

IDENTITY AND UNDERGRADUATE MATHEMATICS: A DISCUSSION OF BARON-COHEN'S SYSTEMISER/EMPATHISER DICHOTOMY WITH REGARD TO MATHEMATICS UNDERGRADUATES AND ASSOCIATED GENDER ISSUES

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Continuing previous work on mathematics undergraduates' identities, we present and critique some of Simon Baron-Cohen's ideas on 'systemizing' and 'empathizing' and how these notions relate to gender. We are concerned that his association of systemizing with 'male brains' could be detrimental to female participation in mathematics.

INTRODUCTION

Mathematics education is influenced by many social and cultural forces and mathematics educators are wise to be alert to emerging ideas outside maths education. This paper focuses on one such emergent idea as expressed in the recent book 'The essential difference: the truth about the male and female brain' (Baron-Cohen 2003). This popularised book offers theorisation on two particular ways of thinking, 'systemizing' and 'empathizing', and claims that "the female brain is predominantly hard wired for empathy and the male brain is predominantly hard wired for understanding and building systems" (*ibid.* p1). This claim is a challenge to inclusive mathematics education as it distances those who are female-identified with the pragmatically systemizing process intrinsic to mathematics. Furthermore, the rhetoric of the book associates systemizing with autism and autism with deficiencies in empathy, thus by association positions systemisers as lacking in empathy. Given that our professional field is that of mathematics education and includes long-held interests in gender and mathematics, it behoves us to understand Baron-Cohen's claims particularly in the context of women and mathematics – and this includes females' identity, participation and agency with regard to mathematics.

THE 'ESSENTIAL DIFFERENCE'?

The central claim of the book, published for a wide audience, is stated as men and women have fundamentally different brains on average (*ibid.* p2). The book is written in a 'folksy' style and Baron-Cohen is quick to say that his topic is a delicate one and is not intended to be grist for reactionary gender oppression. The outline of the book's argument is that: every person has 'empathizing skills' and 'systemizing skills'. These skills are assessed by psychological tests that Baron-Cohen and colleagues have developed that assign to an individual a 'systemizing quotient', SQ, and an 'empathizing quotient', EQ. Results indicate males on average systemize and females empathize (*ibid.* p62) and thus the 'difference' of his title is key to mind and gender.

Roots of these concepts

The author is an academic psychologist whose field is the study of autism and this popular work draws on his research. Autism is defined as a ‘triad’ of abnormalities in behaviour in the domains of “social development, communication, and repetitive behaviour/obsessional interests” (Baron-Cohen, Wheelwright et al. 2002). In this paper, the concepts of the empathizing and systemizing, together with the attributions ‘male’ and ‘female’, were presented. The empathising-systemizing theory is explained in terms of agency and intention: that people with empathising skills recognise mental states in others and produce “appropriate emotional response” and people with systemizing skills “understand and predict the behaviour of non-agentive events” (*ibid.* p495). And it is more than mere capacity – there is a recognition that capacity is fuelled by the subjects’ own agency, their interests, desires and drive. The link to gender comes later in the paper and is based on Kimura’s work (Kimura 1999) and work from his own colleagues, together with Asperger’s previously mentioned conjecture.

Thus someone with autism is ‘untuned’ to the social world and Baron-Cohen and colleagues hypothesise that such social-tuning deficiency is a result of impaired empathising faculties. In a positive turn, Baron-Cohen and colleagues have considered the other aspect of the triad to do with repetition and obsession and constructed the concept ‘systemizing’ which for autistic individuals is “intact or even superior” (*ibid.* p495). Inasmuch as the systemizing concept comes from the criteria for diagnosing autism, one can see why Baron-Cohen would conceptualise systemizing as oppositional to empathizing. The work has a root in exploring Hans Asperger’s 1944 notion that “autistic personality is an extreme variant of male intelligence” (quoted in translation from original German (Baron-Cohen 2003)). Baron-Cohen’s theory extends Asperger’s notion of ‘the male brain’ as ‘systemizing’ (one that understands and builds systems) and he also develops a female counterpart by positioning ‘the female brain’ as ‘empathizing’.

A BRIEF CRITIQUE

(i) The concept of empathizing as used in *The Essential Difference* is defined by means of the ‘Empathy Quotient’ questionnaire. In this questionnaire, empathy is construed sometimes to be social skills (“I can sense I am intruding, even if the other person doesn’t tell me”, “I find it hard to know what to do in a social situation”) but also to relate to a personal emotional state (“it upsets me to see an animal in pain”, “seeing people cry doesn’t really upset me” ...). This begs the question about what empathy is.

(ii) The notion that the concepts of systemizing and empathizing are negatively correlated is suggested but not stated; the nuance cannot be interrogated as the bivariate data are not presented. The book does not claim that systemizers are not empathisers; it is the discourse, rhetoric and style that presents this juxtaposition.

(iii) The book's essentialising of males as systemizers and females as empathizers based on statistics of the extremes, 'queers' the outliers and obscures the fact that the distributions of scores for males and females overlap considerably. Indeed, in another paper (Baron-Cohen, Wheelwright et al. 2001) Baron-Cohen's own data shows that for one characteristic, 'having attention to detail', that is associated with systemizing, the means of scores of 'control females' were actually higher than those of 'control males'.

(iv) Early on in the book, Baron-Cohen defines male and female in 5 different ways: (1) genetic, (2) gonadal, (3) genital, (4) 'brain type', and (5) 'sex-typical behaviour'. Definitions (4) and (5) are his own: your brain is 'female' if your empathizing is stronger than your systemizing, and vice versa, and sex-typical behaviour "follows from (4) brain type" (*op. cit.* 2003 p98). His definitions serve to reify his 'the essential difference' slogan. But tagging on to the list (1-3) of far more physically defined concepts of male and female, definitions that are based on a questionnaire, is misleading: it suggests that these concepts are more real than they actually are. The first three are based on bipolar physical states, not on overlapping normal distributions of attributes.

Issues related to mathematics

Mathematics involves systemizing: sorting out structural features of problems; understanding and working with the logic of events, machines or rules; representing ideas symbolically and attributing meaning to these symbols and operating with them creatively and independently. These are mathematical attributes that involve 'systemizing'. Other questionnaire based work from Baron-Cohen and colleagues, (Baron-Cohen, Wheelwright et al. 1998), certainly indicate that autism is more common in mathematically-orientated families. Highly talented Mathematics Olympiad winners surveyed by Baron-Cohen and colleagues had similar scores to an Asperger syndrome group on the 'attention to detail' sub-scale. On most other sub-scales they had scores about mid-way between the control and the Asperger group but were similar to the controls' scores on 'communication'. Empathy is easier with one with whom you co-systematise. And this suggests that communities of systemisers do develop inter-personal bonds that can be interpreted as empathy. It is worth noting that the notion of an 'appropriate emotional response' is very much culturally relevant. And so in the mathematics communities, if there is a lack of ostensive personal chat that should not be read as 'inappropriate emotional response'; quite contrary-wise, silent support of the practice may well be deeply felt, empathetic. Our maths students speak of the importance of their study mates who share their mathematics undergraduate practice.

DO WE SEE THIS SYSTEMISER/EMPATHISER DICHOTOMY IN OUR STUDENTS?

Our three-year longitudinal study of undergraduates' experiences (Rodd and Brown 2005; Rodd and Bartholomew 2006) included many extensive student interviews

(n=93). Our interpretations of these interviews gave us insight into students' personalities, drives and conceptions of mathematics. In this section, we present extracts from interviews with three successful students. These particular students, who we have called Tessa, Janusz and Lindsey, were chosen as they illustrate variety in the way undergraduates expressed views related to their relationship with mathematics and to their social priorities. Thus they exposed something of their systemizing and empathising orientations as they are experienced in mathematics learning at university. Furthermore, each of these students achieved a top-rank (first class classification) after three years and thus could be said to exhibit good systemising skills.

Tessa

I just worked all the time, I mean, I had a busy social life and everything but every spare minute I was like handing in sheets. "I live with artists and people who really don't do anything" who don't seem to be able to relate "to me revising for twelve hours a day ..because [otherwise] I'll fail".

When we did a group project and we really, it was me and all my friends who all got 90% and we all worked really hard and did this project about sequences I think it was. ...And we worked really hard and made this lovely presentation and I remember feeling really good when we presented it and we did well. And that felt quite good to be able to understand what I was saying and to speak to a class of maths students and know what I was talking about ... [the lecturer] seemed really interested.. Oh, and we'd found something he didn't know. Nothing extraordinary but something he'd never noticed. So that was quite nice.

Lindsey

Because I'm good at maths I like other people to be good at it as well. ...I am very confident in explaining things ... and I always seem to find a way to make it easier to understand, and that is what I like to be able to do for other people, to help them understand it as well.

I want to be a maths teacher ...it feels good, not just to learn new things for myself, but it feels good to be able to tell other people ...to help [people] to understand those simple things, that is the same feeling as when you understand something more complicated itself. ...If I become a maths teacher I'm going to have that feeling all the time.

Janusz

I feel more in control of maths in a way, I know what I have to learn, I know when I've got it right. [I like] the structure of it [maths], the way you get a theorem and prove it systematically...my friends say 'oh maths! can you do this long sum for me? And it's not really about that for me, it's proofs and the ways you get around proving things when there is something I just don't know how you're supposed to get the answer to, it will trouble me a bit and then I can't sleep or I'll go to sleep and then wake up thinking about it

I'd advocate a different method of assessment...I tend to slip back into trying to understand as much as I can every time it comes round to revise and that's where I lose out because I don't have that stringent discipline in just doing the [past] papers finding out exactly what I need to know and no more

...maths isn't, for me it's not the be all and end all, I've always needed to have a social life...you're not a mathematician unless you dedicate your life to it almost

These three brief extracts indicate modes of empathising and systematizing maths undergraduates experience. They illustrate how social and emotional issues relate in different ways to the student's systemizing need. Thus the type of empathizing/systemizing dichotomy that Baron-Cohen writes about does not show up in our data (what is presented is representative in this regard). Women have always been systemisers, but traditionally in different domains to men. Baron-Cohen's questionnaire to gauge a person's systemizing quotient (209-16) is not written to pick up female systemizing. Culturally male activities like doing electrical wiring (SQ qn 7) are given as prompts to assess systemizing skills and in the item on cooking, arguably a gender-balancer, the statement refers to 'a final product' (of cooking) rather than to a 'meal' or 'food' thus presenting the potentially female-friendly item in a female-alien discourse which is missing from the prompts in Baron-Cohen's questionnaire. So it comes as no surprise that males score higher on his test; Furthermore, females' mathematical achievements, at least in England, are increasing (QCA 2004); there is also indication that girls don't necessarily see maths as a boys' subject (Francis 2000) though this has not been a universal change. Females do successfully participate in mathematics though this maybe relatively 'invisibly'.

This critique of *The Essential Difference* has been presented in order to draw teachers of undergraduate mathematics attention to the work that positions males and females as essentially different and that this difference hinges on a personality trait related to systemizing – a trait that is intrinsically mathematical. Teachers of undergraduate mathematics students may want to question this positioning, the assumptions that underpin the work and interrogate the notions from their own experience and identity. What could be an alternative? Personalities can be more or less geared to precision, systemizing, logical reasoning, single-mindedness, etc. They can be more or less geared to other attributes too: compassion, social awareness, fashion sense, family bonding, wide attention span. Specifically, considering the notion of 'systemizing' that is used in the book, we can ask whether this notion of a systemizing mind is helpful in selection? for guidance of students? or for pedagogy?

CONCLUSION

The notion that there are empathising and systemizing skills that psychologists can measure through testing could be a useful contribution to our understanding of peoples' skills and propensities. Yet Sheila Greene (Greene 2004) behoves us to be wary "naïve biological thinking": she positions this work of Baron-Cohen as part of a new version of biological determinism where gender-linked dispositions are

presented as “differences not deficiencies”. Her view is consonant with ours that the ploy that affixes the epithet of male to one attribute, here systemizing, (even while saying ‘it’s needn’t be you’) is to stain the discourse of mathematical participation and achievement. Inasmuch as these ideas become culturally familiar through media coverage they self-reify. Inevitably, consciously or subconsciously the message filters in ‘maths is not female’. This message has historical resonance, after all there were very, very few professional female mathematicians until 1960s feminism opened some doors and there are still not many. But women have always been systematizers: walk into kitchens, nurseries, Women’s Institutes and in suitable examples of these female-privileged domains you’ll be able to see as much systemizing as in car mechanics’ workshops.

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