Learning vowel harmony with transparency in an artificial language

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Transparent vowels in harmony, which appear to be ignored in featural agreement between vowels, have been studied extensively both theoretically (e.g. Archangeli & Pulleyblank 1994; Baković 2000; Goldsmith 1985; Kiparsky & Pajusalu 2003; Pulleyblank 1996) and experimentally (Benus & Gafos 2007; Gordon 1999; Hansson & Moore 2014; Hayes & Londe 2006). Well-known examples include Finnish and Hungarian, in which (high) front unrounded vowels do not participate in front/back harmony (Ringen & Heinämäki 1999; Ringen & Vago 1998). For example, in Hungarian, [rɑdi:r] 'eraser' takes back suffixes (e.g. dat. [rɑdi:rnɑk]), even though the stem-final vowel is front. Transparency is particularly interesting because it violates the locality requirements typical of phonological patterns (Ní Chiosáin & Padgett 2001).

Moreover, Finley (2015) showed that transparency is extremely difficult to learn in an artificial language setting; participants needed the majority of their training items to contain transparent vowels in order to learn the pattern, even though natural language lexicons do not tend to be biased in this way. However, one crucial difficulty with Finley's (2015) study is that the pattern she used is not characteristic of natural language vowel harmony systems. Indeed, since her artificial language was based on the English vowel system, in which front rounded and back unrounded vowels are absent, it conflated rounding and backness. We report on a pilot experiment that instead uses a French-based artificial language to probe the learning of vowel transparency. French has a similar vowel inventory to that of Hungarian and Finnish, and so it is possible to develop an artificial transparency pattern that closely parallels attested systems.

For this experiment, a language was designed with back vowels [o,u], front vowels [ø,y], and neutral vowels [i,e]. Words were spliced together from syllables excised from productions by four native speakers of French. In the training phase, participants were exposed to CVCV nonce stems of four types: back-back (both vowels from [o,u]), front-front (both vowels from [ø,y]), front-[i] (V1 from [ø,y], V2 [i]), and back-[i] (V1 from [o,u], V2 [i]). Participants, who in this pilot study were not native French speakers, were divided into three groups: experimental, stem control, and suffix control. The experimental group heard stems followed by their suffixed forms; the suffix vowel was back ([o]) in back-back and back-[i] words and front ([ø]) in front-front and front-[i] words, mirroring the harmony systems of Hungarian and Finnish. Stem control participants heard only bare stems during training. The suffix control condition was similar to the experimental condition, except that the suffix allomorph (front or back) was counterbalanced across stem vowel combinations, so that there was no pattern to the [o]~[ø] alternation.

In the test phase, participants chose between back and front suffixed forms of stems with all of the training vowel combinations, plus front-[e] and back-[e] stems. In many languages, including Hungarian and Finnish, [i] and [e] are both transparent. However, typologically, the transparency of [i] does not imply the transparency of [e], while the reverse does hold. Thus, if learning reflects typological universals, we would expect the experimental participants not to generalize transparency to [e]. (We plan to test for generalization from [e] to [i] in a later study.)

Participants in the experimental condition learned basic harmony, and many were able to learn transparency of [i], despite the non-native vowel sounds involved. As a group, they did not generalize transparency to [e], though some individuals did. Stem control participants tended to pick a single suffix consistently; however, some extended the stem harmonic co-occurrence restriction to suffixes. The suffix control condition showed no pattern. These results suggest that transparency patterns may be easier to learn than previously believed, and motivate future research into implicational universals and generalizations from static patterns to alternations.

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