

Teacher-student Interactions

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I have recently been spending quite a lot of time observing mathematics lessons in connection with a project concerned with considering how teachers and their students speak with each other. Much of my work has involved interpretation of their speech and actions in an attempt to investigate the motives underlying them. In doing this I have continually met the difficulty of trying to build a more complete picture around these manifestations of the activity. Also as a teacher I have been aware of presenting my intentions through my speech and actions and of the risk that they might not be interpreted as I intend them to be. This has led me to consider more closely how the various motives of the teacher and students interact.

For both the teacher and student there are two time systems in operation: shared or "outer" time as measured by Greenwich, and "inner" time that comprises the tensions between recollections and anticipations. All overt actions occur in outer time but they are seen by the teacher and student through their respective inner times, which also contain the thoughts that surround them that do not mesh into the outer shared world. As an example, I am reminded of a lesson I observed where four five-year old children were trying to arrange eight sticks in order of length. Each action by one of the children created a new ordering of the sticks in outer time. For each of the children, for the teacher, and for me, the system of anticipations in our inner times were quite different. Probably both the teacher and I had a clear image of the final arrangement and of a mechanism for getting to it. Each of the successive arrangements that we observed would be judged by this criterion to see if it was closer, or indeed close. The children, however, appeared not to have such a clear outside view, perhaps being clear neither on how it would look nor on which mechanism might get them there. Also, between the children there are other differences; each acting in outer time according to their anticipations in inner time and thus creating a new context for the others to work in.

The interaction

As the teacher and child acknowledge each other the teacher will have expectations about the nature of the child's situation — open possibilities that become problematic as they are entered into. The exploration of the child's situation involves a projection backwards by the teacher. All of the evidence of acts done is in the present: the child's writing or drawing, the referral back by the child to the situation being contemplated — all essentially signs

indicating the past. The teacher explores the reality as seen by the child in the context of her expectations and with the interest of affecting that reality subsequently. Her perception is thus inevitably coloured and has a unique perspective.

The teacher's expectations will have been derived from her lesson plan, however vague this was, in respect of this particular child or some supposed fantasy child. The teacher will be looking for the things that she expects in the total environment of the signs within the classroom that she sees surrounding this child. She will see evidence of acts done as indications of actions on-going in respect of the fulfillment of her lesson plan.

The teacher may choose to supplement this initial perception by provoking verbal or even non-verbal gestures from the child; by speaking to the child, perhaps in the form of a question. This causes a response which need not be overt. In any case the teacher's speech is subject to interpretation by the child, and in turn the child's response (which may be silence) is subject to interpretation by the teacher.

The exploration of the child's past time-space by the teacher affects the present time-space through which it is seen. Neither the space of the child nor the space of the teacher's perceptions of it are stable; both are purely temporal and cannot be held still. It is in this dynamic context that the interaction develops both as an entity in itself and as a stimulus to subsequent action.

And so, to summarize, the past time-space is viewed through the signs that suggest it in the present, according to the expectations brought to the interaction by the teacher who has the interest of making actions that affect the future time-space. Thus the teacher maps out the past time-space as a basis for mapping out the future time-space, both past and future having elements contained within the time-space of the interaction. In our example, the teacher might approach the four children and observe a few actions that lead to a new arrangement of the eight sticks. This gives the teacher a few clues about where they are and where they have been. She expects that at some point they will get the required arrangement and she might fantasize about how they will progress to it from where they are and which actions she might make, if any, to facilitate it; that is, she projects forwards.

Can we say what happens between the projection backwards and the projection forwards? A transition between the two is suggested, a "middle" to the interaction which

may be seen as the teaching element, the life within the interaction as an entity in itself. The teacher herself may have an "explanation" for what she is doing; this need not reflect her true motives although her explanation may still affect her subsequent actions. (The teacher, of course, does not have this external view of herself.)

In her projection forwards she has to choose between projects of action. But this choice is metaphorical in that it is not presented as a stable bifurcation as in a choice between objects. The interaction continues during the contemplation of various projects, and also the teacher "grows older". A project is considered in the light of other projects that have been considered, so the order in which the various projects are considered is important. The context for the "choice" changes as the interaction proceeds. In our example there was a fairly lengthy period during which the teacher attended to the four children. Perhaps she was choosing between (A) giving clues about what the final arrangement should look like, (B) giving clues about the mechanism for getting there, and (C) waiting for a while. Each of these can be repeated as desired by the teacher and clearly the order in which they are performed is significant. As it happened, in this particular lesson, the teacher chose a combination of (A) and (C). Twenty minutes later the children arranged the sticks in order; however, they were unable to do it again when the order was broken. At this point a classmate was delegated to contribute a bit of (B).

The teacher intends to make actions that influence the subsequent actions of the child. She has expectations about what the child might do and she considers actions that she could take that might influence this. However, she also has to consider the risk that her influence may be read differently by the child. She has to fantasize about how the child will interpret and act upon her actions, i.e. project forwards both within the interaction and beyond.

Clearly the child's reading of the interaction will affect his actions within it, which are again subject to interpretation by the teacher. Whereas the teacher generally enters into an interaction to supervise the work of the child, the child can have all sorts of motivations governing his behaviour. The teacher reads the actions of the child according to her expectations; the child does the same. Both look for the things they expect according to their motives. The rest may appear arbitrary. There is no guarantee of a contract. Even if there is an agreement to tackle a task the attitudes towards the work may be different. For example, the child may just want to get through the work whereas the teacher may want him to develop it.

All the actions taken by teacher and child for each other's interpretation take place in the shared outer world governed by shared outer time. However, all actions are seen by them through their respective inner time systems. The system of recollections and anticipations will be different for each of them according to their particular expectations.

Suppose, for example, that the teacher is motivated by the desire to fulfill her lesson plan whilst the child deal with a succession of immediate situations without any overall plan. The child looks in the teacher's speech for instruc-

tions for the next step whilst the teacher tries to assess whether the child is able to fulfill the demands of her lesson plan. A dialogue takes place, but each person places different weights on the various elements contained within it. In a sense; each is witnessing a different event.

Interaction within the total environment of the classroom

So far I have considered the situation of teacher-student interaction but have not explicitly made reference to the full context of it, the total environment of signs of the classroom. In an individual interaction the teacher in a sense tries to account for how the child spends the lesson. From within the interaction she projects back to the beginning of the lesson and projects forward to the end. She may aim to do this for all of the children in her class — so that for a seventy minute lesson with a class of thirty she has thirty seventy-minutes to observe. And whilst attending to one child's thoughts the other twenty-nine rest in the back of her mind.

But this increased complexity adds other problems. At any one time up to thirty-one people may be speaking or up to thirty people may be listening. Add to this: the diagrams that have been drawn, the symbols that have been written, the bodily movements and the signs that remind the participants of things done in earlier lessons, and we approach a situation that transcends the immediate grasp of those present.

It seems to me that there are three basic types of possible interaction.

1. Pseudo-interaction between teacher and student aimed at an observer, the teacher at the front of the class.
2. Teacher-student interaction concerned with the individual students' work
3. Student-student interaction.

All three types can be witnessed by the teacher herself, by a student, or by an "independent" observer. What might be seen by each of these people? Although each of the nine possibilities can be considered separately, each of the three types of observer may witness each of the three types of interaction each of which may affect their perception of any other of them. For example, a teacher and child, referring to the child's work, may both think back to the pseudo-interaction that introduced the lesson, but they will inevitably have taken different things from it, thus affecting their behaviour in this latest interaction. The sequence of interactions that anyone passes through forms the history of that person meeting a new interaction. Each chooses, which interactions to take part in as well as what to do in them.

I shall restrict myself to the first two types from the point of view of the teacher and the child. I shall conclude with a brief consideration of what might be seen by and "independent" observer.

1 pseudo-interactions between teacher and child aimed at an observer

a) As seen by the teacher

I shall include in this category any occasion when the

teacher intends to be heard by a (large) group.

The teacher has a lesson plan in mind. This involves an intention to influence the actions of the children. Her actions, including her speech, are designed to provoke responses from the children, either overt or covert. In constructing her speech the teacher fantasizes about how her actions will be interpreted. She is managing a discourse to be listened to with the intention that it influences the subsequent actions of the children. The teacher is generally the most dominant person in the class and has the power to select who speaks and to affect the context that they speak in. By posing a question before, and by speaking after, the teacher can manipulate the effect of a child's offering in the interest of fulfilling her lesson plan, however vague this is.

It seems to me that lessons in which the teacher's implied structure subordinates any child's offering are the norm. In pursuing the planned structure the teacher's response to the children's offerings is inevitably superficial. It seems that either the space offered to the child is highly deterministic or alternatively the power of a child's response is suppressed because the teacher emphasizes only those elements in it that are consistent with her intended structure.

b) *As seen by the student*

The teacher in speaking intends to cause behaviour of a certain sort. But the children are still free to act however they want. Some responses are of course more likely than others depending on how deterministic the teacher's actions have been. But the teacher cannot *ensure* that everyone listens to anything, and certainly not to every sentence. Nor can she *ensure* that everyone understands all of the sentences in the way she intends. She can do no more than fantasize about how she will be understood.

The child may decide to listen to some or all of the teacher's speech along with the overt contributions of other children. He may also attend to some or all of the other signs, such as marks on the blackboard. But can he interpret all of the words as the teacher intends, and if he cannot does he always know that he cannot? In some "Imaginations" exercises, students of mine in Dominica reported the types of difficulty they had in listening to a twelve-sentence description of a point following a certain path that I read out to them. For example, "south-west" was understood as any direction between south and west, i.e. the students' interpretation only approximated that intended. Also, a confusion might inspire thought but the discourse being listened to continued and so a sentence might be missed. In attempting to catch up the listener might articulate disjoint sentences. Some students said that at a point their minds went blank and they were unable to continue. These were students who were generally struggling to comprehend. My experience in schools is that some pupils do not struggle so hard.

There is also the matter of interest mentioned earlier. The students may have expectations about the nature of the discourse and look for the things they want to see. They select elements from the discourse that they see as important and give them a weighting and an accent according to their interest.

In such interactions some children will contribute or seek to contribute. The motivations behind such behaviour have been discussed by John Holt.

2 teacher-student interactions concerned with an individual students' work

a) *As seen by the teacher*

We have considered such interactions before but now we shall consider them in the context of the total classroom environment: that is, the teacher is under pressure from her knowledge that she has other things to attend to outside the interaction, this pressure making itself known both prior to and during the interaction. She enters the interaction conscious of her lesson plan and of earlier interactions and meets this new interaction in the context of these. Also, during this interaction she is aware of the outside — the classroom environment and the other things which present themselves during this interaction — thereby disarticulating her attention to this interaction.

Let us consider interaction I.

i) *Pressures from outside the time-space of I*

Before interaction I the teacher inhabits (as she still does) the total environment of signs of the classroom. Some of these signs were present in earlier interactions, and some of them suggest to the teacher that she should act in respect of them — undone actions that require her to add a correlate, for example. These actions are to be in the future time-space that contains the time-space of I. And so I exists in the context of these anticipations.

In I and in respect of I, the teacher has recollections and anticipations which form her inner time system. These suggest a time scale that may compete with the pressures from the outside anticipations. The teacher has other things to attend to and so may be under pressure to reduce her time allocation to I. Remember, she has thirty times seventy minutes to attend to.

For any chosen project of action the time schedule is crucial. For the teacher, I exists in two time structures, outer and inner, which have a tension between them. Pressures from outside I affect the teacher's inner time allocation and perhaps her outer time allocation. The possible projects of action are considered in inner time and the possible time allocations form part of the context for the "choice". The choices are modified as they are considered and place pressure on the inner time allocation. So the "choices" affect the time allocation and vice-versa. They contribute to each other's contexts and thus affect the way each other is seen.

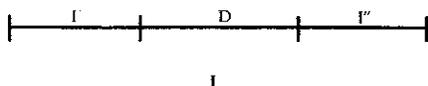
In short, pressures from outside the time-space of I shorten the inner time allocation to I and *may* in turn affect the outer time allocation according to the project of action chosen.

The above has largely been concerned with the economics of time allocation but there could also be affective consequences in I caused by outside factors. For example, the class is behaving badly, which has affected the state of the teacher and thus her perception of possible projects of action available in I.

i) *Pressures from outside the time space of I*

While the teacher is engaged in I something within the total environment of signs but outside I draws her attention. The teacher's attention to I is thus broken causing a disturbance to her inner time schedules: a shock, causing the teacher to shift from one reality to another, breaking the continuity of the action in respect of I.

Let us consider more closely the situation where I is broken by a disturbance D. I is now in two distinct parts: that is, attention to I is allocated to two disjoint time-spaces, I' and I''



The teacher enters I' thinking that it is I. With respect to the child the teacher will have expectations about what he will have done before I and anticipations about his actions post I. She has a perceived structuring of I in her inner time and related expectations about her actions in shared outer time, although there will be some temporality in her choice.

But then there is a disturbance D which turns her attention away from I. D could last half a second, or one minute, or it could completely bring I to a halt, I'' perhaps being pursued on some other occasion, if at all. But in any case D has fractured the anticipations of the time mechanism of I perceived by the teacher; I' at this point becomes a completed act. This break in continuity causes the teacher to perceive an initial completed phase both in inner and outer time, and so changes the context for her various projects of action, and hence changes the choices.

Now the teacher turns to I'' which is another shock — a transformation from the reality of D, I' being recollected as an act done, which now affects the inner-time structuring of I'' and so the actions done in I''.

b) *As seen by the child*

The child meets interaction I in a completely different context. The child sees I in the context of the total environment of signs of the classroom. But the inner-time structuring for the child, and the emphasis placed on different elements, means that the teacher and child witness I as different events. Although both teacher and child exist in the same environment of signs each only gains access to a partial view of it; those bits seen by both are consequently met in different contexts since the teacher and child have different biographically-determined frameworks both prior to the lesson and again as they meet in I. There is also the matter of interest, since, events mutually observed will be interpreted according to the individual's intentions.

The child sees I in the context of interactions with other students, earlier interactions with the teacher, and pseudo-interactions all witnessed in the environment of the classroom. I is also seen in the context of the task being

undertaken and within the time span of the complete lesson. The child selects the elements in the environment that he attends to and the accent he places upon them. I itself is also subject to his scrutiny.

Furthermore, the child selects things to attend to according to some valuation scheme, but it is only after something has been heard that it can be valued. So additionally the child must attend to the signs that suggest the immanence of something of value, but there is no guarantee that these suggestions will be fulfilled. And so what is perceived is a collage of fulfilled and unfulfilled expectations with possibly only a distant association with any linearity inherent in the teacher's speech.

We considered the teacher being distracted by a disturbance D. The child will not recognize D as seen by the teacher unless, firstly, the teacher's actions in respect of D are overt and, secondly, the child associates these actions with D. In any case the child will place a different accent upon it.

Interaction as seen by an "independent" observer

Observers may have all sorts of motivations for watching lessons. I shall restrict myself to a few general notes.

As observer I witness a situation that transcends me and all others present. I may observe elements of interaction I but I cannot anticipate it. I can only see it once I am in it. I can only consider it as an entity when it appears to be complete. As I record it I cannot be sure which elements will belong to what I perceive to be the final form. Consequently I miss bits of significance and so my record often includes articulation of "disjoint" elements. But linearity is only a metaphor to describe such a discourse. The contexts of the elements overlap, intermingle, and are sometimes kept hidden from each other — the elements therefore sometimes being signifiers of the unseen context. Indeed the full context of someone else's speech will never be known; a sentence does not reveal all of its speaker's context to the listener. For example, I am reminded of an investigation lesson where seven children sat around a table. Some broadcast aloud all that they did by themselves, some only spoke quietly to their neighbour, one did not speak at all, one broadcast the results of his clever but quiet neighbour. I cannot say what each of them listened to. It was as if there were two volumes of speech. Conversations at low volume between neighbours were quite independent of each other and out of the context of these conversations some made louder statements to be heard by all. As an observer my view was inevitably partial.

Suppose I observe interaction I between a teacher and a child. I do not share the expectations of either of them in respect of it. I can only develop my expectation as it takes form and this influences what I record of it. And perhaps in recognising I I pursue it at the expense of things I might otherwise record. I am aware that S is p, q, r, s, t, u and v but with respect to I I am only interested in it being q and I place that accent upon it in my selection of exact statements about the situation that I record. I may even choose to make an on-the-spot interpretation as a short cut in