Does the brain favor certain forms of numerical language? Another look at the typological data

Caleb Everett

Human numerical cognition is supported by a phylogenetically primitive sense for approximate quantity discrimination. (Dehaene 2011) Along with this approximate number sense we exhibit a native capacity for tracking a small set of objects, and this object-tracking ability facilitates the precise discrimination of quantities less than four. The exact discrimination and mental storage of most quantities, however, also relies on symbols--typically verbal ones--for those quantities. (Everett 2017) These symbolic representations, numbers, are culturally variable but typically result from similar processes of embodied cognition. This is evidenced by the fact that most number bases are decimal, quinary or vigesimal. Yet the manual bias reflected in most number systems is not the only crosslinguistically evident influence on how people tend to construct those systems. Furthermore, there is an interesting parallel between another pattern in the crosslinguistic data and some neurobiological data: The latter data reveal that humans' discrimination of small quantities is privileged by our mental hardware, more specifically a portion of the intraparietal sulcus. The other relevant pattern in the crosslinguistic data, meanwhile, also hints at the hardwired privileging of small quantities: Grammatical number systems distinguish 1, 2, and 3 items precisely but only refer to other quantities in a fuzzy manner. Furthermore, small cardinal and ordinal numbers are sometimes formally distinguishable from higher numbers in the same language.

Still, it cannot be stated that smaller quantities (1, 2, and 3) are always treated cohesively by the world's languages. Instead we observe variability with respect to how formally distinct small and large numbers are from each other in a given language. This is perhaps surprising given the native facility humans have for discriminating smaller quantities. Some of the relevant variability in the representation of small quantities is well-known, for instance the lack of precise small numbers in some languages. One goal of this talk is to draw attention to lesser known variability--variability in the usage of small number words. Based on an analysis of 5940 lists of phonetically transcribed words in an online database, I show that words for 1 and 2 tend to be significantly shorter in large populations than small ones, possibly due to a greater reliance on numbers in larger societies. So it is not the case that cultures vary simply according to whether or not they have words for smaller quantities. They also apparently vary with respect to how often they utilize smaller numbers. The results surveyed in this paper suggest that the neurobiological and typological data are consistent, but perhaps do not dovetail as cleanly as we might predict. Numerical language is in fact constrained by biological factors, a key observation that is dependent on both kinds of data. Yet, despite some commonalities across languages, I suggest that even small number words and grammatical number vary in unexpected ways.

The issues discussed in this talk also underscore a methodological point: To truly illuminate the intersection of the brain and numerical language, we must pay attention to data gathered in laboratory settings but, just as crucially, we must continue to explore the diversity of numerical language (including its usage) across cultures.

References

Dehaene, Stanislas. 2011. *The Number Sense*. Oxford University Press.

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