CHAPTER 4

SOME LESSONS

Let me begin with an anecdote about two ten year old boys demonstrating various skills in a game of "Multiplication Snap" (Brown, 1994 c). Each had a share of playing cards and took turns to place a card on a central pile. My understanding of the teacher's intention was that if the product of two successive cards was in the range twenty to forty the first person to say "snap" collected the central pile. The game finished when one player ran out of cards.

It soon became clear that if I placed too much concern about what the teacher had in mind I would be distracted from what was really going on. To suggest that adherence to the teacher's rules would optimise the use of skill would be to ignore a considerable range of talents on offer. A variety of strategies were being employed by the boys towards winning the game. For it was the appearance of winning which governed much of what followed.

One of the key strategies was to slap a hand on the table each time a new card was placed on the central pile. Invariably, the boy placing the new card had most success with this since it arose prior to any detailed concern about whether or not the product of the two numbers was in the required range. There was no shame in asserting an incorrect pair, rather it displayed confidence and engagement. This ritual persisted throughout the game although as time progressed more obvious pairings, such as two picture cards which scored 10x10, escaped the slap. Whilst the initial slap often appeared as a demonstration of absolute certainty both players saw through this. On each occasion the successful slapper reluctantly withdrew his hand if confirmation was not forthcoming in the following few seconds, to make way for "reflection".

The ensuing period of relative calm permitted the search for some sort of justification - calculators appeared, jottings took place, friends were asked and searching looks were directed towards me (as the absolute authority!). This process of validation was full of tension and any half baked notion was worthy of an airing if only as a holding device. After all, it would appear from the play that any concern for your partner's ideas distracted you from coming up with your own. Each new declaration was preceded by a renewed slap of the hand on the central pile with varying degrees of decisiveness. Degrees of certainty seemed to displace any sort of right/wrong dichotomy. Uncertainties were often resolved by the loudest granting themselves the benefit of the doubt.

On closer inspection quite a few other strategies were being employed. These included; slapping a hand down as soon as it appeared the opponent was about to slap, offering new interpretations of the original rules, proceeding rapidly through controversial decisions, bluffing, claiming ownership of arguments offered by the opponent, blatant cheating such as changing the order of cards on the central pile. The quest was to convince others rather than to be correct and it was important to present a good case regardless of whether or not you had grounds for actually thinking you were right. The pressure was on to offer convincing arguments and there was no absolute authority available to offer any final confirmation.

The mathematics was inseparable from the social activity which generated it. In social situations generally, negotiation skills and the ability to appear correct are as important as actually being correct. One might suggest that modern day economics has less to do with statistical facts than with assertions of particular interpretations. A recent finance minister in the United Kingdom was sacked for lacking the required political aptitude to supplement his economic skill. (For a classroom example of an economics activity with young children discussed from this perspective, see Brown and Mears, 1994.) However, in classroom mathematics there are many ways of concealing ineptitude (cf. Holt, 1969). But, of course, these strategies should not detain us here since we are concerned with the teaching of mathematics!

In my analysis so far I have introduced some perspectives in which mathematical objects and the perception of them is softened, as the objects and perception of them, evolve together through time. It is this approach which will be taken further in this chapter. Our scope of interest however, will be a little broader. Rather than restricting ourselves to the individual's experiencing of mathematics per se, we step back a little further towards examining more closely how ideas emerge for the individual in the broader context of the mathematics classroom. In this, the classroom will be understood as an environment of signs, comprising things and people, which impinge on the reality of the individual student and influence the way in which ideas are identified and experienced. Conventional views of mathematical phenomena will not be presupposed, nor will physical embodiments of mathematical ideas be seen as transparent. Also, in line with radical constructivist philosophy I will not be relying on an expert overview of mathematics motivating this task, since such an overview is not available to the learner. I will seek to avoid assumptions about an independent, preexisting world outside the mind of the knower. Consequently, mathematical ideas will be seen as being held in the minds of teacher and students, without the anchoring of "actual" ideas. In addressing these issues I shall lean on the seminal work on social phenomenology by Alfred Schütz (1962, 1967).

A particular focus will be on how physical apparatus and language intervene in the process of developing mathematical thinking. I follow Kaput (1991) in seeing physical instructional apparatus as contributing to the "architectural" environment within which students build their own constructions, where physical apparatus guides thinking in much the same way as furniture guides movement around a room. Similarly, following on from earlier discussion, I see language as guiding rather than holding thinking. I will suggest that the characteristics and relative importances of phenomena perceived by the student in the classroom, evolve through time, and, in due course, some of these phenomena may be treated as "mathematical" as they are seen to be displaying particular qualities. However, even in work presented as "mathematical" to students by teachers, the mathematical qualities may not necessarily be immediately apparent for the student. For this reason, I focus on the initiation for the individual which takes place prior to becoming part of a (mathematical) *consensual domain* (cf. Kaput, 1991). That is, before fully formed ideas have been derived from the complexity of classroom engagement and been understood as being mathematical. I will consider how such ideas develop in the mind of a student, through time, in relation to that seen in immediate perception. This activates a concern that will span the next four chapters where I question both how mathematical thinking develops in time and space to produce language, but also how language is produced to create notions of progression through time and movement in space.

In the next chapter I shall introduce a framework through which mathematical thinking is seen as taking place in the imagined world through the filter of the world in immediate perception, with reference to the work of Schütz and Goffman. I will suggest that mathematical ideas are contained and shaped by the student's personal phenomenology, which evolves through time. In particular, I will question how students become aware of mathematical ideas in the complex environment of the classroom. Further, I will argue these ideas are never encountered directly, but rather, are met through a circular hermeneutic process of reconciling expectation with experience. A theoretical framework will be offered which accommodates the time-dependency implicit in this.

In this chapter, I offer some classroom examples of students doing mathematics as a prelude to examining how the student reads the situation they are in and how the significance of the teacher's input shows itself in their activity. I also consider how a teacher's intention is framed in the instructions she gives to students and in the physical instructional apparatus employed. We shall see that whilst the teacher's instructions may appear to be associated by them with very specific actions to be carried out by students, the students' reading and related actions may not be so precise before achieving any ultimate sharing of the teacher's way of seeing things.

Whilst working with trainee teachers in Dominica, I became involved in supervising a project investigating the role teacher's speech has in the management of a primary mathematics lessons. It was addressing the specific issue of finding alternatives to the "chalk and talk" strategies prevalent in a country where school based apprenticeship models of teacher training resulted in many teachers adopting styles similar to how they were themselves taught at school. At the beginning of the project it was common among these teachers to have a heavy reliance on their speech, both in their teaching and as a management technique, yet it seemed that much of this speech was ignored by the students, perhaps exacerbated by many children speaking a French Patois as their mother tongue (Brown, 1984, 1987 d). There often seemed to be a considerable gulf between the teachers' intentions as represented in their speech and the actual work being carried out by the students. The teachers on the project worked on the task of exploring the consequences of reducing their own speech in the classroom towards expressing themselves more economically and relying more on other strategies. By observing each other teach and through taking time out to look at their own teaching they became more aware of the way in which speech was used, but also, of the other factors governing the management of the class. This project, and in particular its concern with how classroom participants understand the space they are in, later became the basis of my doctoral dissertation (Brown, 1987 b). Lessons given by some of the teachers involved in this project will provide examples for the discussion which follows. My intention is to trace out some of the facets of the filter which translates teacher intention into responses by students.

Initially, I explore some situations where the teacher's verbal instructions combine with physical materials to influence the activity of the students. My focus here is on how the environment is read as functioning in shaping ideas in the activity of the students. I offer some anecdotes, produced at the time of the research, in an attempt to capture some of the issues that concerned us during the enquiry. They offer brief accounts of interludes within lessons, followed by some discussion of how the activity of students was being guided. These may be viewed as preliminary notes for the more rigorous treatment in the subsequent chapters. The first example features students representing and adding numbers using base ten strips (a home-made 2-D version of Dienes materials). The teacher's requests for students to make specific arrangements are greeted by substantial delays and much deliberation. Precise requests failed to receive precise responses. In the second example students are producing the sequence of square numbers. A precise course of action was prescribed by the teacher, yet the pupils interpretation of this or their inability to arrange the pieces as requested, stood in the way of smooth responses. The activity is shaped by the materials and the teacher's verbal requests but considerable scope for manoeuvre results from both intellectual and technical difficulties. The third example focuses on a counting exercise where students become immersed in the space created through their own actions, as the teacher's intentions become ever more distant. In particular, I focus on how the individual's perceived space is shaped by the actions of others. In the fourth example, a group of students, confronted with a task of ordering sticks by length, are governed as much by learnt rituals as by physical constraints. The final two examples describe college sessions led by me and attended by the teachers involved in the project. The focus in these two sessions was on how the teacher's intention is captured, transmitted and received in language.

Example 1: Addition using base ten strips

A group of six year old students were working on some problems set by their teacher. These involve using "base ten strips" in tackling double digit addition. The teacher's speech was very brief and sparse, consisting, almost entirely, of requests such as "Make 34", "Now make 21", "Now put them together". The students,

Mathematics Education and Language
Interpreting Hermeneutics and Post-Structuralism
Brown, T.
2001, X, 306 p. 1 illus., Softcover
ISBN: 978-0-7923-6969-1