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On the Social Construction of the Intellect

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Several experiments investigating the possible effects of interindividual interaction on individual cognitive development are reported. These experiments demonstrate that children's interindividual cognitive coordinations are more advanced than their individual coordinations during some phases of their development, that interpersonal interactions have a subsequent effect on the cognitive development of individuals and that conflict of cognitive centrations between individuals is an important source of cognitive development.

For social psychologists it has long been obvious that social factors intervene in cognitive development. Numerous studies of intelligence, for example, have pointed to differences in performance which relate to social class, culture, child-rearing practices, and so on. The manner in which this social intervention takes place, however, is far from clear. In this respect, perhaps our lack of understanding stems from the absence of a theory about the essentially social nature of cognition.

This is not to say that there have been no theories which allow that human thinking has a social origin. One could quote sociologists such as Durkheim and Mauss (1903), ethologists such as Humphrey (1976), who has recently explored the social function of intelligence, and principles espoused in various Marxist sources. Closer to psychology are the writings of G. H. Mead (1934), and in particular his theory of the origin of symbolic thinking. According to Mead, the development of thinking begins in the so-called conversation of gestures, when two individuals interact with each other, perhaps without speaking and maybe even without thinking, in the usual sense of the word. In each specific action which is directed towards the other, the reaction of that other is already anticipated. Mead had no doubt that this process was the foundation of symbolic thought.

While Mead was developing these ideas in the United States, Vygotsky (1965) was developing a similar line of thought in the Soviet Union. In debating with Piaget on the subject of egocentric speech, he argued that the study of speech should start with the social in order to explain the individual process. He is also recorded as saying that "the true direction of the development of thinking is not from the individual to the socialized, but from the social to the individual" (Vygotsky, 1965, p.20). Even Piaget (1932), in his study of moral judgement, really proceeded from a social psychological point of view, in that he studied interactions in children (such as occur in playing marbles), but more so in that he actually invoked peer interaction in explaining the development from heteronomic to autonomic moral behaviour. He went on to give strong emphasis to the

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the classical research dealing with the performance of groups. Generally, these studies try to find out which modalities of interaction improve the group efficiency in specific tasks. Our aim, on the other hand, is to examine the effect those interactions have in bringing about more elaborated cognitive processes with individuals participating in a given interaction. More specifically, although our research deals with an effect of social facilitation, our approach differs from the traditional work of Zajonc (1965). While Zajonc examined primarily the activation of cognitive processes that were already there, our research is aimed at invoking and investigating the *construction of new cognitive capacities* in a given social-interaction situation.

Some of our main research paradigms, together with the more important results they have provided, are now described.

The Cooperative Game

This game consists of a motor coordination task. Three activities can be carried out on pulleys attached by strings to a lead-pencil target: pulling, releasing or blocking. A response on one pulley must be coordinated with responses on either one or two pulleys in order to move the target along a predetermined route, divided into a number of linear segments. Scores are obtained by summing across the number of segments in which the target remains correctly on the middle of the route (hits) and then subtracting the number of segments (misses) where the target leaves the route. A schematic representation of the apparatus can be found in Doise (1978, p.84).

In the first experiments Doise and Mugny (1975) and Doise (1978) compared the individual performances of younger children (7–8 years) and older children (9–10 years), with the collective performances of pairs in which each member handled only one pulley. As predicted, younger children performed better in the collective condition. There were no such differences for older children. Furthermore, developmentally more complex coordinations were observed in inter-individual interactions before they were found in individuals acting alone. Similar patterns of findings were obtained when situations were "individualized", either by appointing a leader or by eliminating verbal communication. In both cases the group performance is contingent to a greater extent on the individual's respective abilities than on coordinated efforts. As before, these differences between experimental conditions held for younger but not for older children. These results are reminiscent of findings from studies of group problem solving, where logical tasks are better performed by hierarchical or centralized groups and creative tasks by more homogeneous groups. In our experiment, older children perform a task which to them has acquired logical characteristics, as they master the necessary coordinations.

In a fourth experiment (Mugny & Doise, 1978) children of three different ages carried out either individual tasks or collective tasks, interposed between a pretest and a posttest criterion. The same apparatus was used in both conditions. The experiment was concerned with improvement in performance on the criterion as a function of performance on the intervening task. For younger children only the collective condition had an effect, while for older children (who already had some mastery over the necessary coordinations) both conditions had an effect. Once again from a developmental point of view it is the collective experience which takes precedence in efficiency.

The Conservation of Liquid Task

These particular experiments were devised by Perret-Clermont (in press), to study the effects of a social interaction situation on the individual, using the well-known Piagetian tasks as described by Inhelder, Sinclair and Bovet (1974). On a pretest children were categorized as nonconservers, intermediates, or conservers. According to the original, and now-famous investigations, the nonconserver is one who, while admitting that two identical glasses equally filled contain the same amount of liquid, judges these amounts to be different when one is transferred to a tall-and-slender glass and the other to a short-and-wide glass. On the other hand, the conserver would maintain that the two quantities remain the same. To support this inference, conservers usually

offer at least one of the following arguments: (a) nothing has been added to or taken from either glass (the Identity argument): (b) if the two quantities were poured back into the original glasses, the latter would be found to be equally full again (the Reversibility argument); (c) the liquid is higher in one glass but wider in the other, so that width compensates for height (the Compensation argument).

There were two conditions in the present expriment, a control condition with a pretest and posttest, and an experimental condition with an intervening social interaction. A child already defined as nonconserving (or intermediate) was required to serve the same amount of fruit juice to each of two conserving children, where one possessed a tall-and-slender glass and the other a short-and-wide one. The would-be donor also had a short-and-wide glass. The nonconserver was only allowed to drink if the other two children agreed that they had received the same amount of juice. As the two recipients were selected on the basis of being conservers, the nonconserving donor was to some extent forced to act out the role of conservation. In this situation, nonconservers used their own short-and-wide glass to measure juice for the tall-and-slender glass. On the posttest, 65 percent of the subjects in the experimental condition progressed from being nonconservers to being either partial or complete conservers on this task, compared with only about 18 percent of control subjects. There was corroborative evidence that this improvement was valid: of 23 subjects who had progressed, 13 were able, during the posttest, to offer at least one of the three arguments for conservation which had not specifically been voiced during the intervening social interaction. Furthermore, in a replication of this experiment, subjects who had progressed on the conservation of liquid task also improved on other conservation tasks, showing a generalization effect.

Conservation of Length Task

In our research the role of sociocognitive conflict was first studied in the context of a conservation of length task. In all of our experiments on length we used subjects who were nonconservers, both on the conservaton of equality and of inequality of length. Conservation of length can be assessed as follows. Two rulers of equal length are laid side by side so that their ends perceptually coincide. They will, of course, be judged to be of equal length. However, if one ruler is displaced to the left or right so that their ends no longer coincide, the nonconserving child fails to compensate for the shift and will say that one ruler is now longer than the other. For the conservation of inequality, two wires or chains of different length are first presented in parallel, stretched out. When the longer wire is folded so that its extremities coincide with those of the shorter one, the nonconserving child now says that both are of equal length. When the extremities of the longer wire are brought still closer together, the nonconserving child may actually consider the shorter wire as now the longer one.

Three conditions were used in our first experiment (Doise, Mugny, & Perret-Clermont, 1976). In the control condition starting with the two rulers in line, four different configurations were obtained by alternatively displacing each ruler in the two opposite directions. After each of these four displacements, the subject was asked whether the rulers were of the same length or not. This is a condition of intra-individual conflict.

In the incorrect model condition, starting with the two rulers in line and after recognition of their equal length, one ruler was displaced. When the subject claimed that the displaced ruler was longer than the other one, the experimenter's assistant pointed to the opposite end of the other ruler and said: "I think *this* ruler is longer; you see, it goes further there". This judgement is of course as incorrect as the subject's one, but it is based on a symmetrical centration. If the subject complied with the assistant, the experimenter reminded him of his previous answer. This is a condition of inter-individual sociocognitive conflict.

The correct model condition was the same as the previous condition, except that the adult assistant now performed a correct judgement: "I think both rulers are equal in length, you see, this one goes further here and that one goes further there, so both are

of the same length''. In Piagetian terms the argument given by the assistant is that of compensation. The results showed that not only the correct-model condition but also the opposed-centration condition leads to progress in about 50 percent of the subjects on generalized tasks of conservation of unequal length. A second posttest ten days later, in a double-blind condition with a new experimenter, showed that this progress remained stable. These results have been replicated using nonconserving children contradicting each other on the same task (Doise, Giroud, & Mugny, in press).

A conservation of unequal length task was also used to initiate our studies on the correspondence between social and cognitive relations (Doise, Dionnet, & Mugny, in press). Two steel chains of unequal length were shown to nonconserving children with the instruction that they could be used as bracelets to wrap around two cylinders of unequal diameter. The longer chain was designed to fit the larger cylinder and the shorter chain to fit the smaller one. There were four presentations of the two chains, and the experimenter systematically folded the extremities of the longer chain until they came closer and closer together, in front of the subject. After each presentation, half of the subjects were required to match the bracelets to the cylinders. Subjects would often make an error in judging the length or in choosing a bracelet for a cylinder, at which point the experimenter would make explicit the conflict between the subject's choice and the preceding judgement or choice. The procedure was similar for the other half of the children, but instead of cylinders the experimenter's wrist and the child's own wrist were used. Two out of 17 subjects progressed in the cylinder condition and 11 out of 18 in the wrist condition. Again, stability of this progress was checked by using a new experimenter in a second posttest one week later, as well as by demonstrating generalization in the conservation of equal length task.

The Spatial Transformation Task

Two tables were placed together in such a way that their surfaces formed an angle of 90°. On one, the experimenter formed a village of three differently-coloured houses,

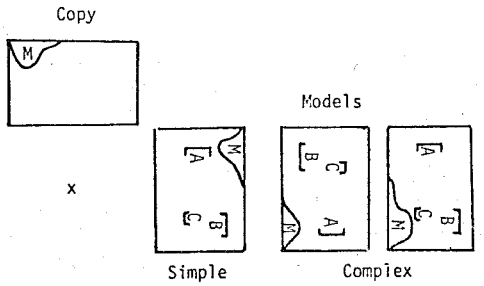

Figure 1. Examples of simple and complex items in the spatial transformation task.

bearing a spatial relation to a fixed marker (e.g. a mountain or lake) in the upper left corner. The subject, standing in position x was given the task to construct the same village on the other table in a way that someone coming from the lake or the mountain would find the individual houses in their respective orientations. This is not a difficult task for children of 5–6 years when the marker on the model table is in the same position on the copy table, relative to the subject, e.g. upper left corner in both cases. The child merely transposes all elements by a body turn of 90°: what is on the left on the model table is also on the left on the copy table, and so on (see Figure 1). But when, for example, the marker is in the near right corner of the model table and in the far left corner on the copy table, the perceptual relations present a far more difficult task for the child. In an individual condition, as in the first experiment, children working alone were given two trials (or items) on tasks of such difficulty, each time using three houses. On the average, they placed only 1.3 out of 6 houses in the correct place. On two easier items they placed 4.75 houses correctly. In a collective situation, children working together performed significantly better, placing an average of 3.3 houses in the correct place on difficult items (Doise, 1978).

Three strategies emerged in the task: no compensation, partial compensation and total compensation. In the first, children locate the houses on the copy table by a 90° body shift, regardless of the position of the marker. In the second, children locate the houses correctly on one dimension, e.g. near-far, but not on the other, left-right. In the third, total compensation yields the correct solution.

In the second experiment, Mugny and Doise (Note 1) required children of different cognitive levels to work together. One important result was that, when partially-compensating children worked with noncompensating children both progressed. In other words, partially-compensating children did not need the presence of a correctly-responding model in order to improve their performance. Noncompensating children, it must be added, did not improve much when interacting with another noncompensating child; but then again the same was true when the interaction was with a totally-compensating child. In the latter condition, the advanced subject tended to solve the problem alone. In so doing, the suggestions of the noncompensating child were ignored and no opportunity was provided to coordinate approaches. In the case of two noncompensating subjects, they tend to agree in their errors from the beginning, and therefore show no improvement.

Despite this, there is a way of relating two noncompensating children to each other so that their interaction leads to progress. Consider the layout in Figure 2. If one noncompensating subject is in position x and the other in y, they give by definition contradictory solutions. In order to progress on the task, they must coordinate their incorrect centrations. In such a situation 13 out of 21 subjects progressed. This can be compared with an individual condition where the same subject moved from x to y in order to evaluate responses from both positions. In this condition only 6 out of 19 progressed. Taking also the results for partially-compensating children into account, it was shown that inter-individual conflict leads to significantly more progress than mere intra-individual conflict (Doise & Mugny, 1979).

In another experiment (Carugati & Mugny, 1978) a noncompensating subject was placed in a position from which the situation was viewed as easy and confronted with another subject from whose position the task appeared difficult. In such a condition, the first child for whom the task was easy, tended not to be much perturbed by the difficulties encountered by the other. Then again, the same child tended not to

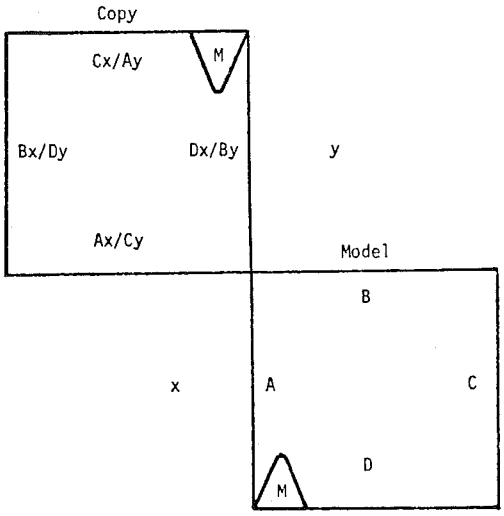

Figure 2. Example of an interaction situation and of the conflicting performances of two noncompensating subjects in different positions. (In the interindividual situation two children, one in the x position and one in the y position simultaneously construct the copy. In the intraindividual condition the single child constructs his copy in the x (or y) position, before moving to the other position in order to check his copy.)

show much progress (two out of 12 improved) on a posttest. However, when confronted with *two* others in the difficult position, sociocognitive conflict is increased, and progress was then observed in five out of seven subjects on a subsequent difficult task.

In social learning paradigms, children with a wrong answer are usually confronted with a more correct model in order to make progress. In our experiment, children with a correct answer needed to experience a strong confrontation with incorrect answers in order to make progress on a subsequent task. Similar results have been recently

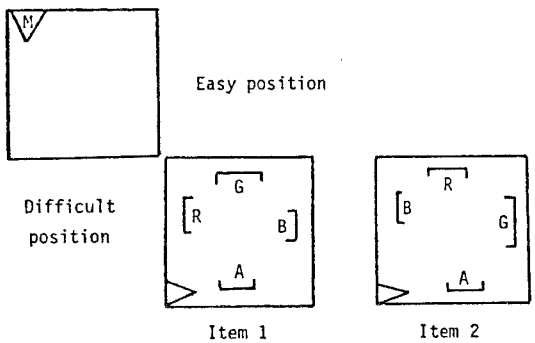

Figure 3. Examples of spatial transformation tasks with a difficult and an easy position.

obtained by Mugny, Levy and Doise (1978), who have systematically shown how the presentation of incorrect models leads to progress when the child is questioned by an adult about the differences between his performance and the performance shown in the incorrect model. Such results, in conjunction with earlier findings that a more advanced child also progresses after working with a child incorrectly solving problems (Doise, Mugny & Perret-Clermont, 1975; Doise & Mugny, 1979) indicate the explanatory inadequacy of social learning paradigms.

Conclusion

We conclude from our research that our conception of cognitive development is socio-constructivistic. By coordinating their actions with actions of other individuals, children progress and are able to participate in even more complex interactions which allow them to make more new progress. Individual cognitive skills can be considered as one moment of a complex social process. To study only cognitive development at the level of the individual is, in our opinion, an abstraction. On the other hand, studying individual performances as part of a spiral in which social coordinations lead to more complex individual coordinations, which in turn allow the individual to participate in more advanced social coordinations, is opening new perspectives on important issues. For instance, we have been able to show in other unpublished work that, on the pretest, significant differences existed between children of different socio-economic backgrounds. These differences became much smaller, or even disappeared, in the posttest of our experimental conditions. In the debate about social differences in intelligence, it is now commonly accepted that statistical analyses should take into account complex interactions between the individual and his environment. It is important to construct more sophisticated models for measuring statistical interactions. But it is still more important to explain these interactions. In our opinion, one can do it only by using socio-psychological models which demonstrate the social construction of cognition.

Reference Note

1. Mugny, G., & Doise, W. Facteurs sociologique et psychosociologique dans le developpement cognitif: nouvelle illustration experimentale. Unpublished manuscript, 1978.

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