Phonetics in phonological representations: Evidence from Hungarian

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The idea that phonetic detail is part of lexical representation is controversial, even as evidence in favor of this view accumulates (Ben Hedia & Plag, 2017; Ernestus & Baayen, 2007). Some would place phonetics outside of grammar (Hale & Reiss, 2000), whereas other argue that it is integrated in, but separate from phonology (Flemming, 2001, 2013). We present evidence form the phonetic properties of Hungarian transparent vowels, which shows that phonetic detail is part of phonological knowledge. We will model our result in a frame enriched which a probabilistic type signature. This type signature allows speakers to extend phonetic information in their phonological representations to novel instances.

Hungarian has backness harmony, which means that the backness of the final vowel of the stem determines the backness of suffix vowels. The front non-low vowels [i:, i, e:], however, are often accompanied by front voweled suffixes, but in some, lexically determined cases, by back suffixes. These vowels are called transparent vowels (Törkenczy, 2016; Törkenczy, 2011).

Benus & Gafos (2007) found that transparent vowels in unsuffixed words are more front when they are followed by front suffixes in other word forms in the paradigm, than in unsuffixed words that are followed by back suffixes in other word forms in the paradigm. Their findings are based on articulatory data gained from three speakers. These findings contrast with the ones reported in Blaho & Szeredi (2013). They measured the acoustics of transparent vowels and found no differences between the backness of vowels that are followed by suffixes with front vowels or back vowels in other words in the paradigm. They used a particular set of transparent vowels, namely vacillating vowels, which are vowels that are variously followed by front or back vowels.

We measured the acoustic properties of transparent vowels in monosyllabic words. 21 Hungarians were asked to silently read a sentence in which an inflected, existing monosyllabic word or a phonotactically legal nonsense word occurred. In the next sentence this word or nonsense word occurred uninflected and they were asked to pronounce this uninflected variant. We then measured the formants of the transparent vowel. We calculated the F2 - F1 and used it as a predictor, because it is a measure of backness of a vowel (Reetz & Jongman, 2011). The smaller the F2-F1 the more back a vowel. We calculated a mixed effects model for each vowel. The models showed that there is a significant difference in the F2 - F1 for the transparent vowel [i], but and a marginally significant effect for type of item (word versus nonsense word). The effects show that [i] is lower when followed by back vowels elsewhere in the paradigm. This result is illustrated in figure 1. The effects for the other vowels are not significant, but they show that for [i:] is numerically more back for back vowels than [e:] is. The direction of our effects is similar as reported in (Benus & Gafos, 2007). The fact that we found only a significant effect for short [i] is not surprising, since it is different phonetically different in that it shows a greater amount of variation than long [i:] and long [e:] (Mády & Reichel, 2007).
We interpret this as a paradigmatic coarticulation effect. The articulation of a transparent vowel in a monosyllabic words is affected by the backness of the vowel in its affixed variants. This effect makes sense when it is assumed that words that form a paradigm are stored together in one representational unit the mental lexicon and that complex words are stored as wholes (perhaps in addition to storage of stem and affixes.)

This paradigm is stored as a frame (Löbner, 2014; Petersen & Gamerschlag, 2014; van de Vijver & Baer-Henney, 2018; Sutton & Taylor, 2017) as illustrated in figure 2. The value of the attribute of the transparent vowel of the unsuffixed word are constrained by a type signature that is determined by the range of formant values of the suffixed words in the paradigm. This distribution is used by the user to make predictions about novel items (Sutton & Taylor, 2017).

Phonetic detail is represented in this frame as a type signature. It needs to be represented for the following reason: In a complex word the suffix affects the articulation of a transparent vowel in the stem and this, in turn, affects the articulation of the transparent vowel in an unsuffixed word. As the fronting of transparent vowels is not phonemic Benus & Gafos (2007); Törkenczy (2016); Törkenczy (2011), but is nevertheless systematically present in our acoustic data, speakers know how to systematically differentiate between the the two types of transparent vowels. The acoustic targets of the vowels are a range of formant values, and, for each articulation the speakers have to sample from this range.

Figure 1: Hungarian transparent [i] in unsuffixed monosyllabic items.
Figure 2: Frame representation of part of the word family of the concept Friend. The referent is given as a double circled node. Its value is defined by its attributes—the arrows—and their values—the labels at the nodes. The type signature is integrated as a rectangular box.

We have shown that phonetic detail is a systematic feature of the articulation of transparent vowels in Hungarian and have proposed a representation. By doing this we contribute to our understanding of cognitive representations in the interaction between morphology, phonology and phonetics.

References


