STUDENTS' USE OF GESTURE AND POSTURE MIMICRY IN DEVELOPING MUTUAL UNDERSTANDING

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In this paper I focus on observations made regarding students mimicking of each other's gestures in face-to-face conversation while problem solving. The data supports the idea that the students may use such gestures to subconsciously signal acceptance. Through talk, gesture, prosody, and intonation, combined with context, the interlocutors may develop a better connection with each other, enabling a belief in having achieved a shared understanding of each other's contribution. In so doing, they are positioned to develop their understanding of the problem. In addition, recordings of students working together on problem solving show evidence of posture mimicking during times of effective collaborative. The results suggest that teachers' recognition of such mimicry may help in knowing when to successfully intervene.

INTRODUCTION

In this report I address the question of what clues a teacher can look for as indicators of when to intervene in student group work. My consideration of the use of mimicked gestures arose on reviewing recordings of students engaged in mathematical problem solving. While not initially looking for such gestures it stood out that the students demonstrated mimicry of both gesture and posture, prompting deeper analysis. My initial question, arising from recognition of this phenomenon, was whether or not there seemed to be any relation between such gesturing and the students' ability to progress with the problem. If so, could this be an indicator of the group's progress? The evidence presented here indicates that a teacher can look for gesture and posture mimicry as guides to appropriate intervention timing.

THEORETICAL FRAMEWORK

The reform-based shift towards a sociocultural approach in mathematics teaching, associated with the Vygotskian school of thought, takes a view of human thinking as being essentially social. There has been a push to replace the traditional classrooms featuring an outspoken teacher and silent students with small groups of learners talking to each other and expressing their opinions in whole class settings (Sfard, Forman, & Kieran, 2001). The need for a teacher to carefully facilitate the discourse in these situations has been noted by many researchers (e.g. Sfard et. al, 1998; Jaworski, 2004). While there is much research on how a teacher can successfully intervene (e.g. Ding et al. 2007), knowing when to intervene has been a less discussed but is an equally important aspect of such facilitation. The close presence of a teacher can stymy the flow of the group, while at other times the teacher needs to intervene in order to encourage and give critical feedback.

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When students engage in mathematical problem solving in a group situation, there is a clear need for good communication to occur within the group if all participants are to gain from the collective experience. In everyday talk, gestures have been considered to be an integral part of communication (e.g. McNeil, 2005), and linked to speech in a semantic and temporal way. Radford (2009) notes that 'thinking does not occur solely in the head but also in and through a sophisticated semiotic coordination of speech, body, gestures, symbols and tools' (p. 111). Sfard (2009) also considers gestures to be 'crucial to the effectiveness of mathematical communication (...) to ensure that all the interlocutors speak about the same mathematical object' (p. 197). Other researchers (e.g. Goodwin, 2000) have examined the role of gesture on the sequential organization of conversation. Clark and Wilkes-Gibbs (1986) argue that interlocutors in a conversation create meaning jointly, with the aim of creating mutual understanding. The process is considered to be in constant need of attention since, at best, the interlocutors can only believe that they have understood what each other meant. Such a belief, however, may be sufficient to allow the dialogue to continue based on the situation. The impression, then, of students working together on a problem, is one of a continuous need to repair meaning and make connections to each other. If we hold the view that learning mathematics is akin to developing a special type of discourse (Sfard, 2001) then observing students participating in such discourses is important. If, in addition, the important feature of group problem solving is in the activity rather than the end result, then being aware of that activity is a more important outcome than viewing the final answers. If we are interested in the unfolding understanding within the group then we 'must focus on the various forms of signs that speakers make available to others as well as themselves. These signs comprise words, gestures, body positions, prosody, and so on' (Roth & Radford, 2011, p. 55). With this in mind, students taking on, or mimicking, each other's words and gestures may be an important and visible part of the process.

There is evidence that people mimic a wide range of behaviours, including postures and mannerisms (Chartrand & Bargh, 1999). The occurrence of mimicry in physical behaviour during mathematics group work has been noted by Gordon-Calvert (2001). Holler and Wilkin (2011) found that mimicry in co-speech gestures does occur and concluded that 'mimicked gestures play an important role in creating mutually shared understanding' (p. 148). Holler and Wilkin also found that mimicked gestures were used to express acceptance of group members, suggesting that such gestures were an important part of the conversational structure, even when such acceptance was not expressed verbally. Gestures were also found to be important in signalling incremental understanding, something the authors paraphrased as 'I am following what you are saying in an effort to reach shared understanding with you' (p. 145). This view supports that of Roth (2000) who notes that 'the human body maintains an essential rationality and provides others with the interpretive resources they need for building common ground and mutual intelligibility' (p. 1685).

A limitation of many gesture studies, however, is that they are focussed on tangible objects that one party is attempting to describe to another (e.g. in Holler and Wilkin case it is abstract shapes with figure like qualities). A similar limitation can be seen in the work of McNeil (2005), wherein participants are asked to recall scenes from a cartoon they have watched. Students working in a classroom are generally describing or talking about mathematics that is not a recollection of an action but rather an ongoing action. Some of the actions involved may be hard for a student to put an image to in quite such a dynamic way as McNeil's subjects. As a result, it might be expected that the gestures can often be more subtle, especially in the early stages of working together. In the case of mathematical problem solving the participants in the dialogue are trying to create a solution without one member having a privileged informational position (such as would occur if a teacher was present). In addition, any power relations within the group may lead to a particular student being granted a dominant starting position. Mimicked gestures may be an attempt by a student to reflect the mannerisms of his/her interlocutor with the aim of acceptance.

METHODOLOGY

The video clips were taken from a larger study in a school in which two classes of grade 5 students (aged 10-11 years) were videoed over the course of an academic year. A camera was set up and left unattended with the intent that neither researcher nor the classroom teacher was a direct part of, or influence on, the conversation. The school is located just outside of a large city in Canada and reflects a very multicultural population, with several ESL students. Economic background is not considered to be an obvious factor in the school. Recordings were made weekly while the students were engaged in problem solving and transcribed using a framework of Conversation Analysis. A second viewing was made paying attention to gestures and body language. As part of the transcription process the occurrence of mimicked gestures became apparent, and led to this reported study. Going through a collection of clips looking for a particular but different event can bring out common features that were not seen as significant on initial observation. On becoming aware of this mimicry in more obvious cases, a random selection of 20 of the recordings was re-examined explicitly for mimicked gestures and posture. The clips discussed here were selected as exemplary of different forms of observed mimicked gesturing and posture. For the purposes of this report, only clear cases of mimicry were included, where a hand gesture or body position was mimicked either collectively or within two turns at talk. A deeper analysis of smaller gestures over the period of the discourse may prove interesting, but in this case I focussed on what might be seen by a teacher in a classroom setting observing several groups from a distance

RESULTS

Table 1 illustrates a conversation between Gina and Susan. The problem concerns the change in area of a desk reduced to half its length but doubled in width. This example matches several recorded in this lesson and is of interest because, while gestures used

differed between groups, there was evidence of gesture mimicry between interlocutors when the students were able to make progress. In examples where the students were unable to make progress, there was no clear evidence of gesture matching. In this example Gina initiated by describing the desk using large gestures. Susan, in her adjacent turn, mimicked the dynamic gesturing of Gina in describing the table.

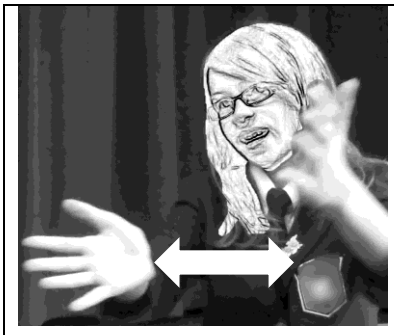
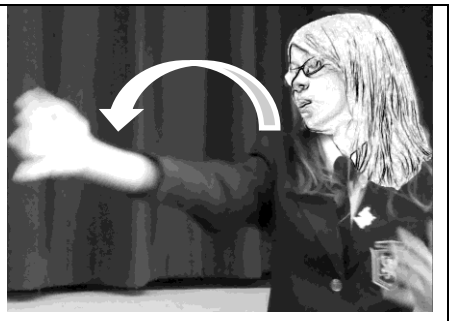
		
1.You're taking it in half	2. (..) and then ….	3. doubling one side, right?
		
4. You take some of it off	5. and you add it to	6. the other side (0.5)

Table 1: Gina and Susan describe the same process.

Table 2 also shows another example of gesture mimicry between two girls working in a group on a problem where they were asked to estimate the size of a bag required to hold a million dollars in $100 dollar notes. Panel 2 shows one girl, Jasmine, making an initial gesture which is then mimicked by Gina (panel 3) as they engaged in conversation. As the conversation develops Jasmine moved gradually closer to Gina until their gesture space became shared. They continued to mimic each other's gestures as they did so. During this time, the conversation was rich, and led to a clear progression in the problem's solution.

Table 2 also shows the group engaging in posture mimicry. The three girls adopted an almost identical posture once they started to work on the problem together. The male member of the group, Jason, seemed to be shut out by this common posture and found it very difficult to gain attention (panel 1) until he adopted a similar posture (panel 3). A male-female dynamic or other social situation, may account for this early barrier to Jason's inclusion, and he may not be aware of his own change in posture during the process, but in order to participate he appears to need to connect through posture first.

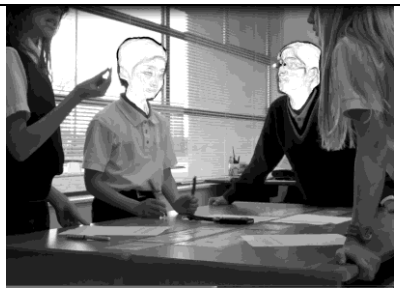
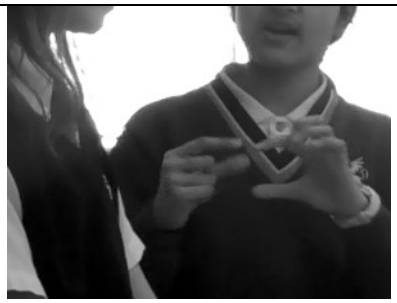
		
Common posture	Initial gesture	Gesture mimic
		
Repeated gesture	Adjacent gesturing	Closing gesture space

Table 2: An example of gesture mimicry within a group.

The group shown in Table 3 also showed signs of gestural mimicry, but in this case it was rare. Panel 5 illustrates the only clear mimicked gesture, a cutting motion used in conjunction with talk of division. A common deictic gesture, as shown in panel 3, seemed to serve the similar purpose of connecting the group while talking. While there were other gestures which were repeated by different members of the group, such as the spread fingers shown by the girl on the left side of panel 5, these may or may not be mimicked gestures since they occurred more than two turns after the initial gesture.

A second example of posture mimicry is illustrated in table 3. Panels 1 and 2 show three of the group have adopted a pose while the fourth student has become disengaged, initially standing while the others leaned, and then a different student sitting while the others stood. Throughout this problem session the group came together in this way, either in pairs, as a threesome, or all together whenever they were successfully sharing something about the problem (as indicated by the conversation transcript). The common posture varied, as shown between panel 1 and 2, but was generally shared by the members of the group. There were occasions when a student stepped back from this shared gesture space, as illustrated in panel 4. This was followed by a return to the group posture, perhaps when the student felt they had something to share, or had given up on an idea.

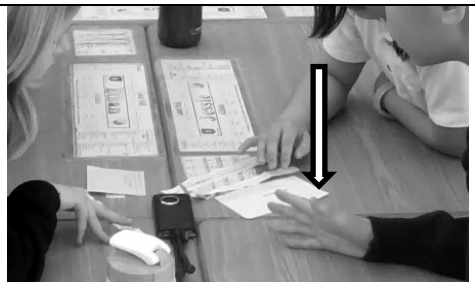
		
Posture mimicry	Participation involves mimicry	Deictic gestures
		
Independent thinking?	Mimicking a cutting gestures related to division	

Table 3: An example of posture mimicry within a group.

SUMMARY

Of twenty recordings analysed there were twenty-one clear incidents of gesture mimicry where students reproduced a given gesture exactly within two turns at talk. In four of the twenty recordings no clear gesture mimicry was observed. Only two recordings demonstrated no posture or gesture mimicry and in both of these recordings the students made little progress with the problem. In all cases gesture mimicry accompanied conversational adjacent pairs rather than an isolated utterance. Groups generally demonstrated several adoptions of posture mimicry and, in all but one case, this coincided with on-task work and resulted in progress with the problem. Gesture mimicry tended to be associated with actions, such as the description of shapes or objects, or mathematical operations such as divide, increase and counting. Very little mimicry was associated with student activities centred on calculating. In seven of the recordings the students were standing and in these recordings gesture mimicry was seen in six cases. These tended to involve a larger gesture space than when the students were seated. There was only one case involving three students mimicking gestures in succession. Generally, only pairs of students mimicked gestures whereas posture mimicking tended to involve more members of the group.

Overall, mimicked gestures clearly occurred but were not seen to be used extensively while students were working on the mathematical processes. Gesture mimicking was predominantly used, and seemed important, in establishing the situation in which the mathematics was framed. When gesture mimicking was observed as related to the actual mathematics, the gestures were seen to represent ‘cutting’ (as in division), ‘framing’ (as in framing a shape such as a circle), ‘counting’ (particularly the action of

skip counting using a bouncing motion) and a 'this-and-that' gesture where the flat hand was rotated at the wrist in a back and forth motion (as in referring to two cases). The predominant gesture seen during discussion about mathematical processes was deictic, with students pointing to the pages being working on. While these gestures often looked similar, there is not enough evidence to suggest mimicking, given the limited variations of pointing. Table 3, panel 3, illustrates this type of gesture.

This study indicates that posture imitation is an important part of group work. When students were working productively on a problem, or exploring an idea together, they tended to imitate each other's posture, whether standing or sitting. These common postures shifted throughout the working session and demonstrated enough variation to indicate that it was not merely coincidental. When a student opted out of the common posture they rarely added to the thinking of the group, or their attempted contribution was less well-received. In some cases it appeared that a student removed themselves from the group so that they could think through a situation independently as in these cases the student self-gestured (table 3 panel 4) before re-joining the group. In just over half of such cases the students made a positive contribution to the group. In other situations a student moved out of the group and showed no signs of thinking independently about the problem (i.e. using some kind of self-gesturing or facial expression); in none of these cases did the student return to offer anything new.

The study suggests that mimicked gestures can play a role in creating a mutually shared understanding of the situation within which the problem is set. The mimicked gestures may help to coordinate a mathematical process amongst the group so that mathematic actions are seen to be agreed upon. This communication of acceptance in a process has been seen as a core step in the process of reaching a shared understanding in dialogue (Clark and Wilkes-Gibb, 1986). While gesture-mimicking may not be significant in advancing the mathematical process itself, it may be seen by the interlocutors as an acceptance that the speaker is understood and seen to be making progress. Gesture mimicry is part of the collaborative process but relies on the belief of the interlocutors that they have interpreted each other's' intent in the same way. It must also be noted that such gesturing may be subject to interpersonal relationship issues. Students with a strong rapport with each other may be more likely to mimic gestures.

In conclusion, analysis of the recordings of student work provides evidence that students mimic each other's posture when being collaborative, and also mimic each other's gestures as a means to establish a common process. As such, mimicked gestures may play an important part in helping to establish a shared understanding amongst the interlocutors and assist in progression of the collaborative effort. Given this possibility, there is an opportunity for teachers' observing from afar to recognise good opportunities to intervene in order to best facilitate the group's progress. When a group is seen to mimic each other's posture or gestures then this may be an indication to stay away from the group and allow them to continue to develop their ideas. If there is no evidence of such mimicry then that may indicate a good time to offer support to the group. This result may also tie in with the findings of Gerofsky (2008), in being

another observable feature that students who are more confident of their ideas tend to use larger gestures.

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