Warm Bodies Using Cold Mathematics

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When I was in grade 7, I was pulled from regular classes for enrichment work. Six of us were going to learn about decision-making. We each had to identify an important decision we faced, list our possible choices, and list factors that would influence our choice. I chose to think about what to buy my brother for Christmas. The factors I identified included the cost, my brother's happiness, the benefit to me from him having the gift, and the effect on the whole family. Then we were supposed to rate each possible choice — each possible gift, in my case — on a scale of one to four for each factor and add up these ratings to identify the best decision.

It dawned on me that this exercise was designed to illuminate the inadequacies of quantification. Not all factors should be equally weighted, I realized. I could scale the factors to adjust for importance. But how would I choose the scale factors? No matter how I thought about it, the decision was still highly subjective, so I asked the teacher about that. He angrily told me that this method was logical and not flawed. I took my leave and refused further invitations to join the enrichment group.

This experience was the beginning of my reflections on the way mathematics works in society. I continued to perform well in mathematics courses, eventually becoming a high school mathematics teacher. As I moved through my studies and my teaching I forgot about my early experience with the problems of quantification, probably because I was caught up in very interesting mathematics that was not related to real situations (though the applicability of mathematics was regularly asserted). When I became a researcher of mathematics learning I again started thinking about mathematics in society.

MATHEMATICS IS AN AVAILABLE TECHNOLOGY

This issue of *Antistasis* focuses on the perils and hopes of technology. Mathematics can be seen as a technology because it is a tool that we use for interpreting and shaping our world. No matter what problems face us as individuals or as communities, we can choose from a variety of available tools to address the problems. When I decide what to buy my brother for Christmas, I may use some mathematics or I may use other forms of reasoning. When we as a country decide whether to increase or decrease aid to other countries, to regulate or deregulate banking, or to join or stay home from a war, we can choose to quantify aspects of these choices and to manipulate our numbers to reflect our values, or we can base our decisions on other forms of reasoning. The same is true for the problems faced by smaller communities – families, businesses, cities, clubs, etc. In choosing to use mathematics to address our problems, we often end up assigning money the status of being the universal quantifier. This approach privileges economic arguments over other values.

The choice to use mathematics transforms the way we see a problem and strongly shapes the solutions available to us. Recognizing that the use of mathematics is a choice brings into focus some important questions. How does using mathematics shape one's view and ways of interacting with the world? And, what then makes for responsible mathematics teaching?

CHOICE IN MATHEMATICS

I suggest that the most powerful effect of using mathematics is that it obscures choices. It is common to see mathematics as frozen and free from human choice. But the history of mathematics demonstrates that human choices were at work in developing mathematical ideas. Both views carry some truth.

Abstraction is at the heart of mathematics. The power of mathematics in society rests on its claims to truths that transcend human subjectivity and culture. For example, for commerce to be fair it is very important that all parties agree on how to find the sum of a set of numbers. The result should not depend on how rich or poor you are or on your ethnic background. In such instances a frozen and static mathematics is a powerful tool for making convincing arguments. This is especially important in democracies, in which argument is supposed to be based on dialogue, not status.

However, even when people use mathematics in deliberation (or argument), they have to decide to agree that mathematics is an appropriate tool for the problem being addressed. Furthermore, when we choose mathematics, we have to choose what to count and how to use the results of our counting. Though mathematics is cold and static, it has to be picked up and manipulated as a tool by a warm human body who makes decisions about how to apply the tool.

Mathematics can be a dangerous tool for exploitation if some people know they can make choices with it and others believe that mathematics is free from human choices. Those who believe that mathematics is values-free or independent of culture are open to being manipulated by others who are savvy with their mathematics.

WHAT CAN WE DO?

Given the danger described above, it is important for mathematics teachers to highlight the human choices behind mathematics. They can do this by contextualizing mathematical ideas to show how they address particular human needs, whether the needs are practical, such as finding the shortest route or the most efficient algorithm, or aesthetic, such as describing an interesting pattern. Reading about the history of mathematics or about ethnomathematics (studies of mathematics in different

cultures) can help with this, but it is possible to think about the motives and choices in mathematics without such help.

Mathematics can also be humanized by giving students tasks that let them make decisions and talk about their choices. In the first issue of *Antistasis* John Grant McLoughlin (2010) describes a good example of this kind of teaching. If students experience this kind of mathematics, they will more likely recognize decisions in any mathematics.

The more we do mathematics ourselves and tell others about what we are trying to do and how we are making choices, the more we and the people around us will see mathematics for what it is — a powerful tool that can be used for harm, for help, or simply for pleasure.

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