Physical Constraints in Non-native Parsing: Evidence from L1-English L2-French

Summary
We address the neuronal bases of non-native processing using a time-frequency analysis. We find effects in evoked and induced power reflecting structuring and interpretation in parsing, with fewer effects in NNSs. Results are consistent with weakly-activated non-native representations maintained by neuroprocessing at a less energy-intensive, slower rhythm, reflecting least effort.

Full Abstract
Non-native processing involves weakly-activated representations (Dekydtspotter & Miller, 2013) and delay (Boxell & Felser, 2017). We must however address the neuronal bases of such processing. This study examines event-related spectral dynamics at frequencies 1-40Hz, considering structuring, interpretation, and parse monitoring in wh-movement in French. Crucially, because the generation of power costs less at lower frequencies than higher ones, sustaining parsing in non-native acquisition should involve a shift to a lower rhythm under the principle of least effort.

(1a) involves an NP-modifier viz. regarding. (1b,c) involve noun-complements viz. about. A time-frequency analysis was conducted as an embedded-clause dependency is anticipated at dit ‘said’ and verified at que ‘that’.

(1a) Quelle décision le concernant est-ce que Paul a dit que Lydie avait rejetée?
which decision him regarding is-it that Paul has said that Lydie had rejected

(1b) Quelle décision à propos de lui est-ce que Paul a dit que Lydie avait rejetée?
which decision at words of him is-it that Paul has said that Lydie had rejected

(1c) Quelle décision à son sujet est-ce que Paul a dit que Lydie avait rejetée?
which decision at his/her subject is-it that Paul has said that Lydie had rejected

(1a) vs (1c) involves a coreference-binding difference across the syntax-semantics/discourse interfaces (Chomsky, 1995; Freiden, 1986; Lebeaux, 1988). (1b) vs (1c) involves the morphosyntax of distinct pronouns involved in binding. Therefore, greater effects for the interpretive syntax-semantics/discourse distinction [(1a)-(1c)] are expected in activity related to communication between processing units (induced activity). Because structural differences [(1b)-(1c)] engage more local neuroprocessing, their effects are expected to be greater in evoked activity phase-locked to stimuli. Processing-mode monitoring found around 20Hz in native speakers (Lewis et al., 2016) is expected to be found in lower frequencies as the processing system adapts to sustaining weakly-activated non-native representations.

Stimuli included 50 gender-specified items (1a,b) and 50 items unspecified for gender (1c) in an RSVP paradigm, with 300ms/word and 250ms/ISI. Context rendered the interrogatives pragmatically acceptable. Comprehension queries followed one-third of stimuli. EEG was recorded at 1000 S/S via a 64-electrode EGI system. Data were filtered by a .05-100.05 hertz band-pass filter and cleaned of artefacts. NNSs (n=22) were post-pubescent learners with an average 1.3 years immersion experience. NSs (n=24) had lived abroad 2.3 years on average at testing. Effects in the evoked vs. induced distinction reflected the structuring vs. interpretation distinction in parsing, with fewer effects in NNSs. This muted neuronal activity was accompanied by group differences with greater NNS activation at ≈10Hz and greater NS activation at ≈20Hz.

Results are consistent with retaining weakly-activated non-native representations by structure maintenance in slower rhythms with the least energy.