

Effects of Intrinsic F0

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In violation of de Saussure's arbitrariness assumption (de Saussure, 1959; Ultan, 1978; Imai et al., 2008; Nygaard et al., 2009; Kovic et al., 2010; Aveyard, 2012; a.o.), words containing vowels with high intrinsic F0 (e.g., front vowels such as /ɪ, i, ε/; Lehiste & Peterson, 1961; Whalen & Levitt, 1995) are perceived as referring to lighter, thinner, smaller and more feminine entities/individuals, as opposed to words containing vowels with low intrinsic F0 (e.g., back vowels such as /ʊ, o, ɔ/). The effect has frequently been observed in the case of pseudowords (e.g., invented brand names; Klink, 2000, 2001, 2003; Yorkston & Menon, 2004; Lowrey & Shrum, 2007; Shrum et al., 2012) but appears to hold for existing words at least in limited domains: in a recent study, Coulter & Coulter (2010) reported that vowel pitch in numerals can influence the perception of price discounts in English and Chinese. The nonarbitrary sound-meaning association, referred to as 'sound/phonetic symbolism', appears to be universal and can, for the most part, be explained by the mechanism of the Frequency Code (Ohala 1984, 1994; Gussenhoven, 2002, 2004), which has been primarily used to account for interpretational effects of rising and falling contours in different languages (Chen et al., 2004). According to the Frequency Code (FC), high pitch is linked to smaller immature speakers (with thinner, smaller vocal folds and shorter vocal tracts producing higher F0) and, hence, utterances carrying high and/or rising pitch are interpreted as less dominant, more uncertain, friendlier and questioning. Existing research in the area of phonetic symbolism has, so far, disregarded the possibility that not just individual phonemes, but also their sequences, might create meaningful associations between phoneme-intrinsic F0 and meaning, by virtue of producing a microprosodic contour. In a series of experiments conducted with Dutch native speakers, we explored the idea that pitch contours might emerge from the combinations of vowel-intrinsic F0 in succeeding syllables and give rise to perceptions predicted by the FC. In the first two experiments, we examined possible effects of three confounds that have mostly been overlooked in sound symbolic research: modality of presentation, lexical status and intrinsic intensity. In Experiment 1 (N = 64), we established that Dutch listeners are sensitive to vowel-intrinsic pitch, disregarding the modality of stimuli presentation (spoken, written) and the lexical status of the stimulus (consisting of novel vs. existing lexemes). In Experiment 2 (N = 146), we examined the interplay between vowel-intrinsic F0 and intensity. So far, the fact that vowels also differ in terms of their intrinsic Intensity (Lehiste & Peterson, 1959) has been disregarded but, in fact, some of the sound-meaning associations reported in the literature might be due to intrinsic intensity, rather than intrinsic F0. We used those vowels available in the Dutch phonemic inventory that represented the most extreme examples of the four categories High/Low F0/Intensity (see Figure 1). The results show both a main effect of F0, as well as intensity, with respect to the perceived power/dominance, with the effect of F0 being somewhat stronger than the effect of intensity ($\eta^2 = .61$ and $\eta^2 = .52$, respectively). In Experiment 3 (N = 56), we tested the interpretation of vowel-intrinsic F0 in combinations of two syllables, using the dimensions 'front-back' (/ɪ-ɔ/ and /i-u/) and 'open-close' (/ε-i/ and /a-ʊ/). With respect to the front-back dimension, the vowel

order had a large significant effect on the perception of Power (a scale with a good internal consistency, measured with the help of four 7-point items, small-big, thin-thick, feminine-masculine, and light-heavy). Stimuli with ‘rising’ combinations of front-back vowels (e.g., /kuki/) were perceived as less powerful than stimuli with ‘falling’ combinations (e.g., /kiku/); they were also judged as being less powerful than monosyllabic stimuli with a high (front) vowel. This finding indicates that sound symbolism is not bound to a single phoneme. We compared the effect to the perception of tones in a tonal language, which we explored in Experiment 3 with Mandarin native speakers (N = 96) judging the perception of Power for 16 monosyllabic novel brand names with four different tones (rising, falling, level and fall-rise). The judgments were in accordance with the predictions of the FC and analogous to our findings for Dutch in Experiment 3. In sum, our study showed that phoneme-intrinsic F0 may give rise to tonal-like effects in an intonational language, in the sense that it influences the interpretation of novel words. In our future work, we intend to test if the meanings associated with contours emerging from combinations of vowels (and, possibly, consonants) also affect lexical choices for existing lexemes, e.g., in contexts where the speaker can choose between two synonyms.