

Fuzzy categorization and the limitations of Intonational Phonology.

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Cette étude montre que les locuteurs retiennent et utilisent systématiquement des informations détaillées qui vont au-delà des contrastes représentés par la phonologie intonative. Les sujets ont d'abord imité des énoncés synthétisés avec diverses courbes de f_0 . Ensuite, ils ont imité leurs propres productions à travers plusieurs séances successives. Des courbes de f_0 stables ne se sont établies que peu à peu, à travers plusieurs imitations successives.

The pitch of the human voice is continuously variable. Nevertheless, phonologists often assert that any language uses only its own small set of discrete patterns to control intonation (roughly, f_0). Listeners are said to interpret and make linguistic sense of continuous pitch changes in speech via such basic patterns. This process presumably involves a mapping between continuous pitch changes and discrete phonological representations. As this claim underlies much of intonational phonology, it needs testing.

We tested the claim by asking subjects to mimic the intonation contours of speech. In an initial session, they mimicked sentences synthesized with various intonation contours. In the next three sessions, subjects imitated their own productions in the previous iteration. (Subjects heard blocks of 100 utterances which were shuffled between iterations.) Figure 1 shows the design. The technique is based upon Pierrehumbert and Steele [1989], Bartlett [1932], and Repp and Williams [1987].

Results from mimicry experiments have one crucial advantage: they do not force the subject to classify intonation contours as do many experiments that require introspection or yes/no or high/low decisions by the subject. Thus, if we see discrete classes in the experiment, there is reason to believe that they have psychological reality rather than being artifacts of the experimental procedure.

The mimicry process involves listening to a stimulus, remembering it briefly, then producing the same sentence with an imitation of the intonation of the stimulus. Hypothetically, if the perception were categorical or memory only phonological, then the speaker should generate few distinct intonation contours. Moreover, if one gave the subject two similar intonation contours to mimic, one would expect that (unless

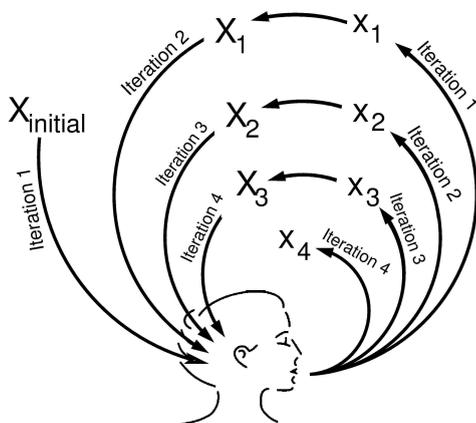


Figure 1: Scheme of the experiment. The numbers refer to the four experimental sessions. In Session 1, the subject mimics the initial synthesized stimuli. Thereafter, the subject mimics his or her own productions from the preceding session.

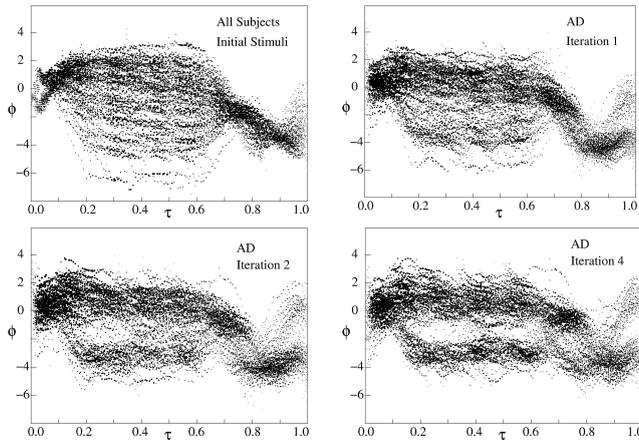


Figure 2: Normalized f_0 contours, $\phi(\tau)$, for a typical subject. In each panel, f_0 measurements are superposed from all the experimental utterances. The time axis τ is normalized to the length of the utterance and the vertical axis shows semitones relative to the speaker's mean f_0 . Upper left shows f_0 for the initial stimuli; other panels contain responses for Iteration 1 (mimicry of the stimulus), 2 (mimicry of 1), and 4 (mimicry of 3).

they straddled the boundary between two phonological descriptions) they would be remembered as identical. Consequently, mimicry would erase subtle differences between the stimuli: within a phonological category, there should be no correlation between the input intonation and the production.

This is not the case, as can be seen in Figure 2. While repeated mimicry caused contours to converge gradually towards a limited set of distinct patterns, this did not happen in one imitation. The loss of phonetic detail is only partial for each imitation. Seven of the ten subjects required several iterations to converge toward a set of stable patterns. Subjects therefore retain and use information beyond the contrasts represented in intonational phonology.

(This poster is based on Braun et al. [2006].)

References

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