Opening remarks: Mat Chivers sculpture

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Minhyong Kim

What is mathematics? Many of us are asked this perplexing question now and then, and I suspect many like me are at a loss to give an answer that does any justice to experience. The question of what something is or is not poses almost insurmountable obstacles in any mildly general context. It's not much of an exaggeration to say that modern science has somehow managed progress by directing the question from other domains of human inquiry into that of mathematics, such as when a practicing physicist is most content to identify force as a vector field. Within these walls, then, I think we have found it wise, by and large, to leave such questions unanswered.

I came into contact with Mat Chivers in relation to a question of more limited scope, although, I think, no less difficult. This is the one of defining geometry. Around the time last year when Mat was in residence at the mathematical institute, I happened to be directing a student project on mathematics and art in collaboration with Senta German of the Ashmolean museum. This had led, through a sequence of awkward thought experiments, to analysing Greek pottery from the 8th century BC, a period whose style is not infrequently referred to as 'geometric.' While struggling to make sense of this classification, I happened to discuss it with Alain Goriely, who quickly suggested I talk to Mat. To say the encounter was illuminating would be a vast understatement, except it's still quite difficult for me to explain in exactly what way.

As a mathematician who has spent a good deal of his life thinking about the issue, I hope I won't be considered too arrogant for noticing in the end the limited conception of geometry that informs the use of the term by many people, mostly from outside the field but occasionally even by experts. It is hard to guess at the intentions of ancient potters, but I think we can see that even an ingenious observer like M.C. Escher worked within a very rigid framework, perhaps the kind that was erected around the time of Klein and Hilbert. That is to say, it seems even great artists and mathematicians can find themselves confined by classification theory of a very homogeneous sort. In the meanwhile, mathematics has moved on from the delicate contemplation of *special* kinds of geometry to grappling in full with complex generic patterns. Indeed, one of the most important geometries to emerge in modern times is that of moduli spaces, where we must analyse high-dimensional spatial interactions between *all* objects of a certain sort, such as algebraic curves, gauge fields, or even simple triangles, as they bend and stretch and twist and turn through the realm of possibilities. Put differently, allowing ourselves a bit of cliché, we tend to think of the 'geometric' as a way of looking at pretty much anything, rather than as a property of certain things.

Incoherent as they are, these hesitant background remarks may convey a bit why I was deeply impressed when first exposed to Mat's vision. As a working-class mathematician, I decline to be a fool by attempting any kind of detailed commentary on his work. However, you are urged to visit Mat's website to get an overall sense of the resolution he proposes to the difficulties I have hinted at and to judge for yourself how successful he has been in dealing with them.

Focussing now on the work before us, I have to admit I was rather taken aback by the name when first told about it a few weeks ago. Most of my mathematical life, I've been somewhat against axioms. However, you needn't worry that I am against the sculpture on this account. You see, my suspicion of axioms can be traced back exactly to the problem of characterising mathematics itself, and to my sense that not a few people vaguely subscribe to a caricature describing a subject that concerns itself primarily with certainty of assumption and inference. One peculiar proposition, for example, suggests that mathematical reality is entirely dependent on axioms, if not defined by them. To the people gathered here, a detailed refutation of this claim should not be necessary. One might compare it to the notion that physical motion depends on Newton's axioms for its existence.

In fact, the sculpture is one of the best illustrations I have ever come across that my prejudice has been largely ill-founded. The creator is clearly someone who senses that Newton's laws do not comprise motion itself, even while their clear formulation has been critical to our understanding of the phenomenon. I think he also knows that mathematical axioms should be taken seriously not as mathematical reality itself, but as organic tools for exploring that reality. Consequently, some are good, some are worse, and they go through the dialectical cycle of birth, growth, maturity, death, and evolution. In that regard, if I may be forgiven one small suggestion bordering on the pretentious, I recommend that you keep your attention fixed on the sculpture, starting from afar as you walk slowly into the building through the south entrance until the image becomes detailed enough to reveal the rough texture of the edges circumscribing the simplices and overlapping naturally at the vertices. Obviously, I have nothing to say about what you are supposed to experience.

I am fond of telling my students now and then to take a moment to marvel at the progress of mathematical understanding over millenia. I think it was A.N. Whitehead who remarked that Plato and Aristotle would have been dumbfounded to learn that ordinary people in our times can multiply and divide with relative ease. Comparing the sculpture we have in our foyer today to Attic pottery, it is easy to be complacent that the vanguard artist's conception of geometry is progressing just as surely.