

### **Dictionaries for the Brain**

You open your dictionary to figure out what your friend meant by 'nasute,' only to find that the definition is "A wittol, or jemadar; bannocked in an emunctory fashion." What good is this dictionary, you wonder, if it only refers me to other words I don't know! Luckily, the definition above is fantasy. Dictionaries are useful, even to those who hardly know the language. But how can dictionaries be useful when everyone knows that they are ultimately massively circular goose chases, with the definition of A referring to B, the definition of B referring to C, and so on until eventually a word's definition closes the loop by referring to A?

The answer is simple, says Mark Changizi, a professor in Cognitive Science at the Rensselaer Polytechnic Institute who has a new paper on the topic appearing soon in the *Journal of Cognitive Systems Research*: Dictionaries do not possess many circularities. Instead, dictionaries are highly hierarchical, with words being defined via words that are simpler, and lower in the hierarchy. At the bottom are a small number of "most fundamental words" no longer having definitions using simpler terms--that's where most of the circularities lie.

Furthermore, there's more than one way to build a hierarchical dictionary. One could use the most fundamental words to define all the other words in the dictionary, so that there would be just two hierarchical levels: the small set of fundamental (or atomic) words, and the set of everything else. Alternatively, dictionaries could use the most fundamental words to define an intermediate level of words, and in turn use these words to define the rest. That would make three levels, and, clearly, greater numbers of levels are possible.

Mark Changizi's main discovery in the paper is to show that having just the right number of hierarchical levels can greatly reduce the overall size of the dictionary. A dictionary with just two hierarchical levels, for example, would have to be more than three times larger than an optimal one that uses around seven levels. And, most importantly, he provides evidence that actual dictionaries have approximately the optimal number of hierarchical levels.

What it means is that language has culturally evolved over the centuries and millenia not only to have the words we need, but also to have an overall organization--in terms of how words get their meanings from other words--that helps minimize the overall size of the dictionary. ...and simultaneously helps us efficiently encode the lexicon in our heads.

(March 28, 2008, M. Changizi's blurb about this research)