

Ghost phonemes in second languages - How orthography can create contrasts without perceptual correlates

Silke Hamann, University of Amsterdam

Several experimental studies on second-language acquisition have shown that learners can create a phonemic distinction in their L2 with the help of orthography. An example is the English /æ/-/ɛ/ contrast, which is notoriously difficult for Dutch and German learners but where the written form can aid in the creation of the distinction, see Escudero et al. (2008) and Escudero & Wanrooij (2010). A more drastic example comes from Italian native speakers who set up an intervocalic contrast between singleton and geminate obstruents in their L2 English on the basis of orthography (Bassetti 2017), even though geminates do not exist in English.

Such interaction of orthography and phonology caused Taft (2006) to propose that phonological representations can be directly influenced by orthographical knowledge. Bassetti (2017) mentions Taft's proposals and adds an alternative interpretation that phonological and orthographical knowledge could be simultaneously activated in such cases. Cutler (2015: 118) goes as far as to say that orthography can only aid in the acquisition of such contrasts if the learners are made aware of them through explicit instructions (metalinguistic knowledge). None of these authors provides a formal account.

In the present study we formally account for the above-mentioned findings by employing a native *perception grammar* (Boersma 2007) and *reading grammar* (authors 2017), the latter formalizing the mapping between graphemes and phonemes with orthographic constraints. We propose that L2 learners can create 'ghost phonemes', i.e. segments without perceptual correlates, if they apply both their native perception and reading to L2 forms. This is illustrated in Figure 1 with the English *cattle-kettle* contrast: on the left we see the native Dutch perception of both sounds as one category, on the right the Dutch reading of the two graphemes as different categories (because the two graphemes correspond to separate phonemes in Dutch). The creation of a geminate contrast in their L2 English by Italians is illustrated in Figure 2: the left represents the native Italian perception of singleton and geminate voiceless alveolar plosives, where only the singleton cues ever occur in English input, and on the right the native Italian reading of English orthographic forms.

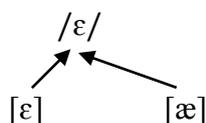
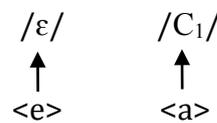


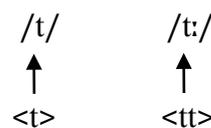
Fig. 1: Native Dutch perception of the English *kettle-cattle* contrast



Native Dutch reading of the English orthographic forms (C₁ = phoneme different from /ε/)



Fig. 2: Native Italian perception of a singleton-geminate contrast (input in grey does not



Native Italian reading of the English graphemes

occur in English)

In both cases the systematic orthographic mapping in the native language (both Dutch and Italian have fairly transparent orthographies) is applied to L2 orthographic forms and creates phonemes that have no perceptual cues in their native language (Dutch case) or where the perceptual cues corresponding to the native phoneme do not occur in the L2 (Italian case).

In this model, ghost phonemes can only occur because (at least in the initial learning stages) orthographic information overrides perceptual cues, as formalized in Tableau 1. Here the orthographic constraint mapping a grapheme consisting of two identical consonantal letters onto a geminate is ranked above the cue constraint against the mapping of a short closure phase onto a geminate. The model predicts that this ranking is changed with sufficient auditory input, thus that representations with the ghost geminate in English will eventually not be activated anymore.

Tableau 1: Simultaneous reading and perception of English ‘kitty’ by an Italian listener/reader

<kitty> [kɪti]	<tt>/t:/	*[t]/t:/
👁️ /kɪt:i/		
/kɪti/		*!

During our presentation we will furthermore illustrate that this model can account for experimental findings with lexical decision tasks where the decision for words containing such ghost phonemes is inhibited (Broersma & Cutler 2011) because their lexical representations are not directly accessible via perception.

References

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