MATHEMATICS AND THE GOOD, REVIS(IT)ED

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Almost twenty-four centuries ago, Plato delivered a public lecture on the topic of *The Good.* The large crowd that had gathered to hear him speak eventually dwindled down to just a very few, with many complaining about its esoteric nature—indeed, as Whitehead writes, "the lecture was a failure" (1941, p. 667). Plato had chosen to treat *The Good* in terms of mathematics, which proved to be a difficult subject for his audience. Though of course we only have second-hand reports of the lecture, the prevailing wisdom is that Plato would have talked about how mathematics models the kind of order and unity that he associated with the goodness of things—that is, their permanence, beauty and form. Still, why would he choose to focus on such a difficult subject, especially given that Athenians were already concerned about the elitist, secretive and potentially dangerous-to-democracy goings-on of the Academy? Gaiser (1980) provides a compelling answer: "If the people of Athens took his ideas for incomprehensible mumbo-jumbo, they would at least cease to regard him as a threat and to prosecute followers of such an abstruse creed" (p. 23).

It might be said that questions about whether mathematics and the good have anything in common are decidedly old-fashioned, harking back to transcendental assumptions about the nature of truth, beauty and virtue. In addition to being old-fashioned, they may also seem hopelessly tied to a Western (in particular, white, male, affluent) worldview. But I do want to address the question of mathematics and the good because I am convinced that it can be fruitful, both for rescuing school mathematics from its current technocratic stranglehold and for pluralising mathematics in a way that is able to resist the collapsing of difference into one, homogenous, correct idea of it—which is to say, its current, Western, quantitative incarnation. This homogeneity is a recent phenomenon. Indeed, a cursory consideration of the very different nature of the objects of attention and styles of engagement involved in arithmetic and geometry is enough to make evident that the discipline of mathematics is and has always been a discontinuous and fragmented space of hybridism, in which the analytic, quantitative arithmetic and the spatial, qualitative geometry, *can* exist side-by-side and on equal footing.

In addition, the topic of mathematics and the good seems a fitting one for this celebration of David Pimm's academic interests, which have included many different contributions to the axiological dimensions of mathematics, including aesthetics, values and style (see Pimm, 2006; Pimm & Sinclair, 2009). Indeed, the topic of mathematics and the good was the theme of a seminar held at Simon Fraser University in December 2019, which included not only David, but also Jan Zwicky, Sean Chorney, Canan Güneş and myself (as well as, more virtually, Plato and Alfred North Whitehead). This article will therefore be a sort of thinking-along-with the conversations at the seminar, as well as a reading-alongside Whitehead's (1941) essay "Mathematics and the Good" and Zwicky's (2019) recent book *The Experience of Meaning*. David's long-standing interest in Zwicky's work on metaphor, both in relation to mathematics and to poetry [1], not only as a source of meaning, but also as a means of expressing in words what words often fail to convey, is another significant connection to this article.

Classical mathematics and the good

Plato was interested in the good because he was interested in ethics. Many before and after him have also been interested in ethics, both within the Western paradigm, but also in non-Western philosophies, including Indigenous ones. But it is rare to find ethics and mathematics taken up together. Although the evidence is scant, many commentators report that if Plato's lecture on *The Good* drew on mathematics it was because mathematics perfectly expresses the idea of unity or the One, where the One is more or less synonymous with the good. As Zwicky (2019) remarks, this hypothesis could mean many things, "from Pythagorean number mysticism to a sophisticated logical argument about the indivisibility, the imperishability of forms" (p. 84). From the idealist, transcendental reading of Plato that we have inherited, mathematics shows in the most general and accurate way possible the ideal forms of order, harmony and unity—and it escapes (or possibly, excludes) the chaos, plurality and mutability of the human world. The good is thus objectively defined.

In contrast, in her vivid reading of Plato's dialogue *Meno*, Zwicky (2009) offers a more subjective account of Plato's project, which focuses less on the nature of mathematical objects and more on the nature of mathematical experience. In her view, the association that mathematics has with the good is based on "the experience of necessary truth in geometry and the experience of moral beauty manifest in Socrates' character" (p. 84). The experience of "necessary truth" might evoke something about the deductive logic of mathematical proof. This, in turn, has somewhat exclusive—not to mention elitist—connotations, which would have the unfortunate consequence of associating "necessary truth" not only with "moral beauty", but also with a very small slice of the population (those who engage in mathematical proofs). But experiences of necessary truths might vary from person to person. Consider the experience of truth offered by the Euclidean style of proving versus the Archimedean carnivalesque style (Netz, 2009) or the highly visual style of the Ming Dynasty Ancient Chinese proofs (Siu, 1993)—to take just three more or less contemporaneous examples.

As she makes clear in her book *The Experience of Meaning,* Zwicky (2019) is particularly interested in the experience of necessary truth *in geometry.* She has in mind a gestalt comprehension that is quite different from the discursive, piecemeal, computational one that is usually associated with mathematics. Her examples include the doubling of the area of a square and the proof of the Pythagorean theorem, both in diagrammatic form. For the former, consider what Figure 1 *shows*, about the doubling of the area of the shaded square.

The experience of meaning here does not require verbal description or symbolic forms or a string of logical operators. Yet, it commands a *feeling* of necessary truth through an awareness of structure. Indeed, Zwicky writes that, “Gestalt thinking fundamentally involves the spontaneous perception of structure: not analytic order—one brick stacked on another—but what might be called resonant internal relations” (2019, p. 19). Whitehead (1938) writes instead of “pattern”, confessing that he derived “a larger pleasure in patterns of relationship in which numerical and quantitative relationships are wholly subordinate” (p. 65). Eschewing “half-hearted” proofs that fail to offer the self-evidence that he took to be synonymous with understanding, Whitehead emphasised the “sense of completion” associated with a self-evident proof, which may correspond to the gestalt of spontaneous perception.

As Zwicky writes, there are many other examples of such gestalt thinking in mathematics, not only in geometry, and not only involving Ancient Greek proofs. While the resonance in the diagram shown in Figure 1 was visual, as in the relating of parts (triangles, diagonal lines, sides) to wholes (squares), and while there are many examples of such resonances in visual proofs, gestalt thinking in mathematics need not necessarily be solely visual. There are more temporal structures that can resonate as well, that may provide gestalts that are more like the ones we experience in music. In Jean-Louis Nicolet’s [2] animated geometry film *Circles in the Plane* (Figure 2), for example, a circle is seen to move and grow and then get attached to a point, after which it moves and grows quite differently, and even more differently after it hooks on to a second point and then, finally, a third one, after which it ceases to move.

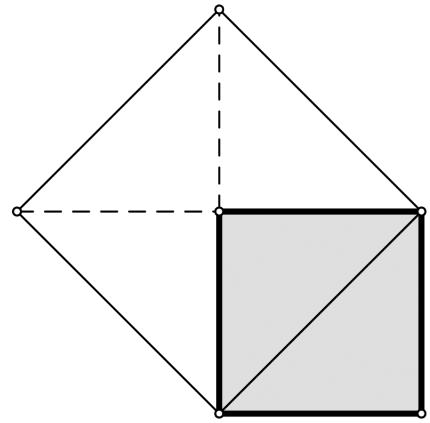

Figure 1. Showing how to double the area of a square.

The “outer meaning” of the film, as Dick Tahta (1981) terms it, can be read as saying that three non-collinear points determine the size and location of a circle. But it is the “inner meaning” with which Tahta is concerned, the one that side-steps the sayable meanings of language. This meaning is *felt*, with little reason to *say* anything but oh! As Tahta writes, “the animations were beautifully timed, lingering slowly so that the viewer was often ready to construct a meaning before the film confirmed it” (p. 25). Indeed, although not using the language of gestalt, Nicolet set out to provide a new way of thinking: “It is necessary to stop thinking of the elements that constitute a set in order to try to think of the set itself. This is very difficult, but there is then a true metamorphosis. The mathematician is to the calculator what the butterfly is to the caterpillar” (in Tahta, 1981, p. 26).

My main interest here is in probing the link between such an experience of gestalt thinking and the notion of “the good” and of “moral beauty”. Again, Zwicky offers some

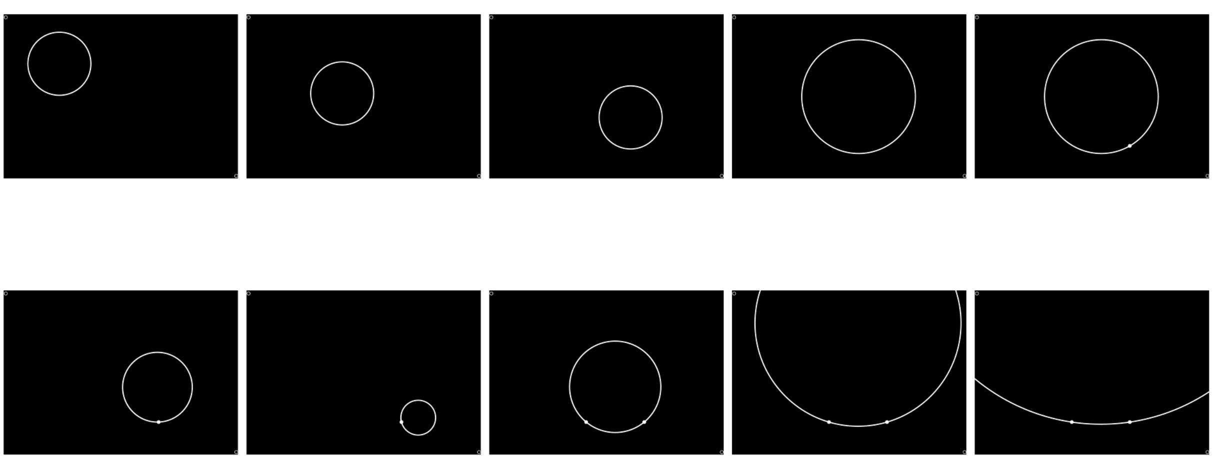

Figure 2. A sequence of images re-created from Nicolet’s Circles in the Plane.

tempting hints when she writes that the failure to detect "real structural resonance across distinctive domains [...] has repeatedly sabotaged Western European discussion of meaning in general" (2019, p. 121), for which meaning is cast as that which is determined, countable, replicable and communicated through language. This produces a culture in which:

> the arts are thought of as entertainment; visual thinking in mathematics and the sciences is derogated; indigenous wisdom is dismissed as superstition; moral issues are treated as problems in cost-benefit analysis; the purpose of education is to get a job. (p. 57)

This can be seen as a call to include more visual mathematics in the curriculum. It is also much more than that, because in protecting and nurturing gestalt thinking, one must care for the many resonant relations that may be at play, including emotions. Indeed, a crucial element of gestalt thinking for Zwicky is that it *expresses* emotion, which is to say, it "*picks up on* emotion in an effort to co-respond with other minds" (p. 158).

In reading with Zwicky, then, the association of mathematics with the good demands an enlarging of the current discursive and linear ways of thinking which are valued in mathematics education (and probably in mathematics itself). My argument is that if there is to be any contemporary experience of the good in mathematics, it will have to involve an opening to opportunities for gestalt thinking, for an awareness of resonance, for the expression of non-verbal meanings, for the production of metaphors. Of course, I do not mean abandoning the literal, discursive, computational ways of thinking dominating Western mathematical culture, including mathematics classrooms, as they are also important. I propose inflecting them with Gestalt thinking.

Modern mathematics and the good

In speaking to the interdetermination of parts and wholes that characterises gestalts, Zwicky evokes quantum mechanics and remarks on the resonance with concepts such as quantum superposition and entanglement. Perhaps, she suggests, these quantum phenomena seem so mysterious to us precisely because we read them through epistemological lenses that are overly piecemeal and language-based. For example, the subject-verb-object construction of the English language insists on sequentiality. Might the concepts that have emerged from quantum mechanics offer up new ways of thinking that disrupt analytical ones which have dominated; might they invite a more lyric comprehension? It is this possibility that I think Whitehead had in mind when he wrote his essay "Mathematics and the Good"—that science, and mathematics in particular, can generate novel ways of thinking. That novel ways of thinking can lead us out of the representational logic of comparison and identity.

In his essay, Whitehead recognised that revisiting Plato's topic in the first half of the twentieth century is an unusual move, especially given the strict separation—at least in most university departments—between moral philosophy and mathematics. Indeed, beyond small forays into the aesthetic nature of mathematics, in which the good is often used interchangeably with the beautiful, few have felt the need to pursue what Plato started. That Whitehead chose to do so was partly due to his conviction that changes in mathematics since the time of the Ancient Greeks, and particularly since the 1870s, warranted a new kind of response.

One of these changes was the creation of non-Euclidean geometries, which allowed mathematicians to appreciate the extent to which their conceptions of points, lines and angles had actually been *in reference to* a particular spatial system—and not just ideal truths. That this particular spatial system (Euclidean) has been taken as the only coherent analysis of space was part of a dogmatism of which Whitehead was very wary, a dogmatism that for him refused to appreciate adequately the contingency of "any item of finite knowledge" (1941, p. 671). Modern mathematics could thus be associated with the good for the way it attends to its premises. The sum of the interior angles of a triangle is invariant, but only when the geometry is Euclidean. For Whitehead, modern mathematics had a singular way of underscoring this contingency, this dependence of the finite (a mathematical concept, a definition) on the infinite (the unbound Universe, which can have no structure).

Anything that leads to less dogmatism certainly sounds good. But Whitehead was not just interested in mathematics for its rigorous demonstration of the truth of relativity. He was interested in the kind of experience that mathematics offers. Indeed, as he insisted, mathematics is in the business of producing concepts, and concepts are modes of emphasis that offer *exact* experiences, that is to say, a particular "cut" that determines what matters. These experiences "vivif[y] our ideals which invigorate the real happenings [of life]" (p. 674). The production of concepts thus confers value upon vague perceptions, where value is used almost synonymously with meaning.

For Whitehead, there is value in the concept of "five" because it is a mode of emphasis that gives meaning to perception. In the billions of atoms circulating in a room, the good accrues when we differentiate—in the bustle of experience—five chairs. The fiveness is a particular "cut" of experience, a particular pattern that provides meaning to experience—though one should not forget the infinitely many different cuts that could be made. The cuts that open up new meanings—rather than reducing phenomena to static, immutable properties—are the ones Whitehead valued. By "pattern", Whitehead meant to focus on relations: mathematicians study the relations between disparate infinites, looking for what changes and what remains invariant. Of all the infinite collections of discrete objects, five is a pattern that is invariant under counting. The study of pattern is *echt* mathematical. It provides that which is known to finite discrimination; that which "is a partial disclosure with an essential relevance to the background of the Universe" (p. 671).

Fiveness provides exact experience. We use it all the time, and not just in mathematics, but in many contexts, in almost every culture and since a long time. It has become a way of experiencing that we barely notice, unless we interact with very young children for which this concept has yet to provide exact experience. So fiveness is interesting, but perhaps, for Whitehead, not as interesting in terms of its partial disclosures as the concepts that were emerging from the then-modern mathematics, a mathematics that was more concept-driven than it had been in the past (Gray, 2004). For example, even if Archimedes had already offered the concept of an actual infinity, modern mathematics introduced infinite sets of different cardinalities. In geometry, there was not just the creation of non-Euclidean spaces (particularly hyperbolic ones, in which there were many lines passing through a single point that could be parallel to a given line), but also of multi-dimensional spaces. Whitehead was also familiar with developments in modern physics, which needed new concepts to handle the non-absolute, co-dependent nature of space and time.

These new mathematical concepts, which sometimes defied intuition, produced much anxiety amongst mathematicians [3]. New concepts were often seen as excessively abstract, qualitatively different from the mathematics of previous times, and overly intertwined with the sciences (Gray, 2004). However, Whitehead may have sensed that some of these concepts provided partial disclosures that could free us from certain dogmatisms of a more onto-ethical nature. For example, the possibility of a 17-dimensional geometry disrupts our perception of a fixed, given, three-dimensional world. This is onto-ethical because it is about the nature of things—making it an ontological issue—and also about a better understanding of *what ought to be* (ethics). The ethical and political "dimension" may become more obvious when considering the shift from two fixed, given (biologically) sexes to the multiplicity of gender possibilities that nature–culture makes possible.

It is obviously not the case that we require (modern) mathematics in order to disrupt dogmatisms related to gender, race and ability. However, for Deleuze and Guattari (1987), for example, it is the case that mathematics provides concepts of an onto-ethical nature that are otherwise almost unthinkable. Indeed, inspired by the differential calculus of Gottfried Leibniz, Deleuze and Guattari re-imagined an ontology based on difference, on the idea that the relation (the differential) can precede the relata (which is to say, the things being related).

Whitehead had also drawn on mathematics to help forge a new process ontology. He was convinced that set theory, the prevailing foundational theory on which he himself had worked with Bertrand Russell, was inadequate for his process philosophy, since it was based on the idea of an abstract set (all the barbers) and the relation of inclusion with its members (the barber cutting your hair). Indeed, set theory invites thinking of the abstract collection, the "universe", and all actual occasions as members existing side-by-side in that collection, all advancing along a single, shared timeline. In contrast, Whitehead's mereotopology, which he described in *Process and Reality,* was concerned with relations between things, without assuming an abstract whole. He abandoned the linear part-whole relation of set-theory in favour of an entanglement of superposed parts *and* wholes, where each part *is* a whole and a part within that whole. This is not just abstruse logical gymnastics, since it matters to the kinds of relations we can experience more broadly, including the overlapping, sometimes contradicting and always changing affiliations we have in the world.

These examples seem to me to provide a glimpse into Whitehead's conviction about mathematics' relationship to the good. With mathematics, it is possible to create new partial disclosures. And it is the freedom of mathematics, its indifference to what many consider the real world, that permits a certain adventure in ideas that distinguishes it from the sciences [4]. It is this adventure, which is speculative in its mode of thinking, that makes dogmatisms easier to avoid and novel ideas easier to create. And this speculativeness (encoded in the mathematical language of conjecture, hypothesis, and even theorem), for Whitehead, is the connection between mathematics and the good. Of course, since it is rarely the case that mathematicians extend their own adventures outside of mathematics, there is a crucial question about the lost opportunities of such a discipline, which is so hermetically sealed within its specialist discourse. Perhaps this relates to Tymoczko's (1993) suggestion that mathematics needs critics in the same way that the arts do, in order to provide a means for the evocation, critique and dissemination of value judgements. As Pimm (1982) shows, Lakatos's *Proofs and Refutations* (1976) performs exactly this function. And perhaps it is why Whitehead was so opposed to so-called expert knowledge.

If it is powerful enough to offer new experiences of meaning that vivify real happenings, and in a *sui generis* way, there is nothing that ensures these experiences will be *good*. Indeed, it can be argued that much of the modernisation of mathematics, which has been a project of arithmetisation (away from geometry), has been anything but "good" (as I alluded to above, the excessive abstractions of modern mathematics were alienating even to mathematicians). Therefore, key to understanding what Whitehead thinks mathematics has to do with "the good", I think, is his unusual, non-moralising, sense of the term. For Whitehead, "Every scrap of our knowledge derives its meaning from the fact that we are factors in the universe, and are dependent on the universe for every detail of our experience" (1941, p. 671). Therefore, no entity can be said to have an isolated, self-sufficient existence. His non-moralising view is unusual because it refuses a stable grounding.

This means that the infinite has no value—neither good nor bad—and that "the universe acquires meaning and value by reason of its embodiment of the activity of finitude" (p. 675). No foundational element (God, constitutions, discourse) can ground or condition the meaning of the good. Therefore, when Whitehead speaks of "the good", it is not as an entity in and of itself. Like evil, the good is always in relation to the possible. Where evil is destructive, the good is creative—in fact, Whitehead would describe evil as the difference between *what is,* as destructive, and *what was* possible. As Isabelle Stengers (2014) writes, "It is never good that overcomes. It is evil that, because it is overcome, designates a good that has no other identity than this overcoming, that possibility of articulating what was destructively opposite" (pp. 286–287). It is not that evil is more basic, in an inversion of the Augustinian view, since evil is also relational. The point is that there is no such thing as stable goodness, because such goodness would not be responsive to the inevitable changing nature of the world.

For Whitehead then, to the extent that mathematics pursues the possible in a creative way, it is concerned with the good. Indeed, his essay suggests that the key to understanding the good is to appreciate the nature of mathematical progress. He writes not only about the disruptive creation of new geometries, but also the on-going creation of new number systems—from the integers to the rationals, to imaginary numbers, *etc*. But, to return to the issue raised above, what if progress became destructive? There is the destructiveness of mathematics as it relates to the increased technocracy of society. There may also be the destructiveness to the discipline itself, which is what the mathematician William Thurston (1995) alluded to in his article "On proof and progress in mathematics". The success of mathematics, in his view, is diminished when dizzying progress occurs without sufficient attention to enable *"people* to understand and think more clearly and effectively about mathematics" (p. 29).

Whitehead may have had a slightly different answer. He constantly railed against what he called the bifurcation of nature in thought, which sets apart human consciousness from its environment; which creates the world as an object that is exterior, static and given; which leads to dogmatic dualisms such as mind/body, abstract/concrete, male/female, real/applied, human/non-human, nature/nurture, and so on. Perhaps, therefore, he would maintain that when progress rests (too long) on bifurcations of nature, it is progress that is not attaining what *was possible,* nor allowing for the perishing that can produce the new.

Contemporary mathematics and the good

Since the time Whitehead wrote his essay over eighty years ago, the discipline of mathematics has continued to evolve. And, as Zalamea (2012) has argued, it is ripe for new philosophical insight and tools, since it is no longer the same discipline that it was in its classical and modern incarnations [5]. Indeed, out of the modern era of arithmetisation, contemporary mathematics can be characterised by a new programme of geometrisation, where mathematicians focus on studying deformations of structure that lead to invariants, and where the re-mixing of the discrete and the continuous takes place. Whitehead's mereotopology [6] is an early foray into contemporary mathematics, even if he only developed his ideas enough to suit his philosophical needs.

Following Whitehead, then, the question is raised of whether a new mathematics might occasion a new way to address the relationship of mathematics to the good. In other words, if classical mathematics offered new insights into experience, and modern mathematics offered new ontologies of becoming, might contemporary mathematics offer still more ways of thinking that are relevant to questions of the good? I think contemporary mathematics does offer new tools for thought. One example can be found in post-1950s developments in algebraic geometry, which underwent a paradigm shift. Perhaps it was related to a release from the concerns with rigour that had obsessed modern mathematics; or the new comfort with the plurality of mathematics and its inevitable intertwinement with science; or the availability of digital tools that could be used to visualise, transform and experiment without being laden with onerous calculations and symbolic manipulations. This shift basically involved the introduction of functions and operators as basic elements, which is to say, tools for morphing, excavating, gluing and constructing.

In contemporary algebraic geometry, mathematical work begins not just with objects but with devices that shape what the objects become. The most central of these devices is the sheaf, and other important ones include germs and stalks—even the evocative botanical language suggests growth, change and transformation! If modern algebraic geometry cared about general or global, identity-driven properties such as closure, smoothness and dimension, contemporary algebraic geometry cares more about local behaviour. It glues sets together to create new ones; it grows germs on local neighbourhoods, gathering functions of different kinds into new relations, then adjoins those relations into stalks. We could see this contemporary algebraic geometry as progress that does not succumb to the bifurcation of nature, in that it works by refusing to separate what something is from what it does. It is less concerned with the *a priori* definition of the abstract whole than with the adventures of local parts, and the transformations of these parts as they take up other parts—in ways that are very resonant with the performative perspectives found in the work of feminist, posthuman philosophers such as Karen Barad (2003).

I am aware of the danger of recklessly transferring concepts in one discipline through metaphoric pronouncements into another (a popular enterprise, especially at the moment with concepts in quantum mechanics). That being said, if it is questionable to proclaim that people are entangled in the same way that subatomic particles are, I suggest that it is entirely appropriate to say that entanglement offers a partial disclosure on *what is possible* in our world, which not only provides meaning and value, but may help us see things we know well in different ways, to gain new disclosures that had hitherto been out of reach.

Conclusion

Mathematics educator Judah Schwartz (1999) outlines three competing purposes of education, which are: (1) enabling personal growth; (2) preparing for the workplace; (3) transmitting culture. With Zwicky (2019), we can observe that the erosion of gestalt comprehension in technocracy has severely compromised (1) and (3). While long division, algebraic manipulations and Euclidean-style proofs are vestiges of (3), they may also be seen as stunningly outdated for (2). In the previous section, I am essentially arguing for a fourth purpose to come into play, one that may be described as attuning both to the human and to non-human worlds. This could be described as engaging with the possible—and in this case, engaging with what mathematics allows one to do, to think, to feel in the adventure of partial disclosures.

De Freitas and Sinclair (2014) provide a simple example of such engagement with the possible that connects to Whitehead's new logics of relations. In a grade three classroom where the topic of even and odd are being defined and exemplified, one student proposes that 6 is both even and odd (because it is a multiple of an even number as well as a multiple of an odd number). In breaking away from the dualisms presented to him, the student engages in a world of possible, a world where things might be both this *and* that. This student is well positioned to continue his engagement with the possible, not only by taking numbers up as being *this* and *that* and the *other*, all-at-once, but in being prepared to encounter other events as simultaneously conjunctive. A new partial disclosure. Good.

In this article, I have attempted to superimpose my takes on mathematics and the good, in a kind of palimpsest mode, on the in-betweenness of ethics, on the possible and on the human/non-human. Though they follow a chronological order, both in time and in the layout of the text as it is read from beginning to end, I think of them as three simultaneous strata, one on top of the other, no one stratum read in terms of the other, nor in counter-punctual way—as the absence of transitions between paragraphs might suggest. The relation between mathematics and the good is this and that and the other. Unapologetically incoherent; possibly disorienting; certainly still partial. But to think of the relationship between mathematics and the good today seems particularly significant because of the power of mathematics and its increasingly specialised, inaccessible disclosures that restrict its openness to questions of the good, questions that are in flux right now as we become increasingly aware of the cultural, historical, racial, gendered potential plurality of mathematics.

Notes

[1] Zwicky has published an article on this theme in FLM **30**(1), with which David Pimm engaged, in a Communication in the same issue.

[2] The original version of the silent 16mm film "Circles in the plane" was distributed in 1951 by Educational Solutions.

[3] This raises an interesting question in relation to Zwicky's work. If a concept is non-intuitive, might it mean that it has no good "gestalt"? And if so, would this preclude the kind of experience of meaning Zwicky is interested in? Or does it mean that the gestalt will become available once new spatial imaginaries can form?

[4] Some may argue that the arts also provide this freedom. It is interesting that so much of the work in the social sciences that has emerged in relation to posthumanism has been fascinated with science fiction, a genre that invites particularly speculative opportunities.

[5] I am framing Zalamea's argument within a very Western perspective—some cultures seem to have happily skipped over the arithmetisation blip; others may have begun there.

[6] Mereotopology: mereology as the study of the relations between parts and whole + topology as the study of the invariants of geometrical objects under continuous deformation. It is concerned with the relations of contact and connectedness of parts and wholes under spatio-temporal transformations.

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For me, this raises the question of time in mathematics and the traces thereof in mathematical language—time and timelessness, time everafter, the implied chronology of "if..., then" as well as causality (and the notions are hopelessly entwined)—axioms as permissions in perpetuity, theorems as predictions—and that can only be about the future, about what would happen if..., about what must happen. About what can never happen, no matter how long or how hard we all work. Will it always work?

— David Pimm, from p. 36 of 'The silence of the body' in *FLM* **13**(1).