Ideas for this semester's project

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At the beginning of last semester, the "about my interests" paragraph that I submitted talked about my interest in lexical knowledge, its acquisition, and the implications for the structure of its relationships. As a shorter-term application to my research, I discussed my desire to learn how to apply dynamics to the graph-theoretical models of "the lexicon." My loftier if-I-could-make-any-dynamical-system goal was to eventually model lexical acquisition with respect to the relationships among the novel words and the existing words, as well as the properties of the environment.

With these ideas in mind and now trying to plan a term project, it seems reasonable to start with the one that can be more readily applied to my research, to provide a foundation that might be able to be expanded over time into the loftier goal. Expanding on an existing study that makes functional predictions from a structural network would be a place to start.

0.1 Extending findings from graph theory in spoken word recognition

Graphs of lexical knowledge can be constructed based on relationships among phonological word forms and used to inform the study of spoken word recognition (Vitevitch, 2008). There is evidence to suggest that this "whole lexicon" approach may be more informative than existing models of spoken word recognition which use only word-word relationships. For example, Chan & Vitevitch (2009) constructed a network where words were connected if they differed by at most a single-phoneme deletion, addition, or substitution, the same criteria used to determine neighbors by Luce & Pisoni (1998). They predicted that the time needed to recognize a word would increase as a function of the word's clustering coefficient, or the extent to which a node's neighbors are also neighbors with one another (Watts & Strogatz, 1998). Importantly, they predicted that this effect would be observed even after accounting for the traditional neihgborhood probability rule, which predicts that the time needed to recognize a word will increase with its number of neighbors or degree (Luce & Pisoni, 1998).

These predictions were supported, which provides preliminary evidence that graph-theoretical models of lexical knowledge may provide useful information not available in classical models by including relationships more complex than simple target-neighbor ones "for free." For example, the authors speculate that there may be some sort of spreading activation during the process of spoken word recognition, where activation may spread from one neighbor to another. In this case, words of a higher clustering coefficient would be harder to recognize because their neighbors would be spreading activation among one another, increasing competition.

However, as the network was purely structural, the above speculation was not actually modeled. I would like to try to apply dynamics to the graph to see if the observed effect could in fact be modeled in terms of spreading activation. I believe that this will involve random walks, which I will need to learn about, and I have identified two papers that can provide a starting place (Rosvall & Bergstrom, 2008; Noh & Rieger, 2004).

References

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