

Subjectivity and cultural adjustment in mathematics education: a response to Wolf-Michael Roth

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Abstract: In this volume Wolf-Michael Roth provides a critical but partial reading of Tony Brown's book *Mathematics Education and Subjectivity*. The reading contrasts Brown's approach with Roth's own conception of subjectivity as derived from the work of Vygotsky, in which Roth aims to "reunite" psychology and sociology. Brown's book, however, focuses on how discourses in mathematics education shape subjective action within a Lacanian model that circumnavigates both "psychology" and "sociology". From that platform this paper responds to Roth through problematising the idea of the individual as a subjective entity in relation to the two perspectives, with some consideration of corporeality and of how the Symbolic encounters the Real. The paper argues for a Lacanian conception of subjectivity for mathematics education comprising a response to a social demand borne of an ever-changing symbolic order that defines our constitution and our space for action. The paper concludes by considering an attitude to the production of research objects in mathematics education research that resists the normalization of assumptions as to how humans encounter mathematics.

Key words: Subjectivity, Ideology, Lacan, Badiou, Žižek, Vygotsky

Introduction

Mathematics Education and Subjectivity (MES, Brown, 2011)

rethinks mathematical teaching and learning with view to changing them to meet or resist emerging demands. Through considering how teachers, students and researchers make sense of their worlds, the book explores how some linguistic and socio-cultural locations link to prevalent conceptions of mathematics education. The locations include classroom mathematics, spatial awareness, media images of mathematics, curriculum development, teacher education and mathematics education research itself. The book introduces cutting edge theories of subjectivity that trouble more familiar psychological theories of 'humans' apprehending mathematical 'concepts'. Rather, it suggests that our senses of self and of mathematics result from self-reflections within the various localities in which we live. In foregrounding subjectivity the book shows how mathematics can provoke alternative ways of thinking towards enlivening our transformative capacities. Learning itself is depicted as participation in cultural renewal, where the very mathematics encountered is becoming something new. Addressing teachers, teacher educators and researchers, the book invites the reader to contemplate alternative trajectories of change into fresh ways of being. (Back cover)

A key theoretical point of the book is that we always occupy an ideologically defined location and that we might productively consider how the current state of affairs shapes our actions. Žižek (e.g. 1989) suggests that we are practically compliant to the ideologies that govern our lives even if we do not notice this compliance, since we are radicals in our thoughts and dreams. The book explores these ideological formations in mathematics education, to see how they work, so that we might see in a different way the potential trajectories of change. The book specifically discusses how mathematics education is conceived and how such conceptions result in particular understandings of what it is to be a teacher or a student, and how this produces the mathematical phenomena in question.

Wolf-Michael Roth's (2012) substantial and interesting review in this issue correctly reminds us that the book's ideologically defined location will create its own blind spots. For example, the book asserts that "psychology", variously attributed to Piaget and Vygotsky, is benignly blended into theories of mathematics education research normalizing certain assumptions as to how mathematics is encountered. In making this assertion Roth argues that the book's account of Vygotsky is incomplete and Roth counters the book's arguments with his own account of subjectivity derived from the work of Vygotsky. More generally, the book argues that the linguistic norms that characterize argumentation in mathematics education research result in particular forms of sense making. Consequently, certain forms of argumentation or modes of object creation available in other areas of the cultural sciences are not typically picked up by the scanners of mathematics education research leading to the exclusion of some productive approaches. Roth argues that the book's success lies in its capacity to disrupt familiar pathways in mathematics education research but in so doing it destabilizes the ground from which we could inspect newer alternatives. This opens the door to further reflection on how we conceptualise change and cultural growth through attempted reconciliation of the alternative models.

This paper mediates contrasting claims made in respect of two alternative conceptions of subjectivity. More generally, Roth (2010) aims to "reunite" psychology and sociology through a reconceptualisation of the individual. The book favours a Lacanian model, which includes neither "psychology" nor "sociology" in its brief. The scene is set in the paper by contrasting how Roth and the book each reference the work of Vygotsky. From this platform the paper goes on to problematise the idea of the individual in relation to the two perspectives with some consideration of corporeality and of how the symbolic encounters the material. I engage with Roth's more direct discussion of Lacan towards challenging some of the other issues that he raises through showing how Lacan's later work supports persistent adjustment to new conditions. The paper develops a Lacanian conception of subjectivity for mathematics education comprising a response to a social demand borne of an ever-changing symbolic order that defines our material constitution and our space for action. The paper concludes by considering an attitude to the production of research objects in mathematics education research that resists the normalization of assumptions as to how humans encounter mathematics.

On Vygotsky

Vygotsky and activity theory are discussed more extensively in Roth's 25-page review than they are in the 234 pages of the book. Vygotsky's theory had been introduced primarily to orientate the book's core discussion of ideology for a general mathematics education audience. I am not a Vygotsky scholar but as the author of MES I was making an attempt to orientate the less familiar Lacanian psychoanalytic theories (e.g. 2008) to better-known material in the field. Vygotskian inspired activity theory, however, is Roth's intellectual home base as evidenced in numerous publications. His review spends much of its space there, critically referencing the relatively oblique discussion of the theory in MES. Notwithstanding his many complimentary observations, MES is not what Roth had wanted it to be. His search criterion is reminiscent of the man who looks for his lost keys under a streetlight where he can see, rather than across the road where he may have dropped them. One solution might be for me to get my Vygotsky act together so that in this paper I could more effectively counter Roth's concerns, now that Roth has re-centred the debate in that domain. My preferred option however is to restore balance by emphasising that my own core frame of reference is centred on the Lacanian theories of Badiou and Žižek who continue writing to this day with no reference to the Russian and his followers as far as I know. I refer many more times to these authors, authors that Roth completely fails to mention in his review and in so doing Roth misrepresents the main theoretical thrust of the book. The book is centred on showing how contemporary theory by living writers offers new analytical resources. In restoring balance, however, the paper will keep to the areas of concern that Roth shares, whilst resisting his tendency to see the issues exclusively through his chosen analytical filter.

Yet given Roth's chosen theme it is surprising that his review so quickly skates over the most extensive direct comparison that MES makes of Vygotsky and Lacan. As MES indicates, Lacan and Vygotsky would both claim that humans feed off the linguistic apparatus that surrounds them. For both authors, "We become ourselves through others" (Vygotskij, cited by Roth, all Roth quotes are from his paper in this issue). They would wholly differ, however, in their understanding of how humans and their formation relate to symbolic mediation (more later). Vygotsky's notion of *Zone of Proximal Development* (ZPD) has been popularised in many instances of mathematics education research as bringing children into the social world. I trust that Roth is more precise: "through the child, the societal becomes individualised and concretised." Yet Vygotsky's work in the very different circumstances that he encountered during his lifetime has been subject to multiple readings within the cultural imaginary of mathematics education research. Bibby (2010, p. 38) argues that the "seductive imagery conjured by Vygotsky's metaphor ... allows us to ignore the difficulties and resistances which the learner will encounter and develop". She continues: "the metaphor encourages us to ignore any differences between the learner and the teacher and seems to suggest that the learner's differences will be unimportant and willingly subjugated to the teacher's benevolent intentions."

Whatever depiction we choose Vygotsky's ZPD contrasts sharply with Lacan's (1986, pp. 203-215) assertion that humans' alienation from language is built into their very constitution as subjects. As we shall see later, the subject's constitution in Lacan's formulation is not, as Roth persistently suggests throughout his piece, divorced from the body or living being (more later). For Lacan, however, the language used to describe

people never quite fits with their own sense of reality, “the imaginary is enough to motivate all sorts of behaviour in the *living being*.” (p. 207, my emphasis) And they can be alienated from the very apparatus used to include them. In Vygotsky’s model, the child’s environment provides both the form and content of his personality, even if that personality is “individualised”. On the contrary, for Lacan, dialogue functions as *the* alienating experience. Teachers may or may not identify with particular aspects of the curriculum they are charged to present. Children may or may not connect with the account of the world that the teacher provides. The space, between the place assigned and the place taken, results in a “permanent hunger” to close the gap (Emerson, 1983). This hunger is never satisfied. The only way out of any restrictive caricature of self is to accept the turbulence of participation in discursive activity, and this participation produces real effects on the body’s formation. For Lacan any attempted identification with specific discourses or ideologies is tainted by the individual’s desire to please, to respond to the demands she perceives (from the Other), even though, as Lacan claims in his later work, those demands may not actually exist. Importantly, however, the difficulty in fit, the alienation, can be experienced as a *positive* condition, releasing an individual who has grown out of the discursive clothing bestowed upon her.

“It is evident that the Russian scholar has anticipated Lacan”. I am rather skeptical on this point. Roth overreaches himself in attributing rather too much of the thought of the late twentieth century, and in particular, too many aspects of Lacan’s writing, to being a later day exemplification of Vygotsky. It may be that Vygotsky provides a particular solution to the issues in question, but the point of MES was to show how Lacan offers an alternative approach. Lacan’s work as developed by more recent writers better supports more recent conceptions of subjectivity introduced long after Vygotsky passed away, and which provide an alternative to present day Vygotskian formulations. In the next section I seek to paint the new territory occupied by Lacan and link it to work by Žižek and Badiou. Conceptions of “psychology” as attributed to Piaget and Vygotsky, so often used in support of mathematics education research, take an altogether more marginal place in MES, as strictly alternative points of reference. The wider notion of subjectivity shifts the focus of the book on to the multiplicity of readings available in the diverse circumstances we face today where consensus on how the world is marked out is not readily achieved. The generation of theory provides alternative analytical filters through which we can read contemporary circumstances, as exemplified in the last Special Issue of this journal (Brown & Walshaw, 2012).

The remainder of the paper addresses Roth’s discussion of Lacan within MES. I commence with a brief sketch of Lacan and two of his followers. Taking the example of the “mathematics education researcher” I consider how subjectivity may be associated with conceptions of the acting human (Roth’s sections 2.1, 2.5). I briefly interrogate Roth’s discussion of language games (2.2). I devote more space to corporeality (2.3) in approaching Lacan’s notion of the Real, since that important dimension of Lacan’s thinking is absent from Roth’s analysis (3.1¹). I respond to Roth’s conceptions of

¹ Lacan’s diagram, as reproduced by Roth as his Fig. 2, comprises the lower levels of Lacan’s more sophisticated *graph of desire*, as discussed by Žižek (1989, pp. 87-129). Žižek discusses the interplay of discourse and enjoyment (*jouissance*), where enjoyment comprises the emotional flows that are activated that transcend mere discourse.

subjectivity, relationality and the discursive networks to which actions, bodies and personalities are referenced (3.2). I conclude by defining a more precise distinction between how Roth (3.3) and I conceptualise subjectivity. My concluding section conceptualises the production of psychoanalytic material as story telling in which research objects derive from ever shifting perspectives (4). I bypass Roth's discussion of cultural history (2.4) for reasons of space.

On Lacan

Lacan, Žižek, Badiou

Lacan's notion of the subject was initiated through his work in psychoanalysis with individual clients. The accounts provided by these clients became the material for his analysis. These accounts can be seen as localised cases of the wider discursive network, a revelation that loosens their connection to the client seen as a standalone living being. (This is not to say that the living being was unaffected by the production of these accounts— more later.) The human subject was defined according to the descriptions available within this network. Indeed the accounts alerted us to how human individuals derived from this wider network. Individuals might no longer be considered primarily as stand alone biological entities but rather as consequences of particular events, or social movements, where the individual is understood in terms of his or her identification with these events. The internet, for example, produces conceptions of humans. Facebook can celebrate the personalities of individuals but then convert them into mere statistics in a large-scale consumer survey linked to a sales drive or election campaign.

Many perspectives on Lacan present in MES have been accessed through Žižek and Badiou, major thinkers in their own right today, concerned with contemporary themes.

Žižek's work is centred on how culture (films, artistic productions, jokes, flower arrangements, news reports, television broadcasts, the internet, PISA test items) is revelatory of how the society thinks of itself. Cultural life is not so much centred in the individual. Rather, the individual is understood through his or her identifications with or participation in certain aspects of cultural life. Yet in this Lacanian formulation these identifications are never quite secure. The subject mistakenly recognises versions of self in this symbolic network that are never quite sustainable. Try as I might I am not like George Clooney. This *alienation*, the gap between place assumed and the place assigned, mobilises subjectivity to find a more comfortable space, yet instead finds that it cannot be encapsulated in any given symbolic form. No story quite fits. Life in such circumstances is governed by unconscious forces and set moves, which shore up the gaps in any overt story that an individual might confidently present.

Badiou's notion of subjectivity (e.g., 2009) also takes a radical step beyond a concern with the individual human in a therapeutic encounter. He drops any privileged link to the living being in favour of seeing subjectivity in terms of identification with a movement to a new state of affairs. For example, Spartacus was instrumental in an anti-slavery movement that transcended the individual human Spartacus. Spartacus' identification

with the anti-slavery movement, the collective assertion of a cause, was more important in locating subjectivity than his individual humanity. Thus subjectivity is associated with a redistribution of the psychological, where perhaps our whole concept of what it is to be human (a teacher, a student) has shifted to a new configuration, and where perhaps the individual human's operative role is rather less central than was previously supposed. Critchley (2008, p. 44) argues: "One can only speak of the subject in Badiou as a subject-in-becoming insofar as it shapes itself in relation to the *demand* apprehended in a situation" (my emphasis).

The place of subjectivity: the case of the mathematics education researcher

In addressing the term "subjectivity" one may reflect on one's own common usage of other familiar terms (such as, individuality, sociality, psychology). Roth (2.1) introduces Leont'ev's activity theory towards criticising what he sees as overly casual use of the term "social" in MES. He distinguishes the term from "societal", which he sees as relating to the political/ideological system. It seems unproductive to spend too long differentiating between the ways in which the terms are used by alternative traditions. The point had been to contrast Radford's teaching approach with an alternative approach in pinpointing subjective engagement. The difference related to the way in which the terms of reference for the given activity (or language game) were set and whether these terms were negotiable or not. The students either followed sequences pre-determined by their teacher in Radford's example or set their own parameters for sequences in MES. The *demands* from one case to the next were very different. The student response was a function of how he or she was *subjected* to the pedagogical space in question.

Roth (2.1) picks up on a theme already debated in the pages of this journal and subsequently included in MES. My response to an *Educational Studies in Mathematics* Special Issue on semiotics led to a reply from two of the authors involved (Presmeg & Radford, 2008). The issue at stake also related to how individuals respond to a given field for action. I conceptualised the subject "mathematics education researcher." What is *demanded* of such a designation (journal or funding agency criteria, employer expectations, professional self image, etc.)? How do individuals follow such a designation? Are there preferred ways of aligning with the designation? The mathematics education researcher could research how to improve the current set of teachers (by improving their techniques, changing the curriculum, setting new priorities), or s/he could research how to get a new set of teachers (paying people to train in this area, relocating troops into teaching, benefitting from the new popularity of physics). Do, for example, particular conceptualisations of what research is lead to a disproportionate number of research papers where certain perspectives are revealed, thereby normalising particular accounts of what it is to be such a researcher, and in turn what constitutes research? One can conceptualise subjectivity more generally as being a response to a *demand* or an expectation of what is required by a particular designation.

Authors in the Special Issue discussed a range of themes, but, MES argued that the emphasis of the work overall supported the proliferation and normalisation of particular research perspectives. In the case in question, there was a tendency towards using

Piagetian and Vygotskian psychological models. That is, the subjectivity of “mathematics education researcher” was conceptualised with respect to particular psychological filters. More generally, MES sought to argue that a disproportionate volume of research in mathematics education is directed to the improvement of teacher technique, perhaps at the expense of ignoring other more effective levers. Similarly, Roth’s account of a teacher-student dialogue (in 3.2) emphasises the quality of inter-personal exchange, within a rather localised activity framework. The need to meet publishing criteria can influence the research author’s conception of who they are and what they are trying to do, the style of paper submitted and the way in which mathematics (e.g. seen as knowledge, analytical apparatus, problem solving, or basic skills), teachers (e.g. as didacticists, facilitators, inspirational figures, carers) and students (e.g. performing in tests, independent thinking, obedient) may be conceptualised. Roth (2.1) asks “Do we tell what has happened to us during any particular working day in exactly the same way to our 5-year-old son, our mathematics education colleague, the hairdresser, or spouse? We don’t!” There is however a risk that we always go down the same tram tracks when talking to our audience of mathematics education colleagues since our working environment is governed by certain norms, preferences, habits and expectations, which result in certain styles of familiar action that may preserve past inequities, redundant models of practice and tired theoretical paradigms. MES argued that there are substantial gaps in the scope of mathematics education research, which is not the fault of individual authors as emphasised (p. 88), but rather the economy of such research does not support interest or coverage in certain areas. There are blind spots. The ideological dimensions of mathematics education shape practices, practices about which we are not always fully aware. We must persistently attend to the assumptions that we are making in setting the terms of reference for mathematics education research.

Language games and renewal

Roth’s critique (2.2) notes two places where MES “complains”: the “individual is obliged to use these languages if they are to be included in social exchanges” (MES, p. 105); “[i]n this way the human subject identifies with something outside of himself. They see themselves in the social languages, but the languages never quite fit” (ibid). Roth associates these two statements with participation in language games *as if* the games already exist and can be participated in according to certain fixed rules, such as in a game of football. As suggested above, however, identifications with the discursive environment in the open sense that Roth depicts by way of Derrida are never quite secure. I fully applaud Roth’s opening remarks where he states: “With every word, (the old) language dies and (a new) language is re/born.” This is a point of strong agreement between us. Although Roth (4) seems to be doubting this point when its sense shifts later: “It may be detrimental to good theory if the categories shift in translation.” Similarly, theory may slip if *meaning* shifts in translation from one *use* (Wittgenstein) to another. In Lacan’s conception of the subject, however, the deluded fellow mistakenly recognises and lives by versions of self in these symbolic networks that are not sustainable. The story telling individual cannot keep up with events and casts an imaginary layer over everything to make sense of the turbulence in unpredictable ways. The gap between place assumed and the place assigned, mobilises subjectivity such that it cannot be encapsulated in any given

symbolic form. It is this very failure that gives the subject license. In the first statement, rather than complaining, MES was hinting at the costs and benefits associated with fitting in with the current collective story. This is rather akin to Roth's (3.2) statement: "The language, however, is not that of Mrs. Turner. She does not invent it here, but it has come to her from the generalized other, to whom, in her utterance, it returns. She is not only the subject who uses the language, but she also is subject to it and the things it can express." The second statement slightly disrupts this however. MES was celebrating the human subject's ability to transform the state of affairs as a result of the rules, or the language, never quite working. The *alienation* can be experienced as a *positive* condition that renews the conception of the "game" guiding action. There is not a game as such, but rather successive shifts of discursive filters that can successively and radically redefine the field of play (for the game, as it were).

In the case of geometry, for example, I do have the option of playing to the rules of established school geometry. But can I be sure that those rules really are stable? If I was to consult my son's last exam paper in this area I would find a much depleted conception of geometry propping up a test designed to be consistent in style with wider TIMSS/PISA assessment where geometrical concepts are partitioned in very specific ways into questions of a particular form. Quite apart from the formal rules of geometry, that which counts as school mathematics is constantly shifting as a result of the pedagogical/curricula layers being permanently on the move in response to ever-shifting administrative demands (Brown & Clarke, in press). More positively, there will be other wholly contemporary depictions of geometry, such as those developed within recent technologies, opening whole new worlds of spatial awareness. Geometry cannot readily be seen as being independent of its social filter or language game, except that we are in a permanent state of adjusting to the supposed rules of new games, or new emphases, adjustments triggered by failures of fit within previous versions of life. Any such cultural adjustment needs to be worked through by individuals and by groups of individuals who are never in the place of their ancestors. "With every word..."

Corporeality and the Real

As seen Lacan's psychoanalytic procedures produced accounts from patients as symbolic material, which could also be seen as a function of wider discursive activity – an example of how people talked more generally. As a patient this would make up part of the story of who I am, and of who we are. But this story also produces who I am as a physical entity in tune with my environment. For example, within mathematics education research there has been much work on the theme of gesture and with how mathematical phenomena are referenced or evoked by bodily movement. This work might be understood as an attempt to understand the subject's identification to the physical world as seen through a mathematical lens. Mathematical understanding is expressed through gesture. DeFreitas and Sinclair (2012) provide a recent example linking this theme to contemporary issues of subjectivity, contrasting gestures and diagrams as alternative modes of physical representation of mathematical phenomena. The more general issue, however, relates to how the subject connects with the world through a mathematical or scientific lens. How does the subject produce herself within a world understood mathematically or

scientifically? MES provides extensive discussion of students bodily situating themselves in, or moving within, large spatial environments as understood through certain mathematical or scientific filters, jokingly referred to as *extreme gesturing*. Pedagogical apparatus more generally however is produced according to supposed modes of apprehension, such as; inside/outside, within a count, grouped according to criteria, in the form of a graph, having been shrunk to an infinitely small point, etc. A mathematical account might be seen as the end point of a process of achieving an ever more precise story of my experience, such as in reaching a generalisation. I am the subject of the story I tell and reveal who I think I am through the way I reflexively situate myself in the telling of that story: a portrayal of a mathematical me. Žižek's work is centred on the fact that we declare who we are through our cultural productions. Likewise we might assert our collective mathematical identity, or more specifically, what counts as mathematics in schools.

In Lacan's (2008, p. 81) terminology this story telling might be understood as follows:

The subject is dependent on the articulated chain represented by science's acquired knowledge. The subject has to take his place there, situate himself as best he can in the implications of that chain. He constantly has to revise all the little intuitive representations he has come up with, and which becomes part of the world, and even the so-called intuitive categories. He's always having to make some improvements to the apparatus, just to find somewhere to live. It's a wonder he hasn't been kicked out of the system by now. And that is in fact the goal of the system. In other words, the system fails. That is why the subject lasts. (MES, p. 123)

In other words, the scientifically defined universe contingently defines worlds (e.g. Newtonian conceived space, food security patterns, Gross Domestic Products), and the physical coordinates of the human's place within them. The individual (such as the child described by Roth living on a coffee plantation), however, may not be especially comfortable with these assigned places provoking consequences to these perceived failures of fit (e.g. medicinal, nutritional, statistical, normative). For example, Piagetian psychology, so influential in earlier accounts of mathematical learning, has a preference for defining individuals in terms of various physical or responsive attributes, or developmental stages, which may bypass the affective or creative sense of self possessed by the individual herself. Or alternatively, the individual human might too compliantly accept externally applied designations – a reduction of life that will ultimately be resisted². Lacan's model locates life as a negotiation in which the individual works through successive accounts of the world, each of which points to a place for the individual. Lacan mocks the failure of scientific constructs to keep up to date, consigned as they are to the need for regular renewal, whilst the human always survives. For example, economic models are notoriously unstable yet maintain a crucial presence in our attempts to control our relation to life through mathematical apparatus. Physical models of the universe move rather more slowly, but no less radically. But what lies beyond this symbolic modelling? Or perhaps, how is the modelling motivated? Lacan's

² This resistance would take the form of *jouissance*, a surplus to the discursive experience.

answer is “the Real”. I need to clear some preliminary points, however, before explaining this important term that is missed in Roth’s analysis.

Lacan always moved on, defying any straightforward representation of his ideas. One only needs to read any random paragraph from his immense body of work, or the two paragraphs included in this present piece, to realise he favoured a poetic style and the provocation of unsteady responses over the delivery of stable ideas. Notwithstanding Roth’s greater access to Lacan’s style as a result of his linguistic background, Roth’s review (e.g. 3.1, 4) focuses on controversial readings of a very specific phase of Lacan’s work³, namely the middle period from the fifties, where the influence of Saussure’s structural linguistics was at its greatest. In addressing this aspect Roth incorrectly separates Lacan’s three orders of the Imaginary, the Symbolic, and the Real, which relate symbolic activity to the tangibility of the world we encounter. The work of Žižek and Badiou referred to in MES is centred on a later Lacan. By this time Lacan had been exposed to a more diverse audience stretching beyond the therapeutic community.

The key difference between the middle and later periods of Lacan’s work is the prominence in his later work of what he calls “the Real”. The Real is variously defined over the years but relates to that which is beyond the scope of representation, “that which resists, the impossible, that which always comes back the same place, the limit of all symbolisation” (Lacan, quoted by Critchley, 2008, p. 63). Critchley continues: “The basic thought here is that the real is that which exceeds and resists the subject’s powers of conceptualisation or the reach of its criteria”. The thought can never comprise a well defined signified. Lacan’s later emphasis on the Real cuts across Roth’s supposition that “Lacan focuses exclusively on language”. For Lacan (1986, p. 221), “philosophical idealism ... cannot be sustained and never has been radically sustained.” Badiou or Žižek assign Lacan’s work to wholly materialist projects. The Imaginary⁴, the Symbolic and the Real, key terms in Lacan’s apparatus, famously comprise a *Borromean* knot of mutual dependency. In MES the Real underpins the mechanisms for change that are depicted, where the Symbolic perpetually chases a Real that defies any final encapsulation.

The Real itself can be responsive to, or be altered by, these attempts at its capture. The physical state of clinical depression can be improved or worsened by talking about it. Similarly, bodily intuitive conceptions of space, such as Roth’s example of a cube, or examples in MES that “in the limit come close to the idea of a circle” (Roth), can be transformed through introducing novel ways of talking about our spatial movements. Roth’s (3.1) suggestion that “Lacan never was concerned with real material life but only with the accounts his clients provided thereof” is inaccurate. It is not an adequate representation of the pain experienced by his patients or of the management of that pain by the analyst. The misery was all too real. Lacan (1986, p. 203) insists that it “is the field of the living being in which the subject has to appear.” The physical state of a body, including its feelings, are a function of how it is mapped out or classified by medical

³ I have not followed Derrida in reading Lacan in the original French, even though Derrida and Lacan, alas, never quite reached final resolution on each other’s obscure texts, despite both of them being French.

⁴ Lacan’s iconic example is of a young child looking into a mirror and recognising the image as herself, an image that suggests a completeness that may not be experienced.

experts, which in turn has an effect on the subject's own awareness of her physical make up, and how she is quantified for medical assessment. The patient may develop awareness of her own bodily condition and how she adjusts various medications to produce particular states of physical wellbeing. Similarly, exercise programmes are quantified (reps, resistances, speeds, weights, timings, targets) and may be adjusted to produce different effects on the body. Likewise the immersion of students in spatial environments (e.g. How do I experience moving on a really big circular locus?) works on the students' physical sense of self ("the force overcoming the resistance of the body to walking, the opposition of the body to gravity, or the walking of the walking" (Roth, 2.3)) rather than just generating mere reportage of that experience. The movements and sensations are part of how they learn mathematics. This negotiation, however, whilst peripherally aware of the Real, can never directly represent it. "My knowledge of myself is limited to the empirical presentations that pass before my gaze. What I *am* - ontologically - remains a gap in knowledge. In Lacanian terms, we are only ever presented with imaginary egos and subjects of statements, but never the subject of enunciation" ("*The accursed share*", anonymous blog).

Discourse, relationality and subjectivity

"Words do not belong to one person, but constitute the realities for two; words are not the words of individuals, but always belong to speaker and audience simultaneously". Roth (3.2) attributes this sentiment to both Derrida and Lacan. Yet surely this image of two people talking is locked in to conceptions of a circumscribed individual (a subject of psychology) alien to both writers. Derrida did not spend much of his time talking about individuals or reality. Lacan's work was entirely about subjectivity but where the psychologically defined individual is less prominent as a distinct entity. Rather the subject is understood relationally in terms of his or her identifications with particular aspects of life, such that it becomes unclear where the individual ends and the world begins. Lacan totally rejected ego psychology's project. Roth's inclusion of the transcript reporting on a conversation between Mrs Turner, Mrs Winter and Thomas provides a typical example of how he sees individuals interacting on mathematical tasks, where for example, Mrs Turner is "allowing Thomas to understand (*the meaning of?*) the question". It seems reasonably straightforward to decide where Mrs Turner ends and Thomas begins, even if they share "realities". Roth has written many other such papers where the expressive physical gestures of the individual humans extend beyond the sharing of spoken or written symbols. He has also responded to discussion in MES where students experience walking the loci of various geometric configurations.

The notion of "one person" or of "individual", however, is not always quite so distinct. Research has described many examples of children accessing mathematics through computers, where the boundary dividing teacher and student is obscured. For example, the teacher function in the educational use of *Cabri-Geometre* can be enacted in different ways. It is easy to generate alternative contemporary examples where the nodal boundaries (teacher, student, mathematics, human, machine) are rather less clear, such as between where the human stops and the machine begins: Stephen Hawking producing equations through his electronic media, children tweeting about their mathematics

homework, or sharing an app on an iPad, computers consummating a prearranged date to trade shares as predicted market conditions move into place (most stock market transactions are now automatic), Lewis Hamilton and Felipe Massa driving their cars into each other, Arnold Schwarzenegger's alter ego terminating one of his adversaries, the absence of centrality in the worldwide web. The talking and gesturing individual human as an immediately present physical entity is rather less prominent in the landscape of contemporary society as a result of machines or pedagogical apparatus replacing so much of what had been human contributions. There are also many instances where the student's demonstration of his or her mathematical understanding amounts to (or subjectivity is reduced to) little more than filling in a gap in a story provided by some sort of assessment device.

There is a difference of emphasis between the ways in which Roth and I are centred in conceptualising subjectivity. In his broader project, Roth (2010) aims to "reunite" psychology and sociology. He focuses on the individual human individuating the collective programme through his or her expressive action, such as in an exchange between teacher and student. More typically MES focuses on how discourses shape subjective action within a Lacanian model that includes neither "psychology" nor "sociology" in its vocabulary. Students were asked to report on their memories of learning calculus at school. Teachers were asked to reveal their agency in implementing new curriculum materials. The work of researchers in mathematics education was analysed to see how the work encapsulated the field. That is, MES (p. 129) asks: "What aspect of the whole person is activated (or brought into being) in any given semiotic configuration?⁵ How are they created as subjects? Which discursive aspect responds, or appears, and why.

MES (p. 127) consults Lacan on this point who writes in his usual playful manner:

The whole ambiguity of the sign derives from the fact that it represents something for someone. This someone may be many things, it may be the entire universe, in as much as we have known for sometime that information circulates in it... Any node in which signs are concentrated, in so far as they represent something, may be taken for a someone. What must be stressed at the outset is that a signifier is that which represents a subject for another signifier. (Lacan, 1986, p. 207)

The "ambiguity" for Lacan is centred on how the "someone" is predicated in semiotic activity. What does Lacan intend by his curious suggestion that the "someone" could be the "entire universe". This term is made yet more obscure by the clause "in as much as we have known for sometime that information circulates in it". This hints at a more extensive engagement with discursive networks and their production of subjectivity, a subjectivity that can never quite hold on to the discursive universe that it reflects. Connectivity to the internet, for instance, re-centres our sense of self, our sense of reach and our scope of receptivity. It affects how we process information, make gestures, impact on others, etc. MES addresses how teachers, students and mathematics itself are *commodified* according to the needs of an exchange economy. Contemporary

⁵ The rather troubled notion of the "whole person" must have slipped into the text accidentally.

understandings of subjectivity centred on human immersion in discursive and signifying activity provide a backdrop to Lacan's pre-internet assertion that "someone" might provide access to the entire network of discursive activity. Everyone is implicated in the discursive construction of society and everyone draws on that construction. And thus: "Any node in which signs are concentrated, in so far as they represent something, may be taken for a some-one". A subject then is not just an individual human, it could also be an agency, a cause, movement, or "fidelity" to a new way of being (more on this shortly). The final sentence in Lacan's paragraph "that a signifier is that which represents a subject for another signifier" might be related to an example referred to in MES:

The old style hospital bed has at its feet, out of the patient's sight, a small display board on which different charts and documents are stuck specifying the patient's, temperature, blood pressure, medicaments, and so on. This display represents the patient - for whom? Not simply and directly for other subjects (say, for the nurses and doctors who regularly check this panel), but primarily for *other signifiers*, for the symbolic network of medical knowledge in which the data on the panel have to be inserted in order to obtain their meaning. One can easily imagine a computerised system where the reading of the data on the panel proceeds automatically, so that what the doctor obtains and reads are not these data but directly the conclusions that, according to the system of medical knowledge, follow from these and other data (Žižek, 1998, p. 74)

The signifier, a graph maybe, represents the subject, a patient in the bed, for another signifier, a doctor or nurse reading the graph with view to it impacting on a specific dimension of their subsequent actions. That is, we are not attending to patient or medic as "whole people". Rather we are considering the patient through the restricted registers of the patient, with particular symptoms, and a medic only interested in those symptoms (perhaps with view to setting a correct dosage), according to the wider system of medical knowledge. One could extend the computerised system so that a sensor could detect a bodily change that triggered some medication being introduced in to the bloodstream.

This example, echoes countless studies in mathematics education research where there is a demand to isolate the mathematical dimension of wider discussion. But such questions are crucially linked to the geography of the supposed interface of subject and object. Mathematics in schools exists substantially as pedagogical material crafted for supposed modes of apprehension. Students are required to spot certain things according to the given mark scheme. But such apprehension depends on how we understand mathematical objects and how we understand human subjects. That is, a given mark scheme supposes a given conception of a student able to answer on those terms, and supposes that mathematics can be seen in a particular way, and taught by a teacher able to evoke it in that way. That is, as above, subjectivity is reduced to little more than filling in a gap in a story provided by some sort of assessment device. In another example above I queried how the subject "mathematics education researcher" derived from the demands placed on that designation. Roth and I have chosen different terms of reference in making this assessment.

Subjectivity, relationality, personality

I fully agree with Roth when he says that “we cannot stop with our consideration of the subject and subjectivity by considering what happens in a mathematics classroom alone. ... A person cannot ever be identified by its subjectivity within the mathematics classroom or within a mathematics education discourse”. Subjectivity cannot be partitioned into just those bits concerned with mathematical learning. Seeing mathematics education as so many classrooms organizing mathematical learning is only one version of how mathematical learning is taking place in the world today. The subject, or the “human”, or the “personality”, in Lacanian terms derives from persistent (failed) attempts to make sense of the world. We can never get our story quite right. The Real can never quite be captured in the Symbolic, even in a given sub-domain of that Symbolic such as that relating to the mathematics classroom. Lacan’s subject (of desire) is always reaching beyond the current state of affairs, a perpetual quest to improve on the current story motivated by spotting the “holes in discourse”. (Lacan, 2008, p. 27)

In the hands of Badiou or Žižek, Lacan’s motivation entails detecting the limits and limitations of the ideological parameters that shape our actions. Badiou’s work, for instance, is centred on the potentialities of noticing blind spots in our current story and how these blind spots might alert us to new perspectives, to new ways of being. Any world relates to a state of knowledge. Knowledge, however, does not capture Truth (for all), and for this reason knowledge will always need to be revised to fit the times and circumstances. For example, mathematics (as knowledge) was expanded when Cantorian set theory permitted infinite sets to be conceptualised as objects, and again when the real number system sought to include i . For Badiou, there is some mathematics that is a function of contingent empirical reference (e.g. mappings of phenomena observed in the physical world *as we presently know it*) and some that is not dependent on such reference (Badiou uses set theory to create his model.) But we occasionally have to shift ground as we are not always entirely sure as to how much mathematics is motivated by some reference to a world. Indeed mathematical thinking relies on *shifts of attention* (e.g. Mason, 1989) to differentiate between particular and general dimensions.

Roth (3.3) cites Rancière for whom subjectification denotes “the production—through a series of action of a body and of a capacity for enunciation not previously identifiable within a given field of experience, whose identification is thus part of the reconfiguration of the field of experience”. I take this to mean that a hole in discourse has been located and that a necessary adjustment has been carried out. Roth rephrases this as: “the subjects are transformed by their own actions that are themselves a function of the *field of experience* and therefore are not entirely owned by the subject”. It seems to me however that the two authors are using the terms “subject” and “body” differently. Rancière, I believe, is using the term “subject” in much the same way as Badiou as described above whilst Roth is seeing “subject” as being linked to an individual human body. Roth is incorrectly assuming that Rancière is also referring primarily to an individual human body. In the work of Badiou and Rancière (thinkers who occasionally share the same stage), I suggest, we are witnessing a radical redistribution of the psychological where, within Badiou’s Maoist preferences, individual personalities follow from a more collectivized account of the world. That is, individuals follow communities of practice

adjusting to new ways of living.

In Badiou's terminology, bodies (whether that be an individual body, or a collective movement, or a body of thought) may be understood in terms of subjective "fidelity" to specific cultural adjustments, that is, to *events*, which comprise new ways of being in a somehow expanded multiplicity of elements (the anti-slavery movement working to include more people as humans, or votes for women doing the same to expand conceptions of the electorate and of democracy). One might also consider changing university entrance requirements to rewrite the conception of a graduate to meet new workplace criteria; highlighting new pedagogical/mathematical objects/priorities consequential to the growing influence of international comparative testing.

The domain of subjectivity is activated and renewed by such events, and hence the possibilities of what it might be to be human. That is, we are not just concerned with humans changing the material conditions as Roth suggests, but also *changing the conditions through which it is understood what it is to be human*, or more specifically what it is to be a teacher or a student. For example, so many "human" interactions are now processed through technical media, affecting spatial and temporal parameters, and thus how subjectivity is produced, represented or accounted for. The living being is sometimes less prominent in this virtual landscape than in the exchange Roth (3.2) describes between Mrs Turner, Mrs Winter and Thomas. Roth's suggestion that "Thomas's own utterance is an integral part of the production of the subject" implies a singular subject "Thomas" in just one place, with the rather flat suggestion that Lacan sees "the subject *in* the relation between the signifiers" (my emphasis), as if some formula of identifications could produce a personality or a clearly defined sequence of subject positions⁶. Thomas, however, has different ways of occupying the space. Lacan, (1986, p. 208) argues that the subject "develops its networks, its chains, its history, at an indeterminate place" beneath the signifier, or dominant story. The "subject may in effect occupy various places, depending on whether one places him under one or other of these signifiers" (p. 209). These multiple opportunities to set the coordinates defy stability or consistency in perspectives or descriptions since the perspectives comprise the learning of new ways of being that might transcend the immediate physical territory of the three people present, such as; in following the wider introduction of a new mathematics curriculum, aligning with a new attitude to curriculums, or in working practices adjusting to new systems or technologies (Hoyles, Noss, Kent & Bakker, 2010).

Conclusion

The method in psychoanalysis entails the production and analysis of symbolic material, or of a story. In mathematics education research we need to attend to the texture of what we produce. The story in itself is a valuable entity, which methodologically produces the research objects that orient the mode of enquiry. This story is not subservient to some *thing* that it is trying to represent (such as how a mind works, or how ideas have been

⁶ Lacan's subject was "barred", as in Roth's Fig. 2, to emphasise the gap between the subject's place of enunciation and the enunciated subject. There is a difference between the individual and the way that individual implies herself through her descriptions of the world. Similarly, in naming my son Elliot there is a gap between how I visualised that name and how Elliot now lives it.

portrayed through the work of historically significant writers, how a meaning has been fixed, or usage familiarised). Indeed the story is productive of that thing, *and* a useful barometer of that thing. It entails *looking at one's own looking* to see how objects (*meanings*) are generated within a story that never settles. But the story is also productive of the person telling the story, since the story reflexively situates its storyteller. We must, however, be cautious. Lacan suggests that when the analysand says "I", the analyst should be mistrustful. In responding to Roth it is more precise when "I", like Roth, refer to the MES text rather than speaking in the first person as the author. The individual, or any collective, is only ever partially self-aware. "I" am surprised by some of Roth's claims as to what MES is saying, whilst learning a lot through that surprise, and for which I am very appreciative. The stories we tell are both part of on-going speech, and part of the wider discursive network. The location of the stories will always move on since speech never stands still. They have a limited shelf life. The stories will adjust to new circumstances. And it may be that our story telling resources will change, such that we tell stories in new ways to produce alternative effects. Different stories will be told before long. But it is possible to learn from these present efforts. That is, we can learn from how those attempts fail to produce the result that we seek. Persistent attempts produce patterns of failure that allude to the Real that is sought. For no part of the Real is there a final encapsulation. It is only ever possible to begin with past illusions, or localised predictabilities. Any adjustment adjusts the whole picture, not just some localised elements. There is no progress through a tick list of certainties.

For Lacan (2008, p. 17) "truth is always new", knowledge is always renewable. But that knowledge provides much of our everyday reality. The emphasis on the stories that we tell is not to suggest that we reject the knowledge that we have. We can learn from how those imposed stabilities guide life, or sometimes, whole lives. We may assume particular discursive formations, set rules, introduce analytical frameworks, or hold certain assumptions for the time being, which influence the research questions that we ask. For such knowledge is a function of the *worlds* in which we live. Indeed much of our infrastructure (buildings, modes of governance, law, social practices, preferred styles, or pedagogical objects, curriculum forms, schools, conceptions of teacher, examinations) is a function or reification of how previous generations conceptualised life. We can however better appreciate the limits and limitations of such worlds and the forms of knowledge that they host, to avoid the false comfort in contingent arrangements and to better understand how those arrangements shape our actions. As in many instances of life we are swayed by our particular versions of common sense and these influence the research that we pursue. This piece of writing is arguing that we might learn more about our own common sense to better understand its effect on our lives.

If Wolf Michael Roth and I were to sit down over a cup of coffee we may well reach some sort of agreement as to from where we are telling our stories and what we are trying to achieve. Or perhaps, sometimes, alternative ways of thinking are mutually exclusive. The task of research surely is to generate alternative arguments, not to suppose that there is a neutral scale that allows us to cross-evaluate. The purpose of this piece is to argue for theory, not so much for a particular type. And theory moves on in response to changing circumstances. To reference everything back to old writers can trap our thinking into the

false security of established modes of thought and their priorities that can fix both objects and the relationships between them. *Mathematics Education and Subjectivity* explores how different sorts of common sense are revealed in instances of mathematics education practices and in the discussions that surround this type of education. The book is concerned with showing how we might work against those forms of common sense that prevent us moving to fresh ways of being that might serve us better in new circumstances. In that quest Roth and I are certainly at one.

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