A computer simulation of Franconian tonogenesis

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The lexical tone contrast in present-day Limburgian, Ripuaric and Moselle Franconian arose from a process of lengthening of vowels in open syllables (around the 11th century), by which e.g. an original length contrast, as in mǿlən 'mill' ~ vǿǿlən 'feel', turned into an accent alignment contrast, as in mǿ́ǿlən ~ vǿǿlən (Boersma 2002/to appear). The lexical and morphological contrast was later enhanced by the drop of final schwa (from non-contrastive vállə 'trap' ~ váĺ 'fall' to contrastive vál ~ váĺ, and from non-contrastive stɛ́ín 'stone' ~ stɛ́ínə 'stones' to contrastive stɛ́ín ~ stɛ́in), by the deletion of intervocalic ð (wɛ́ɛ́kən 'weeks' ~ prɛ́ɛ́ðəkən 'preach' → wɛ́ɛ́kən ~ prɛ́ɛkən), and by various morphologizations and other analogies. Gradually as well, the accent alignment contrast turned into a tone contrast, with for instance the 12 tonal contours described by Gussenhoven (2000) for Roermond, which depend on the lexical tone, on the position in the sentence, on whether the word stands in focus position, and on the intonation type of the sentence.

In this talk I show by computer simulations how the present-day situation could have arisen over the course of a thousand years. The crucial assumption is that we need to take into account **three levels of representation**, namely underlying form (UF), phonological surface form (SF), and (auditory-)phonetic form (PF). At various diachronic stages, the UF of the word contains either a syllable-based accent, or a mora-based accent, or an accent marked for tone, and the UF of intonation contains varying tonal material. At every stage, SF contains moras, mora-linked tones, and segmental information such as feature values for voicing and sonorancy. PF contains pitches, durations, periodicity and spectral information. UF and SF are connected by faithfulness constraints, which perform phonological production as well as word recognition; SF and PF are connected by cue constraints, which perform phonetic implementation as well as phonetic–phonological perception. In production, the UF→SF mapping is evaluated in parallel with the SF→PF mapping, and in comprehension, the PF→SF mapping is evaluated in parallel with the SF→UF mapping.

The computer simulation runs by having a number of virtual adult speakers talk 11th-century Franconian to a number of 11th-century virtual children, who also talk to each other. On the basis of their phonetic input and the meaning of the sentences, the children construct phonological surface representations, underlying lexical forms, and the grammar that relates the three levels of representation. We then let the children virtually grow up, spawn new virtual children, and speak to these. This goes on for a number of generations.

With this computational model, the facts of the Roermond tone system follow "almost automatically"; that is, there exist sets of plausible settings for the numerical parameters that will turn 11th-century Franconian into present-day Roermond Limburgian.

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