Studies on Mathematics Education and Society

# BREAKING IMAGES

## ICONOCLASTIC ANALYSES OF MATHEMATICS AND ITS EDUCATION

Edited by Brian Greer, David Kollosche, and Ole Skovsmose

https://www.openbookpublishers.com







Brian Greer, David Kollosche, and Ole Skovsmose (eds), *Breaking Images: Iconoclastic Analyses of Mathematics and its Education*. Cambridge, UK: Open Book Publishers, 2024, https://doi.org/10.11647/OBP.0407



Volume 2 | Studies on Mathematics Education and Society Book Series
ISSN Print: 2755-2616
ISSN Digital: 2755-2624

ISBN Paperback: 978-1-80511-321-8
ISBN Hardback: 978-1-80511-322-5
ISBN Digital (PDF): 978-1-80511-323-2
ISBN Digital eBook (EPUB): 978-1-80511-324-9
ISBN HTML: 978-1-80511-325-6

DOI: 10.11647/OBP.0407

Cover image: *Fall* by Tara Shabnavard
Cover design: Jeevanjot Kaur Nagpal

Published with the support of the Open Access Publishing Fund of the University of Klagenfurt.

# 6. A short commentary on Kollosche's 'Dehumanisation through mathematics'

*Roy Wagner*

*In this short response to David Kollosche, I briefly point out some complementary historical narratives of mathematics to suggest how mathematics may not only be complemented by more humanized forms of knowledge, but may also be inherently more humanized in itself.*

In Chapter 5 of this volume, entitled 'Dehumanisation through mathematics', David Kollosche follows up on a well-known characterisation of mathematics: it is a rule-based, highly technocratic family of practices, which imposes uniform templates on disparate situations, setting aside not only the specific objects that we mathematise, but also the human – as practitioner, object, and addressee.

Kollosche argues coherently and convincingly – perhaps so convincingly, that one might be tempted to consider him as a math-basher. The critical tradition that he builds on served, at the time of Max Horkheimer and Theodor Adorno, to reign in a rampant scientism threatening to subjugate humanity. Today, it may end up playing into the hands of those who disparage science so as to dissuade us from acting on its warnings about the fate of our planet. Indeed, if mathematics is a dehumanising discipline, how can its own models, applied by climate scientists, serve to save humanity from demise? If the diagnostic tool is poisoned, how can we trust the cure that it suggests?

Kollosche's solution, spelled out in his final paragraphs of the paper, is not to reform mathematics – he is explicitly pessimistic about such

 https://doi.org/10.11647/OBP.0407.06

a project. Since he acknowledges that we can hardly do without it, he proposes, instead, that we should complement mathematical analyses by less dehumanising forms of knowledge, balancing dehumanising mathematics with other methodologies. This is a fair and realistic prospect. To change mathematics is to move a mountain, and it is not clear if this mountain would serve us better once displaced. Anyway, it will take several generations to move it about.

I, however, am still tempted, if not to move the mountain, at least to try to chip at it, and rearrange some bits and pieces. For that, however, the history of mathematics and logic needs to be retold along lines different from those highlighted by Kollosche. Indeed, not all mathematics is as dehumanising. The mystical-cosmological mathematical speculations that for most of the last three millennia were a hugely popular form of mathematics in Europe, North Africa, and Asia (mathematical astronomical/astrology, number-theoretic numerology – practiced by some of the most celebrated mathematicians, like Johannes Kepler and Isaac Newton), were deeply anchored in how humans experienced numbers and geometric patterns. The same goes for the mathematics of artisans and artists, who were after beautiful patterns, virtuosity, and elegance, and for pre-school children, for whom numbers at least begin (although for an all too short a while) with songs and games. And even contemporary research mathematicians evaluate mathematics in ways that cannot be reduced to dehumanised formal rigour ('there is no permanent place in the world for ugly mathematics', wrote G. H. Hardy).

Deduction, as Kollosche notes, can be seen as analogous to patriarchal structures, and the implied genetic relation definitely deserves attention. But other forms of mathematical justification abound historically.[1] Even today, the styles of mathematical reasoning pursued in various contexts, from engineering to elementary school teaching, are often far removed from strictly deductive ideals.

More specifically, a long tradition in the historiography of mathematics has been taking great pains to show the complexities of the manifold relations between mathematical signs, practices, and forms of knowledge. This tradition problematises the dominant narrative of

1 Just as a tip of the iceberg: Eulerian reasoning as analysed by Ferraro (2004, 2012), Chinese mathematics as analysed by Chemla (2020), and Indian mathematics as analysed by Srinivas (2005, 2015).

'loss of meaning' that appears to connect Greek Antiquity to modern formalism – a narrative that would be difficult to attribute even to David Hilbert himself, who considers only one layer of mathematical signs to be purely syntactic, and assigns the epistemological authority of even that layer to its connection with meaningful signs (Hilbert, 1983).

The above revisionist narratives of mathematics are extremely important to a historian, who, like me, has devoted so much work to them. But I can understand how a grand narrative like 'the loss of meaning' is sufficient for others, as it highlights some of the most salient features of mainstream mathematics today. That these are, crucially, some of mathematics' most objectionable, or at least controversial, features, however, is precisely what would lead the followers of this narrative to give up on the hope of humanising mathematics, which I would like to keep alive.

Toward the very end of the chapter, Kollosche diagnoses the one aspect of mathematics that would block any attempt to humanise it: its rigid and impressive consensus. To maintain it, mathematics has to remain dehumanised, at least in some important senses. But even that is not a universal or necessary feature of mathematics. In fact, I recently argued that as a historical phenomenon, it is quite new and exceptional (Wagner, 2022). The most consensual aspect of mathematics today, namely the agreement on whether a given argument does or does not prove a given theorem in a given mathematical system, was much more open for debate in the past. Since many sciences are highly successful despite (or even because of) their longstanding controversies, a non-consensual or less-consensual mathematics need not be thought of as a dead end.

The mathematics we celebrate today is highly valuable and at the same time often dehumanising. But these are not universal characteristics of all past and present ways of doing mathematics. And while Kollosche is right that the most immediate way to handle dehumanising mathematics is to complement it by other styles of reasoning, I would like to hold on to the possibility of building on past and present practices of mathematics that do not set humans and non-humans aside.

In fact, recent developments in Artificial Intelligence (AI) suggest an interesting possible humanistic future for mathematicians – albeit currently restricted to the realm of science-fiction. If AI could, as is projected by some, learn to write valid mathematical proofs of open

problems, and if it would surpass humans in that capacity, then the role of the mathematician may change dramatically from a producer of proofs to that of a commentator. In other words, the mathematician would be charged with the task of making sense of the most important AI-generated mathematical proofs. In the context of this task, intuitive and accessible narration of proofs for the purpose of large- and medium-scale understanding would become more important than fine-grained rigour, since the rigour of proofs would already be guaranteed by the AI that generated them. The mathematician would then become an interpreter-critic and communicator of mathematical ideas, not unlike a literature professor. While some would claim that this is already part of what the best mathematicians implicitly do, in our little science-fiction projection, interpretation, communication and critique would become the very definition of what a mathematician does. Would this open up the way to a (re-)humanized mathematics?

## References

Chemla, K. (2020). Different clusters of texts from Ancient China, different mathematical ontologies. In G. E. R. Lloyd & A. Vilaça (Eds.), *Science in the forest, Science in the past* (pp. 121–146). HAU. https://library.oapen.org/handle/20.500.12657/47354

Ferraro, G. (2004). Differentials and differential coefficients in the Eulerian foundations of the calculus. *Historia Mathematica, 31*(1), 34–61. https://doi.org/10.1016/S0315-0860(03)00030-2

Ferraro, G. (2012). Euler, infinitesimals and limits. https://shs.hal.science/halshs-00657694v2

Hilbert, D. (1983). On the infinite. In P. Benacerraf and H. Putnam (Eds.), *Philosophy of mathematics: Selected readings* (2nd edition, pp. 66–76). Cambridge University Press.

Srinivas, M. D. (2005). Proofs in Indian mathematics. In G. G. Emch, R. Sridharan, & M. D. Srinivas (Eds.), *Contributions to the history of Indian mathematics* (pp. 209–248). Hindustan Book Agency.

Srinivas, M. D. (2015). On the nature of mathematics and scientific knowledge in Indian tradition. In J. M. Kanjirakkat, G. McOuat, & S. Sarukkai (Eds.), *Science and narratives of nature: East and West* (pp. 220–238). Routledge. https://doi.org/10.4324/9781315088358-11

Wagner, R. (2022). Mathematical consensus: A research program. *Axiomathes, 32*, 1185–1204. https://doi.org/10.1007/s10516-022-09634-2