

## Phonological networks and their growth in second language learners

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In the recent decade, network theory has been increasingly adopted by the psychological sciences, including language acquisition research. A growing field is the construction of phonological networks that link words differing by one phonological segment (Levenshtein distance) in a network encompassing the entire lexicon of a language (see Figure 1). These networks have been shown to be meaningful psycholinguistic constructs in first languages, influencing lexical access, processing, and activation spreading in phonological neighborhoods [1-3].

An important question concerns the development of phonological networks and how network connectivity changes when new words are added during language acquisition. Previous research has investigated network growth principles in English and Dutch as first languages [4], but phonological networks and their growth in second languages have not been studied.

The present study analyzes growth mechanisms and patterns in the phonological networks of second language learners of English. Vocabulary lists of each of the six CEFR proficiency levels (A1-C2) were gathered from the Cambridge Learner Corpus with which six phonological ESL networks were constructed. Network evolution from the lowest level A1 to the highest C2 was analyzed in terms of network-theoretical growth algorithms.

Results show a dominance of the algorithm preferential attachment at lower proficiency stages, where dense phonological neighborhoods gain the majority of new neighbors entering the lexical system [5]. This “rich-gets-richer” mechanism is at the heart of the Barabási-Albert network model [6]. Intriguingly, this mechanism is reversed to “inverse preferential attachment” as the lexical network evolves to higher proficiency levels. Here, sparse neighborhoods become the beneficiaries of phonological neighbor addition. The reversal indicates a change in cognitive learning strategies. A similar growth pattern was observed in phonological networks of first language users of English, and the findings of the present study may indicate a universal cognitive dynamic underlying word learning.

