

Introduction

The precise articulation of speech sounds is highly variable, which means that listeners routinely have to cope with imprecision and variation in the speech signal. This requires a system which allows for a degree of flexibility during processing. How the lexicon encodes the differences between sounds is thus of primary importance and two main positions have emerged:

- (1) full specification accounts (e.g. Goldinger 1998)
- (2) underspecification accounts (e.g. Featurally Underspecified Lexicon; Lahiri & Reetz 2002, 2010)

In underspecification accounts, the identification of processing asymmetries when certain sounds appear in contrast is a clear indication of an asymmetry on the representational level. There has been mounting evidence for the underspecification of the place feature [CORONAL] as well as for the manner feature [PLOSIVE] (Bölte & Coenen 2000; Lahiri & Eulitz 2004; Friedrich et al. 2008; Roberts et al. 2013).

Asymmetries are used by the brain as a more efficient way of processing information, as they limit the amount of information which needs to be attended to and processed. Both symmetry and asymmetry are expected depending on the precise features involved in any given contrast.

In the present experiment, we directly compare listeners' perception of a symmetric contrast ([HIGH] – [LOW]) and an asymmetric contrast ([] – [DORSAL]) in vowels, using a mismatch negativity (MMN) design (Näätänen et al. 2007).

Research Questions

- Will the data show a processing asymmetry in the case of coronal underspecification and symmetry for vowel height, or a symmetric pattern for both?
- To what extent does lexical status (i.e. word/non-word) affect the processing of the vowel contrasts?

Experimental Design

Stimuli:

- two sets of ablaut (strong) verbs with different feature changes:
 - vowel height: *sit* [HIGH] – *sat* [LOW]
 - place: *get* [COR]/[] – *got* [DOR]
- corresponding nonwords with a different final consonant: *sif/saf* and *gef/gof*

	Experiment 1				Experiment 2			
	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
STD	sit	sat	sif	saf	get	got	gef	gof
UR	[HIGH]	[LOW]	[HIGH]	[LOW]	[]	[DOR]	[]	[DOR]
DEV	sat	sit	saf	sif	got	get	gof	gef
Surface	[LOW]	[HIGH]	[LOW]	[HIGH]	[DOR]	[COR]	[DOR]	[COR]

UR = underlying representation

- MMN with standard oddball design (15% deviants; 700 trials per block)
- 18 adult native speakers of Southern British English
- ISI = 600ms
- experiments run in two sessions of 50 minutes
- block order randomised across participants and data acquisition sessions

Hypotheses and Predictions

Predictions:

- accounts which propose full featural specification would predict a symmetric pattern of MMN responses in both experiments
- an underspecification account would predict a symmetric response in the *sit/sat* experiment while the *get/got* experiment should produce an asymmetric pattern

We expect to see the following:

- symmetrical mismatch between [ɪ] and [æ] resulting in MMN responses of equal magnitude
- no mismatch between [ɛ] standard & [ɔ] deviant resulting in a reduced MMN response
- mismatch between [ɔ] standard & [ɛ] deviant resulting in a higher MMN response

Acoustic signal	sit	sat	sif	saf	get	got	gef	gof
	[HIGH]	[LOW]	[HIGH]	[LOW]	[COR]	[DOR]	[COR]	[DOR]
UR	[HIGH]	[LOW]	[HIGH]	[LOW]	[]	[DOR]	[]	[DOR]

FUL would predict that this effect will be evident in both words and nonwords, as featural representations are considered to be independent of lexical status.

Experiment 1 Results

Analysis:

- bandpass off-line filter at 0.3/30Hz
- epochs with -100ms baseline + 500ms
- start of epoch time-locked to vowel onset
- difference waveforms (deviant – standard) across blocks

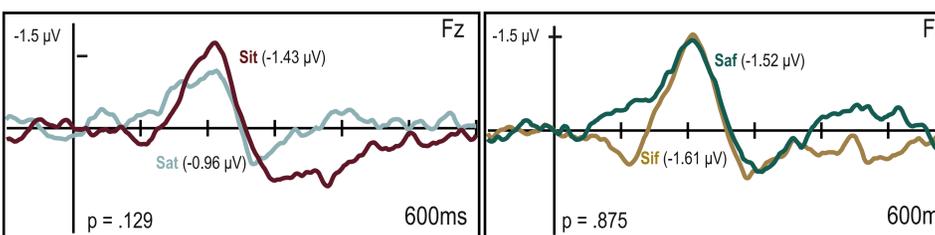


Figure 1: Difference waveforms for *sit/sat* and *sif/saf* at Fz

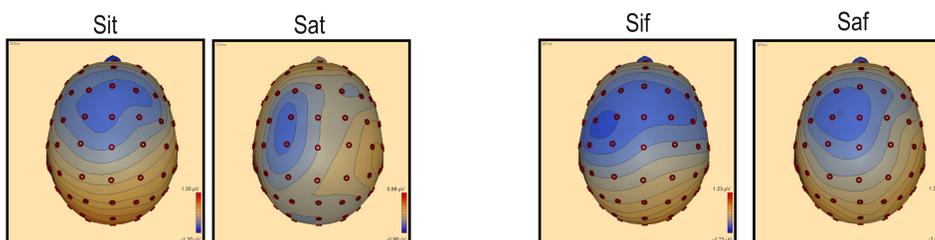


Figure 2: Topographic map at maximum MMN amplitude for *sit/sat* and *sif/saf*

Experiment 2 Results

Experiment 2:

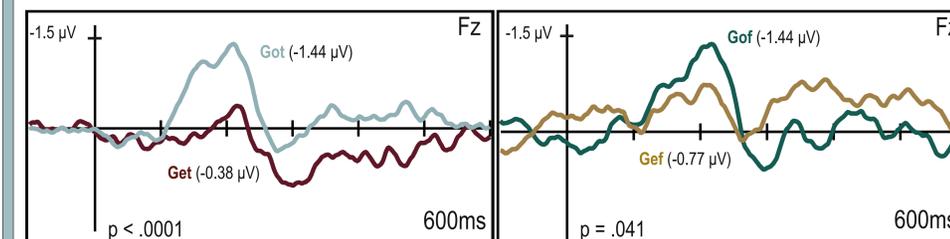


Figure 3: Difference waveforms for *get/got* and *gef/gof* at Fz

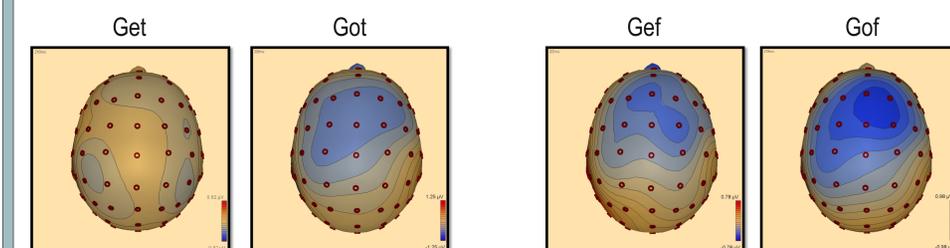


Figure 4: Topographic map at maximum MMN amplitude for *get/got* and *gef/gof*

Discussion

Feature symmetry and asymmetry

The results of both experiments support the predictions made by the FUL model in terms of the patterns of symmetry and asymmetry.

Experiment 1: vowel height symmetry (*sit/sat*)

- both [ɪ] and [æ] are fully specified for height
- *sit* and *sat* show amplitudes of equal magnitude irrespective of condition
- result of a mismatch between the two specified features [HIGH] and [LOW]

Experiment 2: place asymmetry (*get/got*)

- [ɛ] is coronal and underlyingly underspecified while [ɔ] is specified for [DORSAL]
- *get* and *got* show a processing asymmetry
- coronal vowel [ɛ] as deviant and dorsal [ɔ] as standard:
 - MMN of similar amplitude to Experiment 1
 - coronal extracted from the signal mismatches with [DORSAL] in the UR of the standard
- coronal [ɛ] as standard and dorsal [ɔ] as deviant:
 - reduced MMN amplitude
 - dorsal deviant does not mismatch with the standard as [ɛ] is underspecified for place
 - leads to a tolerance, or *no-mismatch*, scenario

Lexical status

- data shows the same pattern as above for nonword pairs *sif/saf* and *gef/gof*
- provides support for independence of feature specifications

Contact

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Selected References

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