



Editorial: Phonological Representations and Mismatch Negativity Asymmetries

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Editorial on the Research Topic

Phonological Representations and Mismatch Negativity Asymmetries

In this Topic, we attempt to refresh the discussion on asymmetries in speech sound representation and speech sound access, measured by means of the Mismatch Negativity (MMN, Näätänen and Alho, 1997). We collected contributions using a diversity of different approaches, in different languages and with different foci of their methodological specifications. All contributions share the quest for explaining asymmetries in speech perception, and all contributions attempt to provide interpretations couched in phonological theories. The collection of these studies shows that not only are asymmetries real and neurobiologically plausible, but rather abundant in the neurophysiology of human speech perception. The challenge that future contributions are faced with consist of cases in which phonological representations seem to modulate the MMN over and above acoustic effects. Cross-linguistic studies can address these interactions, since the acoustic effects will be stable (as the human auditory system is assumed to be uniform across cultures), whereas phonological systems vary across languages. The studies in this special issue provide cross-linguistic evidence that illustrates this interaction.

Riedinger et al. examines a larger set of vowel contrasts than usually covered in MMN studies. A total of 5 contrasts, embedded in existing German nouns, was presented in both directions (/i:/-/e:/, /e:/-/a:/, /y:/-/u:/, /i:/-/u:/, and /i:/-/a:/). Importantly, both MMN amplitudes as well as reaction times from an additional active oddball paradigm without neural measures showed asymmetries which were explicable within the FUL framework (Lahiri and Reetz, 2002), but less so in the NRV-framework (Polka and Bohn, 2003; Masapollo et al., 2017). A certain amount of variation was also explained by the auditory property of “perceived loudness” which in some cases resulted in a response pattern neither compatible with FUL nor with NRV. These results indicate that it is important to consider variables beyond those that are typically addressed in studies using MMN.

Yu and Shafer ask whether neural processing of the spectral differences between the English lax vowels /I/ and /ε/ was compatible with an underspecification account in which [-high] and [-low] are the underspecified values. Their findings were compatible with the underspecification approach, but also with other models, including the NRV model and Patricia Kuhl’s Native Language Magnet model (Kuhl, 1991). In addition, they observed an effect of order of condition presentation (which stimulus first served as the standard in blocks that alternated which stimulus functioned as standard and deviant) and caution that non-linguistic factors also need to be considered as possible sources of speech processing asymmetries (see also Fitzgerald et al., 2018).

Meng et al. examine the predictions of FUL when a phonological assimilation process interacts with underspecification. Mandarin sibilants /s/ and /ʃ/ are distinguished by tongue height features:

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/s/ being [LOW] and /ʃ/ underspecified. Consequently, height of the following vowel can spread to /ʃ/ which correctly predicted asymmetric MMNs in the context of the high vowel /u/ (i.e., /su/[ʃu] > /ʃu/[su]) but symmetric MMNs for the low vowel /a/. This paper adds to the body of literature providing evidence for grammatically conditioned MMN asymmetry.

Fu and Monahan takes a novel approach in testing the nature of phonological representations by allowing inter-category variation in manner features (e.g., stops, fricatives) while testing the status of the place feature [retroflex], that does not vary across the set. They observed an MMN only when the standard stimuli belonged to the retroflex category, showing that a single shared phonological feature characterizing a natural class of standards was used as an abstract memory trace and generated an MMN, as well as providing evidence for underspecification of this feature in Mandarin.

de Rue et al. replicates the finding from German (Eulitz and Lahiri, 2004), showing an asymmetry supporting underspecification of the [coronal] place feature. However, the study also found an asymmetry for a contrast of labiality not seen for this mid-front vowel contrast in the previous study of German vowels. This partial replication reiterates the need for further studies of neuro-phonological representation extending to more languages.

Zora et al. address how Swedish words altered by phonetic assimilation activate their underlying lexical forms and examine whether neural processing is modulated by pre-lexical or lexical information. They found some support for the influence of pre-lexical processing, in observing a significant MMN only for a stimulus change to an unassimilated form (coda /m/ in the context of onset /n/ or coda /n/ in the context of onset /m/), but attestation of the assimilation pattern (that is, coda /n/ -> /m/ in the context of /m/), did not modulate the MMN. The findings are evaluated from the perspective of competing accounts of

how phonetically altered surface forms activate their underlying lexical representations.

Polka et al. examine MMN asymmetries from the perspective of the Natural Referent Vowel theory and the Native Language Magnet theory, where MMN asymmetries would result from contrasts between prototypical and non-prototypical or focal/non-focal vowels. No MMN asymmetries were observed; instead, they found differences in the frequency domain that suggested processing advantages for focal vs. non-focal vowels and interpreted this to suggest increased cognitive demand presented by non-focal (atypical) vowels.

Nudga et al. examine MMNs for two phonemic distinctions in Czech: vowel quality [(a) vs. (e)], and vowel length [(e) vs. (e:)]. In order to test the hypothesis that asymmetries only arise with linguistic representations, they also tested the same spectral and durational properties in non-speech stimuli. An asymmetry was observed only in the linguistic condition, indicating that the asymmetry does not arise from acoustic differences alone, but is conditioned by phonological features.

Cummings et al. examine asymmetry predictions for the contrast between /w/ and /r/ under the assumption that /w/ is underspecified for [CONSONANTAL]. They observed smaller MMN for /r/ than for /w/, consistent with the predictions of FUL. In a second contribution, they examine the contrast between /ba/ and /da/ in typically developing vs. language disordered children and found that neither group exhibited the adult-like asymmetries predicted by FUL. This suggests that underspecification becomes part of the grammatical system through language development.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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