

# Sentences beyond number

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D. TERENCE LANGENDOEN and PAUL M. POSTAL

*The Vastness of Natural Languages*  
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The second word of this book's title will mislead browsers, but precisely expresses the claim that Terence Langendoen and Paul Postal wish to make: that the number of sentences of any natural language is not merely infinite, but some larger *transfinite* number and, for good measure, any of those sentences can also be transfinite in length. The reader should not draw back in alarm from such claims: they are not the product of new or startling research, but rather the leftovers of the Chomskyan movement in formal language studies. For some reason his critics have never been able to understand, Chomsky always took his own claim of the infinity of the sentences of any natural language very seriously indeed. And what Langendoen and Postal have done in this monograph is to spice up and re-serve those leftovers, moving the claims to more arresting and outrageous levels. But the important issues remain what they were when Chomsky first set them out nearly thirty years ago: are they true in any interesting sense and, if true, do they matter?

The crux of the issue is the relationship of languages as we speak them to the formal languages of mathematics, and whether it is cheating or fair play to bring them together. Chomsky was in the great tradition of wanting to do so, whereas psychologists and humanists generally have found the connection forced and misleading. The point at issue can be put in the simplest terms: there is known to be an infinite number of whole numbers and, tautologically, logicians call them denumerably infinite. Denumerable infinity is only the lowest grade of infinity; what it means is that you can

go on saying the next number for ever, or rather (and this is the humanist's point) not really for ever because you inevitably say your last number, even if you have devoted your life to nothing else.

Linking that logical matter to a real language is a standard trick: "Twenty-five is a number" is obviously a sentence of English. Since there is an infinity of whole numbers, there must be an infinity of such sentences. QED. There is another trick that follows this one, in coffee-bars where such things are bandied about: it has been known since Cantor that the so-called *real numbers* (think of them as decimal fractions of any length) are rather more numerous than the integers, or whole numbers. They are not only infinite but *transfinite*, in the sense that they could not be enumerated by a computer running for ever. Cantor showed this by a trick called the *Diagonalverfahren* that can be recreated on the back of an old envelope. It shows that there will always be at least one more decimal fraction than there are whole numbers, and since those are infinite, the decimals or reals must be transfinite. The linkage to sentences is equally easy: "I will be home between 1pm and 20.333 minutes past" is again a sentence of English, or just about. Cantor's result shows that there is a transfinite number of sentences referring to such times.

The reader may wish to draw breath here and wonder what consequences follow about the nature of language, mind and brain. Langendoen and Postal do not use the examples above; I have used the old familiar ones. In fact, they want to go much further than this, and to argue that the sentences of a language are more transfinite than even the real numbers. But we can pause here, and consider their claims on the basis of what has been shown so far.

Both the above illustrations rely on putting numbers directly into sentences and then claiming that languages must therefore have whatever formal properties the number systems have. Chomsky made this move years ago

in order to treat languages as abstract platonic objects with properties over and above any they might gain from their psychological or physiological embodiment in human beings. That was the heart of his insistence that infinitely long sentences were genuine sentences even though no one could ever say one. But, and this is unlike Langendoen and Postal, he stopped at the proof that there are denumerably infinitely many sentences in a language, because he retained the belief that his own systems of grammar were present in human heads, and that that would be the sort of infinity of sentences they would produce. This turned out to be a handy belief for him to retain, since recent work has shown that languages not having that property probably cannot be learned. In going further, as they do, Langendoen and Postal have pulled a neat pupil's trick on their old master: if languages are transfinite, and not just infinite, then the grammars in our heads cannot be Chomskyan. And they seem unworried, just as Plato would have been, by the consequences that languages are transfinite objects, existing over and above all computation or finite process.

What can one say to this? Perhaps one could point out quietly that the whole game relies on very special sentences that may not be central to languages at all; and here readers of the *TLS* would be witnesses as impressive as professors of linguistics. Perhaps those special sentences

could be cordoned off from the rest of a language in some way. After all, many languages have no words for big numbers; are they therefore not languages at all? More formally, any actual computer or brain can construct any finite part of a transfinite number system that it happens to need. Does it then matter if it cannot cover *all* such sentences? Suppose that evolution has found it better to develop a brain that is a make-do-and-mend organ of just that sort, and one of no discernible mathematical type. Is that not a more likely state of affairs, given how small a part numbers have played in the long evolutionary history of human language? How could so tiny a tail wag so huge and subtle a dog?

But the sky-pilots of Cognitive Science are very clear on this: we must choose which abstract type of machine the brain is, and from that all they want follows. Questions about angels were just as pressing to very clever men not so long ago, but those concerned with the nature of the real world, with what processes might account for the subtlety of actual sentences, might well keep their gaze a little lower.

The arguments in this book are not new, but it is good to have them all collected in a single monograph. It will do no harm to those with common-sense, computational, psychological or any other humanistic view of languages to stretch themselves against the arguments of Langendoen and Postal.