

# Mathematical Kinds, or Being Kind to Mathematics

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## Abstract

In 1908, Henri Poincaré claimed that:

...the mathematical facts worthy of being studied are those which, by their analogy with other facts, are capable of leading us to the knowledge of a mathematical law, just as experimental facts lead us to the knowledge of a physical law. They are those which reveal to us unsuspected kinship between other facts, long known, but wrongly believed to be strangers to one another.

Towards the end of the twentieth century, with many more mathematical facts since discovered, several mathematicians proposed overarching schemes to organise the facts they considered most significant. In this paper, I shall briefly discuss three of these schemes (those of Arnold, Atiyah, and Baez and Dolan), before drawing some philosophical consequences from their attempts. Rather than the kind of claim made by Frege that with the entry of imaginary numbers we reach the 'natural end of the domain of numbers', we are dealing here with a more open-ended sense of conceptual growth. I shall illustrate this theme by discussing the elaboration of algebraic structures designed to measure symmetry.

What emerges is that at any one time mathematicians are operating with a notion very similar to that discussed in the philosophy of science under the heading of 'natural kinds'. We find 'quasi-causal' talk of properties being 'responsible' for a phenomenon, projectability, the transfer of robust mechanisms between domains, and reference to entities not yet fully determined. Debates in philosophy of science prompt further questioning as to the 'naturalness' of these mathematical kinds, whether one should expect them to be dependent on varying human interests, whether there is a distinction between artefactual and real kinds, and whether there is convergence of kinds.

I believe that these questions present a wonderful opportunity for a philosophy of mathematics to treat 'real' mathematics, while making powerful points of contact with philosophy of science, and philosophy in general.

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