

From the Learnability of Tonal Dissimilation to the Representation of Contour Tones

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Summary In an artificial grammar learning (AGL) experiment, two groups of learners were exposed to disyllabic inputs to learn tonal dissimilation patterns by analyzing contour tones as a single units or a sequence of level tones (i.e., OCP-Unit vs. OCP-Level). Results suggest that OCP-Level learners extended their generalizations better to novel items than OCP-Unit learners, which casts doubt on tonal dissimilatory rules/constraints constructed on the basis of contour tone units.

Background & Method Since Pike (1948), there has been a heated debate over whether phonology can see contour tones as a single unit rather a sequence of level tones for contours to spread, assimilate, and dissimilate as a whole (e.g., Chen, 2010, Duanmu, 1994, Evans, 2008, Yip, 1989). The dispute nevertheless remains unsettled, in part because both unit-based and non-unit-based analyses could sometimes explain same tone sandhi patterns. To provide additional evidence, the current study tested experimentally the learnability of two dissimilatory processes based on the two possible contour tone representations in an AGL task. This direct comparison of the two rules' learnability would help shed light on the mental representation of contour tones. An artificial language of 220 disyllabic items was created based on the segmental phonology of Taiwan Mandarin (TM) with a three-level tonal contrast H, HL, and L. For the OCP-Unit group, identical *tonal units* across the syllable boundary (H-H, L-L, and HL-HL) were excluded from in the training items. For the OCP-Level group, the H-H and L-L gaps remained unchanged, and the HL-HL gap was replaced with the H-HL gap; identical *level tones* across the syllable boundary never occurred as part of the training items. HL-L was further excluded from *both* artificial languages to serve as an *accidental gap* for the OCP-Unit group but a *systematic gap* for the OCP-Level group; HL-L was therefore expected to be accepted and rejected by the respective group in the test session. A set of 128 novel test items were created with all possible di-tonal patterns other than L-L, which was a clear violation to Third-tone Sandhi in our learners' L1. Both training and test items were recorded by the author. During the training phase, training inputs were presented auditorily to participants in random order. In the post-training test, participants listened to the 128 test items divided evenly into two lists. In the *inclusion* list, participants pressed the space bar as quickly as possible if a test item sounded like the target artificial language and did not respond when an item was judged unlike the language. In the *exclusion* list, they were instructed to only respond to unlike items (Destrebecqz & Cleeremans, 2001). Eighty-seven TM-speaking college students were recruited for the experiment and assigned randomly to one of the two groups. Seven of them were excluded for failing to pass an input memorization task in the training phase or technical issues that interrupted the experiment. Data from forty participants of each group was analyzed below.

Results & Discussion Binary-coded response correctness was analyzed separately for HL-L and non-HL-L test items using mixed-effects logistic regression including Group and Task Type (include vs. exclude) and their interaction. By-participant and by-item random effects were also taken into consideration. For non-HL-L test items, the above-chance response accuracy does not vary significantly across the two groups, demonstrating some learning of tonal regularities for both groups. However, the HL-L test items were *wrongly rejected* only by the OCP-Unit learners (significant Group effect: $B = -1.86$, $SE = 0.249$, $z = -7.457$, $p < .001$). Accordingly, we conclude that the OCP-Level learners converged on the target tonal dissimilation grammar and analyzed contour tones as a sequence of level tones, whereas the OCP-Unit learners fell short of analyzing contour tones as units to conclude at a unit-based tonal dissimilation grammar; OCP-Unit learners might have acquired separate tonal generalizations for each tonal gap in the learning input (e.g., *HL-HL as ease of articulation; see Myers & Tsay (2000)).