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investigating the pre-activation negativity
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Anticipating morphological and syntactic structures
An analysis of the pre-activation negativity (PrAN)

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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 (cueing only one type of structure), whereas high tones are less constraining (cueing 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 P600 over left electrodes for LoInvalid
- A conjunction analysis (to isolate effects of tone) 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