and child try to interpret each other's speech and intentions (which is the concept also put forward by Ryan, 1974), but also the vaguer notions of "shared experience" and the establishment of a strong "link" between mother and child. Bruner also claims that the child has the "innate capacity to construct interpersonal schemata". Innateness is also important for Trevarthen's idea of intersubjectivity (1974, in press). From his films of mothers and infants interacting, he concludes that there is a 'highly specialised form of psychological action concerned with the transmission of intentions and attentions", and this is present at birth. He also believes that this transmission of intention is usually successful. (In contrast to this, Ryan emphasizes the difficulties mothers have in trying to understand the child's early utterances). Clearly one of the first things needed in this area is an adequate interpersonal account of early language acquisition perhaps based, as we have already suggested, on the insights of Dewey and Grice.

The recent research in this area has paid little attention to Piaget's theory of language acquisition (Piaget 1951). In Piagetian theory, language is very much regarded as merely another form of representing the external world, and Piaget pays very little attention to the interpersonal situations in which early language is acquired. Although imitation is an important process in Piaget's theory of language acquisition, there is no real discussion of how much this involves taking another person's point of view, and how far it relates to his concept of egocentrism. This does seem to be a large defect in Piaget's theory, and it seems more than likely that future research in language acquisition will show that infants have a far wider range of interpersonal skills than Piagetian theory at present allows for.

(b) Deixis in personal pronouns

A more specific example of the kind of interpersonal skill we have in mind is that of learning the deictic constraints on the use of personal pronouns. This example has been used more than once by Bruner, who connects this skill with both the Piagetian concept of decentration and his own account of intersubjectivity.

> "Indeed it is a further differentiation of inter-subjectivity that finally produce decentration or linguistic deixis - knowing that 'I' refers to self when self-generated but to another when generated by them, what Jakobsen (1972) calls 'shifters'..." (Bruner, 1973, p.24)

Bruner has hypothesised that this skill arises out of the transfer of roles occurring during play between mother and child. Having analysed a section of film in which such a transfer occurs, he continues,

> "The child, initially Recipient of Action, now calls on mother to act as Recipient. He ends with himself as Agent and mother as Recipient. We take this as the prototype of deixis, illustrated by such conventional 'shifters' as 'I' and 'me'..." (Bruner, 1974, p.8.)

This example raises several points. First there is not yet a clear developmental picture of how this skill is arrived at. For example Sully (1895) noted that the first use of 'I' and 'you' between 2 and 3 years is often incorrect. "The child proceeds imititatively to use 'I', 'me', 'mine', for 'you' and 'your' (p.178). On the other hand Huxley (1970), who recorded the acquisition of pronouns in two young children, reported that neither of these children confused 'I' and 'you'. However both children often referred to themselves in the third person (i.e. by their own name) before settling on the correct use of 'I'.

Secondly there is the interesting phenomenon that a very common syndrome found in autistic children is precisely this inability to use 'I' and 'you' correctly[5]. A psychoanalytic interpretation of this has been made by Bosch (1970), but the general opinion of those working on autism is that there is simply a lack of the necessary interpersonal skill in these children (Kanner 1943, Hermelin and O'Connor 1970). At the same time some autistic children are able, in their own fashion, to transfer roles in play (e.g. Park 1972), which suggests that Bruner's hypothesis of role transfer being the prototype of deixis needs to be amended, or at least clarified[6].

Finally there is the problem of relating the acquisition of this skill to egocentrism. Bruner refers to the acquisition as "decentering", yet it certainly does not seem to require the possession of concrete operational thought. Can Piagetian theory allow such partial decenterings between stages?. And how does this skill relate logically to Piaget's (1928) study of relational terms such as 'brother' and 'sister'?. There seems to be a very close connection between knowing that I am 'you' to you and knowing that I am 'brother' to my brother.

(c) Egocentric speech

Despite the vast amount of attention devoted to this topic over the last 50 years (see the reviews by McCarthy 1954 and Kohlberg et al 1968), it has never been satisfactorily resolved. We will not here go over the same ground yet again, but rather suggest alternative approaches which may turn out to be more fruitful. We will consider the spontaneous speech situation and the communication tasks separately.

(i) Spontaneous speech

Traditionally, Piaget's position on the egocentrism of the child's spontaneous speech is contrasted with that of Vygotsky (1962) and Mead (1934), and indeed what evidence there is seems to favour these two theorists rather than Piaget (Kohlberg et al 1968). Here, however, we will suggest an approach which is an alternative to all three of these positions.

The major problem in analysing young children's spontaneous speech is that it is often impossible to say for whom it is intended.

Often a given remark may not be clearly intended either for the child himself or for any other person present. Piaget's solution to this problem was to say that this kind of speech is intended for others but that the child cannot differentiate their viewpoint from his own. Vygotsky and Mead, on the other hand, said that this kind of speech is intended for the child himself, but both had to add the proviso that the child is unable to differentiate some aspects of himself from some aspects of the others.

What is common to all these theorists is that they felt obliged to answer the question: for whom is the child's speech intended?. This may not be the most fruitful question to ask of a lot of the child's spontaneous speech. A suggested alternative is to regard the child's speech as an activity performed in social settings, and to look for the extent to which it influences, and is influenced by, the other verbal and non-verbal activity in the situation. The emphasis here is on looking for the rules and structure of sequences of social activities, rather than attempting to discover the intentions of the participants. A good example of this approach is given in a study by Garvey and Hogan (1973), who found that many utterances which Piaget would have classified as egocentric are in fact part of a larger complex sequence of regulated social activity. This suggests that young children, in maintaining such sequences, are showing a higher level of interpersonal competence than Piagetian theory would allow.

(ii) Communication tasks

The communication tasks designed by Piaget in 1926 have since become the paradigm for a large number of studies of communication

skills (e.g. Flavell et al 1968, Glucksberg and Krauss 1967, Peterson 1972). This basic paradigm is often compared either with Piaget's example of the lecturer failing to appreciate his audience's lack of knowledge of the subject matter of his lecture, or with the example given by Brown (1965) of the local inhabitant giving traffic directions to a stranger in terms of local landmarks which the stranger cannot be expected to know. The main points we will make here are first, that these analogies with the lecturer and the local are misleading, and secondly, that these communication tasks, in their present form, may tell us very little about the child's ability to take another person's point of view.

For a start, one difference between the young child in a communication task and the lecturer or local is that we cannot be sure that the child understands the nature of the situation and what he is expected to do, whereas the lecturer and local are both clearly intending to convey some information and presumably understand the nature of the communication situation they are in.

More importantly, if a child or adult fails to communicate adequately in any of these situations, there could be several explanations:

(1) he may be incapable, due to the structural level of cognitive development, of realising that his audience has a different viewpoint;

(2) he may be capable of this, but fails to realise it in the actual situation;

(3) He may realise the difference of viewpoints, but lack both the linguistic skills (such as possession of required structures,

adequate lexicon, etc) and the perceptual and memory skills which are needed to express his knowledge;

(4) he may realise the difference, and possess the skills, but fail for one reason or another (lack of attention, tiredness, etc) to monitor his output and so produce an inadequate message.

It seems unlikely that explanation (1) is relevant for either the lecturer or the local. Yet this is precisely the explanation Piaget gives for the young child who fails the communication tasks. Indeed he believes that explanation (3) is identical with explanation (1)

> "... Each child has his own world of hypotheses and solutions which he has never communicated to anyone, <u>either because of his egocentrism, or for lack of the means of expression - which comes to the same thing</u> if (as we hope to show in this chapter) language is moulded on habits of thought."
> (Piaget, 1926, p.79, introduction to the chapter on communication skills, emphasis added)

Clearly a detailed examination of each communication situation is needed to discover which of the above explanations is relevant. To do this one would have to examine separately the speaker's knowledge of the relevant aspects of the listener's point of view, and test for the speaker's relevant linguistic, perceptual and memory skills. Furthermore each message the speaker produced would have to be discussed with him, and the truth or falsity of the presuppositions of the message pointed out to the speaker, to see if this kind of awareness would help him to change his message.

(For example, the local would be told that the strangers had not heard of the features he used in his directions.) So far none of the recent studies of children's communication skills have used a design subtle enough to do this, although Fry (1966, 1969), Glucksberg and Krauss (1967) and Peterson (1972) found that older children get some benefit from a knowledge of the effects of their message. Informal investigation by the author suggests that a procedure like the one outlined above, though difficult, is possible even with children as young as 4 years old. What we are saying here, then, is that these studies of communication skills must be refined considerably before they can tell us much about the young child's ability to take another person's point of view.

5. Conclusion

In the previous section we have considered a few areas of possible conflict between Piaget's theory that young children are egocentric and unable to take another person's point of view, and the position that communication is an interpersonal process for which the ability to take another person's point of view is a basic prerequisite. In each case it is clear that there is a great lack of precision in specifying what processes are involved and what abilities are required, and overall there is a general fuzziness surrounding the concept of taking another person's point of view. What is needed most is for each of the specific areas mentioned to be subjected to a precise and detailed study in order to determine, in each situation, in exactly what ways young children are able or unable to take another person's point of view.

Accordingly, the rest of this thesis will focus on one particular issue: the extent to which young children can calculate what another person can see. In the next chapter we will consider some aspects of the social interactions of the young child which suggest that he may be able to calculate what another person can see, while in Chapter 3 we will look at the relevant experimental studies of this ability.

Chapter 2. Visual Attention in the Social Interactions of the Young Child

1. Introduction

In this chapter we will consider some aspects of the social interactions of the young child which suggest that he may be able to calculate what another person can see. Before we do this, though, a number of qualifications need to be made.

First, the analysis given here is mainly speculative. As we pointed out in chapter one, there is little adequate theory in this area, and this chapter is primarily an attempt to provide some ideas for future work. As yet there is virtually no systematic data on any of the topics discussed here, and consequently much of the evidence is based solely on casual observation.

Secondly, we are using the term "the young child" to cover the whole age range from 0 to 5 years. Obviously the interactions and abilities of neonates are totally different from those of a 5 year old child. We use the blanket term "the young child" not because we want to ignore these differences, but simply because we are not in a position to speculate as to the precise age at which these abilities appear.

Thirdly, "being able to calculate what another person can see" covers a wide range of skills and abilities. The most we can conclude from this chapter is that the young child may be able to calculate what another person is looking at, but he may not be able to calculate how it looks to the other person. We will discuss this distinction in more detail in chapter three.

Fourthly, we will not speculate as to what cues the child is using in order to calculate what the other person can see. He may use the other person's eye position or eye movements, or the orientation of the head or body, or perhaps something harder to define, such as the focus of the other person's movements. It is probably impossible to tell, without careful experimentation, exactly what cues are used in practice. Similarly it may be impossible to tell from observation alone how accurately the child can calculate what another person can see. The child may, for example, only be capable of determining the general area the other person is looking at, from which he then selects the most salient feature. This may in practice give him a high degree of success. Again, observation needs to be combined with careful experimental study of the abilities involved.[7]

Two main areas will be considered here, coming loosely under the headings of reference and clearance. The first is concerned with the interpersonal processes which lead to a common focus of visual attention, while the second is concerned with the role of visual attention in initiating more complex interactions.

2. Reference

The topic of reference is, for philosophers, particularly perplexing (e.g. Strawson 1950, 1964; Geach 1962, Quine 1960, 1968). For example there are problems as to how to express logically the fact that words are used to refer to entities that are ephemeral, non-existent, or simply dead. The present approach hopes to avoid these problems by concentrating on some basic interpersonal processes involved in referring.

A convenient starting point is supplied by Quine:

> "There are two parts to knowing a word. One part is being familiar with the sound of it and being able to reproduce it. This part, the phonetic part, is achieved by observing and imitating other people's behaviour, and there are no important illusions about the process. The other part, the semantic part, is knowing how to use the word. This part, even in the paradigm case, is more complex than the phonetic part. The word refers, in the paradigm case, to some visible object. The learner has now not only to learn the word phonetically, by hearing it from another speaker, he also has to see the object: and in addition to this, in order to capture the relevance of the object to the word, he has to see that the speaker also sees the object."
>
> (Quine 1968, p.186, emphasis added)

The fundamental point here is that, in order for one person to learn the name of an object from another person, then not only must the object be named, but it also must become the common focus of attention.

This is the heart of the problem of referring, and it is of particular importance for early language acquisition. By the age of 3 years the child has a vocabulary of around 1000 words, and a considerable proportion of these are the names of simple objects, persons, events, and features in his immediate environment. Thus

it is an important question to ask how these objects become common foci of attention between the young child and his language teachers. Does the process involve paradigms like Quine's, which require the young child to be able to calculate what the other person can see?.

There are clearly a variety of methods by which this common focusing can occur, apart from the one outlined by Quine. One extreme example is the purely tactile method used by the teacher of Helen Keller, who was blind, deaf and dumb. Another example, equally extreme, would be a hypothetical semi-Pavlovian situation where the child was invariably told the name of an object whenever the object fully occupied his attention. Presumably, on this kind of schedule, a child could acquire a large vocabulary without ever looking anywhere near his teacher's face.

When we restrict ourselves to considering more normal language-learning situations, then it soon becomes apparent that a common focus of visual attention is often reached in a quite unremarkable manner. The following episode, for instance, may be typical of many situations where a name is learnt without any specific interpersonal skills being needed by the child.

(1) Mother (to Father) "Pass the teapot";

(2) Father passes teapot;

(3) Child watches teapot passing in front of him.

Alternatively the common focus of attention may be reached by a general orientation response by all persons involved.

(1) Telephone rings;

(2) Mother, Father and child all orient to the telephone;

(3) Mother (to Father) "Telephone again".

Clearly a common focus of attention may be reached without any interpersonal processes involving the child. Moreover, mundane examples like these suggest that the philosophical problem which Quine (1968) calls "the inscrutability of reference" (i.e. that one can never be sure that what is being pointed out is an object, or the location of an object, etc.) may in practice be solved by the presence of common psychological mechanisms of orientation and attention.

Nevertheless adults and young children do seem to use various interpersonal methods for obtaining a common focus of attention. Of course this is not always accompanied by naming, and often occurs as part of the ordinary activities of mother and infant such as bathing and feeding, demanding and fetching things, and playing games. We are not concerned here with a full description of all these activities. Instead we will just describe a few simple paradigms for reaching a common focus of visual attention, and see which ones might require the child to actually calculate where his mother is looking. We will consider an extremely simplified situation of mother (M), child (C) and object (O).

The first distinction to be made is whether one person simply <u>follows</u> another's attention to the object, or whether the first person actually <u>directs</u> the other's attention to the object. This gives us four basic paradigms.

Paradigm A (1) M attends to O;

(2) C attends to M;

(3) C <u>follows</u> M's attention to O.

Paradigm B (1) C attends to O;

(2) M attends to C;

(3) M *follows* C's attention to O.

Paradigm C (1) M attends to O, C *not* attending to O;

(2) M attends to C;

(3) M attracts C's attention to M;

(4) M *directs* C's attention to O.

Paradigm D (1) C attends to O, M *not* attending to O;

(2) C attends to M;

(3) C attracts M's attention to C;

(4) C *directs* M's attention to O.

These paradigms assume efficient and successful functioning. No doubt, though, there will be many occasions when, for instance, one person fails to direct the other's attention, or fails to locate what the other is attending to, or tries to direct the other's attention to what the other is already attending to. We will not consider these here.

We will look first at paradigms A and B, which involve one person following another's attention. The main cues showing where a person is attending are *head and body orientation* and *direction of gaze*, and in order to follow their attention the other person must be able to use these cues to locate the source of attention. This paradigm, moreover, covers a variety of cases. The mother may be attending to an object as part of a fairly static performance (such as reading a book) or else she may make a sudden orientation reaction involving sharp changes in head and body orientation and direction of gaze, (for instance, when another person enters the

room unexpectedly). One would expect that following the mother's attention in these two situations would involve quite different processes. It would also be quite difficult, in the second example for instance, to determine if the child was accurately following the mother's attention or merely picking up from her the general direction in which to start looking himself. Nevertheless paradigm A could well cover several situations where the young child is actually calculating where his mother is looking. In paradigm B, on the other hand, it is the mother who needs to calculate where the child is looking, and this is of relatively little interest to us here.

Paradigms C and D involve more interesting interpersonal processes. There are a variety of ways one person can direct another person's attention to an object, such as turning one's head and body towards it, looking at it, holding it in front of the other, pointing at it, saying "Look at that", or even, as John Churcher has kindly pointed out, forcing the other person's head round until they are looking at the object. With older children one can just tell them to "Come and see what I can see". And of course various combinations of these are possible.

Although it may at first sight seem arbitrary as to which of these methods are used, a closer look at the processes involved reveals some constraints. Consider first paradigm C. The mother wants to direct the child's attention to an object, which she is probably either holding or looking at. First she must check that the child is not already looking at it. Then she must divert his

attention away from what he is looking at, and direct it first to herself, and then to the object. Throughout this she must monitor the child's attention to see that she is actually achieving her purpose.

All of this means that simply to turn and look at the object, as in paradigm A, will not usually even divert the child's attention from his ongoing activity. The simplest way to draw the child's attention to an object is just to put the object in the child's own line of sight. For distant or immovable objects the mother may lift him up and carry him to the object. Presumably these are the methods generally used with young infants. With slightly older children the mother may call (either the child's own name, or "look"), which will usually result in the child attending to her. She can then either hold up the object, or point to it, perhaps repeating "look". It is interesting that at this point she is unlikely to redirect the child's attention by simply turning and looking. The child would no doubt be able to follow this, but the mother, having taken her eyes off the child, wouldn't know if he had. However if she were instead to point to the object, this would probably be accompanied by a quick shift of her gaze from the child to the object and back again, perhaps turning her head as well.

Thus in paradigm C it is most unlikely that the child will be following the mother's direction of gaze, as for the most part she will be looking at him, in order to monitor his direction of gaze. So paradigm C, it turns out, will not elicit many examples of the child's ability to calculate where his mother is looking.

Instead many more examples of this skill will emerge from paradigm D. This is probably the most important paradigm for our purposes. Here the roles are reversed, and the child is directing the mother's attention. Just as the mother did in the previous paradigm, he must, in theory at least, first check that she is not attending to the object, then divert her attention, either first to himself and then to the object, or directly to the object. Throughout this this he must, again in theory at least, monitor her attention to make sure he is accomplishing his purpose.

However, in practice it is not clear how often the pure paradigm occurs. For instance, as Bruner (1974) points out, one of the earliest ways infants call attention to objects is by simply "fretting" and gesturing at the mother, who then has to work out what object she must attend to, and what she must do with it. Although this is probably the earliest kind of paradigm D occurrence it is unlikely that the child is doing anything like monitoring his mother's attention in these situations.

In a similar way, even when an infant has developed a rudimentary method for drawing attention to an object, such as crying out and reaching towards the object, he will mainly use this method when he wants some action performed on the object (for example, if he wants it to be given to him). Thus the child's attempt to direct his mother's attention to the object may take no account of whether his mother is already attending to it. All that is important is that the child does not have the object. Again the child's monitoring of the mother's gaze may be non-existent. He may simply look at her until she performs the desired action, irrespective of whether she

actually looks at him, or the object. Here again we must be careful not to read too much into such an episode.

It seems likely that there will be some more clear cut cases of this paradigm when the child reaches the holophrastic stage (single word utterances). Several investigators of early child language have noted that one of the earliest functions of some words in this stage, particularly "look", "see", "that", "there"[8], etc., is to draw another person's attention to an object or event, and these utterances are often accompanied by pointing (e.g. Sully 1895; Lewis 1937; Leopold 1949). This literature is discussed by Atkinson (1974) who goes on to suggest that many "content holophases" (such as the names of people or objects) are uttered in order to draw another person's attention to the person or object concerned, and are not necessarily cases of "naming" as is often claimed. On several occasions, when the child has got the other person's attention, he then goes on to say something about the person or object named. This may occur whether the referent is present or absent, as the following two examples show:

> "Sitting in front of the fire Daniel holds up a toy car and says 'car'. No response is forthcoming from me and so he repeats 'car'. Again the word is repeated several times until finally I look up and say 'car' to which he immediately responds 'broken' which is true." (Atkinson 1974, p.13)
>
> "The child's mother has been out for several minutes and the child approaches the father and says 'Mummy' with no signs of distress or question intonation.

> The question then is what is the child doing with this utterance. He is certainly not naming anything, nor wanting anything, nor asking anything. What happened next is interesting because the father, obviously picking up the fact that the utterance is none of the things already enumerated, responds with 'Mummy?' using a question intonation, to which the child immediately responds with 'gone'. (ibid, p.7a)

If Atkinson's interpretation is correct then these episodes can be the source of some interesting theoretical speculation. For example they could be the earliest form of the topic-comment distinction which Gruber (1967) has claimed to be the fundamental structure of child language. Similarly they could be taken as examples of the deictic function that Lyons (1973) has proposed as one of the fundamentals of his "quasi-English", an ultra-simple language that he considers may be the basis of child language. Lyons goes on to suggest that this deictic function is the prototype of more general referring functions, such as the definite article and personal pronouns.

It is not clear, however, whether Atkinson's interpretation is correct. For example the child may be using the words "car" and "Mummy" as a clearance request, to get the adult to attend to <u>him</u>, rather than to the object or person. This can only be determined by detailed examination of such episodes to see who is attending to what and when. For instance we would want to know whether the adult responds by looking at the child, or the car, or both. Which of these responses does the child himself respond to?. Does he in fact monitor the adult's attention to see where he is looking (at

himself or at the car) and could he in any case tell the difference?. These questions, moreover, are precisely the ones we want to ask in order to find out if these episodes constitute genuine paradigm D situations in which the child is actually calculating what the adult can see. Yet again we must be careful not to read too much into such episodes without more detailed investigation.

There is a similar danger of drawing too hasty a conclusion when slightly older children are at the "naming" stage. It has often been proposed (e.g. McCarthy 1954) that the dramatic increase in the child's vocabulary between the ages of 2 and 3 years comes when he learns to ask "what's that?" of anything in sight. This seems to be a clear case of paradigm D. The child is attending to the object, and wants to know its name. Thus he has to combine asking "what's that?" with some method of directing his mother's attention to the object, and this, at least in theory, requires him to monitor her attention in order to know that she is in fact attending to the object.

However a casual observation of such episodes shows that in a high proportion of cases the child is not explicitly monitoring his mother's attention. Often the episode is conducted successfully without the child ever looking at his mother, and she herself may only give a brief glance in the required direction. Quite a common phenomenon is for the child to ask "what's that?" of something when his mother is out of sight in another room. This has been discussed both by Flavell et al (1968), who claim that it shows that the child does not know that his mother cannot see what he sees, and by Atkinson and Griffiths (1973), who suggest that it shows that the

child has not yet learnt the appropriacy conditions for using the word "that" to refer to something. Neither conclusion seems justified until we have ruled out a third possibility, namely that the child knows his mother cannot see what he sees and knows how to use "that", but is simply using "what's that?" to get his mother to actually come into the room and attend either to him or to the object of his attention. Certainly older children and adults use this strategy, usually with great success.

So far this account has been mainly speculative. This is because there is virtually no discussion of anything like these issues in previous work on infant development. Investigators of early human development have in the past been more interested in questions like whether eye contact elicits smiling in babies (e.g. Spitz and Wolf 1946). There is surprisingly nothing of relevance in Piaget's work on infancy, although he does report in one place that between the ages of 9 months and 12 months all his own children responded to his opening and closing his eyes by opening and closing their hands or mouths! (Piaget 1951 p.44). Presumably he did not test their responses to shifting his gaze because it is impossible for the person doing this (even if he is Piaget) to see the exact response he is getting.

However, work is currently in progress on this topic at Strathclyde, under Shaffer, at Edinburgh, under Trevarthen, and at Oxford, under Bruner.

Shaffer (1974) has observed mothers and infants in a free situation with a number of novel and conspicuous toys present, and reports that mothers follow the direction of gaze of their

infants from an early age, but that right up to the end of their first year it is rare to see infants following their mothers' direction of gaze. On the other hand, some preliminary work done at Oxford by Scaife (1974) suggests that infants as young as 4 months can respond to other people's direction of gaze. Scaife found that 30% of his babies between 2 and 4 months responded positively when an unknown experimenter first engaged the child in eye-to-eye contact and then turned his head through 90° away from the child. By the age of 11 to 14 months all the infants were responding positively to this. Moreover, if the "looking away" was accompanied by pointing and saying "look" then the response was even higher. Scaife argues that the discrepancy between his findings and Shaffer's is due to the fact that his situation was less distracting for the child.

Scaife's findings with pointing are surprising in view of another study by Anderson (1972), who made an ethological observation of mothers and young children in a London park. Anderson found that children below two years did not respond to their mother's pointing, but merely stared at the mother's face or hand. "Though the mother may emphasize the gesture and shout, the infant continues to stare blankly at her face" (ibid, p.209).

It has indeed often been reported that young children (and dogs too) respond to pointing by looking at the hand instead of at the object pointed to. It will be recalled from Chapter 1 that Dewey referred to this as "an original mechanism ...to the movement, not to the pointing", and mentioned that one learns "that the movement is a pointing". John Churcher, of the Oxford group referred to earlier,

is about to do extensive work on this problem. He makes the important distinction between conventional and non-conventional meaning, and has argued that to respond to another's pointing involves understanding the convention of pointing. He is particularly interested in how this evolves from non-conventional actions such as reaching, holding out an object to another person, etc.

It is relevant both to the above discussion of pointing and to our earlier discussion of paradigm D that Elly, the autistic daughter of Park (1972) did not point.

> "Elly is eight years old now. I have still never seen her point. She has a vocabulary of hundreds of words. But although it includes 'rectangle', 'square', and 'hexagon', it does not include 'what's that?'." (ibid, p.12)

In general, then, it seems likely that there will be many episodes in the child's early development where he is either following another person's attention, or trying to direct their attention to something, and these episodes may well require the child to be able to calculate what the other person can see. At the same time it must be emphasized yet again that the existence of these episodes does not automatically ensure the presence of this ability, and much more work is needed before such a claim can be substantiated.

3. Clearance

So far we have considered some fairly straightforward ways in which mothers and infants may reach a common focus of visual attention. As the child gets older his interactions will become

more complex, form more discrete units, and will focus more and more on topics which are not in the immediate visual environment. They may well occur without a shared visual environment at all (e.g. telephone conversations). It may seem at first sight that the role of visual attention in such situations is limited. Novertheless, the following analysis shows that it is still important.

We start with Goffman's description of how unfocused interactions develop into focused interactions. This distinction comes from Goffman (1961): an unfocused interaction is the result solely of people being in one another's presence, while a focused interaction occurs when people "effectively agree to sustain for a time a single focus of cognitive or visual attention".

Goffman describes the initiation of focused interactions as follows:

> "An encounter is initiated by someone making an opening move, typically by means of a special expression of the eyes but sometimes by a statement or a special tone of voice at the beginning of a statement. The engagement proper begins when this overture is acknowledged by the other, who signals back with his eyes, voice or stance that he has placed himself at the disposal of the other for purposes of a mutual eye-to-eye contact, even if only to ask the initiator to postpone his request for an audience." (Goffman 1963 pp.91-2)

Goffman calls this process "clearance". Thus the simplest form for the initiation of an interaction is

(1) A requests clearance;

(2) B grants clearance;

(3) A proceeds with interaction.

The concept of clearance has already been used by Kendon and Ferber (1974) in their detailed observational study of adults greeting each other at an outdoor party. Kendon and Ferber unearthed some subtle variations on the main theme. For example they found that the initiator often gives only tentative clearance requests such as disguising a "look" at the other person as part of the general scan of the scene, or simply by synchronising his body movements with the other person's. They suggest that if these subtle requests are not granted then no major loss of face[9] occurs, such as might happen if a more clear cut request was made and rejected.

Goffman himself gives some examples of one party <u>refusing</u> to grant clearance by avoiding looking at the other person.

> "A waitress, for example, may prevent a waiting customer from 'catching her eye' to prevent his initiating an order. Similarly, if a person wants to ensure a particular allocation of the street relative to a fellow pedestrian, or if a motorist wants to ensure priority of his line of proposed action over that of a fellow motorist or a pedestrian, one strategy is to avoid meeting the other's eyes and thus avoid co-operative claims." (Goffman 1963 p.93)

And of course merely to look <u>at</u> another person often does not constitute granting clearance. A waitress may look at her customer and meet his gaze without "having her eye caught", and it is possible to look at someone whom one suspects one knows, and meet their gaze, without "recognising" them.[10] This should be distinguished from "looking through" someone, which is an interesting phenomenon in itself.[11]

Clearance is a useful concept in describing young children's interactions, particularly in a nursery setting. Here young children are for the most part in an unfocused interaction, yet periodically form and dissolve short focused interactions both with each other and with the nursery staff. A large number of informal observations by the author suggest that almost all these focused interactions are initiated by sequences involving clearance. Much of the time this is done by one child looking at another child and either calling their name or saying something to get their attention, and clearance is granted by the other child's looking back. These informal observations are being confirmed by a much more systematic study by Maureen Child (see Child 1974). She points out that clearance is often requested by the child putting himself directly in the other child's line of regard, or by touching an object the other child is looking at while himself looking directly at the other child. Sequences like these closely resemble the episodes discussed in the previous section under paradigm D, and our interest in them here is precisely because they may well require the child to calculate where the other person is looking.

One common form of clearance request used by preschool children is to combine looking at the other person with some variation of "do you know what?" (e.g. "do you know what I watch on T.V.?", or "do you know what I've just done?"). The conventional reply is "No" and the child, clearance granted, will continue with his story. It is interesting that to reply "Yes" may confuse the child but rarely stops him continuing. This is further evidence that the initial question was not a factual enquiry but simply a clearance request. Adults often use this form on young children, and sometimes find it rebounds when they do want to ask the child a factual question, e.g.:

(1) Adult: Do you know what that's called?

(2) Child: What's it called?

(3) Adult: No, I'm asking you.... etc..

Garvey and Hogan (1973) have also noticed that the "do you know what?" sequence is an example of clearance request in preschool children. They report a sequence when one child uses the power of the routine to play a joke on the other:

(1) A: Do you know what?

(2) B: What?

(Pause; B turns to A and moves toward him)

(3) B: What?

(Repetition is louder with broader rising-falling intonation)

(A grins, then laughs before speaking)

(4) A: You're a nut.

(Garvey and Hogan 1973, p.566)

The following episode, observed by the author, also illustrates the power of clearance in eliciting the next stage in the interaction, even if it is not appropriate to do so.

(1) Child approaches nurse, from over 30 feet away, looking at her.

(2) When child is about 25 feet away, nurse looks at him.

(3) Child immediately starts to speak. However he is too far away for the nurse to hear him properly.

(4) Child continues approaching, nurse looks away.

(5) As child gets to within 2 feet of the nurse, she looks at him again.

(6) Child repeats what he said earlier.

This suggests that what determines when a child starts to speak in such a situation is not so much the distance between him and his listener but whether or not he has just received clearance. We see also that the nurse looks away again at step (4) so that she can give him clearance again at a more convenient moment. This of course is a well known source of embarrassment to adults, the problem of premature salutation (or what to do when you're granted clearance but you're too far away to talk.) Kendon and Ferber (1974) found that this often occurred in their study of adults greeting out of doors. Almost invariably both adults would look away while approaching each other between the "distance salutation" and the "close salutation" and only look at each other again when they were a few feet apart.

The power of clearance in eliciting an utterance from young children is also demonstrated when they learn how to respond when a teacher asks a question in a classroom[12]. There are apparently

two stages here. First the child must learn not just to call out the answer if he knows it, but to make the "conventional" clearance request of raising his hand. Five year old children learn this quite quickly. The second stage, however, is harder. Here the child has to learn that the teacher will often scan the class, looking in turn at each child with raised hand, before selecting one child either by pointing, by naming him, or by giving a "look" combined with a characteristic nod of the head. Apparently 5 year old children find it hard to inhibit their response when the teacher looks at them as part of her "scanning" the calss. The "look", the usual way of granting clearance, continues to elicit their response.

We are proposing, then, that the social interactions of young children are initiated by sequences involving a complex interplay of speech with the attention of both parties, and that these sequences can be organized around the concept of clearance. However, apart from the sources already mentioned, there is little hard data on this topic.

However, two further studies deserve mention. Castell (1970) observed individual children playing freely in a room with an adult who either read a book or looked continuously at the child. It was found that children looked more at the adult and moved physically closer to him in the second condition. This not only goes against Argyle's "intimacy" theory of eye contact (see Argyle and Dean 1965) which would have predicted the opposite, but suggests instead that looking encourages interaction. In our

terms, clearance is being continually granted.

The second study again involves autistic children. Hutt and Ounsted (1966) made films of autistic children interacting, and concentrated on their characteristic tendency to avoid another's gaze[13]. The children in this study did not simply look away continually from other children. Instead they monitored each other's gaze and specifically averted their own gaze just at the last moment before eye contact was made. In other words, these children seem to be calculating where the other is looking, but doing so in order to avoid contact rather then make contact. Clearly, some very interesting questions are posed by this study and by the other features of autistic children we have already discussed.

4. Concluding remarks

In the previous two sections we have proposed that the child's early interactions contain sequences in which he may be required to calculate what another person can see or, at least, what another person is looking at. We focused on two main areas: first, the interpersonal processes which lead to a common focus of visual attention; and second, the role of visual attention in initiating more complex interactions. In the first area we were mainly concerned with children in the first 2 or 3 years of life, while in the second area the emphasis was on older children between 3 and 5 years old.

There are obviously many more areas we could have considered, such as the role of visual attention throughout the interactions of older children. Alternatively we could have concentrated on specific

lexical items, such as "here", "there", "this", "that", "in front of", "behind", "left" and "right", whose use involves to some degree the awareness of where others are looking or what they can see. These issues were simply too large to have been encompassed here.

It seems that the general area of the role of visual attention in the young child's speech and interactions is being converged on from many sides, e.g. by linguists such as Atkinson (1974), by psychologists such as Bruner (1974) and Trevarthen (1974) and by child ethologists such as Leach (1972) and Child (1974). With the advent of more sophisticated recording techniques (such as twin video cameras with split screen mixing) it seems likely that there will soon be a large body of data relevant to the claims made here.

It has already been mentioned that the present author made a large number of informal observations of the kinds on interactions discussed here. However it was decided not to do empirical work in this area for three main reasons. First, there was not readily available the kind of sophisticated equipment mentioned above. Secondly, even if such equipment had been available, there did not seem an easy solution to the problem of working out precisely where people are looking in natural interactions. These difficulties are present not only for the other people in the interaction, but also for the experimenter trying to analyse the interaction, and they present a severe methodological problem (see Vine 1971). Finally, as has been emphasised several times in this chapter, observation and recording of natural interactions would in any case have to be accompanied by careful experimentation in order to unearth the precise skills and abilities involved. Consequently it was decided

to focus entirely on experimental studies of the young child's ability to calculate what another person can see. In the next chapter we will review existing studies of this ability.

Chapter 3. A Review of Relevant Experimental Studies

The most important experimental study of the young child's ability to calculate what another person can see is, of course, the mountain task of Piaget and Inhelder (1956). In a typical version of this task the child is seated before a model of three mountains, and a doll is placed at various positions around the model. The child is then shown several pictures of the mountains, taken from different viewpoints, and asked to select first the picture showing his own view, and then the picture showing the doll's view. Piaget and Inhelder found that most children below 7 or 8 years can correctly select their own view, but few can select the doll's view. After 8 years children are partially successful in selecting the doll's view, but it is not until 9 or 10 years that they are completely successful on the task.

In another version of the task, one of the pictures is selected first and the child has then to work out which position of the doll corresponds to that picture, while in a third version the child has to construct his own view and the doll's view using three pieces of cardboard to represent the mountains. These two versions of the task produced results similar to the first method.

Most of the subsequent replication studies give results similar to those of Piaget and Inhelder, although on the whole they suggest an even later age for completely successful performance. The following studies all used three mountains and procedures based on Piaget and Inhelder's. Dodwell (1963) tested children aged between 5 and 11 years, and found that

although performance improved with age only a very few of his oldest subjects were completely successful. Neale (1966) found that at 8 years performance was about 30%[14], rising only to 45% at 11 years. Good performance was found by Aebli (1967), who claimed that 43% of his $6\frac{1}{2}$ year olds and 68% of his $7\frac{3}{4}$ year olds showed a "significant tendency to solve the problem correctly", although he gives no data to explain what he means by this. Sullivan and Hunt (1967) investigated class differences in performance. They found that at 7 years middle class boys scored 35% and lower class boys 28%; at 9 years the respective scores were 62% and 50%, and at 11 years they were 90% and 71%. The overall class difference, incidentally, was significant, but the variance was in fact totally accounted for by differences in I.Q. Finally, Laurendeau and Pinard (1970) found that performance was less than 50% below 10 years, rising only to around 70% by 12 years.

Other investigators have used procedures and materials similar to the mountain task, but typically involving a group of 3 different objects instead of mountains. For example Youniss and Robertson (1970) used a scene of a tower, a tree and a house. They found that performance was around 45% at 9 years and 75% at 11 years. Shantz and Watson (1971), in one of the few studies to test younger children, used a scene of a school, a flag and a sandbox. For their children, aged between 3 years 8 months and 6 years 6 months, they found very low performance; most of the children failed all trials or passed only one trial. Flavell et al (1968) used a sequence of tests of increasing complexity,

most of which involved a group of 3 coloured cylinders. Flavell found that overall performance gradually increased from around 20% at 7 years to around 70% at 15 years. Rubin (1973) used Flavell's tests and found an increase from 22% at 5½ years to 64% at 11½ years. Finally, Huttenlocher and Presson (1973) used a line of 3 coloured blocks which could be rotated to various positions. In the condition which most resembled Piaget and Inhelder's mountain task (Huttenlocher and Presson's "visible perspective" condition) performance was around 50% both at age 8 years and at age 10 years.

On the whole, then, these studies support Piaget and Inhelder's main findings, and suggest that for the mountain task and similar set-ups children younger than about 8 years are unable to calculate what another person or doll can see. After 8 years performance gradually improves, although completely successful performance may not be reached by even 11 or 12 years.

Clearly the calculations involved in the mountain task and these replication studies are more complex than those required in the simple interactions considered in the previous chapter. The main difference between those interactions and the mountain task is that in the former the child has only to calculate what another person is looking at, while in the mountain task he must not only do this but also calculate how it looks to the other person. This is an important distinction which we will expand.

The abilities involved in calculating what another person is looking at we will call projective abilities, while the further

abilities involved in calculating how it looks to the other person will be called perspective abilities. In each case there are two main components: first, a basic awareness of possible differences in viewpoint, and second, the ability to perform the necessary calculations.

Thus the projective abilities involved in calculating what another person is looking at consist of

(1) a basic awareness that what the other person is looking at may be different from what one is looking at oneself;

(2) the ability to calculate what the other person is looking at. This involves

(a) using the relevant cues from the other person (such as their eye position or eye movements, or the orientation of their head or body etc.) in order to calculate their direction of gaze;

(b) knowing that people see in straight lines (lines of sight, or visual lines)[15];

(c) being able to project, or construct, a straight line along their direction of gaze in order to locate the object of their gaze;

(d) knowing that people see the nearest object along their line of sight, and that objects further along their line of sight will to some extent be hidden or occluded by the nearest object.

Having located what another person is looking at, then a further set of perspective abilities are involved in calculating how it looks

to the other person. These consist of

(1) a basic awareness that things look different to another person in a different position to oneself;

(2) the ability to calculate how it looks to the other person by performing various transformations on one's own view. These transformations concern

(a) orientation: knowing that other people will see the part of an object that is turned towards them;

(b) front/back: knowing that other people will see objects that are nearer to them in front of objects that are further away;

(c) left/right: knowing that which objects are seen on the left and which on the right may be different for the other person, but systematically related to one's own view of the objects.

The essence of this distinction between projective and perspective abilities is that with the former one is concerned simply with whether a certain object is or is not in the other person's visual field, while with the latter one is concerned with the actual details of the other person's visual experience of the object.

Having made this distinction between projective and perspective abilities, it seems that there need not be any direct conflict between our suggestions from chapter two and the experimental results just discussed. All we are saying in chapter two is that

by 5 years children may be able to calculate what another person is looking at, which involves projective abilities. On the other hand, the experiments just discussed are tests of relatively complex perspective abilities, in particular the ability to perform an integrated series of front/back and left/right transformations, and these studies show that this level of performance is not reached before 8 years at least. These results by themselves do not rule out the possibility that children aged 5 years or under may have some projective abilities, or that they may even be able to construct simpler perspectives than those required in the mountain task. Indeed, such a possibility seems a reasonable implication from the experimental results just discussed.

Nevertheless, although this possibility is not imcompatible with Piaget and Inhelder's results, it is in fact incompatible with their interpretation of these results. Piaget and Inhelder's theory clearly rules out the possibility that preschool children may have simple projective or perspective abilities.

There are three distinct strands to their argument. These are:

(1) that children below 6 years are not aware that things look different to another person in a different position. This is our basic perspective awareness;

(2) that children below 8 years do not have simple projective abilities, such as being able to construct a straight line of sight;

(3) that children below 8 years cannot construct simpler perspectives than those required in the mountain task, such as being able to calculate how

a single object looks to another person.

We will examine each of these strands in detail.

First we will look at Piaget and Inhelder's claim that children below 6 years are unaware that things look different to another person in a different position. This claim is based on their division of performance on the mountain task into four main stages:

> Stage IIA (roughly 4-6 years): the child tends to select his own view instead of the doll's view. This is generally known as the egocentric response.
>
> Stage IIB (roughly 6-7 years): the child is still unable to calculate the doll's view and makes various kinds of errors, such as always selecting the same view for different positions, or turning a picture of his own view towards the doll's position, etc..
>
> Stage IIIA (roughly 7-8 years): the child is partially successful in calculating the doll's view. For example he will select pictures showing some aspects of the doll's view, but is unlikely to be completely correct.
>
> Stage IIIB (roughly 9-10 years): the child is completely successful in calculating the doll's view.

We will focus here on the distinction between Stage IIA and Stage IIB. Piaget and Inhelder argue that because the child gives the egocentric response at Stage IIA this indicates that

> ".... the child fails to realise that different

observers will enjoy different perspectives and seems to regard his own point of view as the only one possible."

(Piaget and Inhelder, 1956, p.213)

and again

"..... the children ... all really imagine that the doll's perspective is the same as their own, they all think the little man sees the mountains in the way they appear from where they themselves sit." (ibid, p.220)

On the other hand the fact that children make different kinds of errors at Stage IIB suggests that

"Compared with Substage IIA, the present level is a definite step towards true relativity, to the extent that there is some awareness that things will look different to an observer stationed elsewhere. But this idea is not yet by any means sufficiently developed to warrant an understanding of perspectives or their fundamental relativity."

(ibid, p.233)

Piaget and Inhelder's argument, then, is that egocentric responses indicate a lack of awareness that others see things differently, while the non-egocentric errors typical of Stage IIB indicate that the child is aware of the difference. The argument, however, is not necessarily valid[16]. We cannot rule out, a priori, the possibility that a child may be aware that the doll has a different view from him, but because he is unable to calculate the doll's view he may all the same give an

egocentric response. In a similar way, a child may be unaware of the difference between the doll's view and his own, and yet still give a non-egocentric error response.

Moreover, Piaget and Inhelder themselves seem to admit that the presence or absence of this basic perspective awareness cannot necessarily be deduced from the type of error the child makes. In another study described in the same volume (the "perspectives task") children were asked to construct various views of a single object. Piaget and Inhelder found that children at Stage IIA in this study did not usually make egocentric reponses, but in fact their errors were more like the Stage IIB (i.e. non-egocentric) errors of the mountain task. Nevertheless Piaget and Inhelder conclude that there is "no real contradiction" between these two tasks, for the results show in each case that the child is "quite unaware that he possesses a viewpoint distinct from those of other observers". (p.243). In other words, Piaget and Inhelder are implicitly admitting that the kind of error produced does not necessarily imply the presence or absence of a basic awareness of differences in perspective.

Furthermore there is considerable empirical evidence against this argument. Although, as we have seen, there have been many replications of Piaget and Inhelder's main finding that children aged 8 years and below do fail on the mountain task, there has been virtually no confirmation of their claims as to how they fail. For a start, both Dodwell (1963) and Flavell (1968), who explicitly looked for stages like Piaget's, had distinct trouble in even identifying them, let alone confirming their sequence of appearance.

The main source of trouble seems to have been the distinction between Stage IIB and Stage IIA; egocentric responses (Stage IIA) were easily identified.

Secondly, a number of studies have reported the curious finding that the proportion of egocentric responses to other non-egocentric errors actually increases with age (Houssidas 1965, Houssidas and Brown 1967, Laurendeau and Pinard 1970, Fishbein et al 1972). This of course directly contradicts Piaget and Inhelder's position. It should be noted, though, that not all replications have found this result. A few studies in fact agree with Piaget and Inhelder in finding that the proportion of egocentric to non-egocentric errors decreases with age. (Flavell et al 1968, Aebli 1967).

Finally, Aebli (1967) found that the proportion of egocentric responses to non-egocentric errors varies according to how the task is presented. If the child is asked to select his own view of the mountain before the doll's view, then his errors are more likely to be egocentric. Garner and Plant (1972) found a similar effect of order of presentation on the actual number of egocentric errors given.

Taken together, these studies all show that whether or not a child gives an egocentric response is in itself an interesting question, and that the mere occurrence of an egocentric response does not by itself necessarily imply the lack of a basic awareness of differences in perspective. As this is the cornerstone of Piaget and Inhelder's argument that children below 6 years do not have this basic awareness, we conclude that their argument is not necessarily valid. We cannot, a priori, rule out the possibility that children below 6 years do have this basic awareness of differences in perspective.

We will now look at Piaget and Inhelder's second argument, that children below 8 years at least do not have simple projective abilities such as being able to construct a straight line of sight. In order to understand their argument here we must first describe their projective line task (Piaget and Inhelder 1956, chapter 6). In this task, children were given several matchsticks, each stuck vertically into a plasticine base, and told they were telegraph posts. Two of the posts were placed some distance apart on a table, and the children were asked to put the others in a perfectly straight line between these two.

Piaget and Inhelder found that children between 4 years and 6 years could make a straight line if it was parallel to the edge of a straight table, (see figure 1), or across the diameter of a round table, (see figure 2).

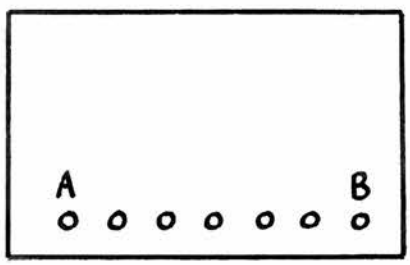


Figure 1

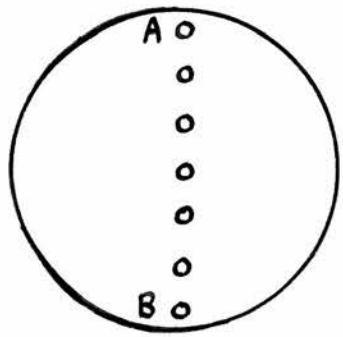


Figure 2

At this age, however, they could not construct a straight line across the corner of a table, but typically they would follow the edges of the table (see figure 3).

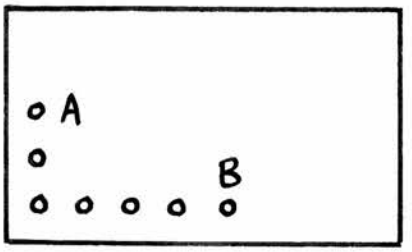


Figure 3

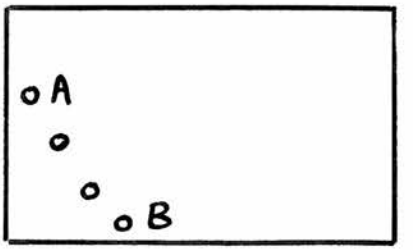


Figure 4

By seven years they could construct a straight line across the corner (see figure 4). They would frequently do this by "taking aim" or "sighting along the line", either spontaneously or after prompting from the experimenter.

Piaget and Inhelder produce a detailed argument to explain this result, and to connect this task with the mountain task. There are three steps to the argument.

(1) The construction of a straight line in the crucial situation across the corner of the table, requires the child to adopt the method of "sighting", or to use even more complex Euclidean relationships,

> "In this case, imagining the line no longer consists of merely imitating a past or present perception, but entails creating new relationships within an existing pattern distinct from those sought after. Such an achievement requires either a projective operation based on the action of "taking aim", or else a Euclidean operation based on changes of position". (ibid. p.163)

(2) The method of taking aim involves the knowledge that people see in straight lines.

> "In other words the discovery of the projective straight line is made when the child grasps that two points X and Y can be related to the observer O through the agency of his line of regard OXY".
>
> (ibid, p.169)

(3) The knowledge that people see in straight lines requires the prior concept of "a point of view" which can only arise when the mountain task has been solved.

> "The discovery that he has a particular viewpoint, even the child's becoming aware that he occupies one momentarily, is far more difficult to come by than might at first be supposed. For such a discovery or awareness really presupposes the coordination of all possible viewpoints. The operation of "sighting" is therefore not just a simple action but the result of discriminating between, and hence coordinating, all the several points of view that may be involved."
>
> (ibid, p.165)

The conclusion from the above three steps is that the child cannot construct a straight line until he has solved the mountain task.

"As we have just seen, the precondition for forming a projective straight line is a progressive discrimination and coordination of different viewpoints, or in other words, perspectives." (ibid, p.171)

and again:

"The main conclusion to be drawn from this discussion is therefore, that global or comprehensive coordination of viewpoints is the basic pre-requisite in constructing simple projective relations." (ibid, p.244)

In this form, the argument seems inconsistent with Piaget and Inhelder's own data, which shows that children succeed on the projective line task at 7 years (the beginnings of Stage IIIA) while they are not completely successful on the mountain task until 9 or 10 years (Stage IIIB). Moreover Piaget and Inhelder themselves point out that projective relations are acquired before perspective relations.

"In short, once the projective straight line has been discovered through the method of 'taking aim' (Substage IIIA) the operations thereby introduced are subsequently extended in the course of Substage IIIB to cover perspective in general." (ibid, p.190)

This objection, however, is not particularly serious, as we can modify the final stage in Piaget and Inhelder's argument so that it merely states that the appearance of projective abilities is

closely connected with the appearance of perspective abilities, and that neither are present before 7 or 8 years. This is still a strong argument against the possibility that preschool children may have any projective abilities.

However, like their previous argument, it is not necessarily valid. It is possible that, contrary to step 1, a child could construct a straight line of posts without taking aim. It is also possible that, contrary to step 2, a child may know that people see in straight lines without developing the schema of "taking aim". And finally it is also possible that, contrary to step 3, a child may know that people see in straight lines without having any perspective abilities at all.

Thus, although we cannot bring any convincing empirical evidence against this second argument of Piaget and Inhelder's, we have at least pointed out that it is not necessarily valid, and that it does not, a priori, rule out the possibility that children below 7 or 8 years may have some simple projective abilities.

Finally we will look at Piaget and Inhelder's third claim, that children below 8 years at least cannot construct simpler perspectives than those required in the mountain task. This third argument resembles the second one, in that it arises out of Piaget and Inhelder's attempts to connect the mountain task with another task described earlier in the same volume, the perspectives task (Piaget and Inhelder 1956, chapter 6). In this task, the child sits at a table with a doll sitting in another position at 90^{o} to him. The child is shown various objects, such as a needle, a stick, and a thin disc, and asked either to draw how this object looks to

himself and to the doll, or to select his own view and the doll's view from a collection of pictures. Thus this task is essentially a single object version of the mountain task, although it is reported, and seems to have been conducted, in a much less systematic manner than the mountain task.

Piaget and Inhelder distinguish four main stages in the child's performance on this task.

Stage IIA (roughly 4-6 years): the child tends to draw or select the same picture irrespective of the orientation of the object, and irrespective of which view is required.

Stage IIB (roughly 6-7 years): the child is partially successful in selecting pictures showing the doll's view, but still fails on the drawing.

Stage IIIA (roughly 7-8 years): the child's drawing and picture selection correctly show the general shape of his own view and the other's view, but are often inaccurate in detail.

Stage IIIB (roughly 9-10 years): the child is generally completely successful and accurate on the details of both his own view and the other's view.

There seem to be several inconsistencies between this account of the perspectives task and Piaget and Inhelder's account of the mountain task. We have already noted that the kind of errors which Piaget and Inhelder class as Stage IIA in the perspectives task (i.e. the child selecting one picture for all views) are classed as Stage IIB in the mountain task. Similarly, in both tasks children pass through a stage of at least partial success on picture selection, but in the perspectives task this is classed as Stage IIB, while in

the mountain task it is classed as Stage IIIA. On the whole, then, it seems that the two tasks are not stage-for-stage equivalent, as Piaget and Inhelder are trying to suggest, but rather the same level of performance is reached about a stage earlier on the perspectives task than on the mountain task.

However, we are more concerned here with Piaget and Inhelder's argument that children below 7 or 8 years at least cannot construct simple perspectives. There are three main steps to the argument.

> (1) To construct any perspective, even if it is simply to represent one's own view of a simple object, or to calculate another person's view of that object, requires one to be consciously aware of one's own viewpoint.
>
> "To see an object with a given perspective is to view it from a particular viewpoint, but it is not necessary to be consciously aware of this viewpoint in order to perceive the object accurately. On the other hand, to represent this object in perspective by means of a mental image or a drawing necessitates a conscious awareness of the percipient's viewpoint...." (ibid, p.178)
>
> (2) To be consciously aware of one's own point of view involves being able to differentiate it from others, and to coordinate it with them.
>
> ".... to discover one's own viewpoint is to relate it to other viewpoints, to distinguish it from and coordinate it with them." (ibid, p.193)

(3) This can only be done when the mountain task is solved, as this is the essential test for coordination of viewpoints.

"Consequently, to the extent that the child can coordinate his own viewpoint with others, he succeeds both in constructing these alternative viewpoints and in distinguishing his own from them (Substage IIIA, and especially IIIB). In so doing he masters simple perspective relations and solves the problems of global coordination (chapter 8) along with perspectives of isolated objects (chapter 6) ...." (ibid, p.243)

There are two main objections to this argument. The first is concerned with the notion of being "consciously aware" of one's own point of view. Piaget and Inhelder do not elaborate on what they mean by this, although it is most likely connected with their idea of the preoperational child being unable to reflect on his own experience. However it seems likely that the minimal requirement for conscious awareness of one's own point of view is simply the basic awareness that other points of view may be different. Even Piaget and Inhelder admit that this is present at least 3 years before the child is able to solve the mountain task although, as we have pointed out, their arguments for this are unsound. All the same, this basic awareness is a long way from the complete ability to solve the mountain task, and thus we cannot accept a priori Piaget and Inhelder's argument that they are the same.

More convincingly, there is firm empirical evidence against Piaget and Inhelder's position from their own data for the perspectives task. The objects used in this task were fairly simple, although some of the views of these objects which the children were asked to construct were in fact quite difficult to represent (e.g. a rod seen end on, a thin disc seen edge on, etc.). A close examination of the protocols for this task which Piaget and Inhelder actually discuss shows that even in Stage IIA (4-6 years) children were often able to calculate simple perspectives, but were failing on the more difficult views, e.g. "ZUM (5:2) draws the stick vertical when it is vertical for the doll and horizontal when it is horizontal. But he also draws the stick seen head-on as horizontal." (ibid, p.176). Similar performances are given by UL (5:2) and GER (5:5).

Thus, far from supporting Piaget and Inhelder's claim that children younger than 8 years at least cannot construct perspectives simpler than those required on the mountain task, their own data in fact shows the opposite. Thus Piaget and Inhelder's third argument is unconvincing.

We have now considered three separate claims made by Piaget and Inhelder. First they claim that children below 6 years are not aware that things look different to another person in a different position. Secondly they claim that children below 8 years at least cannot have simple projective abilities. Thirdly they claim that children below 8 years at least cannot construct simple perspectives. In each case we have demonstrated that there are either logical or empirical objections to their arguments, and

we have also pointed out some internal inconsistencies in their own explanations. We conclude that their arguments do not, a priori, rule out the possibility that preschool children may have simple projective or perspective abilities.

It seems at first sight strange that Piaget and Inhelder should have made these suggestions at all. We have already seen that the possibility that preschool children might have these abilities is not incompatible with the results of any of their three relevant experiments (the mountain task, the projective line task, and the perspectives task). Indeed it seems that the most reasonable assumption to make from these results is that younger children might be able to succeed on tasks which are simpler than these three. Yet Piaget and Inhelder explicitly argue that this is not possible. Why do they adopt this strange position?.

It is perhaps easier to understand their position here when we consider it in relation to their overall theory of egocentrism and preoperational thought. We have already seen that although the main sense of egocentrism is the inability to take another point of view, it is closely connected to several other preoperational concepts, such as the absence of groupings, the inability of the child to reflect on his own experience, being tied to his own perception, etc., and that these concepts form a closely linked web. Piaget and Inhelder's position here is a reflection in miniature of this overall interconnecting pattern. Thus the young child who fails the mountain task does so not only because he is egocentric and unable to take another point of view,

but also because he has not yet acquired groupings and so cannot perform the transformations needed to calculate the doll's view, and because he cannot reflect on his own experience (or in other words he is not "consciously aware" of his own viewpoint), and because he is tied to his own perception of the situation and cannot free himself from his own point of view. This beautiful convergence of several different kinds of explanation is well illustrated by the following quotation:

> "... the purely preceptual point of view is always completely egocentric. This means that it is both unaware of itself and incomplete, distorting reality to the extent that it remains so. As against this, to discover one's own viewpoint is to relate it to other viewpoints, to distinguish it from and to coordinate it with them. Now perception is quite unsuited to this task, for to become conscious of one's own viewpoint is really to liberate oneself from it. To do this requires a system of true mental operations, that is operations which are reversible and capable of being linked together." (ibid, p.193)

Unfortunately it seems that such beauty is only achieved at a price. There are, as we have seen, several inaccuracies and inconsistencies in Piaget and Inhelder's position here, and because of these we are unable to accept their a priori argument that preschool children cannot have simple projective or perspective abilities. Instead this possibility needs to be tested empirically.

There is, however, very little relevant empirical evidence available. We have already reviewed the evidence that children below 8 years fail on the mountain task and on tasks of similar complexity. Surprisingly enough, there has been only one attempt so far[17] to see how preschool children perform on tasks which are simpler than these. Although this study (by Flavell et al, 1968, chapter 5) was only a series of pilot studies, it is still worth considering.

Flavell gave a series of 6 tasks (in his terms, tasks IIIA-F) to 40 children, 10 each at ages 3, 4, 5 and 6 years. Three of these tasks (IIIA, C and F) were revised and given to ten 3-year olds and ten 5-year olds. The most relevant tasks for our purposes are tasks IIIA (revised), IIIC (revised), IIID and IIIE.

Task IIIA (revised) is a very simple perspective test, in which the child (C) is required to turn a picture so that the experimenter (E) sees it in a certain way. To begin with, E and C are at the same side of the table, and E shows C a simple picture of a human figure. E says, "In this game I have just one card. It is a picture of a child. He is standing up. Now let's turn the card around (that is, upside down). How does he look now?" If C does not indicate that the picture is "upside down", "standing on his head", or something equivalent, then E says, "He is standing on his head, isn't he?" E then turns the picture the right way up. "Now he is standing up again. Can you make him stand on his head?" After the child does so E goes to the other side of the table and places the picture crossways between him and the child. "Now you take the picture and show it to me so I can see the man standing

on his head. Be sure to show it to me so that I see the man standing on his head."

Flavell found that six out of ten 3-year olds placed the picture correctly (i.e. right side up for the child), and so did nine out of ten 5-year olds. Unfortunately, Flavell did not try other orientations of the picture, or have E sitting in different positions, and so we cannot be sure if the children knew exactly what they were meant to be doing. It is a pity too that the "correct" resonse may also be the child's most natural response - i.e. simply to turn the picture so that he sees it right way up himself. Nevertheless, the results suggest the presence of at least a basic perspective awareness in preschool children.

The other three relevant tasks are all simple projective tasks, in which the child is asked to identify what E sees. Task IIID is the simplest of these. E and C sit on opposite sides of a table. "I have a card here that has two pictures on it. On this side (demonstrates) is a little dog, or puppy, and on the other side, (turns card over) is a picture of a birthday cake." E then holds the card so that C sees the puppy and E sees the cake. "In this game I am looking at a picture right now. See if you can tell me what picture I am looking at." Flavell found that 7 out of 10 three year olds, 9 out of 10 four year olds, 8 out of 10 five year olds and 8 out of 10 six year olds were correct. These results strongly suggest that most children in this age group at least have what we call simple projective awareness, or the awareness that the other person may be looking at something different from what the child himself sees.

Task IIIE was a more complex version of this. This time the card had the same three pictures on both sides: an aeroplane at the top, a teddy bear in the middle and a clown at the bottom. E shows both sides of the card to C, and then sits opposite C with a card between them. First E takes a piece of cardboard hinged in the middle and covers two of the pictures on each side, leaving only the clown visible. E then asks C "Now, can you tell me what picture I can see on my side?" (pretest). E then takes another piece of cardboard, wider than the pictures, and covers first the top picture, and then the top two pictures, on E's side of the card only. Each time, E asks "Can you tell me what I see on my side now?"

Most of the children passed the pretest, and most of the children between 4 and 6 years passed the two main trials. However, few 3 year olds succeeded on the main trials. Although a few children gave egocentric responses (i.e. merely reported what they themselves saw), for the most part their errors indicated an awareness that what E saw was different from what they themselves saw, together with an inability to work out exactly what E did see.

Finally, in task IIIC (revised), the materials were two identical cubes (6" side) with a different picture on each vertical face. First E shows one cube to C, asking him to name all four pictures (a teddy bear, a bird, a chair and a doll in a cradle). E then shows how the second cube is identical to the first and says "I am going to turn my block around. Now can you turn your block around so that you can see on your block the same picture that I am looking at on my block." After the child has turned his block

E asks two questions: "What picture are you looking at?" and "What picture do you think I am looking at?"

The most common response of the 3-year olds (5 out of 10) was to give incorrect responses both to the block turning and to the verbal question about what E saw. (All children correctly answered the verbal question about what they themselves saw.) The most common response of the 5-year olds (6 out of 10) was to give all correct responses. Most of the errors were egocentric: the children turned their blocks so that they saw on their own block exactly what they saw on E's block. However, it is hard to say how much their difficulties lay in deciphering the rather complicated instructions, and how much they were due to the children's inability to make the necessary calculations.

Despite the few weaknesses in methodology that we have pointed out, these studies do suggest that preschool children do have some simple projective and perspective abilities. The first two tasks discussed suggest that even 3-year olds are aware that other people can see pictures which the child himself cannot (task IIID) and that other people can see the same picture in a different way (task IIIA revised). The last two studies (IIIE and IIIC revised) suggest that most 5-year olds can work out exactly what another person can see in a more complex situation, but most 3-year olds cannot do this.

These tentative results strongly suggest the need for a more detailed and systematic investigation of the projective and perspective abilities of preschool children. The experiments reported in the next chapter are the beginning of such an investigation.

Chapter 4. Eight Experiments on Egocentrism

Experiment 1

Introduction

The first experiment is concerned with whether preschool children have simple projective abilities. We have already seen in the previous chapter that Piaget and Inhelder argue that they do not. Their argument is based on the results of their projective line task, in which children were asked to construct a straight line of "telegraph posts" between two end posts placed in various positions. Piaget and Inhelder found that children between 4 and 6 years could make a straight line if it was parallel to the edge of a straight table or across the diameter of a round table. However, the crucial condition was whether the children could construct a straight line across the corner of a table. Piaget and Inhelder found that children below 7 years were unable to do this, and claimed that this was because it required the child to "take aim", or "sight along the line". This, they argued, depends on the knowledge that people see in straight lines, and this in turn depends on the child's being able to succeed on the mountain task.

We saw earlier that Piaget and Inhelder's argument was not necessarily valid, but we were unable to bring any direct empirical evidence against it. It should be noted here, though, that the few attempts that have been made to replicate the projective line task have produced conflicting results. For instance Lovell (1959) found that for his youngest group (below 4 years) 93% could make a straight

line (or a straight line with slight irregularities in it) parallel to the edge of a square table, and 40% could make a straight line across the corner of this table. The corresponding figures for his oldest group (5 years 1 month to 5 years 8 months) were 100% and 56%. Clearly these children are performing much better than Piaget and Inhelder's subjects. On the other hand, Laurendeau and Pinard (1970) found a lower level of performance than Piaget and Inhelder. In their study children were not generally able to construct a straight line parallel or perpendicular to the edge of a table until 7 years, and were unable to construct a line across the corner of the table until 8 years. There is some doubt, then, as to the reliability of Piaget and Inhelder's original finding.

The following experiment compares two methods of constructing a straight line in identical situations. First two small dolls are placed, facing each other, on a table. One method, the projective line task, is identical to that of Piaget and Inhelder. The child is given a number of dolls and asked to put them in a straight line between the two end dolls. The other method, the line of sight task, is more direct. The child is given an object and asked to put it so that one doll cannot see the other. The child can only do this successfully by calculating the straight line of sight between the two dolls.

Subjects

Twenty 4-year old children (11 boys and 9 girls) and twenty 3-year old children (10 boys and 10 girls) were subjects. The ages of the 4-year old children ranged from 4 years 9 months to 4 years 2 months (mean age 4 years 6 months). The ages of the 3-year old

children ranged from 3 years 11 months to 3 years 3 months (mean age 3 years 8 months). They were all attending preschool playgroups and were of mixed social class.[18]

Materials

For the projective line task the materials were six small wooden dolls, 6 cm high, with round bases 3 cm in diameter.

For the line of sight task the materials were one of these dolls, a wooden policeman 7 cm high with a round base 3 cm in diameter, and a small wooden "wall", 7 cm high, 4 cm wide, ½ cm thick.

Procedure

The children were split into two groups, matched as far as possible for age and sex. One condition performed the projective line task, the other performed the line of sight task.

Projective Line Task

All six wooden dolls were placed in a group on a table in front of the child. The experimenter (E) told the child that the dolls were a group of boys and girls. E then placed two of the dolls about 30 cm apart on the edge of the table (see figure 5).

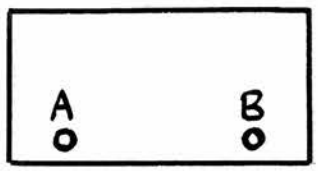


Figure 5

E said "put these boys and girls (pointing to the group) in a straight line between that one (pointing to A) and that one (pointing to B)".

This was repeated with the two initial dolls either pointing directly away from the child (see figure 6) or across the corner of

the table (see figure 7). These three situations were always presented in this order.

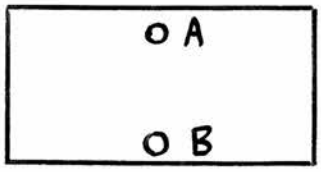


Figure 6

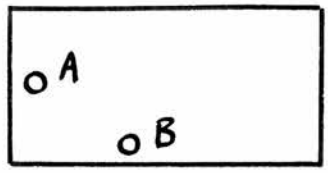


Figure 7

Line of Sight Task

The policeman, the single wooden doll, and the wall were placed on the table. The child was told that the doll was a small boy.

E said "The policeman is looking for the boy. The boy wants to hide from the policeman."

Then the policeman and the boy were placed facing each other on the edge of the table, at A and B respectively (see figure 5).

E said "Put the wall so that the policeman cannot see the boy."

This was repeated with the policeman and boy at A and B respectively, as shown in figures 6 and 7. As before, these three situations were always presented in this order. The policeman and the boy always faced each other, and the child could always see the policeman's direction of gaze.

Scoring

It is difficult to give hard and fast criteria for when the child has constructed a straight line in the projective line task. Straight lines, and lines with slight irregularities were scored as correct. Curved lines, discontinuous straight lines, and straight lines in the direction AB but not between A and B were scored as incorrect.

It is easier to give criteria for the line of sight task. If the

wall was placed on the line AB so that it obscured the policeman's view of the boy, it was scored as correct. All other placements were incorrect.

Results

Table 1 shows the number of correct responses, (out of a possible 10), for each situation.

Table 1: Number of correct responses for each situation.

Age	Situation	Projective Line	Line of Sight
4 years	Parallel to the edge	7	9
	Perpendicular to the edge	7	10
	Across the corner	8	10
3 years	Parallel to the edge	4	9
	Perpendicular to the edge	2	10
	Across the corner	1	10

Contrary to Piaget and Inhelder, there is no significant difference between the three initial positions of the dolls (parallel to the edge, perpendicular to the edge, and across the corner). These scores are combined and expressed as percentages in Table 2.

Table 2: Combined percentage scores for each task.

	Projective Line	Line of Sight
4 years	73%	97%
3 years	23%	97%

The performance of the 4-year olds on the projective line task is lower than their performance on the line of sight task, but not significantly so ($U=34$, $p>0.1$, Mann-Whitney U test, two-tailed). The performance of the 3-year olds on the projective line task is both significantly lower than that of the 4-year olds on this task ($U=17$, $p<0.01$, Mann-Whitney U test, one-tailed) and significantly lower than that of the 3-year olds on the line of sight task ($U=1$, $p<0.002$, Mann-Whitney U test, two-tailed).

Discussion

Virtually all the children, 3-year olds as well as 4-year olds, could construct lines of sight in every situation. Most of the 4-year olds could construct projective lines in all three situations, including the crucial situation across the corner of the table. Few of the 3-year olds could do this.

There are three main implications of this result. First, the present study supports the previous finding of Lovell (1959) that the performance of preschool children on the projective line task is better than Piaget and Inhelder claim. In particular the present

study found that, contrary to Piaget and Inhelder, there was no difference between constructing a line parallel to the edge, perpendicular to the edge, or across the corner. This last finding may be due solely to the small number of subjects used here, and more data is needed, particularly from the younger group, in order to clarify this. More definitely, we can reject the possibility that the result occurred because all the subjects received the "across the corner" condition last, since this was the order adopted by Piaget and Inhelder themselves. For now, all we can suggest to explain the higher level of performance is that in the present study great care was taken to make the instructions as simple and precise as possible. Unfortunately neither Lovell nor Piaget and Inhelder give the precise wordings they used, and so we are unable to make a direct comparison.

Secondly, the results show that preschool children are able to construct a straight line of sight before they can pass the projective line test. This needs some explanation, as the tasks are formally identical. In each case the child has to calculate a straight line between two points, and place objects on this line. Why, then, is the line of sight task easier than the projective line task?.

Part of the answer is that the projective line task requires the child to handle several dolls. This is superfluous to the formal requirements of the task. In another informal study only three dolls were used. Two of these were set up, as in the standard task, and the child was asked to put the third "in a straight line" between them. Young children performed better on this than on the standard projective line task with six dolls. However, performance

still was not as high as on the line of sight task. The number of dolls used, then, only partly explains the difference between the tasks.

It is possible that in the projective line task the child has difficulties understanding the term "straight line". There is some informal evidence for this. Children who fail the projective line task typically produce a large variety of arrangements of the dolls. In another informal study children who did this were asked by the experimenter to "show me the straight line you've made." Many children would trace out a line joining up the dolls, although this line would be far from straight, typically giving comments like "here's the straight line". Piaget and Inhelder (p.160) and Lovell have also pointed out that 3- and 4-year old children have difficulty with the term "straight line", and this needs more systematic investigation.

The third, and by far the most important, finding of this experiment is that both 3- and 4-year old children give virtually errorless performances on the line of sight task. This shows that by 3 years children already have considerable projective abilities. In Chapter 3 we outlined the various component abilities involved in calculating what another person can see. The present results show that a 3-year old child has at least some competence in <u>all</u> these component abilities. We will discuss each in turn.

First, a 3-year old child has the basic awareness that what the other person is looking at is different from what he himself is looking at. This follows directly from the fact that no child attempted to put the wall between <u>himself</u> and the doll. Secondly,

the child has at least a basic ability to calculate what the other person is looking at. He is aware of the approximate direction in which the policeman is looking, although it is not certain which cues the child uses to calculate this, or whether he simply assumes from the context that the policeman is looking in the doll's direction. The child is also aware that the policeman sees in a straight line, and he has at least the primitive ability to construct this line, for he can place an object so as to intercept it. Indeed most children showed a fairly clear sense of the extension of this line by placing the wall roughly midway between the policeman and the doll. Only one or two placed the wall close to the policeman, while a few more placed it close to the doll; in all these cases the wall still intercepted the policeman's line of sight. Finally, the child who passes the line of sight test seems to be aware that placing the wall between the policeman and the doll means that the policeman is no longer able to see the doll but instead only sees the wall.[19] In other words, he seems to be aware that the other person sees the <u>first</u> object along his line of sight.

This first experiment, then, directly contradicts Piaget and Inhelder's claim that preschool children cannot have simple projective abilities. Instead it shows that children as young as 3 years have considerable competence in this area.

This experiment could be followed up in several ways. For example, we have suggested various factors which may be responsible for the child's poor performance on the projective line test, and these factors could be investigated further. Alternatively, more demanding tests could be made of the young child's projective abilities.

We could investigate what cues he actually uses in determining the other person's direction of gaze, and how accurately he uses them; or we could see how accurately he can construct a straight line of sight; or if he can construct the intersection of <u>two</u> straight lines of sight. This last suggestion will in fact be taken up in experiment 7.

However, we will concentrate instead on the question of whether or not young children have perspective abilities comparable to these projective abilities. The next experiment is an attempt to answer this question.

Experiment 2

Introduction

The main aim of this experiment was to see whether preschool children have simple perspective abilities comparable to the projective abilities unearthed in Experiment 1. This was done by comparing each child's performances on a simple projective test and a simple perspective test in the same situation. The materials used here were a toy dog and a cup, which could be turned to any position. The child's projective ability was tested by verbal questioning, i.e. the child was asked, for various positions of the cup and the dog, whether the dog could see the handle of the cup. In another session, the child's perspective ability was tested by the standard method of picture selection, i.e. the child was asked, for various positions of the cup and the dog, to select the picture showing his own view and the picture showing the dog's view. Thus the main aim of the experiment was to compare verbal questioning with picture selection.

Two subsidiary aims were introduced by using picture selection. First, it was not clear from previous work whether preschool children could even select their own view correctly. It was noted in Chapter 3 that this was one of the discrepancies between Piaget and Inhelder's findings on the mountain task and their report of the perspectives task. In the former they found that children between 4 and 6 years were able to select their own view correctly (and of course they also selected their own view when asked to give the doll's view). In the perspectives task, on the other hand, Piaget and Inhelder claimed that children of the same age were unable to select their own view of the

single objects used in that task although, as we pointed out in Chapter 3, their own protocols cast doubt on this claim. Similarly, Aebli (1967) claimed that children younger than 6 years cannot reliably select their own view, although he gave no data to support this. Thus the second aim of this experiment was to see whether preschool children could even select their own view correctly.

The final aim was occasioned by the finding of Aebli (1967) that the proportion of egocentric errors to non-egocentric errors varies according to how the task is presented. If the child is asked to select his own view before the other's view, his errors are more likely to be egocentric than if the reverse order is used. Garner and Plant (1972) found a similar effect of order of presentation on the actual number of egocentric responses given. This is relevant both for interpreting what the egocentric response means, and for general methodology. The third aim of this experiment, then, was to investigate the effect on egocentric responses of varying the order of presentation of own view and other view questions.

Subjects

32 nursery school children (17 boys and 15 girls) were subjects. Their ages ranged from 4 years 11 months to 4 years 2 months (mean age 4 years 7 months). They all attended a preschool playgroup and were of mixed social class.

Materials

The materials used were a large yellow cup, four pictures of the cup, and a toy dog called Ringo.

The cup was 10 cm high, with a handle. It was placed on a table in front of the child with the handle in one of four positions:

(i) at the left, (ii) at the right, (iii) at the front, pointing towards the child and (iv) at the back, hidden from the child.

The pictures used were each 15 cm x 8 cm and were fixed on a board 45 cm x 17 cm. The pictures showed the four views corresponding to the four positions of the cup.

The dog, Ringo, was about 30 cm high, and sat on one of two chairs around the table. One chair was directly opposite the child. The other was 90° to the child's right. The experimenter sat behind and to the left of the child.

Figure 8 shows a plan view of the experimental situation, while Figure 9 shows a schematic representation of the four pictures.

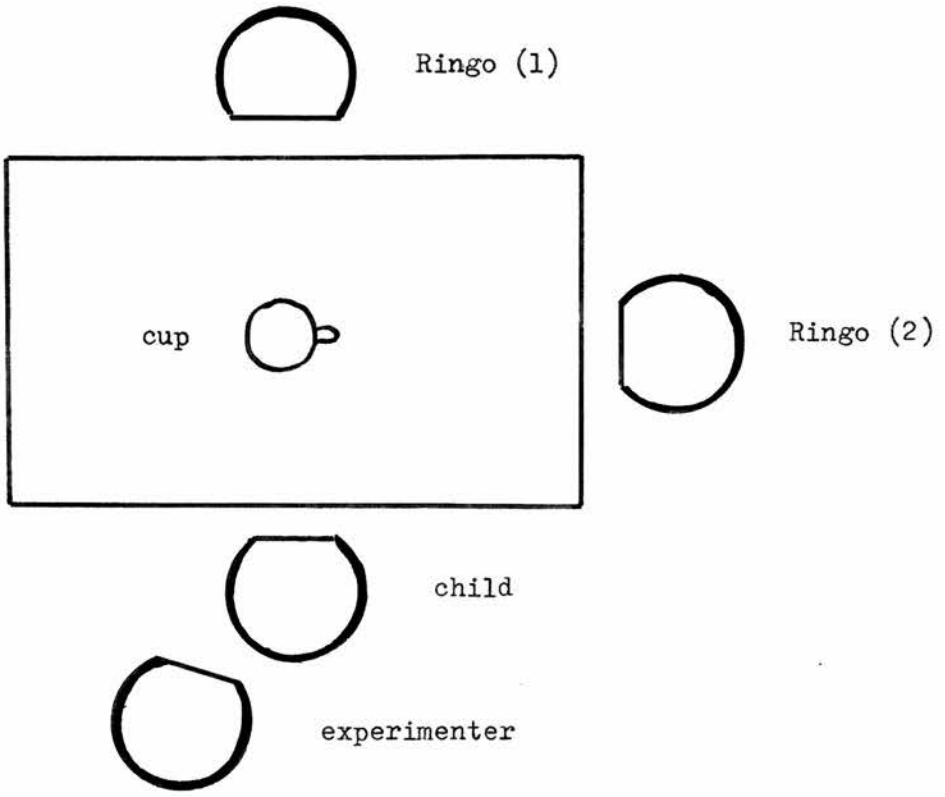


Figure 8: Plan view of the experimental situation

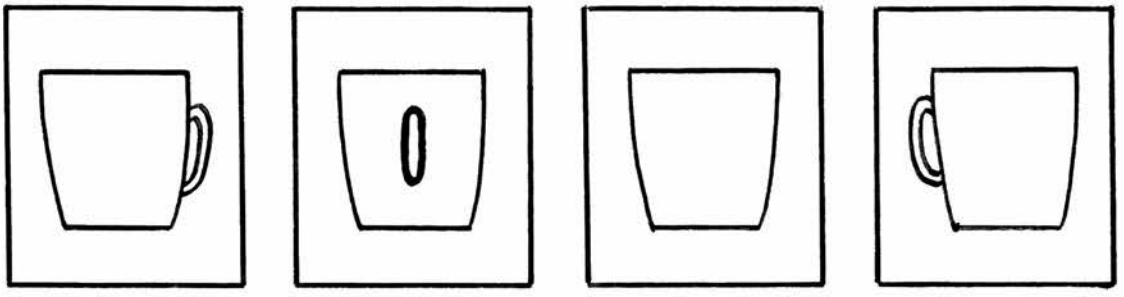


Figure 9: Four pictures showing different views of the cup.

Procedure

Each child was tested twice, with a week between each session. In one session he was given verbal questions; in the other he was given picture selection. Half the children were given own view questions before other view questions throughout ("own view first"), and the other half were given the reverse order ("other view first"). Whether the children were given verbal questions before picture selection, and whether they were given Ringo opposite before Ringo to the side, were also counterbalanced.

At the start of the first session each child was introduced to Ringo and asked to name the cup and handle (all children were able to do this).

(A) Verbal questions

(i) Own view

Ringo is out of sight behind the table. E says

"Look at the cup.

Can you see the handle?"

After the child responds, E says "O.K." He turns the cup to another position and says

"Can you see the handle now?"

This is repeated for the other two positions of the cup.

(ii) Other view

E puts Ringo on one of the two chairs. E says

"This time Ringo is looking at the cup.

Can Ringo see the handle?"

After the child responds, E says "O.K." He turns the cup to another position and says

"Can Ringo see the handle now?"

This is repeated for the other two positions of the cup.

E then moves Ringo to the other chair and repeats for all four positions of the cup.

(B) Picture selection

(i) Own view

Ringo is out of sight beneath the table. E takes out the pictures and shows them to the child. E says

"These are four pictures of the cup.

Look at the cup. Now look at the pictures.

Which picture shows what you see?"

After the child responds, E says "O.K." He turns the cup to another position and says

"Which picture shows what you see now?"

This is repeated for the other two positions of the cup.

(ii) Other view

E puts Ringo on one of the two chairs. E says

"This time Ringo is looking at the cup.

Which picture shows what Ringo sees?"

After the child responds, E says "O.K." He turns the cup to another position and says

"Which picture shows what Ringo sees now?"

This is repeated for the other two positions of the cup.
E then moves Ringo to the other chair and repeats for all four positions of the cup.

Results

No significant order effects were found for either

(a) verbal questions first / picture selection first, or

(b) Ringo opposite first / Ringo to the side first.

Table 3 compares own view first with other view first. The figures given are the percentage of correct responses, except for the last column which is the percentage of egocentric errors out of the total number of errors.

Table 3 - Comparison of percentage correct scores for own view first and other view first

Table 3

	Verbal questions		Picture selection		
	Own view	Other view	Own view	Other view	
				(correct)	% of errors egocentric
Own view first	97%	88%	64%	19%	71%
Other view first	98%	82%	50%	13%	66%

These results show that performance is generally slightly better in the own view first condition, with the exception of verbal questions (own view) where performance is virtually errorless in both conditions. However, none of these differences is statistically significant at the 0.05 level (Mann-Whitney U test). In particular, the proportion of egocentric errors in the total number of errors is slightly higher in the own view first condition, although there is virtually no difference in the total number of egocentric responses in each condition (74 compared with 73).

These scores are combined for Table 4.

Table 4: Total percentage correct scores for verbal questions and picture selection.

	Verbal questions	Picture selection
Own view	98%	57%
Other view	85%	16%

All these differences are highly significant. Thus performance is better for own view than for other view both with verbal questions ($N=17$, $x=2$, $p=0.002$, sign test, two-tailed) and with picture selection ($N=28$, $z=3.2$, $p=0.0014$, sign test, two-tailed). More interestingly, performance is much better with verbal questions than with picture selection, both for own view ($N=25$, $x=1$, $p<0.002$, sign test, two-tailed) and for other view ($N=32$, $z=5.5$, $p<0.0001$, sign test, two-tailed).

The kinds of errors made were different in each condition.

(i) verbal questions, own view: only 3 errors occurred out of 128 responses. All 3 were "false positives", i.e. the child said he could see the handle when he could not.

(ii) verbal questions, other view: 38 errors occurred out of 256 responses. Of these, 3 were "false positives", i.e. the child said Ringo could see the handle when he could not. The remaining 35 were "false negatives", i.e. the child said Ringo could not see the handle when in fact he could. All 35 of these false negatives

occurred when Ringo saw the handle either on the right side of the cup; there were no errors at all when the handle pointed directly at Ringo. Moreover these false negatives occurred totally independently of whether the child himself saw the handle.

(iii) picture selection, own view: 55 errors occurred out of a total of 128 responses. Of these, the biggest single category was of left/right reversals, i.e. when the child saw the handle on the left he picked the picture showing the handle on the right, and vice versa. Left/right reversals constituted 20 out of the 55 errors, while random responding would have produced only 9 errors in this category.

(iv) picture selection, other view: 215 errors occurred out of a total of 256 responses. The vast majority of these were egocentric responses, i.e. the child selected his own view instead of Ringo's view. These made up 147 out of the 215 errors (68%). The proportion of egocentric responses out of all the responses (correct and incorrect) in this condition is 147/256, or 57%. This is identical to the proportion of correct responses in the picture selection, own view condition, which was 73/128, again 57%. Thus in both picture selection conditions, 57% of the responses consisted of the child simply selecting his own view, irrespective of the instructions.

Discussion

There were three aims of this experiment. The most important one was to compare verbal questioning and picture selection. The two subsidiary aims were to see if preschool children could correctly select their own view, and to investigate the effect of varying the order of own view and other view conditions. These three aims will now be considered in reverse order.

(1) Order effects

Performance is slightly better in the own view first condition, and the proportion of egocentric responses in the total number of errors is also slightly higher in this condition. However, no differences reached significance. Moreover the total number of egocentric responses was the same in each condition. Thus we can give tentative support to Aebli (1967) who also found that the proportion of egocentric errors was higher in the own view first condition, while disagreeing with Garner and Plant (1972) who found a difference in the total number of egocentric responses.

Although the suggestion that egocentric responding may be subject to order effects is interesting in itself, we are more concerned here with its methodological implications. In all subsequent experiments own view conditions were always given before other view conditions.[20]

(2) Picture selection, own view

The results showed that the 4-year olds in the present experiment could select their own view of a simple object with a fair degree of success (57%), contrary to the doubts of Aebli, and of Piaget and Inhelder.

The largest single category of errors was left/right reversals, i.e. if the handle was on the left the child selected the picture showing the handle on the right, and vice versa. This is in agreement with a well known series of experiments which suggests that preschool children have difficulty in discriminating between figures differing only in their left/right orientation, (e.g. Gibson

et al 1962, Rudel and Teuber 1963). These results were originally taken as showing that young children were unable to discriminate between such figures, but more recent work has shown that if the task requirements are simplified and the perceptual context in which the figures are presented is varied then young children can perform such discriminations (e.g. Over and Over 1967; Huttenlocher 1967 a, b; Bryant 1969; Taylor and Wales 1970). It seems that unless certain conditions are satisfied preschool children will tend to ignore the left/right dimension.

It was hoped that such problems would be avoided in the present study because the handle of the cup would act as a distinctive feature and draw the child's attention to differences in orientation on the left/right dimension. This strategy seems to have been only partially successful, and a number of left/right reversals did occur. Again, the implication here is mainly methodological; with the present materials, merely changing the position of the cup without otherwise drawing attention to relevant features or dimensions is insufficient for completely successful own view picture selection.

(3) Verbal questions/picture selection

The main aim of this experiment was to compare children's performances on two different procedures, verbal questioning and picture selection. The results show a striking difference between the two procedures. The children performed much better with verbal questioning than with picture selection, both on their own view (98% compared with 57%) and on the other view (85% compared with 16%). Both these differences are highly significant. Although the direction of the differences was predictable the magnitude,

especially for the other view condition, was quite unexpected.

There are no real precedents for this finding in the experimental literature. Only one previous study, that of Aebli (1967), has compared two different procedures in this way, and although Aebli suggested that his subjects performed better with verbal questioning than with picture selection, he did not give any precise data.

At first sight this finding seems to suggest that 4-year old children are able to calculate what Ringo is looking at, and in particular whether or not he can see the handle, but that they cannot calculate how it looks to him. This result confirms the finding of Experiment 1 that children of this age have simple projective abilities, but suggests that they do not have simple perspective abilities. Moreover, the fact that the majority of errors in the other view picture selection were egocentric errors suggests that most of these children do not even have the simple perspective awareness that Ringo's view of the cup is different from their own.

Although this seems to be the direct implication of this result, it is not easy to accept conceptually. For example, it seems very strange (though not impossible) that a child should know that Ringo will not see the handle of the cup when it is turned away from him, and yet still select as a picture of Ringo's view one in which the handle is clearly visible. Before accepting this result at face value we must first investigate the possibility that picture selection is not an adequate test of perspective ability. This possibility is examined in the next experiment.

Experiment 3

Introduction

The aim of this experiment was to compare the method of picture selection with an alternative method for testing perspective abilities, using the same materials as in Experiment 2. This alternative method was developed from a spontaneous comment made by one of the subjects in Experiment 2. When the cup was turned so that the handle was not visible to her, this subject spontaneously remarked "it's a bowl", thus suggesting that different views of the cup could be distinguished by different names. This idea was developed into an alternative method for testing perspective abilities, in which the child is shown a cup with the handle visible and told that he sees a "cup". Then he is shown the cup with the handle turned away from him and told that he sees a "bowl". He is then asked to turn the cup so that "Ringo sees a 'bowl'". The child is judged to have responded correctly if he turns the cup so that the handle is away from Ringo, thus showing that he is considering how it looks to Ringo. This method is known as "cup rotation".

The two methods were compared by first giving all the subjects the picture selection condition, and then giving the cup rotation condition only to those subjects who failed to reach criterion on the picture selection. After the cup rotation condition a further picture selection question was asked to see if there had been any facilitation of picture selection due to the cup rotation.

Subjects

44 preschool children (23 boys and 21 girls) were subjects.

Their ages ranged from 5 years 2 months to 3 years 10 months (mean age 4 years 6 months). They were of mixed social class, and all were attending nursery school or preschool playgroups in the Edinburgh area.

Materials

The materials were the same as in Experiment 2.

Procedure

There were two parts to the procedure. In part I all children were given picture selection (own view followed by other view) exactly as described in Experiment 2. Any children who reached the criterion of 3 correct responses out of 4 in selecting Ringo's view were not tested further. All the other children were divided into two equal groups according to age and, after a short interlude during which the experimenter and child played with other toys, they were all given part II.

In part II the experimenter (E) starts with just the cup on the table. He turns the cup so that the child can see the handle and says

"When it's like this you see a cup."

E then turns the cup so that the child cannot see the handle and says

"When it's like this you see a bowl."

E repeats this if the child appears not to understand. E then puts Ringo on the chair at 90° to the child's right, and turns the cup so that the handle is visible to both the child and Ringo. He then says

"Now can you make it so that Ringo sees a bowl?"

After this cup rotation procedure, E gets out the pictures again and asks one picture selection (other view) question:

"Which picture shows what Ringo sees?"

Results

Part I

The overall scores were 52% for picture selection, own view, and 11% for picture selection, other view. These scores were slightly below those found in Experiment 2.

4 out of the 44 subjects reached the criterion of 3 or 4 correct responses out of 4. This left 40 children for part II. They were divided into two groups of 20 according to age. The mean age of the older group was 4 years 11 months, and that of the younger group was 4 years 2 months.

Part II

Table 5 shows the number of children, out of 20 in each group, who

(1) responded correctly to cup rotation;

(2) responded correctly to subsequent picture selection, other view.

Table 5: Number of children responding correctly to cup rotation and picture selection.

	cup rotation	picture selection
Older group (4 years 11 months)	13	9
Younger group (4 years 2 months)	5	4

13 out of 20 children in the older group and 5 out of 20 in the younger group succeeded on cup rotation, while all of them had previously failed on unfacilitated picture selection. These differences are significant (N=13, x=0, $p<0.001$ for the older group, and N=5, x=0, $p<0.05$ for the younger group; both sign test, one-tailed).

9 out of 20 children in the older group and 4 out of 20 in the younger group were facilitated on picture selection by the cup rotation procedure. This improvement is significant for the older group (N=9, x=0, $p<0.005$, sign test, one-tailed) but not significant at the 0.05 level for the younger group.

It seems that facilitation was due to successful performance on cup rotation. In the older group, 9 out of 13 children who succeeded on cup rotation were also facilitated on picture selection, while none of those who failed on cup rotation were facilitated. For the younger group, 3 out of 5 children who succeeded on cup rotation were facilitated, while only 1 out of 15 who failed on cup rotation was facilitated (for both these, p 0.01, Fisher exact probability test, one-tailed).

The older children performed better than the younger children on cup rotation (13/20 compared with 5/20, $\chi^2=4.97$, df=1, $p<0.025$, χ^2 test, one-tailed). The difference between the groups on picture selection facilitation is not significant at the 0.05 level.

Errors

(i) Picture selection

As in Experiment 2, the largest category of errors on picture selection (other view) was egocentric errors. In part I this category

constituted 61% of the total errors. In part II it constituted 64% of the total errors for the older group, and 88% of the total errors for the younger group.

(ii) Cup rotation

For cup rotation every single error was identical. Every child (22 out of 40) who did not correctly turn the cup so that the handle was away from Ringo, instead turned the cup so that the handle was away from himself. This can also be considered an egocentric error, for the child turned the cup so that he saw the "bowl", not Ringo.

Discussion

The main findings of this experiment are:

(1) that 4-year old children perform much better on cup rotation than on picture selection;

(2) that successful performance on cup rotation facilitates subsequent picture selection;

(3) that performance on cup rotation improves with age.

The most important implication of these findings is that the method of picture selection in the form used here, and in Experiment 2, is not an adequate test of the young child's perspective abilities. The alternative method of cup rotation shows that many children do have a certain degree of perspective ability, yet these children still fail on picture selection. The question of why they do this will be taken up again later.

The rest of this discussion will focus on the question of precisely what this experiment, and the method of cup rotation, tells us about the perspective abilities of preschool children.

For a start, we must point out certain defects in this specific experimental design. First, the cup rotation procedure was severely limited by using only one position of Ringo for each child, whereas more reliable data could easily have been produced by using at least three different positions. This is also true for the subsequent picture selection trial. Secondly, it would have been better to compare the two methods of picture selection and cup rotation either by having parts I and II in separate experimental sessions or by having two independently matched groups, one performing picture selection and the other cup rotation. Either of these alternative designs would have avoided the possibility that an initial failure on picture selection in some way affected later performance. Thirdly, there was no proper control for the possibility of spontaneous facilitation on picture selection performance due simply to its being repeated in the same session. In fact this possibility seems remote in view of the lack of facilitation with the subjects who failed on cup rotation.

There are also some deficiencies in the specific method of cup rotation used here. First, more effort could have been made to ensure that the children understood the distinction between the "cup" and the "bowl". The distinction is not an easy one to make, anyway, as the cup is a "cup" in almost all positions, and a "bowl" in only a few positions. The procedure could have been extended to include a longer period in which the children learned the distinction, followed by a short test of whether learning had occurred, perhaps using a set of pictures of "cups" and "bowls".

A much more important deficiency in the method of cup rotation used here is that incorrect responses do not necessarily indicate a lack of perspective ability. This is because the instructions are ambiguous and allow two different legitimate interpretations. One of these, the view interpretation, will tend to produce the "correct" response, while the other, the object interpretation, will tend to produce the "incorrect" or egocentric response. This distinction is explained in the following analysis.

If a person is looking at an object and is asked "What do you see?", then their reply will probably fall into one of two main categories. Either they may simply name the object, e.g. "I see a cup" or "I see a house", or they may actually specify the particular view they have of the object, e.g. "I see a cup with its handle on the right" or "I see the front of a house". The choice they make will depend on how they interpret the question in the context in which it is asked. The object interpretation will be generally much more likely to occur than the view interpretation, because people are generally much more concerned about objects than about particular views of objects. This is true not only in perception, as is shown by the early acquisition of shape constancy, but also in language, as evidenced by the fact that it is objects, not views of objects, which have names. This is no accident, of course, but is due to the interpersonal (and therefore non-subjective) nature of language learning and use. This point is well made by Quine:

> ".... The usual premium on objectivity is well illustrated by 'square'. Each of a party of observers glances at a

> tile from his own vantage point and calls it square; and each of them has, as his retinal projection of the tile, a scalene quadrilateral which is geometrically dissimilar to everyone else's. The learner of 'square' has to take his chances with the rest of society, and he ends up using the word to suit. Association of 'square' with just the situations in which the retinal projection is square would be simpler to learn, but the more objective usage is, by its very intersubjectivity, what we tend to be exposed to and encouraged in." (Quine 1960, p.7)[21]

This analysis can now be applied to the cup rotation situation. It will be recalled that in that procedure the experimenter turns the cup so that the child sees the handle, and says

(1) "When it's like this you see a cup."

He then turns the cup so that the child cannot see the handle and says

(2) "When it's like this you see a bowl."

The experimenter then puts Ringo on the chair at 90^{o} to the child's right, turns the cup so that the handle is visible to both the child and Ringo, and says

(3) "Now can you make it so that Ringo sees a bowl?"

The assumption behind this procedure is that the child will give a view interpretation to statements (1) and (2) and regard them as

referring to his own subjective view of the cup. He will then differentiate between one kind of view which is of a "cup" and another kind which is of a "bowl". He will finally interpret instruction (3) as requiring him to attend to Ringo's view, and he will then turn the cup so that it looks like a bowl to Ringo. And presumably these assumptions were justified for the 18 children out of 40 who responded "correctly".

However, a child may given an object interpretation to statements (1) and (2), and, given the general prevalence of object interpretations in ordinary language, this would be a very reasonable interpretation. If he did this he would regard statements (1) and (2) as referring to objective positions of the cup. He would interpret these statements as saying that when the cup is turned to one position it is called a cup, and when it is turned to another position it is called a bowl, and that these labels applied irrespective of the viewpoint from which the cup was seen. It would then be quite consistent for this child to interpret instruction (3) as a request to turn the cup back to the position in which he knows it is called a bowl, and hence would produce the "incorrect" or egocentric response of turning the cup so that the handle was away from him.

It is not possible to tell how many of the 22 children who gave the incorrect response did so because they interpreted the instructions in this way, and how many did so because they were "egocentric" in Piaget's sense - i.e. they interpreted the instructions as referring to views but believed that Ringo's view was identical to theirs. This could be discovered by means of a more systematic design in which

children would be asked "Do you see a cup?", "Do you see a bowl?", " Does Ringo see a cup?", "Does Ringo see a bowl?", for several different positions of the child, Ringo, and the cup. For example, the cup might be turned so that the handle was away from the child, and the child told that he saw a bowl. The child could then be taken round to the other side of the table and asked if he saw a bowl. Presumably those children who gave a view interpretation would say "No", while those who gave an object interpretation would say "Yes".

We have argued here that "incorrect" responses on cup rotation do not necessarily indicate a lack of perspective abilities, and this is a fairly serious drawback to this method. Nevertheless there is no doubt that "correct" responses do indicate the presence of perspective abilities. In order to make a correct response the child must not only interpret the instructions as referring to Ringo's view, but he must also to some extent "construct" Ringo's view in calculating where to turn the cup.

This involves much more than if he had been merely asked to "make it so that Ringo does not see the handle", which only involves the same projective abilities required in Experiments 1 and 2. Correct responding here involves the perspective ability of knowing how it looks to Ringo, and the results of this experiment show that at least 18 out of the 40 children tested have this ability. If this experiment was repeated with the various improvements suggested here, it might well produce an even higher figure than this.

Thus, despite its deficiencies, the method of cup rotation still provides us with firm evidence that preschool children have simple

perspective abilities, and so directly contradicts Piaget and Inhelder's claim that children of this age cannot have such abilities. Taken together with Experiment 1, this experiment shows that there are at least two areas, projective and perspective, in which preschool children are able to calculate what another person can see.

We will not, however, pursue the method of cup rotation any further. Instead we will concentrate on the implications which this result has for the method of picture selection. The fact that many children fail on picture selection yet succeed on cup rotation suggests that picture selection is not a valid test of the child's underlying perspective competence, and the fact that many children who initially fail on picture selection subsequently succeed later in the session suggests that it is not a reliable test either. Given that picture selection has been the standard method for testing perspective ability since the mountain task was devised, the possibility that it is an inadequate test has serious implications for this whole area of investigation. The next experiment is an attempt to discover exactly why picture selection, in the form used here, seems to be an inadequate test of perspective abilities.

Experiment 4

Introduction

This experiment looks at the effect of using different specific instructions within the picture selection procedure. This was done because it was realised that the instructions used in Experiments 2 and 3 were ambiguous in exactly the same way as were the instructions used in the cup rotation procedure, i.e. they allowed both a view interpretation and an object interpretation.

It will be recalled that in the picture selection (own view) procedure the experimenter presents the child with four pictures showing different views of the cup and asks him

(1) "Which picture shows what you see?"

The experimenter then turns the cup to each of the other three positions, asking the child each time

(2) "Which picture shows what you see now?"

In the picture selection (other view) procedure, the experimenter puts Ringo on a chair and asks the child

(3) "Which picture shows what Ringo sees?"

The experimenter then turns the cup to each of the other three positions, asking the child each time

(4) "Which picture shows what Ringo sees now?"

The assumption behind these procedures is that the child will interpret the questions (1) - (4) as requiring a view interpretation. It is hoped that he will regard questions (1) and (2) as each time asking him to focus on his own particular view of the cup, and to select the picture which shows this view, and it is hoped that he

will regard questions (3) and (4) as referring to Ringo's particular view of the cup, and asking him to select the picture showing Ringo's view.

However, it would be perfectly reasonable if a child instead gave an object interpretation to each of these questions. In this case the child would interpret the phrase "what you see" in questions (1) and (2) as referring each time simply to the cup and not to his own view of the cup. Similarly the child would interpret "what Ringo sees" in questions (3) and (4) as also referring simply to the cup and not to Ringo's own view of the cup. He would then be entirely justified in choosing any of the pictures because, on his interpretation of questions (1) - (4), any picture of the cup shows "what he sees" and "what Ringo sees".

We pointed out earlier that in everyday situations the object interpretation of "see" is what is generally required. It might seem surprising, then, that the experimenter expects children to make the view interpretation of questions (1) - (4) in the experimental situation. However, it is hoped that several features of the situation will help to induce this interpretation. First, the experimenter shows the child pictures of different views of the cup, rather than pictures of different objects (one of them being a cup). Secondly, the experimenter, after giving the child question: (1) ("Which picture shows what you see?"), turns the cup to a different position and asks question (2) ("Which picture shows what you see now?"). This repetition of the question seems to expect a different answer or, at least, a reconsideration of the previous answer and, given that the only change has been in the orientation of the cup, this suggests

that the repetition of the question and the change in orientation are connected.[22] On an object interpretation of the question, no meaningful connection is possible, while on a view interpretation there is an immediate connection. If one assumes that the child is trying to make as much sense as he can of the experimental situation, then one hopes that this procedure will induce the view interpretation. A similar argument holds for the interpretation of questions (3) and (4).

However, although it is hoped that these aspects of the procedures will induce the view interpretation, there is still the possibility that a child may adopt the object interpretation. This possibility means that if a child fails picture selection, either of his own view or of the other view, then this does not <u>necessarily</u> mean that he is unable to calculate the required view. It may simply mean that he has given the object interpretation to the question, rather than the view interpretation.[23]

What we are proposing here, then, is that the instructions used in picture selection allow two possible interpretations, and that the children in Experiment 3 who seemed to have the necessary perspective abilities and yet failed on picture selection (other view) did so because they made the "incorrect" interpretation of the instructions.

It is not immediately apparent how this hypothesis can be tested directly. However, it can be tested indirectly as follows. If we alter some aspects of the experimental procedure so as to reduce the likelihood of an "incorrect" interpretation and find that this leads to an improved level of performance, then we have some tentative support for our hypothesis.

In this experiment we will concentrate on the wording of the instructions, and attempt to reduce the ambiguity by adopting alternative wordings. However, it is hard to find wordings for these instructions which are unambiguous yet simple enough for a preschool child to understand. Previous investigators in this field have used a large variety of instructions, yet all of them seem to have their drawbacks. We will briefly review the most important of these previous efforts.

In their original account of the mountain task Piaget and Inhelder (1956) do not give the precise wording they used, but their procedure involved telling the child that the doll was either painting a picture or taking a photograph of the mountains, and then asking him to choose the picture which the doll would paint, or the photograph which the doll would take. (A similar procedure was used by Houssidas and Brown, 1959). The main disadvantage of this method is that the child is required to understand that, conventionally, taking photographs or painting pictures from a single point gives a unique <u>view</u> of the objects being photographed or painted. It is certainly possible that this principle, which is superfluous to the formal requirements of the task, may not have been fully understood by some of Piaget and Inhelder's younger subjects.

Another method of presenting the task which may not have been easily understood was that used by Flavell et al, 1968 (and subsequently by Rubin, 1973). In one condition, Flavell used two identical blocks with different pictures on each side and asked his subjects to "....take <u>your</u> block and put it on the paper here so that it looks

to you here just like that block looks to him there - so that you see on your block just what he sees on his block." (emphasis in original). The youngest children Flavell tested with this procedure were 7 years old, but even they may well have had difficulty following such instructions.

Other investigators used instructions similar to those of Experiments 2 and 3. For instance Neale (1966) asked his subjects to "...choose a picture showing what the man would see from his position." Shantz and Watson (1971) asked their subjects for "the picture that shows what the doll sees from there", while Dodwell (1963) used the instructions "I will put this little doll at different places and then I would like you to pick out the picture that shows what the doll would see from those places." However, all these instructions contain the same ambiguity as those used in Experiments 2 and 3; they allow both an object interpretation and a view interpretation. This ambiguity is not removed by the addition of "from his position" or "from there" after "see".

Indeed, only one previous experiment seems to have used unambiguous instructions, that of Garner and Plant (1972). They asked their school-age subjects "If you stand where the doll is standing which picture shows what it would look like?". Although these instructions are unambiguous, they are not suitable for preschool children, who would tend to respond by actually going to stand where the doll was standing.

The fact that most of the experiments in this area, including the mountain task, have used ambiguous or confusing instructions has

very serious implications. It raises the strong possibility that many children below 8 years failed on these tasks simply because they could not understand what they were required to do. It also shows the extent to which previous investigators have failed to consider how their instructions might be interpreted by a young child.

The present experiment compared the standard instructions using "see", which were simple but ambiguous, with instructions using "how it looks", which were less ambiguous but more complex. The precise wordings were:

(1) "Which picture shows what you see? / what I see?"

(2) "Which picture shows how it looks to you? / to me?"

Pilot studies for this experiment also tried the instructions "Which picture shows my view? / your view?" but preschool children found these were too difficult.

A third wording was also used, which was specific to the actual materials used in this experiment. These materials were three dolls of different colours, each mounted near a corner of a triangular base and facing outwards. They were introduced for two reasons. First, being three objects in a triangle, the dolls resembled Piaget and Inhelder's mountains much more closely than did the cup used in Experiments 2 and 3. Secondly, the different views of the dolls could be easily identified, since for each view a different coloured doll's face was visible. Consequently the third wording used was:

(3) "Which picture shows the doll's face that you see? / that I see?"

This set of instructions is similar to instructions (2) in that they are both more complex but less ambiguous than instructions (1).

Because these dolls were already being used in this experiment, it was thought that it might be confusing if another toy animal (such as Ringo) or doll was used for the other view condition. Moreover it was thought that it might also be confusing for the child to be asked what a toy animal or doll could "see" when these inanimate objects did not really see at all.[24] Instead, for the other view condition the experimenter himself sat looking at the dolls from different positions around the table. This explains why the instructions contain "you" and "I".

Subjects

45 preschool children (24 boys, 21 girls) were subjects. Their ages ranged from 4 years 1 month to 5 years 2 months (mean age 4 years 9 months) and all were attending full time nursery school. They were split into three groups of 15 children, matched as far as possible for age and sex.

Materials

The materials used were three coloured dolls (red, blue, yellow) and three pictures of the dolls.

The dolls were 15 cm high, with prominent faces. They were each mounted near a corner of a triangular base 5 cm high and side length 30 cm. Each doll faced outwards from its corner of the base.

The dolls were placed on a table in front of the child. The base was always in one of three positions, i.e. with either the red doll, the blue doll, or the yellow doll facing the child.

The experimenter (E) also sat at the table, 120° to the right

of the child.

Thus for each position of the base, the child saw the face of the doll nearest him, and side views of the other two dolls. Similarly, E saw the face of the doll nearest him, and side views of the other two dolls.

The pictures were each 15 cm x 10 cm, and fixed on a board 36 cm x 15 cm. The pictures showed the three views corresponding to the three positions of the base. Thus for each position of the base one picture showed the child's view and another picture showed E's view.

Figure 10 shows the experimental set-up, and figure 11 is a black and white representation of one of the pictures of the dolls.

Figure 10: Plan view of the experimental situation.

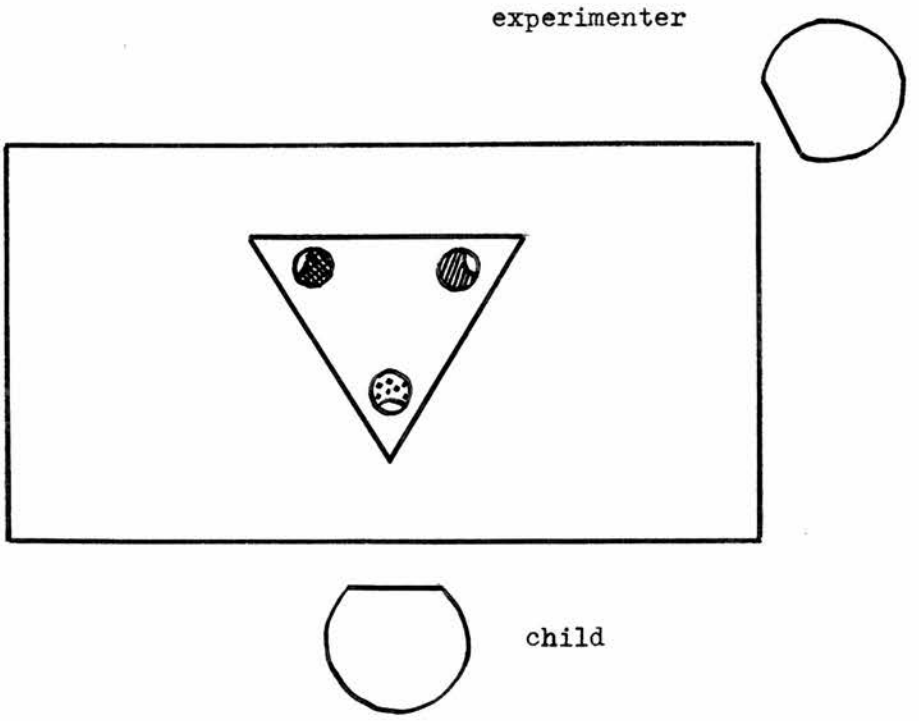
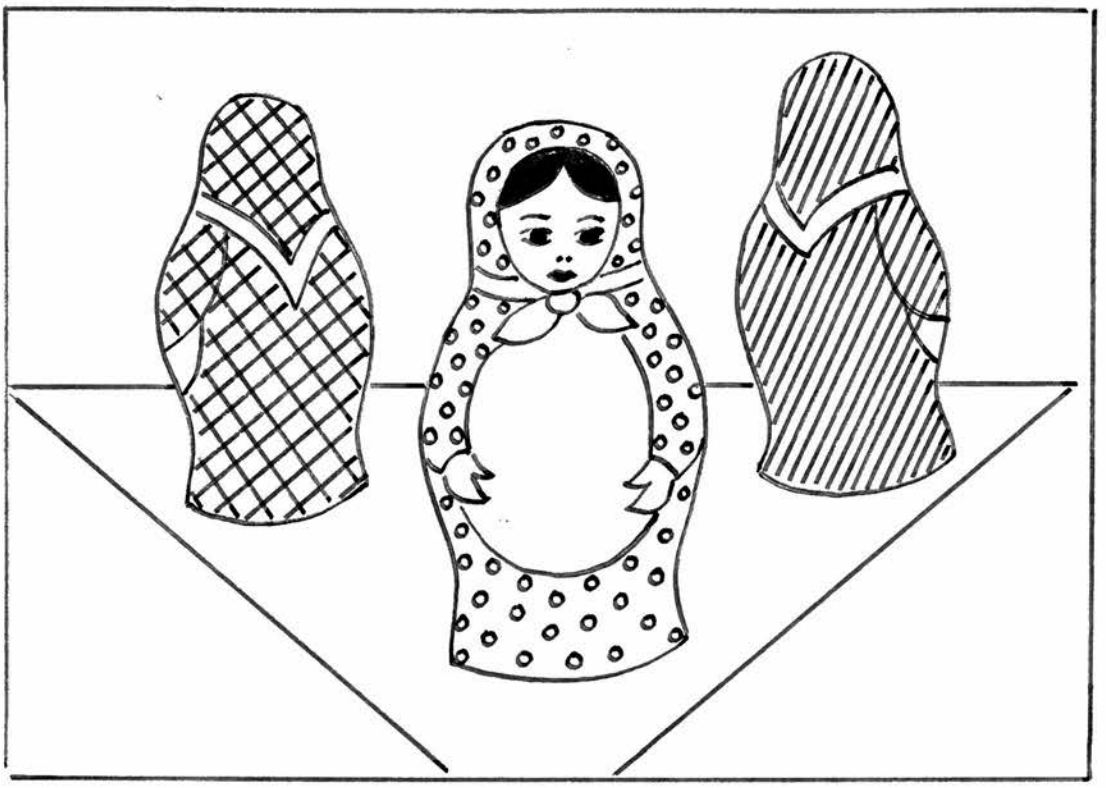


Figure 11: Representation of one of the pictures used.



Procedure

Each group of children received one set of picture instructions. The wording of each set of instructions was as follows:

Condition (1) ("see")

own view: "Which picture shows what you see?"

other view: "Which picture shows what I see?"

Condition (2) ("looks")

own view: "Which picture shows how it looks to you?"

other view: "Which picture shows how it looks to me?"

Condition (3) ("doll's face")

own view: "Which picture shows the doll's face that you see?"

other view: "Which picture shows the doll's face that I see?"

The procedure for each condition was identical, apart from the difference in wording. Only the procedure for Condition (1) will be given in full.

Condition (1) ("see"):

(i) own view

E shows the pictures to the child and says

"These are three pictures of the dolls.
Look at the dolls. Now look at the pictures.
Which picture shows what you see?"

After the child responds, E says "O.K." He turns the base and repeats

"Which picture shows what you see?"

This is repeated for the third position of the base.

(ii) other view

E says

"I am looking at the dolls.
Which picture shows what I see?"

This is repeated, as above, for the other two positions of the base.

Results

Because there are only three pictures to choose from, the probability of guessing the correct picture purely by chance is quite high (33 1/3%). Accordingly, a criterion of two or three correct responses out of three was set. The following table shows the number of children (out of 15 in each group) who reached criterion.

Table 6 - Comparison of different instructions

	own view	other view
Condition (1): "see"	9	5
Condition (2): "look"	4	2
Condition (3): "doll's face"	6	3

None of these differences is significant at the 0.05 level, using the Fisher exact probability test, two-tailed.

Errors

Most of the errors for the other view conditions were egocentric i.e. the child selected the picture showing his own view rather than the emperimenter's view. Egocentric errors amounted to 69 out of 111 errors, or 62%. This figure is very similar to the proportion of egocentric errors in Experiments 2 and 3.

There were no significant differences (at the 0.05 level) in the proportion of egocentric errors between the various instruction conditions.

Discussion

These results show that varying the wording of the instructions used produces no improvement in performance on picture selection, other view. If anything performance was lower with the alternative

instructions (2) and (3) than with the standard instructions (1).

If this experiment had found that performance on selecting the experimenter's view was improved dramatically by using the less ambiguous instructions of conditions (2) and (3), then this would have been strong support for our hypothesis that the children were failing on picture selection because the instructions allowed more than one interpretation. However, the actual results found do not enable us to either confirm or reject this hypothesis. For instance, it is possible that the children in condition (1) failed because of the ambiguity of the instructions, while those in condition (2) and (3) failed because of the complexity of the instructions.

It is of course possible that other wordings would have produced dramatic improvements in performance. For instance, we could have tried

(4) "Which picture shows what you see from there? / what I see from here?" or

(5) "Which picture best shows what you see? / what I see?"

However, it seems from this experiment that changing the wording of the instructions alone is unlikely to produce major improvements in performance. The next experiment looks for other ways of improving performance.

Experiment 5

Introduction

The previous experiment tried to raise the level of performance on picture selection simply by altering the wording of the instructions, but failed to find any improvement. In looking for other ways of improving performance, several different lines of argument lead to the same conclusion: that performance might be improved by prefacing the picture selection with a series of verbal questions on the child's own view, on the other view, and on the pictures.

The main argument for doing this arises directly out of the previous experiment. The hypothesis put forward there was that some children failed on picture selection because they gave the object interpretation to the instructions rather than the view interpretation. It was argued that various features of the experimental situation (such as the fact that the pictures were different views of the same object or set of objects, rather than being pictures of different objects, and the fact that the instructions were repeated after moving the object to different positions) were designed to induce the view interpretation, but that it was still possible for a child to ignore or misinterpret these features and so make the undesired interpretation.

This possibility, that the child might ignore or misinterpret these features, seems all the more likely since his attention is not explicitly drawn to them by the experimenter. This suggests that if the experimenter explicitly disambiguates the situation before asking the picture selection questions, then the child will be more likely to succeed on picture selection. This can be done, using the

same materials as Experiment 4, by asking the following series of verbal questions before going on to the picture selection procedure:

(1) verbal questions (own view): "Which doll's face do you see?"

(2) verbal questions (other view): "Which doll's face do I see?"

(3) verbal questions (pictures): "Which doll's face do you see in this picture?"

A second argument for adopting this procedure arises out of the findings of Experiment 3. It was found in that experiment that performance on picture selection was facilitated by successful performance on cup rotation. This suggests that when the facilitation effect occurred it was because the cup rotation procedure had focused the child's attention on the differences between various views of the cup, perhaps coupled with the fact that the child had been given different verbal labels for these different views. This in turn suggests that performance on picture selection will be improved by prefacing it with a procedure which draws the child's attention to different views of the dolls, and which also makes available to the child different verbal labels for each view. These conditions are satisfied by the three sets of verbal questions described above.

The results of Experiment 2 suggest that the verbal questions (1) and (2) will be more straightforward for a 4-year old child than the standard picture selection questions. Thus the two main aims of Experiment 5 are:

(i) to try to replicate the finding of Experiment 2 that performance on verbal questions is higher than on picture selection alone; and

(ii) to see whether performance on picture selection prefaced by

these verbal questions is higher than on picture selection alone.

Subjects

40 preschool children (22 boys and 18 girls) were subjects. Their ages ranged from 4 years 10 months to 4 years 0 months (mean age 4 years 5 months). They all attended either the morning session of a nursery school, and they were of mixed social class.

Materials

The materials were the same as in Experiment 4.

Procedure

The children were divided into two groups of 20 children, matched as far as possible for age and sex. One group, condition A, received picture selection only (PS only). The other group, condition B, received verbal questioning followed by picture selection (VQ and PS). Each child was tested once.

At the start of each session the child was introduced to the dolls and shown all three positions of the base. He was then asked to name the colour of each doll. Most children could do this (the inability to do this, it turned out, did not affect the results, as will be discussed later).

Condition A (PS only):

The children in this condition were given picture selection questions exactly as in Experiment 4, condition (1), i.e. the questions were

(i) own view: "Which picture shows what you see?"

(ii) other view: "Which picture shows what I see?"

Condition B (VQ and PS):

(i) VQ own view

No pictures are shown. E says

"Look at the dolls.

Which doll's face do you see?"

After the child responds, E says "O.K." He turns the base to another position and says

"Which doll's face do you see now?"

This is repeated, as above, for the third position of the base.

(ii) VQ other view

No pictures are shown. E says

"I am looking at the dolls.

Which doll's face do I see?"

This is repeated, as above, for the other two positions of the base.

(iii) VQ pictures

Only the pictures are shown. E says

"These are three pictures of the dolls."

E points to one picture and asks

"Which doll's face do you see in this picture?"

This is repeated for the other two pictures.

(iv) PS own view, PS other view

These were exactly as for condition A.

Order of instructions

All questions were given in blocks of three similar questions.

PS (own view) was always given before PS (other view). Similarly VQ (own view) was always given before VQ (other view).

Ten children in condition B were given VQ (pictures) before VQ (views). Ten children were given the reverse order. All 20 children in this condition were given VQ before PS.

Results

No significant order effects were found.

A criterion was set of two or more questions correctly answered out of a block of three questions. Table 7 shows the number of children, out of 20 in each group, who reached this criterion for each set of questions.

Table 7: Number of children reaching criterion in each condition.

	VQ own	VQ other	VQ pictures	PS own	PS other
Condition A (PS only)				12	1
Condition B (VQ and PS)	20	19	16	13	13

Condition A (PS only)

The results for this condition were very similar to those found with picture selection in Experiments 2, 3 and 4. That is, 12 children out of 20 succeeded on PS (own view) but only one child succeeded on PS (other view). The majority of errors (64%) on PS (other view) were egocentric errors.

Condition B (VQ and PS)

There were two main findings here. First, all children performed at nearly 100% on VQ. All 20 children succeeded on VQ (own view), which is significantly higher than the number succeeding on PS (own view) in condition A ($\chi^2=7.65$, df=1, $p<0.005$, χ^2 test, one-tailed).

19 children out of 20 succeeded on VQ (other view), which is significantly higher than the number succeeding on PS (other view) in condition A (χ^2=28.9, df=1, p<0.0005, χ^2 test, one-tailed).

Secondly, performance on PS (other view) was dramatically higher than in condition A (13 children reached criterion compared with 1, χ^2=13.1, df=1, p<0.0005, χ^2 test, one-tailed), while performance on PS (own view) was not significantly higher (at the 0.05 level) than in condition A.

Discussion

The main findings in this experiment are as follows:

(1) As expected, children perform much better with verbal questioning, both on their own and on the other view, than with picture selection. Indeed, their performance here on verbal questioning came close to 100%. This finding confirms the main result of Experiment 2, where a similar difference was found.

(2) However, the major finding of this experiment was that children's performance on picture selection, other view, was dramatically improved by giving verbal questions before picture selection. The magnitude of this effect was unexpected and striking: only 1 child out of 20 succeeded in condition A while 13 out of 20 succeeded in condition B.

This finding raises two related questions: first, what strategy were successful performers using to select the correct picture? and second, how did the presence of verbal questions help to encourage this successful strategy?.

The verbal questions used in this experiment were:

VQ own view: Which doll's face do you see?

VQ other view: Which doll's face do I see?

VQ pictures: Which doll's face do you see in this picture?

All these questions refer to the dolls' faces. This suggests that those children who succeeded on picture selection, other view, in condition B used a strategy involving the dolls' faces. That is, they may well have used the following two-stage strategy:

(1) the child calculates which doll's face the experimenter sees;

(2) the child selects the picture showing this doll's face.

There is informal evidence for this from Experiment 5. Many children in condition B, when correctly selecting a picture showing the experimenter's view, made some kind of reference, either by pointing, or verbally, or both, to whichever doll's face the experimenter saw. For example, if the dolls were positioned so that the experimenter was looking at the blue doll's face, the child would point to the blue doll saying "You see this one's face", and then select the correct picture. Moreover, this kind of referring was still done by children in condition B who failed picture selection. For example, a child would correctly say "You see the blue doll's face" and then select an incorrect picture. At the same time the child would point, in the picture chosen, to the blue doll. Of course, as this is an incorrect choice, only the side view of the blue doll would be visible. In terms of the strategy outlined above, these children seemed to be adopting only the first of the two stages. None of the children in condition A made reference to the dolls' faces in this way.

An important point to note here is that between 10% and 15% of the children could not in fact name the different colours of each doll when asked at the beginning of the experiment. However this did

not seem to affect performance, for many of these children still referred to the relevant doll's face, typically saying 'you see that one's face', before selecting the correct picture. This suggests that it is not necessary that the child actually possesses a verbal label for each view, as long as he can adequately differentiate between the different views.

If the children who succeeded on picture selection, other view, were for the most part using the strategy outlined above, then the effect of the verbal questions is essentially one of inducing this strategy.

This effect may be brought about in several ways. One possibility is that each set of verbal questions acts independently. That is, VQ (views) may increase the probability of the second stage being adopted. If this were so, then both VQ (views) and VQ (pictures) would be needed to produce the effect. Alternatively, the effect may be produced by either VQ (views) or VQ (pictures) alone.

The next experiment is an attempt to clarify and extend the findings of this experiment.

Experiment 6

Introduction

There were four aims to this experiment.

(1) The first aim was to try to replicate the main finding of Experiment 5 using a slightly different experimental design. In Experiment 6 all subjects were first given standard picture selection questions, and only those who failed to reach the criterion were subsequently retested on a second session. This ensured that all subjects who started the second session were at a comparable level.

(2) The second aim was to see if a similar effect was possible with 3-year old children as well as 4-year olds.

(3) The third aim was to try to confirm that children who succeeded on picture selection after being given verbal questions were in fact using the two-stage strategy outlined in the discussion of Experiment 5. This cannot be tested directly, but indirect evidence can be obtained as follows. If children do succeed on picture selection by using this two-stage strategy, then it is likely that they will also perform well if each picture session is presented in two stages directly parallel to the strategy. Thus in some conditions of Experiment 6 the child is asked "Which doll's face do I see?" followed directly by either

"So which picture shows what I see?"

or

"So which picture shows the doll's face that I see?"

This presentation has individual picture selection questions following

individual verbal questions, and thus it differs from the presentation used in Experiment 5 and in other conditions of Experiment 6, which has blocks of picture selection questions following blocks of verbal questions.

(4) The final aim of Experiment 6 was to explore in more detail precisely how the verbal questions were improving performance on picture selection. This was done by comparing the effects of VQ (views) alone, VQ (pictures) alone, and VQ (views and pictures).

It was mentioned in the discussion of Experiment 5 that several children who had received verbal questions as well as picture selection made errors in which they pointed to the correct doll but in the wrong picture. As errors of this kind are a useful indicator of the strategy that the child is using, it was noted whenever they occurred in this experiment.

Subjects

Two hundred and sixteen nursery school children (118 boys and 98 girls) were subjects. Their ages ranged from 5 years 3 months to 4 years 0 months (mean age 4 years 6 months) and they were of mixed social class. None were subjects for Experiment 5.

Material

The same materials were used as in Experiment 5.

Procedure

There were two parts to this experiment. In part I all children were given PS exactly as for condition A of Experiment 5, i.e., a block of three PS (own view) questions followed by a block of three PS (other view) questions. Children who spontaneously passed PS

(other view) were not retested. The remaining children were given part II.

In part II the children were divided into eight groups (A to H) matched, as far as possible, for age, sex, and performance in part I. These children were given part II between one and two weeks after part I.

Instructions for part II

Condition A (control VQ and PS)

The control VQ were verbal questions about the dolls which did not help to differentiate the child's view from the experimenter's. For example, they were questions about the identical aprons which all the dolls were wearing.

Condition B (VQ pictures and PS)

Condition C (VQ views and PS)

Condition D (VQ views, VQ pictures, and PS)

In all the above conditions, VQ and PS were always given in blocks of three similar questions, exactly as in Experiment 5. PS (own view) was always given before PS (other view) and VQ (own view) was always given before VQ (other view).

In conditions E, F, G and H, each PS question was presented in two stages. The wording used in conditions E and F will be indicated by PS*; the wording used in conditions G and H will be indicated by PS**.

Condition E

(i) PS* (own view)

At first E has the pictures turned face down, so the child cannot see them. E says

"Look at the dolls.

Which doll's face do you see?"

After the child responds, E says "O.K." He then shows the pictures and says

"So which picture shows what you see?"

This is repeated for the other two positions of the base. Each time E keeps the pictures overturned while asking "Which doll's face do you see?"

(ii) PS* (other view)

With the pictures overturned E says

"I am looking at the dolls.

Which doll's face do I see?"

After the child responds, E says "O.K." He then shows the pictures and says

"So which picture shows what I see?"

This is repeated, as above, for the other two positions of the base.

Condition F

This was identical to condition E except that PS* was preceded by VQ (pictures).

Condition G

This was identical to condition E except that "So which picture shows what you see?" was replaced by

PS**: "So which picture shows the doll's face that you see?"

Similarly, "So which picture shows what I see?" was replaced by

PS**: "So which picture shows the doll's face that I see?"

Condition H

This was identical to condition G except that PS** was preceded by

VQ (pictures).

Results

Part I

36 out of 216 children spontaneously reached the criterion (at least two correct responses out of three) on PS (other view), leaving 180 children who failed to reach criterion. Most of the errors (59%) in PS (other view) were egocentric errors.

Of the 180 children eligible for Part II, 20 were unavailable at the time of retesting. This left 160 children, 20 for each of conditions A to H.

Part II

Table 8 shows the number of children, out of 20 who reached the criterion in each condition.

Table 8: Number of children reaching criterion in each condition.

Condition	VQ own view	VQ other view	VQ pictures	PS own view	PS other view	PS* own view	PS* other view	PS** own view	PS** other view
A				8	2				
B			20	14	4				
C	20	20		12	6				
D	20	19	19	15	16				
E						19	17		
F			20			20	20		
G								19	19
H			20					19	18

Conditions A to D, and conditions E to H, will be considered separately.

Conditions A to D

(i) verbal questions

As in Experiments 2 and 5, VQ presented little difficulty. Almost all the children in conditions B, C and D succeeded on their respective VQ.

(ii) picture selection

Own view: 8 children reached criterion in condition A, which is not significantly different from chance responding. 14 children in condition B, 12 in condition C and 15 in condition D reached criterion. While all these differ from chance ($p<0.05$, χ^2 test), only condition D differs significantly from condition A. ($\chi^2=3.7$, df=1, $p<0.05$, χ^2 test, one-tailed).

Other view: 2 children in condition A, 4 in condition B and 6 in condition C reached criterion. None of these differ significantly from chance responding. However 16 children reached criterion in condition D. This differs significantly from condition A ($\chi^2=17.1$, $p<0.0005$), from condition B ($\chi^2=12.1$, $p<0.0005$), and from condition C ($\chi^2=10.1$, $p<0.005$; all these df=1, χ^2 test, one-tailed).

The results from conditions A to D thus replicate the main findings of Experiment 5. Further, they show that performance on PS (other view) is significantly improved only after both VQ (views) and VQ (pictures). Neither set of VQ alone has this effect.

Conditions E to H

Virtually all the children in all the conditions E to H reached criterion on all questions. There were no significant effects produced

by VQ (pictures), and no significant differences between the wording used for PS in condition E and F, and the wording used in conditions G and H.

The results from conditions E to H show that when PS questions are presented in two stages they present no difficulty to the children.

Errors

In all conditions the majority of errors on picture selection, other view, were egocentric errors. Overall, these amounted to 101 out of 158 total errors, or 64%.

A more detailed analysis of the error patterns suggests that the verbal questions have a differential effect on the two stages of the strategy. It was mentioned in the discussion of Experiment 5 that children will often select an incorrect picture while pointing, in that picture, to the doll whose face the experimenter sees. It was suggested that such errors might indicate that these children had adopted only the first stage of this strategy. In other words, these children correctly calculate which doll's face the experimenter sees, but then select an incorrect picture.

Now if the verbal questions do have a differential effect, then children in conditions A and B who do not receive verbal questions (views) would make fewer of these errors than children in conditions C and D, who do receive verbal questions (views).

This is in fact the case. The numbers of this kind of error out of the total errors are:

condition A - 10 out of 49 (20%)

condition B - 7 out of 43 (16%)

condition C - 17 out of 33 (52%)

condition D - 9 out of 16 (56%)

This is strong support for the differential effect hypothesis.

Additional results from 3-year old children

After these results had been obtained from 4-year old children, a group of 3-year olds were given some of the above conditions.

There were 47 3-year old children (21 boys and 26 girls). Their ages ranged from 3 years 11 months to 3 years 1 month (mean age 3 years 8 months). They were of mixed social class.

The materials and procedure were exactly as described above.

3 children spontaneously reached criterion on PS (other view) in part I. 8 children were unavailable for retesting. This left 36 children for part II, 12 each for conditions D, F and H.

Table 9 shows the number of children, out of 12, who reached the criterion in each condition.

Table 9: Additional data from 3-year olds

Condition	VQ own view	VQ other view	VQ pictures	PS own view	PS other view	PS* own view	PS* other view	PS** own view	PS** other view
D	12	10	12	10	9				
F			12			10	10		
H			10					11	11

These results are almost identical to those from the 4-year old children in the same conditions. Table 10 directly compares the scores of the 3- and 4- year olds on picture selection, other view.

Table 10: Comparison of 3- and 4-year olds.

Condition	3-year olds	4-year olds
D (PS)	9/12 (75%)	16/20 (80%)
F (PS*)	10/12 (83%)	20/20(100%)
H (PS**)	11/12 (92%)	18/20 (90%)

The 3-year olds are clearly performing as well as the 4-year olds in all conditions.

Summary of results

We will briefly summarise the results in terms of the main aims of the experiment.

(1) Replication of Experiment 5: The main finding of Experiment 5 was replicated. Performance on PS (other view) was dramatically improved when picture selection was prefaced by VQ (views) and VQ (pictures). The effect was, if anything, slightly larger than that of Experiment 5, although the procedure was slightly different. Thus 16 out of 20 children who had all previously failed on picture selection alone succeeded when picture selection was prefaced by verbal questions. This compares with 13 out of 20 children who succeeded in Experiment 5.

(2) Three-year olds: An almost identical improvement on PS (other view) was found with the 3-year olds. Thus 9 out of 12 3-year olds, who had all previously failed on picture selection alone, succeeded

when picture selection was prefaced by verbal questions.

(3) Two-stage strategy: This experiment provided further indirect evidence that successful performers on picture selection, other view, were using a two-stage strategy. All children, 3-year olds as well as 4-year olds, scored virtually 100% when the picture selection questions were presented in two stages in conditions E to H. For the 4-year olds, performance was just as high whether or not these two-stage questions were prefaced by VQ (pictures), and the two different wordings of the instructions produced equally high performances.

(4) Differential effect of VQ (views) and VQ (pictures): For the 4-year olds, the improvement in performance only occurred after both VQ (views) and VQ (pictures). Neither set of verbal questions alone produced this effect. This suggests that the verbal questions have a differential effect: VQ (views) increase the probability of a child's adopting the first stage of the strategy, and VQ (pictures) have a similar effect on the second stage. Further evidence for this differential effect hypothesis comes from the error patterns. No comparable data is available for the 3-year olds.

Discussion

This experiment replicates and extends the main finding of Experiment 5, and shows that most 3- and 4-year old children can, in certain conditions, select pictures showing another person's view. They appear to do this by adopting a two-stage strategy. Most children do not adopt this strategy spontaneously, but only if picture selection is prefaced both by verbal questions about the child's view and the other person's view, and by verbal questions

about the pictures. It seems that these verbal questions have a differential effect: verbal questions (views) increase the probability of the child's adopting the first stage of the strategy, and verbal questions (pictures) have a similar effect on the second stage.

The rest of this discussion focuses on the following questions:

(1) Why is it that children do not spontaneously adopt the successful strategy?

(2) What do these findings imply about the child's perspective and projective abilities?

We will then present a general discussion of Experiments 1 - 6.

(1) To ask why children do not spontaneously adopt the successful strategy is the same as to ask why verbal questions are necessary at all. The main reason for introducing verbal questions in the first place was put forward in the introduction to Experiment 5. There it was argued that some children failed on picture selection because they adopt the object interpretation of the instructions rather than the view interpretation, and it was suggested that they would be more likely to adopt the view interpretation if the experimenter explicitly disambiguated the situation before asking the picture selection questions. On this particular line of argument, then, the verbal questions are necessary because they disambiguate the situation, and so encourage the child to adopt the view interpretation.

This argument, as it stands, is unable to explain all the findings of the present experiment. In particular it cannot explain the occurrence of errors in which the child selects an incorrect picture while pointing, on that picture, to the doll whose face the

experimenter sees. We have argued that children who make this kind of error have adopted only the first stage of the two-stage strategy. That is, they have correctly calculated which doll's face the experimenter sees, but have not chosen the correct picture. In terms of the two possible interpretations of the instructions, these children have clearly made the view of interpretation and not the object interpretation. If they had made the latter, they would not have focused on an aspect of the group of dolls which was specific to the experimenter's view, but would just have considered the group as a whole.

The occurrence of this kind of error shows that it is possible for a child to make the view interpretation of the instructions but still fail to make the correct response. Adopting the view interpretation is a necessary condition for correctly responding, but is not a sufficient condition. The child must also understand the conventions of the pictures.

It is often implicitly assumed that the conventions used in a certain picture or set of pictures will be immediately understood by anyone looking at this picture or this set. Yet at the same time pictures are often ambiguous, and the conventions have to be determined from the particular context in which the picture appears. This point has been made several times by Gombrich (1960, 1972), and also by Marshall and Wales (1974) who suggest that pictures are often more ambiguous than language:

> "...there appears to be no general set of interacting pictorial conventions which specify the pragmatic functions of an expression with the same degree of

> precision and clarity that attends, for example, the communicative consequences of optional transformations in linguistic structure."
> (Marshall and Wales, 1974, p.8)

Marshall and Wales point out that there has been no developmental study of how children learn the conventions of pictures comparable to the vast amount of research that has been done on the acquisition of language. They also stress that we know little about how the two representation systems interact with each other, both in adults and in children.

In one of the few studies to have looked at preschool children's understanding of pictures, Wheeler (1972) presented children with pairs consisting of an object and a picture of the object. She then asked the children to show her the object, the picture, and the picture of the object, and found that the children's errors consisted mostly of pointing to the picture when asked to point to the object. She concluded from this, and similar findings, that preschool children had not yet developed "the pictorial attitude", i.e. the ability to distinguish between an object and its picture. The conclusion, however, does not seem justified from her data, for her subjects may simply have been confused because the picture and the object had the same name.

In another part of the same study, Wheeler presented 5- and 6-year olds with an array consisting of a red star, a green circle and a blue square arranged vertically. She showed her subjects various pictures which more or less resembled the array and asked each time if the picture was a picture of the array. She concluded that

the most important feature children used in making their judgments was simply whether the three shapes were present or absent in the picture. The order of the shapes was next important, and the colour was least important. Thus some children would accept a picture as being a picture of the array even if it included yellow shapes.[25]

This finding is clearly relevant to the pictures used in Experiments 4, 5, and 6, where the different views of the dolls were differentiated solely on the grounds of colour. If young children do not spontaneously regard colour as important in matching pictures to external objects then they are unlikely either to have adequately differentiated between the pictures, or to have fully understood that the pictures represented different views of the same set of objects. Thus there are strong grounds for assuming that children do not spontaneously understand the specific meaning of the pictures used in these experiments. It is just as important to disambiguate the conventions of the pictures as it is to disambiguate the language of the instructions.

What we are proposing here, then, is that the dramatic effect of verbal questions on picture selection, other view, occurs because the verbal questions (views) disambiguate the language of the instructions, while verbal questions (pictures) disambiguate the conventions of the pictures. This raises the important question of how this relates to our earlier proposal, that verbal questions (views) increase the probability of the child's adopting the first stage of the two-stage strategy, while verbal questions (pictures) have a similar effect on the second stage.

We will argue here that these two explanations are very closely related and that, in this particular situation, they may well amount to the same thing. That is, the child's fully understanding the language of the instructions may be identical with his developing the first stage of the strategy, and his fully understanding the conventions of the pictures may be identical with his developing the second stage of the strategy.

This seems, intuitively, to be the most likely explanation of these results. The main objection to this argument, though, is conceptual rather than empirical. The objection focuses on the implicit assumption that "understanding instructions" can be equated with "knowing what to do". This assumption, it might be argued, denies the possibility that a child may understand the instructions yet be unable to develop a successful strategy. This possibility, after all, is what happens when adults "know what they have to do but not quite how to do it".

This objection raises questions which are conceptually very difficult, such as whether a child can understand instructions without translating them into real or hypothetical actions, or, indeed, what it means to understand a sentence at all. It is not immediately clear how, or even whether, such problems can be settled empirically. For the time being, we will merely repeat that the most likely interpretation of these findings is that the two explanations are essentially the same, and leave the discussion at this point.

(2) We will now consider what these findings imply about the young child's perspective and projective abilities. At first sight it seems that picture selection is a relatively straight forward

test of the child's perspective ability; i.e. the child is required to select a picture showing how it looks to the other person. The results of Experiments 5 and 6, then, show that children as young as 3 years do have the simple perspective ability needed for this task.

However the situation is more complicated than this. If a child is using the two-stage strategy, then he will

(i) calculate which doll's face the experimenter sees,

and then

(ii) select the picture showing this doll's face.

The first stage, however, only requires the child to have the projective ability of calculating what the experimenter sees, and the second stage only requires him to use this knowledge to infer which is the correct picture. In other words, it seems that the child's apparent perspective ability is really a combination of projective ability and inferential ability.

Although this seems at first sight surprising, it will quickly be realised that many similar perspective abilities can be broken down in this way. Consider for example a situation which might have arisen in Experiments 2 or 3, where a child is asked to select a picture showing Ringo's view of the cup when the handle is turned away from Ringo. A child might succeed on this by first calculating that Ringo could not see the handle (projective ability) and then inferring that the correct picture was the one in which the handle could not be seen (inferential ability). Another more complex example might arise in the mountain task, where a child

has a brown mountain on his left at the front, a green mountain in the middle at the back, and a grey mountain on his right at the front, and he is asked to select a picture showing what a doll, sitting opposite, sees. He might well do this by first calculating that the green mountain is nearest the doll, so reducing his choice to those pictures with the green mountain at the front. He may then calculate that the doll sees the brown mountain on the right, and hence narrow his choice down to the correct picture.

What we are saying here is simply that children may well succeed on quite complex picture selection tasks by developing inferential strategies based on relatively simple projective or perspective abilities. This seems quite a reasonable assumption to make, particularly in view of our analysis of the three dolls task. It is, however, generally assumed by other investigators in this area that children in fact succeed on picture selection by a process involving imagery. That is, it is assumed that a child will look at his own view, and by systematically applying a number of mental transformations or rotations to it he will construct an image of the other person's view. He will then select a picture showing this image.

Certainly Piaget and Inhelder believe that the mountain task is a test of the child's ability to "imagine", or produce "visual images" of, other views. For instance they said that a child who fails on the mountain task "...cannot form a comprehensive mental picture detailed enough to enable him to think out the transformations in terms of virtual perspectives ...it is the egocentric illusion

which prevents these children from reversing to the left-right, before-behind relations and thereby rotating the perspectives along with their changing viewpoints..." (p.218); and "... he appears to be rooted to his own viewpoint in the narrowest and most restricted fashion so that he cannot imagine any perspective but his own." (p.242)

This position is held even more explicitly by Huttenlocher and Presson (1973), who claim that 8- and 10-year old children solve a problem similar to the mountain task by "mentally rotating" the display. Huttenlocher and Presson also asked adults to solve the problem and report on how they had done it. Most adults reported forming an image, although a few said that they had used an inferential process.

Clearly this kind of task can be solved either by inference or by imagery, and it is important to discover which conditions favour one method rather than another. For the time being, we will merely claim that our 3- and 4-year old children solved the present perspective problem by using inference, although they probably could not solve it by means of imagery.[26]

General Discussion of Experiments 1 - 6

Taken together the results of Experiments 1 - 6 show that preschool children have considerable abilities in both the projective and perspective areas. In the projective area the results of Experiment 1 show that almost all 3-year olds have at least the basic projective abilities outlined in Chapter 3, up to and including knowing that other people will not see objects which are hidden by nearer objects along their line of sight. The results of Experiment 6 show that 3-year old children can also perform simple perspective calculations, when these involve merely the transformation of orientation (i.e. knowing that another person's view of an object, or group of objects, will be of the side of the object which is nearest to them). The results of Experiment 3 suggest that only the older 4-year old children can perform perspective calculations involving the front/back transformation (i.e. knowing that another person's view will not contain objects which are occluded by objects nearer to them on their line of sight). However this last ability has not been tested for under the optimal conditions discovered by Experiments 5 and 6.

Since the work reported here was started a handful of studies have appeared which give considerable support to these findings. Fishbein, Lewis and Keiffer (1972) report an unpublished study by Lewis and Fishbein (1969) in which a single toy was used, and children aged from $3\frac{1}{2}$ years to $9\frac{1}{2}$ years were asked to identify the perspective of the experimenter by either pointing to a photograph or turning the toy. Lewis and Fishbein found that all the children

performed well on both the pointing and turning tasks, the latter producing virtually errorless performance. Unfortunately no more details are given of this earlier study.

Fishbein et al go on to describe a study in which they compared children's performance on a 'turning' task, in which the child was asked to turn toys so that the experimenter could see specified views of the toys, with their performance on a 'pointing' task, in which the child was asked to point to a photograph of the experimenter's view. The toys all had distinguishable front, back left and right side views. (e.g. a toy mouse with a candle in one hand and the other hand at his side). In some conditions only one toy was used, while in other conditions a group of 3 toys was used. In the turning task E used instructions like 'show me the front of the mouse', while in the pointing task E said "I want you to point to the picture which looks like what I can see from where I am sitting". Fishbein et al found that for a group of preschool children aged from 3 years 5 months to 4 years 8 months (mean age 4 years 0 months) performance on the turning task was very high (over 90%). On the pointing task performance depended on the number of toys used and the number of photographs to be selected from. Thus with 1 toy and 4 photographs performance was 75%, with 3 toys and 4 photographs it was 66%, with 1 toy and 8 photographs it was 48%, and with 3 toys and 8 photographs it was 34%.

These results fit reasonably well with our own findings. The turning task requires fairly straightforward projective abilities, and so Fishbein's results confirm our findings that such tasks present few problems to 3- and 4-year old children. The pointing

task, on the other hand, is a picture selection task similar to those used in Experiments 2 - 6, and so it might at first sight seem strange that Fishbein et al found high performance in some conditions without any of the preliminary verbal questions found necessary in Experiments 5 and 6. However a closer study of the procedure used by Fishbein et al shows that they had an extensive 'familiarisation' procedure before giving the test questions. In this 'familiarisation' procedure the experimenter sat beside the child and described the distinctive features of each view of the toys, using labels such as 'front','back' and 'side'. He then asked the child to select a picture showing his own view of the toys, and corrected all the errors which the child made. Moreover in the actual test session the experimenter gave the child evaluative feedback, correcting him when he was wrong and giving him sweets when he was right. It seems highly probable that this procedure was equivalent to the preliminary verbal questions used in Experiments 5 and 6, and this could in fact be tested experimentally.

Another recent study by Masangkay et al (1974) investigated the projective abilities of children aged from 2 years 1 month to 3 years 7 months. In one task, the 'picture' task, the experimenter held a piece of card with a picture on each side between himself and the child and asked 'what do you see?' and "what do I see?'. In some trials the pictures were the same on each side, and in other trials they were different. In another task, the 'eye-position' task, 4 toys were positioned around the child (on the ceiling above him, on the walls to his left and right, and on the floor at his feet).

The female experimenter sat facing the child and asked him which toy she was looking at while she fixated each toy in turn. In between fixations E closed her eyes and moved them to the next fixation position when closed. Thus the only cue available to the child was eye-position, not eye-movements. Masangkay et al found that performance was similar on both tasks; the 2-year olds scored around 50% on each task while the 3-year olds performed at near 100%.

Again these results fit in well with our findings, confirming that almost all 3-year olds have simple projective abilities and suggesting that a considerable number of 2-year olds also have such abilities. Indeed the performance of the 2-year olds is remarkably high considering the problems involved in testing children of this age. Moreover the eye-position task is clearly a useful paradigm for investigating these projective abilities in more detail (e.g. finding out which cues are used in calculating what another person is looking at, or how accurately children can perform such calculations).

Masangkay et al report two further experiments which are also relevant here. In the first experiment they compared the performance of children aged between 3 years and 5½ years on a series of 5 tasks. The first of these, the 'picture' task, was a slightly modified version of the picture task described earlier. In the second of these tasks, the 'turtle' task, E sat opposite the child and held horizontally between them a card with a picture of a turtle on it, asking, for various positions of the card, 'do you/I see the turtle right side up or upside down?'. In the third task, the 'fishes' task,

three differently coloured fishes were mounted at 120° to each other (as in the 3 dolls task used in our Experiments 4 - 6), and three comparison fishes, each identical to one of the other fishes, were lined up facing the child to one side of the display. E sat at 120° to the child so that he saw one fish nearest to him while another fish was nearest to the child. E asked the child 'does the one that you/I see best look like this one, this one, or this one?' (pointing to each comparison fish in turn). In the fourth task, the 'witches' task, E sat opposite the child with a toy witch between them which faced either one or the other of them, and for comparison there were three identical witches, in different orientations, lined up close to the child. E asked the child to say which of the comparison witches 'looks exactly like what you/I see?'. The last task, the 'clown task', was similar to the turtle task except that the picture showed a smiling clown's face when seen from one orientation, but a frowning face when seen from 180° to this orientation. E sat opposite the child and asked 'do you/I see the smiling face or the frowning face?'.

The results were fairly straightforward and showed that performance on the picture task and the fishes task was near 100% for almost all the children from 3 years upwards. The turtle task and the clown task elicited around chance responding for the 3-year olds but performance was near 100% for the 4-year olds. Performance on the witches task was low for all the children below $4\frac{1}{2}$ years but improved steadily to over 80% for the 5-year olds.

As before, these results fit in very well with our own findings, In our terms, the picture task and the fishes task are both simple

projective tasks, and Masangkay's results confirm our findings that almost all 3-year olds succeed on such tasks. The turtle task and the clown task are both perspective tasks, in that they require the child to calculate 'how it looks' to the experimenter, and are essentially simpler versions of the 'cup rotation' procedure used in Experiment 3. Thus Masangkay's findings that the tasks are difficult for 3-year olds but easy for 4-year olds confirm our finding that the cup rotation procedure produces good performance only with the older 4-year olds. Finally, the witches task is a perspective task closely resembling a standard picture selection task, and without anything like the verbal questions used in our Experiments 5 and 6 it is not surprising that performance was low for all children below $4\frac{1}{2}$ years.

In the final experiment reported by Masangkay et al 12 children aged between $3\frac{1}{2}$ and 4 years were given a series of 4 tasks in the same order. In the first of these, the 'witch-spots' task, a blue spot was painted on the nose of a toy witch and an orange spot was painted on the back of her hat. The witch was then placed between the child and the experimenter who asked 'do you/I see the nose with the blue spot or the hat with the orange spot?'. In the second task, 'witch-split', a witch was split down the middle and the two halves mounted on opposite sides of a board. This was placed between the child and the experimenter who asked 'do you/I see the witch's nose or the witch's hat?'. The third task was the standard 'witches' task used in the previous experiment, while the fourth task, the 'block' task was a simple picture selection task in which the child was asked to select from 2 photographs the one showing the experimenter's view of a block mounted on a platform.

Masangkay et al found that performance was near 100% on the first two tasks (witch-spots and witch-split), but was low for the last two tasks (witches and block). There was no evidence of any facilitation on the witches task due to successful performance on the witch-spots or witch-split tasks.

In our terms the first two tasks were simple projective tasks and the results show yet again that these present few problems for 3-year old children. The last two tasks were simple perspective tasks involving either picture selection or a similar comparison procedure, and Masangkay's results confirm our findings that 3-year old children usually fail such tasks if no form of preliminary questioning is given. What is interesting here is that there was no facilitation effect on the witches task due to successful performance on the witch-spots or witch-split tasks. Clearly these two earlier tasks did not function in the same way as the verbal questions did in our Experiments 5 and 6, and so Masangkay's subjects were unable to develop a correct strategy for solving the problem. One possible reason for this failure to obtain a facilitation effect is that the questions used in the witch-spots and witch-split tasks were concerned only with the distinctive features of the <u>test</u> witch. The comparison witches were not even present during these first two tasks. This situation resembles condition C in Experiment 6, where the only verbal questions asked were about the dolls, not about the pictures. In that condition too, no facilitation effect was found. We would predict on the basis of our findings in Experiment 6 that performance on the witches task <u>would</u> be facilitated by preliminary verbal questions

about the test witch and about the comparison witches.

On the basis of these experiments Masangkay et al distinguish between two levels of ability, which they call levels 1 and 2, and conclude that while level 1 is present to some extent in at least half of their 2-year olds, level 2 does not appear in the majority of children until 4 years.[27] This level 1/level 2 distinction is virtually identical to our projective/perspective distinction, and we can in fact suggest from the results of Experiment 6 that some degree of level 2 ability (our perspective ability) is present in almost all 3-year olds. Apart from this important difference, though, these experiments of Masangkay et al provide strong support for many of our own findings.

The final study to have appeared on this topic since this thesis was begun is an unpublished study by Light (1974) of the role-taking skills of 4-year old children. Light followed up a sample of 31 Cambridge children who had been studied intensively in their first year of life by Richards (e.g. Richards and Bernal, 1972), and gave them a battery of role-taking tasks around their fourth birthdays. The first task closely resembled Masangkay's turtle task but used a small plywood figure of a man instead of a turtle. The child and the experimenter sat at various positions around a table while E asked the child to put the man 'up the right way' or 'upside down' either for E or for the child. Light's second task was similar to the first in that it required the child to place flat pictures the right way round for the experimenter sitting opposite. This time, however, this was not made explicit to the child. Instead the child

and the experimenter took it in turns to give each other 'presents' (cards with pictures of objects on them), which involved them placing the cards in rows in front of each other. Light found similar results for the two tasks. About half of his subjects were predominantly correct in orienting the man in the first task while a similar proportion of the children in the second task turned most of the pictures so that the experimenter saw them the right way up. This is consistent with the findings of Masangkay et al that performance on the turtle task was at the chance level for the 3-year olds but near 100% for the 4-year olds.

Two more tasks devised by Light, his 'pyramid' tasks, are also relevant here. In these tasks he used a 3-sided pyramid which had different pictures on each side. In the first task the pyramid was placed between the experimenter and the child so that two faces of the pyramid were visible only to the child while the other one was visible only to the experimenter. The child had to work out which picture the experimenter could see. In the second task a doll was placed at various positions around the pyramid (including positions where <u>two</u> pictures were visible to the doll) and the child was asked to say what the doll could see. Light found that most of the children were able to manage the first task without too much difficulty, and that virtually all the children managed those trials of the second task where the doll could only see a single picture. However only half of these children were successful when the doll could see two pictures. Again these results are fairly consistent with our findings, and show that simple projective tasks are performed well at this age level.

These three recent studies, then, give very strong support to the findings of Experiments 1 - 6, and suggest that we are justified in drawing the following conclusions.

(1) Virtually all tasks which require only projective abilities (i.e. those in which the child has only to calculate what another person can see) are performed well by almost all 3-year olds and by a fair number of 2-year olds. This includes the turning task of Lewis and Fishbein, and of Fishbein et al; the eye-position, picture, fishes, witch-spots and witch-split tasks of Masangkay et al; and the pyramid tasks of Light, as well as our Experiment 1. The single exception to this list is the part of Light's second pyramid task in which two pictures were visible to the doll.

(2) Simple perspective tasks in which the child has to place a figure in a given orientation to another person are performed poorly by most 3-year olds but very well by most 4-year olds. This includes Masangkay's turtle and clown tasks as well as Light's first two tasks. A more complex version of this kind of task, our cup rotation procedure, is performed well by older 4-year old children.

(3) Slightly more complex perspective tasks in which the child has to match the other person's view to some representation of this view are generally performed poorly by most 3- and 4-year old children. This includes Masangkay's witches task as well as the orthodox picture selection procedures used in Experiments 2, 3 and 4, and in some conditions of Experiments 5 and 6.

(4) However, if these tasks are presented in a way that effectively disambiguates the instructions and the representation conventions being used, and allows the child to develop a successful

strategy which relates features of the other person's view to representations of this view, then a high proportion of 3- and 4-year old children will succeed on these tasks. These conditions were certainly met in our Experiments 5 and 6, and were probably met in Fishbein, Lewis and Keiffer's pointing task.

The final question to be considered in this general discussion of Experiments 1 - 6 is: how should these findings be followed up in future experiments?

It seems that little more can be discovered with the materials of Experiments 4, 5, and 6, although it would be interesting to know whether both verbal questions (own view) and verbal questions (other view) were needed in condition D, or whether the same improvement in performance would be produced with only one of these sets of questions. Both the "disambiguation" hypothesis and the "strategy formation" hypothesis would suggest that verbal questions (other view) would be necessary at least, although neither hypothesis is sufficiently precise to make a clear cut prediction. It would also be interesting in view of the findings of Masangkay et al, to know how well 2-year olds perform with these materials.

However it would be much more interesting to see whether the main findings of Experiments 5 and 6 are replicable with different materials and different task requirements. In particular we would want to know whether preliminary verbal questions can dramatically affect children's performance on perspective tasks which involve transformations in either the front/back dimension or the left/right dimension (as in the task used in Experiments 2 and 3), or even in both dimensions simultaneously (as in the mountain task).

Can preschool children succeed on these tasks if they are presented in the right way?.

There are, however, problems in knowing what verbal questions to use in such tasks. The most direct way of specifying each view and each picture would be to use the words 'left', 'right', 'front', and 'back': i.e. one would ask the child

'does the doll see the handle on the left?'

or

'which mountain do I see <u>at the back</u>?'

Unfortunately young children are known to have difficulties with all these terms. Piaget (1928) found that children below 5 years could not specify which was their left or right hand, while children below 8 years could not say which was the left or right hand of a person sitting opposite them. Similar results were found by Swanson and Benton (1955) and Elkind (1961). Young children also have difficulty with the terms "in front of", "behind", "at the front" and "at the back" (Harris and Stronmen 1972; also unpublished work by the author). One of the difficulties they have with these terms is that they confuse opposites[28], such as "front" with "back", although they find it easier if the objects concerned themselves have "fronts" and "backs" (e.g. houses, people, cars, etc.).

It does not seem that there is an easy way to avoid the problems caused by young children's inadequate knowledge of these terms. In an informal pilot study with mountains the present author tried

"Which mountain do you see <u>in the middle</u>?"

and

"Which mountain do you see <u>nearest to you</u> / <u>furthest from you</u>?"

but found that preschool children also have difficulty with these

wordings. In any case these wordings alone are insufficient to differentiate all views of the mountains. Another approach to this problem would be to have preliminary training sessions in which young children would be taught the correct use of "left" and "right", but this could well be an arduous and unrewarding process for all concerned. Alternatively, one could try slightly older children, although one might expect, in view of the findings of Piaget and others, that children of 5 or 6 years would be unable to tell which was "right" and "left" for the person sitting opposite them.

There are, then, rather difficult problems to be solved before this line of enquiry into preschool children's perspective abilities can be continued in its logical direction. In comparison, the further study of preschool children's projective abilities presents far fewer problems. More positively, the results of virtually all the studies of projective abilities so far suggest that the performance of children of 3 years (and even younger) is remarkably high in this area. Consequently the last two experiments to be reported here are studies of young children's ability to perform more complex projective calculations, and they follow on directly from the findings of Experiment 1.

Experiment 7

Introduction

Experiment 1, it will be recalled, compared two methods of constructing a straight line between two dolls facing each other on a table. In one condition, the "projective line task", the child was given a number of dolls and asked to put them in a straight line between the first two dolls. In the other condition, the "line of sight task", the child was given a small "wall" and asked to put it so that one doll could not see the other. The child could only do this successfully by calculating the straight line of sight between the two dolls.

It was found in that experiment that most of the 4-year olds passed the projective line task, but few of the 3-year olds did so. However, virtually all the children, 3-year olds as well as 4-year olds, passed the line of sight task, thus showing that children as young as 3 years have simple projective abilities. Moreover, the line of sight task is both easy for the children to understand and enjoyable for them to do, and so it seems to be a useful paradigm for investigating more complex projective abilities.

The present experiment investigated whether preschool children could perform calculations involving the interaction of two lines of sight. This was done by using three dolls (two policemen and a small boy) and a configuration of walls shaped in a cross. The children were asked to hide the boy from both the policemen, and thus had to keep in mind two lines of sight in choosing where to hide him.

Subjects

30 preschool children (20 boys and 10 girls) were subjects. Their ages ranged from 4 years 11 months to 3 years 6 months (mean age 4 years 3 months). They were all attending the morning session of a preschool playgroup and they were of mixed social class. They were split into 3 groups of 10 subjects according to age. The mean ages of the groups were 4 years 9 months, 4 years 3 months and 3 years 9 months.

Materials

The materials used were 2 small wooden policeman (identical to the one used in Experiment 1), one of the dolls from Experiment 1, and a cross-shaped configuration of walls. The walls were 7 cm high and ½ cm thick, and each arm of the cross was 7 cm long. Figure 12 shows a typical arrangement of the policemen, boy and walls.

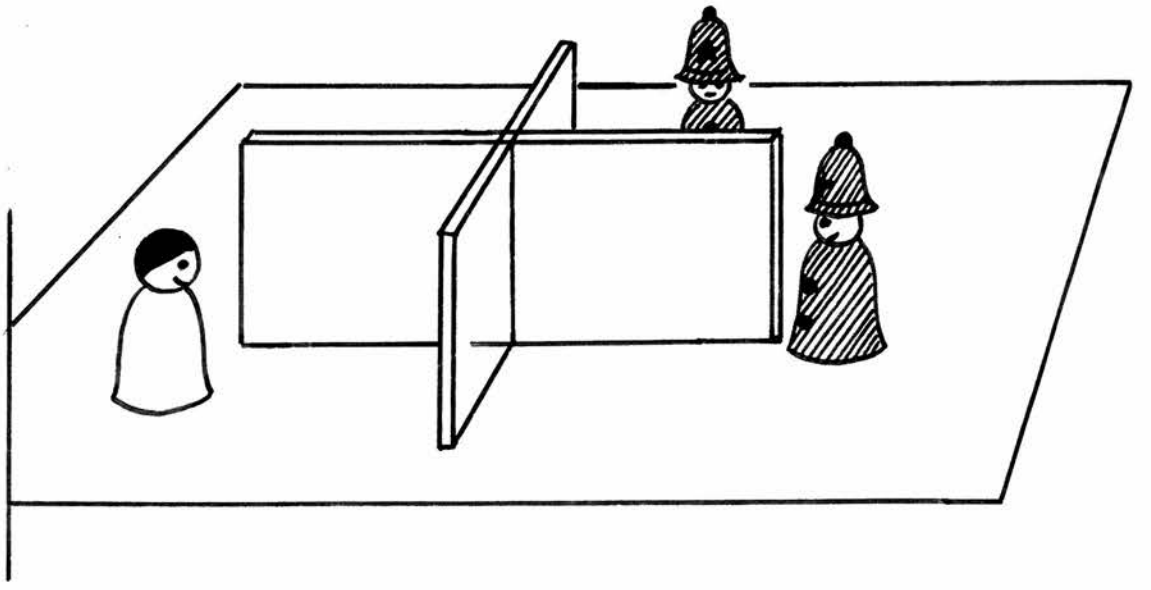


Figure 12: Typical arrangement of the policemen, boy and walls.

Procedure

(1) Preliminaries

The preliminaries were designed to familiarize the children with the materials and the experimental situation. The experimenter brought out one policeman, the boy, and the walls, and placed them on the table in front of the child. He said "The policeman is looking for the boy. The boy wants to hide from the policeman." He then placed the policeman and the walls, as shown in figure 13.

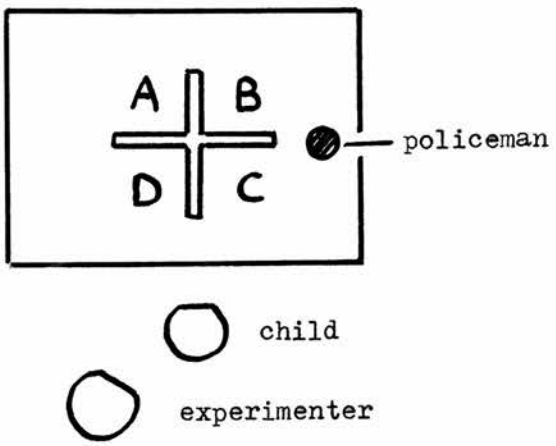


Figure 13

The policeman could see into sections B and C but not into sections A and D. The experimenter then placed the boy in section A and asked

"Can the policeman see the boy?"

He then placed the boy successively in sections B, C, and D, each time repeating this question.

He then placed the policeman as shown in figure 14, so that the policeman could see sections A and D but not sections B and C.

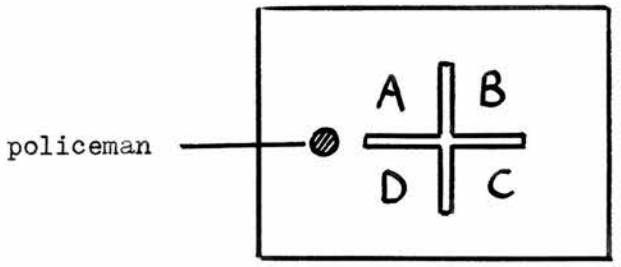


Figure 14

This time the experimenter handed the small boy doll to the child and said

"Can you hide the boy so the policeman can't see him?"

If a child gave an incorrect response the experimenter pointed out his error and repeated the question until the child had made a correct response.

(2) Test

When it was clear that the child fully understood the situation, the experimenter brought out the other policeman, and said

"Here's another policeman. He is also looking for the boy.

The boy must hide from both policemen."

The experimenter put one policeman between sections B and C, and the other between sections C and D, as shown in figure 15.

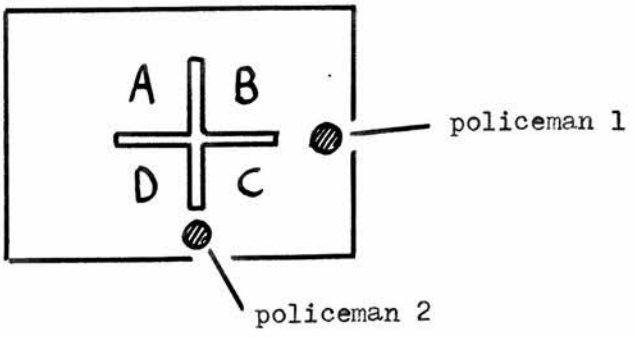


Figure 15

Thus policeman 1 saw into sections B and C, and policeman 2 saw into sections C and D. This left section A as the only place where the boy could hide. The experimenter then said

"Can you hide the boy so that BOTH the policemen can't see him?"

This was repeated three times, each time leaving a different section as the only hiding place. This made a total of four test trials with the two policemen.

Results

(1) Preliminaries

Performance was very high on all the preliminary questions. Overall, the children responded correctly on 138 out of 150 trials (i.e. 92% correct). There were no age effects.

(2) Test

Performance was also very high on all the test questions. Overall, the children responded correctly on 108 out of 120 trials (i.e. 90% correct). The scores for each of the three groups are shown in table 11.

Group	Number correct	% correct
Group 1 (mean age 4 years 9 months)	38/40	95%
Group 2 (mean age 4 years 3 months)	35/40	88%
Group 3 (mean age 3 years 9 months)	35/40	88%

There were no significant differences between any of these groups.

Discussion

These results show that there was a strikingly high level of performance throughout the preliminaries and the test. Children found very little difficulty in correctly identifying where the boy could hide from both policemen. As this task requires the child to handle two lines of sight, these children were clearly performing at quite a complex cognitive level.

Before we analyse this finding any further, we will attempt to replicate and extend it.

Experiment 8

Introduction

This experiment attempted to extend the findings of Experiment 7 in two ways; first, by using slightly younger subjects, and secondly, by using more complex materials. The number of policemen was extended to three, and the configurations of walls were extended to allow five, and then six sections.

Subjects

20 4-year old children (11 boys, 9 girls) and 20 3-year old children (10 boys, 10 girls) were subjects. The ages of the 4-year old children ranged from 4 years 9 months to 4 years 0 months (mean age 4 years 5 months), and the ages of the 3-year old children ranged from 3 years 11 months to 3 years 1 month (mean age 3 years 6 months). All children attended a full time nursery school and they were of mixed social class.

Materials

The materials used were similar to those of Experiment 7. There were three policemen and one small boy doll (identical to those used in Experiment 7) and two configurations of walls (shown in figure 16).

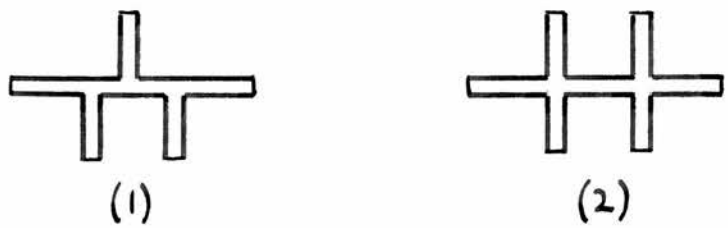


Figure 16: Configurations of walls used in Experiment 8

All the walls were 7 cm high and ½ cm thick. The two larger sections in configuration (1) were 7 cm x 10½ cm; all the other sections, in configurations (1) and (2), were 7 cm x 7 cm.

Procedure

The children were split into two groups, matched as far as possible for age and sex. One group, condition (1), performed with two policemen and configuration (1). The other group, condition (2), performed with three policemen and configuration (2).

All children received a set of preliminary questions exactly as in Experiment 7, to familiarise them with the materials and the situation.

Condition (1)

The test procedure was virtually identical to that used in Experiment 7. The experimenter placed the two policemen between sections A and B, and between sections C and D, as shown in figure 17.

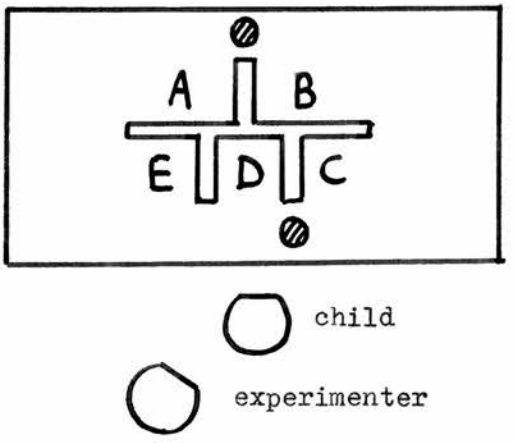


Figure 17

This left section E as the only place where the boy could not be seen. The experimenter asked the child

"Can you hide the boy so that BOTH the policemen can't see him?".

This was repeated for three other positions of the policemen, such that the only possible hiding places were, respectively, sections C, D and B.

Condition (2)

The test procedure was virtually identical to that of condition (1), except that three policemen were used with the different wall configuration. The experimenter placed them between sections A and F, D and E, A and B, as shown in figure 18.

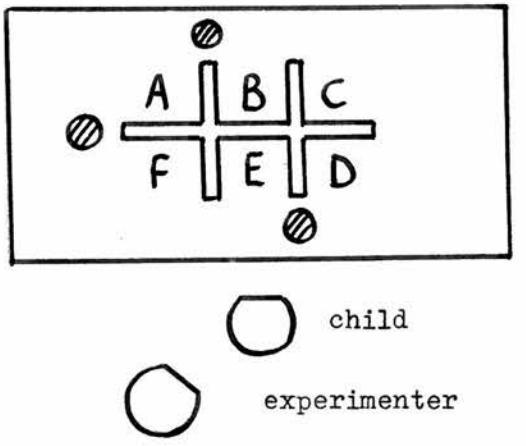


Figure 18

This left section C as the only place where the boy could not be seen. The experimenter asked the child

"Can you hide the boy so that NONE of the policemen can see him?".

This was repeated for three other positions of the policemen, such that the only possible hiding places were, respectively, sections F, E and B.

Results

Table 12 gives the scores (out of 40 in each case) for each age group in each condition.

Table 12

Age group	condition (1)	condition (2)
4-year olds	39 (98%)	36 (90%)
3-year olds	25 (63%)	28 (70%)

For the 4-year olds, performance was near 100% for both conditions. For the 3-year olds, performance was fairly high, but not as high as for the 4-year olds. In condition (1) the difference between the 3- and 4-year olds was significant at the 0.025 level (U=23, Mann-Whitney U test, one-tailed), but in condition (2) the difference just failed to reach significance at the 0.05 level (U=31 Mann-Whitney U test, one-tailed).

Discussion

These results are as striking as those of Experiment 7, and confirm that children as young as 3 years can perform well on tasks of this complexity. Although the difference between the 3- and 4-year olds is not unexpected, it is surprising that there is no difference between conditions (1) and (2). The latter seems to be a much harder task than the former, for not only does the wall configuration have more sections, but the child has to hide the boy from three policemen.

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It is important to point out at this stage that these tasks are very enjoyable for the children, and they find it very easy to get totally involved with the situation. The tasks are very similar to the children's own games of hide and seek, and the children readily

identify with the boy and his need to hide from the policeman. They are particularly excited if the policemen are introduced one by one, and many of the subjects in condition (2) were eagerly waiting for even more policemen to appear. This involvement must inevitably improve their performance, although it is not easy to express this in formal terms.

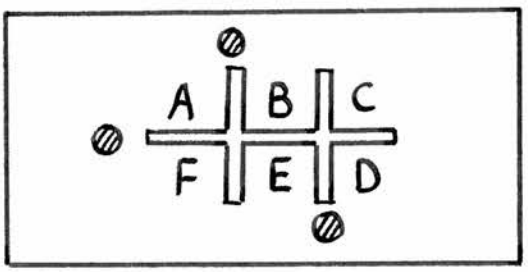
It is surprising, in view of the fact that preschool children universally play at hide and seek, that this kind of paradigm has not been used before now in testing young children. By an interesting coincidence, however, at the same time that these experiments were being carried out, a very similar paradigm was being used in a totally independent study of 4-year old children in Cambridge. This unpublished study, by Light (1974), has already been referred to in Chapter 4. Light gave a battery of role-taking tests to a small group of children around their fourth birthdays, and two of the tasks involved 'hide and seek' situations. In one task, one doll had to be hidden from another amongst a group of objects (such as a house and a car), while in the other task the doll had to be hidden from two other dolls within a configuration of walls similar to those used in Experiments 7 and 8. Light found that performance was generally high; well over half of his subjects gave predominantly correct responses on both tasks. Thus Light's findings substantially confirm the results obtained here.

The rest of this discussion will focus on two main questions;

(1) What kinds of mental operations are required for success on these tasks?.

(2) How should these experiments be followed up in future work?.

(1) Let us start by considering a typical situation from condition (2).



(as Figure 19)

With the policemen in these positions, the only section where the boy can hide is C. How does the child work out that this is the correct solution?.

One possibility which we must consider is that the child is simply placing the boy as <u>far away</u> from the policemen as possible, and that he is not even taking any account of where each individual policeman is looking. We can discount this possibility, however, for two reasons. First, children typically place the boy as close as possible to the inside corner of each section, and this is in fact the part of the section which is <u>nearest</u> to the policemen. On the above hypothesis they would not do this, but would try to place the boy as far away from the walls as possible. Secondly, and more importantly, there is direct evidence that several children do actually take account of where each policeman is looking. These are children who characteristically move the boy to one section and, <u>without letting go of him</u>, look around to see if he is visible to any of the policemen. If he is, then they try another section.

This characteristic performance of moving the boy to a section and holding on to him while checking if he can be seen closely resembles a practice that often occurs when a person is learning to play <u>chess</u>.

Beginners frequently move a chess piece to a square and, without letting go of the piece, look to see if it can be captured, or if the move is otherwise unsafe. This practice soon disappears as the player learns to internalise the whole process instead.

The comparison with chess is an important one in trying to understand these tasks, and it may well be that there are similar mental processes involved in both situations. If we pursue this comparison a bit further, then we can hypothesize that those children who do not actually move the boy from one section to another, checking each time to see if he can be seen, have instead internalised the process. That is the children are mentally considering a number of sections in turn and working out, for each one, if the boy could be seen if he were actually to move there.

To be more explicit, we are claiming that the child has internalised the following sequence:

1. Move boy to a particular section.
2. Can any policeman now see him?
3. If yes, move boy to another section and repeat 2.
4. If no, then this is correct response.

If we assume that children are mentally checking out each section in turn, then the next question to consider is what overall strategy they are using in doing this. It is possible that they may start at one section, work out if that section is being covered by a policeman or not, and then proceed to the next in a completely systematic manner. Alternatively, they may make a rough estimate of a likely section, perhaps based simply on distance from the policeman, and then work out

if the boy would be seen in that section or not. We cannot at this stage speculate as to which strategy the subjects in these experiments were using, but it might be possible to determine this in future work by studying the child's eye movements. Although this would present considerable problems, it might well produce valuable insights as to how children succeed on these problems.

Whichever strategy the child is using, he must still be able to work out from a given situation which of a number of possible alternative states are likely to meet the task requirements and provide the boy with a safe hiding place. This process must almost certainly be regarded as inference, for the child must infer the correct alternative by applying certain rules to the given situation. It may also involve imagery, in that the child may actually imagine the boy in each of the alternative positions. This seems unlikely, although we have no direct evidence either way. In any case it is not easy even to specify what would count as evidence for such a claim.

(2) How, then, should this finding be followed up?. We have already suggested that repeating Experiments 7 and 8 and recording the children's eye movements might tell us a lot more about the kinds of strategy they were using in performing the tasks. There are, however, a large number of other ways we could continue. We could, for instance, increase the complexity of the situation almost indefinitely, adding more policemen and more sections to the configuration of walls. Figure 19 shows a possible set-up with four policemen and nine compartments.

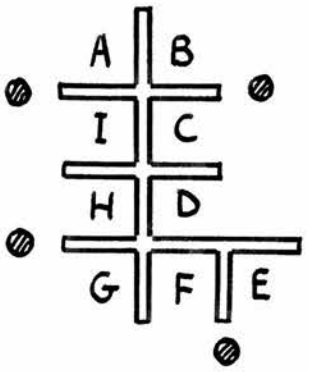


Figure 19

Successful performance on this task, however, would only require a more exhaustive application of the same basic 'checking out' process needed in Experiments 7 and 8.

Alternatively we could use slightly different paradigms which require a different kind of reasoning to be used. For example, in the situation illustrated in figure 20 below

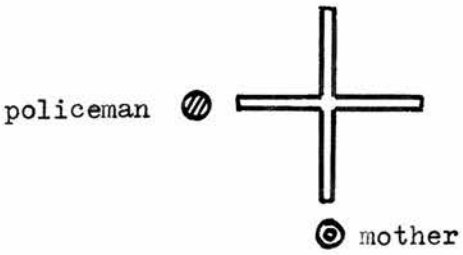


Figure 20

the child's task is to place the boy so that

(1) the policeman cannot see him, but

(2) his mother can see him.

It would also be interesting to investigate in more detail the children's understanding of the basic rules of the paradigms used in Experiments 7 and 8. This could be done, for example, by using anomalous situations (such as placing the policemen so that all the sections are

covered and there are no safe hiding places), or by making ineffectual rearrangements of the policemen which do not affect which section is safe. One could also investigate the extent to which the children explicitly took into account which way the policemen were looking on every trial, or whether they simply assumed that if a policeman was 'near' to a section then the boy could not hide in that section. This could be looked at by having trials in which a policeman was near a section but in fact looking away from it.

A rather different way to follow up these experiments would be to use them to see how accurately children could perform simple geometrical calculations, such as calculating the intersection of two straight lines. In figure 21, for example, the child's task would be to place an object such as a model tree so that both the boys would be hidden at once.

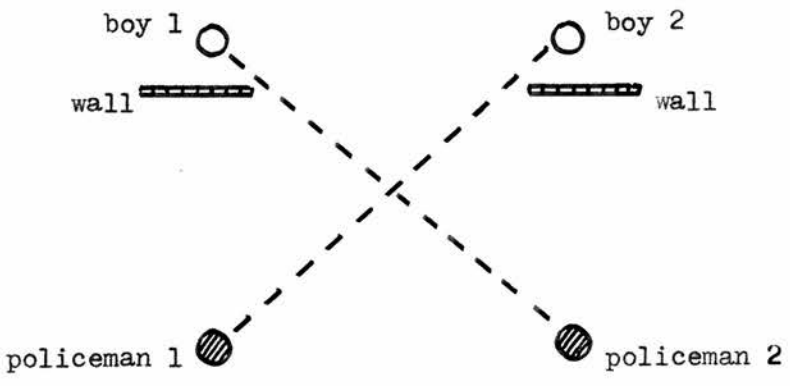


Figure 21

Clearly there are a variety of interesting ways in which these

experiments could be followed up.

This concludes our account of Experiments 1 to 8. In the final chapter we will summarise the main findings of these experiments and present our conclusions.

Chapter 5: Summary and Conclusions

We will first present a summary of the experiments described in Chapter 4, and then try to draw some general conclusions.

Experiment 1 looked at the extent to which preschool children have simple projective abilities. This was done by comparing their performance on Piaget and Inhelder's "projective line task" with their performance on a "line of sight" task. In the former task the child was given a number of dolls and asked to put them in a straight line between two end dolls placed some distance apart on a table. In the latter task the child was given an object and asked to place it so that one end doll could not see the other. It was found that, while most of the 4-year old children succeeded on the projective line task, few of the 3-year old children could manage this. On the other hand, virtually all the children, 3-year olds as well as 4-year olds, succeeded on the line of sight task. These results were taken as showing that, contrary to Piaget and Inhelder's claims, preschool children can succeed on the projective line task, and that the projective line task is not as direct a test of the ability to construct a straight line as the line of sight task. More importantly, the results with the line of sight task show that 3-year old children do have considerable projective abilities. Not only do they know that what the dolls see is different from what they themselves see, but also they are able to construct the line of sight from one doll to the other, and they are aware that blocking this line of sight means that one doll can no longer see the other.

The main aim of Experiment 2 was to see whether preschool children

have simple perspective abilities. This was done by comparing the performance of 4-year old children on a projective test with their performance on a perspective test in the same situation. The materials used were a toy dog and a cup. The child's projective ability was tested by verbal questioning, i.e. the child was asked, for various positions of the cup and the dog, whether the dog could see the handle of the cup. The child's perspective ability was tested in another session by the method of picture selection, i.e. the child was asked, for various positions of the cup and the dog, to select the picture showing his own view and the picture showing the dog's view. It was found that there was a considerable difference between the two procedures. The children performed much better with verbal questioning than with picture selection, both on their own view (98% compared with 57%) and on the other view (85% compared with 16%). Although the results for the other view condition suggest that 4-year old children do not have simple perspective abilities, it was argued that this conclusion could not be accepted immediately without first investigating whether picture selection was an adequate test of perspective ability.

Experiment 3 investigated this possibility by comparing picture selection with the alternative method of cup rotation. In this method the child was shown the cup with the handle visible and told that he saw a "cup". Then he was shown the cup with the handle turned away from him and told that he saw a "bowl". He was then asked to turn the cup so that the dog "saw a bowl". It was found that, for 4-year old children, cup rotation was much easier than picture selection, and that successful performance on cup rotation facilitated

performance on a subsequent picture selection trial. This result showed that 4-year old children do have simple perspective abilities, and that the method of picture selection as used in Experiments 2 and 3 was not an adequate test of these abilities.

The next three experiments looked for ways of modifying the picture selection procedure so as to make it a more adequate test of perspective ability. Experiment 4 looked at the effect of varying the wording of the instructions used in picture selection. This was done because it was realised that the instructions used in Experiments 2 and 3 were ambiguous. The materials used in this experiment were three dolls of different colours, each mounted near a corner of a triangular base and facing outwards. 4-year old children were asked to select pictures showing their own view, and the view of the experimenter who sat at 120° to the child's right. The instructions used were

(1) "Which picture shows what you see/I see?"

(2) "Which picture shows how it looks to you/to me?"

(3) "Which picture shows the doll's face that you see/I see?"

It was found that there was very little difference between the instructions, with the standard instructions (1) being slightly easier than instructions (2) or (3). This result showed that changing the wording of the instructions alone was unable to produce any improvements in performance.

Experiment 5 looked at whether performance on picture selection could be improved by prefacing the picture selection questions with a series of verbal questions about the child's own view, about the

experimenter's view, and about the pictures. The same materials were used as in Experiment 4. One group of 4-year old children were asked the following series of verbal questions before picture selection:

(1) verbal questions (own view) "Which doll's face do you see?"

(2) verbal questions (other view) "Which doll's face do I see?"

(3) verbal questions (pictures) "Which doll's face do you see in this picture?"

Performance on these verbal questions was near 100%. More importantly, subsequent performance on picture selection, other view, was strikingly higher for this group than for a group who received only picture selection (13 out of 20 children reached criterion after these verbal questions, while only 1 child out of 20 succeeded with picture selection alone). It was argued that the children who succeeded on picture selection did so by using the following two-stage strategy:

(1) the child calculates which doll's face the experimenter sees;

(2) the child selects the picture showing this doll's face.

Experiment 6 replicated and extended the findings of Experiment 5 in several ways. First, it was found that a similar effect could be obtained despite a slight change in the experimental design, and that this effect also occurred with children as young as 3 years. Thus 16 out of 20 4-year olds, and 9 out of 12 3-year olds, all of whom had previously failed on picture selection alone, succeeded when

picture selection was prefaced by verbal questions. Secondly, in some conditions the picture selection questions were presented in two stages, directly parallel to the two-stage strategy outlined earlier. Thus the children in these conditions were asked

"Which doll's face do I see?" followed directly by

either "so which picture shows what I see?"

or "so which picture shows the doll's face that I see?"

All children in these conditions, 3-year olds as well as 4-year olds, scored virtually 100%. Finally this experiment looked at whether both sets of verbal questions were needed to produce the improved performance in picture selection, other view. It was found that both sets were needed; neither set of verbal questions alone produced the effect.

It was argued that this experiment provided further evidence that the children who succeeded on picture selection were using the two-stage strategy; that both sets of verbal questions were needed for the adoption of this strategy; and that the verbal questions served to disambiguate both the language of the instructions and the conventions of the pictures. It was further argued that the children who succeeded on picture selection were demonstrating perspective ability, and that this perspective ability consisted of a projective component and an inferential component.

The results of Experiments 1 - 6 were then considered in the light of some other recent studies of young children's projective and perspective abilities. It was argued that these studies, by Fishbein et al (1972), Masangkay et al (1974), and Light (1974), gave strong support to the findings of Experiments 1 - 6.

The last two experiments followed up some possibilities suggested by the results of Experiment 1. It was found in Experiment 1 that children as young as 3 years had little difficulty in constructing a line of sight between two dolls on a table. Experiment 7 looked at whether preschool children could perform calculations involving the interaction of two lines of sight. This was done by using three dolls (two policemen and a small boy) and a configuration of walls shaped in a cross. The children were asked to hide the boy from both the policemen, and thus had to keep in mind two lines of sight in choosing where to hide him. It was found that children as young as 3 years performed very well on this task and scored around 90% correct.

Experiment 8 extended the findings of Experiment 7 by using more complex materials. In one condition there were, as before, two policemen and a small boy, but the wall configuration had 5 sections rather than 4. In the other condition there were three policemen instead of two, and the wall configuration had 6 sections. For the 4-year olds, performance was near 100% for both conditions, while for the 3-year olds performance was between 60 and 70%. It was argued that the children who succeeded on these tasks were mentally calculating whether or not certain sections were safe places for the boy to hide, and that this showed that children as young as 3 years were capable of some degree of inferential thinking.

Conclusions

In the previous chapter we discussed each of these experiments in some detail and outlined some ways in which they could be followed up in future work. We will now try to draw some more general conclusions.

First, we can claim with some confidence to have answered the

questions we set out to investigate. We now know that preschool children are able to calculate what another person can see, and indeed have considerable abilities in this area. In the projective area, we have shown that children as young as 3 years are able to calculate what another person can see in a large number of situations. More specifically, in terms of the analysis of these projective abilities put forward in Chapter 3, we have shown that for the range of situations used in our experiments 3-year old children:

(a) can use the relevant cues from the other person or doll in order to calculate their direction of gaze;

(b) are aware that people see in straight lines;

(c) are able to construct a straight line along the other person's direction of gaze in order to locate the object of their gaze;

(d) know that other people see the nearest object along their line of sight, and that objects further along their line of sight will be occluded by the nearest object.

Moreover, we have shown in Experiments 7 and 8 that children as young as 3 years perform well on tasks requiring them to co-ordinate 2 or 3 lines of sight. These abilities go a long way beyond those originally outlined in the analysis of projective abilities given in Chapter 3. However, it is not clear to what extent they can be considered as high level projective abilities, or whether successful performers in these tasks were in fact combining a relatively low level projective ability into a more general non-projective strategy (e.g. 'if a policeman is next to a section then that section is not a good hiding place.'). As we have already mentioned in the discussion

of these experiments in Chapter 4, this possibility could be investigated in further experiments.

In the perspective area we have shown that children as young as 3 years can calculate how an object or group of objects looks to another person when this involves the transformation of orientation (i.e. knowing that other people will see the part of the object or group which is turned towards them). We have also shown that most older 4-year old children and some younger 4-year olds can calculate how it looks to another person when this involves transformations in the front/back dimension. (i.e. knowing that other people will see objects that are nearer to them in front of objects that are further away, and that the nearer objects may occlude the further objects). However the ability to perform this particular transformation has not yet been tested under the optimal conditions discovered by Experiments 5 and 6. Similarly, we have no knowledge yet as to whether preschool children can, under optimal conditions, perform transformations in the left/right dimension (i.e. working out which objects another person sees on the left and which are seen on the right).

As we have already seen, these findings are for the most part supported by some recent studies which have appeared since this thesis was begun (Fishbein et al, 1972, Masangkay et al, 1974, and Light, 1974). Thus we have strong grounds for concluding that preschool children are able to calculate what another person can see, and that this constitutes substantial evidence against Piaget and Inhelder's claim that preschool children are unable to perform such calculations. Clearly preschool children are not egocentric in this particular respect.

Indeed, there is a growing amount of evidence suggesting that, in

other areas as well, preschool children are not as egocentric as Piaget has claimed. For example Borke (1971) presented children between 3 and 8 years with a series of stories, and asked them to indicate how the child in each story felt by selecting a picture of a 'happy', 'sad', 'afraid', or 'angry' face. Typical situations involved eating a favourite snack, losing a toy, getting lost in the woods at night etc. Borke found that even the 3-year olds were able to make appropriate responses, scoring above chance with all the faces apart from the 'afraid' face. Performance was best with the 'happy' face; by $3\frac{1}{2}$ - 4 years almost all the children could respond appropriately with this face. These results are very encouraging, particularly in view of the fact that Borke's task required the child both to discriminate between the different faces and to apply them correctly to the situations.

Another recent study which concluded that preschool children were less egocentric than Piaget maintains was that of Garvey and Hogan (1973). In this study Garvey and Hogan videotaped dyads of children aged between $3\frac{1}{2}$ and 5 years, and found that several different measures revealed a 'high level of mutual responsiveness' in the children's interactions. For about 2/3 of the time the children were judged to be in 'mutual focus' (i.e. their actions, both verbal and non-verbal, were interdependent; see Goffman 1963), and well over half of the children's speech was classed as 'social' (i.e. it was either a relevant response to the other child's previous activity, or it evoked a relevant response <u>from</u> the other child). Moreover there were frequent occurrences of quite complex social routines between the children (see the example quoted earlier on p.56).

Garvey and Hogan conclude that preschool children are capable of a 'surprising level of interpersonal understanding'.

This present study then, adds further support to the growing belief that preschool children are not as egocentric as Piaget has claimed, and shows that in this particular area at least, children as young as 3 years are able to take another person's point of view. Moreover, the findings that preschool children do have these perspective and projective abilities strongly raises the possibility that they <u>are</u> using these abilities in their ongoing social interactions. We discussed this possibility in some depth in Chapter 2, and as we have no more direct evidence for this, we will not elaborate on the argument here. Nevertheless, the present experiments must be considered as strong informal evidence for this possibility; it seems highly unlikely that young children would have such a well developed and useful skill, yet fail to make use of it in their ongoing interactions.

The experiments reported here, however, amount to somewhat more than a demonstration that preschool children have the projective and perspective abilities listed above. Accordingly, the rest of this chapter will consider what further implications can be drawn from these experiments.

First, we will consider the results of Experiments 5 and 6, which showed that quite striking differences in performance can be produced by what are superficially quite small differences in procedure. Experiment 6, in particular, showed that if two sets of verbal questions are given before picture selection then most children can develop the correct strategy for succeeding on the task, while if only one set of

questions, or no questions at all, are given, then very few children can succeed on the task. Moreover, if the procedure is then structured so that the questions asked are directly in line with the correct strategy, then again it is found that most children can succeed on the task.

Such dramatic effects are quite unusual in the experimental literature, and apart from their immediate implication for the ability being tested for, they have more general implications for the whole area of testing young children's cognitive abilities. For a start they suggest that we must pay very close attention to how tasks are presented to the child. This means more than just considering the language used in the instructions of the task (although this is important in itself, as Donaldson and Wales (1970) amongst others have pointed out, and as Grieve (1971) has convincingly proved with respect to class inclusion tasks). The results of Experiment 4, as well as those of Experiments 5 and 6, show that the language of the instructions alone may not be the crucial factor.

Instead we must consider how the child will interpret the whole test situation, where this includes not only the language of the instructions but also the conventions of any pictures that may be used. It also means considering how the child will interpret any changes the experimenter makes in the array, or indeed how the child will interpret any aspect of the experimenters behaviour which might be considered relevant to the situation. In short, it is of vital importance to consider the test situation as an interaction between the child and the experimenter, in which both sides are actively trying to give meaning to the whole situation and to interpret each

other's behaviour accordingly.

A further implication of the dramatic results of Experiments 5 and 6 is that they demonstrate the importance of considering which strategy a child may use in solving a task, and in particular they show the value of shaping the task procedure so that the questions asked are directly in line with the strategy. It might of course be objected that this is making the task unnecessarily easy for the child. Such an objection, however, confuses two aspects of such a task; first whether the child can spontaneously work out which strategy to use, and secondly whether he can in fact perform the calculations. These two aspects are typically confused in most tests of cognitive ability. However it is clearly of vital importance to separate the two whenever possible, so that one can say, for any given task, whether the child's difficulties are in working out what to do, or in actually doing it. The results of Experiments 5 and 6 show that in the 3 dolls task the child's difficulties are in the former area.

This conclusion, that the children in Experiments 5 and 6 have the correct strategy but do not spontaneously know when to use it, is similar to the conclusion reached by Bryant (1971) with a kind of conservation task. Bryant asked children to judge which of two unequal rows of flat counters laid out in one-to-one correspondence had more counters in it. Then he transferred the two rows to two different glasses so that, because of the thinness of the counters, the columns of counters in each glass were the same height, and again asked which set of counters had more in it. Bryant found that despite the similarity of the height of the columns, his 4-year old subjects

were able to correctly 'conserve' their judgements of which set had more. He concludes that children of this age can form hypotheses about quantity, but do not know when to apply them correctly. Taken together with our findings, this suggests that we must grant young children greater abilities than we have done previously, and concentrate more on discovering the situations in which these abilities will or will not emerge.

Another important aspect of these experiments to be considered here is our claim that children as young as 3 years succeed on the 3 dolls task and the policeman/boy tasks by using inference. If this claim is true, then this is a very important result, for it is generally held (e.g. by Piagetian theory) that children of this age are tied to the immediate situation and are unable to make inferences beyond the present. How justified are we then, in making this claim?.

The main problem here lies in deciding what does or does not count as inference. In its most general sense inferring means making some deduction or calculation which goes beyond the given situation. However such a definition includes, at one end of the scale, making abstract logical deductions (such as going from the premisses that 'all men are mortal' and 'Socrates is a man' to the conclusion that 'Socrates is mortal'), while at the other end of the scale it includes knowing that an object hidden behind a screen will still be there if the screen is removed. Clearly the latter ability is possessed by all 2 year olds, while preschool children are generally thought to be incapable of making the former kind of deduction (although there is informal evidence that this may not be so; see Donaldson 1971).

Thus with such a broad definition it is meaningless to make general claims such as saying that preschool children either can or cannot perform inferences.

A more fruitful approach to the question is to argue that if inferences are deductions which go beyond the immediate situation, then they must involve the operation of certain rules. These rules may be universal (e.g. the Laws of Predicate Calculus) or they might be quite local (e.g. the rules that allow me to infer from the state of this room that children were crayoning in here earlier). Thus in Experiments 5 and 6 the crucial rules are those which connect each of the experimenter's views of the dolls, via a particular dolls face, to the appropriate picture. Similarly the crucial rules in Experiments 7 and 8 are those which determine, for any given arrangement of walls and policemen, which of the sections will effectively hide the boy. On this analysis the ability to perform inferences is seen as the ability to perform logically within a rule-governed system so that given one feature of the system one can systematically relate it to other features or states of the system.

As before this approach allows a large number of phenomena to be regarded as 'inferences'; its advantage is that it focuses on the rules of the system with which the child is dealing, and suggests that the important questions to ask are concerned with the complexity and generality of these rules. It also suggests that if a child's inferential capacities are being examined in a given situation it is crucial to consider the extent to which the child must work out the rules for himself, as well as considering both the complexity of the rules the child must operate with, and the complexity of the

calculations involved in specific applications of these rules.

If we apply this kind of analysis to Experiments 5 - 8 important differences between the two kinds of task are revealed. For example it is clear that the main difficulties the child has with the 3 dolls task is in working out which rules are appropriate; the rules themselves and their applications in specific situations are relatively straightforward. On the other hand in the policeman/boy tasks the rules are explained to the child in the preliminaries and the rules themselves are quite simple; the most complex part of the task is applying the rules on specific occasions. Thus this analysis shows that the importance of the results of these experiments lies not so much in showing that 3-year olds can perform 'inferences', but rather in showing, in the 3 dolls task, the conditions under which they can extract the relevant rules of the situation, and in the policemen/boy tasks, in showing the extent of their abilities to perform the calculations. We have already discussed the 3 dolls task from this point of view earlier in this chapter; we will make two further points about the policemen/boy tasks here.

First, we have already argued in Chapter 4 that to succeed on these tasks the child must perform a sequence of internalised actions which is incorporated into some kind of overall strategy. In view of Piaget's definition of operations as 'internalised actions' (see Chapter 1), it seems reasonable to ask if this sequence can be considered as concrete operational thought. However there is no simple answer to this question, mainly because it is not easy to understand precisely what Piaget means by concrete operations. For example, they are frequently defined as internalised actions, which are reversible,

and co-ordinated into an overall system (e.g. Piaget and Inhelder, 1969). On one interpretation of these terms our sequence must qualify, for it satisfies each of these criteria. The child has internalised the action of moving the boy to the particular section, and this action is reversible, for the child has also internalised the reverse action of moving him off the particular section. Moreover, these actions are co-ordinated into an overall system, namely that of checking if the boy can be seen in each position and continuing appropriately whether the answer is yes or no.

Thus on one interpretation of Piaget, it seems that the children who succeed on our tasks are manifesting concrete operational thought. On the other hand, the kind of sequence we have here bears little resemblance to such typical Piagetian operations as the "union of two classes", although it does seem quite close to seeing the action of pouring water from one container to another as "reversible" (Piaget and Inhelder, 1969, p.98). For the time being, we will merely suggest that this sequence may be concrete operational thought. In any case, even if it does not meet the precise Piagetian definition, it certainly constitutes quite complex organised thinking. As such, the fact that it occurs in children as young as 3 years is quite remarkable by any account.

The second point we want to make about the policemen/boy tasks is that the child is making calculations about a situation which is primarily social. That is, the actions which the child must internalise in order to solve the task are the actions of people in social situations (e.g. moving the boy to a given section etc.) and the basic rules of the situation are primarily interpersonal (can the policemen

see the boy? etc.). This argument retains its force even though the actual situation is a model involving dolls. The importance of this observation lies in the fact that to date, cognition has been regarded as being almost exclusively concerned with the analysis of the physical, non-social world. For example, virtually all the standard Piagetian tests for concrete operational thought, (such as conservation, class-inclusion, transitivity etc.) are concerned with the relationships between and within inanimate, physical objects.

This bias is particularly surprising in view of the obvious importance to young children of people and social situations generally. Indeed it could well be argued that for the preschool child the social world is more important than the physical world, and thus it would not be surprising if it were found that the cognitive abilities of pre-school children were more advanced when the calculations required were concerned with social rules and situations, rather than with non-social situations. At present we are not in a position to make such a claim. However the results obtained here suggest that a closer study of young children's ability to perform calculations in primarily social situations would be highly profitable.

This raises the question of what social situations should be investigated in this way. We will not give a direct answer here but instead point to the value of the present study as a heuristic for future work. The approach taken here was to start from existing claims made about young children's cognitive abilities, and to consider these in the light of a close examination of some of the abilities young children need to function in social situations. The success of this approach, both in answering the question it set out to answer, and in

providing further knowledge about young children's cognitive abilities, suggests that it is an approach worth adopting in future work.

Appendix A: Footnotes

1. It is not easy to determine the exact nature of this relationship between egocentrism and the other features of the young child's thought. In some places it seems as though Piaget believes that egocentrism is the fundamental feature of the young child's thought and all the other features are simply manifestations of egocentrism (see especially his discussion of the relationship between egocentrism and syncretism - Piaget 1926, pp.127, 157 and 161, and 1928, p.228). In other places he specifically denies the importance of egocentrism and claims that all these features form a coherent group of inter-related features each of equal importance (Piaget 1928, pp.201 and 256).

2. Again we cannot determine the exact nature of this relationship, for instance whether the connection is logically necessary or merely empirical. This seems to be a common problem in interpreting Piaget (see for example Flavell, 1963, p.37).

3. Piaget however denies that epistemological egocentrism is the same as mere ignorance (Piaget, 1959, p.270). The difference seems to be that knowledge can be acquired without the fundamental shifts in perspective which characterise decentration. A more serious objection to Piaget's epistemological position lies in the fact that many of the fundamental shifts in perspective which <u>have</u> occurred in the history of science have been caused by purely non-scientific factors (such as changes in fashion, political climate, etc.) rather than by the pull of "objective truth" (see especially Kuhn 1962).

4. Dewey's theory of meaning, incidentally, not only anticipated Grice by some 30 years by emphasising intention, but also argued that a "naturalist" approach to intention and meaning was possible. "Primarily meaning is intent and intent is not personal in a private and exclusive sense.....meaning is not indeed a psychic existence; it is primarily a property of behaviour and secondarily a property of objects". (ibid, pp.179 and 180)

5. The following is a graphic account by the mother of such a child:

> "It is perfectly logical, when one considers it. Elly thinks her name is 'you' because everyone calls her that. No one ever calls her 'I'. People call themselves 'I', and as a further refinement Elly began to call them 'I' herself. The reversal of meaning seems nearly impervious to teaching; now, at eight, when Elly says 'I like that' it means not that she herself likes it but that her interlocuter does. What can I do?. I can tell her to say 'kiss me' and reinforce it by kissing her; I can refuse to give her a shove in the swing until she says 'push me'. But these rare ways of dramatizing the correct usage cannot hold their own against the hundreds of incorrect reinforcements that every day provides. 'You made a mistake,' I say and Elly replies 'You made a mistake!' 'No, I didn't make a mistake, you made a mistake.' 'You made a mistake.' Everything one says makes it worse. Twice on occasions a year apart - Elly has used 'me' correctly,

'Becky gave me a book', she said recently, the book in her hands. Hurrying to encourage her, I caught myself saying 'Yes, she did give you a book', thus destroying the effect I had meant to reinforce. I have come to wonder how it is that ordinary two year olds can grasp anything so subtle."

(Park, 1972, pp.199-200)

6. Alternatively it may simply be that these children are at the same overall level of language development as the normal 2-year olds described by Sully. We cannot determine this until we know more about the language development of both normal and autistic children.

7. There are a few experimental studies using adult subjects, which have looked at how accurately they can judge another person's direction of gaze in artificially controlled situations (e.g. Gibson and Pick 1963, Cline 1967, Ellgring 1971 and von Cranach 1971). In the basic paradigm the subject sits opposite another person ("the looker") who fixates various targets in a random order while the subject judges whether the looker is looking at him or at some other location. So far these studies have produced little agreement. Gibson and Pick (1963) claimed that their subjects' accuracy in determing whether or not they were being looked at approached the limits of human visual acuity. Cline (1967) also found accurate performance when subjects were judging if the looker was looking at their eyes or not, but found poor performance for other kinds of judgements. On the other hand, several studies by von Cranach and his associates at Munich (von Cranach 1971, Ellgring 1971, von Cranach and Ellgring 1971) have

found that performance was much poorer both for judgements of eye-contact and for other kinds of judgement. Vine (1971) reviews these studies and attempts to reconcile them to some extent on the grounds of differing methodology. It seems that the important methodological factors are the kinds of decision required, the distance between the looker and the subject, the length of time the looker fixates the targets, and the amount of discrepancy between the looker's head orientation and gaze direction. On the whole, though, it is still very unclear how accurately adults can in fact make such judgements in these artificial situations. More importantly, it is not clear if these studies are at all relevant to the abilities needed in natural interactions. First, it seems that they require finer discriminations than are actually needed in practice (see Vine 1971). Secondly, as we have already pointed out, it is unlikely that judgements of other people's gaze direction in natural interactions is based solely on a single static cue such as eye position.

8. An analysis of the words "here" and "there" which particularly emphasises their attention-drawing properties is given by Atkinson and Griffiths (1973). Some developmental data on how these terms are understood by young children is given by Wales (1974).

9. The importance of the concept of "faces" in describing social interactions was first pointed out by Goffman (1967) who showed the extent to which interactions are specifically organised so as to prevent embarrassment due to loss of face.

10. It is hard to say exactly what constitutes "recognising" someone in this way, although Eibl-Eibesfeldt (1971) has suggested that it may be the universally found "eye-flash", a very short movement

(lasting about 1/3 of a second) consisting of looking, smiling, raising the eyebrows and giving a short head nod.

11. For instance, does one actually focus on the other person or at a point beyond the other person, as the name of the phenomenon implies?. What difference does it make if one "looks through" someone because one is actually preoccupied with other thoughts, or because one is pretending to be so occupied?.

12. I am grateful to Sally Walker for pointing this out to me.

13. This syndrome has also been reported in psychotics by Riemer (1949, 1955).

14. Percentage scores are very misleading in considering replications of standard tests. Each investigator tends to use different scoring methods and the final percentage score can be one of many things, e.g. the group mean of raw scores, or the number of subjects below a certain age who have reached a certain (usually arbitrary) criterion of success. If we also note that most replications vary in small but significant ways in such matters as materials, instructions, procedure, social class and I.Q., of subjects, then it becomes clear that a direct comparison across studies is of little use. At best, these kinds of studies will reveal only general trends in performance.

15. The term visual line comes from Hering (1861) who defined it as "the locus of all points fixed relative to the eye which stimulate a given point on the retina". The issue is complicated, however, by binocular vision. This means that for one object fixed relative to the eyes there are in fact two visual lines, one corresponding to each eye, although these are usually experienced as one. Hering referred to this as "the Law of Identical Visual Directions", which

says that "for any given two corresponding lines of direction or visual lines, there is in visual space a single visual direction line along which appears everything which actually lies on the pair of visual lines". (Hering, 1942, p.41). Duane (1931) calls this the "cyclopian eye" while Howard and Templeton (1966) refer to it as the "egocentre".

16. The argument is typical of much Piagetian reasoning in that its conceptual status is hard to define. It is not clear if it is meant to be a logically necessary deduction, in which case it can be countered by purely logical arguments, or an empirical claim, in which case it can only be disproved by actual empirical evidence. In discussing this argument of Piaget and Inhelder's, and the two following arguments, we shall consider both the logical validity of each argument and the empirical evidence for or against it.

17. Two more experimental studies of particular relevance (Fishbein et al 1972, Masangkay et al 1974) and a review (Flavell 1974) have been published since this thesis was started. These three publications will be discussed in more detail later.

18. No specific social class or I.Q. data was collected in any of the experiments reported here as these variables were not of primary interest. However no child was tested who was considered by the staff to be in any sense backward or disturbed.

19. It would have been pertinent to have asked the child at this point "Does the policeman now see the doll, or the wall?", or "What does the policeman now see?". Unfortunately this was not done.

20. We feel this is justified because our main concern here is to find the most accurate methods for testing the child's competence,

rather than merely to enumerate performance variables.

21. A similar point about the primacy of objects in ordinary language has been made by philosophers interested in the theory of sense-data. For example Austin, in discussing Warnock, says

> "His statements of 'immediate perception' so far from being that from which we advance to more ordinary statements, are actually arrived at, and are so arrived at in his own account, by retreating from more ordinary statements by progressive hedging. (There's a tiger - it seems to me that there's a tiger - it seems to me now that there's a tiger - it seems to me now as if there were a tiger)."
> (Austin, 1962b, p.141)

Mackie also makes the same point:

> "If there are (genuine sense-data reports) they may turn out to be of some such form as 'It looks to me as if there is a book on the table' and hence would be parasitic upon the language of material objects."
> (Mackie, 1970, p.116)

22. James McGarrigle has suggested that a similar analysis holds for conservation tasks. The experimenter makes a change in one aspect of an array and then repeats a question asked before the change, thus suggesting that the repetition and the change are connected (see McGarrigle and Donaldson, 1975).

23. It might be objected that the occurrence of a large proportion of correct responses to the own view questions, and of a similar proportion of egocentric responses to the other view questions,

counts against this possibility. Both these kinds of response consist of the child simply selecting the picture of his own view of the cup, and so it might seem that the child must be making the view interpretation of both sets of questions. Unfortunately this objection does not hold, as a child may make the view interpretation when asked what he sees, but the object interpretation when asked what Ringo sees. This kind of mixed interpretation would produce the responses typically found.

24. It is an interesting reflection on our assumptions about children's knowledge of other people's inner states that we do not normally question the use of dolls in such experiments.

25. This is not altogether surprising in view of the fact that colour is often irrelevant in pictorial representation, particularly in the picture books young children are usually exposed to.

26. It might be objected that we cannot then be certain in Experiments 5 and 6 that the selected picture shows 'how it looks' to the other person. This kind of objection is very easy to make in this sort of research (it might, for example, be made by a Piagetian who insisted that the child should be able to justify his response) and is often very hard either to refute or to substantiate. We will reply here that we are taking the selection of the correct picture as sufficient evidence for the presence of this ability while recognising that these children may fail to meet stricter criteria, such as being able to justify their response, or recognising the uniqueness of the other person's view. However we doubt very much whether such criteria are strictly necessary.

27. This distinction is elaborated by Flavell (1974) who was also one of the co-authors of the Masangkay article.

28. This confusion of opposites is a common feature of semantic development in preschool children (see for example Donaldson and Wales 1970).

29. It may be that the greater symmetry of the configuration used in condition (2) counteracted these other features.

30. This last point is well illustrated by an unpublished study by McGarrigle and Donaldson (1975). Young children were given conservation tasks in which the change in the array was caused by 'accident' rather than by the experimenter explicitly changing the array in front of the child. McGarrigle and Donaldson found that performance was much better with the former procedure than with the latter.

Appendix B: References

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