# HOW MANY BURGERS CAN A HUMAN BEING EAT? WRITING WORD PROBLEMS WHEN ENGLISH IS AN ADDITIONAL LANGUAGE.

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*Last term, as part of my doctoral research, I recorded pairs of English Additional Language (EAL) students as they worked on the task of writing word problems together. What kind of 'resources' do EAL learners use when jointly thinking and constructing word problems? In this paper, taking the discursive psychology of Derek Edwards (1997) and others as a basis for examining students' interaction, I discuss one transcript from the above work. There is evidence that the students are oriented both to the genre of word problems, and to a personal narrative.*

## Introduction.

Despite concern that children from minority ethnic backgrounds under-achieve in mathematics in British schools, particularly if English is an Additional Language (EAL) [1] (e.g.OFSTED, 1999) there has been little research investigating the relationship between language background and mathematical learning, and even less examining the learning processes of EAL students. My research investigates the nature of interaction involving EAL students as they work on mathematical activities in order to gain insights into their mathematical learning processes. A key part of this work is the development of a way of researching the interaction of students from diverse cultural and linguistic backgrounds.

## Theoretical and methodological perspectives.

Multicultural classrooms are complex environments with students from a wide range of different backgrounds which must be taken into account in any conceptualisation of classroom interaction. Bruner's (e.g. 1990, 1996) cultural psychology aims to "show how human minds and lives are reflections of culture and history as well as of biology and physical resources" (Bruner, 1990: 138). He sees culture as shaping the mind "by imposing the patterns inherent in the culture's symbolic systems - its language and discourse modes, the forms of logical and narrative explication, and the patterns of mutually dependant communal life" (p34). These patterns of language and behaviour are the key to Bruner's work, since they allow the interpretation of situated meaning (p19). Saying and doing form an inseparable unit, since what is said only makes sense in the context of what is being done, and what is done can only be interpreted in the light of what is being said. There are "agreed-upon, canonical relationships between the meaning of what we say and what we do in given circumstances" (p19). This notion of the canonical is the basis of the 'tool kit' (p21) of resources that cultures provide for interpreting and making meaning in interaction, linking the historical dimension of cultural patterns with the situated nature of their reproduction.

In their participation in classroom activity, students are exposed to patterns of discourse and of action and interaction, which add to and interact with those of their previous experiences, their "individual histories" (Bruner, 1996), including their experience of education. Recognition of the importance of each EAL student's cultural and linguistic history presents a problem: if the meanings produced in classroom discourse are seen as subjective and situated within each learner's cultural background, the languages they speak and their previous experiences of education and of mathematics, difficulties arise in assuming that 'we all know what we're talking about'. Whilst there may be enough common understanding for interaction to continue, this is an inadequate basis for systematic inquiry. Two students may be able to talk about a 'big circle', say, but the subjective nature of 'big' and 'circle' may be entirely different for each. I must therefore develop a way of exploring and analysing students' mathematical interaction that does not rely on assumptions about those meanings.

Discursive psychology (Edwards and Potter, 1992; Edwards, 1997) offers both a theoretical perspective of interaction and a methodological approach which avoids the problem outlined above. Discursive psychology examines how reality is constructed in discourse, focusing on the business performed by utterances in context. Analysis of classroom discourse asks "not *what* do children think but *how* do children think" (Edwards, 1993: 216). Language is conceptualised as primarily "a medium of *social action* rather than a code for representing thoughts and ideas" (Edwards, 1997: 84, original emphasis). Social action is foregrounded as the primary function of language, which is seen as having evolved through social interaction, and therefore as being structured both by and for social interaction. From the plurality of possible forms and modes of expression at any given moment of interaction, only one utterance can emerge. The path taken through this plurality of expression is determined by the social action and interaction of the participants. So for example, an utterance designed to persuade will take a different form from an utterance designed to placate, even if the 'content' is the same. The patterns of language through which these different actions take their form derive from each individual's experience of social interaction, their cultural and linguistic history. Thus Bruner's (1990) view that saying and doing are inseparable (p19) is extended: saying *is* doing.

This theoretical position leads to the following research questions:

- What cultural resources do EAL students recruit in their participation in the discourse of school mathematics?
- How are these cultural resources interactionally deployed and what is accomplished by their use?

Discursive psychology also offers a methodological perspective including an approach to discourse analysis which emerges from the theorisation of

interaction presented above. Edwards and Potter (1992) outline five distinctive aspects of the discourse analysis of discursive psychology:

1. Analysis is of naturally occurring talk and prepared texts.
2. Analysis is concerned with the content of talk and its social organisation. This includes seeing talk as sequential and analysing utterances within the sequential context in which they occur.
3. Analysis is concerned with action, construction and variability. Different ways of talking are used in different circumstances and for different rhetorical purposes.
4. The rhetorical organisation of talk and thought is designed to counter potential alternative versions which may arise. The form of an utterance is determined by the action it is designed to perform, including the prefiguring of potential future courses of interaction.
5. It is the consideration of 'cognitive' issues such as intention or meaning in terms of how they are dealt with in discourse that leads to this approach being characterised as 'psychological'. The focus is on looking at how participants construct and rhetorically deploy psychological concepts in interaction. This is not to deny that people have intentions or meanings, but to argue that we can only examine how such notions are interactionally employed in different ways to suit different occasions and thereby accomplish different social actions (Edwards 1999: 272).

**Research context.**

I have been visiting the Year 5 (aged 9-10) mathematics lessons in a multilcultural urban primary school in the UK. The school has approximately 150 students from a variety of cultural and linguistic backgrounds. In Year 5 there are six students recognised as EAL. Initially I had hoped to record students as they worked in order to obtain records of naturalistic interaction. As this proved impractical the approach was modified: small groups of students were withdrawn from the classroom and recorded while they worked on a task together. Although not identical to classroom situations, the teacher frequently asks students to work together in this way. Furthermore, the task selected was one which the teacher uses during her mathematics lessons. Thus although the interaction was not completely natural, neither is it particularly artificial.

The research design involved selecting a topic from the teacher's schedule for the term. In this case the topic concerned calculators, including some work on using calculators in the context of money. Six pairs or threes of students were recorded both before and after the calculator topic working on the task of writing word problems which could be used in the money part of the topic. A calculator was provided. The students were also asked to solve their problems. The primary data consists of audio recordings of the interaction which were fully transcribed. The analysis offered in this paper is of a pair of students

working on the task before the lesson sequence. 'Safia' comes from a Somali speaking background and arrived in the UK about 18 months ago, since when she has learnt virtually all her English. 'Helena' is an English speaking African-Caribbean student.

**A concert and then some fast food.**

In analysing this paper, I am seeking evidence for two related patterns I have identified in another transcript involving Helena working with another EAL student (see Barwell, 2000). I called these patterns generic orientation and narrative orientation. I will explicate these terms through the analysis below.

During their 15 minutes' work the two students write and solve two problems, with Helena seeming to dominate much of the interaction. The transcript of their interaction is messy and complex, with many distractions, disputes and negotiations over details. Nevertheless, despite the twists and turns of their discussions, the outcome is two recognisable word-problems, the first of which eventually becomes (typed but unedited):

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Leanne went to a Rock 'n' Roll
concert, it cost £11.50 for one person
and there was 12,163 people there when
the show started and the doors were closed.
How much money did the concert Raise
altogether?
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Whilst neither student has a clear idea of what the final problem will look like, there is a guiding sense of what kind of thing they are meant to end up with. In this sense, the students are jointly oriented (Sacks, 1987: 64) to producing suitable problems. One aspect of this orientation I have identified is an awareness of and orientation to the generic form and language of such problems. Thus, for example, the typical first move in most of the recordings, is the selection of a name or names (see [2] for transcription conventions):

| | | |
|---|---|---|
| 166 | H | [ come on/ you have to tell me one now/ I tell |
| 167 | | you one you write it/ (stupid pencils)/ |
| 168 | S | okay then/ name another name/ a boy now |
| 169 | H | Paul |

What is noteworthy here is the way in which the two girls appear to know exactly what they are doing, their interaction working seamlessly to produce the beginnings of their second problem. Safia asks for a name for the character in the problem which Helena supplies. That a name should be the starting point and that this is taken as unremarkable is evidence that the two students are oriented to the genre of mathematical word problems which frequently feature a named but non-existent protagonist (Gerofsky, 1996). This orientation is also apparent when Helena offers a first version of the problem:

| | | |
|---|---|---|
| 190 | H | oh/ yeah/ Paul and Chris/ went/ to/ McDonalds/ and had fifty seven |
| 191 | | meals/ which cost three pounds/ chicken burger and chips/ joke/ yeah |
| 192 | | yeah yeah yeah write it actually// what's that say? |

193 S McDonalds/ I can't spell it properly I don't

Despite Helena's signals of uncertainty ("joke") Safia raises no objection to the basic form and scenario that Helena proposes. The ensuing interaction is devoted to negotiating the details of the problem. The implicit joint acceptance of 'what a word problem is like' is evidence for the students' orientation to genre.

By the same argument there is also evidence of an orientation to a narrative frame which also guides their joint deliberations. Thus having accepted the fast-food scenario, Helena suggests purchases of burgers and chips, of apple pies and banana and toffee, none of which are challenged as inappropriate for the narrative scenario by Safia. This could be explained by Helena's dominance in their interaction: in fact Safia *is* prepared to challenge Helena on narrative grounds, as when they are negotiating how many meals Paul and Chris buy:

225 H [ let's do five million/
226 S Nah
227 H no just do it/ they bought/ no just say/ they bought five/ &
228 S wait/ wait wait wait wait
229 H & **thousand**/ six hundred/ and fifty four
230 S can you eat that many?
231 H no but
232 S can a human being eat that many
233 H no/ they shared it amongst the concert
234 S you're mad/
235 H this is to do with the concert/ why're you writing twenty for?

Helena is suggesting rather large quantities of take-away - five million - which unusually Safia rejects outright. Helena tries to assert herself "just do it" (line 227) and gets as far as saying but not completing "just say they bought five" (line 227). Safia's "wait wait wait wait" is treated as another rejection, prompting Helena to ameliorate the earlier five million to five "**thousand** six hundred and fifty four" (line 229). Safia then draws on a strong, commonsensical question to reinforce her position against Helena's suggestions: "can you eat that many?" (line 230), repeated when Helena is unable to respond (lines 231-232). Safia is recruiting narrative sense to argue against Helena's more generically focused details, invoking a tension between the more arbitrary narrative (and mathematical) world of the word problem genre and a more personal idea of what makes sense. Intriguingly Helena also recruits narrative sense in her response, linking this question with the concert in the previous one (lines 133, 135), both drawing on and constructing an overarching narrative for the two questions. In this exchange, the two students are trade narrative meaning in the course of negotiating the problem, although little of the exchange is apparent in the final version of the problem.

**Concluding remarks.**

In their interaction as they write the two problems, Safia and Helena, display a joint orientation to producing suitably word-problem-like questions. They are guided by an implicit sense of the generic form and mathematical content of such problems, drawing on this shared sense in their negotiations. There is also evidence for an orientation to a personal narrative sense which both students to support different possible versions of the problem. Safia notably draws on a personally meaningful narrative sense to challenge Helena's general dominance of the interaction. Following Bruner (1990), these orientations, as embodied in patterns of interaction, could be described as cultural resources in the sense that the guiding narrative and generic orientation of each student must derive in part from their "individual histories": their generic orientation, for example, derives from their prior experience of a word problem 'canon'.

This analysis also shows that it is possible to explore interaction between students who come from very different backgrounds from the researcher without making problematic assumptions about what their utterances subjectively mean. So, for example, despite having no direct access to Helena's understanding of concerts or to Safia's experience of fast-food restaurants, I *can* explore how they use these notions in their interaction.

**Notes.**

1. English additional language (EAL) refers to any learner in an English medium environment for whom English is not the first language and for whom English is not developed to native speaker level. Native English speakers are described simply as monolingual.
2. Bold indicates emphasis. / is a pause < 2 secs. // is a pause > 2 secs. (...) indicates untranscribable. ? is for question intonation. ( ) for where transcription is uncertain. [ for concurrent speech. & for utterances which continue on a later line.

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