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# Mathematics, capitalism and biosocial research

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## Abstract

In my previous work, I criticised studies within the sociopolitical turn for disavowing a comprehension of schools as places of capitalist production. Here, I extend this critique to what is being flagged as a new turn in educational research. I am referring to biosocial research, particularly in the way it is coupled with new materialist and more than human philosophies in the work of Elizabeth de Freitas. I use elements from Marxian theory and Lacanian psychoanalysis to explore the concomitances between mathematics and capitalism, showing how both mathematics and capital need to suture the subject in order to thrive. Biosocial research epitomises this drive towards automation and totality, and, notwithstanding de Freitas' attempts to rescue it from the logic of control, I will argue that agent-centred intentions dismiss the underlying workings of capital as a real abstraction. I do so by engaging with elements of Deleuze's philosophy, showing how the more than human frame in which de Freitas' biosocial research rests contradicts her own perception of how biosocial research can be rescued for inclusive purposes.

**Keywords** Mathematics · Capitalism · Biosocial · Deleuze · Lacan · Marx · Sohn-Rethel

## 1 Introduction

The advent of the social (Lerman, 2000) and sociopolitical (Valero, 2004) turns signalled a preoccupation in the community with the ways in which cultural conditions, societal arrangements and political decisions influence the way students, teachers, researchers and policy makers engage with mathematics education. The first decade of the 2000s was a prolific period for research addressing issues of social justice and equity, and some authors have found in postmodern theories a language to address problems historically unconnected with mathematics (e.g., Atweh, Graven, Secada, & Valero, 2010; Brown & Walshaw, 2012; Gutiérrez, 2010; Valero & Zevenbergen, 2004; Walshaw, 2004). These theories brought to the research gaze cultural, social and political aspects of mathematics education that are now widely recognised

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as influential when learning mathematics. Authors such as Paola Valero, Margaret Walshaw, Paul Ernest or Rochelle Gutiérrez have been writing or editing books that disturb the taken-for-granted assumptions, truths and certainties of mathematics education research, whether they concern modern rationality fuelling mathematics and its education, or constructivist and individually centred approaches to learning.

Emancipation is also a flag of the sociopolitical. There is at the core of this research a desire for betterment—no more the naïve modern idea of progress, in which human beings rationally seek an ideal high-tech society with plenty of resources available to everyone, but a more localised concern with empowerment and liberation from a plurality of social constraints and injustices associated with race, sexuality, ecology, language, cultural minorities, colonialism, religion, rurality and class. In line with the postmodern paradigm, change is not conceived as a change in the totality—a change in the global mode of production, for instance—but as being based in local struggles which take into account the complexities of particular contexts (D’Ambrosio, 2003; Ernest, 2004; Gutiérrez, 2010; Gutstein, 2003; Knijnik, 2012; Skovsmose & Borba, 2004; Valero & Stenoft, 2010). Valero and Stenoft (2010) synthesized this idea by arguing that we should move beyond a Marxist idea of social justice which was based in the inequalities generated by the system of *capital*, to an idea of social justice revolving around the way modern institutions and discourse formations fabricate the modern *subject*.

In 2008, and after teaching mathematics for nearly 10 years in different Portuguese schools, I resigned from my job and started a doctoral study in mathematics education. Being a teacher is a very challenging and enduring work, but it does not (perhaps strategically) give you time to think. And I needed time to reflect on all the contradictions I felt accumulating during the last years of my teaching.<sup>1</sup> Looking in mathematics education research for writings that could help me map some of these problems, I soon realised that studies within the sociopolitical turn most closely addressed the conundrums I was experiencing as a teacher. These problems are in a way more mundane than the increasingly specialised research on topics as diverse as cognitive strategies for teaching geometry proof, or teaching methods for modelling students’ self-efficacy expectations. They are related with contradictions in my role as a teacher and the role of school in society, and they are difficult to map within the theoretical straitjacket of “learning” that drives mathematics education research (Pais & Valero, 2012). They require a positioning of mathematics and its education within an *institutional* frame, where one can see more in mathematics education than the teaching and learning occurring in a classroom.

I spent the first couple of years of my doctoral research studying mathematics education literature within the sociopolitical turn, especially the one supported by postmodern theories. Reading this work had an eye-opening effect. I started to posit school not as a necessary institution of our society but as the result of a historical process tamed by power relations and deeply involved in the fabrication of the modern subject. It may be that in school people learn specific contents (mathematics, history, geography, etc.), but they also learn the symbolic norms that structure their acting in the world. Mathematics, when inserted in a school frame, functions as a disciplinary device of subjectification (Foucault, 1979; Popkewitz, 2004). Mathematics education research, by being primarily focused on pragmatic approaches to the improvement of classroom practice, lacks a theoretical comprehension of how its own activity is at the same time entangled and generating broader systems of reason that format what is possible to think about practice (Llewellyn, 2018; Valero, 2004).

<sup>1</sup> Elsewhere I provide a detailed account of these (Pais, 2011).

Notwithstanding the importance of poststructuralism and postmodernist theories in sharpening my critique of mathematics education, I was progressively feeling that these theories were missing an important dimension of schooling. Such uneasiness resonated with the work of Roberto Baldino and Tânia Cabral. While mathematics education research was roughly divided between a “didactical” approach, with no social or political concerns whatsoever, and a “postmodern” approach, with its emphasis on discourse and power relations, Baldino and Cabral were using old Marxist categories to analyse their work as mathematics teachers at the university (e.g., Baldino, 1998; Baldino & Cabral, 1999). They have been suggesting that considering school as a place of economic production may shed light on students’ learning difficulties. Their entire research is an attempt to show the inconsistencies of capitalist schooling. They bring forward the usually disavowed role of mathematics within what Vinner (1997) called the *school credit system*, by developing an account of the role of schools in guaranteeing the necessary capitalist and worker ideology that is to be reproduced in society. Their work allowed me to express in a new language many of the problems I felt as a teacher. Moreover, it made me suspicious of the way studies within the sociopolitical turn reject capitalism as a central organising principle of today’s society.

In the last 8 years, most of my research has focused on rehabilitating Marxian theory as an important frame to understand the current impasses of mathematics education. This implies developing a critique of the way sociopolitical perspectives disavow the *economic* dimension of schooling (Pais, 2014, 2015, 2016). In this article, I continue this endeavour by developing a critique of what some authors argue to be a new “turn” in education research. I am referring to *biosocial research*, a radical reconfiguring of education research, merging research methodologies from the life sciences and the social sciences (de Freitas, 2018; Youdell, 2017). Although biosocial research can easily fall into a reductive scientism, this situation is solved by coupling it with the ethics of new materialism and more than human philosophies (de Freitas & Sinclair, 2013, 2014). Elizabeth de Freitas (together with Natalie Sinclair) has been the main proponent of such a turn in mathematics education. In their writings about biosocial research, de Freitas and Sinclair are aware of the reductive scientism surrounding investigations in this area, which can easily serve the purposes of state control or corporative management (de Freitas & Sinclair, 2016). As an antidote to this framing of biosocial research, de Freitas (2018) introduces elements of Deleuze’s philosophy as to reclaim biosocial research “as part of a more inclusive materialism” (p. 298), by creating “a robust bioethics adequate to twenty-first-century new empiricisms” (p. 293), where biodata is conceived not as the property of an individual, but as being *environmental*: “my aim is to develop a particular approach to biosocial research that shows how digital bio-data belongs to learning environments rather than to individuated organic bodies” (p. 294).

Similar to de Freitas (2018, p. 302), my suggestion is also not to reject biosocial research. However, I do not see my role as one of making biosocial research more adequate to the dynamics of today’s capitalism. Instead, I take this new trend, in the same way as I take postmodernism, as being symptomatic of the status of contemporary society, and use it to investigate how capital is present as a concrete universal in our emancipatory endeavours. While critical of postmodernism’s disavowal of material features (such as the body, senses, gesturing, etc.), this new trend shares with postmodernism the rejection of political economy. Both perspectives rest on a tacit acceptance of capitalist economics as the unquestioned framework structuring our social life. In doing so, they miss addressing crucial questions. What is the background against which biosocial research is emerging? What kind of society and subject does it presuppose?

In this article, I explore these questions through the lenses of Lacanian psychoanalysis and Marxian theory. I start by briefly underscoring features of capitalism that will be important for my analysis, based on a Lacanian reading of Marx's notions of *abstraction* and *commodity*. I then elaborate on the concomitances between modern mathematics and the development of capital, attempting to show the genesis of modern mathematics as an essential part of the capitalist relations of production. For this purpose, I rely on the philosophical work of Sohn-Rethel (1978), who offers important insights to study the intermingling of capital and modern mathematics. Finally, I explore biosocial research in mathematics education, showing how it constitutes a typical case of capital's drive towards accumulation, where new trends, new methodologies, new pedagogies are devised as an *acting out* against the impossibility of education. I do so by engaging with elements of Deleuze's philosophy, showing how the more than human frame on which de Freitas' biosocial research rests contradicts her own perception of how biosocial research can be rescued for inclusive purposes.

## 2 Capital: a vital force

I will focus on a set of aspects that characterise capitalist economy, which I find important for my analysis of mathematics and its education. These stem from a Lacanian reading of Marx's theory (a thrilling research enterprise carried by Lacan himself, Althusser, Sohn-Rethel and, more recently, by Žižek and Tomšič), which, far from moving away from Marxism, lead deeper into it.

Marx first expressed the view that *abstraction* was not the exclusive property of the mind, but arises in commodity exchange, in the beginning of *Capital* (1976) and earlier in the *Critique of Political Economy* (1970), where he speaks of an abstraction other than that of thought. Sohn-Rethel (1978) further developed this idea by exploring how the essence of commodity abstraction is not thought induced: "it does not originate in men's minds but in their actions" (p. 43). That is, independently of what we consciously think to be the meaning and the outcomes of our actions, these originate their own system of knowledge, a knowledge, as Lacan (2007) puts it, that does not know itself, but that, nonetheless, conditions our activity in the world. One can say that while we may be rational in our thoughts, in our actions, we are irrational.<sup>2</sup>

At stake here is the separation between the *exchange value* and the *use value* of a commodity, which, in capitalism, assumes the necessity of an *objective social law* (Marx, 1976). As expressed by Sohn-Rethel (1978), "wherever commodity exchange takes place, it does in effective 'abstraction' from use", and he adds, "this is an abstraction not in mind, but in fact" (p. 25). That is, no matter how people think of commodities as objects of use, during the exchange, the use of the commodity is insignificant, and what counts is its exchange value. In other words, although people perceive commodities as multiple (every commodity has a different use, and even the same commodity can have different uses for different people or in different situations), its existence is one, defined by its exchange value in the market. The action of exchange is reduced to strict uniformity, eliminating the differences of people, commodities, locality and date (p. 30). In this way, it functions as a *social synthesis*, where

<sup>2</sup> Our daily lives are rich with examples of this dialectic. For instance, apropos of the recent paranoia concerning surveillance and personal data, while we rationally may know that the use of platforms such as Facebook exposes us to unforeseen troubles, in our actions and against our better knowledge we keep using them.

all commodities, including labour power, can be equated, despite their different uses, colours, flavours or any other particular characteristics. Because it detaches itself from human activity, the exchange value of a commodity functions as a social synthesis, providing a unified field of exchange. One can say that capitalism functions better without humans.<sup>3</sup>

This “non-human” feature of Marxian theory is often disavowed. For instance, de Freitas (2018, p. 302) suggests that theories of labour and capital were built upon conventional understandings of the human body, and that Deleuze and Guatarri’s theorisations provide instead a frame where the concepts of dividuality and becoming allow for a disassembled understanding of the human body—that is, an understanding of the human body as unbounded and fragmented, indistinguishable from other (non-human) bodies, and not subject to the overriding mechanism of a unified subjective consciousness.<sup>4</sup> However, one can argue that this “disassemblance” was already at play in Marxian theory, particularly evident in Marx’s investigations around the notion of *commodity fetishism* (Marx, 1976; see also Žižek, 2008). Later on, I will return to a discussion of Deleuze’s philosophy in articulation with capitalism and biosocial research.

The *drive towards automation* and the technological development that encompasses modernity is a result of the revolutionising nature of capital. Marx himself was fascinated by the great material potential that a capitalist economy unleashes, as well as by its inherent contradictions. One relates with the fact that, while the tendency of production is always to increase, markets do get saturated. However, instead of reducing production, capital increases it, diversifies it, and transforms the market, so that production does not stop increasing. *All is possible* under the auspices of capitalism, which creates new consumer populations, new products and new needs, and this is also its *irrational* character, in the way it prioritises production over human needs. Moreover, the concept of “human need” itself becomes a function of the needs of the market (Marx, 1970).

As recently explored by Lacanian philosopher Samo Tomšič (2015), one way of describing capitalism is that it is life without negativity, that is, the efficiency and the logic of capitalism is supported by a fantasy/ideology of a subjectivity and a society without negativity (p. 7), where everything is conceived as “possible”. In this sense, capital is creative potential, a specific form of vitalism, where any new senses and meanings are a priori foreseen in the real abstraction of commodity exchange.

### 3 M20 and capitalism

The enormous scientific development of the last 200 years, particularly in M20,<sup>5</sup> is concomitant with the establishment of capitalism as a global economic system. How to understand this concomitancy is an open debate, one that social sciences and humanities have been tackling from different angles. Here, I take the materialist assumption that the historical and logical

<sup>3</sup> Taylorism (as explored by Sohn-Rethel) exemplifies this drive towards automation, where it is not only machines replacing human work, but also human work that becomes purely mechanical, lacking the dimension of life proper (the worker who complains, wants more holidays, gets sick, pregnant, etc.).

<sup>4</sup> I am thankful to one of the anonymous reviewers for this phrasing.

<sup>5</sup> M20 is a term coined by Roberto Baldino to designate the developments in mathematics that resulted from the work of mathematicians such as Cauchy, Weierstrass, Dedekind, Cantor, Hilbert, Frege and Russell, in their attempts to substantiate mathematics with a secure axiomatic system, whereby previous faulty notions of limit, continuity, infinity and infinitesimals can be elaborated in a secure way. That is, in a way that conventional meanings surpass ambiguities of common language (as small as we wish, infinitely close, etc.).

genesis of sciences is part of the capitalist relations of production (Sohn-Rethel, 1978). This implies that any recognisable social or scientific innovation or transformation springs from the economic relation. The social synthesis made possible by the abstraction of commodity exchange provides the historical background to understand the synthetic role that mathematics has in science. Mathematics is seen as the science that can potentially unify, through quantification or formalisation, different systems of knowledge (including alien knowledge, see Stewart (2017)). This synthesis is possible because mathematics is “the only symbol language which renders itself free from [the] tie-up with human activity” (Sohn-Rethel, 1978, p.112). This division between symbol and human activity is already at play in the social synthesis made possible by the separation between the exchange and the use value of a commodity: “the social necessary forms of cognition in any epoch have no source from which they can originate other than the prevailing functionalism of the social synthesis” (p. 57).

In Pais (2017a), I explore this logic, by arguing that modern mathematics thrived so vigorously through the XX century because it lost contact with reality, its reality became endogenous with the signified, with the “meaning” of its symbols. The meaning of its symbols became conventions understood only by the initiated. Mathematics can be said to be the science where the foreclosure of subjectivity is most severe (see also Baldino & Cabral, 2018; Lensing, 2017). The process of mathematical formalisation seeks to assure that mathematics can function without a subject, making sure that one can find nowhere a trace of what is usually called the “subjective error”. As previously explored, the same logic is at stake in capitalist production. The value of a commodity is not only defined by its use (by the “meaning” it has for the people who use it), but by the place it occupies in the set of all commodities, which defines its exchange value. Here resides the secret of capital’s mesmerising growth: by reducing people to commodities, it gets rid of the burden of “subjectivity”, reducing people to the value of their qualified labour power. Moreover, it is not only that “subjectivity” as such ceases to exist, but also that individuals are produced that *enjoy* this exclusion (Lacan, 2007).

It forms part of the very nature of modern science to foreclose the subject, inasmuch in the same way as it forms part of capitalism to register and manage people by numbers. Against this background, and particularly important for the discussion of biosocial research are those sciences whose methods are based on pattern recognition and pattern matching. Borovik (2017) uses the term *patternism* to designate the increasing saturation of patterns that characterises the new information environment. Particularly with mathematics, there is a push to abandon the formulation of mathematical models of real-world objects and processes, in favour of pattern-matching algorithms over large data sets. Google is a typical example in the way it focuses on identifying patterns of behaviour of information seeking to predict the actions (intelligent writing, for instance) or the thoughts (intelligent search) of the user. The problem with this scheme is that one tends to only have access to what one already knows; if one is always within the same cosmos of information, built only out of one’s own interests, we will hardly experience the new, leading towards “a determinism, a teleology, a prescriptive destiny and a pre-given trajectory” (François, 2017, p. 98). As noticed by Fochi (2013, p. 40), the paradox of an apparatus like Google is that the world of seemingly extreme personalisation that Google creates (each user has its own personalised information, according to his or her recorded choices), “can only function by flattening the subject onto its identity with itself” (p. 41). That is, by limiting the subject to the information one has of it.

Pattern recognition and pattern matching does not lead to the formulation of new thoughts. The subject is flattened. As mentioned by O’Neil (2017) when discussing her

inciting book *Weapons of Math Destruction*, “we have all this data and we have patterns, and the machine learning algorithms are very good at pattern matching – but what they do is propagate historical practices” (quoted in Tarran, 2016, p. 42). These endeavours rest on the underlying logic that one can elaborate with precision what society needs and propose solutions accordingly. It is assumed that one day soon it will be possible to calculate all human activity reduced to objectifiable behaviour (Laurent, 2013). As analysed by Lensing (2017), this happens even in areas historically less prone to mathematical elucubrations, such as love and self-knowledge:

phenomena can be processed by a computer exactly then, when they are reduced to their quantifiable aspects: “Love”, for example, becomes a matching of two persons qua psycho-metrics; “health” becomes the result of the combination of singular physiological characteristics, etc. In this way, human practice –and with it the subject itself– becomes reduced to those aspects that can be quantified in an apparently objective way, and the regulation of even larger social areas –hitherto contingent on human interaction– becomes replaced by mathematically formalized complements. (p. 678)

Love, a sentiment historically resistant to any sort of understanding, becomes possible through quantification. This “becoming” is not only a contingency, but a necessary feature: love *must* become a matching of two persons qua psychometrics to satisfy the needs of the market. What these endeavours render visible is capital as a real abstraction, where, in order to be, every inch of reality needs to be registered in the space of commodity exchange. Biosocial research can thus be seen as an answer to the capitalist demand for total commoditisation, where a person must become an assemblage of biodata to be registered and recognised in the symbolic field.

#### 4 Biosocial research and inclusive materialism

de Freitas presents *biosocial research* as a “radical reconfiguring of education research” (2017, p. 56). Biosocial research, within the realm of education, consists mostly in tracking bodily movement and activity, together with a “rapid take-up of machine learning and new computational approaches” (p. 56) to processing data. This data is conceived as being “below the level of human perception” (p.57) and has been used with children and adults to track any behaviour amenable to measurement and modification. Biosocial research is thus part of a current transformation of biology itself, as it becomes increasingly computational and data driven (de Freitas, 2018; Stevens, 2013). de Freitas (2017) reports research in mathematics education within this new trend, arguing, “this kind of research is changing the way we study mathematics education” (p. 56, 57). In particular, de Freitas focused on the recent research into *number sense* (Dehaene, 1997), involving brain imaging technology detecting parts of the brain that are activated when people and animals do calculations: “scientists are searching for the ‘number neuron’ on which they believe number sense is based” (p. 57).<sup>6</sup> This “number sense” seems to be biologically determined (Chinn, 2015, quoted in de Freitas, 2017, p. 56), so that a better knowledge about it could allow for the fixing of many of the problems that students find when dealing with numbers in school.

<sup>6</sup> It is truly remarkable that neuroscientists were able to register what mathematicians have not been able to do for centuries. The closest they got are the Peano’s axioms, which do not quite define a number but set the frame wherein one can operate with numbers.



de Freitas (2017) is aware that drawbacks may occur when applying biosocial research to education, namely the production of highly conventional and reductionist models of learning due to the failure to capture the complexity of lived experience (p. 58). She wants to break “with the reductive scientism that often fuels biosocial research in education” (p. 58), and to reframe biosocial research as an affirmation of “bodily forces and materiality” (p. 58). This move is “adequate to the accelerated flows of advanced capitalism” (p. 70), and she urges the community to reconsider what constitutes the “social” by studying “how the digital sensors track the limit of human perception and turn it into the source for technical innovation and new configurations of control and governance” (p. 70).

Rather than dismiss all biosocial research, the goal is “to invest in the possibility of neuroscience research that does not serve the computational dream of a control society” (de Freitas & Sinclair, 2016, p. 229). de Freitas and Sinclair (2013) are well aware of how research is always embedded in broader societal arrangements that colour the way we engage in it: “[t]he human body is, ultimately, a social entanglement, and any theoretical approach attempting to grasp its role in the classroom will have to address these larger socio-political issues” (p. 456). In de Freitas and Sinclair’s (2014) work, the term *inclusive materialism* is introduced to signal their concern with these larger sociopolitical issues (as well as their philosophical positioning). Inclusive materialism follows the “micro-visceral of mathematical activity, while also attending to the enduring political forces that operate through material assemblages” (de Freitas & Sinclair, 2014, p. 41). Their hope is that “this dual emphasis on the micro and the macro will furnish a more robust study of the mathematical body” (p. 57).

Inasmuch as inclusive materialism, Marxian theory also moves away “from a theory of power as a totalizing, external force” (de Freitas & Sinclair, 2014, p. 41), and follows capital as it flows through commodity exchange—including the exchange of sensations and affects (Massumi, 2002b). In this way, Marxian theory offers us elements to study what de Freitas and Sinclair (2014) call “the political forces that flow across and through these bodies” (Freitas & Sinclair, p. 41). However, while in de Freitas and Sinclair’s new materialism these “political forces” are not discernible, in Marxian theory, they concern the working of commodity exchange (see discussion above). Capitalism is not a (macro) entity that exercises its power on people but is instead animated by the actions of all of us who participate in it through our most mundane activities. It is in this sense that it is a “concrete universal”: it is universal because it lives through/in the actions of each particular individual (and not necessarily their thoughts).

In de Freitas and Sinclair (2014), there are two chapters—*The sensory politics of the body mathematics* and *Mapping the cultural formation of the mathematical aesthetic*—where it becomes visible how, inasmuch as in postmodernism, politics is emptied from its economic dimension, and we are left instead with considerations about aesthetics, power, and bodily features. One cannot find in their writings any attempt to address what inclusive materialism means in terms of political economy and, particularly, within a problematization of today’s capitalism. It is precisely this disavowal of political economy, and the concomitant disavowal of schools as places of economic production (Baldino & Cabral, 2013), that makes both postmodernism and new materialism so amenable to the dynamics of capitalism. Instead of critique, one engages in “creative experimentation and the development of new theory” (de Freitas, 2018, p. 293), producing new experiments, new methods and new trends.

Lacan (2007) identifies the *logic of accumulation* as characteristic of modern science under the auspices of capitalist economy. Within capitalism, any measure has to produce surplus value; otherwise, it is discarded as obsolete, against the rules of the market, even

immoral or unethical.<sup>7</sup> And the same with science. Any scientific result that threatens the homogeneity of science, its corpus of truth, results in a crisis. Modern science is built as an accumulative regime of knowledge, inasmuch as capitalist economy has at its core the accumulation of capital. Any threat to this cycle of accumulation is seen as irrational and retrograde. I argue that Capital's logic of accumulation is at work in the way de Freitas proposes biosocial research as a new trend in mathematics education. This new trend guarantees that not only new educational markets are produced but also that these new "products" do not pose any threat to the dynamics of capital. It is okay to move forward and produce the new, as long as you do not disturb the smooth workings of capital. As a result, approaches that focus on a critique of capital are discarded as "agonistic" (de Freitas, 2018, p. 293), pessimistic and paralysing (Gutiérrez, 2010).

## 5 The humanism of inclusive materialism

As explored above, notwithstanding our intentions and better knowledge, there are mechanisms at work that do not depend on our idea of them.<sup>8</sup> That is, notwithstanding de Freitas' cautions and intent to appropriate biosocial research from an "inclusive materialistic" position (2017, p. 58), science and education do not occur in the political vacuum of inclusive materialism, but are in conformity with the exchange abstraction and commodity production. No matter de Freitas' thoughts on the matter, her actions—the very fact that she is highlighting biosocial research as a new reconfiguration for educational sciences, and the absence in her work of any attempt to posit education within political economy—seems to be aligned with the very same society of control that de Freitas is trying to distance herself from. In this respect, and notwithstanding the will to "decentre human agency" (de Freitas & Sinclair, 2014, p. 43) and moving away from humanism, de Freitas' position is still too human: she believes that through our thoughtful actions we can thwart the educational effects of biosocial research.

This position presupposes a belief in human beatitude, in an autonomous, self-conscious subject that, faced with an ethical choice—what should I do with biosocial research—opts for the good (political ecology, inclusive materialism, etc.). This position is discernible when, for instance, after recognising that sensor data is already being used to fuel predictive analytics, de Freitas (2018) urges that "we develop this theoretical and practical approach to rethinking the nature of its futurity" (p. 301). However, if de Freitas' approach considers "sensibility outside the human-centric notion of perception, as there is no subjective unity capable of hosting such sense-making" (p. 303), the question is, who is this "we" that will rescue biosocial research from the auspices of capitalism?

My suggestion is to apply de Freitas' logic to herself as a researcher. When she advocates for a shift of focus from "theories of agent-centred perceptual capacities to theories of worldly sensibility and 'environmentality'" (de Freitas, 2018, p. 304), what does this move entail in terms of the environmentality of the researcher? Although our "agent-centred" perception is one where we see ourselves as resisting the pernicious tendencies of biosocial research, when considering the "environment"—understood as the frame that determines the effects of our

<sup>7</sup> Suffice to think about the frantic reaction every time someone suggests an increase in social benefits, a reduction of the working hours, a public investment in public healthcare and education, or an end to the multibillion-dollar industry that traps knowledge behind paywalls.

<sup>8</sup> For an exploration of this Lacanian logic into mathematics education, see Pais (2015).

actions—knowledge is generated through our actions that is independent of our better thoughts. In the way I am framing my argument, this knowledge functions as a real abstraction, below the radar of perception. In order to map our actions, one needs to conceptualise what the “environment” entails. In what follows I give a possible framing of our current environment, relying on Deleuze’s philosophy.

Deleuze is a philosopher of the virtual, of the bodies without organs, of flux and intensities, of percepts and affects.<sup>9</sup> In the words of Žižek (2004), Deleuze is the philosopher of late capitalism: with his lexicon and logic, he analysed the crucial changes allowing capitalism to enter its current phase. Contemporary capitalist ideology no longer functions towards centralisation, consolidation, homogenisation and against diversity. Contrarily, the latest trend in corporate management is to diversify, devolve power and try to mobilise local creativity and self-organisation, instigating decentralisation as the flag of the “new” digitalized capitalism. On the other hand, the old Foucauldian notion of normalisation—that power/knowledge relations mould the subject towards the Norm—so dear to industrial capitalism, seems today no longer holding its power. Instead of the logic of “totalizing normality” today’s capitalism adopted the logic of the “erratic excess”:

the more varied, and even erratic, the better. Normalcy starts to lose its hold. The regularities start to loosen. This loosening of normalcy is part of capitalism’s dynamic. It’s not a simple liberation. It’s capitalism’s own form of power. It’s no longer disciplinary power that defines everything, it’s capitalism’s power to produce variety –because markets get saturated. Produce variety and you have a niche market. The oddest of affective tendencies are okay – as long as they pay. Capitalism starts intensifying or diversifying affect, but only in order to extract surplus-value. It hijacks affect in order to intensify profit potential. It literally valorises affect. The capitalist logic of surplus-value production starts to take over the relational field that is also the domain of political ecology, the ethical field of resistance to identity and predictable paths. It’s very troubling and confusing, because it seems to me that there’s been a certain kind of convergence between the dynamic of capitalist power and the dynamic of resistance. (Massumi, 2002a, p. 224, quoted in Žižek, 2004, p. 184, 185)

Against this background, de Freitas and Sinclair’s inclusive materialist approach uncannily resonates with the dynamics of late capitalism, where emphasis is given to variety, destabilisation and redistribution:

We see our inclusive approach to concepts as complementary to socio-political work, in that we are trying to attend to various kinds of agencies that have been denied value or status in the past. Our efforts to destabilize concepts, as we did in the previous section, and to redistribute agency across a field of potential, feed into our commitment to map political configurations of life. (2014, p. 58)

As Massumi suggests, the power of capital—a strong machine of deterritorialization that generates new modes of reterritorialization, as Deleuze and Guattari (2004) put it—to produce variety is coupled with its power to co-opt what in principle are resistant forces against it. The

<sup>9</sup> Affects in Deleuze are those pre-conscious “processes” that are beyond signification or coding, but which, nonetheless, structure our sense of reality (Deleuze, 1990). They belong to the field of the Virtual, the “‘real but abstract’ incorporeality of the body” (Massumi, 2002b, p. 21). Brian Massumi and Patricia Clough have been developing Deleuze’s theory to analyse political economy in terms of what they call the “capitalization of affects”, which can be seen as one of the crucial extensions of late capitalism.

capitalist *machinic* (to use a Deleuzian term) integrates in itself the different and fragmented local forms of resistance, by, for instance, creating new research trends, innovative educational approaches, new methodologies, giving the impression that things are being done, that education is possible, that people are engaged in making things better. Because capital has to grow and we cannot stop doing research, one has to look for the spaces where it can be done. After the poststructuralist train lost its steam, new materialism, more than human and biosocial research appeared as the new vanguard in social sciences and cultural studies. Biosocial research, especially cognitive and educational neuroscience, is today an area of increasing interest and funding opportunities. How long its steam would last depends entirely on how its results resonate with the real abstraction of capital. That is, it will depend on how lucrative and silent biosocial research can be.

## 6 Conclusion

“If you have something that you don’t want anyone to know, maybe you shouldn’t be doing it in the first place.” (Eric Schmidt, former Google CEO, 2009)

Schmidt’s statement above is a sign of the “knowledge society” we live in today. It presupposes a society where everybody follows the letter of the Law, a complete society where there is no place for “misbehaviours”. You should only do what is supposed to be known. In the horizon lies the idea of a total society—each one in her or his own place, causing no friction, no alarm, doing only what the other knows. Mathematics, in particular, presents an exemplary case of science and society’s dreams of totality, in the way it seeks in its endeavours to tame the subject of its investigations. It is this *untamed* student—that talks, screws teacher’s plans, refuses to learn, etc.—that becomes obliterated in biosocial research (and, for that matter, also in the great majority of mathematics education research, see Pais and Valero (2012)). In this article, I argued that this obliteration is already at play as a real abstraction in the capitalist mode of production (Sohn-Rethel, 1978). Something happens in the daily life of people that makes them prone not to consider such an *un-sutured* subject.

This negativity of the subject (and the truth that encompasses it, see Pais, 2017b) thwarts any endeavours to completely map subjectivity. This feature is not dear to capitalist mechanics, which requires an increasing codification (commoditization) of reality in order to thrive. Nothing can be outside the radar of capital’s movement. Mathematics, being the archetypical case of a *fly-by-wire* science (Laurent, 2013, p. 30)—that is, of a science where significant efforts are made to obliterate any traces of subjectivity—is concomitant with the capitalist drive towards automation and totality. In capitalism, all is possible, as long as it is registered within the space of commodity exchange. A person becomes possible from the moment it can be registered. It is easier to “register” a person through quantification (including biodata) than through speech—after all, while biodata can be quite aseptic and “analysable”, people’s speech is often incoherent, contradictory and muddled. As mentioned by de Freitas (2018), “[l]ived experience becomes unrecognizable in a world of microtemporal biometric data that circulates and is absorbed at rates well below and above the bandwidth of human consciousness” (p. 303). Biometric data thus seems to offer a swift way to bypass human life for the sake of capitalism. As said before, capitalism works better without humans. Perhaps this explains the success that more than human theories are experiencing today.

My plea is not to reject the relevant insights that biosocial research and new materialism bring into mathematics education. I am also for “a curriculum that was less concerned with procedures and more with creativity” (de Freitas & Sinclair, 2013, p. 466) providing students with the opportunity “to engage with the new virtual spaces” of concepts (de Freitas & Sinclair, 2014, p. 54), for the reanimation of “ossified mathematics concepts” (p. 213), or rethinking learning as “an indeterminate act of assembling various kinds of agencies rather than a trajectory that ends in the acquiring of fixed objects of knowledge?” (p. 52). In thought, one cannot but agree with these ideas (which are not entirely new). The problem arises when one starts to think about the concrete circumstances that need to be met so that these thoughtful changes can actually become a classroom reality. We know well how mathematics education research tends to create a picture of school mathematics at odds with the reality of schools, and how its results have little impact on schools (e.g., Klette, 2004; Lerman, 2014). To ask the question of actualisation implies confronting the research discourse with the real of schools (Pais, 2016). While the former is (usually) rational, schools’ organisation tends to be “irrational” and against teachers and researchers’ better knowledge. As I have been exploring in my work, I suggest that it is only by positing schools against the background of capitalist economics that one can understand this resistance to change. It is the fact that schools *need to produce failure* that colours many of the students’ difficulties usually identified by the research community as “cognitive”, “sociocultural” or “more than human” impediments. In short, I am pleading for the *return of the primacy of the economy*, not to disregard all the important insights of research around the postmodern and new materialist concerns, but precisely in order to create the conditions for the more effective realisation of them.

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