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Nice designed experiment goes to the local community[17]

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Abstract:

The point of departure for the issues that will be addressed in this paper is our astonishment at the result of our experiment using the Piagetian conservation task in a primary school setting. We found that the responses of the children in the experiment did not fit our expectations. The starting point of the experiment was the hypothesis that repetition of the same question in a conservation task could mislead children to give a preoperational answer. We designed the experiment (tasks, balancing, and a well defined procedure) with precise and simple questions that seemed appropriate for testing the hypothesis. However, during the experiment we realized that almost no child from the first grade of primary school gave a concrete-operational answer.
In trying to understand the background of this unexpected event we realized, once again, that the children's reference frame was different from ours: while we asked them about the amount of juice in the glasses, they (re)constructed the question as a task consisting of comparing levels of juice in the glasses. Moreover, we found that we were testing not only the children but in fact the whole community. Parents, teachers and school authorities were behind the scene actors if not the very actors in our research.

1. Introduction:

This text focuses on a "meta-methodological" dimension of the experimental situation and raises the following issues: what do we, as researchers, do when we construct a research design aimed at observing the behaviors of individuals? Are we sure to understand the responses of our "subjects"? To what extent are they dependent on the specificities of the situation here and now? We were lead to this reflection in particular when the results of an experimental research (in which we used the Piagetian conservation task in a primary school) did not fit our expectations, and we could not find any explanation in our initial interpretative reference frame! In general, studies with this kind of result are put back into the drawer. On the contrary, in this paper, instead of hiding away this result as a "failure", we are going to do a serious review of this research and its "negative" results. We will consider it as a positive opportunity to address the question of the *interpretative processes* that are always at work in experimental situations and are sometimes far more "intrusive" than we expect, sometimes even transforming completely the intended aim of the experiment (Donaldson, 1978; Grossen, 1988; Grossen, 1989; Light & Perret-Clermont, 1989; Rommetveit, 1976).
We start with the idea that psychological research must consider more seriously that the experimental situation is a *situation of communication*. This experimental situation involves participants who are necessarily engaged in an activity of interpreting the elements of the situation based on *their experiences and knowledge of other kind of contexts:* they test hypothesis on what is at stake, trying to elaborate the meaning of the situation through complex interactive dynamic, involving conflict of perspectives, misunderstandings, co-construction, negotiation, etc. (Grossen, Liegme-Bessire & Perret-Clermont, 1997).
In this sense, we will reflect on the experimental situation *as a screen on which the interpretative processes of both "subjects'" and researchers' are "projected" and enlightened.*

[17] This text was presented orally at the Congress of the International Society for Cultural Research and Activity Theory (ISCRAT) held in Amsterdam from 18 to 22 June 2002, under a session entitled «, *Why streets are wet? Or how to be in the shoes of our subject?!* (Coordinators: Aleksandar Baucal & Nathalie Muller Mirza).

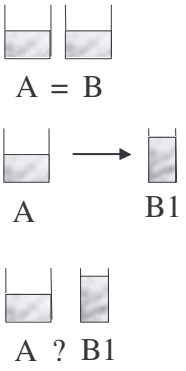
First, we will give a narrative about what we intended to do, what we actually did and how we understood the designed experiment and the interviewed children during this research. Then, we will share what we realised when we analysed what happened in terms of interpretative and interactive dynamics among the different actors of the situation. We will also discover that there were many more actors in this activity than just those who stood face to face during the experiment!

2. Narrative

One upon a time we as researchers made a hypothesis (from our background theories, experiences, insights…) about the role of the repetition of the same question in the Piagetian conservation tasks: this repetition could mislead children to give a preoperational answer even if they are able to think at a concrete-operational level (Donaldson, 1978; Light, 1983; Baucal & Stepanovic, 1999; Rose & Blank, 1974).

In the Piagetian universe, the child has to pass through the preoperational way of thinking to be able to construct a more powerful, logical way of reasoning based on concrete operation. According to this frame of reference, the conservation task is a proper empirical test of the level of cognitive development of the child.

Let us take the example of the liquid conservation test:



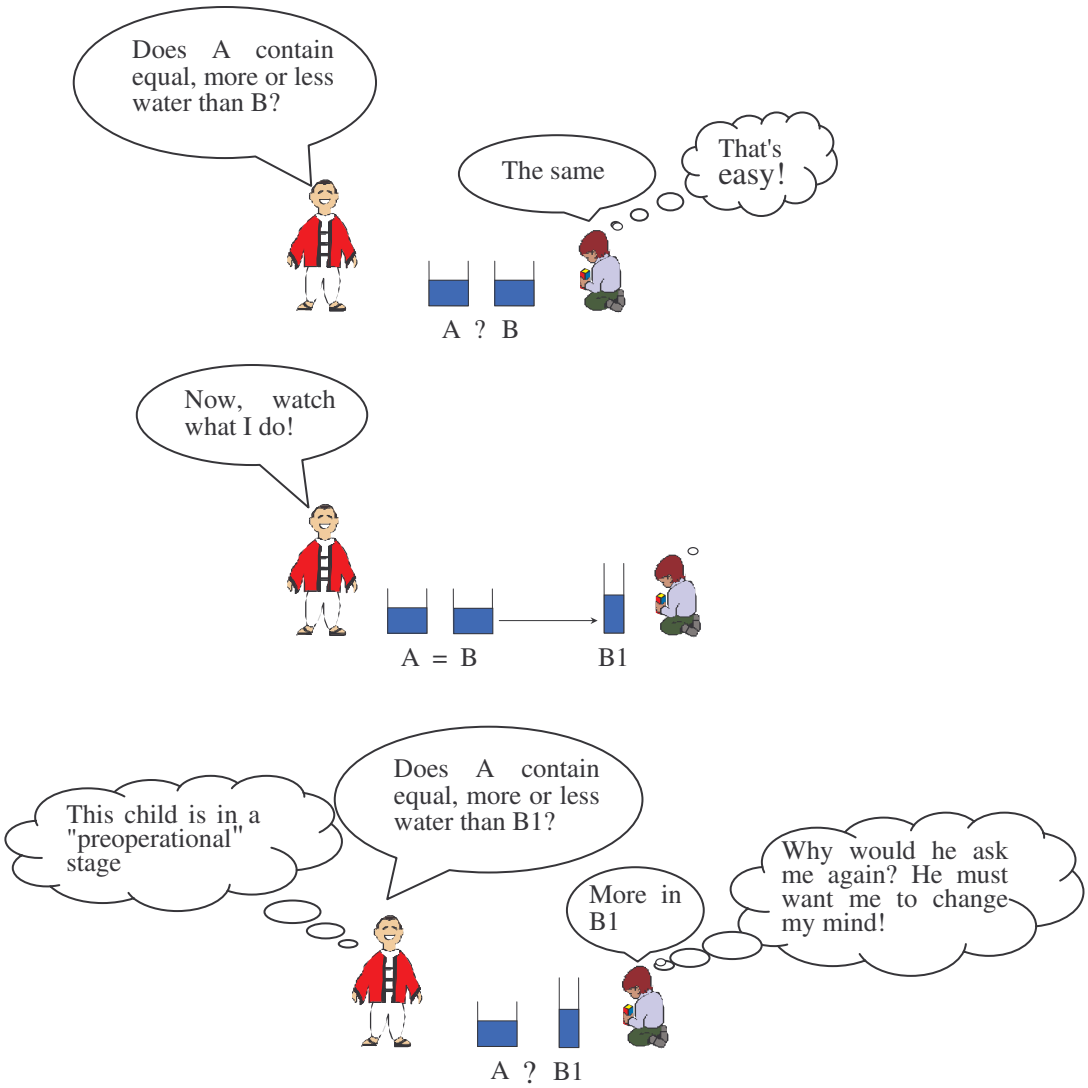
Does A contain equal, more or less water than B1?

Does A contain equal, more or less water than B1?

If a child claims (after transformation) that the two glasses contain the same amount of liquid and offers a proper explanation, then it could be concluded that the child is at the concrete operational stage, otherwise the child is at the preoperational one.

Nevertheless, some researchers have stressed the role of the social and communicative aspects of the conservation task, and propose an alternative hypothesis: in order to be able to understand the children's responses the researchers must address the social, communicative and cultural dimension of the situation (Grossen, 1988; Light, 1983; Light & Gilmour, 1983; Light et al., 1979; Perret-Clermont et al., 1979/1996; Rommetweit, 1976; Segall et al., 1999).

Some of them (Perner et al., 1986; Siegal, 1991) have looked at one particular communicative aspect of the experimental discussion: the repetition of the question. As we can see in the following image, the same question is repeated twice in the conservation task and this could mislead the child to give a preoperational answer.



Thus, the child might say that the two glasses do not contain the same quantity of water not because (s)he does not understand conservation, but because (s)he thinks that if the question is repeated it means that the adult thinks that her/his first answer was wrong. If this hypothesis is confirmed then conservation tasks are not indicators of cognitive but of social competence. According to this "repeating question" hypothesis, two factors shape the answer of the child: a cognitive factor (the ability to conserve the quantity of liquid), and a social factor (let's call it "sensitivity to the repeating of the question").

Following the standard scientific methodological way of thinking, in order to separate the cognitive and the social factor, a new conservation task has been constructed (Stepanovic & Baucal, 1998; Baucal & Stepanovic, 1999).

Like in the classical task this consists of asking the children about the amount of liquid in different glasses but involves three phases (in our experiment we also added pre and post-test interviews):

1) in the first phase, the adult puts the same quantity of juice in two glasses of the same dimension; the child is asked to agree that "there is the same amount in the two glasses"
2) in the second phase, the adult makes a decantation from one of the two glasses to another narrower and taller glass (the level of liquid is thus now higher in one while the quantity remains unchanged); the child is asked: "do you think that there is the same as much of juice in the two glasses or more or less?". According to the Piagetian interpretive frame, only children who are able to say that the amount is the same in both glasses are "conservant", which means that they are at the concrete operational stage;
3) in the third phase, the adult makes a decantation from one of the two glasses to another one of the same dimension. In this phase, children at both the preoperational and at the

concrete operational stage should give the same answer: thus the cognitive factor is controlled. According to the repeating question hypothesis if the child changes his/her answer after the second question it is not an effect of the cognitive factor, but an effect of the repeating of the question. In other words, it seems that this task gives to us an opportunity to distinguish children according to their sensitivity to the repeating question.

The research design thus follows some basic methodological rules of experimental thinking (if certain hypothesis claim that some behaviors are produced by two factors, let us find a way to control some of these factors and follow changes in behavior).
We took our "nice designed experiment" and went to a primary school close to Neuchâtel, in Switzerland, to test the repeating question hypothesis. We set up the methodological tools for the experimental research. Moreover we tried to take into consideration the childrens' understanding/interpretation of the experimental situation, so we planned an entry and debriefing interview with the children. Before the experiment they were asked, "do you have an idea of what you will be asked to do?" and after the experiment they were asked what they actually did.
35 children (10 girls and 25 boys) from 6.4 to 7.8 years old were tested. 6 children came from kindergarten and 29 from the first year of school.
Everything was going well until some moments into the experiment. The first five children went through the test, and all of them gave a non-conservant answer. "OK," we told to ourselves, "It happens. Conservant answers will surely come later on." After ten children, nothing had changed. Again we told to ourselves, that conservant answers would probably appear later on, and so on. In the end, only 4 children had given conservative responses in this group of average 6,0-6,9 years old – according to other researches, usually most of them are conservant! It was obvious that something else was going on. So, we stopped the experiment in order to take time to reflect on the situation.

3. What did happen?
Why was the result strange to our eyes? First of all, there are many studies in which it was shown that children of similar age are able to pass this task. Moreover, the same study was realized in Belgrade with a sample of children of similar age, and 40% of the children gave concrete-operational answers (Stepanovic & Baucal, 1998). Thus, it meant that the age of the children could not be an explanation.
Another assumption might be that these children were less mature than others. We refused this assumption since nothing in the scholastic or everyday behaviors of the children gave us cues for this kind of explanation.
Could it be possible that it was a specific effect of this school? Again, the answer was negative since there was nothing special about the school that could be used as an explanation. It was simply a school like any other in the area.
So, we decided to take a very close look at the videotapes of the testing sessions and analyze the flow of communication between each child and the experimenter. The idea was that the children may have understood the meaning of the task in a different way than it was supposed by the research design. Referring to Bruner's (1990) claim we tracked clues in our data in order to understand the way the children gave meaning to the experimental situation.

The results so far had led us to the conclusion that our first research design had been inappropriate for the context of our study. It followed that we should put away the results into a drawer, but instead we decided to try to understand how children constructed different interpretations of the experimental situation.
Thus, we came back to the video-recordings and transcripts of the interactions and tried to find a way to follow the processes of interpretation from the point of view of the children. In particular, we tried to answer to the following questions:

1) In which terms did the children interpret the situation?

2) How did the interpretation develop in the dynamic of the interaction?
3) Is this interpretation linked to the surrounding context of the experimental situation?

4. In which terms did the children interpret the situation?

When we analyzed the transcripts of the recordings we observed that children tended to construct their responses with a clear focus on the dimension of the *levels* of juice in the glasses and not on the *quantity* of juice.

Indeed, many children interpreted the situation as that in which they had to compare the levels of the juice in the different glasses. For example, some children put their head down in order to be at the same level as the glasses as if they wanted to be sure that they had the best position to compare levels of juice. Other children used their fingers to compare the levels precisely. These kinds of behavior happened many times, even before the experiment started!

The frequency of the term "equality" (in French; "égalité") surprised us as well (40 times by 15 children) since it was not used by the experimenter at all! It is also worth noting that at the very beginning of the task, children asked the experimenter, several times, to add some (or very little) juice in a glass, in order to be sure that levels were *exactly* the same as if it was the goal of the task. Obviously, the experimenter underestimated this behavior and did not adjust the interpretation of the children, leaving them in their belief that it was actually the issue of the test.

As explained before, according to the experimental plan, besides the conservation task, each child was interviewed before and after the test. In the interview just after the task, another experimenter asked the child about what s/he did with the adult. Many times the child said that s/he had to say whether it was "equal" or not, or to "look if it was at the same height", or to "tell if the juice was higher or lower (in French: "plus haut ou plus bas")".

These different observations lead us to make the hypothesis that the children were looking for a solution in terms of levels, and that they did not understand the piagetian intention that is focused on the operations. Did they understand that the action of equalisation was the main goal of the test rather than a first step for a reflection on the effects of the decanting of the juice?

During a discussion with teachers about this observation, they told us that a few weeks before, following their mathematical program they had made exercises with weighing machines in order to practice the notion of equality with the children. Did the term of equality and the will to equalize the juice come from this "everyday" school activity where the children had to understand how to balance the two arms of a machine? Was it that the children had used this school task as a reference to give meaning to our questions.[18].

5. How did this interpretation of the situation develop in the dynamics of the interaction?

Taking a closer look at the transcription and analyzing the verbal communication between the experimenter and the child, we observed some interesting features:

a) The adult's interventions play a role in the construction of the child's interpretation.

In responding to the child, often the experimenter suggests an interpretation of the child's previous utterance, especially when they were ambiguous. We found many occurrences of these "translations" made by the adult of an ambiguous or unclear response given by the child, as in the following example (on the right side of the table you can read in italics our interpretation of the verbal exchange)

1	Exp	Here we are. I'll put some juice in this glass. OK? And now, do you think that there is the same as much of juice in the two glasses or a	*The adult uses the formulation that is used in the procedure.*

[18] Some children made explicitly reference to the classroom situation (during the debriefing interview): "I did it all right, I succeed!" (in French: "j'ai fait tout juste; j'ai bien réussi"), or that s/he had "to find which glass had more" ("je devais trouver lequel en avait plus").

		bit more or a bit less? [Voilà. Je vais mettre le sirop dans ce verre, hein ? Voilà. Et maintenant est-ce que tu penses qu'il y a la même chose beaucoup de sirop dans les deux verres, ou un peu plus ou un peu moins ?	
2	Loïc	XXX this one is bigger [xxxxx çui-là il est plus grand]	*Does the term of "big" indicate the size of the glass or the the level in the glass? Is it a response to the question or a description of the difference between the two glasses?*
3	Exp	That one there, there is more juice? [Celui-là il y a plus de sirop ?]	*It seems that the adult translates "bigger" by "more juice", and thus tends to infer a non conservant response from the child.*
4	Loïc	Yeah [Ouais]	
5	Exp	And how do you know that? [Et comment tu sais ça ?]	
6	Loïc	Because there, there is a bigger glass [Parce que là il y a un grand verre]	
7	Exp	Mmm. OK. Let's continue. [Mm. D'accord… Okay alors on continue].	

b) The absence of counter-suggestion in the experimental procedure

In order to control what the adult says to the child, the procedure, as we had planned it, considered that the adult was not to give any explicit ratification of what was said by the child and no counter-suggestion whatever the response. No clue was to be given to the child to make her/him aware of the rightness or not of her/his answer. But, in looking at the transcripts we observed that the adults were handling the communication with expressions like "ok", "let's continue", "all right". It seems that the children took these expressions as ratification of their responses, and not only as part of the flow of the conversation, since the children went on giving the same argument throughout the interaction. It was as in the school context where the didactic contract stipulates that if the teacher tells me to continue it should mean that I am right…

1	Exp	What makes you thinking that there is less? [qu'est-ce qui te fait penser qu'il y en a moins ?]
2	Tania	It is bigger ? [Il est plus grand]
3	Exp	It is bigger? What is bigger? [il est plus grand ? qu'est-ce qui est plus grand ?]
4	Tania	The glass [le verre]
5		The glass is bigger? Ok, thanks, let's continue [le verre il est plus grand ? d'accord, merci, on va continuer]
		And later…
6	Exp	How do you know that? [comment tu sais ça?]
7	Tania	Because it is smaller [parce qu'il est plus petit]
8	Exp	What is smaller? [qu'est-ce qui est plus petit ?]
9	Tania	The glass [le verre]
10	Exp	The glass is smaller? Thanks, let's continue [le verre il est plus petit ? Merci, on continue

c) A "semantic" conflict between "much" and "height"

The procedure, as the experimenters followed it, implies the use of the formulation "the same as much of juice" ("il y a la même chose beaucoup de sirop") in order to express the idea of quantity in a way that can be understood by young children. But in contrary we observed in the transcripts of the exchanges, a sort of misunderstanding between the child and the experimenter, a misunderstanding that remained not only unresolved but was not even taken into account.

In the next sequence, it seems that each interlocutor keeps his position. The experimenter speaks of "muchness" (quantity) of juice and the child of "highness" of the glasses. Not only are they not able to reach any shared definition, but it is as if they did not understand that they were talking about different things…

1	Exp	And there, do you think that there is the same as much of juice in the two glasses? [Et là, est-ce que tu penses que/ qu'il y a la même chose beaucoup de sirop dans les deux verres ?]	*Phase of equalization in the two similar glasses*
2	Child	Yes [oui]	*The child agrees*
3	Exp	Yes, Ok, so now you are going/ could you have a look at what I am doing. I put some juice in this glass, Ok? Here we are. And here do you think that there is the same as much of juice? [Oui. Okay, alors maintenant tu vas/ tu veux bien regarder ce que je fais. Je mets le sirop dans ce verre-ci, hein ? Voilà. Et là est-ce que tu penses qu'il y a la même chose beaucoup de sirop ?]	*Decantation of the juice from one of the two previous glasses to another narrower and taller one.*
4	Child	Heu, no. There, there is a bit, a bit medium, there. Yeah, yeah it is not, it is not the same size [Heu non. Là, y'en a un petit/ y'en a un peu moyen/ là/ Ouais, ouais, ben c'est pas/ c'est pas la même *taille]*	*The child tries to give a response, but he is hesitating. The difference of size that he indicates seems to make it difficult for him to respond in terms of quantity.*

In addition, the procedural formulation that the adult uses later gave the child another ambiguity: the experimental procedure assumes that the adult would follow his/her first sentence by: "…or is there more or less [juice]?" (…ou est-ce qu'il y en a plus ou moins?). In this exchange, it seems that the child understood the sentence as a question where he had to indicate in which glass there is more juice… (indeed in French, it is sometimes difficult to make the distinction between "ou" – "or" in English – and "où" – "where" in English):

5	Exp.	Mmh. Heu. Or (?) is there more? [Mm. Heu. Ou est-ce qu'il y en a plus]	*The adult continues his sentence but the [ou] in French can be problematic orally*
6	Child	There [là]	*It is important to give a response to the adult's question, isn't it?!*
7	Exp	Ok. And heu, how do you know that? [D'accord. Et heu, comment tu sais ça?]	
8	Child	Heu. Because this glass is not the same size as this one [Ben. Ben parce que ce verre-là il est pas de la même taille que çui-là.	

6. A counter experience

Different examples like the above lead us to reflect on the way we had interpreted the interventions of the children. Do we really understand what they try to tell us?

Because of the very strict procedure we choose, it was not possible for the experimenter to handle misunderstandings. Taking this assumption into consideration, we decided to change to a more flexible procedure (closer to a discussion about how to reflect on a problem) allowing the children to negotiate the meaning of the situation's features. And, it worked! Three out of four children were able to reach an understanding of the conservation task and to give a concrete-operational answer.

In the following example, the child faced with the same "problem" as the other children but the adult seems to allow him to develop and explain his previous interventions:

1	Exp	Okay. So now, look at what I am doing. I am going to put some juice in this glass, ok? Here we are. And now Johan, do you think that there is the same as much in the two glasses or more or less? [OK d'accord. Alors maintenant regarde bien ce que je fais. Je vais mettre le sirop dans ce verre hein? (bruit) Voilà. Et là Johan est-ce que tu penses qu'il y a la même chose beaucoup dans les deux verres ou plus ou moins?]	*The adult makes the decantation following the experimental procedure*
2	Jo	Well in highness XXX [Ben en grandeur XXX]	*The child gives a first response in terms of the size of the glasses like many other children*

3	Exp	In highness? [En grandeur?]	*The adult repeats the words of the child seeking to lead him to explain his last intervention*
4	Jo	Well this one it has got more [Ben çui-là il en a plus]	*The child continues his explanation and gives a (non conservant) response in terms of quantity*
5	Exp	I am asking you if there is the same as much and if you would have the same as much of juice to drink if, for example, each of us was to drink the juice. Would you have as much juice with this glass? [Moi je te demande s'il y a la même chose beaucoup donc si t'as la même chose à boire de sirop par exemple si on devait chacun boire le sirop. Est-ce que toi tu aurais avec ce verre autant de sirop]	*The adult repeats her question but with other words, and introduces a new formulation: if we had to drink the juice, would you have as much as…*
6	Jo	Ah. Well it would be the same because before you had put in the a big glass like that except that there it is narrower and taller. [Ah ben ce serait la même chose parce qu'avant tu as mis dans le un gros verre comme ça sauf que là il est plus maigre mais plus grand].	*The child seems to understand what is at stake for the experimenter and uses another register of response: he takes the adult's last operation as a reference to construct his "conservant" response*
7	Exp	Mm. Mm.	

In this example, it is interesting to follow the change of perspective in the child: he begins by a response focusing on the size of the glasses like the other children. But after the intervention of the adult he is able to take another point of view. In the end, he shows his capacity to make a distinction between the two glasses as an explanation for the different levels of juice and shows that the previous operation of the adult does not change the quantity of the juice. It is as if the intervention (5) of the adult has lead the child to reflect on the different actions he has observed and he is now more focused on the operations than on his visual perception.

7. Is the interpretation in terms of quantity linked to the surrounding context of the perimental situation?

We gave some examples of the way the children constructed their responses to the adult by aking references to both the context of the classroom and to the interactive dynamic of the discussion. However, this did not seem sufficient to us. In many other neo-piagetian experiments the same observations would have been made. So why were we having so much confusion in the adult-child communication? Could it be due only to the adult's rigidity in the procedure? We decided to go and look at the "backstage" of the research.

In the ethnographic tradition, researchers take into account what they call "the field entry" or the way they enter into the community and gain the confidence of people they want to study. This step is conceived not as secondary but as an integral part of the research itself. In our case also, it seems worthy to us to mention how we negotiated our entry into the school.

After having prepared the hypothesis, the experimental procedure and so on, we contacted the school authorities. In this case, the president of the local school board took his job very seriously and decided not to content himself with providing general information to the parents. He asked them to give their consent after providing them with an unusually detailed description of our goals and of the kind of experiments that we were to carry out. To do this, he borrowed the model of medical research. All this pre-information for a supposedly classical piagetian test made the parents quite insecure. Knowing what was at stake, some of them trained their kids in advance with piagetian tasks so as to be sure that they would impress these psychologists! We found some traces of this preparation in the children's answers. For example, as an explanation of her answer a girl said "J'ai réfléchi dans ma tête" (I thought in my head). And when she was asked to explain her thought, she answered that her daddy – obviously well informed on piagetian tests – had told her that when he showed her that a tablet does not vanish in a glass of water… Our intention had been to be cautious and discreet, and the reality is that the whole local community (parents, teachers, kids) lived an exciting time around the research… sharing rumors, experiences, knowledge. We suppose that the parents and the teachers wanted their children to perform at their best and trained them to answer in a supposedly conservant mode… and probably, confused the children!

Therefore, although in the experiment room one could see three persons (the child, the experimenter, and an adult who recorded with a video camera), there were also some "ghosts" watching over the shoulders of the children - voices of parents, teachers and other children that shaped the way the children interpreted the situation. From this perspective, these voices also influenced the children's answers. If this was the case, it means that preoperational answers were not only the children's answers, but in a way answers constructed jointly by all the "participants".

8. Conclusion

The experimental situation seems to be at a crossroad of references for different activity systems, those of the researcher and those of the subjects. These systems of activity "meet" in the experimental interaction leading to a shared interpretation or construction of a misunderstanding (Muller, 2002)… Adult and child are trying to understand each other, but sometimes, because of the procedure the adult wants to follow, and the lack of cues (or confusing ones) about what is at stake, it seems that they miss each other.

We have observed in this research that children are involved in the hard work of interpreting, during which they make references to different dimensions of their social and cognitive reality:

- What they know about the problem and what they think it relates to (it probably has to do with equalizing levels as in the exercises our teachers gave to us?)
- What they know about the situation of interlocution (when an unknown adult is asking me questions in the school context it probably means that s/he wants to test my knowledge, even if s/he says that it is a "little game"…)
- What they know about the situation of communication (when an adult in the school context, is responding to me by "ok", "all right", "let's continue", it probably means that my response was right and that I can continue in that direction…)
- What they know from other people who experienced this situation (I was told that the task is about knowing if "it is the same or not"…).

Thus, entering a research as a "subject" is entering into an activity system. But subjects are already members of other activity systems. In this case especially, the activity system of the school where the research is hosted, with its own goals, rules, constrains, expectations. In this system, children are used to exams, inquiries (for instance PISA) and other collective testing. In entering in our experiment they do not leave their activity system but take it in with them…

a) The experimental procedure

Let's come back to one of the messages of the study. What is especially important is the fact that "standardized" experimental scenario (all subjects should be asked in the same way) does not allow "space" for negotiation of different perspectives. Therefore it is possible that some children did not have the same point of view as the experimenter, and consequently her/his answer belongs to a different reference frame. This means that it is not possible to make any conclusion about the kind of reasoning used by the child in performing the task.

b) The importance of a "grounded intersubjectivity"

Thus, in order to work out the problem of misunderstanding between the experimenter and the child, the researchers should open a "space" for negotiation. This means giving the experimenter more freedom to try out different ways of communicating with the child in order to reach intersubjectivity. This probably would have allowed us to avoid some of the problems we faced in this study.

However, this "testing by discussion" approach contains some potential gaps. There is the possibility that the child could be led to a certain kind of answer by the communication. In this case, children's answers would reflect the interlocutor's mind and not the children's perspective. This issue could be handled through communication if the researcher is aware of it. But what if it happens implicitly and outside of the awareness of the researcher? Another implication of this "testing by discussion" is that the children are not examined under the same conditions. Therefore, it would not be possible to compare the children's responses. How would the results be understood if the children participating in different kinds of discussion or negotiation get different kinds of support and help during their examination? How do we compare their performances?

It seems that what we are faced with has no easy answer – whatever approach we choose we loose something. In such situations it might be a good strategy to define what the opportunities and constraints of these two approaches are in order to be able to make the most appropriate choice for a particular situation.

With regards to this issue, it could be helpful if we went with Vygotsky's suggestion about two ways of examining children knowledge and cognitive development: an "individual testing setting" (an examination of what kind of tasks the child is able to solve alone in a standardized setting) and a "testing in the zone of proximal development (ZPD) setting" (examination of what kind of tasks the child is able to solve through joint activity and communication with adult).

Starting with this distinction we could say that we could get more comparable results by the "rigid" experimental procedure, but with a possibility of getting a biased picture about children's abilities. On the other hand, "testing by discussion" could bring out information about children's ZPD, but not about individual abilities.

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