Doin' the Math: On Meaningful Mathematics-Ethics Connections

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Abstract: In this essay mathematics is conceived of as intentional human activity. Since intention implies choice, there are ethical dimensions to making mathematical choices. Embracing these dimensions requires acknowledging the contextual nature of mathematics. First John Dewey's philosophy of mathematics and a reconsideration of mathematical empiricism are posited as ways to foster a context sensitive understanding of mathematics. Next, I address the ways in which existent conceptions of mathematics—even those which support reform in mathematics education—are insufficient with regard to their ability to recognize its human dimensions. The essay concludes with a distinction between mathematics education that ethically applies existing versions of mathematics and mathematics education that seeks to recast mathematics as a necessarily and undeniably ethical enterprise.

> All of that time where did it go?
> What did you do and what have you got to show for it?
> Doin' the math is kind of a bummer
> You best avoid crunchin' that number
>
> Where are they now and what are they doin'?
> Everyone's ancient at your high school reunion
> Doin' the math don't bring satisfaction
> There's no more addition now it's all subtraction
>
> A monkey, a dog, a horse, a giraffe
> *They're all gonna die but they don't do the math*
> Doin' the math is kind of a bummer
> You best avoid crunchin' that number
>
> --Singer-songwriter Loudon Wainwright III, from *Doin' the Math*

A central argument of this paper is that mathematics is an intentional human activity and that—since intention implies choice—there are ethical dimensions to making mathematical choices. Embracing these connections requires moving away from how we typically conceive of mathematics. Accenting the intentional aspects of engaging in mathematical activity is one effective way to counter the predominant ways of thinking about mathematics and mathematical knowledge, namely that it is different *in kind* than most other forms of knowledge. Blurring the

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***The Montana Mathematics Enthusiast*, ISSN 1551-3440, Vol. 5, no.1, pp. 59-66**

sharp distinctions between mathematics and other activity/knowledge makes possible new ways to think about mathematics in the context of its teaching and learning.

As I sat down to begin the task of writing this paper, the first strains of *Doin' the Math* emanated from my office computer speakers. The song is a wry but somewhat bleak account of the inevitability of growing old. When Wainwright refers to "doin' the math" what he presumably means is something akin to thinking about aging, dwelling on the inevitable, or something along those lines. I doubt that the songwriter was trying to make a profound philosophical statement about the nature of mathematics and yet, to my ear—toward the song's end—that's exactly what he did. I was half-listening to the music when Wainwright crooned, "*A monkey, a dog, a horse, a giraffe…they're all gonna die but they don't do the math*."

Wainwright's point, as I take it, is that the years are increasing for all of us, animal friends included, but that this increase in years is understood as *adding* only by humans. This is significant, as it forms the basis of a powerful plain language philosophical counter-argument to the ubiquitous commonsense understanding of mathematics as beyond the human pale. This extra-human, often Plato-inspired conceptualization of mathematics can best be summed up by the response I often get when I mention that my work considers what happens when we choose to think of mathematics as sets of tools humans have constructed to help solve our problems. A common response is that this cannot be so and typically some version of the "if everyone on the planet died tomorrow 2+2 would still equal 4" argument is employed. The power of Wainwright's claim is that it suggests that if "everyone died tomorrow" mathematical activity would *cease*. Certainly, giraffes and other animals would still be aging, but there would be no *addition* of years, as addition requires intentional activity.

My sense is that getting people—particularly those responsible for mathematics teaching and curriculum design—to fundamentally change their way of conceiving of mathematics will require more than just Wainwright's lyrics. Thus, in this paper I argue for a recognition, even an embracing, of the human and hence, of the ethical dimensions of mathematics. Andrew Ward (2007) argues similarly for recognition of the science-ethics connection. In order for the two to be thought of as coexistent, he claims that science must be thought of differently; namely, its contextuality must be put in the foreground. Here, I apply the same strategy with the mathematics-ethics connection, but with mathematics it is a tougher argument to make, as many mainstream versions of mathematics do not acknowledge that it has *any* context, let alone that we can choose to focus on contextual factors. This paper is a call for such a reconceptualization.

To support this call, I first provide a summary of John Dewey's philosophy of mathematics—positing it as a way to think about the nature of mathematics that requires acknowledgement of its contexts. Next, I argue that in order for the context of mathematical activity to be appreciated, mathematical empiricism needs to be given consideration. Next, I address the ways in which existent conceptions of mathematics—even those which support reform in mathematics education—are insufficient with regard to their ability to foster awareness of its context and hence its human dimensions. In the final section of the paper, I make a distinction between mathematics education that ethically applies existing versions of mathematics and mathematics education that seeks to recast mathematics as a necessarily and undeniably ethical enterprise.

What are generally taken to be sterile, extra-human, ethics-neutral mathematical knowledge and techniques have, to paraphrase William James, the trail of the human serpent all over them.

Simply saying so is insufficient and the case needs to be made that rethinking the nature of the mathematical enterprise can help us make meaningful mathematics-ethics connections and, subsequently, to pave the way for an engaging brand of school mathematics that draws sustenance from these connections.

Dewey's *Psychology of Number*: "Doin' the Math" *is* the Math

I probably found Wainwright's song so compelling because it serves as the musical complement to one of Dewey's central points about the nature of mathematics. In *The Psychology of Number and its Applications to Methods of Teaching Arithmetic* (1895), James McLellan and Dewey[2] posit that mathematics exists when existential circumstances give way to a need for consideration of quantity. Dewey surmises that mathematics originated when human questions turned from the crude question of "how much?" to the more refined query of "how many?" Thus, from the start, Dewey frames mathematics in terms of its activity. One of Dewey's most potent (and humorous) quotes on this topic even employs an animal metaphor quite similar to Wainwright's. In making the point that mathematics is intentional human activity, Dewey claims, "There are hundreds of leaves on the tree in which the bird builds its nest, but it does not follow that the bird can count" (p. 23).

Dewey's unorthodox operationalization of the term "psychology" is crucial to understanding his philosophy of mathematics. Contrary to most philosophers and philosophers of mathematics of his day, rather than viewing an individual's psychology as an impediment to or distorting factor of clear apprehension of truth, Dewey saw it as a critical component of coming to know. This is one reason why *Psychology of Number*, a philosophical look at how children come to grasp the concept of number, is such a clear expression of Dewey's philosophy of mathematics. That is, how children come to know mathematical concepts centers on the mental activities (i.e., psychology) of children as they encounter various empirical situations. Dewey described this simple sense of quantity as coming about in light of the human need to measure in order to solve practical problems and to improve lives (p. 42).

Dewey saw the commonly understood distinction between counting and measuring as getting in the way of understanding how children organically come to know number. Counting relates to determining how *many* of something there are and measuring involves determination of how *much* of something there is. In other words, the counting-measuring distinction relates to whether something is a series of parts of one whole, or a related group made up of individual units. Dewey's pragmatic answer held that—depending on context— they may be either. The reasons the individual engaged in the mathematical activity in the first place must be taken into account when answering the question.

Deweyan mathematics is defined and understood by its use. The concept of a particular number (say three) does not reside within a group of three apples, beanbags or any other objects any more than it does in the symbol "3." Three, as a construct, emerges from activities requiring quantification as a means to an end. Dewey's accompanying pedagogy accordingly focuses on measurement, as all counting is measuring and all measuring is counting. Making measurement the vehicle for mathematical explorations ensures, according to Dewey, that number symbols will

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[2] Although the *Psychology of Number* was co-written with McLellan, for the remainder of this paper I will refer only to Dewey. See Stemhagen (2003) for a justification of this decision as well as for a fuller description of Dewey's philosophy of mathematics.

always be linked to concrete units and encourages active, empirically-oriented, and contextualized conceptions of mathematical enterprises. Finally, Dewey understands measurement as taking place in contexts wider than simply the act of measuring. He uses the measurement of a field as an example. In a genuine mathematical inquiry, simply finding the area of the field will not meaningfully measure it. To do so, wider contexts must be considered—that is, what is the field capable of producing? How does it relate to our lives? To answer these questions counting and/or measuring must be employed (e.g., amount of produce, the price it will bring at market, the costs of growing the produce, etc.). Dewey sums up the ways in which mathematical inquiries are inseparable from our broader aims: "All numerical concepts and processes arise in the process of fitting together a number of minor acts in such a way as to constitute a complete and more comprehensive act" (p. 57).

Any number of calculations could be done to measure the fields, but the ones that relate to how we actually live our lives are the calculations that will help us successfully conclude our inquiry. In other words, mathematics is more than just crudely counting or measuring; it requires thoughtful consideration about a multitude of contextual factors. Thus, Dewey's version of mathematics emphasizes the interplay between empirical objects and our actions; it acknowledges the importance of the role of human intent in the construction of mathematical knowledge. To Dewey, the development of mathematics is driven by the ways in which we use it. In fact, it is not too strong of a claim to sum up Dewey's philosophy of mathematics as mathematics is its use. To borrow from (and add to) Wainwright lyrics, "doin' the math" *is* the math.

(Re)Opening the Door to Mathematical Empiricism

While Dewey was certainly no simple mathematical empiricist, his attention to context, particularly physical contexts, possibly leaves him susceptible to critique from those skeptical of the place of empiricism in philosophy of mathematics. By simple empiricism, I am referring to the idea that mathematics exists "out there" in the physical world. That is, the reason why 2+2=4 is because that is what is true in the physical world. To the simple empiricist, the idea of number resides in the environment and one's development of mathematical knowledge takes place as one observes the environment. Although it is beyond the scope of this paper to fully make the case for a reconsideration of the merits of mathematical empiricism,[3] it is interesting that Gottlob Frege's attack on J.S. Mill's mathematical empiricism had much to do with the subsequent marginalization of empiricism as a viable philosophy of mathematics (Kitcher, 1980).

This event is noteworthy because the part of Mill's position that Frege so savagely attacked was, by my read, actually the part whereby Mill went beyond that of a simple empiricist and treaded lightly into the territory of the mathematics-as-human-activity camp. Mill claimed that "… Two pebbles and one pebble are equal to three pebbles…affirms that if we put one pebble to two pebbles, those very pebbles are three" (Mill, p. 168). Here Mill suggests that there is a "we" required to "put" together the pebbles to make three. I see this as a nascent affirmation of the human hand in the creation of mathematics. Kitcher (1980) agrees, stating: "Thus the root notion in Mill's ontology is that of a collecting, an activity of ours, rather that that of a collection, an abstract object (p. 224). To Mill's notion that number comes about from arranging objects, Frege responded: "if Mill is right, we are very lucky that not all objects in the world are nailed down, for otherwise it would be false that 2+1=3" (1997, p. 94).

[3] It should be noted that I am uncertain about the worth of making such a case.

If the premise that the contexts of mathematical inquiry matters is on the mark, then Frege's critique is errant. At first blush, it appears that Frege is attacking the notion that the truth of mathematical statements resides in physical contexts. I think this misses the point, as "nailing down" objects prevents their arrangement and not their physical existence. Clearly there is still a physical context, it is just that Frege's idea of "nailed down" suggests a lack of mobility that, if it was actually the case, may very well have affected the direction of the development of mathematics. If our physical reality was so different that our genuine inquiries had no need or place for the grouping of objects, it is difficult to imagine how (and maybe more importantly, why) mathematics as a discipline would have developed as it did.[4]

All of this suggests Mill is not thinking like a simple empiricist—in focusing on the activity of arranging he is nodding toward the ways in which our choices (in this case choosing to engage in mathematical grouping) create mathematics. Frege mischaracterized Mill's point when he stated that without the moving of objects that addition would be *false*. Dewey, Mill, and other non-simple empiricists might argue that rather than false, without the need and ability to rearrange physical objects it might be that 2+1=3 would be *irrelevant*.

With the tasks of brief explication of Dewey's philosophy of mathematics and a quick plug for the merits of reconsidering empiricism in mathematics complete, let us consider how it is that such a way of thinking about mathematics and mathematics education can help to shed light on the intersections between mathematics and ethics. Dewey's description of the origins and nature of mathematics as emerging from willful human interaction with the environment is one way to make the case that the mathematics and ethics are inseparable. If mathematics comes about as we engage in inquiries in order to live better in the world, it follows that ethics is never far from mathematics.

What's Wrong with the Ways We Think about School Mathematics?

The "math wars" is a label given to the dispute between two mathematics education factions. Traditionalists or back-to-basics proponents argue that the aim of mathematics education should be mastery of a set body of mathematical knowledge and skills. The philosophical complement to this version of the teaching and learning of mathematics is mathematical absolutism. Reform-oriented mathematics educators, on the other hand, tend to see understanding as a primary aim of school mathematics. Constructivism is often the philosophical foundation for those espousing this version of mathematics education.[5]

Given this paper's focus on the task of establishing the importance of human contexts to mathematics it should not be hard to see that the traditionalist's point of view, to the degree that it conceives of mathematics class as a place for the transmission of preexistent, extra-human mathematical truths and skills, is not going to be of much value. The more interesting claim is that reformers, to the degree that they rely on constructivism as an undergirding philosophical

[4] For those who are questioning how it is that I can make the leap from children's rudimentary mathematical understandings to the endeavors of contemporary professional mathematicians, I suggest reading Kitcher's *The Nature of Mathematical Knowledge* (1983). In it, he works to link the simple origins of mathematics to today's complex discipline.

[5] I do not wish to claim that philosophies and pedagogies correspond perfectly to one another. Weber's notion of selective affinity (1996) is useful here as while there are no hard fast rules, there seems to be a tendency for particular ways of thinking about mathematics to have some relation to certain pedagogies.

support also do not have much to offer with regard to the contextualization of mathematics. Reform mathematics has had to work against very firmly entrenched and stubborn traditional mainstream perceptions of mathematics. As a result, some of its reliance on philosophical constructivism has fostered a preoccupation with the ways in which individual children make sense of new mathematical ideas in light of their existing understandings. While I applaud the reform movement's efforts to make school mathematics more learner-centered, this focus can lead to a mathematics education that is overly individual and cognitive. The constructivist focus primarily on the individual's construction of mathematical knowledge, can lead to neglect of other contextual factors, such as social and environmental factors.

Toward a Strong Form of Contextual Recognition

In an effort to answer a very important question—one that serves as the title of their essay—*What is Mathematics Education For?*, Greer and Mukhopadhyay (2003) refer to a contemporary shift whereby mathematics is increasingly being thought of as a human activity with a requisite increase in "recognition of the historical, cultural, and social contexts of both mathematics and mathematics education" (p. 2). While I embrace their vision of a mathematics education that recognizes these connections, I believe that for mathematics to play a meaningful role in making our world a more just place, we need to embrace a strong form of recognition of context and to move away from how we typically conceive of mathematics. Furthermore, rethinking the purpose of school mathematics as a means to arm students with tools for social justice, while certainly an improvement over school mathematics as drill-and-kill or even as sets of isolated individual constructions, might miss the point. It might miss the point because it is a *post hoc* application of mathematics to our social problems. In other words, a strong form of recognition as to the historical, social, and cultural contexts of mathematics and mathematics education requires means that—in addition to using pre-decided upon mathematical knowledge and skills to improve our social circumstances—we need to acknowledge that mathematics itself is fundamentally historically, socially, and culturally situated.[6] In other words, rather than simply finding ethical uses for mathematics, we need to teach mathematics in a way that recognizes that it is not different in kind than other enterprises (particularly ethical ones).

Distinguishing between Ethics as Application and Inseparable, Meaningful Mathematics-Ethics Connections

I have argued that Dewey's philosophy of mathematics with a small dose of appreciation for the role of empiricism in mathematics is one way to pave the way for meaningful mathematics-ethic bonds. In making this claim I have implied a distinction that I wish, at this point, to make explicit. While still certainly not in the mainstream, there is much work being done to study the socio-ethical contexts and possibilities of school mathematics. Moses and Cobb's *Radical Equations* (2001) is a good example of the moral/ethical questions related to choosing to use school mathematics achievement as a sorting mechanism, whereby those who can make it through Algebra I get to go to college and those who don't do not. There are also ethical dimensions related to the performance of marginalized groups in math class. While this certainly relates to Moses' look at mathematics and poor Southern African-American students, scrutiny of the posited gender gap in mathematics performance is also a prime example of this mathematics-

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[6] Jean Lave's anthropological explorations of the situated nature of cognitive activity, particularly of mathematical thinking, provide a good point of departure for such acknowledgement. See, for example, Lave, Murtaugh, and de la Rocha (1984).

ethics connection. Finally, there are clearly ethical dimensions related to choosing to apply mathematics in order to illuminate social justice issues, with Gutstein's *Reading and Writing the World with Mathematics* (2006) serving as a recent example of this line of scholarship. While I believe deeply in the worth of the social justice-oriented projects above, I see such efforts as consisting primarily of using mathematics as it exists in an ethical matter. Although I would certainly never argue against the merits of using mathematics in an ethical matter, I believe that right-minded application is not the extent of the mathematics-ethics connection and that there are deeper, more fundamental connections that relate to the very origin and nature of mathematics.

According to Dewey, the ethically fertile questions of how we can best arrange ourselves provide the origins of mathematics. Thus, the distinction I am making is between ethics as application of existing mathematics for good intent versus the notion of a reconceptualization of mathematics as a fundamentally ethics-laden enterprise.[7] There is a similar question hotly debated in philosophy of technology, where some argue that the commonsense understanding of technology as a neutral set of tools that can be used for good or ill ignores the ethics that are built into technological artifacts from the start (Winner, 1986). Winner gives an example of such non-neutrality by noting how the telephone, rather than being a neutral communication tool to be implemented by users as they see fit, possesses powerful tendencies toward certain social arrangements and has greatly contributed to fundamentally different social arrangements. Winner sums up this technological non-neutrality by asking: "As we make things work, what kind of world are we making?" (p. 17). Part of his solution to this problem is to call for a reconciliation between the making and use of technology. Winner sees our lack of understanding about technology as emerging from a sharp division of labor between those who make technological artifacts and those who consume them.

Davis and Hersh (1981) similarly warn: "The social and physical worlds are being mathematized at an increasing rate. The moral is: We'd better watch it, because too much of it may not be good for us" (p. xv). One way to counter unchecked mathematization and the making-use distinction in mathematics education might be to help students experience some of what goes on in the world of those who are involved in the making of mathematics and in the mathematization of our experience. Hersh (1997) explains mathematics as divided into two areas, front and back. The front is the highly polished finished product of mathematicians and the back is the area where mathematicians are busy engaging in the messy but often practically fruitful activities of mathematicians. He uses the analogy of a restaurant. In the dining room (front) everything is to appear orderly and under control. Those in the front (students) are not privy to all that goes on behind the scenes (in the back) in order to create the seamless experience of dining in the front.

The idea is that if students can get involved in the messy but engaging practices of mathematical creation that it will go a long way toward ensuring that mathematics class is a place where

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[7] Efforts that seek to both reconceptualize mathematics *and* to apply the reconceptualization for social betterment deserve the highest praise. An example of this vein of scholarship is Jo Boaler's work to broaden what we mean by mathematical rationality and to apply it to making school mathematics more inclusive. See, for example, Boaler (1997) Boaler and Greeno (2000). Gutstein also engages in thoughtful philosophical reconstruction in his project and accordingly he also deserves recognition. Since his philosophizing operates instrumentally as a means to support his pedagogy, I position his overall project on the application side of the divide.

children's experiences are grounded in genuine inquiry. That is, our live, human problems could serve as a starting point for the teaching and learning of mathematics in class. The value of what gets taught and learned there could be measured against how well the products of mathematics class address the initial problem. Recalling this essay's opening claim that mathematics should be thought of a form of intentional human activity, I hope that this exploration has helped to render a vision of school mathematics in which students are encouraged to engage in intentional ethical activity to identify problems that lend themselves to mathematical inquiry and that they meaningfully engage in "doin' the math."

References

Boaler, J. (1997). E*xperiencing school mathematics: Teaching styles, sex, and setting.* Buckingham, UK: Open University Press.

Boaler, J. & Greeno, J. (2000). Identity, agency, and knowing in mathematics worlds. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning.* Westport, CT: Ablex Publishing.

Davis, P. & Hersh, R. (1981). T*he mathematical experience*. Brighton, England: Harvester.

Frege, G. (1974) Foundations of arithmetic. In M. Beaney (Ed.), *The Frege Reader.* Malden, MA, Blackwell.

Greer, B. and Mukhopadhyay, S. (2003). What is mathematics education for? *The Mathematics Educator*, 13(2), 2-6.

Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. New York: Routledge.

Hersh. R. (1997). *What is mathematics, really?* New York: Oxford University Press.

Kitcher, P. (1980). Arithmetic for the Millian. *Philosophical Studies*, 37, 215-236.

Kitcher, P. (1983). *The nature of mathematical knowledge*. New York, Oxford University Press.

Lave, J., Murtaugh, M., & de la Rocha, O. (1984). The dialectic of arithmetic in grocery shopping. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: Its development in social context* (pp. 67-94). Cambridge, Massachusetts: Harvard University Press.

McLellan, J. & Dewey, J. (1895). *The Psychology of Number and its Applications to Methods of Teaching Arithmetic*. New York: D. Appleton and Company.

Mill, J. S (1967). *A system of logic*, 8th ed. London: Longman's, Green and Co.

Moses, R., & Cobb, C. (2001). *Radical equations: Math literacy and civil rights*. Boston: Beacon Press.

Stemhagen, K. (2003). Toward a pragmatic/contextual philosophy of mathematics: Recovering Dewey's 'Psychology of Number'. In 2003 Philosophy of Education Yearbook. Urbana, IL: Philosophy of Education Society.

Stemhagen, K. (2007). Empiricism, contingency and evolutionary metaphors: Getting beyond the "math wars". *International Electronic Journal of Mathematics Education*, 2(2), 91-105.

Ward, A. (2007). Ethics and observation: Dewey, Thoreau, and Harman. *Metaphilosophy*, 38(5), 591-611.

Weber, M. (1996). *The Protestant ethic and the spirit of capitalism*. Los Angeles: Roxbury Publishing Company.

Winner, L. (1986). *The whale and the reactor: A search for limits in an age of high technology*. Chicago: The University of Chicago Press.