

Most classic discussions of phonetic and phonological universals start from an explicit or implicit assumption of the segment as a real (or at least highly useful) unit of analysis. However, a growing quantity of more recent research has suggested that phonetic and phonological knowledge may be better understood as familiarity with an ensemble of tokens of specific words and utterances (e.g. Pierrehumbert 2001, Goldinger 1998). ‘Episodic’ models of this type help account for a variety of phenomena, including that performance on lexical recognition tasks is better with familiar rather than unfamiliar voices, the occurrence of phonetic drift over a speaker’s lifetime, and the fact that words clearly have individual histories. Much attention has been focused on differences correlated with relative word frequency (e.g. Bybee 2001), with more frequent words reported to be typically shorter and subject to more articulatory and acoustic reduction. Frequent words thus can be said to use a different set of sounds from less frequent ones. This way of thinking challenges not only the idea that an overall inventory of segments can be established for a given language, but the familiar categorical framework used to classify phonetic entities in general. Purely episodic models are challenged by speakers’ judgments that homophones exist, as well as experimental evidence that training with biased (unusual) pronunciations generalizes to words not presented in the training, and observed first-language effects on second language processing (e.g. Pallier et al 2001, Cutler et al 2010). These results suggest that abstract categories also play a role

However even more persuasive evidence in favor of a categorical component may be found in examination of verbal arts and traditions. These provide evidence of how speakers understand the phonological structure of their language (e.g. Hayes 1979, Dell & Elmedlaoui 1988, Schuh 1989, Minkova 2003). The patterns of alliteration in verse and forms of ritual speech in early Germanic provide strong *prima facie* evidence that speakers can be sensitive to the *segment* as a unit organizing their knowledge of the sound structure of their language. In essence the alliterative convention is as follows: one or two of the onsets of stressed syllables must begin with the same segment in two successive phrases (i.e., poetic half-lines which generally contain two stresses), but not more than three onsets may alliterate in the line. Crucially, in the case of onsets containing clusters only the first consonant is relevant (except for */sp, st, sk/). Thus the identity of a single segment guides the pattern; the onset as a whole is not required to be identical.

The suggestion that the alliterative tradition provides evidence for users' sensitivity to the segment as a unit has been challenged. One alternative was proposed by Fleischhacker (2000, 2005). She proposed that it is simply the overall perceptual similarity between onsets that accounts for which singleton C's and clusters form acceptable alliterating pairs. For her "If a cluster-singleton pair ... does not alliterate, then that pair must be less similar than a cluster-singleton pair that does". To support this interpretation she sought pairwise similarity ratings from speakers of modern American English. The subjects assigned similarity scores on a 7-point scale to rhyming word/non-word pairs such as [bleim]/[breim] (Cl/Cr), [bleim]/[beim] (Cl/C) or [breim]/[beim] (Cr/C). No significant difference was found between these three types of comparisons. That is, forms with an onset cluster containing a liquid were found to be perceptually equidistant both from each other and from a singleton onset. Fleischhacker therefore suggests that a scalar notion of perceptual similarity can account for the acceptability of series such as /bl, br, b/ as good alliterating sets without appealing to the notion of discrete segments (and presumably the same would apply to sets such as */hr, hw, h/ and */kw, kn, k/). Fleischhacker implies that /sp, st, sk/ are unacceptable alliterations as they are too dissimilar.

More elaborate versions of Fleischhacker's experiment have been run with English and French subjects to see if the results are reproducible, and to incorporate a wider range of onset types into the comparisons. American English-speaking subjects were asked to perform two tasks. In one they provided similarity ratings of pairs of rhyming words using a 7-point scale, along the general lines of Fleischhacker's experiment. All pairs consist of either two real words of English or two nonsense words (e.g. *fog/frog* or *krig/kig*), rather than being word/non-word pairs. In the other task they judged which two out of a triplet of rhyming real (e.g. *fog/frog/flog*) or nonsense words (e.g. *kig/krig/klig*) are more similar to each other. This task is believed to present a more direct and thus potentially more sensitive test of which particular onset pairs are more similar to each other.

A similar experiment was also run with native speakers of French. Experiments in the 1980's suggested that French speakers are more attuned to syllables than English speakers who are more attuned to segment-level parsing of utterances (Mehler et al 1981, Cutler et al 1986). Both a similarity rating of rhyming pairs on a 7-point scale and a task requiring selection of the most similar pair from among a rhyming triplet were performed by all subjects. Since the English experiment proved to have too many variables involved for all to be successfully evaluated, a smaller range of onset types and only real words were used in the French experiment.

Central to Fleischhacker's suggestion is the idea that stop + liquid sequences involving either a lateral (Cl) or a rhotic (Cr) are rated as equally similar to singleton stops in onset position. Global results from our experiments do not support this idea. In the pair similarity rating task English subjects in aggregate judged obstruent + liquid pairs (Cl/Cr) as significantly more similar than pairings of a singleton obstruent (C) with either a lateral (Cl) or a rhotic (Cr). French speakers judged the two pairwise comparisons involving a lateral (C/Cl and Cl/Cr) as significantly more similar than pairs comparing a singleton obstruent with an obstruent + rhotic onset (C/Cr). Anecdotal comments by French subjects suggest that the salient phonetic character of the French rhotic, usually a uvular fricative or approximant, plays an important role in these judgments. However, common to both groups is the judgment that the two stop + liquid pairs (Cl/Cr) are more similar to each other than singleton stop versus stop + rhotic pairs (C/Cr). A sharper picture emerges from the triplet task. For both English and French subjects there is a very apparent judgment that onset pairs including the two liquids (Cl/Cr) are more similar than pairs containing a singleton C and a C + rhotic cluster, but French subjects again differ from the English ones in judging C/Cl pairs as more similar than C/Cr. Both experiments indicate that singleton stop onsets and stop + liquid clusters are not perceptually equidistant. Neither do the similarity ratings predict the relative frequency of alliterative pairings among C/Cr/Cl in the long Old English alliterative poem *Beowulf*.

Similarity may play some role in the alliterative tradition. In triplets involving s+Stop (sT) clusters (e.g. 'seam/team/steam'), the T/sT pair is most often selected as most similar, suggesting the stops dominate the perception of similarity. Avoidance of alliteration between different s+Stop clusters may be a way to observe the regularity that the initial segment must alliterate while at the same time respecting the perceptual prominence of the stops.

It seems there is no reason to reject the *prima facie* conclusion suggested by examination of the alliteration pattern, namely, that it depends on speakers making an analysis of the onsets into their constituent segments (or something that amounts to the equivalent) and accepting as alliterations those pairs that begin with the same segment. These results provide reassurance that it continues to make sense to discuss at least some types of phonetic universals in terms of categorical elements of the size of a segment.

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