Soundings: Toward Mathematics and Peace

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This paper explores why and how the use of mathematics has contributed toward peace and violence, and how we, as educators, can resist the negative tendencies, and, in our teaching, work toward peace.

Introduction

From the beginning of the modern scientific project, the measurement of the world, and its analysis through mathematics, have been central to the scientific project. Descartes developed Cartesian geometry as a tool for scientific knowledge. Brahe's empirical research was conducted through careful enumeration of the positions of the planets. Kepler systematized this research into his three mathematical laws. Newton then invented calculus in part, to rigorously prove and explain, Kepler's Laws.

Because of this close connection between mathematics and the other STEM fields, science, technology, and engineering, mathematics educators contribute to this scientific project by training future scientists and engineers in mathematics—particularly when we teach at a university level. And even when we teach students who will not themselves be scientists, we introduce our students into a society that values mathematics in large part because of its importance in the other STEM fields, and inspire them to share those values. To ask then what it is for mathematics educators to attend to the ethical dimension of teaching mathematics, particularly, to the uses of mathematics for peace, and for breaking peace, is to ask how this larger scientific project is tied to peace.

The ethical responsibilities of mathematicians and mathematics education have been stated with utmost clarity by Ubiratan D'Ambrosio:

> It is not sufficient to say, as it is common in our profession – — indeed, in every profession – — that we are fulfilling our commitment and responsibility to mankind "By doing good Mathematics" or "By being a good Mathematics teacher" But doing good mathematics should be complemented with the question "What will be done with the Mathematics I am helping to develop?" and a good mathematics teacher must always be asking "How will my students perform? Will they be conscious of their moral commitment in their professional life?" Our responsibilities include the uses society makes of our intellectual production and what is the influence we have in the behavior of future generations. (http://en.wikiversity.org/wiki/Ethics/Nonkilling/Mathematics)

In his *Discourse on Method,* Descartes set the program for modern science. "It is possible to arrive at knowledge highly useful in life… by means of which, knowing the force and the action of fire, water, air, the stars, heavens and all other bodies that surround us, as distinctly as we know the different crafts of our artisans, we might also apply them in the same way to all the uses to which they are adapted, and thus render ourselves the lords and possessors of nature." (Part VI). He goes on to call for people to sacrifice their own personal agendas for the sake of the good of the human race, particularly through medical research.

This quote clearly articulates the scientific project, and the goals and hopes entailed by the project. Most prominent is the wholly admirable attempt to be of true service to the neighbor, and to sacrifice personal interests for the interests of the whole of humanity. That is to say, to pursue universal peace.

And many of the positive goals of science and mathematics have been realized. Infant and maternal mortality are significantly down. Many ancestral diseases have been turned back and destroyed. Smallpox is no more. Leprosy is curable, and, in much of the world, is not a scourge. Plague is, in much of the world, no longer a threat. Rabies has a vaccination, and, in much of the world is hardly a threat. And though it is indeed unjust that gains have inequitably favored the wealthy nations, there is some hope that the progress can and will be extended to the rest of the world.

However, the quote also brings to light the negative aspects of the scientific project: First, and this will become clearer through

interaction with Arendt, the relationship between science and craftsmanship. Second, a selfish domination of "them"—nature—for our good.

In the twenty-first century, this second problem is clear even when "they" are nature: The ecological destructions wrought by our scientific, technological society defy imagination, and through global warming, civilization itself—perhaps, if scarcer resources bring nuclear war, life itself—is threatened. Nor have "they" always been nature. Science has equally been used to help: We Americans through the domination of the rest of the world—thus the U.S. Military Industrial Academic complex (Giroux, 2007), Hiroshima, etc. We Germans, through the domination of the Jews. We White People, through scientific racism, and the domination of darker peoples.

And, even when "we" have attempted to help "them", we have often done so with the assurance that we know better than they do, and so have imposed ourselves on them, for instance, in the destruction of traditional Native Farming practices through the mathematization and rationalization of farming (Brandt, 2009; c.f. Eason & Robbins, 2011) or of Palestinian culture (Fasheh, 2012). Or, for that matter, imposing the vision of the elite intellectual Europeans on the European laborers and workers (Sturt, 1963). Indeed, Bishop (1990) claims that since "Western" mathematics is a particular culture's product, but claims universality, "'Western mathematics'…[is] one of the most powerful weapons in the imposition of western culture."

These beneficial and negative poles of the scientific project raise the important question: How can we, as educators, continue to initiate students into what is good in the culture of mathematics and science, while resisting the bad. That is, how can we, "fulfill, as Mathematicians and Mathematics Educators, our commitments to humankind?" (D'Ambrosio, 2011, p. 125).

This question is particularly pressing for teachers in the United States, where the education agenda is ultimately set by the desire to out-compete our rivals. A desire even President Obama seems complicit in, for instance, in his speech introducing "Race to the Top", the Federal initiative behind Common Core, he summons us to educate well, because "countries that out educate us today will out compete us tomorrow."

To begin to answer the question of our ethical duties, this paper examines more closely the nature of the domination of nature

inherent in the scientific project, so that the root of the evils can be seen more clearly. After exploring the nature of science in a little more depth, this paper asks what sources there are for remedying the problem. To that end, non-"Western" philosophies are inquired, first, in hopes that they might have solutions to the problems "Westerners" have created, and second, in hopes that by the very act of, as teachers, attending to the other, and opening ourselves up to new perspectives, we might encourage our students to do the same.

Science and Conflict

While there is much disagreement about the nature of science, one theme is particularly common, occurring in Henry, Arendt, Heidegger, American philosopher of technology, Albert Borgmann, and mathematicians Davis and Hersh. As Henry (2012) argues, science externalizes things, abstracting them away from the felt and experienced life-world, and thereby, transforms them into items for manipulation.

This theme is explored from a very different perspective, but in considerable depth, in Arendt's *The Human Condition* (1998). She distinguishes between three different types of human activity: labor, work, and action. Labor is the production of food and the other necessities of existence, "man's metabolism with nature" (p. 98, quoting Marx). Especially important, in labor, the distinction between ends and means doesn't make sense: Does the laborer work so he can eat, or does he eat so he can be strong and work (p. 145)? This is in contrast to work, or craftsmanship. Here, the distinction between ends and means comes to the fore: The legs of a table are made with the goal of a table in mind. Work is good, and necessary, when a part of human society, particularly (and this is me, not Arendt), when it is intimately connected to beauty. However, when it becomes the driving force of society, as it is in our scientific, Capitalist society, abstract and arbitrary value, for consumption, replaces the intrinsic worth of items (p. 166)—and dangerously, this principle is then applied also to society, that is, to other humans, instrumentalizing and colonizing them.

Arendt's claim that a society based on making transforms the worth of objects into external, arbitrary exchange value is similar to the conclusion reached by Albert Borgmann (1987) in his analysis

of technology, and its benefits and pitfalls. According to Borgmann, technology transforms what used to be a location of communal life into an external commodity for consumption. Thus, for instance, the hearth, formerly the locus of family life, both as a family huddles around it to escape from the cold, and as they order their various activities toward it, is replaced by the commodity "heating". This, obviously, has advantages, but nevertheless, it serves to sever people from nature, transforming a locus of integration into an external, abstract, commodity, subject to human domination.

Finally, turning more directly to Mathematics, mathematicians Davis and Hersh (1986) argue that when mathematical abstraction is applied to humans and to human processes "dehumanization is intrinsic to the fundamental intellectual processes that are inherent in mathematics" (p. 283) precisely because it abstracts away from the individuals and the groups, reducing them to abstract, impersonal numbers. I would add that the same is true regarding nature: Mathematics reduces our animal and plant neighbors to numbers. Thus, in the act of doing mathematics, the mathematician or mathematical society is cut off from them, and them from our community. This is not to say that all such attempts are illicit, but that it becomes problematic when the useful abstraction inherent in mathematics is not treated as an intellectual exercise, to be passed through, but as a final statement about reality.

In all these explanations of the modern scientific condition, as in Descartes' quote, the power of science exists in the separation of us humans from "them", from nature. If we, as educators, wish to address the ambiguous nature of science, particularly in our teaching, we should perhaps begin by attempting to unify us and them—by making them, once again a part of the community that includes, but is not coextensive with, humans, and inspiring our students towards the same. For this task, "non-Western" metaphysics are particularly helpful, particularly, indigenous sciences, and non-dualistic philosophies like Daoism.

Though it would be wrong to suggest that there are no resources within the "Western" traditions, looking abroad for cross pollination is important for several reasons. First, listening to "them" is an important aspect of overcoming the dualism between us and them that I have argued is important to the doing of science. Second, throughout the European tradition, helpful and damaging strands are entangled,

and by looking away from Europe, we do not need to spend quite so much time disentangling. Finally, one of the problems that mathematics currently faces is that though it claims universal jurisdiction, it is the work of a particular people, and so, Eurocentric. By listening to non-European traditions, we can hope to begin to overcome that Eurocentrism, and to inspire our students to follow that same course.

It also needs emphasized that this should not be taken as dividing the world into Westerners and non-Westerners, as if there were two different peoples. Rather, this movement outside is motivated by a recognition that though each people has their inheritance of wisdom, the current intellectual map a little too closely resembles a Mercator Projection, in its overemphasis on Europe and North America. And we can all gain by listening to the wisdom of people from the corner of our global map, and thus, shifting toward a more just projection. However, just as, in either case the map is a map of the world, so too here, it is the human community that stands to benefit from hearing the inheritance of the "corners".

Before beginning to sketch the nature of a potential solution, a more thorough investigation of the nature of the competition and desire is required. For that, I turn to Girard (Girard, 2009; Palaver, 2013) and Dupuy (2013).

Drawing heavily off literature, particularly Dostoevsky, Girard has developed an anthropology that attempts to describe the roots of violence in society. According to Girard, humans desire deeply, but we do not know the object of our desires. We learn the object of our desires by imitating the desires of others, particularly by those close to us. This inevitably leads to conflict and violence, as imitation of a friend's desires puts one into direct rivalry with the friend, since both cannot possess the object of desire. Girard's claim is then that this mimetic rivalry drives individuals, and groups, into deep, irresolvable conflict: For instance, on his analysis, World War One was the result of a mimetic crisis, as Prussia attempted to imitate Napoleon's military success, and France, in turn, attempted to imitate Germany's nascent success, propelling the two nations into inevitable conflict. Or, in U.S. international policy, a perceived threat of out-competition from other nations, is met by a call for further competition—even by President Obama, as his speech introducing Race to the Top indicates.

Various mechanisms have been developed by different cultures to contain this violence, notably in our society, money. As Dupuy

(2013) argues, we each imitate our neighbor's pursuit of success and monetary accumulation, thus fueling the drive for consumption, and for the unrestrained growth of the national economy. People and nations follow their neighbor in projecting forward a more prosperous future, and then act, collectively and individually, to pursue that goal. This imitative pursuit of money inevitably will bring conflict since resources are scarce—and disappearing, due to global warming. Furthermore, in teaching science, we inspire students to pursue science, and thus to participate in this problematic pursuit of national and individual "success".

Recommendations for Education

This is enough to begin to give outline to the sort of strategy that educators could use in overcoming the negative, violent tendencies in mathematics and science, as we educate our students. We need to find a way to treat nature, or other peoples, not as "them", but to view us all as members of one community—or, following Derrida (1999), to distinguish between "us" and "them", but to recognize that we are fundamentally the guests of nature, and nature the host, and we are called to be hospitable. However, to do this merely as private individuals, is to play into the hands of the competition: The problem is corporate, and what is needed is not an individual response, but a corporate response stronger than the corporate drive for competition. One aspect of the corporate nature of this project particularly important to educators, is the inspiration of students to participate.

In order teach our students to desire both to learn from "them", from colonized peoples, rather than mastering them, and to treat nature as part of the community that Includes, but is not limited to humans, mathematics educators can turn to several sources: First, to the knowledges and sciences of indigenous and neo-indigenous peoples. ("Neo-Indigenous" is a term for "non-Western" civilizations coined by Aikenhead and Ogawa (2007) to emphasize the many commonalities that sciences have in these civilizations and in indigenous communities). Second, to appreciation of the beauty inherent in mathematics. Finally, to "non-Western" philosophies, particularly, Daoism.

Indigenous and neo-Indigenous sciences are important for two reasons: First in attending to other peoples' understandings of nature, we

model the inclusion of a people often treated as "them" among "us"—and, following Girard, inspiring them to desire to join in our attempts. Second, these Indigenous peoples have created a rigorous, empirical, form of knowledge, which is sustainable, and treats nature as part of a community with humanity, not as a separate "they" (Aikenhead & Ogawa, 2007).

Concrete work on how to integrate Indigenous understandings of nature, or more accurately, indigenous ways of living in nature, into the science curriculum, has been carried out and educators could begin to draw on that research. For instance, Waiti & Hipkins (2002) suggest teachers contrast "Western" Science with other forms of knowing nature, and offer three suggestions for doing so: School curricula could be broadened to include indigenous ecological knowledge; students could use insights from other peoples to critique "Western" Science; and indigenous ways of knowing nature could be valorized separately from "Western" Science and the importance of "Western" Science correspondingly downplayed. And Belczewski (2009) describes her own process of and struggles with decolonizing herself as she taught science to First Nations students in New Brunswick.

There does not seem to be as much work on bringing indigenous and neo-indigenous mathematics into the "Western" classroom—particularly if not only the mathematics but the connections between mathematics and the indigenous ways of living in nature are emphasized. This is even more pronounced at the college level. I offer here three concrete suggestions. First, our curricula could incorporate Indian infinite series (Raju, 2007), contrasting the forms they take in Indian and European cultures, and the different values reflected in the two mathematical traditions. Second, rather than presenting mathematics as an abstract, universally true system, the stories and histories of European mathematics could be more present, with the goal of making the lack of "non-Western" perspectives at least noticeable, and the silence of "non-Westerners" audible. Third, Magrebi symbolic algebra (Schubring, 2008) could be incorporated into the algebra curriculum, and the values of Islamic mathematics contrasted with the values of European mathematics.

Second, and related, (Eason & Robbins, 2011) educators could draw attention to the beauties of science and mathematics and of the natural realities investigated in science (Winston, 2010), and model appreciation of the beauty for students. Beauty is a major component

of much European science (Lang, 1985), however, it is often lacking in our curricula. An emphasis on beauty is important because in our recognition of something's beauty, we unite ourselves with it, rather than treating it as external.

However, important as these suggestions are, they don't have the corporate power to oppose the corporate system of competition. For that, we need something that is both powerful, and yet, paradoxically, devoid of power. A power that could control the world, yet does so, precisely, by undertaking nothing—since otherwise, we merely enter into the system of competition. As far as I know, the philosophy which has been both powerful, and yet, has advocated the power of emptiness and nothingness, as it were, is Daoism (Laozi, 2010). And Daoism does offer a power, but a power based on "undertaking nothing" (Dao de Jing, 48), whose method is based on weakness (Dao de Jing, 40), and, particularly relevant for the competitive drive for acquisition, claims "There is no calamity greater than now knowing what is sufficient, there is no fault greater than wishing to acquire" (Dao de Jing, 46). So finally, educators can attempt to find ways to incorporate Daoist perspectives in teaching, perhaps through the Contemplative Education movement (Gunnlaugson et al., 2014), and the incorporation of silence into the classroom (Acheson, 2007; Senechal, 2014).

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