Communications

A case of you: remembering David Fowler

DAVID PIMM

David Fowler was not a major contributor to *For the Learning of Mathematics*; in fact, he published precisely two pages, in issue **11**(2). He was not a designated mathematics educator either, although he did write two short pieces for *Mathematics Teaching* and a number for the *Mathematical Gazette* [1]. So, why might reading even a little about him be of potential interest to readers? What might he have to offer 'for the learning of mathematics'?

I have framed this brief appreciation in terms of influence; specifically, his influence on me as a teacher, both in person and through his writing (most of all his attempted rewriting of much of the history of Greek mathematics). But I will also try to make some second-order remarks about the influence of teachers (and start by invoking the reversed claim, that 'when the student is ready, a teacher appears').

In the opening essay of his wonderfully-titled quartet, *Untaught lessons*, Jackson (1992) explores his sense of being indebted to a childhood (mathematics) schoolteacher, Mrs Henzi. In the preface to this collection, Jackson writes:

> This book is about the influence teachers have on their students [...] what we learn from our teachers about ourselves and others, and about life in general. Some of these "lessons," most of them "untaught" in the sense of not being part of the teacher's explicit agenda or lesson plan, take the form of the things we remember about our teachers long after we have bid them adieu. (p. xi)

From his musing about what he recollects of Mrs Henzi's class and practice, Jackson passes seamlessly into an eloquent philosophical discussion of scepticism, its truths and its attendant risks before, in the end, opting for the importance of both acceptance and acknowledgement of a presumed debt of influence.

David Fowler taught me (and many others) mathematics as an undergraduate at Warwick University during the early 1970s. He was a mathematician turned historian of mathematics [2]. David also subsequently became a friend whom I would visit whenever I could. Stories from and about him abound (as does his internet correspondence on the history of mathematics network) and are, I am sure, being traded even more since his recent death in April, 2004.

Because of him, I came to know some things worth knowing about how mathematics, its teaching and its history are done (and undone). For instance, I first learnt linear algebra from him in the spring of 1972 and, in a subsequent course on geometric analysis, he unknowingly resolved a question I had had about the relation between the f(x) and the 'dx' in an integral and that between the 'dx' and 'dy' in a double integral. I also recall David's explicit aesthetic of 'powerful definitions and simple proofs', illustrated by Stokes's theorem being made almost a computational triviality – see also Spivak's (1965) *Calculus on manifolds*.

In the 1970s, Warwick was in the thick of the development of catastrophe theory and the subsequent contention around its application [3]. Soon after the attack by Sussman and Zahler (1978) appeared in *Synthèse,* I asked David what he thought, how he would respond; his comment was, "I'd simply suggest they read it all again, with a little more sympathy".

David's historical voice in print was measured, engaged, sceptical yet always sympathetic – warm, sympathetic scepticism characterised his approach to the intellectual world. Like Jackson, he was aware of the limits to and tenuous nature of human knowledge, especially about ancient Greek mathematics. Not for him Hilbert's compulsive cry, "Wir müssen wissen, wir werden wissen". After completing his major work on early Greek mathematics, *The mathematics of Plato's academy*, David remarked to me, "I am only now beginning to get a sense of what it means to claim to know something".

In the preface to his small, insufficiently read book *Introducing real analysis*, David (1975) wrote, "I, the author, address you, the reader, in a way that may be considered unseemly by my colleagues" (p. 8). I did not know [4] then that questions of audience and voice in mathematics, specifically the connections between verb tense and pronouns, would be a place I would be actively exploring thirty years later. Recently I have been writing about Bourbaki, drawing on conversations I had had with David twenty-five years past (see Pimm, 2004). Influences are far more visible when looking back.

Yet these fertile coincidences comprise a significant part of influence, whether marked at the time or not. For instance, Fowler (1999, p. 366, footnote 12) acknowledges a debt to Knorr 'for pointing this out to me in January 1991 in a train somewhere between Verona and Venice'. Netz too [5], in his striking work *The shaping of deduction in Greek mathematics*, writes:

> David Fowler had to wake me from my dogmatic slumbers [that definitions in Euclid are not neatly and sequentially numbered] [...] the text of the definitions appears as a continuous piece of prose, not as a discrete juxtaposition of so many definitions. (1999, p. 94)

There is something for us all to learn in this public marking, valuing and simple recollection of the intellectual gifts of others. To teach you need to feel generous towards the person you are trying to teach. David gave his time, passion and wisdom with enormous generosity: he was an adventurous, yet careful scholar and a most caring man. His remembrance piece for Knorr, published in 1998 in *Historia Mathematica* is a profoundly moving piece of academic scholarly writing.

Influence is about a flowing in, whether conscious or not, whether deliberate or not, whether willed or not (on either's

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part), and then turning this not-me into me. The title of this piece could have come from a three-page article – entitled 'A case for non-intervention' – that David published in 1995 in the *British Medical Journal* about the brain tumour that first forced itself upon his awareness the year before [6]. I recommend this article, not least because of what David conjectures about his 'uninvited visitor's' influence on his historical work.

But, in fact, 'A case of you' is the title of a song by Joni Mitchell (from her album *Blue*), a song I used to listen to at Warwick between linear algebra lectures. It contains the words:

> part of you pours out of me
> in these lines from time to time.

This is how I see an important facet of influence; namely both hearing and recognising another's voice inside your own. I say things, I write things and, at the time or later, I may realise their provenance. And now, for me at least, that is the main place David's voice is – inside. He was and remains one of my most important teachers. I both chose him as my teacher and had him thrust upon me, by circumstance. I remain interested in the way teachers 'appear' and the use we make of them. On a good day, the world gives us what we need.

Notes

[1] For a full bibliography of his academic writing, see: www.maths.warwick.ac.uk/maths/papers/dhf.html.

[2] Fowler's twenty-five year engagement with Greek mathematical history began by him being given a copy of Knorr's (1975) *The evolution of the Euclidean Elements* to review for the *Mathematical Gazette*. In a brief autobiographical epilogue to the revised second edition of *The mathematics of Plato's Academy*, he also subsequently tells what "changed my attitude towards early Greek mathematics from that of an amateur dilettante to someone obsessively gripped by the fascination of the topic" (1999, p. 402).

[3] Fowler was the English translator of Thom's (1975) *Structural stability and morphogenesis.*

[4] In reading for this piece I found a related passing reference in Netz's chapter near to one of David's (which, in an uncomfortably fitting way, was the last piece David was to publish on Greek mathematics) in a volume dedicated to Knorr's memory – this time a reference to absent differences between Greek constructions by analysis and by synthesis:

> Even without any second-order pronouncements [*i.e.*, meta-commentary about purpose or intention], there could have been suggestions of a sequence of discovery, *e.g.*, using a past tense in the assertions of the analysis as opposed to the present tense in the assertions of the synthesis, or using a first person active for the constructions in the analysis as opposed to the third person passive for the constructions in the synthesis. But nothing like this happens, everything is in the present tense or the third person passive suggesting the impersonal work of mathematical necessity rather than the accident of authentic discovery. (2000, p. 146)

[5] See also Netz's 1998 article 'Greek mathematical diagrams: their use and their meaning' in FLM **18**(3).

[6] John Fauvel, another UK historian of mathematics likely more familiar to readers of this journal, whom David Fowler singles out for particular acknowledgement in the second edition of his book on Greek mathematics, and who (like Knorr) died only in his early fifties, wanted to be credited with a co-authorship of a medical paper that featured his liver, the organ that eventually killed him.

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From the editor

LAURINDA BROWN

What am I doing here? When there is an *Editorial* you can still expect that to be placed on page 2 but there are a number of pieces of information that I want to pass on in this issue and it felt like those were best placed as a *communication*.

Firstly, from now onwards, Elaine Simmt at the University of Alberta is taking over the role of Managing Editor for the journal and the office will move to Alberta from Queen's University, Kingston. The distribution of **24**(3) will be under new management. There are new e-addresses, in the administrative notes in this issue, to one of which you will now submit your articles, and to the other you can ask any business questions such as ones related to subscriptions. We are all looking forward to as smooth a transition as possible.

Whilst welcoming Elaine to her new role I am mindful of the work carried out at Queen's by Geoffrey Roulet as Managing Editor and Bonnie Knox as the administrator. Having only relatively recently taken over as editor of the journal I wish to record publicly my thanks for their hard work and support, also mentioned by David Pimm in his final editorial piece (FLM **23**(2), p. 2). This will be the last issue that they will have responsibility for distributing.

In FLM **23**(2), facing David Pimm's *Editorial,* is an article by Marion Walter entitled 'Looking at pizza with a mathematical eye'. Marion e-mailed me saying that she had received a *communication* wondering:

> in what way the goat problem "is EXACTLY" (FLM **23**(2), p. 9) my problem.

Her e-message continued:

> Of course it is not, especially as I had more than one problem and [it] is not exactly any of them. I think it [the statement] would be rescued if it read 'exactly your KIND of problem' which would be true. I wonder if anyone else caught that. Are you willing to print a correction?

Obviously I am willing to print such comments and, in fact, welcome them. Again, the *communications* section seems the place for corrections, rather than in an editorial. For those of you who read Marion's article with interest, you might like to know that the May issue of *The College Mathematics Journal* (Mathematics Association of America, MAA) included, in its *Media Highlights* section, what Marion calls "a nice capsule of the article".

The *communications* I would encourage most strongly are the continuing discussions of articles that have appeared in the journal. The next piece in this section is a reply from Dave Baker and Brian Street to Richard Barwell's comment in FLM **24**(1) on their original article in FLM **23**(3). I am interested in other readers' views on this issue but Richard will have to send any more comments he might have directly to the authors since I would like to broaden the discussion.

I have been exploring, in response to comments from authors, whether it would be possible for the journal to be in particular citation indices. The process leading up to inclusion is usually quite long and there are criteria that have to be met. Most of these are now simple to demonstrate, such as 'timeliness' (*e.g.* for three consecutive issues the journal is distributed when expected) and 'peer review systems in place' (the journal now has a two-stage procedure that seems to be working well to support authors in developing their writing). There are other criteria, however, that seem more problematic. There is a requirement that there are abstracts and keywords included with each article, possibly presupposing that the articles are all research papers, whereas the articles in this journal are not generally of this form. I would value your comments as readers to add to the discussions of FLM board members at the Canadian Mathematics Education Study Group meeting in May (you will be reading this in the following July) and between members of the Advisory Board.

I am looking forward to receiving articles or communications related to how you have used any of Gregory Bateson's ideas in your research in mathematics education or teaching.

Throughout this issue I have used quotations of key ideas from his writings that I hear mentioned in discussions to fill the spaces between articles. If you have no time to write an article or *communication* I am happy to receive suggestions for other Bateson quotations that I would use as fillers in **24**(3). In discussions, comments, like 'That's Bateson's blind man and his stick', or 'the map is not the territory' or 'that's a difference that makes a difference' are part of some people's shared histories, but they are also a shorthand that must seem mysterious to those not having read the originals.

When I was thinking about what image to use for the front cover of this issue I was influenced by the idea of *difference*. In looking at the three contrasting images on page 24, I was struck, as if for the first time, by how surprising it is and beautiful that, as triangles enlarge on a flat surface, their angles remain the same. The fact that the photograph already had the triangles coloured in yellow made the connection easier to make to recognising the cover image.

At a PME conference in Brazil in 1995 I went to a discussion group focused on ideas around 'the embodied mind' (run by Raphael Nùñez and Laurie Edwards) where there were discussions of the works of Maturana and Varela (*e.g.* Maturana and Varela, 1998; Varela, Thompson, Rosch, 1992) amongst others. I felt comfortable with the ideas immediately. It was not until a member of the 'audience' said 'Isn't that like Bateson's blind man and his stick' that I made the connections back into a book that I had read in 1972. The ideas had simply become part of me. The influence which David Pimm describes in the previous *communication.*

I was at a lecture that Mary Catherine Bateson gave at the Tavistock Institute in London last week and one of the discussants mentioned that ideas such as self-regulation were similar to Maturana and Varela's use of the word autopoiesis. This is not perhaps surprising since Maturana and Varela contributed along with Bateson to some of the conferences organised by William Irwin Thompson, the Lindesfarne Fellows conferences. They worked together:

> Ideas, like grapes, grow in clusters. People like to hang out together because they can feel their ideas growing fuller and richer on the vine. This book is just such a cluster of ideas that comes from a small group of people who have been hanging out together for the last six years [...] each person began to recognize that there were dimensions of his or her own work that did not show up when one looked into the mirror built into the vanity of one's private work, but did appear when one saw one's work described and extended in the ideas of a friend. (Thompson, 1987, p.7)

I would be happy to include explorations of your use of these other authors' work in your research into mathematics education or your teaching. I am not intending that there will be one special issue for such writing but that a theme will emerge that will be explored over time.

I am also developing a theme, related to Anna Sierpinska's article in this issue: what do you consider to be the most important problems that, as mathematics education researchers, we could be working on together.

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Mathematics as social

DAVE BAKER AND BRIAN STREET

A comment on 'What is numeracy?', Barwell, **24***(1)*: We would like to debate a number of issues associated with literacy and numeracy and with developing a 'social' perspective on numeracy, particularly in relation to four points arising from Barwell's intervention:

- the use of the terms mathematics and numeracy
- the notion of text as it is applied to these domains
- whether road signs can usefully be described as numeracy, literacy or more broadly 'semiotic'
- relationships between ethnography of numeracy and education.

In addressing these issues we will attempt to clarify what we see as the meanings of numeracy practices, the relationship between activity, events and practices; and what it means to mathematise.

The use of the terms mathematics and numeracy

Barwell claims that the term 'numeracy' is not used widely in mathematics education and he asks whether there is therefore a distinction implicit in our use of the term, between numeracy and mathematics. The Leverhulme Research Team simply chose to use the term 'numeracy' because this was prevalent in UK educational circles at the time of the project, being used, for instance, in the National Numeracy Strategy. We tend to use the term interchangeably with mathematics and have done so in this response to suit the text.

However, the distinctiveness of our usage is less to do with any distinction between numeracy and mathematics than with a focus on numeracy practices. Here, we will use numeracy practices to cover both numeracy and mathematics practices. The social practice approach that underpins our research leads us to be interested not in numeracy *per se* but in numeracy practices - not in mathematics *per se* but in mathematics practices. Using this approach, we believe, enables us to avoid some essentialising definition of mathematics or of numeracy and instead to focus on the practices, words and events people actually engage in. As we say in the article:

> We see numeracy practices (like literacy practices) as more than the behaviour that occurs when people 'do' mathematics or numeracy. Numeracy practices are not only the events in which numerical activity is involved, but are the broader cultural conceptions that give meaning to the event, including the models that participants bring to it. (Baker *et al.*, 2003, p. 12)

We ask the question, what is gained by looking at numeracy/mathematics from such a 'social' perspective? We attempt to answer in terms of the explanatory power such terms and concepts may offer us in understanding children's underachievement in schooled numeracy. A broad analysis of the use of the term 'practices' is given in Baynham and Baker (2002).

Numeracy as text?

Barwell uses the concept of 'text' to attempt to locate numeracy with respect to literacy. He re-works a statement by Barton and Hamilton (1998, p. 3) regarding the 'situated' nature of literacy and substitutes the term 'numeracy' in their account. This leads him to ask:

> [W]hat is the text? Literacy is defined through reference to text (which some have broadened to include visual texts; see, for example, Gee, 1996, p. 144). Is text a part of numeracy events? (p. 21)

He answers this by suggesting that numeracy practices might be a 'subset' of literacy practices.

A clue to a more satisfactory analytic framework for relating numeracy to literacy is provided by the passing reference to Gee's work in social semiotics. The study of sign systems in their social contexts and in particular of 'multi modality' in the field of social semiotics by Kress and his colleagues (Kress and van Leeuwen, 1996), has extended this insight and might be helpful here. Kress argues that the dominant approach to communication has over-stressed language at the expense of other 'modes' of communication that may be more salient in contemporary society. By 'mode' he means: "a regularised organised set of resources for meaning-making" (Kress and Jewitt, 2003, p. 1) such as image, gaze, gesture, movement, music, speech and writing. Computers and advertising, for instance, are amongst the high profile areas that use a mix of modes in which language is only one component.

Literacy practices, whilst dominantly focussed on a written mode, are almost always embedded in oral language and frequently use a visual mode, as in layout or in the relationship of images to written language. This, we suggest, provides a useful framework for considering the communicative aspects of numeracy and for dealing with Barwell's concern to relate numeracy practices to literacy practices. Numeracy practices, from this perspective, can be thought of as enacted in a number of different modes such as speech, writing and visual representation (*cf.* Street, forthcoming). A particular numeracy event may involve a mix of such modes, similarly to other acts of communication. The implications of this approach become apparent when we examine a further issue raised by Barwell, the example of road signs.

Road signs: numeracy, literacy, multiple modes

Barwell takes an example of a variety of road signs to discuss whether everyday numeracy practices are also 'mathematical'. He suggests that a sign with no numbers in it, such as a triangle with silhouettes of children, and drivers' responses to it, such as slowing down or ignoring it, are best classed as 'literacy practices'. When a sign has a number included, as in a speed-limit sign, when drivers respond in a more 'numerical' way such as checking their speedometer, these behaviours he does term 'numeracy practices'. However, he still wants to distinguish these numeracy practices from 'mathematics'. To make these behaviours mathematical would, from his perspective, involve introducing a more abstract level of analysis, as is found in schooled mathematics where problems might be set regarding, for example, direction or speed.

From a 'social' perspective, however, the issue is not the distinction between numeracy and mathematics, as though the latter were in some way more abstract, but rather, on analogy with literacy, between events and practices. Whether an event such as this is a literacy event, a visual event or a numeracy event is a matter of interpretation and depends to some extent on how the observer or researcher locates it in larger patterns of practice. In our work on numeracy as social practice, we would view it as a numeracy event, in that, even though it also includes literacy events and other modes of communication, such as the visual, it contains mathematical ideas about measures of speed and communication.

From a social practice perspective, we would want to draw out from this event the nature of the *practices* in which the event is situated. If we are focusing on the numeracy dimension, then we might label it as a numeracy event within 'driving-numeracy practices', although from a different perspective researchers might choose to focus on the literacy dimension and then ask what larger literacy practices give it meaning. The researcher has to justify their 'take' in terms of the outcomes *e.g.* do we learn more about the situation by describing it in one way or another?

A numeracy perspective here might help us understand how everyday life involves decisions about distances, speeds, orders of operations, laterality and angles that are part of larger institutionalised frameworks regarding numeracy or mathematics. But a social focus on these decisions would always force us to locate them within social practices and not to see them simply in terms of an essentialising mathematics. Drivers engage in these events in a context that has many social, ideological and value-laden dimensions. In terms of speeds, they accept or defy the regulatory nature of the controls laid upon driving. That is, they accept which side they drive on, and the number on the speed limit sign tells them the speed they can travel at without possible penalty. The penalties here are related to speeds represented in numbers and society has constructed a range of institutional practices to identify them and to enforce the regulations associated with them.

Driving-numeracy-practices therefore include power relations and institutional relations of this kind. Apart from an initial driving licence test, UK institutions do not formally test the driver's abstract numeracy skills: there is no need for drivers to abstract ideas explicitly – in Barwell's words to mathematise – in order to operate effectively as a driver. There are many people, for example, who operate competently in driving (even heavy-goods vehicles (HGV)) without any formal qualifications in school numeracy. These driving-numeracy practices are, then, different from formal school-numeracy practices. As Rogers comments, in terms of his theory of adult learning (Rogers, 2003):

> […] they simply see it as completing a task (except when the tasks are closely related to schooled tasks) and they evaluate it [not by formal abstraction] but by whether they get home safely! […] It is a continuum and we all pop into schooled practices and out of them again. People engage in many different numeracy activities […]; the way they do these tasks may differ from the schooled practices. (personal communication, Rogers, 2004)

Whether particular practices are better described as driving-numeracy practices or school-numeracy practices depends, then, partly on the context but also on the aims of the observer or researcher. In our case we wish to highlight aspects of such everyday behaviour that might otherwise be marginalised by an emphasis on school numeracy. But it remains a research question, rather than a matter of assertion, how far driving-numeracy practices are different from school-numeracy practices.

In addition to describing such events in terms of their numeracy dimension, we would also draw attention to the communicative practices and modes through which they are enacted. There is, as Barwell notes, a literacy dimension and there are other modes of communication too. Some of the road signs may involve no overt numbers but use words and some, as Barwell points out, may involve visual images with no words or numbers, as with the image of the child in a red triangle. Drivers have to make a complex association between such road signs outside and the speedometer inside their car. Again, they perform these semiotic feats without having to resort to explicit abstract analysis of the practices. They do not need, for instance, to be able to articulate explicitly how the dial of the speedometer relates to the speed limit. But they do need, in this case as in that of the regulatory framework, to understand and accept the numeracy practices that exist in the field of driving; to recognise semiotic associations; to understand the social values and relations implicit in the event. Recognising all of these dimensions of the event can help us understand better how people learn to engage with it, a theme we develop in the last section.

Ethnography of numeracy in education

Barwell acknowledges that the ethnography of literacy can contribute to educational practice, but suggests that the same may not be true for the investigation of abstract mathematics. This concern arises from his earlier distinction between numeracy and mathematics. With respect to Aaysha's finger-counting, for instance, he suggests that a study of her numeracy practices does not necessarily "reveal anything about mathematics", which he is taking to be at an abstract level that differentiates it from what we mean when we refer to numeracy as social practice. The justification for a social perspective on numeracy practices does not, however, depend on such a distinction or such a claim. Rather, when we identified "multiples of three" in a child's "counting three-to-a-finger" as a "numeracy practice", we were trying to understand how the numeracy event we saw was situated within a broader set of culturally defined home numeracy practices. We could then ask, how such home numeracy practices may relate to and affect attainment in what is defined as school numeracy.

There may be implications here for both pedagogy – helping teachers to understand the 'affordances' that children arrive at school with – and curriculum – what counts as schooled numeracy practices –, both of which may be broadened to relate more closely to varied cultural practices. Such an analysis is premised on a theoretical move away from the notion that there is only one mathematics, which is decontextualised and abstract, a notion on which Barwell is drawing. Instead, our approach conceptualises multiple mathematical practices of which informal mathematical practices are just one set and schooled mathematical practices another.

We do not wish to deny the beauty and power of abstract mathematics as enacted in formal mathematics practices, but rather to add them to the array of tools available for understanding people's relations to mathematics practices. An example of the way this can be done in academic mathematics practices in Higher Education is given in Baker (1996). In the case of the Leverhulme research on which we were reporting in FLM **23**(3), we adopted this perspective and these terms in order to provide tools that could help us understand why some children underachieve in schooled numeracy. Recognising a distinction between informal numeracy practices and school numeracy practices and thereby identifying the relation between both of these, can, we suggest, help us to explain why some children engage with schooled mathematics/ numeracy and others do not, with consequences for 'success and failure'. If the mathematics as social practices approach does contribute to such explanation, then we believe it will have made a useful contribution to educational research and practice.

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Distinctions

The act of indicating any being, object, thing, or unity involves making an *act of distinction* which distinguishes what has been indicated as separate from its background. Each time we refer to anything explicitly or implicitly, we are specifying a *criterion of distinction,* which indicates what we are talking about and specifies its properties as being, unity, or object. [...]

Unities

A *unity* (entity, object) is brought forth by an act of distinction. Conversely, each time we refer to a unity in our descriptions, we are implying the operation of distinction that defines it and makes it possible.

(Maturana, H. and Varela, F. (1998, revised edition) *The tree of knowledge: the biological roots of human understanding,* Boston, MA and London, UK, Shambhala, p. 40.)