A Generative Phonetic Analysis of the timing of L- Phrase Accents in English
Edward Flemming
Massachusetts Institute of Technology (USA)
flemming@mit.edu

The narrow goal of this research is to develop an analysis of the timing of the English low phrase accent (L-) in H*L-L% and H*L-H% melodies. This is challenging because L- is generally realized as an ‘elbow’ in the F0 trajectory – i.e. a point of inflection rather than a local maximum or minimum (fig. 1) – and it is notoriously difficult to locate F0 elbows precisely. I argue that the proper approach to locating tonal targets involves an ‘analysis-by-synthesis’ approach: Given an explicit model of the mapping from tonal targets to F0 trajectories, we can infer the location of targets by fitting that model to observed F0 contours. So a broader goal is the development of a model of tone production. The proposed model analyzes F0 trajectories as the response of a dynamical system to a control signal that consists of a sequence of step functions connected by linear ramps (fig 2). Tone realization then involves selecting the control signal that yields the F0 trajectory that best satisfies constraints on the realization of tone targets.

The analysis-by-synthesis method is used to test two extant hypotheses concerning the timing of L- elbows: (a) L- occurs at a fixed interval after H*, (b) L- is aligned to the end of the nuclear-accented word. The results do not support either hypothesis: L- is not aligned to the word boundary, but there is a significant tendency for L- to occur earlier when the interval between H* and the word boundary is shorter. This pattern of realization is analyzed as a compromise between two constraints, one enforcing a target duration for the fall from H* to L-, and a second, weaker constraint requiring the fall to be completed before the end of the word.

Fig.1 F0 track of an English H* L-L% melody produced on the phrase ‘alien annihilator’

Fig.2 F0 measurements (red), model F0 trajectory (solid line), and input to the production model (dashed lines) for the utterance shown in fig. 1.