Vague language and politeness in whole-class mathematical conversation

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Politeness theory is based on the notion that individuals in a conversation are endowed with face – positive face is concerned with a desire for social approval and negative face is concerned with a desire to be unimpeded. The theory is relevant in the context of whole-class discussion of mathematics where a teacher has to facilitate development of students' disciplinary understanding and, at the same time, reduce their threats to face as they make contributions in public. In this paper, it will be shown that a teacher's use of vague language can play a role in protecting threats to student face and thereby facilitate participation in argumentation and reasoning. It will also be shown that the competing claims on a teacher's attention in this context render his/her role highly complex.

Keywords: Politeness, face, vague language, whole-class discussion, primary mathematics.

INTRODUCTION

At a time when there is an emphasis in mathematics teaching and learning on the co-construction of meaning by teacher and students, it can be challenging for a teacher to take a supportive role in the classroom and, at the same time, steer students towards increasingly sophisticated understandings of mathematics. This challenge is exacerbated in the context of whole-class discussion where the teacher has to take account of the vulnerability that students might feel when they make a contribution in the public forum of a classroom. The strategies that he/she often employs to meet both of these demands are generally indirect, e.g., the use of questions, or revoicing (Brodie, 2010). The use of such indirect strategies relates to politeness theory – a theory that was constructed by Brown and Levinson (1987) to describe pervasive features of social interaction. Politeness theory has been used as an analytical framework in a range of contexts, including the teaching and learning of mathematics (Bills, 2000; Rowland, 2000; Weingrad, 1998). Rowland (2000) has focused on the role that vague language plays in supporting politeness in mathematical conversations between teachers and individual (or small groups of) students. In this paper, the role of vague language is extended to politeness in whole-class mathematical discussion. It will be shown that a teacher can use it as a means of developing a learning environment where children take intellectual risks and develop a view of mathematics as a subject that is a human activity and a social phenomenon (Hersh, 1997).

POLITENESS THEORY

One of the ideas upon which politeness theory is built is that each participant in a conversation is endowed with *face* (Brown & Levinson, 1987). Face, a term used metaphorically to represent respect, esteem and sense of self, takes two forms: positive face, a desire to be appreciated and valued by others, a desire for approval; and negative face, a concern for freedom of action, a desire to be unimpeded.

However, certain acts threaten face. Such face-threatening acts (FTAs) can be directed towards positive or negative face. For example, criticism and disagreement threaten positive face whereas orders and requests threaten negative face. Moreover, the seriousness of FTAs is influenced by factors such as the power relation or social distance[1] between speaker and hearer.

Threat to face can be mitigated by use of redressive actions which include positive politeness (oriented to positive face), negative politeness (oriented to negative face) and use of hints and metaphors. It is in the mutual interest of persons involved in a conversation to maintain each other's face, as part of a strategy for maintaining their own face. Brown and Levinson present a range of strategies that are available to a speaker in order to protect, or not, the face of a hearer. For example, if an individual solves a mathematical problem incorrectly, a colleague might deal with it in one of the following ways (see Rowland, 2000, p. 86):

1) Don't do the FTA – simply agree or keep quiet.
2) Do the FTA by
   a) going 'off record', that is implicating the FTA rather than doing it directly (e.g., 'I wonder if we have done a problem like this before...')
   b) going 'on record' either
      i) baldly – making no attempt to respect face ('That is not correct')
      ii) positive politeness ('You have come up with a really interesting way of solving that problem but I thought that ...')
      iii) negative politeness ('Would you mind showing me how you applied this formula here...')

While there is a variety of ways in which teachers endeavour to protect the face of students in small-group conversation (Bills, 2000) or in whole-class discussion (Weingrad, 1998), of particular interest to this paper is the way in which vague language used in mathematical (and other) contexts – in particular, (a) the pronoun *we* and (b) linguistic hedges – can be exploited by a teacher to serve this purpose.

VAGUE LANGUAGE

Rowland (2000), amongst others, maintains that coming to know mathematics is imbued with uncertainty and that the use of vague language – for example, hedges and pronouns - points to these uncertainties.

Hedges

Linguistic vagueness is encoded by *hedges* which are words "whose meaning implicitly involves fuzziness - ... whose job is to make things fuzzier or less fuzzy" (Rowland, 2000, p. 471). Rowland (2000) developed a taxonomy of hedges with reference to the discourse of mathematical conjecture. The first major type of hedge, *a shield* indicates some uncertainty in the mind of the speaker in relation to a proposition. There are two types of shield: (a) a *plausibility shield* and (b) an *attribution shield*. A plausibility shield (e.g., "I think", "probably", "maybe") can suggest some doubt on the part of the contributor that the statement will withstand scrutiny. For example, in the statement, "I think that the sum is twenty", the speaker injects a level of vagueness into his mathematical assertion and thus implicitly invites feedback on his solution. The attribution shield implicates some degree or quality of knowledge to a third party (e.g., "Ann got an answer of twenty"). The second major category of hedges are termed *approximators*. The effect of the approximator is to modify the proposition rather than to invite comment on it. One subcategory of the approximator is the *rounder* which comprises adverbs of estimation such as "about", "around" and "approximately" (e.g., "The answer is around twenty.") The second type of approximator is the *adaptor* – it indicates vagueness concerning class membership such as "somewhat", "sort of", "pretty much", e.g., "I am pretty sure that twenty is an even number."

In the interviews conducted with individual (and small groups of) students, Rowland (2000) found that teachers used shields and adaptors in recognition of the face wants of students, whereas students used rounders and plausibility shields to serve their own face wants. He found that, in general, young students seemed to be less sensitive to the face wants of a teacher than to their own. This could be explained by a perceived power difference between a young student and his/her teacher. In the context of whole-class conversation where argumentation is encouraged, a teacher might have competing demands on his/her attention in terms of addressing face wants of different students. Moreover, students might well decide to protect or not the face of their peers. In the excerpt that follows, consideration is given to how vague language is used by a teacher to deal with such complexities.

The pronoun "we"

Bills (2000) says that one of the strategies for positive politeness used by teachers is the use of "we" or "us" to infer inclusion, e.g., "Let's try starting with this one". Rowland (2000) expands on the uses of pronouns (particularly, "it", "you" and "we") in mathematical learning contexts. He suggests that while the pronoun "we" can often be used to indicate a teacher's solidarity with a student (or group of students), the term can also be used to convey distance – "to associate the speaker with a select and powerful group ... to urge acquisition of the 'proper way' of doing [mathematics]" (p. 98). In a classroom situation it can also serve to assuage a command, thereby mitigating threat to negative face (e.g., "We add the units and then the tens…").

METHODOLOGY

In order to investigate the construction of new mathematical ideas by pupils in the context of whole-class discussion, I conducted a classroom design experiment in three different primary schools in Ireland (that is, a series of lessons in each school consecutively). This approach has its roots in the teaching experiment, the central elements of which include instructional design and planning, ongoing analysis of classroom events, and the retrospective analysis of all data generated (Cobb, 2000). Because of its focus on theory development, the teaching experiment has been subsumed into design-based research and, more recently, has been termed a "classroom design experiment" (Cobb, Gresalfi, & Hodge, 2009). I taught 32 lessons (some of which extended over more than one class period) in all to pupils aged 9 – 11 years. I, as researcher-teacher, taught the lessons but the class teacher assisted in planning, teaching and post-lesson analysis. The main data collected were audiotapes of whole-class and group interactions – video recordings were not used due to ethical constraints. Data collection and data analysis were interwoven. Retrospective analysis was conducted on micro- (between lessons) and macro- (between and after cycles of research in the three classrooms) levels. The analytical approach I adopted was microethnography (Erickson, 1992) in which I first considered whole events such as lessons and gradually filtered them to explore the construction activities of individuals, focusing particularly on the sequential emergence of talk and action. This construction sometimes happened within a short period – at other times, it occurred in a zig-zag fashion over the course of a lesson or indeed a few lessons. The use of vague language by children was a crucial element of construction activity in mathematics lessons (e.g., Dooley, 2011). In particular, such language allowed them to engage in the conjecturing activity that is central to the development of novel ideas. Furthermore the follow-up actions by me, the teacher, to their contributions was salient, e.g., revoicing or press moves allowed for pupils to build on each others' thinking (e.g., Dooley, 2009). Re-analysis of the data to explore my use of vague language revealed that I and, to a lesser extent, the pupils used vague language as a means of being polite. In this paper, I examine the issue of politeness in whole-class conversation – in particular, how my utilization of vague language within follow-up moves was another core dimension to children's mathematical constructions. I draw on data derived from lessons that I taught in the first and third schools. I chose these lessons because they exemplify how vague language on the part of the teacher can be used to support contributions by those traditionally excluded from mathematics while, at the same time, move the group towards mathematically correct ideas. Such vagueness encouraged peers to be the arbiter of correctness in the lessons concerned.

EXCERPTS FROM TWO LESSONS

The Grasshopper Lesson

This lesson was one of eleven lessons that I taught in the first school. The school was of middle socio-economic status. There were 30 pupils, 17 girls and 13 boys, aged 10 - 11 years in this class and Mr. Allen was the class teacher[2]. The problem reads as follows:

> A grasshopper is journeying across a mat that is 1 meter long. He starts at the top of the mat, jumps half-way across and takes a short rest. He then jumps half-way across the remaining bit and takes a short rest. He then jumps half-way across the next bit and so on. What are his landing points? Will he ever get to the end?[3]

I drew a line on the blackboard, the initial point of which was marked *0* and the end point was marked *1m*. I asked the group to name his first landing-point and then I drew an overarching loop from 0 to ½. I explained that the grasshopper would next jump half-way across the remaining section. I invited a pupil to mark the second landing-point and again asked the group to name this point (¾). The lesson continued thus. As expected, identification of the fourth landing-point (15/16) challenged some pupils because they had not yet been formally exposed to sixteenths. While some agreed with Jack (a pupil of "average" mathematical attainment on the basis of standardised test scores) that it was fifteen sixteenths, others aligned with an idea proposed by Kate (a pupil of "below average" mathematical attainment) that it was seven and a half eighths. The transcript that follows centres around this episode[4]:

104	TD:	What do you think is going to happen next?
105	Chn:	It's going to half it//half it//half…

106 Jack: It's half of seven eighths (whisper) [ ]
125 Jack: He's on fifteen sixteenths.
126 //Ch : Seven and a half eighths.
127 Chn: No.
128 TD: He's on fifteen sixteenths, seven and a half eighths or fifteen ...
//*Ch talking* ... So you think he's on fifteen sixteenths. Where are you getting fifteen sixteenths from?
129 Jack: Cos I think, I think em ... I think a half an eighth is sixteen ...
130 TD: Right.
131 Jack: and eh ...
132 //Ch: I know ...
133 Jack: when ...
134 //Chn: Seven and a half!
135 Jack: and then another sixteenth ... if she went another sixteenth (*other children talking in background*), she'd be there but she didn't go another sixteenth, so she went fifteen sixteenths.
136 Ch: Three quarters ...(*in background*)
137 TD: Fifteen sixteenths ... and who said seven and a half eighths, who said that?
138 Paula: Me.
139 TD: It was yourself, what is your name?
141 Chn: No, it was Kate//it was Kate.
142 TD: I thought it was this girl down here, was it? Yes, Kate ...well maybe both people said it ... that's fine, I thought it was Kate.
143 Kate: It was seven eighths and if he went eight eighths, he would be at the end, so if you go half of it, then it's seven and a half.
144 Mr. Allen: Good girl!
145 TD: Seven and a half eighths and do you think ... Dan? [ ]
159 TD: The jumps ... oh, I know what you mean. So what do we call ... will we call it seven and a half eighths or fifteen sixteenths?
160 Chn: Seven and a half //Fifteenth sixteenths//Seven and a half is easier to manage// No, it's not//Cos you are going two, four, eight//Seven and a half is easier.
161 TD: I think ... you could call it seven and a half eighths but we normally these things ... normally they are brought up to full numbers. But seven and a half eighths would be ok but ... normally it's brought up to something like fifteen sixteenths. (*I write both on blackboard.*)

When Jack proposes fifteen-sixteenths, I ask him to explain his thinking. Although he initially hedges by using a plausibility shield, "I think," in line 129 (l.129) – possibly due to his uncertainty about the fractional name for half an eighth, his reasoning in l.135 is cogently expressed, reflecting his conviction around the argument that he is making. It is interesting that I do not evaluate his contribution in l.137 which, at this juncture, might have had the effect of closing off other contributions (O'Connor & Michaels, 1996). I respond by maintaining his input ("fifteen sixteenths") and then following up on the "seven and a half eighths" contribution. The question that I pose in l.137 ("[W]ho said seven and a half eighths?") may well be due to the fact that I genuinely do not know who has made the input. However, my remark in l.142 ("I thought it was Kate") could be a redressive action in anticipation of an FTA - that is, by not asking Paula directly if she has said it, there is no need for her to admit that she has not done so. In this instance, Paula replies that it is she who volunteered the contribution and immediately other pupils in the class claim it to be Kate's idea. By redressing the threat to Kate's positive face, they make no effort to respect Paula's positive face. In l.142, I make some effort to redress what might be perceived as a combative situation (Kate versus Paula):

> 142 TD: *I thought* it was this girl down here, was it? Yes, Kate ... *well. maybe* both people said it ... that's fine, *I thought* it was Kate.

I indicate that I believe the contributor to be Kate rather than Paula but distance myself from the assertion by use of the plausibility shield, "I thought." In this way I am effecting a double save, that is, with regard to Paula's face (protecting her from possible embarrassment) and to Kate's (if she had not been the originator of the comment). While I give Kate credit for the idea, my "[W]ell, maybe both people said it" represents a further effort on my part to redress Paula's face. Rowland suggests that the particle, *Well,* delays a reply on the part of a speaker (thus inferring refusal or disagreement) – as such, it is one of the ways that threat to positive face can be lessened. In this instance, my use of the term suggests doubt on my part that both people did in fact make the contribution. My subsequent action (giving Kate the floor) suggests that my main motive here is to save Paula's positive face. My gamble – for that is what it is – seems to pay off as, like Jack, Kate justifies her argument ably, indicating that she has indeed constructed a way of naming this point.

In my question in l.159, "Will we call it seven and a half eighths or fifteen sixteenths?," I am probably hoping that the children will resolve the issue. My use of the pronoun "we" in this instance infers solidarity. Failure to agree will offend my positive and negative face wants (as I am the teacher and they are the pupils). On an individual level the children do as required but take different positions on the issue. While this may be due to mathematical preferences, it could also be that the children themselves are engaging in face-saving acts with respect to Kate or Jack (but, not in this instance, both). My discomfort in l.161 is palpable. I am aware that this is a critical event for Kate who does not often make contributions in mathematics classes. I first hesitate – "I think – you could…" referring to the mathematical correctness of her idea. However, I also seem to feel some duty to conventional correctness when I suggest that "we normally … normally they are brought up to full numbers." In this instance the "we" refers to the general mathematical community – I am suggesting that, while seven and a half eighths is acceptable, the convention is to *round up* denominator and numerator. The "seven and a half eighths would be ok" is a positive redressive action (directed towards Kate). Interestingly, I use the adaptor "something like" with Jack's "fifteen sixteenths" (although I know this to be conventionally correct). In fact, most of my politeness is directed towards Kate rather than to Jack and this may be because I perceive Jack – at this juncture – to have less face want than Kate. My ultimate resolution is to write both suggestions on the blackboard. In the next part of the lesson, other pupils built on Kate's idea to justify their naming of further landing points on the line.

The Gauss Lesson

The Gauss lesson concerned the sum of numbers from 1 - 100 and was a lesson that I taught in the third school. In a previous CERME paper (Dooley, 2009) I reported how one pupil, Anne, used linearity inappropriately to determine the sum. She had suggested that the solution could be found by multiplying 30 (what she thought was the sum of 1- 10) by ten. After some disagreement by others in the class, she revaluated her method. She then made a new estimate and there follows an excerpt of the conversation that followed:

166	Anne:	I think the answer would be a thousand.
167	TD:	You think it's going to be a thousand. Do you agree with Anne that it's about a thousand? Brenda?
168	Brenda:	Eh, no, cos when I em added up forty for it and, em, I got more than a thousand.
169	TD:	Oh, wait till we see now, so Brenda is thinking of the problem we were doing yesterday. Brenda yesterday added one plus two plus three plus four plus five all the way up to forty. And what did you get when you added, do you remember when you added up to forty?
170	Brenda:	Eh a thousand and something.
171	TD:	I think, do you know something, I think it was … I am not completely sure … I think it might have been seven hundred and eighty, but I am not sure about that.
172	Brenda:	I know it was a thousand.
173	TD:	You think it was a thousand … Anyway Brenda added up, yes Fiona?
174	Fiona:	Well, yesterday, forty was seven hundred and eighty.

On the previous day, Brenda had used a calculator to sum numbers from 1 to 39 in order to find a solution for a different mathematical task. When Anne conjectured that the sum to 100 was a thousand (l.166 above), Brenda intimated that this could not be the case by making an implicit reference to the result of this sum. Her recall is inaccurate as she had found the solution to be 780. However, I am interested in drawing pupils' attention to her contribution, as it is a means of moving the lesson forward, that is, of making an accurate estimate for the sum, 1- 100. I use the pronoun "we" (l.169) to do so – "Oh, wait till *we* see now…". I broadcast her input ("Brenda is thinking of the problem we were doing yesterday") although I am inferring this since she has not mentioned the problem of the previous day explicitly. I also rebroadcast the contribution that she made in the previous lesson ("Brenda yesterday added one plus two plus three plus four plus five all the way up to forty…"). I made an error in this rebroadcast by suggesting that Brenda "added up to forty" when she in fact added up to 39. My evaluation of her estimate ("a thousand and something") is marked by vagueness:

171 TD: *I think* do you know something *I think* it was ... *I am not completely sure* ... *I think it might* have been seven hundred and eighty, but *I am not sure* about that.

My recourse to the plausibility shield is interesting – I am quite sure that the solution found by Brenda was 780 and want to indicate this to the rest of the pupils in a way that respects her positive face. I obviously do not wish to engage in the FTA baldly (by telling Brenda that she is incorrect) and thus distance myself from giving the correct solution ("I am not completely sure", "I think it might have been..."). In l.174, Fiona provided the correct solution. She prefaced her input with

"Well" to infer disagreement in a way that lessened the threat to both my and Brenda's positive face. This excerpt, though brief, marked a turning point in finding a solution to the problem concerned - most notably because Brenda drew attention to the lesson that had taken place the previous day where pupils found a formula for adding consecutive whole numbers.

CONCLUDING REMARKS

In a classroom where argumentation and negotiation of mathematical meaning are encouraged, a teacher has to take several factors into account in her moment-to-moment decisions. The excerpts above are interesting not because they are models of exemplary teaching but because they offer an insight into the complexity of teaching in an 'adventurous way' (Weingrad, 1998). Rowland (2000, p. 173) says that:

> Quasi-empirical teaching, inviting conjectures and the associated intellectual risks, is unimaginable if the teacher is not aware of the FTAs that are likely to be woven into her/his questions and 'invitations' to active participation. Redressive action dulls the sharp edge of the interactive demands that the style places on the learner.

In whole-class discussion, there is even more onus on the teacher to 'dull the sharp edges'. In the Grasshopper lesson, children tended to use vague language only to defend their own face. It is true that they did engage in FTAs and some redressive action and this is probably due to their sense of an equitable relationship with their peers. However, they generally engaged in FTAs baldly (e.g., making no attempt to respect Paula's face) in an effort to protect overtly the face of others (e.g., Kate's). There was more politeness in the exchange between Fiona and Brenda – probably because of the task involved. In both instances, my redressive actions were directed towards pupils who would not have been overly confident about their mathematical competence. I, as teacher, had to encourage their participation and, at the same time, focus on the development of mathematical thinking by the whole class, that is, I had to be attendant to the ethical dimensions of teaching mathematics (see Davis, 1997). The use of vague language – because it lessened threat to pupils' positive face and because it seemed to instigate mathematical argument by other pupils – was a means of doing this. The question of how it can best be exploited so that pupils do not develop incorrect mathematical ideas remains to be explored.

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ENDNOTES

1. Social distance is culturally determined and can relate to phenomena such as social class, occupation, religion, sex, age, race etc. (Parrillo & Donoghue, 2005).

2. Gender-preserving pseudonyms are used throughout the paper.

3. The Grasshopper problem is loosely based on Zeno's (490 B.C.) 'racetrack' or 'dichotomy' paradox although Zeno referred to a continuous journey.

4. Transcript conventions are: TD: the researcher/teacher (myself); Ch: a child whose name I was unable to identify in recordings; Chn: two or more pupils making utterance simultaneously; ... : a short pause; [ ]: lines omitted from transcript because they are extraneous to the substantive content of the lesson; //encloses utterances overlapping that of next or previous speaker; (*word*): transcriber's comments.