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## The Möbius Metaphor

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When the topic of mathematics is brought up, people associate it with balancing their checkbook, the pressure of memorizing times tables in elementary school, or the misery of high school geometry proofs.

I contend this is not what real mathematics is about.

Instead, I believe mathematics embodies human creativity and intellectual struggle, provides a language to describe and explain the physical world, epitomizes aesthetic beauty as much as art or music, is critically useful, and permeates all aspects of our existence.

To illustrate these last three points, consider the following small example from my mathematics courses for elementary school teachers and liberal arts students:

- Tear off the left edge of this paper as indicated.
- Bring the ends together to make a loop-like those children use to construct Christmas chains.
- Instead of joining the ends as usual, flip one over so the labeled ends are glued together. You have created a Möbius band, named after the German mathematician August Ferdinand Möbius.

So what? Well, this seemingly simple object is in fact quite exotic. For it is one-sided! It is a “non-orientable surface” in mathematical jargon. Check for yourself. Try to color just “one side” blue. Can’t be done. In the same way, the Möbius band has only one edge. Moreover, if you try to cut the Möbius band down the middle, or into thirds, well... Look out! All kinds of surprising results await you.

This kind of beauty is the norm in mathematics, not the exception as most believe. It’s deep, but not complicated. I share Möbius bands with my future elementary teachers in the hope that their students will construct all their Christmas chains from Möbius bands.

For there’s no reason an art project, Christmas chains for example, can’t be mathematical. As the nineteenth century mathematician Gosta Mittag-Leffler said, “the mathematicians best work is art, a high perfect art.”

Nice, but does the Möbius band really matter? You’d be surprised. Because Möbius bands have only one side they make perfect conveyor belts--they wear twice as well! B.F. Goodrich Company patented conveyor belts made in the shape of Möbius bands long ago, and such belts are commonplace in every large industry and machine shop--even today. Discovered in 1983, the chemical compound tetrahydroxymethylethylene, takes the natural shape of a Möbius band. Möbius bands have also provided a model for high performance, nonreactive electronic resistors.

Applications such as this are the norm rather than the exception.

Whether considered on aesthetic or utilitarian grounds, mathematics is ubiquitous. We’re not just talking of the arithmetic many confuse with mathematics, but also geometry, pattern, structure and form.

Not convinced? Let’s look to the Möbius band again. The Möbius band is the symbol for recycling 1, and recycling’s mascot is a Möbius-faced creature appropriately named Möbius. Recycling’s Möbius symbols are found everywhere. Suppose each time you see one of these symbols, you look around and see where you can find mathematics. You’ll be surprised how much you see. As you look, day after day, you should begin to appreciate the words of the physicist James Hopwood Jeans who remarked, “the Great Architect of the Universe now begins to appear as a pure mathematician.”

If all this fails, come join me and my students on our voyage of mathematical discovery. We’ll help you find the way.