Modelling accent retraction in Indo-European using agent-based simulation

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One of the characteristic diachronic developments in Indo-European accentuation is the leftwards movement of accent position in a number of languages. In some (e.g. prehistoric Italic, Celtic, and Germanic) this was the loss of the lexical accent in favour of word-initial stress. In Greek, a leftmost accentuation was generalised for most verb forms within a window at the end of the word. Some Old Hittite words (e.g. the numeral *téri-* 'three' < Proto-Indo-European (PIE) **trí-*) have initial stress which does not tally with the inherited accent position; these have been explained [1] as symptomatic of a general leftmost accent assignment for forms which had lost their distinctive lexical accent marking through a demorphologising process.

Accent loss and movement may be motivated by widely varying factors such as language contact and the prestige of novel pronunciations, as well as the operation of morphophonological processes. However, as in all kinds of sound change, there may be a phonetic basis. Such may be the case for word-internal retraction of accent in Balto-Slavic in e.g. *dūkterin ('daughter' (accusative singular), as in e.g. Lithuanian *dùkterį*) from PIE *$d^{h}ugh_{2}tér̥n$ with accent on the agentive suffix. The leftward shift of accent from a word-medial light syllable (with short vowel) is in accordance with the principle of weight-to-stress ([2]: 118-9). The question of right-to-left accent shift on phonetic (and not simply analogical) grounds warrants experimental investigation.

The present research uses an agent-based simulation (ABS) to model accent retraction. ABS is a technique widely used to model physical processes such as the spread of an epidemic or the movement of riverbeds, in which a complex situation is represented as a network of interdependent agents, which both act and are acted upon; in a language model these actions may represent such phenomena as lexicon preservation, coarticulation, and grammatical assimilation. The technique has been successfully applied to phenomena such as schwa deletion in Hindi ([3]), the evolution of vowel harmony in Turkic ([4]), and the formation of a common spoken accent among scientists living and working in Antarctica ([5]). A 'multi-agent system' is a computational loop which allows different influences to interact in a network, producing outputs of decreasing probabilistic weighting. A probable output may be interpreted as the outcome of years of talkers interacting with one another. Modelling accent shift in this way is appropriate because members of a language community are being influenced by ambient language while simultaneously influencing others around them, without a consciousness of or ambition for change.

The model is seeded with representative polysyllabic sequences possessing the potential for weight-based retraction of stress. The input acoustic measures for these words are generated using audio concatenations of contemporary 'proxies' for reconstructed forms. Articulation and perception models are based on [3] and the simulation follows the method of [3] with agents modifying the mental/lexical models according to success or failure in communication. I demonstrate the impact of different parameters on convergence, and the simulation is evaluated as a tool for interpreting established examples of accent retraction from light syllables in words and paradigms in the philological literature.

Keywords
Balto-Slavic; Indo-European; word accent; retraction; sound change; multi-agent simulation; computational modelling

References

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