Avoiding ambiguity

Scientists sometimes use mathematics to give the illusion of certainty.

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What words conceal is as important as what they reveal. Although the essence of raw communication may be clarity, in literature it is the inexact and the imprecise that allow us to push forward the boundaries of human experience and cognition. This is most obvious in poetry, which relies on the flexibility of meaning to record and analyse the breadth and depth of human emotion. For example, the wealth of tenderness in this extract from Seamus Heaney's poem "Sunlight" derives from the mystical alliance between love and a well-worn object:

And here is love
like a tinsmith's scoop
sunk past its gleam
in the meal-bin

Yet it also questions our very definition of love. Such poetry highlights not only the ambiguities in the relationships between the words that it uses but can also cause one to pause and reflect upon the relationship between the word and the object or idea to which it refers. And it is not only the reader who is held in this state of productive perplexity, for post-modern literary theory grants the author the prerogative of being equally unaware of the layers of meaning contained within his or her own creation.

The exploitation of ambiguity seems to occupy a much smaller place in the pursuit of scientific knowledge. Notably, the language of mathematics — which has proved to be an indispensable tool in scientific inquiry — distinguishes itself by the lack of ambiguity in its terms. Mathematical metaphors are powerful analytical tools precisely because of the unequivocal relationships between their components, whereas the power of the literary metaphor derives from the incertitude in the connections between its parts. Thus, by their very nature, mathematical metaphors can only be applied to a narrow range of problems: those that lend themselves to reduction into very precise elements, and for which the relationship between these elements can be explicitly declared. Most importantly, this whole artificial exercise has to be able then to comment on some aspect of the problem that would otherwise not have been evident.

But something about the comforting rigidity of the process, its seductive notation, but perhaps mostly its connotations of intellectual privilege, has drawn a diverse selection of disciplines to the altar of mathematical reasoning. Indeed, the widespread misappropriation of the language of mathematics in the social and biological sciences has to be one of the great tragedies of our time.

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Beyond words: injudicious use of mathematics to analyse events such as stock-market crashes can often confuse rather than clarify.

Nothing can be sadder than the sight of equations crawling down a page of literary theory, nothing more raucous than the invasion of simple rules of cause and effect into the language of psychoanalysis. Far less obvious in its poverty of reasoning is the inappropriate application of mathematical methods to the analysis of certain scientific problems for which we have no obvious solutions. These projects are usually driven by our inability to cope with the unpredictable — stock-market crashes, hurricanes, earthquakes and epidemics. Although we now have at our disposal some fairly sophisticated methods of characterizing uncertainty, these do not actually enable us to control or even predict the extent of disaster. Used injudiciously in these circumstances, mathematics — and especially mathematical modelling — can serve to obfuscate rather than clarify, or at best add nothing at all to the situation other than the illusion of control.

There are a number of reasons why the language of mathematics may not always provide much insight into a complex reality. At a very simple level, many of the fundamental processes involved, such as consumer choice or movement of livestock, may not be amenable to mathematical formulation. Of greater concern is that, when one is attempting to formalize a set of complicated interactions, assumptions can creep in unawares. This is particularly true when a previously useful mathematical model is retailored to fit a new crisis. It is rather easy in these circumstances to become trapped in, and even comforted by, a prevailing paradigm. It is unfortunate that the assumptions embedded in the mathematical structures employed may not always be obvious to the general public.

There is the danger here that mathematics is being used as a signifier of power much as English is currently used in several post-imperialist cultures. At least its very flexibility sometimes permits English to escape the fate of oppressor's language by mutating into a poetic hybrid, as in some examples of post-colonial literature. Mathematics, however, by virtue of its inflexibility, is liable to be less tolerant of misapplication. No phoenix is likely to arise out of the ashes of a misguided mathematical model.

We are fortunate to have at least two modes of inquiry at our disposal: one that depends upon the fidelity of the word to its referent, and another that conversely makes use of the gulf between a word and its referent, as well as between words themselves. But both may fail, as indeed they have time and time again, in the face of human disaster. It is when a catastrophe occurs that we become acutely aware of the limitations of language, and seek to hide behind a curtain of polemic or an abstruse set of equations. It is in these situations that word becomes completely divorced from its referent, and thus negates both poetic and scientific logic.

The language of mathematical reasoning is no less beautiful for the lack of concealment of meaning. In trying to capture the essence of a system through a minimum of unambiguous relationships between a minimum of unambiguous symbols, scientists and artists are driven by a similar concern for beauty and symmetry, a similar thirst for light. What makes mathematics special is its promise of prophecy, the promise that it will help us understand all mysteries and all knowledge. Without a humble awareness of its limitations, such prophecies can have a very hollow ring. ■

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