‘Chained to the rhythm’:
Using agent-based simulation to model the evolution of stress pattern diversity in English

English is characterized by a relative heterogeneity of stress patterns (e.g. *léntil* vs. *hotél*, *ábject* vs. *intáct*, *íncrease* [N] vs. *incréase* [V]). We lay out a usage-based explanation for the historical evolution of stress pattern diversity in languages such as English and present it in the form of an agent-based model. We find that the predictions derived from such a model are in line with diachronic corpus data.

In stress-based languages such as English, physiological and cognitive constraints (Lehiste 1970; Pitt & Samuel 1990; Peelle & Davis 2012) favor an alternating rhythm made up of sequences of stressed and unstressed syllables (Hayes 1984; Selkirk 1984; Schlüter 2005). These preferences can affect lexical stress diachronically by biasing words or entire word classes towards those patterns which most successfully produce alternating rhythmic sequences in combination with other words in language use (e.g. *the* ***ín****crease* *wórries* *us* vs. *híkes* *in****créase*** *the* *cóst of living*; cf. Kelly & Bock 1988, Kelly 1989). In evolutionary terms (Croft 2000), the rhythmic preferences operating at the level of phrasal phonology exert a selective pressure on lexical stress, constantly testing the viability of a pattern within its usage context.

We choose agent-based simulation (Wilensky & Rand 2015) as a method for probing this line of argumentation. The agent population in our model is made up of constituent types (i.e. a proxy for lexical items) defined by linguistic attributes, notably stress pattern, syllable weight and morpho-syntactic class. In each round of the simulation, a predetermined number of agents are probabilistically selected to occur and interact with one another within one of a range of possible syntagmatic contexts to form a rhythmic phrase. The phrase is evaluated with respect to prosodic criteria (rhythmic alternation and weight-to-stress) and the agents are rewarded or penalized accordingly. These payoffs continuously update the agents’ fitness attribute, which in turn determines the agents’ chances of successfully reproducing into the next generation.

The simulation suggests that stress pattern diversity will stably establish itself if the occurrence contexts of polysyllables also include monosyllabic material at a sufficiently high rate. In such a setting, diverse rather than uniform lexical stress patterns will reduce the probability of rhythmically suboptimal clashes and lapses. This prediction matches diachronic data from the Penn-Helsinki Parsed corpora of English (Kroch & Taylor 2000; Kroch, Santorini & Delfs 2004; Kroch, Santorini & Diertani 2016).

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