WHO IS SPEAKING? AN EXPLORATION OF VOICE AND STYLE IN WRITING ABOUT MATHEMATICS CLASSROOMS

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All writing is, to some extent, fiction. Descriptive, factual writing involves creation and artistry, artifice in its construction. Even a written mathematical proof, designed to demonstrate truth, is in some sense a fictitious account of mathematical reasoning.

Writing (and reading) is perhaps the primary form of interaction among mathematics education researchers. Such writing includes research reports, essays, book reviews, and so on. Tusting *et al.* (2019) identified over 100 genres of writing that academics say they use, 40% of which were related to their research activities. These genres included journal articles and other forms of reporting, but also feedback to students, or slides for presentations (pp. 65–66). In mathematics education, writing about research for public consumption generally consists of factual accounts of research procedures, discussions of theory and prior research, and, very often, portrayals of mathematics classrooms. That is, we, mathematics educators, devote much time, effort and space (and ink) to describing students and teachers engaged in learning and teaching mathematics. These descriptions are, however, to an extent (although not entirely), fictions—carefully arranged creations, inspired by prior observation or experience.

Part of the art of writing about mathematics classrooms is in the arrangement of these accounts of learning and teaching. Indeed, the fact, or the claim, that learning or teaching mathematics happened at all, depends on this artistry. We do not "see" mathematics being learnt, we only see words on a page. As researchers, as authors, we learn to include appropriate textual elements so that, we hope, readers will see mathematical thinking or learning or understanding; we include, for example, quotations, descriptions, transcripts, images or examples of students' written work (Barwell, 2009). Given that this writing plays an important role in our work, it is curious that we do not pay more attention to how it is or could be put together.

On the last page of his book *Speaking Mathematically,* published more than 30 years ago, David Pimm (1987) asks "Why is the study of mathematics not more like the study of English? What would a theory of mathematical literary criticism look like?" (p. 207). I think Pimm has in mind here the study of mathematical texts in order to understand their organisation, rhetorical effects, style and so on. The question stems from the focus of the entire book—an examination of the claim that mathematics is a language. It is an intriguing question that has, despite the intervening decades, not been widely taken up. There isn't really a literary theory of mathematics—or of mathematics education, for that matter—despite both of them having an established "literature".

In this essay, I explore some aspects of the art of writing about mathematics classrooms. I am interested in the idea of a literary theory of mathematics education. I am in no position to propose such a theory, but I hope to offer some preliminary thoughts about a couple of aspects from which such a theory might eventually emerge. Informed by ideas developed by the Russian literary theorist, Mikhail Bakhtin, I will focus on the related notions of voice and style. If all writing is, at least in part, fiction, questions arise about the arrangement of different voices in the text: those of learners, teachers and that of the author, among others. The nature of such arrangements relates to style [1].

I take *Speaking Mathematically* as my sample text, a particular which will serve to make observations of a more general nature. It is a foundational work of mathematics education, still highly relevant (and recently reissued) and the starting point of my own journey in mathematics education. By way of counterpoint, I also make reference to the writing of Charles Dickens, whose work served as a canonical object of study for Bakhtin, and who had much to say about education, schools and teaching.

Murdering the innocents: the social dimension of writing about classroom life

> Thomas Gradgrind, sir. A man of realities. A man of facts and calculations. A man who proceeds upon the principle that two and two are four, and nothing over, and who is not to be talked into allowing for anything over. Thomas Gradgrind, sir—peremptorily Thomas—Thomas Gradgrind. With a rule and a pair of scales, and the multiplication table always in his pocket, sir, ready to weigh and measure any parcel of human nature, and tell you exactly what it comes to. It is a mere question of figures, a case of simple arithmetic.
>
> In such terms Mr. Gradgrind always mentally introduced himself, whether to his private circle of acquaintance, or to the public in general. In such terms, no doubt, substituting the words "boys and girls", for "sir", Thomas Gradgrind now presented Thomas Gradgrind to the little pitchers before him, who were to be filled so full of facts.

"Girl number twenty," said Mr. Gradgrind, squarely pointing with his square forefinger, "I don't know that girl. Who is that girl?"

"Sissy Jupe, sir," explained number twenty, blushing, standing up, and curtseying.

"Let me see. What is your father?"

"He belongs to the horse-riding, if you please, sir."

Mr. Gradgrind frowned, and waved off the objectionable calling with his hand.

"We don't want to know anything about that, here. You mustn't tell us about that, here. Your father breaks horses, don't he?"

"If you please, sir, when they can get any to break, they do break horses in the ring, sir."

"You mustn't tell us about the ring, here. Very well, then. Describe your father as a horsebreaker. He doctors sick horses, I dare say?"

"Oh yes, sir."

"Very well, then. He is a veterinary surgeon, a farrier, and horsebreaker. Give me your definition of a horse."

(Sissy Jupe thrown into the greatest alarm by this demand.)

"Girl number twenty unable to define a horse!" said Mr. Gradgrind, for the general behoof of all the little pitchers. "Girl number twenty possessed of no facts, in reference to one of the commonest of animals! Some boy's definition of a horse. Bitzer, yours."

"Quadruped. Graminivorous. Forty teeth, namely twenty-four grinders, four eye-teeth, and twelve incisive. Sheds coat in the spring; in marshy countries, sheds hoofs, too. Hoofs hard, but requiring to be shod with iron. Age known by marks in mouth." Thus (and much more) Bitzer.

"Now girl number twenty," said Mr. Gradgrind. "You know what a horse is."

(Abridged from *Hard Times,* Chapter 2, by Charles Dickens, first published in 1854)

Dickens's tenth novel, written as the industrial revolution gathered steam in England, addresses, among many other themes, competing perspectives on the nature and purpose of education and learning. These debates have never gone away. Gradgrind (a member of parliament, industrialist and school supervisor) represents, in contemporary parlance, a back-to-basics view of education that is still influential today. In this utilitarian view, the purpose of teaching is to fill children with facts so that they may be useful workers for the new mills and factories. Hence to know something, such as what a horse is, is to be able to recite factual information, as Bitzer demonstrates. In this back-to-basics classroom, Sissy is ridiculed for not being able to "define a horse" and of being "possessed of no facts". The journey from there to the contemporary idea that children not in possession of mathematical facts are seriously lacking (as are their teachers) is not much of a journey at all.

It is sobering to note the portrayal of mathematics in this excerpt. The reference to multiplication tables remains the iconic shorthand for back-to-basics mathematics teaching to this day. And the reduction of the value of all things to measurement and "arithmetic" remains, in my view, one of the major flaws of neoliberal capitalism and a contributing factor to the environmental crisis. We continue to debate the "best" way to teach mathematics and to critique some uses of mathematics in our technological, post-industrial consumer society in terms that were already circulating more than 160 years ago.

Dickens is a great satirist and his novels are rich in the voices and discourses of the times. The title of the chapter from which the opening extract is taken signals Dickens own critical stance: Gradgrind's treatment amounts to a murdering of innocents, even a murdering of innocence, as children's creativity and their rich experiences, are systematically dismissed in preference for approved, scientific facts. As the novel unfolds, Sissy comes to represent an alternative view of education and learning, one that involves creativity, imagination and human relationships. She helps Gradgrind understand that his rigid adherence to facts is harmful to his family. *Hard Times* prefigures the educational debates of our own times, Dewey's emphasis on experience on one side, Skinner's still subversive reduction of learning to a programming of responses to stimuli perhaps an extreme example of the other.

Hard Times illustrates several ideas fundamental to Bakhtin's theorisation of language, of novelistic discourse, and his broader reflections on the nature of human consciousness. Language, for Bakhtin, is intrinsically social. This means, for example, that every utterance, including in written form, is addressed to someone, and is part of a continuing exchange of utterances. Meaning arises from this dialogic interchange, rather than from the words themselves. Indeed, Dickens seems to be satirising the idea that the meaning of a word like horse might reside in its dictionary definition, rather than in knowing and working with horses, and talking about horses. One version of education on offer, then, aligns with a formal view of language based on definitions (Barwell, 2005). Dickens challenges both this idea of education and this idea of language.

More fundamentally, every utterance is itself a site of interaction between various forms of language circulating in society. Thus, even if we identify Dickens as the author of the above passage from *Hard Times,* his text is entirely composed of forms of speech observed or experienced by Dickens, or else carried by the language itself, and employed with greater or lesser degrees of deliberateness. The various ideas and tensions about education, for example, are not simply reported or inserted by Dickens; they are part of the social fabric from which Dickens creates his story. This social fabric includes the highly stratified nature of nineteenth-century English society, as reflected in different forms of social language. Sissy Jupe, for example, refers to her father as belonging "to the horse-riding", which Mr. Gradgrind revises to "a veterinarian, a farrier and horse-

breaker", suggesting an ideology of education as "revising" children by revising their language. In many respects, this is still true today (for an example, see Barwell, 2016), and is perhaps an integral part of any ideology of schooling.

Dickens's use of multiple voices to comic effect was discussed by Bakhtin (1981) in his lengthy examination of novelistic discourse. In the extract from *Hard Times,* we hear prevailing and contrasting ways of talking about education, occupations and animals. These voices are portrayed through dialogue (Gradgrind's interrogation of Sissy and Bitzer), internal thoughts (Gradgrind's way of mentally introducing himself), reported voices (Sissy's account of her father's occupation), as well as Dickens's own authorial voice. Bakhtin traces how Dickens frequently uses the device of "another's speech in another's official-ceremonial language" (p. 304). Bitzer, for example, speaks like a dictionary or encyclopedia, while in the first paragraph of the extract, Gradgrind is described as though being formally and approvingly presented (the use of "sir"—we can easily imagine the hand holding the lapel in the manner of a barrister) at some ceremonial occasion. For Bakhtin, the comic effect depends on the inherent heteroglossia of human language. Dickens does not *create* this diversity of voices; he *exploits* it. In novelistic discourse, it is the hybridisation of voices that is crucial, so that an utterance that is ostensibly uttered by one character (or by the narrator), in fact contains other voices. In the ostentatious, exaggerated presentation of Gradgrind, for example, we also hear Dickens's satirical voice. In Gradgrind's revoicing of Sissy's description of her father, we hear the social stratification of language and society, as well as the hierarchy of everyday and educated or scientific discourses. Dickens is at once reproducing and critiquing some of the diverse ways of talking about education of his time. Bakhtin shows us how this portrayal exploits the heteroglossia of all human speech to do so.

Dickens's orchestration of different voices is a feature of his comic style. Bakhtin (1981, pp. 283–284) emphasises how style involves a relationship between the text and the discourses of wider society: "the internal politics of style (how the elements are put together) is determined by its external politics (its relationship to alien discourse)" (p. 284). In the case of *Hard Times,* Dickens's satirisation of utilitarian approaches to education is constructed from elements of educational discourses in Victorian society. Dickens was conscious of his audience (he wrote *Hard Times* in instalments published in his weekly *Household Words* in order to boost sales) and we must assume that he relied on his readers recognising the different forms of speech included in the story, for if they did not, the satirical effect (and the boost to sales) is lost. Particular styles can be understood by examining the particular way in which they place different forms of speech in relation, for a particular audience. The question of who is speaking (and to whom), becomes central to an understanding of how writing works.

Who is speaking in Speaking Mathematically?

Speaking Mathematically is not a comic novel, although it does begin with a joke. The joke is quoted from a 1950s BBC Radio comedy series (*The Goon Show* – repeats are still broadcast on BBC Radio) and has one of the characters speaking mathematics "like a native". The joke serves to introduce the main focus of the book in "another's voice". By quoting a source from popular culture, the idea that mathematics is a language gains validity; the book will not explore some pet theory of its author, but an idea of sufficiently wide circulation that it features in a popular comedy show. The joke is, therefore, an example of multivoicedness: it is voiced by the actor, Harry Secombe (having in fact been written by Spike Milligan), but is also voiced by David Pimm, who writes it into his text. These three voices intermingle.

Academic writing (in education, at least), including writing about mathematics classrooms, involves a lot of multivoicedness, a form of intertextuality in which intentions are explicitly expressed through the words of others. We quote other academic texts or mathematics classroom transcripts, for example, and more subtly reproduce fragments of academic discourse, mathematical discourse, educational discourse, and others. Intertextuality is inevitable, but the particular ways in which different voices are combined serves to define a particular style and, more broadly, a culture of writing within a particular field, along with an associated relationship between the organisation of voices within a text to an external politics. We can immediately see, for example, that explicit quotation of "external" voices is a distinguishing feature of writing about education that is mostly not present in novels. Dickens draws on many such voices, but for the most part, they are not marked as such, but are voiced by the characters. In both cases, however, these external voices are important in the relationship between internal and external politics of style.

In *Speaking Mathematically,* we see that some of the same competing educational discourses that were the target of Dickens are clearly present 130 years later. Pimm cites a William Taylor (1984):

> Take, for example, the way in which contemporary educational discourse has become politicized. Words such as "child-centred", "unstreamed" and "creativity" on the one hand, and "basics", "core curriculum" and "excellence" on the other have become the property of left and right respectively, serving to label the political and social affiliations of those who employ them. (p. 8, cited in Pimm, 1987, p. 76)

Pimm uses this quotation to highlight the importance of being aware of different discourses. In effect, although it is not explicitly stated, Pimm is not quoting Taylor to simply reproduce Taylor's point of view, but rather to illustrate how all language is inscribed in different discourses, and as authors we need to be aware of how our choices can, deliberately or not, draw on these underlying discourses to convey additional meaning, including of a political nature. Taylor's complaint is naïve, in the sense that it is in the nature of language that words are never neutral. The comic effect of Dickens writing Gradgrind would be entirely lost if we could not read more into words than their basic declarative sense. The Taylor quote does not create a comic effect, but instead introduces contemporary ideas from the broader politics then surrounding mathematics education (as well as a response to them in the reader).

Speaking Mathematically contains many instances of "traditional" teaching, if not quite fully Gradgrindian,

nevertheless oriented to facts and procedures, and thus inscribes itself into the continuing politics of education. Many of these instances involve examples or quotations, often with a humorous dimension. For example:

> One difficulty peculiar to the teaching situation occurs when teachers ask questions: not to discover something they did not know, but in an attempt to ascertain whether or not the pupil asked knows it. The existence and predominance of this […] purpose for questioning in school can result in some peculiar exchanges. A history teacher, who had forgotten, asked, "How many wives did Henry IV have?" A diffident pupil hesitantly replied, "Er, was it three, Miss?" The teacher replied in an annoyed tone, "I don't know. Why do you think I'm asking?" (p. 55)

> Words are to be found in dictionaries, suggesting that they provide an appropriate unit for the discussion of meaning. It is commonplace to hear a teacher in a classroom asking pupils if they have understood the meaning of a particular word, and possibly trying to test their understanding of it by requesting either a formal definition or a paraphrase of its meaning. (p. 8)

In both these examples, recognisable classroom activity is reported in a somewhat unspecified way. The first is attributed to "a history teacher", with no additional information about the source, location or person. The vignette, works, however, not as directly reported speech, but as a disruption of the expected practice of a teacher already knowing the answer (or an answer, at least) to the question they are posing. The second example is more general still, reported as "commonplace" (not unreasonably, given the dismissal of Sissy and the supposed success of Bitzer). This indirect reporting is a recurring feature in *Speaking Mathematically.* In both cases, the reader is invited to recognise the situation and perhaps also to have or to develop a position with respect to such practices, or at the very least to question them. These examples illustrate, in the context of Pimm's book, Bakhtin's point about the politics of style. Pimm uses indirect examples that readers are expected to recognise; they are part of educational discourse at the time the book was written.

The book also contains many directly transcribed examples. In one of my favourites, Pimm cites an exchange from "a lesson involving ten-year-old pupils" (note again the generic presentation) to examine the use of the pronoun "we" in mathematics classroom talk. The following snippet gives just a flavour of it:

Teacher	Six take away seven. Can you do it?
Pupil	No.
Teacher	No. Why can't you do it?
Pupil	Cos it's … bigger number on the bottom.
Teacher	All right. Because six is smaller than seven. All right? So what do we do then? We go to the …
Pupil	The … the units.
Teacher	No. What column's that? The tens column. Right. And what do we do there?

(Pimm, 1987, p. 65, formatting modified)

The example is once more designed to spark recognition on the part of the reader—who hasn't seen a mathematics class like this? It concerns the application of an algorithm and includes examples of the kind of talk that adults often still retain decades later to guide them through it ("six take away seven; can't do it"). In re-presenting the exchange of voices, Pimm's critical eye is caught (or is it the reader's eye that he catches?) by the use of "we", leading to the wonderful question, "Who is 'we'?"

The text now offers a tour of different situations in which "we" does not refer straightforwardly to "us". These examples include Joyce Grenfell's satire of a schoolmistress (probably now long forgotten, she would not have been out of place in a Dickens novel). For Pimm, this discussion highlights the use of "we" in indicating broader social conventions, including, in this case, mathematics classroom conventions. Again, there is an internal politics of style, in which a carefully selected transcript stands for a common mathematics classroom practice, with connections made to analogous situations, all of which rely on a degree of recognition by the reader. These "commonplace" forms of mathematics classroom talk, or of ways of talking about mathematics, are set against alternatives. It is arguably the interaction of these different discourses that drives much of the book.

One aspect of the art (or artifice) of this kind of writing is the presentation of the transcripts [2]. The extracts are polished, abstracted representations of human interaction, and as such are somewhat simplistic and partly fiction, not in the sense of being invented, but rather the sense that as representations, the reader must do some inventing to fill in the gaps. The use of ellipses to mark pauses in the above transcript works if the reader has spent time in mathematics classrooms. The teacher who leaves a space at the end of a sentence ("We go to the…"), perhaps with a rising intonation and a particular facial expression, indicates that this is where the students should supply the next words. As Pimm points out, this is a common feature of classroom talk, but relatively little of it is captured by the three dots; like the students, the reader must fill in the blanks [3].

Moreover, many of the transcript examples provided by Pimm are quoted from other published sources. He reproduces sections from transcripts appearing in Erlwanger's (1973) classic paper in which he traces the non-standard but remarkably consistent way in which a student, Benny, works with fractional arithmetic questions. Hence we have Pimm, quoting Erlwanger's record of Benny's utterances as part of Pimm's discussion of how students interpret written mathematics.

Transcripts, then, are particularly interesting sites of multivoicedness, with the voices of once-real participants (speaking to us now from a lifetime ago), as rendered by a transcriber, and intertwined with Pimm's authorial voice inserting these exchanges into his text *and* the reader's own voice, reading and making sense of the words, drawing on the full depth of their experience and filling in a lot of

blanks, just as readers of Dickens's many examples of schoolroom talk must also do [4].

This constant interplay between voices and, in particular, between one's own voice and another's is, for Bakhtin, a basic property of human interaction from which meaning arises and is its source. That is, meaning comes not from combining distinct and prior meanings, but emerges in the interplay across these boundaries:

> La culture même, pour Bakhtine, « n'a pas de frontières, elle se situe entièrement sur les frontières, ses frontières passent partout, en pénétrant tous ses éléments ». Ainsi, aucun phénomène de la culture ne serait jamais neutre, mais se définirait toujours par rapport à quelque chose d'autre. (Velmezova, 2011, § 19) [5]

Thus, in reading the above transcript, or the earlier indirect accounts, the meaning, style and culture of writing emerge on the boundaries between the reader, the author and the other voices invoked, as well as that between the internal and external politics of style.

In *Speaking Mathematically,* Pimm explores another kind of boundary related to audience: the idea that writing (and speaking) can be for self or other. He is referring to the writing the students may do in their mathematics classes, but the point applies just as well to researchers writing about these classes. Arguably, both purposes are always present, it being a matter of degree or emphasis as to which audience is most in view. The scribbling we may do in working out a mathematics problem might primarily be writing for self, but we may then at some point show it to another. Similarly, writing for another such as a teacher might also serve as writing for self, as a working out of ideas. *Hard Times* was one of Dickens's more programmatic novels, organised more around a polemical intent than strongly developed characters (Tomlin, 2011). As such, we can imagine it served as a working out of ideas about education for Dickens.

Pimm is clearly working out ideas, but is equally clearly engaged in a dialogue with several other authors whose work is referred to regularly throughout the text. René Thom, is one frequent interlocutor:

> According to Thom, a prominent contemporary mathematician, the construction of meaning rather than the question of rigour is the central problem facing mathematics education. How is such meaning to be constructed? (p. 7)

> How might such a conception of mathematics [as social in nature] be conveyed through a written medium, with the reasons for particular conventional agreements being communicated and explored? Any proposal would need to contend with the phenomenon of text authority alluded to by Thom when he claimed that "as soon as one uses a textbook, one establishes a didacticism, an academicism, even if the book be so written as to promote individual research". (p. 73)

> "Every mathematician endowed with any intellectual honesty will agree that, in each of his proofs, he is capable of attaching a meaning to each of the symbols he manipulates" (Thom, 1971). […] School teaching at all levels seems to have accepted the goal of symbolic algorithmic fluency, without sufficient concern for semantic re-integration. (p. 175; mathematicians seem to have been exclusively male in 1971)

These excerpts capture part of Pimm's dialogue with the writing of a mathematician and illustrate a different aspect of the politics of style. For in mathematics education, as well as prevailing popular discourses about mathematics teaching (back-to-basics, and so on), there are also discourses originating within the community of mathematicians. These excerpts illustrate another feature of Pimm's writing; he juxtaposes quotations or references to others' ideas with questions. This method gives the feel of a dialogue, but is, of course, a stylistic device, since Pimm is writing both parts (much like the transcripts). It is effective in creating space for the reader to add their voice, what Bakhtin sometimes calls the "responding voice" that is, in fact, ever present.

A final feature of *Speaking Mathematically* I will highlight is the attention given throughout the book to the way mathematical communication relates to mathematical ideas. For example, in a section on the mathematics register, Pimm discusses how the phrase "spherical triangle" might have come to make mathematical sense, given that an understanding of the two distinct words might suggest a contradiction, or at least an incongruence. He uses this example to illustrate the importance of analogy in extending established mathematical ideas into new areas. In this case, the idea of a triangle on a plane surface is extended to a similar-looking form on the surface of a sphere. Some mathematical work is necessary to complete the analogy and render it coherent; in particular, straight lines are recast as great circles.

This process of linguistic innovation reflects how language systems work. Through use and over time, language is in continual evolution displaying a tendency to diversify that Bakhtin likens to a centrifugal force. There is not, therefore, one mathematics register, but multiple such registers, relatable to particular times, groups of people, domains of mathematics and even individuals. And these registers are constantly changing. In pointing this out, Pimm is reaching back into the history of language and of mathematics to myriad voices whose traces remain in the language of mathematics, long after their human sources have disappeared. The story of spherical triangles is largely reconstructed, but at some point (or points) in time, someone uttered the phrase "spherical triangle" and their voice remains with the words to this day, mingled with Pimm's own voice.

Finding the authorial voice: singing with the choir

Todorov (1984) offers a lovely summary of a key Bakhtinian idea: "A single voice can make itself heard only by blending into the complex choir of other voices already in place" (p. x). For those joining the field of mathematics education, learning how to write about their research, experiences and ideas and make themselves heard can be challenging. It can be tempting to adopt a reference-laden, third-person reporting style that leaves little space for the reader to participate, and even less space for the author. Would-be contributors to *For the Learning of Mathematics* have often discovered,

sometimes to their surprise, that a more personable, engaging and less cluttered style is preferred. Nevertheless, each journal has its preferences and traditions and all have their place.

At the very end of *Speaking Mathematically,* Pimm writes "one goal of mathematics education should be to ascertain and explore ways of seeing mathematics which provide insight into its learning and teaching" (p. 206), and that the study of mathematics in terms of language can do just this. In response, I note that the fruits of such explorations must themselves be communicated in some form, and that while conference presentations, professional development workshops, informal conversations or, increasingly, videos are all ways of sharing or developing insights, writing remains the predominant channel. There is, therefore, a purpose to examining how writing about mathematics classrooms can be done, since, as with all human communication, it can be done in many and varied ways, including in many journals with their preferences and traditions. What difference do these differences make?

Speaking Mathematically is a fine example of stimulating writing about mathematics classrooms and the learning and teaching that goes on within them, offering many insights and questions that are likely to be generative for readers. As a particular example, it serves to illustrate some general features of writing in mathematics education. It draws on a variety of sources, including quotations from research texts, excerpts from transcripts of mathematics classroom interaction (often themselves quoted from research or professional development texts or videos), excerpts from mathematics textbooks or problem sheets, and excerpts from students' written work. It also draws on indirect accounts of mathematics classroom happenings or interactions. And it draws on the long history of the language of mathematics and of mathematics education. Thus, multiple voices are present and interanimate the text, in dialogue with Pimm's own voice. The sense of dialogue and writing for self is brought about by an interweaving of examples and quotations with questions and observations. He makes himself heard, as must we all, by joining the choir

The particular ways in which different voices are arranged and juxtaposed in the book is related to a broader set of external politics, including prevailing popular discourses about education and mathematics education, as well as discourses circulating within professional mathematical and mathematics education communities. We can hear ideas about education that seem to have been part of educational debate since the time of Dickens; the master framing of education as facts and definitions versus imagination and experience, which Dickens satirises but also reproduces. We see it in *Hard Times,* and we see it in many of the examples in *Speaking Mathematically*, as well as in much current debate and in the interminable "math wars" in North America. Indeed, one of the challenges for anyone writing about mathematics education is how to do so in a way that escapes this framing, or at least stays in the borderlands where meaning-making is still possible.

Part of the response to this conundrum is to think about style within a broader literary theory of mathematics education. Such a theory or set of theories could contribute to deeper interrogation of how research in our field is reported and presented, encouraging us to think more about questions of voice, and the politics and ethics of research writing. There is a form of authority (and author-ity) at play when researchers decide to quote a teacher or a student. A literary theory of mathematics education, then, might also be a way to more fully explore and recognise the craft of writing about how we do research and of writing about the people who participate in our research.

Differences in style orient the writing to different audiences, portray participants in different ways, position and connect the text with respect to prevailing discourses and debates, and create or limit the space for readers to insert themselves. Different styles may lend themselves to sharing, invoking or triggering different kinds of insight or awareness about mathematics or mathematical thinking. In *Speaking Mathematically,* Pimm's style invites the reader to join in the dialogue and think for themselves. This reader, at least, has endeavoured to do so since first reading it in 1992.

Notes

[1] Even mathematical texts have style (Pimm and Sinclair, 2009).

[2] See Ochs (1979) for a classic discussion of the constructed and constructing nature of transcripts in research.

[3] Pimm (1987) seems to acknowledge this point; on p. 58, he invites the reader to view the original video since the transcript captures so little of the richness of the interaction.

[4] There is a curious rhetorical effect by which transcripts, which ostensibly represent an actual interaction, but can only ever partially capture it, become entire in themselves, so that authors refer to features in the transcript as evidence for their claims about mathematical thinking (see Barwell, 2009). On p. 135 of *Speaking Mathematically,* Pimm does this, in pointing to "the above transcript" to support his point. I have probably also done this myself.

[5] "Culture, even, for Bakhtine, 'has no borders, is found entirely on the borders, its borders are everywhere, penetrating every aspect of it'. Thus, no cultural phenomenon would ever be neutral, but would always be defined in relation to something else." (My translation)

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