Metaphor and Analogy in Mathematics*

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The claim that mathematics is, *inter alia*, a language is often made, but serious investigation of this assertion has been limited. The major focus of research in the area of language and mathematics has been on readability of mathematical texts or difficulty of verbal arithmetic problems [Nesher, 1976; Pimm, to appear; Rothery, 1980] The sense of approach I wish to explore is that of subjecting certain figures of speech, in particular analogy and metaphor, to close scrutiny. These figures make natural language so powerful and I want to suggest that we can identify comparable processes at work within mathematics itself. The initial inclination is to view analogy, and metaphor in particular, as uncertain methods of working and therefore unsuited to mathematics. "Analogy, however, is not proof, but illustration." I hope to show by means of examples culled from arithmetic, algebra and the calculus that this is far from the case and in fact these processes are as central to the expression of *mathematical* meaning as they are to the expression of meaning in natural language.

Before turning to mathematical examples, however, I wish to discuss a particular view of analogy and how metaphor relates to it. Metaphor is a particularly troublesome phenomenon for philosophers, linguists and literary critics alike, and no common terminology is agreed on by all writers [Black, 1962; Ortony, 1978] I by no means wish to claim that the main construction identified in this paper characterises all cases of metaphor in mathematics; merely that it permits the identification of one class of metaphoric statements which I shall call *structural* metaphors. Some splendid work has been done on the use of extra-mathematical metaphors and the dynamic metaphors implicit in the language of the calculus [Kaput, 1979].

The view of metaphor I wish to employ is one based on analogy (characterised and criticised by Black [op cit] as the "comparison" view of metaphor). Let us return to the Greek term *analogia*. Szabó [1978] informs us that, "It is less well known that this same word (viz, *analogia*) was not..."