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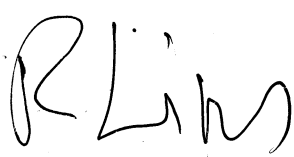

A CENTRE AND A MATHEMATICS

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In 1989 I attended my first PME. In Paris, 200 years away from the French Revolution, I was sitting at the chair next to my PhD supervisor and friend Alan Bell, during the general assembly. I remember there was a heated debate as to how much of didactics was to be acceptable at a conference named 'Psychology of Mathematics Education'. Alan's position was that it made no sense trying to be normative on that matter: if more people wanted to discuss didactical issues, that would be the direction taken by the group of people interested in attending those conferences.

Alan was not, of course, being careless: he's never been. At that point my understanding was that maybe Alan was just manifesting his British roots, more precisely English and Welsh: pragmatism.

At PME Mexico, 1990, in one of the sessions of our 'Algebra Working Group', led by Ros Sutherland with the help of Teresa and others, a colleague vigorously protested against the many contributions which mentioned the History of Mathematics, Theory of Knowledge and Linguistics, saying that all of that had nothing to do with the *psychology* of mathematics education.

A number of years later, at the closing plenary during PME in Recife, Brazil, Kath Hart, then the PME president, ended her presentation urging all to honour what the name of the conference said: ***P***sychology of ***M***athematics ***E***ducation, with strong emphasis on all three words.

In view of those episodes, and having being absent from PMEs for a while, I couldn't help but consider the possibility that, given the theme of this 2006 conference, 'Mathematics in the centre', this might be our last trench: mathematics. After 17 years — and I am not counting what might have happened before I joined the PME community — the inner centre seemed to have been moved to 'mathematics'.

The key issue that troubled me even before I hit the 'send' button to reply to the invitation to organise this panel, was "what is 'mathematics' to be at the centre of?" The two simpler, general, answers were 'at the centre of the psychology of mathematics education' and 'at the centre of mathematics education'. It seemed to me that the latter was more general, so I decided to dedicate my attention to it. If I could make sense of what it meant, making sense of the other would follow, in a very mathematical way.

I suppose we can — or should — begin by asking 'what is mathematics education?' I will not go into many details or shades. Roughly speaking, the camp is divided into 'educating *for* mathematics' and 'educating *through* mathematics'. The former refers

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to processes through which people of all sorts become apt to practice mathematics as required in examinations, professions and everyday life (simple, daily, tasks). The other refers to processes through which people become apt to have a full status citizen life in a world in which mathematical models might be part — to a greater or lesser extent — of the governance of our lives, much as Ole Skovsmose and others have brought to our attention.

Unfortunately, given the existence of those two broad ways of understanding 'mathematics education', I was still left with the question "what is mathematics to be at the centre of"?

There is, indeed, a large amount of work done in Mathematics Education that would be de-characterised as such if one left proper mathematical content out of it. Teresa's paper, for instance, makes this point sufficiently clear and supported.

But there is also work, indeed quite interesting and relevant work, that barely mentions – or does not mention at all – specific mathematical topics (for instance: equations, fractions) or areas (for instance: geometry, algebra). I would like to mention the work of three colleagues in which I see this happening: Ole Skovsmose, already mentioned, Gelsa Knijnik, who is a key player in the Landless Workers Movement in Brazil, and Bob Moses, from the Algebra Project. Konrad's paper is another example and one close to us in this panel.

How can that be and what does it mean?

In my view, that is due to the fact that the very word 'mathematics' is something that, in our western or wersternalised cultures, floats above all of us or, better, it fills, in a sense, some cultural 'air' we are immersed in, something whose presence does not depend on the mention of any specific content or area.

When someone says "I hate mathematics" or "I love mathematics" or "mathematics is important to society", there is a sense in which that person is not referring any specific mathematical content. These are quite fuzzy statements if one tries to make sense of them in relation to school mathematics or to the mathematics of the mathematician. But, still, we are able and willing to accept those statements *prima facie*, as being about 'mathematics' and, so, related to 'mathematics'.

When Susie's paper mentions a keen interest in what she calls 'subject cultures', I think she is precisely acknowledging that there is a sense in which 'mathematics' in 'mathematics education' does not need to mean a reference to specific topics and the teaching and learning of those topics, although it may, of course, be meant in this way.

Also in Zahra's paper, one can sense a way in which 'mathematics' is present as a demarcation post in what can be characterized as a power struggle involving mathematics educators and mathematicians (and educators, although the mention to them is much less emphatic in the paper) and the negotiations to promote a pacific co-existence. Near the end of the paper she mentions the way in which a mathematician questioned a masters candidate, during the examination, about the

'mathematical identity' of the candidate's work. What could it be, in this case, that would add a 'mathematical identity' to her masters dissertation? I believe that from the point of view of the mathematician that would likely be 'mathematical content'. My reason for believing so is that, much more often than not, for the mathematician, professionally, talking about how people feel about mathematics and about what mathematics is, is not 'mathematics'. Generally speaking, asking a mathematician 'what is mathematics' may well produce an answer like '*this* is mathematics', pointing to an open mathematics book, and there is nothing intrinsically wrong with this; there are of course, cases in which a different kind of dialogue would follow.

Such questioning, in the context of Zahra's paper, gives us, I think, a quite clear example of how 'mathematics in the centre' can be part of an anchoring process that has not much to do 'properly' with the teaching and the learning of mathematics, but rather with different kinds of relations.

Let me offer, at this point, a metaphor that might help us to bring those and other aspects together in relation to the 'mathematics in the centre' issue.

Hurricanes have a quite disturbing characteristic: at their centre there is an intense calmness, no matter how violent things are closer to their edges. For those who know of that and find themselves taken by a hurricane, it is disturbing because despite the temporary quietness one knows that things might – and probably will – change at some point.

Let's now think of Mathematics Education — a field of professional activity —, as a hurricane. At the eye, its centre, everything is quiet and much as usual outside hurricane centres; should someone be magically transported straight to the centre, it would be possibly difficult to imagine something dramatic is happening around, apart, perhaps, from the dark sky in the horizon.

At the centre of Mathematics Education, then, people would not worry much about things being too different from what it uses to be in usual times. Unless, of course, they are aware of where they are and of what is happening around them.

Now, my metaphor forces me to bring together the ideas of time and space, because when I speak of 'usual times' I am also speaking of 'usual places (within the community)'. Here, again, Teresa's paper is enlightening, because it traces the issue of 'mathematics in the centre' both to tradition and to more recent concerns about the teaching and learning of mathematics. Tradition roots this issue in the transmission of mathematical knowledge in order to foster the science and in the emergence of the general idea of didactics; more recent concerns root it in the widely and socially perceived need for people who are mathematically proficient — as pointed by Susie, referring to Kilpatrick, Swafford and Findell's construct — and in the widely and socially perceived specificity of the teaching and the learning of *mathematics*.

I propose that, adopting the hurricane metaphor, we place tradition and current concerns at the eye of the storm. Teaching, development and research taking place

there *naturally* has mathematics at its (inner) centre. Parts of what Teresa says in her paper somewhat agree with this application of the metaphor.

But that region of stability can be understood as being the eye of a hurricane as much as it can be understood as simply being a region of calmness with some strong rain somewhere around. In other words, it seems of interest to consider that such calm region might or might not be understood as the same as an equally calm region away from any hurricanes. For one thing, as I have already mentioned, those who are there and know it will most likely not be at ease with the possibly coming trouble, but, on the other hand, one may consider that what is happening at the edge of the hurricane (or should we say, in this case, in the visible horizon?) does not or will not significantly affect the calm region.

If we imagine a 'stationary' hurricane an argument could be made for both sides: it *does not* matter what is going on at the edge for us to understand what is happening at the centre; or, it *does* matter.

The key issue here is, I think, one of representation: how is the centred calmness represented, and, perhaps more crucially, by whom? And why so? I think these are questions that may help us to clarify the issues involved in the consideration of 'mathematics in the centre'.

The hurricane metaphor came to my mind almost through a naïve word association or meaning slip. But aided by it, examining the initially unsuspected — for me — complexity of 'mathematics in the centre', and considering the richness of elements and insights offered by the other four papers produced by the panel members, I decided that perhaps my best contribution would be towards offering a perspective from which our theme could be 'rephrased', so to speak, possibly allowing our discussion to illuminate as yet invisible corners of that issue. There are, of course, as all the four other papers make clear, many other corners which are already in the sunlight, for instance, the relationship between teachers' confidence with mathematics and their confidence to teach mathematics, and I certainly do not take issue with any of them.

That reflection led me to consider that instead of looking to 'mathematics in the centre' straight in the eyes, so to speak, I could rather deal with the issue of '*a centre and a mathematics*'.

On the one hand, the indetermination allows me to refuse assuming there is only one centre or even one that I should be taking as preferential here —thus allowing me not to engage in trying to determine what that centre is. On the other hand, that expression presents me with a useful degree of separation between the two elements in it.

With respect to this discussion, I will take *a centre* to be a region of stability, be it the eye of a storm or be it a nice day somewhere with clear sky. And I will take *a mathematics* to be a reason for 'mathematics' being mentioned. By doing so I can now argue that the issue of 'mathematics in the centre' can and should be understood

both as the issue of what, within specific social practices of a specific culture, is perceived as mainstream in Mathematics Education — needed, recommended, natural, essential —, and the issue of the nature of *a mathematics* within those social practices and that culture.

Let me consider the latter issue first. When we use, in our professional considerations, the expression 'the nature of mathematics', what are we referring to?

Konrad's, Susie's and Zahra's papers tell me that we could be referring to the social and cultural nature of mathematics, here understood as an element in a culture that relates to other elements in possibly many different ways. Teresa's paper tells me that we could be referring both to the historical and to the epistemological natures of mathematics.

But if in Zahra's paper I see the most evident cultural aspect of 'mathematics' as that related to power structure and struggle, in Susie's the notion of 'subject cultures' blends a sociological view with an epistemological view, while Konrad's approach seems to me more definitely sociological.

Teresa takes us to the edge of the hurricane when she says that "*[...] the disciplinary boundaries that mathematics education shares with other disciplines [...take us to the fact that] the place of mathematics in the field of mathematics education cannot always be well determined.*" Are there centres at which, contrary to this, we will find mathematics clearly dominant, as in the traditional views of mathematics teaching? (and, in my formulation, speaking of centres implies speaking of social practices and cultures)

When Konrad urges us on the need to produce "*[...] public relation activities in order to make the power and beauty of mathematics better understandable for our citizens.*", the nature of 'mathematics' is no different, in my view, from that of 'non-violence' or 'healthy life', and before the reader comes to the conclusion that I am saying this in a demeaning manner, let me clearly state that I fully agree with him, even to the extent of saying that those public activities could well involve mass-media public relations campaigns.

As to '*a centre*'.

What can be a centre for the mathematics education one practices? It could be reaching one of the top positions at a PISA table. It could be avoiding that pupils drop out of school before they get a certain number of years of schooling — thus avoiding that, not being in school, they stay somewhere else, perhaps engaging in totally undesirable activities (crime, harmful drug consumption). It could be to create an adequately prepared workforce — from the point of view of the needs of a society, from the point of view of the productive system or from the point of view of the Capital. It could be to help people to assume a full status citizenship (as necessary in highly technological societies, as Ole points out) or, quite on the contrary, to prepare people to be obediently disciplined. Or many more, and many shades and combinations of those. All that is not new, of course.

'*Centres*' as places. '*Mathematicses*' (sic) as reasons for mathematics to be at a centre, that is, at a place. The hurricane metaphor helped me to understand that centres as regions of stability bring together the notions of tradition, cultural values and social demands, and that different reasons for mathematics to be at a centre may produce different natures for 'mathematics'.

In no sense it was my intention to argue for or against the views represented in the four other papers related to this plenary panel — or any other views related to what I have said so far. In particular, the fact that I did not mention a number of points made in those four papers does not imply that I disagree with them, and given the emphasis I decided to have on this paper, I explicit mention all points in which the authors argue that mathematics should have a central place in mathematics education, although arguing that taking mathematics as the last trench in defense of our identity or specificity is a dangerous step.

So, my only claim is that it seems useful to approach our key question with a clear sense of 'situatedness'. That is why I prefer to speak of *a mathematics* (in the sense I did) instead of speaking of (the) mathematics. It is not a matter of offering an alternative view of what 'mathematics' is, I leave this to the philosophers. And that is why I prefer to leave which centre we are talking about to those who are actually speaking about a centre.

The many possible combinations of the '*a mathematics*' mentioned above (and many others not mentioned), with the various '*a centre*' suggested, give, I think, at least a glimpse of the complexity of the issues we are dealing with in this panel.

If anything, I hope this paper can help us to keep this complexity present in our considerations about 'mathematics in the centre'. And the same hope applies in relation to the *differences* that such a complexity and respect for it are bound to elicit within our Mathematics Education community.