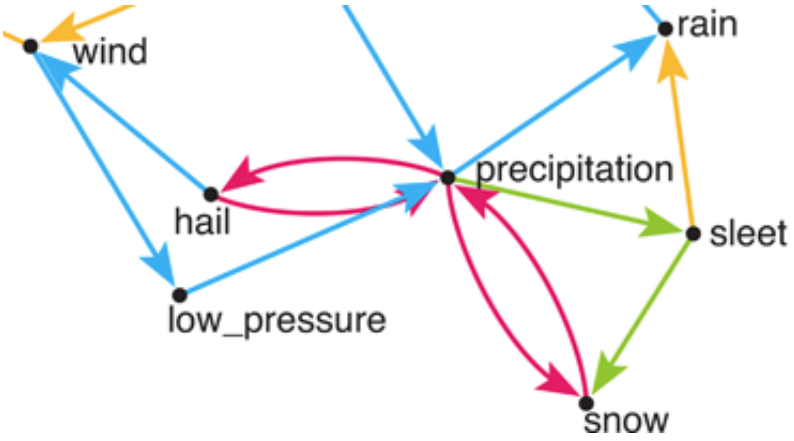
Physics

Synopsis: The Value of Circular Definitions



D. Levary *et al.*, Phys. Rev. X (2012)

Loops and Self-Reference in the Construction of Dictionaries

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More than one reader has looked up a word in a dictionary, turned to a word used in the definition, only to be eventually pointed back to the original word in a loop of circular definitions. As annoying as this might sometimes be, such loops offer insights into the structure of a language and the expansion of its lexicon. David Levary, of Harvard University, and colleagues report in *Physical Review X* their use of methods from graph theory and statistical physics to study networks of words in dictionaries and show that creation of these loops is a fundamental mechanism in the growth of a language.

The authors looked at the words in a database called WordNet, treating them as nodes in a graph structure connected by directional links (that is, the link points to words used in the definition). Levary *et al.* show both theoretically and from watching how nodes are incorporated into the graph that new concepts can only be introduced by adding a loop to the network. They also discovered that words in a given loop often were introduced into the language at about the same time. When the dates of origin of words in a loop differ greatly, it typically indicates a fundamental change in a word's meaning after its earlier introduction.

Levary *et al.* further found that new words preferentially attach to existing words with a large number of links pointing to them, a kind of linguistic "rich get richer" behavior. This matches our intuition that new words are defined in terms of well-used common words for better understandability. Taken together, the results suggest that such techniques from physics and graph theory could be a valuable forensic tool for uncovering the deeper workings of human communication and the evolution of language. – *David Voss*

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