WHY THEORIZING AFFECT MATTERS FOR MATHEMATICS EDUCATION RESEARCH

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This paper briefly examines theories of affect and some of its possibilities and limits for mathematics education research. First, psychological, socio-cultural, embodied, and new materialist perspectives are considered. The paper juxtaposes emerging and older theories of affect in mathematics education with alternative approaches in the humanities and social sciences. Then, the paper briefly historicizes some of the changing and enduring economies for affect in mathematics education across three historicized "moments" of U.S. mathematics education reform circa the 1830s, 1890s, and 1930s. This section aims to consider some of the ways 'bodies' have become differently legible for theorizing affect in problematic ways with potential implications for future research.

Keywords: Affect, Equity, Body Studies, Emotions, Inclusive Materialism, Reform, History

What is affect and why might its theorizations matter for mathematics education research? To start, affect, however conceptualized, is widely considered to be important to learning school mathematics. Most commonly, affect has been defined as a complex psychologized construct located in individual minds, distinct from cognition, and bundled with some amalgam of emotions, attitudes, moods, feelings, beliefs, and/or values (de Freitas & Sinclair, 2019; Hannula, 2012; McLeod, 1994). Somewhat less frequently, affect in mathematics education has also been theorized to include physiological effects, such as changes in neuronal firing patterns, pulse rates, skin sensations, and other changes – sometimes at levels considered outside the range of conscious awareness (de Freitas & Sinclair, 2019; cf. Dowker, Sarkar, & Looi, 2016). More recently, socio-cultural and -historical perspectives have begun to (re)consider affect as something that may also exceed analysis at the level of the individual, such as by theorizing its emergence through practices, activity, and/or norms (Hannula, 2012; Roth, 2012).

The latter focus on practices, norms, and activity have also intersected with a recent proliferation of "body studies" (de Freitas & Sincliar, 2019; Roth, 2012). Here, perspectives tend to eschew long-standing dualisms familiar to mathematics education research (e.g., cognition/emotion, mind/body, abstract/concrete). For example, a "mathematical concept" conceptualized with a Deleuzean-Spinozan perspective, may be approached as a kind of 'body' that affects (and is affected by) classroom atmospheres, teacher-student conversations, and corporeal body movements (de Freitas & Sinclair, 2014). This notion of affect need not privilege human agency or center the human as 'in control' of the 'bodies' that are made through shifting material-discursive practices and/or "affective networks" (de Freitas, Ferrara, & Ferrari, 2019; see also, Barad, 2007).

At the same time, despite considerable social and political shifts occurring through the COVID-19 pandemic, a 'mathematical concept' may at once circulate as a 'new' amalgam of messy and dynamic 'bodies' that, without alternative possibilities for thinking-doing, tend nonetheless to stabilize what (school) mathematics may be, become, and/or do. Put another way, while 'bodies' may produce complex and emergent amalgams of *affectivity*, much not only necessarily escapes capture by the research apparatus - (school) mathematics is also stabilized by grids of capture that treat affect as a knowable 'object' or 'objects' that take school mathematics as a more or less neutral site for producing affect based on various pedagogies (see also, Popkewitz, 2008). Indeed, mathematics education research has little theory to engage research questions that attend to such (always partial and incomplete) complexity, messiness, and multiplicity. Yet, theories of affect in the humanities and

In: Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.). (2020). *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, Mexico. Cinvestav / AMIUTEM / PME-NA. https:/doi.org/10.51272/pmena.42.2020

social sciences have for several decades offered possible entry points that do not seek to foreclose (school) mathematics or the 'bodies' with potential for affectivity as stable or necessary objects of inquiry (see also, Sinclair & de Freitas, 2019).

Of course, opening to new possibilities may also invite old dangers. For example, and as discussed briefly below, the emergence of efforts to theorize the mind as something interdependent with the corporeal body and, at times, as intimately linked with emotionality and materiality have historical antecedents that were also problematic. For example, Herbartian efforts to mathematize and study 'correct' sensation as the basis of truth claims were carried forward through social control projects and scientific racisms in the late nineteenth century in ways that continue to haunt contemporary education (see, e.g., Crary, 1988).

This theoretical paper, then, aims to provide a brief introduction to theories of affect in mathematics education research and consider both possibilities and limits for mathematics education research. In the first section, the paper provides a brief overview of research on how affect has been conceptualized in mathematics education research. In the second section, examples of three well-circulated perspectives on affect theory from the humanities and social sciences that are largely absent in mathematics education are considered. Finally, the focus shifts to three sketches of "moments" in U.S. discourses taken from a larger study investigating how objects of inquiry (or, 'bodies') in psychologized and socio-cultural approaches to research have shifted with respect to changing economies for affect in U.S. mathematics education. Because an in-depth discussion is not possible in this space, the "moments" selected are not intended as comprehensive 'histories.' Rather, they are intended as entry points for further discussion about how affect has become differently available with shifting notions of 'bodies' and their presumed relations. Finally, the approach to the three "moments" also seeks to draw attention to how emphasis on 'affect' may inadvertently stabilize the 'bodies' it purports to investigate in ways that obscure their historical traces in making the present appear thinkable and actionable (see Popkewitz, 2008; Yolcu & Popkewitz, 2019).

Theorizing Affect

Affect in Mathematics Education Research. There has been wide agreement across many fields in the social and mind sciences that affect is messy at best. As noted above, affect has been operationalized and defined in mathematics education research as something primarily bio-psychological, and, with less frequency, as something socio-culturally and historically contingent. As a psychological construct, affect has typically been considered something available to self-report in the form of emotions, beliefs, attitudes, values, and moods; where each category is presumed to differ primarily with respect to duration and/or intensity, and, at times, with respect to relation with (but distinct from) cognition and sometimes behavior (Hannula, 2012, 2019; McLeod, 1994). For example, a belief may seem more durable over time when compared with an emotion, mood, or feeling and have different 'effects' on cognition (McLeod, 1994). In studies prior to those considered explicitly as part of what became considered domain-specific studies of "affect" in the late 1980s, attention to 'affect' tended to center on constructs of anxiety and attitudes (see, e.g., McLeod, 1989; Zan, Brown, Evans, & Hannula, 2006). More recently, psychologizing approaches have also begun to include notions of identity and motivation among the collection of psychologized constructs (Hannula, 2012).

Socio-cultural perspectives on identity formation have also circulated widely in 'equity'-oriented literature. However, such scholarship rarely attend explicitly to theories of affect. This is particularly of note given the prominent role given to theories of affect once had on formulating theories of identity formation (e.g., that school mathematics appears to *affect* identity formation differently across racialized, gendered, and abilized categoriess) (see, e.g., d' Ambrosio, 1987; Fennema, 1979). More recently, theories of affect in 'equity'-oriented scholarship may be implicit in concerns with

identity formation in multiple ways. For example, calls for improving "engagement" with school mathematics often require assumptions that something beside 'cognition' matters for learning, such as with what appears to constitute a "racialized narrative", grids of "positionality", an activity, or an artifact (e.g., Nasir & Shah, 2011).

In more recent socio-cultural approaches dealing explicitly with theories of affect, some scholars have claimed that intellect and thought are fundamentally inseparable from emotion (and/or affect) in ways that are culturally and historically specific (e.g., Radford, 2015; Roth & Walshaw, 2019). Additionally, Hannula (2012) has argued that affect understood through "situatedness" or "enactivism" may be understood as a social as well as mental process. Related scholarship has argued that recruiting the corporeal body and/or social groups to make generalizations based on movements and/or practices as adaptation to situations and environments also work to erode long-standing emotion/thought and mind/body binaries (Hannula, 2012). However, the majority of scholarship from socio-cultural and -historical perspectives has not engaged in substantive historicizing or moved much away from emphasizing that 'emotions' and 'bodies' are cultural and historical productions (see, for examples, Radford, 2015; Roth, 2012; cf. Yolcu & Popkewitz, 2019).

Biological and/or physiological theories of "affect" are often located somewhere between the confluence of second-order cybernetics and new materialisms, neuroscience, and physiology. At one pole, for example, transcranial electrical stimulation (tES) has been offered as a potential hope for treating "mathematics anxiety" (Dowker et al., 2016), reducing affect to something solely in the brain. At another pole, theories of embodiment that avoid brain-based reducationisms abound. Examples include perspectives linking gestures to semiotic constructions (e.g., Abrahamson, 2009), embodiment as generative of metaphorical worlds-forming (Lakoff & Nuñez, 2000), or relational embodiment as immanent to what it means to be and become a mathematical 'body' (de Freitas & Sinclair, 2014). While the former two perspectives on embodiment have been discussed at length (see, e.g., Hannula, 2012; de Freitas & Sinclair, 2013; Radford, 2009), inclusive materialisms are more recent arrivals to the literature. In brief, and often drawing from feminist and post-structural perspectives, inclusive materialisms assume relationality as an *ontological* commitment, where matter and mathematical concepts, diagrams, or other objects, much like corporeal bodies and feelings, are not bracketed out as something independent of language or thought. Matter, like subjectivity, from this perspective, is thus necessarily ongoing, immanent, unfinished, agential, and perspectival (de Freitas & Sinclair, 2013). In other words, 'bodies' are *made* mathematical by a "dance of agency" that does not start or finish as a property of or in people or things (p. 454). Rather, "agency" is understood as emerging through the complex and ephemeral ways human-nonhuman assemblages become differently intelligible for thought and action, such as through tools, symbols, pedagogies, curricular texts, corporeal body gestures, and research.

In some ways, new materialisms also invite comparisons with second-order cybernetics and enactivisms that themselves recall lines of research drawing from American cybernetics-inspired radical and social constructivisms (de Freitas et al., 2019; Hannula, 2012; see also, Eisenhart, 1988; von Glasersfeld, 1995). For instance, relational and systems-oriented ways of knowing do not presume or center an observer that is independent from complex social and material fluxes that are always partial and emergent. However, inclusive materialisms differ in important ways. For one, material (or the 'environment') is not a neutral space devoid of its own agency. Rather, matter is both produced through discourse *and* produces discourse. Put another way, 'maps' of minds, groups, flows, and/or practices are only possible because the various objects bracketed through apparatuses of observation also 'map back' in ways that 'cut' and make 'bodies' differently legible, invisible, and/or 'able' (Barad, 2007; Yolcu & Popkewitz, 2019). For instance, 'mapping' the purported cognition of a child also participates in *making* the child's cognition as something available for new strategies of intervention through pedagogy, policy, and research (see also, Popkewitz, 2008). In the

next subsection, additional alternative approaches to theorizing affect in the social sciences and humanities are considered as potential supplements to existing scholarship in mathematics education.

Affect Theory. In one reading of affect theory, Sara Ahmed (2010) defines affect in part with the term "affective economy" as "what sticks, or what sustains or preserves the connection between ideas, values, and objects" (p. 29). Here, affect is not understood as an emotion or feeling *per se* (though whatever may be understood as an emotion or feeling are not excluded from participating in affective economies). Rather, affect is considered to be *circulated* as a kind of *economy* in the sense that objects become affective and "sticky" through their circulations. In other words, affective economies circulate in ways that may recruit notions of the cultural, psychological, and the political, but they also exceed capture as something *primarily* psychological and cultural that can be located as something 'in' individuals or 'in' social groups. Rather, affective economies gesture to how different notions of interiority and exteriority are produced through material-discursive practices. For one example, by thinking of "growth mindset" as something that may produce neuronal growth (and thus rebiologized notions of "intelligence") in the brain (Boaler, 2015), the brain (and neuronal growth) also becomes exteriorized and mappable as a site appearing to justify new forms of intervention (e.g., those that may promote "mindset" changes) and create new notions of interiors that can be divided and sorted in ways that perpetuate exclusionary practices (e.g., those that 'have' growth mindset and those that do not). Yet, whether or not "growth mindset" is considered in this way or otherwise, the notion of "mindset" has also become "sticky" and circulated in 'other' economies of affect concerned with enhancing and optimizing bodies and selves assigned various degrees of risk. A possible critique of perspectives of affect for Ahmed include the potential 're-centering' of affect as something involving emotions, feelings, and/or something of the psyche, however deconstructed.

From another perspective, affect theory is concerned with how bodies are 'affected' and 'affect' each other *prior* to and/or between 'capture' and labeling as emotions, feelings, etc. (Massumi, 1995; de Freitas et al., 2019). Here, affect is *not* emotion, feeling, attitude, belief, etc. – it is potentiality. This analytic shift involves theorizing both the messiness and the incompleteness of the assemblage of 'bodies' that appear to make emotions and feelings possible for capture and 'self' through processes that exceed human control and/or agency. By 'decentering' the human, some analyses have emphasized studying physiological and neuronal changes that seem to anticipate *and* exceed conscious 'capture' in the messiness of the everyday (Massumi, 1995). If, for example, mathematics anxiety (or joy) is approached not as a state or dynamic construct but as something necessarily partial, emergent, and messy, what assemblages of 'bodies' (e.g., tools, symbols, spaces, temperatures, political 'moods' and 'atmospheres', texts, etc.) may be virtually affective *before* it it put into feelings labeled as 'anxiety'? Or, how do not-quite-yet sensations and changes in 'bodies' become differently available for capture in research apparatuses when viewed as potential pathologies (e.g., as anxiety) through cultural theses about which "mathematical bodies" are desirable (and having 'health') and which are not (and thus needing 'intervention')? Despite the promise of new lines of inquiry that take seriously health discourses in relation to school mathematics in such ways, it is also of note that critics have argued that this approach may invite new and problematic universalisms and reductionisms, especially when affect appears to be something relocated in neurons and/or physiological responses in ways that recall various forms of humanism (see, e.g., Rutherford, 2016).

Additional perspectives in affect theory have built on the work of Sedgwick and Frank (1995) and suggested that even more familiar constructs such as 'emotions' like *shame* can be quickly denaturalized by attending to its complex, contingent, and multifaceted messiness that exceeds capture as a clear construct. For instance, shame as an amalgam of "interest-excitement" and "surprise-startle" and "contempt-disgust" *at the same time* invite a kind of messiness and incompleteness less familiar to more orthodox psychological renderings that have since been

circulated as entry points into rich description in gender and sexuality studies. Turning to mathematics education, the always already excess of categories may provide entry points into studies that question either/or paradigms that often assign affect constructs along continua of duration, intensity, and absence/presence. Further, they may invite new renderings that open discussions about identity that exceed efforts to generalize and reduce identity to debates between essence and/or environment. Such perspectives may also open new lines of inquiry into 'old' problems, in part by noting how questions of knowledge-power in mathematics education-related spaces are not simply matters that can be hashed out on an 'empowerment-oppression' continuum. Critiques may question the extent to which complicating existing constructs move away from centering the 'self' and experience as the primary focus of theories of change.

Finally, affect theory also may have something to say about how research is presented, as the *approach* to writing also matters in much contemporary affect theory (Massumi, 2015; Seigworth & Gregg, 2010). It is not enough, for example, to address racializations/racisms in mathematics education through counter-narratives, histories, quantitative studies, or meta-analyses without *also* attending to the (political) aesthetics of presentation and the circulations of affective 'bodies' that are differently "sticky", such as via terms like equity, urban, or diverse. Additionally, if the human is not centered as the primary agent or subject-object of analysis, how might affect theory at once contribute to analyses of a broad field of possible considerations involved in the makings of what produces possibilities for feeling, action, and/or thought while not collapsing the potential for 'strategic essentialisms' that may offer new points of resisting oppression? This may not be an either/or – perhaps by explicitly attending to the messiness of how geographies of social categories (e.g., race, gender, class, ability) become configured through the messy and ongoing emergence of new 'body' assemblages that exceed the possibilities of capture, research may open to generative spaces that do not require school mathematics as a kind of "slow emergency" that doubles as a 'necessary' condition for mattering in the world (Anderson, Groves, Rickard, & Kearns, 2020; Sinclair & de Freitas, 2019).

In short, affect theory, at least via some perspectives, may offer one set of possibilities for attending to the messiness and spillage of the 'everyday' that may trouble (while not necessarily jettisoning) assumed categories, boundaries, representations, states, rules, modes of capture, etc.; if research is less concerned with making definitive statements or claims about what 'happened' and more concerned with how different 'bodies' come to matter in ways such that their incompleteness and messiness are no longer pathologized but offer springboards into the necessarily unknowable (de Freitas & Sinclair, 2019). In this sense, rather than seeking to define "affect" *as* 'this' and *not* 'that', many approaches seek to explore affect as something *necessarily* processual, messy, as multiplicity, 'not yet' and thick (Seigworth & Gregg, 2010).

In the next and final section, I pivot to attend to some of the limits of affect theory as a strategy for research that do not attend meaningfully to how 'bodies' are themselves historically and culturally contingent. To do so, I shift to provide a brief sketch of the additional need to historicize how some of the objects of inquiry of mathematics education research and affect theory (minds, bodies, emotions, and their presumed relations) have become differently circulated and made intelligible through different 'economies' for producing affect (see also, Baker, 2013). Brief engagements from 3 "moments" of considerable ontological and epistemological change in ways of thinking about 'bodies' and school mathematics reform discourses were selected that continue to resonate with some of the social, cultural, and political themes that continue to move with mathematics education (research).

3 "Moments"

Circa 1830s. Schooling and society in the post-revolutionary United States saw many changes that directly affected how school mathematics was to be learned and taught. In addition to the emergence of publicly-funded school systems, educational journals, and a proliferation of organizations and institutions, the first quarter of the nineteenth century also saw a marked increase in circulation of mathematics textbooks and materials intended specifically for children (P. Cohen, 1999; Monroe, 1917). On the one hand, such changes were not surprising, given the perceived stability of the Republic and the increasing efforts to link mathematics education (mainly as arithmetic and cyphering) with managing commercial and industrial affairs and promoting mental cultivation for the presumed rigors of democratic (and 'white male') citizehnship (P. Cohen, 1999).

Within this milieu, the concept of "mental discipline" – a term widely circulated as marking aspects of nineteenth century theories of mathematics – emerged as a central hope for what school mathematics could provide beyond applications to practical affairs (e.g., Stanic, 1986). Briefly, mental discipline has typically been described as a doctrine suggesting the mind was like a muscle composed of separate but interdependent faculties, where 'exercise' of any of the faculties (such as via arithmetic) offered routes to strengthening the mind and, by extention, the intellect (e.g., Clason, 1970; Stanic, 1986). However, such a perspective may obscure the nuances and traces of how mental discipline and faculty psychology were also circulated in their historical present through a wide array of new theories of minds and bodies. For example, faculty psychology accompanied new theories such as phrenology that began to consider capacities for mathematics as something at once 'in' the brain, correlated with head shape and character, and, at times, differently modifiable through physical exercise (Tomlinson, 2005). [1]

Further, mental discipline was also understood in part through new medical discourses. For example, from the perspective of the influential U.S. physician Benjamin Rush, bodies could now be conceptualized as systems of "oscillatory matter", where mental "laws" were equated with physical "laws" (Altschuler, 2012). Further, for Rush, mind was understood as influenced by diverse and distributed social and material systems, including blood circulation, political affiliation, occupation, commercial trade, and perceived racialized/racist effects of institutional slavery on health and physiognomy (Herschthal, 2017). And, with phrenology, the faculties of mind that appeared to be exercised through school mathematics also circulated with new theories of associations between physiognomy and intellectual capacity. The corporeal body and the emotions/passions were considered interdependent with 'healthy' mental cultivation and theories linking heredity to dispositions toward mind-body-spirit im/balance and the future of the Republic (Ziols, 2019).

Finally, new theories of childhood also emerged that located children as ontologically distinct from immature adults. As such, children were considered particularly vulnerable to too early or too intense exposure to mathematics (though they were also felt to be especially sensitive to Lockean sense impressions and capacity for cultivation) (Ziols, 2019). Within this milieu, it is perhaps not surprising that school mathematics became a subject that was increasingly to be designed specifically for children in ways that included new hopes and fears about the potential effects of school mathematics in new economies for affect. For example, Samuel Goodrich (1818) was among the first arithmetic textbook authors who argued that arithmetic should be "attractive" to children and "divest[ed]" of "all that is not necessarily difficult or disagreeable" (p. iii). Goodrich's hopes also included making arithmetic more "inviting", satisfying, and pleasurable. Although Goodrich's textbook is among the more explicit in this way, subsequent textbooks across a range of "systems" for teachers also began

[1] Tomlinson (2005) has argued that phrenology discourses *a la* George Combe and Horace Mann were woven into the inception of U.S. public schooling as a "moral technology" linking the "exercise" of minds-bodies with racist, sexist, and abilist efforts to eliminate the "abnormal" as routes to 'improving' humanity.

to include appeals to securing interest and preventing injury. For example, in addition to advocating arithmetic as a site for "mental discipline", Colburn felt that using fingers and objects had made arithmetic learning more appealing for younger children in "both sexes and among all classes" (Colburn, 1830, as quoted in Monroe, 1912, p. 465). At the same time, with an arithmetic textbook intended for children as would-be missionaries, school mathematics was less about learning to 'reason' per se and more about converting 'heathens' through "Christian benevolence" and by "training a rising generation to esteem the privilege, and the practice of doing good" (Weeks, 1822, p. iv).

In short, school arithmetic had now become available through changing notions of children, mental cultivation, schooling, and their presumed relations with new theories of minds, bodies, and groups (e.g., by sex, race, age, nation, language, profession, brain size, blood circulation, physiognomy, ability, class) (Ziols, 2019). In this economy for 'affect', the arrival of mental discipline was not simply about 'beliefs' or 'ideas' that mathematics could cultivate the mind and/or affect the emotions – it also required complex changes and new amalgams that included colonizing logics, racialized and newly 'bodied' notions of mathematics learning, and theories of reasoning that recruited the corporeal body in different ways (Ziols, 2019). It is perhaps no surprise, then, that school mathematics also began to emerge as a school subject that could potentially injure children by 'unbalancing' mind-body-spirit amalgams in ways that reinforced exclusionary discourses (Ziols, 2019; see also, Jenkins, 2010).

Circa 1890s. By the 1890s, what might have seemed "difficult or disagreeable" in Goodrich's historical present shifted to new ways of thinking. Some texts lamented old fears of arithmetic study in new ways. For example, an article in *The Journal of Education* claimed a "juggernaut Arithmetic" was "grinding" children into "physical and nervous wrecks" and making "a sound body, steady nerves, and a clear brain impossible" (Arent, 1896, p. 77). (Such "grinding" pain was also described as the mental equivalent of a man being hung by his thumbs as punishment for committing a crime). Those at risk for becoming "wrecks" retained earlier nineteenth century fears that pathologized the 'precocious' child as those considered to be "ambitious for high scholarship" (Arent, p. 77; Ziols, 2019). However, the risks of too much study were now put in the language of experimental physiology and the "new" psychology (Popkewitz, 2008; Stanic, 1986). In short, new amalgams of 'danger' accompanied a (partial) erosion of mental discipline logics, as mathematics education became increasingly visible as a topic of concern in a growing number of "attacks" on U.S. school mathematics (Stanic, 1986). Importantly, responses to such "attacks" also recruited new assemblages of 'bodies' for reform-oriented justifications for the 'why' of school mathematics.

For instance, the "new" psychology sought to map the child's mind as a scientific object for study and planning the future through the mind and social sciences in response to fears of (im)migrant populations moving to the cities (Popkewitz, 2008; Ziols, 2019). Also, as learning school mathematics became largely domain specific and less tethered from its value for 'mental discipline,' it paradoxically became increasingly relied upon as a standard for mental testing, partly linking scientific racism and eugenics through new bio-psychologized notions of intelligence, character, and individual difference (Danziger, 1997; see for an example, Thorndike, 1922).

Importantly, though, mapping the child's mind was not simply a project related to studying the child's mind as a psychologized object. It also appeared to require the study of children *in situ*, a perspective informed in part by the study of 'othered' cultures such as through ethnology, folklore studies, and history (see, e.g., Dewey, 1884, 1886). In brief, by providing a sense of teleological progress as the inevitable directionality necessary for a desired moral order, a technoscientific future could be secured through application of scientific 'expertise' to pedagogy (Popkewitz, 2008; Yolcu & Popkewtiz, 2019). Progress had also become entangled with Spencerian notions of human agency and cultural 'development', secured in part through efforts to predict and control behavior by

studying the duration and intensity of various senses (Crary, 1988). In short, as the mind-body-spirit became set in linear notions of technoscientific progress, it also became increasingly available (along with disciplinary mathematics) as a social and cultural construct that both required and exceeded notions of human agency to secure 'advancement' along rank-ordered developmental continua on a 'great chain of being' (Baker, 2013; Crary, 1988).

Within this milieu, James McClellan and John Dewey (1895) in the *Psychology of Number* argued that scientific principles would provide a plan for the "natural" alignment of children's mathematical activity with "civilization." Culturally-mediated activity would foster discernment and reason in ways that would move 'inward' to the corporeal body and 'outward' to secure the mind (and civilization) from ethical and psychological "destruction" (McClellan & Dewey, 1895, see pp. 4-5). The avoidance of 'destruction' also entailed efforts to tie activity to the production of quantity through accurate measurement, discernment, and relation as strategies to predict, control, and direct the future. For example, McClellan and Dewey argued: "The child and the savage have very imperfect ideas of number, because they are taken up with the things of the present moment. There is no imperative demand for the economical adjustment of means to end; living only in and for the present, they have no plans and no distant end requiring such an adjustment" (p. 38). By moving 'out' of the present moment, the 'child' and the 'savage' required developing an "idea of quantity" through "arrang[ing]… acts in a certain order, to prescribe for himself a certain course of conduct so as to accomplish something remote" (p. 38). In one section, the racializing/racist psychologizing of number was also one that could be summarized by "embodying the idea that number is to be traced to measurement, and measurement back to adjustment of activity" (p. 52).

Also, with this 'new' onto-epistemological framing, the psychologizing of number accompanied new claims that *all* humans and some animals had mathematical 'capacities.' Cultural 'activity' then, was, what explained purported differences in the power and rigor of 'culturally'-specific mathematical practices and distinctions made between humans and animals (Ziols, 2019; see for different examples, Dewey & McClellan, 1895; McGee, 1898). Further, 'access' into 'civilization' was explained not only by converting and/or assimilating the activities of the child-as-savage into 'civilization' but also as a political project that located 'access' based on theories of cultural tool use. For example, ethnologists, working in part to establish anthropology as the pinnacle of the sciences, argued that cultural tools (e.g., the hand, objects, and written signs) provided the levers that would 'liberate' the 'primitive' mind from its 'mystical' past (see, e.g., Conant, 1896, McGee, 1898). From one perspective, by directing one's goals toward an imagined future through targeting cultural group "leaders" (as the 'strong'), educators-as-scientists could offer the most direct routes for 'racial' uplift and desired social change (Haller, 1971; Ziols, 2019). Such notions not only exacerbated racist and ethno-centric discourses centered around 'Western' concepts of mathematics – they linked static notions of the environment and climate with the 'extranatural' (or socio-cultural), unconscious, kinetic, and linguistic as sites for securing imperial notions of Spencerian 'progress' in social groups defined as on separate developmental trajectories (see, e.g., Haller, 1971).

Finally, although the modern psychologized notion of the personality (and the person) as a set of discrete constructs was not yet thinkable (Danziger, 2012), character-building and habit-forming discourses also permeated journals and books related to mathematics education. For an example distinct from *The Psychology of Number*, an article in the *Journal of Education* suggested that "reasoning about things" in early school mathematics was subsidiary to learning to "use the signs and symbols" of arithmetic and "by every ingenious contrivance" to "cultivate habits, habits, HABITS, of accuracy, rapidity, and neatness, both in mental and manual activity, and of speech as well" (emphasis original, Allyn, 1892, p. 281). However, it was not 'enough' to simply cultivate 'mathematical' practices believed to align the mental and the manual through activity and speech. A

teacher was also to cultivate "above all… truthfulness and honest sincerity" in ways that avoided "making dunces who hate math" (p. 281).

However partial the above account, the intention here has been to note that although the mind may have been conceptualized as distinct from the body, mind-body amalgams were not eschewed with the arrival of new theories about how 'mental' processes were produced through social and cultural practices, the corporeal body, the senses, language, and notions of character and conduct. Similarly, though reworkings of a mind/body split were certainly present in such discourses, new notions of materialisms and efforts to mathematize sensation also undergirded them (Crary, 1988). In the next subsection, a third shift in economies for affect are considered, where new notions of character and individual difference were increasingly scientized through hopes and fears about securing democracy, promoting the 'adjustment' of the modern personality, and impressing the 'cultural value' of mathematics.

Circa 1930s. Around the 1930s, the institution of mandatory secondary schooling in the United States accompanied efforts to address new fears, particularly those involving the inclusion of the "other 50%" now required to attend secondary school (see Lagemann, 2000). One primary site for addressing 'new' hopes and fears of a mathematics education under "attack" was via the insertion of mental hygiene and cultural value-creation into policy documents and pedagogies (Ziols, 2019). On the one hand, reform discourses sought to reconceptualize the "un-emotional subject *par excellence*" of mathematics education as one intimately requiring both emotion *and* intellect as essential and interdependent for meangingful learning (Progressive Education Association [PEA], 1940). By "understanding the student", mathematics educators would avoid the potential dangers of psychological, social, and physiological 'maladjustment' (PEA, 1940). Or, from the joint Yearbook published by the Mathematics Association of America and the National Council of Teachers of Mathematics (1940), educators were to focus on the "problem of the dull normal" who differed in "degree" from the "gifted" (p. 133). And, though the "[t]he data" appeared to show the "fact that the slow group grows in the same proportion as the fast group though on lower levels of development" (MAA & NCTM, 1940, p. 134), the 'problem' was considered in part to be one of "implanting the cultural value of mathematics" such that students would "comprehend certain essential elements of the civilization they are to share" (NCTM & MAA, 1940, p. 48).

To achieve a sense of cultural value, the 'why' of mathematics education also appeared to need justification. On the one hand, justification was now expressed in new (eugenic) theories of health that included not only concerns with 'intelligence' but also with attention to emotion and conduct, attitudes, and "traits" (MAA & NCTM, 1940; PEA, 1940; Zachry & Lighty, 1940). On another hand, approaches such as those in the *Mathematics Teacher* included efforts to link the "mathematic of a culture" to that culture's purported "soul" or "spirit" (Schaff, 1930). Such a perspective was not unique. Schaff drew in large part from Oswald Spengler's (1965) widely circulated book, *Decline of the West,* that argued every culture was defined by its "mathematic", where developments in mathematics marked a 'culture' as either ascendant or in decline. Schaff, however, argued for a more optimistic interpretation: Mathematics as a human and cultural product suggested that humans were the "the law givers of the universe" and that it was "possible… that the greatest of our material creations is the material universe itself" (Sullivan, as quoted in Schaff, pp. 502-503).

Additionally, creating a shared sense of a cultural value for regulating emotion and conduct involved another object of inquiry: the "modern" personality (Danziger, 1997). As an amalgam of "traits", the "modern" personality emerged through efforts to measure a person's character – a perspective drawing heavily from Galtonian-inspired eugenics (see Danziger, 2012). In related U.S. mathematics education journal articles and policy documents, some authors explicitly argued for "reform" as a "concern with the effect of arithmetic on personality" that required "a major reorganization of subject matter and methods" (Buswell, 1941, p. 10). Further, in the same chapter,

such "reorganization" involved engineering "an organized body of number experiences from which both mathematical insight and social significance may be derived" (p. 10), where a "number experience" was what might offer "positive contributions to the development of desirable personality traits" (p. 10).

Lastly, shifts in the 1930s could also be summarized in part by the PEA's (1940) companion report to *Mathematics in General Education* titled *Emotion and Conduct in the Adolescent* (Zachry & Lighty, 1940), where what constituted the "un-emotional subject" of school mathematics was now juxtaposed with perspectives on how emotion and conduct were to be reconceptualized by bucking the purported status quo. Namely, it was argued that the "Puritan tradition" believed "responsible [for]… the tendency in all Anglo-Saxon cultures paradoxically both to discount emotion and to counsel its mastery" was to be challenged (Zachry & Lighty, 1940, p. 5). "Emotion thus broadly conceived" was to be "fused with thinking - for the most part harmoniously - in the healthy, competent individual" (Zachry & Lighty, 1940, p. 5).

In short, school mathematics had become in part a translation device for addressing fears of "maladjustment" in adolescents and children through reforms centered on "understanding the student" to regulate emotion and conduct, establish and secure social cohesion, cultural unity, and "democratic order," and strengthen and/or muting un/desirable personality and character "traits" during times of perceived crisis in school and society (see also, Yolcu & Popkewitz, 2019).

Concluding Remarks

This paper has had two aims. First, it has made an argument that mathematics education research may broaden its scope by engaging with theories of affect that eschew analysis of the individual or group. Second, it has argued that affect theory is also limited with respect to what it may take as assumptions of ahistorical continuity across different material-discursive assemblages and space-times. While neither argument is entirely new to mathematics education research (see, e.g., de Freitas & Sinclair, 2019; Popkewitz, 2008), little research has addressed how and why mathematics education research continues to locate desirable 'affect' as something messy and seeming to be a problem of largely ahistorical approaches to methodology *despite* rather dramatic onto-epistemological shifts in how affect (and mathematics education) has become intelligible. Engaging with affect as historically and culturally contingent assemblages of 'bodies' requiring further scrutiny and historicizing may thus provide important new entry points for future research.

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