22

On the interdigitation of social and cognitive processes

ANNE-NELLY PERRET-CLERMONT AND ALAIN BROSSARD

Mead, Vygotsky and Piaget have elaborated different views of the interdependence of cognitive processes and interpersonal relationships. In the first part of this paper we will be concerned with the *debate about the causality of cognitive development* that these different theories have postulated and we will refer to some empirical research carried out as a contribution to reconciling these different schools of psychological thought. However the experience gained from this empirical work in turn raises questions about the root of the debate: is it relevant to distinguish 'cognitive' vs. 'social' processes? And is it adequate to think in terms of a relatively mechanistic causal model relating univocally cognitive (or social) causes to cognitive (or social) consequences? In fact all these different aspects of reality are always incorporated within a larger set of meanings that is perceived differently by the subjects according to their previous and present socio-cognitive experience.

In the third part of this present contribution we will return to the 'founding fathers' and remember that their scope was much larger that the solving of a causal enigma and was concerned with the description of the integration of the different levels of verbal and nonverbal behaviour within a biopsychosocial model of development. This will call our attention to some aspects of behavioural interaction (e.g. gaze) that we have neglected up to now and that could open fruitful perspectives for a deeper understanding of the interdigitation of the cognitive and the relational factors in the elaboration of so-called 'cognitive' responses. Unfortunately the data available at present are not sufficient for an empirical validation of our hypothesis but we will put forward some case studies that illustrate our point in order to stimulate debate and ideas for further research on the integration of behaviour.

1 Cognitive processes and interpersonal relationships

Piaget's model of the development and functioning of thought was elaborated on the basis of his training as a biologist, his interest in epistemology

and his view of the development of the child's cognitive processes. This orientation led him to focus on biological processes (self-regulation, equilibration) and processes of logical abstraction to the detriment of personal and social factors which, although acknowledged, were considered of secondary importance. The priority Piaget gave to the biopsychological dimension over social and symbolic interaction is found in many later studies, whose explanations imply a relatively mechanistic model of causality, whereby the individuals' social competences or sensitivities depend on their cognitive development. By contrast, the research to which we have contributed has explored an inverse causal model in which the structure of cognitive behaviours is seen as the result of adequate social interactions (Perret-Clermont 1980; Doise and Mugny 1981). This inversion of perspective finds its source in the work of authors such as Mead and Vygotsky. Let us say though, in order not to reduce the subject to a simplistic bipolarity, that Piaget finds its source in his first publications contributed to this orientation, and that Mead, on the oher hand, sometimes explicitly refers to the biologist Darwin (in particular to his study of emotion).

Piaget's, Mead's and Vygotsky's theories of cognitive development and their conceptions of the impact of social factors on intellectual growth

For Piaget, social factors are necessary for the completion of the structures of intelligence, *but they are not at the source of these structures*. In order to assimilate the contributions of his social experience, the child must already be endowed with mental structures which make this assimilation possible. Although Piaget allows for a possible incidence of social factors which might more or less facilitate the individual's development, he considers them only as supplementary variables which might affect individual behaviours. At one time the Piagetian school of cognitive psychology hoped to discover the basic mechanisms of intelligence, whose structure and functioning would be unaffected by social factors. But the ambition underlying this undertaking—*the search for universally valid explanations*—often leads to a failure to analyse the structuring effects of the *concrete* object's and partner's specific characteristics, to which the individual adapts his behaviour. There is a severe risk, then, to consider erroneously as general processes, phenomena which might be more accurately envisaged as *artefacts of particular social situations*. (This we will attempt to demonstrate later on.)

G. H. Mead (1934) proposed a conceptualisation of the links between social interaction and intellectual development via symbolic interactions stemming from *conversations with gestures*: even before the appearance of self-consciousness or of actual thought, the interaction between two individuals furnishes a base for the construction of symbolic thought. The interaction between two individuals rests firstly on gestures. For Mead, gestures are not 'simply the expression of emotions in the Darwinian meaning of the word. They are the first stages of an individual's behaviour in response to another individual; they are thus the forerunners of the future stages of social behaviour, as they progressively become symbolic gestures. Animals also have conversations of gestures, but they are devoid of symbolic signification. Mead gives the example of a dog fight (Mead may have underestimated the complexity of a dog-fight, but it does not really affect his argument): each animal chooses his behaviour according to what the other does or will do. The behaviour of one of the two dogs forms a stimulus for the other, who will in turn be able to adjust his own behaviour in response to the other's. This adjusted behaviour becomes in turn a stimulus for the other dog and so on . . . Such acts, such behaviours, are a kind of communication. But if these gestures are to become significant symbols for the others, the individual must be able to anticipate by inference the response his gesture will elicit from the other, and thus to use this response of the other in order to determine his own future behaviour. Yet, according to Mead, the animal does not seem to be able to tell himself. If the animal comes from this direction he is going to spring at my throat and I will turn in such a way' (p. 43). Hence the following definition:

'Gestures become significant symbols when they implicitly arouse in an individual the same responses which they explicitly arouse, or are supposed to arouse, in other individuals, the individuals to whom they are addressed' (p. 47).

For Mead, construction of thought proceeds from the interiorization of conversations of gestures performed with other individuals. In this respect, Mead is in opposition to Wundt's theories, for whom the analyses of the communication between two individuals *presupposes* the existence of thoughts which can be communicated. The thus interiorized gestures (including verbal gestures, i.e. speech) are significant symbols because they have the same meanings for all the individuals of a given social group. For Mead, thought appears as the interiorization of the conversation of gestures. This interiorization occurs especially when verbal behaviours are mixed with the conversation of gestures.

Vygotsky (1934) developed a theory according to which the causal direction of the development of thought goes from the social to the individual. The instrument of thought is language which, before it is interiorized, is socialized, i.e. used to address the adult. But Vygotsky also refers to gesture in examples such as the one of the child who tries vainly to reach an object. This failure does not elicit a reaction from the object, but from another person. The repetition of this experience will soon lead the child to consider his act as an indicative act aimed at someone-else. The function of this act will change: before, it was oriented towards an object, now it is

meant for another person, and becomes therefore a means to initiate social interactions (the act of pointing which precedes deictic gestures, has been studied recently from an ontogenetic point of view by Murphy and Messer 1977; Clark 1978; Clark and Sengul 1978; Ochs and Schieffelin 1979; Masur 1982; and Wilcox and Howse 1982). The act of grasping becomes an act of indicating.

For Vygotsky, this transformation of an interpersonal process into an intrapersonal one can be generalized to all higher functions in Man, and to the cognitive ones in particular.

Some empirical investigations on the effects of social interaction on cognitive development in children

We thought it would be interesting to attempt to investigate further Mead, Piaget, and Vygotsky's conceptions by creating experimental paradigms which could ascertain more precisely the effect of social interactions between children or between adult and child.

Our hypothesis, contrary to those dominating the field of Piagetian research, can be expressed as follows: *cognitive co-ordinations between individuals* are at the basis of *individual cognitive co-ordinations*. Or in other words: the individual cognitive act is only a phase in a more complex process whose nature is also social. This thesis implies that cognitive co-ordinations in the individual are only made possible through social co-ordinations. It is by co-ordinating his actions with the actions of others that the individual gains individualized mastery of the co-ordination systems he will then later use on his own. This interactionist and constructivist conception takes from Piaget the idea that by acting on his environment the individual elaborates organizing systems. It also insists on the fact that the causality ascribed to social interaction is not unidirectional, but circular, or even more complex. Indeed, from a genetic point of view, it appears that inter-action enables the individual to master certain co-ordinations that enable him then to take part in more complex social interactions which, in turn, become the source of cognitive development. Social interactions are not only inductors, but also structuring causes of cognitive productions. And these can no longer be predicted when the psycho-social conditions of their elaboration are modified.

Our aim then was to illustrate experimentally, by using variations of classical Piagetian tests, that operational capacities that were absent in the individual during the pre-tests could be elicited, or even fully mastered, during the post-tests following situations of social interaction where the partners had to take into account each other's view-point (Perret-Clermont 1980; Doise and Mugny 1981; Perret-Clermont and Schubauer-Leoni 1981).

We began by studying the conditions of social interaction during the elaboration of operational notions, such as the notion of liquid conservation. This research showed that when children aged 6 to 7 (which is the age during which this notion is constructed), could interact in the task with other children of the same age, they made more progress during the post-test* in the acquisition of this notion than children who were not given this opportunity.

These results suggest the importance of confrontations between peers. The non-conserving subject is led to *re-structure* his thinking as a result of the emergence of a conflict between his point of view and his partner's differing one, when the situation calls for common agreement or joint action. With Doise and Mugny we called these specific types of encounters 'socio-cognitive conflicts' and tried to determine their characteristics and impact:

a) First appeared the crucial role of *the difference between the cognitive view-points of the partners*. This might be due to the different stages of development of the children, but also to their different perspectives concerning the tasks (for example, in the research of Mugny, it is due to the respective spatial positions of the subjects during the test of building a village; see Doise, this volume). It appeared moreover that the 'right' answer given by the partner is not a necessary condition for cognitive progress: such progress is also observable when the partner's answer is different but wrong. It is therefore sometimes sufficient for cognitive progress that there be an opposition of view-points, a conflicting confrontation between partners.

b) There are developmental prerequisites necessary for the subjects to benefit from this situation of social interaction. Perret-Clermont and Schubauer-Leoni (1981) showed for instance that none of the subjects who did not show evidence of the notion of reversibility during the pre-test of liquid conservation progressed at the post-test. These results confirm former ones (Perret-Clermont 1980) concerning the conditions for the acquisition of number conservation. In other words, this means that the child must have reached a minimum operational level if the socio-cognitive conflict is to have any effect on his or her cognitive development. Some cognitive pre-requisites are thus essential for the child to benefit from the situation of social interaction.

* The experimental procedure is as follows: firstly a *pre-test*, in which the test for the conservation of liquids is given individually using a semi-directive clinical interview, in the Genevan tradition—this pre-test permits evaluation of the subject's operational level (other tests are sometimes added for a more precise assessment of the cognitive level). Then the phase of *social interaction*, which takes place after one week. Each non-conserving child interacts with another child (either non-conserving, intermediate, or conserving) by playing a game whose purpose is the sharing of an equal quantity of juice. The game is over when the children both agree that they have the same quantity to drink. Finally the *post-test*, which takes place one week after the interaction session. Non-conserving subjects are re-tested on the conservation of liquids, as in the pre-test, and on other generalization problems.

social interaction. If the non-conserving child is unable to grasp the incompatibility of diverging viewpoints, he will not perceive the conflict and he will not be able to engage in the cognitive activity which would lead to its solution. Such an interaction will therefore have no effect on the operational structuring of the child's thought.

c) Let us also mention that there is no evidence of a causal link between the performance level observed during the interaction between peers and the cognitive progress of participants at the post-test. The *solution* of conflict during the phase of social interaction does not seem therefore to be a necessary condition for cognitive progress. The main element seems rather to be the *conflictual* aspect of the interactions as an urge for mental restructuring. But from a clinical point of view, it appears that this conflict should remain centred on the task and be perceived by the partners as a cognitive conflict, rather than as a sign of socio-affective tensions (unfairness, jealousy) or of incompetence ('Of course he gets it wrong, he is too young to understand'), in which case the subjects do not get involved in the search for a cognitive solution.

d) The cognitive restructuring that follows the interaction between peers influences the operational development of the child beyond the particular problem discussed: it can influence development on other conservation tests (matter and length, for instance), and results confirm the hierarchical order of genetic development according to Piaget's theory (Inhelder *et al.* 1974). However, the degree of generalization seems to depend on the type of relationship in the interaction situation: a complementary analysis of the data presented in Perret-Clermont and Schubauer-Leoni (1981) has shown that 'horizontal' (child-child) interactions provoke more generalization than 'vertical' (adult-child) interactions.

Some characteristics of the interpersonal relationships established between the subjects during the interaction are liable to render more or less salient the object of the socio-cognitive conflict, and hence the differing perceptions of the partners. This is one of the possible explanations for the results we have just mentioned (Perret-Clermont and Schubauer-Leoni 1981). Differences in cognitive performances have also been observed as a function of the repartition of the differently shaped glasses between the partners of the interaction who then seemed to be more or less favoured in the quantity of juice offered (Hendrix and Van de Voort 1982; Grossen and Perret-Clermont 1983; Rijsman 1984). Doise *et al.* (see his contribution to the present symposium) account for this type of phenomenon in terms of social marking effects.

However, in all these studies the causal system is complex: the social and cognitive processes are 'prerequisites' as well as 'consequences'. During the course of our experimentation, we have observed that subjects were

sensitive to dimensions of the experiment other than those controlled by our paradigms. This is what we now propose to examine, postulating the hypothesis that the dissociation of processes into two distinct categories ('cognitive' and 'social') is an heuristic but arbitrary distinction which is liable to entrap the psychologist in causal dilemmas (see Bryant's contribution to the present symposium).

2 The interdigitation of social and cognitive processes

Data always came from socially marked situations

Traditionally, the 'psychological subject' has been viewed as if he had been raised free from any specific characteristic transmitted by his social and cultural origin. However every behaviour of the child is more or less revealing of his position in the socio-cultural field of which he is both inheritor and keeper. A certain number of observations have lead us to reconsider the testing situation as socially and culturally marked, and to take into consideration the fact that the socio-cultural conflicts we describe do not happen in a social vacuum. The impossibility of designing 'culture-free' tests is well known, but our point is precisely that the consequences of this impossibility have not yet been fully considered in cognitive psychology or in intercultural research. We are therefore concerned in this paper with the study of the interdigitation of these processes. This has lead us to suggest that the distinction between 'cognitive' and 'social' processes does have an heuristic value (as shown before), but that it could erroneously lead to an over-simplistic view of the phenomena and their underlying causation.

A sociological analysis of our data revealed differences in the performance of subjects which were linked to their social characteristics. These results are difficult to explain within the theory of genetic psychology. Considering these data together with others concerning the impact of various types of situations on social interaction, we were lead to study the relation of the children to the proposed tasks and to the style of interpersonal communication established by the experimenter.

In this perspective, we recognized that the pre-test is already a situation of social interaction that can provoke socio-cognitive conflicts between the child and his interlocutor and hence elicit learning right at the start of data collection.

a. The *operational level of pre-test subjects varies according to their social category*: analyses of Piagetian tests have often been shown that the pre-test is influenced by his socio-cultural origin (for a description of these effects, see Perret-Clermont *et al.* 1984b). In the pre-test, children from privileged backgrounds present a significantly higher operational level than children of the same age who come from an underprivileged

environment. Likewise, boys sometimes show a higher operational level on the pre-test than girls.

b. The cognitive effects of situations of social interaction seem to depend on which social category the children belong to: although the pre-tests often differentiate the subjects according to a hierarchy of cognitive levels which parallels the social hierarchy outside the test situation, post-test results often show that the participation of the subjects in the interaction session can reduce, or even eliminate, these differences of social origin and sex. The amount of cognitive progress shown in the post-test by children from underprivileged environments seems to be linked to the conditions of inter-action (Perret-Clermont and Schubauer-Leoni 1981) and to the child's developmental level at the time of the interaction (Mugny and Doise 1978).

These observations imply that we should acquire the means to go beyond mere sociological explanations of the differences between groups in order to examine the *relation* between these *sociological variables* and the *socio-psychological situation of testing* in which the cognitive level of the child is expressed in his behaviour. The fact that cognitive progress can be elicited experimentally through the experience of the subjects in interactions would suggest that individual psychological competences are not the only ones that are important, but that socio-psychological competences (i.e. the capacity to establish a certain type of discourse about a given object, with a given interlocutor and in a given type of situation) are also involved. Con-cepts like 'socio-cultural handicaps' are of little use for describing the subtlety of the processes which determine, in our research, these differ-ences; differences which are sometimes (but not always . . .) liable to dis-appear after simple (but adequate!) experimental interaction situations lasting no more than ten minutes.

c. The pre-test situation in itself is already an occasion for operational and social learning: from the beginning of an operational test, the subject must take a stand socially and understand what is expected of him. Some tests, for example the conservation of liquids, may sometimes appear extremely ambiguous as to expected roles. Thus, in order to produce an operational answer, the child must understand in particular that:

  (i) the partners present must be considered as formally equal;
  (ii) the result of the pouring of the juice in spite of the illusion of non-conservation created by the differently shaped containers is legitimate within the framework of the experimental instructions;
  (iii) the object of the interview concerns only the abstract notion of *quantity*;
  (iv) and that after the pouring of the juice, the perceptual illusions pur-posefully created by the very choice of the material being used, must be perceived as such and not ignored, but rationalized in order to demonstrate

to the experimenter the constancy of the quantities considered (even though the adult must be considered as aware of this, being the author of the experimental scenario!).

We have reviewed elsewhere (Perret-Clermont et al. 1984b) a series of studies (e.g. Rose and Blank 1974; McGarrigle and Donaldson 1974; Light 1979; Rommetveit 1979, among others) whose aim has been to understand how the subject, during the pre-test, is involved in intense cognitive activity in order to interpret the situation and to understand its meaning through the staging, the instructions, the questioning and the feedback inscribed in the choice of material, and the verbal productions and gestures of the child's interlocutor. From these cues, the child learns more or less quickly and with greater or lesser success, the kind of answer he must give. Results from the above mentioned studies suggest that children from dif-ferent social backgrounds are unequally familiar with the type of interper-sonal and cognitive exchanges required in an operational test. It seems that the children from more educated environments have better performances in Piaget's tests. Results from a study by Nicolet (1984) can be interpreted in a similar manner in that urban children perform better than rural chil-dren; among the latter group, it appears that children of farmers have the lowest level of operational performance. However, these sociological dif-ferences disappear in most of the experiments after the interaction session, indicating that they do not depend upon 'profound' differences. Data from the research using the conservation of liquid test (Perret-Clermont and Schubauer-Leoni 1981) also show that during the first exchanges of the standardized interview, and in particular after the fourth item of the inter-view procedure which consists in the traditional Piagetian 'counter-sugges-tion'* a certain number of subjects changed their answers by introducing operational answers among their initial non-conserving behaviours. It appears that for a certain number of subjects, this counter-suggestion could open the way for the elaboration of operational answers, perhaps because it makes explicit the nature of the reasoning expected by the adult. A close look at the data suggests that this counter-suggestion on its own is more effective with subjects who come from a socio-cultural background similar to that of the experimenter: their greater social ease when confronted with the staging of this test would given them a chance to *progress* more in terms of the operational level of their answers, than other children during the pre-test.

These observations call for an investigation of the effects of social vari-ables and interactional processes involved in the realization of an oper-ational notion. This is what we are going to attempt now, taking the three

* The strength of the subject's response is tested by suggesting him the answer opposite to his own.

situations (pre-test, interaction between peers, and post-test) as *three separate moments in which socio-cognitive conflicts are likely to take place*, three interactional situations which require both cognitive and social competences from the subjects.

How does the subject perceive these social situations?

In the course of the interactions which are the source of socio-cognitive conflicts, it appears that the participants must not only activate the cognitive skills necessary for solving the problems, but they must also draw on social knowledge which is essential to the understanding of the situation. Socio-cognitive conflicts will be fruitful only if the context and the object of the interaction are mutually understood. The crucial factor for mutual understanding is the sharing of a common framework of reference. The development of 'intersubjectivity' (Rommetveit 1979), i.e. the ascertaining of a shared and congruent social reality, is the *sine qua non* condition for signifying speech. This communality of significations depends on more or less explicit norms whose application is the condition for the success of the interaction; one of them being the acceptance of the limitations imposed by the adult experimenter in the structure of the task and of the interview. This means that when faced for the first time with a task of this kind, the main goal of the child will be to try to decode the adult's tacit assumptions concerning the definition of the situation, their respective roles, and the aim of the discussion. We will now consider the social knowledge required from the child to interpret the adult's discourse and intentions.

a. Perceptions of the experimental situation and task

For the child, the experimental situation is entirely new: the pre-test starts with an unknown adult who tells the child that 'we are going to play a game together'. However this game has nothing in common with the games the child is used to. This 'game' looks more like an exam situation in which the adult asks the child questions. Thus the situation can look quite ambiguous in the eyes of the child! One can therefore venture the hypothesis that the gap between the child's preconception of the concept of game and what the adult defines as a 'game' in this context can lessen the chances of the child answering correctly. For instance a situation requiring juice to be divided up between two dolls appeared to require a high degree of abstraction from the child who must understand that the game is about the equal distribution of juice and not about playing with dolls. This effect was found more marked for girls than for boys (Perret-Clermont and Schubauer-Leoni 1981).

One of the important elements in the perception of the situation is the

understanding of the task. Faced with the material, the child must be able to distinguish which of its aspects are relevant to the resolution of the task. However the most evident clues of the situation—for instance the glass of juice the child would like to drink—are the very ones he must ignore! A testing situation implies an adult-child relation. In the experiment of the conservation of liquids, the adult asks the child to pour a quantity of liquid equal to the adult's. According to 'normal' social relations between two such participants, the child may find this demand absurd, because adults and children are not equals, neither in their social nor in their physical status! In order to succeed at the task, the child must therefore neglect relative status during the test situation. It seems moreover that operational reasoning is more efficient when the social relations structuring the tasks are isomorphic with the ones the child has to develop on a more abstract level (Doise et al. 1978; Doise and Mackie 1981).

The task concerning the conservation of liquids can be analyzed according to the expectancies that participants in the interaction have of their respective roles in the evolution of the situation. Each participant arrives at this situation with preconceived ideas, for instance about the manner in which the child—or the adult—must behave. Finn (1982) has studied the expectancies of children faced with a test situation by posing questions which transgress the usual rules of questioning: the questions the children were asked were nonsensical and were therefore impossible to answer. Yet almost all the subjects took the experimenter very seriously and answered his questions. Finn concludes that children create a context of intelligibility for the questions of an adult and their own answers depend upon their prior social knowledge. They strive to attribute meaning to the task situation.

b. The image of the partner

The experiments mentioned above show the importance of the child's perception of his partner in the interaction; this perception can determine the manner in which the socio-cognitive conflict will be solved. Other studies have measured the impact of various images of the experimenter on the cognitive performance of the child. Levy's results (1981) show that the induction of a negative image of the adult reduces the child's progress in a task of spatial transformation.

3 In search of nonverbal indicators of this interdigitation

In the first part of this paper we saw, referring to the importance of the socio-cognitive conflict for cognitive progress, that during the interaction between peers, some children do not always manifest behaviours corre-

sponding to the operational level they had reached during the pre-test. It became clear to us that the expression of the operational level of the child depends, on the one hand, on the capacities of socio-cognitive adaption he must display in the experimental situation; and, on the other hand, on the social and cognitive background he has acquired previously in his interpersonal relationships. It is therefore misleading to consider (as we did at the beginning of our research endeavour) the expression of an operational level as an individual characteristic of the subject, given the number and complexity of cognitive and relational factors intervening in the realization of an operational behaviour. The operational level could thus be better understood as an index of the *testor-testee relationship* which is constructed during the interview.

Are there some *observable* signs in the child's behaviour which could inform us about this relationship, and hence about the interdigitation between cognitive and social elements? Two observable outputs can be analysed: the verbal behaviour, and the nonverbal behaviour of the child. We shall now but touch on the former in order to concentrate on the latter.

Verbal behaviour

The analysis of the verbal behaviour can be roughly divided along two main axes: a cognitive axis where verbal language becomes an index of the understanding (or of the lack of understanding) of the emitted or received utterances; and a social axis where verbal language appears as a means for regulating interindividual interactions.

a. Verbal behaviour as an index of understanding on the cognitive level

During the last thirty years, many studies in experimental psycholinguistics have tried to determine the cognitive processes involved in the understanding of verbal language, be it at lexical, syntactic, or semantic level. In the early fifties, a first generation of psycholinguists appeared in the United States (Osgood and Sebeok) who were much imbued with information and communication theory (Shannon and Weaver), behaviourism (Watson) and the theories of operant learning (Skinner). By the 1960s a second generation of psycholinguists was born, influenced by the work of Chomsky. Chomsky was mainly concerned with the syntactic aspects of language which he considered as an autonomous and genetically preformed tool; a conception opposed to Piaget, for whom language is linked to the general cognitive evolution of the individual, and is a result of a progressive construction.

We now find, at present, a third-generation in psycholinguistics, which tends rather to integrate language in a global activity unique to the subject

(enunciation theories) and linked with the contextual communication strategies (pragmatics).

b. Verbal behaviour as a mean for regulating social interaction

The second function of verbal language was described during the 1960s. The ethnomethodological approach studies some verbal-vocal phenomena regulating conversational interactions, such as pauses, simultaneous speech, intonations, etc., in samples of conversations taken from daily situations: family conversations, in-the-street dialogues, etc. (Garfinkel 1967; Goffman 1973, 1974; Sacks and Schegloff 1974; Schegloff, Jefferson, and Sacks 1977; Sudnow 1972) or in therapeutic situations (Labov 1977) or even in school teaching situations (Sinclair and Coulthard 1975).

Nonverbal behaviour

There has been a prolific amount of research and publications in the last few years concerning nonverbal communication processes (cf. the impressive bibliography established by Key 1977). The subject of nonverbal communication covers a diversity of elements such as paralinguistics, facial expressions, gestures, proxemics, etc. Among these, *gaze* has already been studied in a number of ways (Cook 1977).

We shall concentrate on gaze, starting with the hypothesis that it might be an indicator of the changes in operational level if these are associated with a stronger need to interact with the experimenter. Our decision to study gaze was reinforced by the following considerations:

1. It is one of the nonverbal activities least controlled by the subjects, even in a formal experimental situation. Some studies have shown, also, that a modification of gaze in the direction of the partner (be it an increase or a decrease) rapidly provokes a reaction of the interlocutor, which could go as far as interrupting the interaction (Argyle and Williams 1969; Cook and Smith 1975).

2. The proxemic situation of our experiments with the adult and the child sitting side-by-side facilitates the analysis of gaze patterns: among others, it forces the subject explicitly to move his head in order to look at his partner. This is not the case in a face-to-face situation.

Systematic research on gaze since the 1960s, mainly in the United States (Nielsen 1962; Exline 1971) and in Great Britain (Kendon 1967) where a research group was formed with Argyle, Crossman, and Cook. has shown that gaze patterns can vary very much from one subject to another, and are closely linked to the structure of the individual's personality. Extrovert subjects look more at their interaction partner than introverts do (Cook 1977). An abnormally high or low level of gazes has been observed for

asocial patients (Argyle et al. 1974). Depressive patients tend to avoid looking at others (Rutter and Stephenson 1972); the same goes for autistic children (Richer and Coss 1972, cited in Argyle and Cook 1976).

a. Gaze as an indicator of cognitive processes

Gaze has been studied primarily in connection with cognitive processes accompanying verbal speech. Kendon (1967) has shown for instance that spontaneous language activities are very often linked to gaze avoidance. Kendon hypothesizes that spontaneous verbal emissions require cognitive activity by the speaker. As the brain's capacity for simultaneous treatment of items of information is limited, temporarily irrelevant items which would interfere with the activity of verbal elaboration must be suppressed: hence the suppression of visual information.

b. Gaze as means for regulating social interaction

Several studies have demonstrated the role of gaze in regulating processes in communicative situations. The importance of gaze is manifest right from the first vocal and gestural interactions between the infant and its mother. Its regulating function is exerted from the very beginning through synchronous gazes connected with rhythmical vocalizations; these exchanges are the forerunners of future conversational interactions (Bateson 1975; Bruner 1975; Jaffe et al. 1973; Snow 1977; Stern et al. 1975).

With the appearance of language, the child extends the regulating function of gaze to simultaneous interaction with several partners. A study by Craig and Gallagher (1982) on groups of two or three interacting children shows that these American middle-class children are perfectly able to have a conversation as a threesome, and also that gaze patterns and proxemics are intimately linked to conversational turn-taking.

In conversations between adults, gaze is one of the behavioural elements that regulate interaction. A sophisticated system of conversational rules co-ordinates turn-taking between adults, offering regulating procedures which are necessary to start a conversation (Schegloff 1968), to maintain it (Schegloff and Sacks 1973), and to make progressive transitions from one interlocutor to the other. For instance, when the speaker wants to give the floor to his interlocutor, he punctuates the end of his speech with more frequent gazes aimed at him (Argyle et al. 1973; Duncan 1972, 1973; Duncan and Niederehe 1974). All these studies underline the fact that the regulation of speech between adults is the product of a complex interdigitation of verbal and nonverbal elements.

c. A few preliminary results based on case studies

We have undertaken a preliminary study whose aim is to evaluate possible connections between development on the operational level, abilities to regulate interaction, and gaze patterns. Our hypothesis can be worded as follows: changes in the operational level of the subject might be associated with a stronger need to interact, which can be translated as 'a stronger need to look at the other person'. Will the gaze patterns of a subject announce and accompany the transition from non-conservation to conservation?

As of present, we have studied data (i.e. video-tapes) only from the pre-test (phase I), in which we analysed nine interactions between child and experimenter (the same experimenter interacted with all subjects). Among the nine subjects, three were already conservers, three became conservers during the post-test (phase III), and the last three remained non-conservers on the post-test. In order not to bias the analysis of gaze patterns, we thought it was methodologically important that the 'decoder' should not know which, among the six subjects who were non-conservers (NC) during the pre-test would remain NC, and which would become conservers (C) during the post-test. The gaze directions, both for the children and for the adult were recorded in three categories:

(i) towards the task;
(ii) towards the partner (from child to adult and from adult to child);
(iii) elsewhere.

These three gaze patterns in both children and adults were observed every five seconds resulting in approximtely 70–80 observations per subject. The data (expressed as relative percentages) are presented in Fig. 22.1. These results suggest the following observations:

1. Subjects who are already C seem to look most often at the task (respectively 83 per cent, 76 per cent and 67 per cent) in comparison to subjects NC who remain NC during phase III (respectively 83 per cent, 69 per cent and 57 per cent) and to those NC who become C during phase III (respectively 73 per cent, 69 per cent and 50 percent); conversely, it is precisely with these C subjects that the experimenter seems to look least often at the task (respectively 39 per cent, 52 per cent and 49 per cent).

2. Subjects NC who become C during phase III seem to look most often at the adult (respectively 16 per cent, 26 per cent and 46 per cent) in comparison with subjects NC who remain NC during phase III (respectively 6 per cent, 11 per cent and 39 per cent) and with subjects who are already C (respectively 15 per cent, 17 per cent and 21 per cent); conversely, the adult seems to look least often at these future C children (respectively 49 per cent, 34 per cent and 29 per cent).

3. Subjects NC who remain NC during phase III seem to look most often elsewhere (respectively 3 per cent, 10 per cent and 19 per cent) in
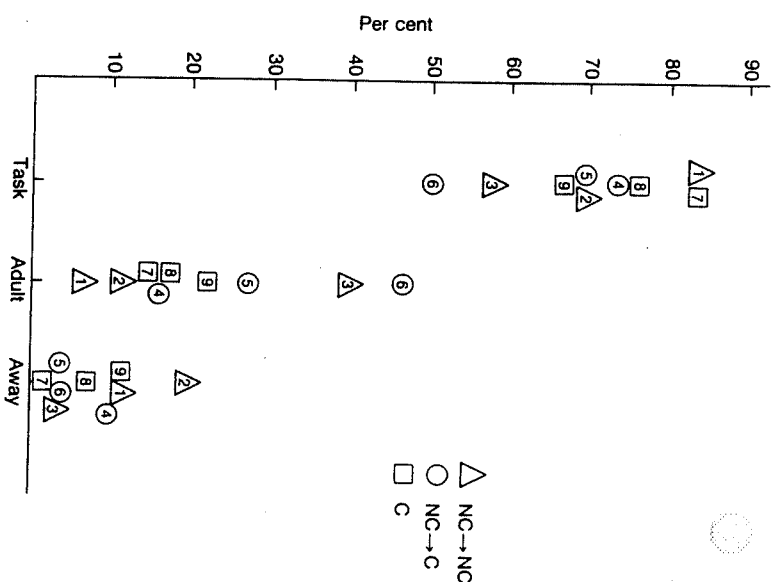
Fig. 22.1(a) Distributions of gaze for each child. [For example, during the pre-test, the gaze distribution of the child no $\boxed{7}$ (a conserver, C) is respectively 83% towards the task (first column), 15% towards the adult (second column), and 2% elsewhere (third column).]

Fig. 22.1(b) Distributions of gaze for adult. [For example, during the pre-test, the gaze distribution of the adult with the child no $\boxed{7}$ (a conserver, C) is respectively 39% towards the task (first column), 51% towards the child (second column), and 10% elsewhere (third column).]

comparison with C subjects (respectively 1 per cent, 6 per cent and 11 per cent) and future C children (respectively 3 per cent, 3 per cent and 10 per cent); there is no noticeable difference between the looking-elsewhere patterns of the adult.

The experimenter looks more often at the children than they do at her, and this lowers the proportion of gazes directed at the task. It seems that the adult's gazes are equally divided between the child and the task with the C group. This is the group where the adult seems to look most often at the children, but these C children look least often at the adult. On the contrary, the future C group looks most often at the adult, who looks least at them. These results confirm Cook's (1977) observation that mutual gazes are difficult to maintain and are hence avoided. We observe for our subjects the existence of rather marked individual differences in the distribution of gaze patterns. On the other hand, the experimenter's distribution of gazes is relatively stable from one group to the other and from one subject
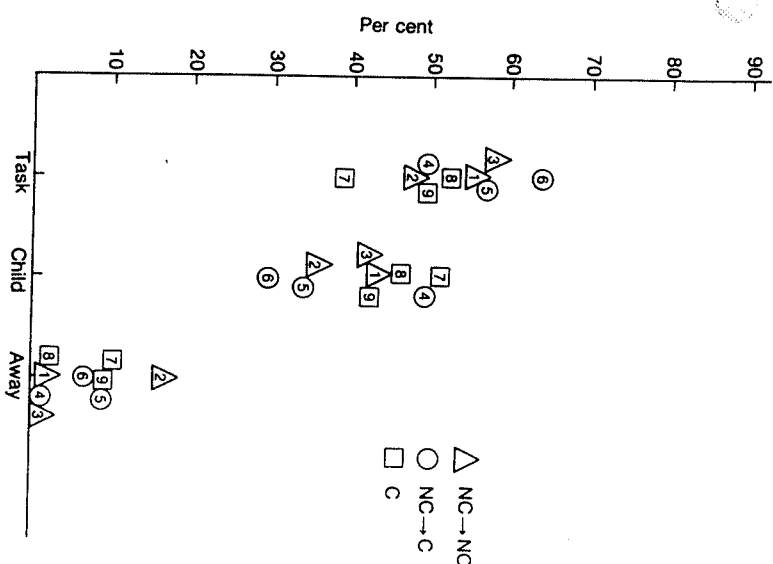
to the other. This is concordant with Kendon and Cook's observation (1969) of an intra-individual stability of gaze.

The most interesting result, in our opinion, if confirmed by subsequent research, is the percentage of gazes directed at the adult: this seems to be the greatest for future C subjects. This would illustrate that it is during the elaboration of an operational concept that social interaction seems to have a special importance. It is as if these children were looking at the other person in a social quest for approval of their responses.

For a given task, the child's gaze towards the adult might serve different functions according to their developmental level. We suggest the following hypotheses, for each group of subjects:

(i) in the C group, these gazes function mainly as *regulators*, being shorter than 'gazes of understanding';

(ii) in the group of children who remain NC during phase III, these gazes would mainly indicate non-comprehension and they would hence tend to be less frequent but longer;

(iii) in the group of future C, the importance of these gazes would indicate both an unsecure understanding and a search for indications to regulate the course of social interaction.

d. . . . Which lead to others

Other results present some research perspectives:

1. If we consider the total duration of each experimental situation during the pre-test, we see that the three interactions with subjects who remain non-conservers during phase III (NC → NC) are systematically longer than the ones with other groups (with the exception of one future C subject).

2. For two subjects (one NC → NC and one NC → C), we had video-tapes to analyse the gaze patterns in the two other phases of the experiment: interaction with a peer (phase II) and post-test (phase III). From this analysis, it appears that:

- as during the pre-test, the future C child looks mainly at the adult during the interaction with a C peer, with remarkably stable percentages (46 per cent in the pre-test and 47 per cent during the interaction with a peer). The subject who remains NC looks almost as often at the task during the interaction with a peer (62 per cent) as during the pre-test (69 per cent). Moreover, in each of these two interactions, peers look very rarely at each other. This result could be partially explained by the fact that, as in phase I and III, the two participants were sitting side-by-side.

During the post-test, the constancy of the distribution of gazes as compared with the pre-test is striking. For example, during the post-test the NC → NC child looks at:

- the task in 65 per cent of the time units (as compared to 69 per cent during the pre-test);
- the adult in 12 per cent of the time units (as compared to 11 per cent during the pre-test);
- elsewhere in 21 per cent of the time units (as compared to 19 per cent during the pre-test);

whereas the NC → C child looks at:

- the task in 50 per cent of the time units (as compared to 50 per cent during the pre-test);
- the adult in 44 per cent of the time units (as compared to 46 per cent during the pre-test);
- elsewhere in 5 per cent of the time units (as compared to 3 per cent during the pre-test).

These results are similar to observations made by Kendon and Cook (1969), who showed the stability of gaze patterns of a given individual across different situations. But further research is needed to test if this

stability is not a function of the mastery of the notion discussed in the interaction. Will these NC → C subjects not change their patterns when they will have become 'old faithful' C?

In conclusion, considering the scarcity of publications relating cognition with nonverbal processes in interpersonal relationships, we think it is important to explore further the links between these two fundamental aspects of the psycho-sociological development of the individual. This implies for us that we must:

(i) augment the samples of subjects studied;
(ii) refine the time-cuts for gaze-patterns observations, taking into account the important variations in the duration of gazes (using for example intervals of one second instead of five);
(iii) search for other indicators.

Discussion

Experimental procedure

Chandler drew attention 'to the relevance of your work to the topic of experimental procedures and intervention studies brought up by Bryant. With many children and especially children of low SES there is an improvement between pre- and post-tests, not because of the power of the independent variable or intervention strategy, but because of increased familiarity with the experimenters.' This of course, cautions against controls which are simply no-treatment controls, which have little or no enduring contact with the experimenter.

Perret-Clermont replied:

'We have controlled for the effect of familiarity with the task and the experimenter by comparing the cognitive development of groups of children submitted to the same experimental treatment (for instance: sharing juice or smarties) but with partners of different cognitive levels. We observed that those children who interacted only with peers displaying the same point of view did not progress in spite of their acquired familiarity with the setting. Instead the subjects who had been confronted with partners of different opinions due to their different cognitive level (for instance an intermediate subject having discussed with a non-conserver or a conserver, or a non-conserver having faced an intermediate or a conserver) were found more likely to progress.'