Signal- and expectation-based processing of pitch accent types

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In many languages speakers employ prosody to highlight new or surprising information, making it more prominent, while they attenuate given or expected information, making it less prominent. For German it has been shown that pitch accent types differ in their degree of perceived prominence [1] and play an important role in the marking of information status (e.g. [2]). The pitch movement leading towards the target on the accented syllable ('onglide' [3]) is the major tonal cue for prominence, rising onglides being perceptually more prominent than falling ones [1]. A previous ERP study [4] found that different pitch accent types were mapped onto information status in real-time and suggested that the processing of prosodic cues used by the speaker to (re)orient the listener's attention interacts with expectations evoked by the pragmatic context. The present ERP study further investigates this interaction between signal- and expectation-driven processing, involving pragmatic contexts that generate an expectation for a particular prosodic form (L+H* vs. H+L* accent) and thus lead to differential neural correlates of expected or mismatching informational processing.

A set-up with two discrete pre-contexts for each test sentence (60 items) was designed to trigger expectations about appropriate upcoming prosody. For example, the pre-context in (1a) builds up an expectation for new, exciting information, guiding the attention of the listener to an event that should be highlighted by prosodic prominence. The pre-context in (2a) establishes that nothing new or unusual is going to follow and builds up an expectation for neutral information. Test sentence (1b), with a prominent accent (L+H*, rising onglide) appropriate for new, exciting information, matches context (1a) but not context (2a). Conversely, test sentence (2b), with a less prominent accent (H+L*, falling onglide), typically found on contextually derivable information, matches context (2a) but not (1a).

We hypothesize that mismatches (incongruent combinations of prosody and context expectation) will result in an expectation-based error at an early discourse processing stage which has been found to engender a negative ERP deflection (N400) (e.g. [5, 6]). Furthermore, signal-driven attention orienting (involving prominence-lending cues) requires listeners to update their mental model at a later discourse processing stage. Such mechanisms may engender a late positive ERP deflection, e.g. when expressing topic shift or for prosodically marked new information and focused constituents (e.g. [6, 7]). Given that rising onglides are perceptually more prominent than falling onglides, we predict that the former will trigger more attentional orienting. However, previous results were mixed, since unexpected accents, too, may cause a late positivity (in addition to an N400) (e.g. [4, 6]).

Twenty-four monolingual native speakers of German (19f, 5m) participated in the current study. They listened to context and test sentence (240 test items + 120 filler items) and performed a word recognition task. We calculated regression-based ERPs [8] and computed linear regression models (factors: rising/falling onglide and exciting/neutral context; continuous covariates: pitch and intensity). Results (see Fig.1) indicate for both accent types a significantly more negative deflection (N400) following the mismatching context. Furthermore, both accent types elicit a late positivity following the exciting context. This may be tied to a mechanism of attention orienting triggered by a highlighting effect of the exciting context. Rising compared to falling onglides also show an early positivity. Hence, the results provide evidence for discrete neurophysiological correlates of prosodic and content-related prominence: Unexpected accents yield an expectation error (N400) while a prominent rising accent consumes attentional resources and engenders updating processes (early positivity) which is also observed for content-related highlighting (late positivity) independent of the prosodic realization of the target word.

(1) (a) *Rate mal, was uns heute passiert ist!* 'Guess what happened to us today!' **exciting context**  (b) *Wir haben Mi**LE**na getroffen.* 'We met Milena.' **L+H* (rising onglide)**	(2) (a) *Heute ist nichts Besonderes passiert.* 'Today, nothing special happened.' **neutral context**  (b) *Wir haben Mi**LE**na getroffen.* 'We met Milena.' **H+L* (falling onglide)**

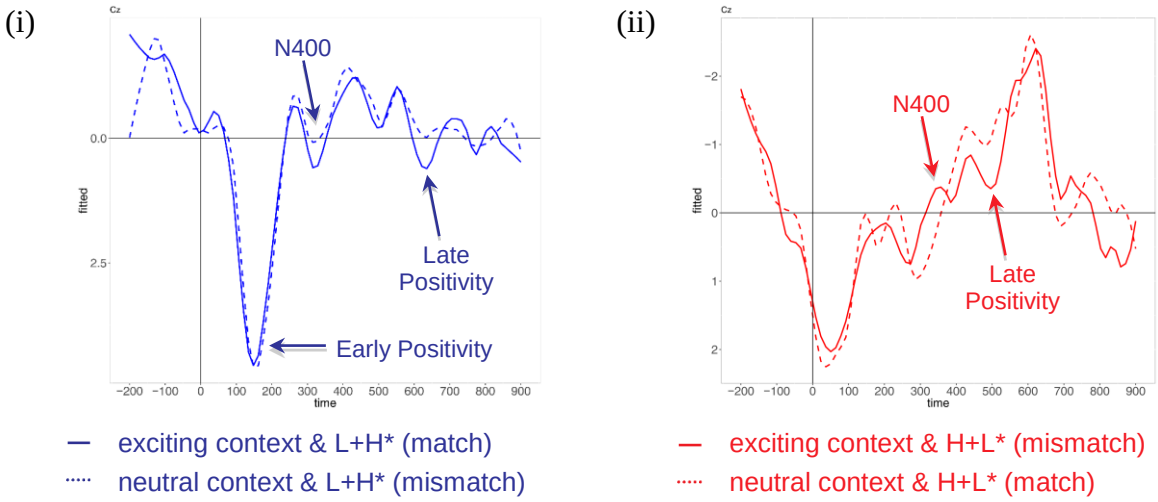

Figure 1. *Grand average rERPs at a selected electrode (CZ) from 200 ms before until 900 ms after the critical word (= name/object; onset at vertical bar). (i) shows the rERPs for L+H* accents (rising onglide), (ii) for H+L* accents (falling onglide). Exciting (solid lines) and neutral contexts (dotted lines) yield different (mis)matches depending on target prosody.*

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