Effects of Emotional Speaker Face- and Event-Sentence Mismatches on Sentence Processing: An Event-Related Brain Potential Study

Katja Münster (Humboldt-Universität zu Berlin), Johanna Kissler (Bielefeld University) & Pia Knoeferle (Humboldt-Universität zu Berlin, Einstein Center for Cognitive Neuroscience, Berlin School of Mind and Brain)
Katja.muenster@hu-berlin.de

In communication, many non-linguistic cues could enrich language processing, among them a speaker's emotional facial expression, and events (e.g., a woman in pain). Both can (mis)match in emotional valence / reference with what a speaker is about to say. In principle, rapidly integrated, matching cues could elicit facilitation and mismatching ones processing difficulty for a comprehender. Using ERPs, we investigated how real-time language processing is affected by a speaker's matching vs. mismatching emotionally-valenced facial expressions / event-sentence mismatches. Previous eye-tracking research (Carminati & Knoeferle, 2013) has reported that negative emotional event photo-sentence processing can be facilitated by an emotionally congruent speaker prime face. This suggests rapid integration of the speaker's emotional face with the sentence. We used ERPs to test these findings: (i) Do people integrate a speaker's face emotion with the valence of event-sentence pairs on the fly? (ii) Would emotional event-sentence congruence effects resemble referential event-sentence congruence effects?

In an EEG experiment (Figure 1), young German adults (*N*=25, female=12) first inspected the face of a speaker and listened to the beginning of a spoken German sentence [1]. The face was either emotionally positive or negative. Next, participants saw an emotionally positive or negative IAPS (International Affective Picture System) event photo and heard the sentence continuation[1]. Starting from NP1, the sentence content matched (vs. mismatched) the photo. If we replicate and extend the eye-tracking findings, ERP deviations between emotionally congruent (negative) speaker face-photo-sentence and emotionally incongruent (positive) speaker face (negative) photo-sentence trials should emerge.

[1] *Ich denke, dass die Blonde die Migräne leidend verflucht.*
lit. transl.: 'I think that the blonde (NP1) the migraine (NP2) sufferingly (Adj/Adv) curses (Verb).'

ERP Results: Interestingly**,** in the NP1 N400 time window, mean amplitude negativities were significantly larger for negative (vs. positive) photos and for trials in which photo and NP1 content mismatched (vs. matched, Figure 2). This effect however only emerged when the event photo was negative and mismatched (vs. was positive & mismatched) the NP1. Additionally, post adjective/adverb onset, when a positive (vs. negative) speaker face preceded negative event - sentence pairs, ERPs show significantly larger broadly distributed negative mean amplitudes in an earlier (250-400 ms) and a later (300-600 ms) time window (Figure 3).

Discussion: The effects in the adjective/adverb region corroborate and extend previous eye-tracking results, specifying how an emotional facial expression can rapidly impact real-time sentence processing. Assuming that an increase in negativity can be associated with processing difficulties, participants show more difficulties integrating a positive speaker face into negative photo-sentence pairs (vs. integrating negative faces into positive photo-sentences combinations). Assuming further that a decrease in negativity can be associated with facilitation, adults might show processing facilitation for neg. (vs. pos.) faces during emotional sentence processing.
Interestingly, this effect seems reversed when an emotional event photo is integrated with the NP matching vs. mismatching photo content. Seeing a negative (vs. positive) photo increased processing difficulty when this event mismatched the noun phrase. Differences in emotional face and event photo processing during real-time sentence processing will be discussed.

[1] Pictures and sentences were controlled for a number of psycholinguistic, emotional and visual measures, among others: valence, arousal, syllable/sentence length, visual saliency, number of people in the photo. NP1 was emotionally neutral and Adj/Adv and Verb conveyed the strongest emotional valence.

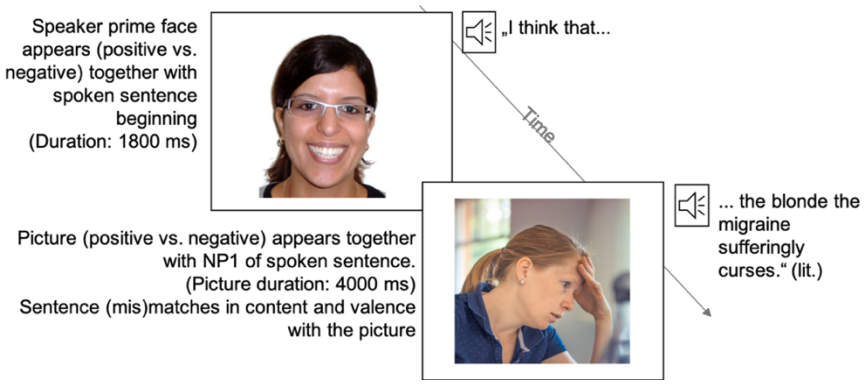

Figure 1: *Experimental procedure exemplifying a trial in which the speaker's positive emotional prime face mismatches in valence with the event photo (negative) and the sentence (negative, the literal translation of the German sentence is presented). The NP1 of the sentence is emotionally neutral, the adjective/adverb and verb convey strong emotional valence. Participant task after sentence end: indicate via button-press if the sentence was positive or negative. Note: The IAPS photo has been substituted due to the database's user agreements.*

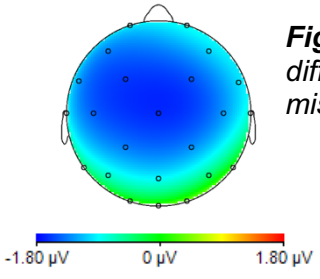

Figure 2: *400-600 ms post NP1 onset, scalp topography of mean amplitude difference between negative event photo – positive sentence (i.e., NP1 mismatch) and positive event photo – positive sentence (i.e., NP1 match)*

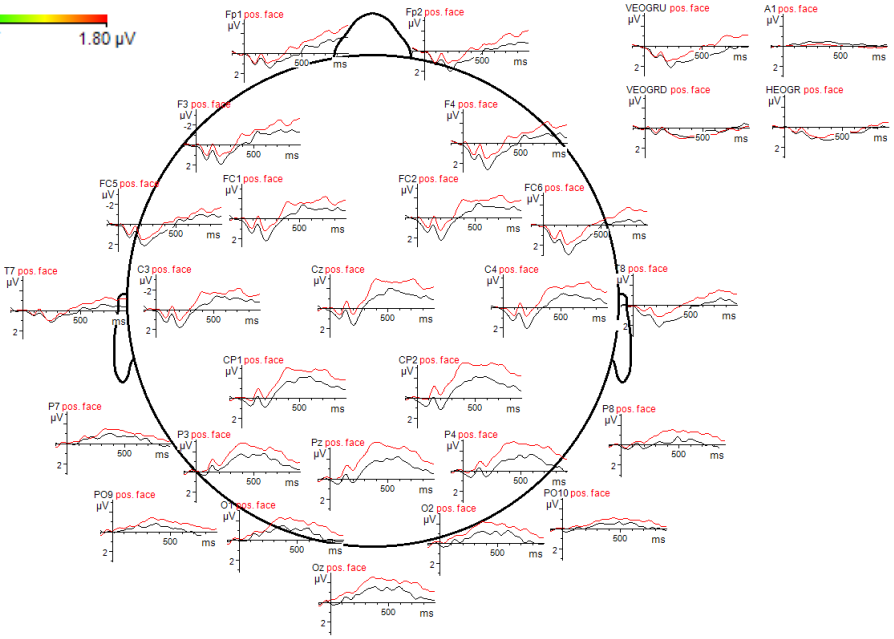

Figure 3: *Adjective/adverb onset, significantly larger mean amplitudes for mismatching positive face – negative photo-sentence (red) vs. matching (black) negative speaker face – negative photo & sentence pairs (negative is plotted up). Note: The differences between the conditions starts early, this might result from overlapping activity from the preceding noun phrase (e.g., the migraine). This region has not been analyzed yet. Mean word onset times from photo presentation onset: NP1=0 ms, NP2=1376 ms, adverb/adjective=2808 ms, verb=3914 ms, mean range of pause between words: 196-251ms.*