Anticipating morphological and syntactic structures
investigating the pre-activation negativity
Söderström, Pelle; Horne, Merle; Mannfolk, Peter; van Westen, Danielle; Roll, Mikael

2017

Document Version:
Publisher's PDF, also known as Version of record

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain.
• You may freely distribute the URL identifying the publication in the public portal.

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Anticipating morphological and syntactic structures
An analysis of the pre-activation negativity (PrAN)

Pelle Söderström, Merle Horne, Peter Mannfolk, Danielle van Westen & Mikael Roll
Department of Linguistics, Centre for Languages and Literature
Lund University, Sweden

Introduction
• Listeners constantly try to predict upcoming words when processing speech
• A brain potential – the ‘pre-activation negativity’ (PrAN) – has been suggested to reflect morphological pre-activation of likely word endings [1-4]
• We tested whether PrAN could be found in syntactically predictive contexts as well

The present study
• Using a concurrent fMRI/ERP paradigm, we tested whether syntactic structure could be pre-activated based on strongly constraining tonal cues
• In Swedish, clause-initial tones (low/high) function as cues to syntactic structure
• Low tones are more predictively constraining (cuing only one type of structure), whereas high tones are less constraining (cuing a larger class of structures)
• More predictively useful tones gave rise to left frontal ERP negativity (PrAN) 140 ms after tone onset, as well as activity in left insula and inferior frontal gyrus
• Invalidly cued word orders elicited P600 after low – but not high – tones, suggesting the disconfirmation of a syntactic prediction

Method and results
• 19 native speakers of Swedish (11 female, mean age 24.5 years)
• Concurrent event-related fMRI/ERP (Brain Products GmbH)
• 50% of sentences had invalid word orders based on tonal cue (LoInvalid/HiInvalid)
• ERP data from 16 participants analysed
• Two time points: predictive tone onset, and word order disambiguation point
• Low tones gave rise to ERP negativity in 136-280 ms time window (cf. [3]) over left-lateralised electrodes (F(1,15) = 7.252, p = 0.017)
• A gRMS analysis revealed two peaks of neural activity at 100-150 ms (F(1,15) = 5.691, p = 0.031) and 150-230 ms (F(1,15) = 5.264, p = 0.037) for low tones
• P600 over left electrodes for LoInvalid (F(1,15) = 5.354, p = 0.035)
• Slower response times for LoInvalid as well (F(1,15) = 5.944, p = 0.028)
• A conjunction analysis (to isolate effects of tone) was performed on fMRI data (z threshold = 3.2, p = 0.001, GRF statistics)
• Largest cluster for the low minus high tone contrast spanned the left anterior insula and left inferior frontal gyrus
• Subject variability correlation between BOLD in prefrontal cluster and gRMS (r = 0.609, p = 0.024)

Conclusions
• Strong cues to syntactic structure elicited ERP negativity (PrAN) as early as 140 ms after cue onset
• Disconfirmed predictions gave rise to P600
• PrAN was found to mainly be underpinned by activity in left insula and IFG (cf. [6-9])
• Syntactic structures can be pre-activated based on a strongly constraining cue

References