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MATH: It's Not Just a Four Letter Word

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It's Not Just a Four Letter Word

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Ahhh, arithmetic—those were the days. Addition, subtraction, multiplication tables. Then things got complicated. Along with those familiar numbers suddenly they added x, y, π , and all kinds of other symbols that certainly looked more at home in the alphabet than combined with numbers.

Like most people, I made it through algebra and geometry. To this day I do not know how, but I did. However, a life long fear of higher math has plagued me ever since those long ago high school days.

The decision to further my education came many years later. Every semester the "math requirement" for my associate degree loomed overhead. Like death and taxes it was inevitable. I continued to put off signing up for a math course, knowing full well my days were numbered.

If only math were something more than *just* numbers. Well, Virginia, there is more, much, much more.

In the Fall of 1991, I approached one of our math professors and discussed the possibility of taking an independent study course relating to math. With his approval and guidance, it was decided that I would study independently and write papers pertaining to mathematics and culture. One book in particular, given to me by my professor, opened new doors of understanding and a desire to learn more. My enthusiasm for this book is unqualified.

Marcia Ascher's book *Ethnomathematics*[1] has a wealth of information that should appeal to teachers, math majors, and those who consider themselves math-phobic. It certainly appealed to me; it opened new paths to understanding mathematics and its origins. Instead of square roots and multiplication tables, I learned about the Quipus invented by the Incas of Peru. Consisting of a variety of colored and knotted cords attached to a base rope, the Quipu was used for calculating and recording numbers. Perhaps after reading and learning about this interesting "calculator" of long ago, children could make a Quipu and use it in some project. What a great way to learn Math!

A section of the book explores number words with many examples of how cultures make different use of the counting facility; some generate lots of number words and a very few generate none. Nahuatl is a language of central Mexico. Nahuatl and Mayan numerals have a cyclic pattern based on twenty. One of my favorite examples is the numeral classifier, wich is a term that is included when number words are spoken with nouns. Their purpose is to convey information about the nouns

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that is qualitative rather than quantitative but a necessary part of a quantitative statement. While some languages have as few as two classifications others have as many as two hundered.

The language of the Maori, the indigenous people of New Zealand, illustrates the numeral classifier. When a statement is made about a number of human beings, it must contain the classifier for humans. For example, "five humans women" or "five humans Americans." A clear distinction between classes is possible, human versus everything else.

The use of numeral classifiers by the people of the Gilbert Islands shows us how a language uses its

classifiers to reflect the specifics of their environment. There are 18 classifiers from (a) animates (except for fish longer or larger than people), spirits, and ghosts to (r) general (often replacing other classifiers of inanimates and used for serial counting). The letter, (p), means all modes of transportation. So, if we were to tell someone that we had six boats it would be as if we were to say "sixp boats." The Gilbertese classifiers become affixed to the number words. It was fun to use the list of classifiers given and try to make up sentences using this method of communicating quantities of objects, people, anything.

The Kusaiean language has just two classifications which also combine into number words. It is much simpler than Gilbertese and yet reflects the specifics of their environment.

While the drawing of continuous figures in the sand superficially appears to be a children's game, it is actually part of a widespread storytelling tradition among the Tshokwe. The figures called sona are drawn exclusively by men. It is primarily older men who are knowledgeable and proficient in the drawing skill. To draw the sona, an array of dots is first constructed. The continuous figure is drawn surrounding the dots without touching them. Aspects of the Tshokwe culture need to be presented to help comprehend the figures and their associated stories and names. Learning about the Tshokwe culture and their sand tracings is a wonderful walk through another world. This is a recognizable form of what we now call "graph theory".

Ascher tells the story of Euler in Königsberg and the beginnings of modern graph theory. According to the story, seven bridges spanned a forked river that separated the town into four land masses. The townspeople were interested in knowing if, on their Sunday walks, they could start from home, cross each bridge once and only once and end at home. Euler showed that for the particular situation, such a route was impossible. We read on to find out why and are given many different graphs to illustrate what became known as Eulerian paths and also graphs where no Eulerian paths exist.

We are even given a look at kinship of people and how this can be related to mathematics. The Warlpiri, who live in a desert area in Australia's Northern Territory, have a particularly complex kin system. It consists of eight sections and each person is in one of them. Preferred marriages are to take place with persons from other specified sections, and their children are in another section, which depends on the section of the mother. We are given sections 1 - 8 and also a diagram of the marriage rules. One can trace through several generations using this diagram. What a great way to introduce math to children or any age group for that matter.

And, of course, we can all identify with games of chance and those involving strategy. Games of chance such as bingo and roulette are games in which players may bet but they make no choices that affect the outcome of the game. Winning or losing is out of their control. However, in games such as checkers or chess, each player does make choices. In games of chance, there is involvement with concepts of probability.

A popular game of chance among Native Americans involves the use of a dish and some small flat disks. The objects are shaped and decorated or colored so that each has two faces that are different from each other. Usually there are six or eight disks. One of the two players places the disks in the dish and, by striking or shaking the dish, causes the disks to jump and resettle. The resulting assortment determines the number of points won and whether or not the player goes again or must pass the dish to his opponent. In some cultures, such as the Cayuga, the dish was a wooden bowl and the disks were six flattened peach stones which were smooth and had been blackened by burning on one side. Along with the description of this game, we are also given a look at some of the probabilistic implications. This game reminded me of many childhood games

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which were similar in several ways. While playing these games as a child, it would have been of interest to learn in school that the games my friends and I had been playing were like those enjoyed around the world in many other cultures. Examples of these games and possibly giving the opportunity to play the games of other peoples by making the game pieces as they would, could be a helpful tool in building a foundation for math.

From Quipus to sand tracing, it becomes evident that Math is more than just numbers. It's a fascinating world of information that stretches far back into the past, a past that holds a wealth of knowledge for even the most skeptical person. Didn't you ever wonder why people, even very young children, are able to sing a song and remember each and every word? Perhaps that is because we view singing a song as pleasurable—it makes us feel good. Maybe a similar approach to teaching math and sciences is the answer. When the fear is removed and one finds learning pleasant and no longer intimidating, one can begin to explore new worlds that once were thought to be unreachable.

[1] Ascher, Marcia, *Ethnomathematics*, Brooks/Cole, Pacific Grove, CA, (1991).

Poetry by Helen Lewy

Presented at the Mathematics Poetry Reading, Jan 14, 1994
Joint Mathematics Meetings, Cincinnati, OH

THE MATHEMATICIAN COMES HOME

"Hello, my dear,—and how are you?"
"I'm fine. I baked a cake!
And how was your day, Husband Mine?"
" Oh, just the 'standard take'."

"What kind of goodie did you bake?"
"Upside down" she quoth
" Oh, no! Not that!!" he cried in pain,
"It' s happened to us both!

For some eccentric Fate of ours
Is playing Cosmic Clown:
The math I did today,—it, too,—
Came out quite upside down!!"

A programmer living in Gates
Was subject to odd sorts of states;
In a rage, a while back,
He hacked up his Mac,—
Now his future is up to the Fates!

A researcher in Algebra (Linear)
Didn't dare to talk math during dinnear!