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**“==”**

# Help me and let me help you

Anna Craycroft talks with cyberneticist Ron Eglash about the infinite unity of thinking and doing

AC:_First off, I'd like to talk about the origins of your work in ethnomathematics, before your Fulbright to travel throughout Africa studying fractal geometry. I’m curious what sparked your interest in the relationships between mathematic patterning and material culture.

**RE: When I was in high school I read Norbert Weiner’s book about cybernetics, *The Human Use of Human Beings*, and was impressed to see that a guy famous for math and science could also think about culture and politics. So I did my BS in cybernetics and my MS in systems engineering at UCLA, and then for my doctoral work I went to the History of Consciousness program at UC Santa Cruz, looking for research that would give me a link to social justice. I figured the literature on technology transfer in the third world would be a good place to start.**
**I read anthropologist Pat Caplan’s description of an Islamic village in Tanzania, in which women had a great deal of autonomy due to their ability to create architecture as it was needed (e.g., it allowed them divorce when they wanted it, they could move annoying teenagers into their own rooms, etc.). Caplan described the “modernization” plans to replace this flexible architecture with concrete block houses lined up in rows and columns. She said this was a threat to women’s autonomy. I knew what the geometry of rows and columns was: the Cartesian grid. But what was the “geometry of freedom” that the grid threatened to replace? So I wrote to her asking for aerial photos, and surprisingly she sent them to me. That’s when it struck me that fractals would make a good model for that architecture.**

AC:_ In phrases like "geometry of freedom" you seem to speak directly to the potential for mathematics to reveal desires, curiosities, or particular logics of human behavior. At the same time you frequently point out in your writings how important it is that we don't get carried away with interpretations or deductions about the cultures you study. This sounds like something of a conflict, since your attraction to the fractal patterns in this Tanzanian architecture, for example, began with a curiosity about its cultural significance. How do you resist the temptation to associate each mathematic pattern with a specific symbolic function?

**RE: Yes there is a conflict there—a temptation that we need to both attend to and question. The temptation is to come up with some simple, universal formula for freedom or social justice. When I read Caplan’s description of**

**self-organized, or "bottom-up," and then realized that these "bottom-up" architectures are fractal, my first thought was, "Okay, so fractal = freedom, mission accomplished." But human experience is too expansive to reduce to an equation. Eventually I found some counterexamples. One was a village in Mali which was self-organized, but it had a caste hierarchy: the low-caste people put themselves in the worst areas to live. Eventually they left and moved out along a new road that was built nearby. So they went from fractal spatial arrangements to linear organization as a way to empower themselves. As anthropologist Clifford Geertz points out, meaning is locally constructed: what constitutes the geometry of freedom in one culture might be a recipe for disaster in another.**

AC: Within the search for meaning there also seems to be embedded the basic human desire to identify with others. I think you address this urge in your discussions about intentionality. Thinking of the technologies of other cultures in terms of "conscious creations" provides a kind of access into the thought processes of the makers—on both a cultural and an individual level. Perhaps there is something to the practice of mapping human experiences through patterns that connects the scientist to the subject in an intimate and mutually exposing exchange?

**RE: I often meet scientists who are "mapping human experience though patterns" and wouldn't know an intimate and mutually exposing exchange if it bit them on the nose. And occasionally I run into someone just the opposite: a mathematician or scientist whose work is utterly abstracted from human experience, and yet they have an overwhelming passion for life and art and social interaction. But for me personally, I think the way you phrased it is an accurate reading of what motivates me, and the more ethnographic approach I have to mathematical modeling. I like to think of shapes in the human-made world as a sort of material manifestation of the knowledge or understanding that went into creating them. A geologist looking at a waveform on a seismograph can deduce something about the particular kind of earthquake that produced it. So what can the form of a mud house or a textile weaving or graffiti lettering tell us? You can't know unless you are willing to enter into that intimate exchange.**

**Take, for example, the intricate designs in the African tradition of cornrow hairstyles. When Karl Marx wanted to describe money, he said it was "congealed labor"—his theory was that since we can't actually see the labor in money, we are fooled into thinking its value comes from somewhere else. With intricate braiding, it's just the opposite: you really <u>can</u> see the labor—the many hours that went into it. And that visible version of congealed labor becomes an expression of some human relationship: I love my friend so I will spend hours fixing her hair. Or maybe, I want to look good for my lover so I will get someone to give me a style that shows my dedication. To me that kind of "backstory" is just as important as knowing the technical details about the algorithm used to**

**create the hairstyle. It's in the intersection of the two—technical execution and social meaning—that the pattern takes on its significance.**

**Of course, you said "mutually exposing" exchange. There is a big difference between the end result—having a neat and tidy description like I just gave above—and the actual messy process of doing fieldwork, in which you often do expose your own ignorance or have some other kind of vulnerability. That is just a necessary part of building trust and making yourself open enough to have that exchange.**

AC: It's funny to think of "messiness" in relation to understanding mathematics. When I picture fractal geometry or a Cartesian grid I imagine graphic illustrations that do not reveal the handiwork of their makers. And while the abstract qualities of these diagrams may be representative of the immaterial nature of thought, the fact that their imagery is mostly divorced from a physical world makes them difficult to relate to. By contrast, your focus on technology allows this intangibility to feel palpable. The process of mathematical thinking becomes located in the physical experiences of hair braiding, architectural construction, basket-weaving, divining rituals, etc. The messiness of thinking (a process of continuous tidying) can then be understood as an intimately social and tactile experience. I have always believed this to be the role of art and read your studies as a blurring of the lines between art and technology. Your description of "shapes in the human-made world as a material manifestation of the knowledge or understanding that went into creating them" transforms our surroundings into a kind of map or a portrait of the thinking they evolved from. The photoshoot I developed for *Garage* with Shala, Elle, and Jenke is a playful homage to your provocation to consider how complex theories can be materialized and humanized. In the context of your studies, how do you consider the role of art?

**RE: I like your phrase "how complex theories can be materialized and humanized." But it sounds a little one-directional, as if math starts in some ethereal realm and gets transported to earth. From my point of view, it's a two-way road. Ideas in math, computing, etc., start with material, sweaty human beings. Alan Turing's foundational concept for the field of artificial intelligence, which we now call the Turing Test, was based on a gender guessing game (Turing himself was a closeted gay, so he knew a lot about "passing"). Sophia Kovalevskaya, perhaps the most accomplished female mathematician in history, devoted herself to mathematical abstraction: but she said she did so because she wanted to counter the assumption that women could not think abstractly; she was a member of radical political groups fighting for freedom in Russia and France.**

**But if these complicated theories started with ordinary human desires and bodies and lives, then why do we think of them as cold cryptographies, closed to all but a few elite minds? I can't help but think that part of the problem is deliberate obfuscation. Benoit Mandelbrot, the father of fractal geometry, used to rail against the way that images were banished from professional mathematics, and how that prevented people**

**with a more visual or artistic approach, like himself, from engaging in math. As a Jewish child hiding in France during World War Two, he knew a thing or two about the mentality of supremacist beliefs. He once asked me what sort of criticism I had received about my *African Fractals* book. When I told him the bulk of it was hate mail from "white power" groups, he said, "You should think of that as a tribute to your work. You have angered the right people."**

**Or, to pick a more mundane example: in mathematics, the "=" sign means "equals." But in most computer languages, the "=" sign means something else, and so if you need a math equation in your program you have to use a different sign (often "==") to mean "equals." You just don't create that much confusion and obfuscation unless you have complete disregard for how you will allow lay people access to programming. That particular issue happens to be on my mind at the moment because we have a lovely cornrow hairstyle simulation for teaching math (www.csdt.rpi.edu), and we recently (thanks to the National Science Foundation) introduced a programming interface for it. Kids love it; we have even used it in art classes. But I can feel that art/science divide getting in the way every time I try to explain "==".**

**Of course, we are not alone; there is a whole new generation of people who are crossing over the art/science divide from both sides. Graffiti artists who use laser projection from homemade hardware; mathematicians like John Sims, who collaborates with artists in Harlem. What was once an enormous divide between art and science is becoming more like a braid, in which our abstract equations, passion for self-expression, and prosthetics for the human experience recombine through an infinity of fractal intertwinings.**

AC: Can you unpack that last sentence?

**RE: Some of my colleagues like to use the word "holistic" to talk about such things, but I find that word frustrating, as if the only way to bridge the art/science gap is some sort of zen transcendence – what my doctoral advisor Donna Haraway called "the view from nowhere." I prefer the view from some particular place. Its hard work that gets you over the gap, and the really powerful bridges are the ones with two-way traffic and multiple crossings. Take music: it used to be that engineers might be involved with a recording studio or concert hall, and there were a few experimental electronic artists like Louis and Bebe Barron, but that was about it. Then popular artists like Jimmy Hendricks started using electronic instruments, and engineers started creating things like drum machines and mixers that were accessible by armatures. Now we even have technologies for peer to peer distribution; fractal intertwinings indeed.**

AC: Somehow when I start considering cultural production and technological innovation in the context of "peer to peer", I begin to see this incredible potential

for exchange everywhere. Take your anecdote about "==" for example. You described how it refers to both a sociocultural divide and the art/science divergence. On the other hand, when I read it as a sentence fragment: "equals, equals", it looks to me like a poetic symbol for constancy in a relationship, like reaching a blissful state of infinite unity.

I totally agree with you about the reciprocal enmeshing of abstract thinking and corporeal doing, and am so grateful you are making this point in your work. The braid is an apt metaphor. I'm not sure if it is possible to distinguish one strand from another without taking it apart. But if we do, we lose sight of the equation of intertwinings you just described.

If you will forgive the artistic license, I am picturing the potential of this metaphoric braid as symbolized by "==".

**RE: Using an image to try to sum it up is a great idea. Let me offer one that reminds me of what you say above but is a little more visually nuanced.**

**Adinkra symbols are used in a stamped cloth tradition in Ghana; each symbol is associated with some aphorism. The adinkra symbol *boa me na me mmoa wo* ("Help me and let me help you") makes use of a geometric combination of symmetry and asymmetry: both are triangles, but one contains a white square and the other a white circle. This conveys the concept that social reciprocity contains both—you gave me a more expensive gift (asymmetry) but we treat them as if they were of equal value (symmetry). I need your help more than you need mine, but if it is a relation based on friendship, we treat the exchange of help as if the needs were equal.**

**You can take that to a deeper level looking at the black outer circle and square—the arrow with the white square has a black circle at the end, and vice-versa for the other. So the asymmetry is created in a symmetrical fashion, a kind of higher-order symmetry.**

**Art and science are not equally empowered in our society. We are familiar with the phrase "starving artist," but "starving scientist" sounds like an oxymoron. We think of artists as people who are drunk on life, scientists as wet blankets and wallflowers. If we are really going to fashion new braids from elements on both sides of the divide, they will have to be with an understanding similar to *boa me na me mmoa wo*.**