

## Abstraction in implicit and explicit imitation of intonation

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Previous research has shown robust evidence of abstraction in explicit imitation of intonation contours (e.g., [3]). When asked to imitate model talkers, participants produce categorical patterns of pitch accents and boundary tones, consistent with phonological abstraction. Previous research has also provided evidence of both abstract phonological imitation of intonation (e.g., [5]) and acoustic-phonetic imitation of  $f_0$  (e.g., [2]) in the absence of instructions to imitate. In both interactive and shadowing tasks, participants produce categorical intonation contours and  $f_0$  means that are more similar to the model talker after exposure than before exposure. The goal of the current study was to examine explicit and implicit imitation of abstract and acoustic properties of intonation, in a fully-crossed design.

Ninety-one adult self-reported native speakers of American English participated in a word shadowing task, either with or without explicit instructions to imitate and with a female model talker who produced either all rising intonation contours on the target words or all falling intonation contours. Instruction condition and intonation contour were crossed between-subject factors, with 22-23 shadowers (10-13 male, 10-12 female) in each cell of the design. Imitation of abstract phonological contours was assessed by coding the intonation contour of each target word produced by each shadower in the baseline (reading) and shadowing (repeating/imitating) blocks as a rise, fall, or plateau [1]. Imitation of normalized phonetic contours was assessed by estimating the root mean-square distance (RMSD) in  $f_0$ , sampled at 30 equidistant timepoints within each target word and transformed to centered equivalent rectangular bandwidths (ERB) [4], from the shadowers' utterances to the model talker utterances, separately in the baseline and shadowing blocks. Finally, acoustic imitation of overall  $f_0$  was assessed by estimating the median  $f_0$  in ERB for each utterance [2].

Linear mixed effects models revealed significant convergence to rising intonation contours for all three measures: shadowers produced more rises, RMSD was smaller, and median  $f_0$  was higher (i.e., closer to the model talker's high overall  $f_0$ ) in the shadowing block than in the baseline block. All three effects of convergence to the rising intonation contours were larger in the explicit condition than in the implicit condition. For the falling intonation contours, the results were mixed: RMSD was smaller in the shadowing block than in the baseline block, but only female shadowers produced more falls in the shadowing block than in the baseline block. In addition, the median  $f_0$  for male shadowers was lower in the shadowing block than in the baseline block, consistent with divergence from the female model talker's higher  $f_0$ . Instruction condition had a limited effect on convergence to falling intonation contours. Together these results suggest robust phonological, phonetic, and acoustic imitation of rising intonation contours in American English, but primarily phonetic imitation of falling contours. We suggest that this difference reflects the relative salience of the two contours, with the more salient rising contours leading to greater implicit and explicit imitation across levels of abstraction.

### References

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