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Discussion

What we know about what we have never heard before: Beyond phonetics ☆
Reply to Peperkamp

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Abstract

Berent, Steriade, Lennertz, and Vaknin (2007) [Berent, I., Steriade, D., Lennertz, T., & Vaknin, V. (2007). What we know about what we have never heard: evidence from perceptual illusions. *Cognition, 104*, 591–630] demonstrate that English speakers' perception of onsets that are unattested in their language mirrors their typological markedness. We suggest that these findings might reflect the presence of universal grammatical constraints, a proposal challenged by Peperkamp's commentary. Our reply exposes mischaracterizations of our claims and presents additional empirical arguments in their support.
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1. Introduction

In our target paper (Berent, Steriade, Lennertz, & Vaknin, 2007), we show that onsets that are dispreferred across languages (e.g., *lbif*) are systematically

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misperceived by English speakers as containing an epenthetic vowel (e.g., *lebif*). The parallels between the typological facts and speakers' misperceptions might indicate the existence of universal markedness constraints in the grammars of all speakers (Prince & Smolensky, 1993/2004). Such constraints prevent the faithful perception of highly marked (i.e., grammatically dispreferred) onsets and trigger their epenthetic repair as less marked structures (e.g., *lbif → lebif*). Peperkamp's thoughtful critique (Peperkamp, 2007) challenges the role of grammatical repair in perception and outlines an alternative phonetic explanation. According to the critique, the perception of unattested onsets only reflects the phonetic mapping of acoustic structures onto the "closest language-specific surface structures" – grammatical markedness constraints play no role in this process. Below we address some of the critique's arguments.

2. Are marked onsets repaired in perception?

Peperkamp's principled objection to our proposal of grammatical repair in perception is based on the observation that certain processes applying in production might differ from those operating in perception. The evidence presented in support of this claim – the discrepancy between the epenthetic vowels used by Japanese speakers in perception (/u/) and production (/i/) – is unclear: Japanese speakers frequently use epenthetic /u/ in production (Itô & Mester, 1999; Kawahara, 2006), and since the scope of repair and its nature are conditioned by lexical and phonological properties (Itô & Mester, 1999), the alleged perception–production discrepancy could potentially reflect differences in materials, not a genuine difference between perception and production. But even if it turned out that *some* grammatical processes in perception differed from those operating in production, this would hardly demonstrate that *no* shared processes exist, or that the hypothesis of grammatical repair in perception is mistaken (for support, see Pater, 2004; Smith, 2006).

Other objections concern the interpretation of our empirical findings. We show that, as the markedness of an onset increases, people are more likely to misperceive it epenthetically (e.g., misperceive *lbif* as *lebif*). We take the monotonic relationship between markedness and epenthetic repair as evidence that marked onsets are represented less faithfully. According to the critique, however, the findings are consistent with the possibility that the representation of marked onsets is as faithful as unmarked onsets – unmarked onsets are simply more likely to elicit non-epenthetic misperceptions. Accordingly, markedness plays no role in perception. In support of this possibility, Peperkamp notes that our spelling results yield a higher rate of erroneous monosyllabic responses (e.g., *bnif → nif*) to onsets of rising sonority compared to those with plateaus and falls.[1]

Peperkamp's argument is well taken, and it is consistent with the pattern of monosyllabic errors. However, an inspection of the spelling results shows that the rate of

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[1] Peperkamp also notes that previous research (Massaro & Cohen, 1983; Pitt, 1998) has observed non-epenthetic errors in the perception of unattested onsets by English speakers. But these results are inconclusive – these experiments did not compare different forms of repair, nor did they examine the effect of markedness.
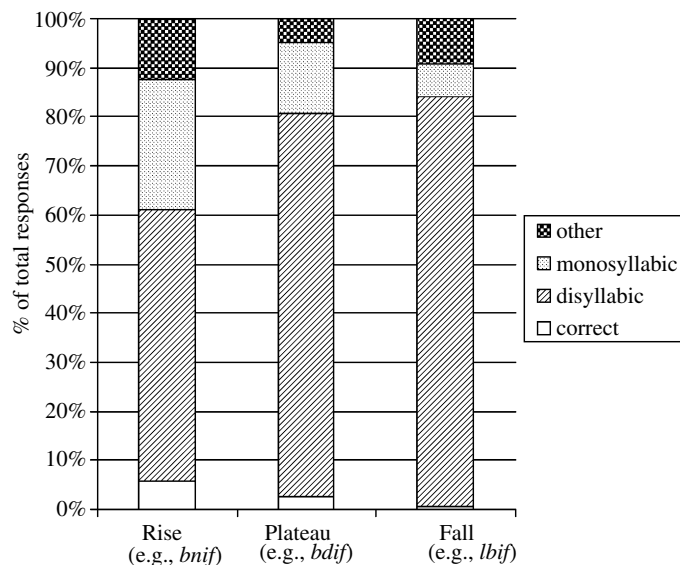
Fig. 1. The rate of correct responses and various types of errors in the spelling of unattested onsets. Errors include monosyllabic (e.g., *bnif → nif*) and disyllabic responses (e.g., *bnif → benif*); other responses are lexicalization and omissions. Data are from Berent et al. (2007, footnote 5).

correct, faithful responses was *highest* for unmarked, rising sonority onsets – significantly higher compared to onsets of either sonority plateaus or falls (a full description of the results and statistical tests is provided in footnote 5 of our target paper – the means are reproduced in Fig. 1). These findings are inconsistent with the proposal that the representation of marked and unmarked onsets is equally faithful, and that epenthetic errors only reflect a phonetic source. Indeed, such phonetic explanation cannot account for the increased rate of monosyllabic errors to unmarked onsets – the very observation that Peperkamp cites to refute the markedness explanation. If the high rate of monosyllabic errors to unmarked onsets is only due to phonetic failures to encode the input, then it is puzzling why the same onsets also yield the highest rate of accurate responses. Likewise, if markedness plays no role in perception, then it is unclear why marked onsets yield the highest rate of disyllabic errors (in spelling) and epenthetic misperceptions (in our main experiments).

The entire set of results – the increased rate of correct responses and monosyllabic errors to unmarked onsets and the decrease in disyllabic responses – can be accommodated by a markedness account. In this view, spelling errors reflect two consecutive stages: one is the initial encoding of the auditory stimulus by the grammar, a stage at which marked onsets are subject to epenthetic repair. At a second stage, the phonological output is transferred to a spelling buffer for generating the spelling representations and responses, a process that is error-prone.[2] Since the spelling buffer

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[2] Such errors, together with people's reluctance to produce unattested onsets might explain the low rate of correct responses.

maintains the number of syllables more accurately than segmental contents (Caramazza & Miceli, 1990), correct and erroneous spellings agree on the number of syllables: inputs that are correctly encoded by the phonological grammar as monosyllabic (i.e., unmarked onsets) are also more likely to yield erroneous monosyllabic errors than those grammatically encoded as disyllabic (i.e., marked onsets). Thus, the existing results are fully consistent with the hypothesis that marked onsets are represented unfaithfully.

3. Why are marked onsets misperceived: Phonological repair or phonetic fragility?

Our repair account attributes the misperception of marked onsets to markedness constraints that prevent their faithful encoding. But on an alternative explanation, the misperception of marked onsets might be solely due to difficulties in the phonetic encoding of marked onsets: people confuse *lbif* with *lebif* because the phonetic form of *lbif* is harder to distinguish from the phonetic form of *lebif*. To argue against this possibility, we point out that the preference for unmarked onsets also modulates the perception of their disyllabic counterparts (e.g., the preference for *bnif* results in a decrease in correct responses to *benif*), forms whose phonetic properties are far more robust than those of onset clusters, and we present two priming experiments that specifically contrast the predictions of a phonetic and a phonological account of epenthesis. Peperkamp believes that our argument from the perception of disyllabic forms is inconclusive – she points out that the disadvantage of *benif*-type items might be due to phonetic factors, although she concedes that the nature of such factors remains unclear. Our priming experiments directly examine the hypothesis that the repair of marked onsets reflects a phonetic failure, but in view of the critique, it now appears that the logic of our experimental design was not sufficiently clear.

The critique tacitly assumes that the target article employs a certain logic, namely, that we infer the nature of epenthesis as "phonological" or "phonetic" from a preconceived categorization of certain experimental tasks as either "phonological" or "phonetic": "Phonological" processes (e.g., grammatical repair) should operate only under tasks that call for phonological processing (e.g., our Experiment 5), so if a given process is absent under "a phonetic" task (e.g., epenthetic misperceptions are reduced in our Experiment 6), then the process must be "phonological" (e.g., misperception is due to grammatical repair). Peperkamp rightfully rejects this logic. Since similar strategic shifts are known to occur even in the processing of phonetic information (Norris, McQueen, & Cutler, 2003), she concludes that the change in performance across our Experiments 5 and 6 does not refute the phonetic account.

We certainly concur that the inference of mental representations from task characteristics is problematic, but our rationale is quite different. Our argument does not infer the nature of epenthetic misperception from its persistence across *tasks* (i.e., the absence of misperception in a "phonetic" task suggests it's "phonological") – instead it is the persistence of misperception across phonological *structures* – the likelihood of misperception for marked relative to unmarked onsets – that is at the center of our argument.

A phonetic account attributes the misperception of marked onsets to their fragile phonetic properties relative to the properties of unmarked onsets. If it's harder to encode the phonetic properties of *lbif* relative to *bdif*, then this *relative* difficulty should always persist. It is of course possible that the attention to phonetic detail would improve the absolute level of accuracy for *lbif*, but its disadvantage relative to *bdif* should be maintained. Our results show that this is not the case – conditions that call attention to phonetic detail actually cancel the relative disadvantage of *lbif*, and the pattern of priming results (in Experiment 6) suggests that the *lbif–lebif* discrimination is as good as the *bdif–bedif* one (by the way – the critique seriously mischaracterizes this result as a lack of priming – it is the lack of *misperception* we demonstrate – priming was of equal magnitude for *bdif* and *lbif*). The typical misperception of *lbif* is therefore unlikely to stem from a phonetic source. Unlike the phonetic explanation, a phonological account allows for the possibility that the phonetic forms of *lbif* and *bdif* are equally robust (at least in the context of the present experimental conditions). This would explain why conditions that encourage the inspection of phonetic forms would yield equal priming for *lbif* and *bdif*, and why, elsewhere, when response is based on the repaired phonological form, *lbif* is misperceived as *lebif*.

4. On phonological universals and nativism

At various points in her commentary, Peperkamp characterizes our paper as an argument that ''knowledge about the markedness of onset clusters is innate''. Our target article makes no such claims. In fact, we even hedge the conclusion that our results implicate grammatical knowledge of sonority, and we note that, if it exists, universal markedness knowledge regarding the sonority hierarchy could be acquired from experience with the articulatory and acoustic properties of attested onsets. Our only firm conclusion is that the pattern of preferences observed by English speakers mirrors the typological data, and that the parallels could potentially reflect on universal markedness constraints. ''Universal'', however, is not synonymous with ''innate''. Whether the markedness constraints on onset structure are specified in the grammar in advance of experience, or inferred based, in part, on the phonetic properties of one's linguistic experience remains to be seen. Our experiments are but an initial step in the investigation of these questions. We thank Sharon Peperkamp for her critique, and we hope the exchange helped clarify the implications of our research program and our findings so far.

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