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Pre-activation negativity in language brain potentials



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Pre-activation negativity (PrAN)

PrAN: An event-related potential (ERP) indexing how constraining phonological cues are (Roll et al., 2023).

Early phase: 136–200 ms¹

- Auditory cortex and surrounding temporal areas
- Activation of upcoming word form

Late phase: 200 ms onwards

- Broca's area
- Inhibition of irrelevant words or syntactic structures

¹But see Lulaci et al. (in preparation)

Segmental PrAN

More constraining word beginnings lead to increased PrAN:

- Word beginnings with few competitors (Fig. 1) of high frequency (Fig. 2) (Roll et al., 2017; Söderström et al., 2016).
- Example /fʏ/ 52 competitors, av. freq. 16 /fa/ 657 competitors, av. freq. 37
- Lower within-word entropy (Hjortdal et al., submitted).
- Word beginnings with more competitors when the task was to identify real words vs. pseudowords (Söderström & Cutler, 2023).

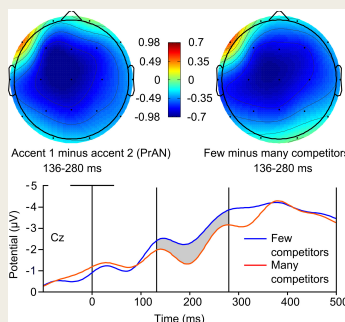


Fig. 1. PrAN increases for word beginnings with few competitors (Söderström et al., 2016).

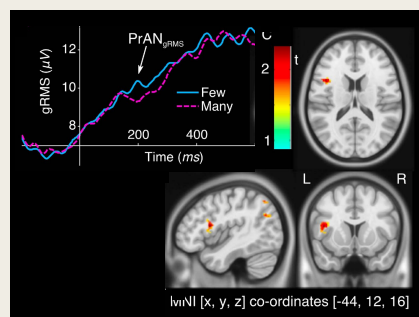


Fig. 2. Word beginnings with fewer competitors of higher average frequency increase the PrAN (Roll et al., 2017)

Suprasegmental PrAN

Swedish lexical tone accents and Danish stød cue suffixes

L* accent 1	H* accent 2
bil-en	bil-ar
car-the	car-s

PrAN increases for:

- Central Swedish Accent 1 (Roll et al., 2010; 2015; Novén, 2022) 10.5 x lower lexical competition (Söderström et al., 2016).
- South Swedish accent 1, acoustic mirror image of Centr. Sw. (Roll, 2015; Kwon et al., in preparation)
- Danish stød, creaky voice feature (Hjortdal et al., 2022)
- Accent 1 in pseudowords (Söderström et al., 2017a,b)
- Accent 1: L2 listeners after training (Gosselke Berthelsen et al., 20 Hed et al., 2017)
- Accent 1 even during passive listening (Kochančikaitė et al., submitted). Negativity just before suffix (Fig. 5).

Dissociation of PrAN and N1

- Accent 2 (H*) without segmental info increases N1 (Roll et al., 2013).

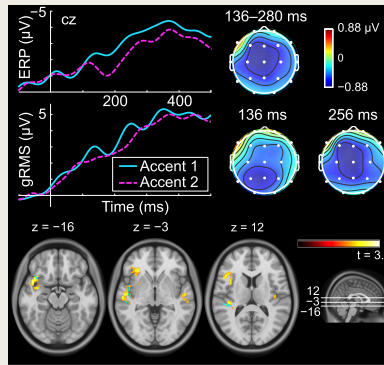


Fig 3. Word accent PrAN and correlated BOLD contrast in Wernicke's (136 ms) and Broca's (256 ms) areas (Roll et al., 2015)

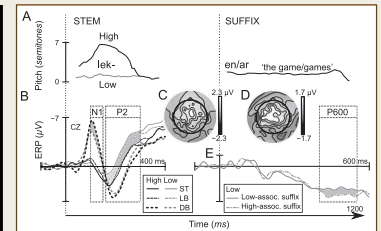


Fig. 4. Accent 1 PrAN overlaps P2 for words with segmental content. Without segmental information, accent 2 increased the N1 (Roll et al., 2013).

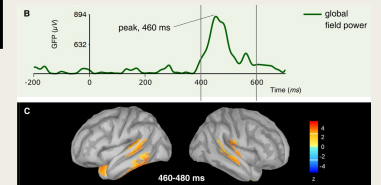


Fig. 5. Passive listening PrAN for accent 1. Suffix onset at 457 ms (Kochančikaitė et al., submitted)

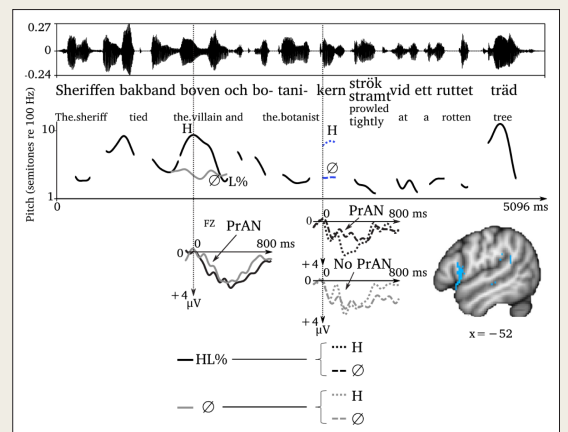


Fig. 6. Intonation PrAN. Ø left-edge boundary tone PrAN occurs only after Ø right-edge boundary tone. BOLD contrast in Broca's area (Roll et al., 2023, data from Roll & Horne, 2011; Söderström et al., 2018).

Syntactic PrAN

The absence of right- and left-edge boundary tones (a.k.a. initiality accents) is more constraining than its presence due to fewer structural alternatives. Therefore, no boundary tone leads to a PrAN when informative (Roll et al., 2009; 2011; Roll & Horne, 2011), correlating with BOLD contrast in Broca's area at 210-230 ms (Söderström et al., 2018) (Fig. 6). Similar to León Cabrera et al. (2017).

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