# (DIS-)CONFIRMATION OF LINGUISTIC PREDICTION BY NON-LINGUISTIC CUES

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We present findings from an ERP study (24 German right-handed participants, 19–28 yrs) investigating the influence of speaker gaze on listeners' retrieval and integration of expected (True) and unexpected (False) nouns in a shared visual scene. In face-to-face interactions, speakers gaze at objects about 800ms prior to their mentioning [1, 2, 3]. Previous eye-tracking studies provided evidence that participants use such a gaze cue to anticipate upcoming object references, expressed by a higher inspection rate of the gazed at object compared to a competitor [4, 5]. Here, we investigated whether the gaze cue toward a later mentioned object does indeed prepare, or even advance, referential processing. We utilized a stylized face performing gaze cues time-aligned to an auditory sentence.

Each experimental item consisted of a visual scene containing three objects that either differed in size (small, medium, large) or brightness (bright, medium, dark). After three seconds, a stylized face was displayed in the centre of these objects. Gaze cues were time-aligned to an auditory sentence describing a comparison of two of the objects of the form "Das Haus ist größer als das dargestellte Auto, denke ich" ("The house is bigger than the displayed car, I think"). The gaze cue preceding the mentioning of the second noun was manipulated in a way that it either was directed toward the consequently named object (Gaze) or redirected toward the listener (No-Gaze). As a second manipulation, the noun rendered the sentence either as True or False given the visual context (the resulting four conditions were fully counterbalanced). Each participant was presented with 38 items per condition.

We analysed ERPs time-locked to the onset of the gaze cue for the four conditions (Gaze–True, Gaze–False, No-Gaze–True and No-Gaze–False). Overall, a gaze cue toward an object led to a long lasting positive deflection starting at 150ms. Additionally, a gaze cue toward the unexpected object (Gaze–False) showed a negative deflection in the time-window between 200 and 450ms compared to its expected counterpart (Gaze–True).

The ERPs time-locked to the onset of the noun following the gaze cue region showed no effects if a gaze cue toward an object was present (Gaze–True, Gaze–False). In the absence of a preceding gaze cue, however, we observed a larger negativity in the N2 time-window (150–300ms) as well as in the N4 time-window (300-450ms) for the False condition compared to the True condition. Importantly, a late positivity is only observed when no gaze cue precedes the mentioning of the referenced object.

The effect in the N2 time-window on the noun can be interpreted as a PMN. This early effect is explained as a mismatch between the expected word form given a context and the actual activated word candidates given the speech signal listeners perceived [6, 7].

We argue that the N4 effects in both regions (gaze cue and noun) reflect expectations about the upcoming referent (the one that makes the utterance true), that can be formed once the comparator (größer/bigger) is heard. That is, an N4 effect is only elicited when the comparator is followed either by an unexpected gaze cue towards the false referent (in the Gaze-False), or by the unexpected noun, when no gaze cue is present (No-Gaze—False).

The positive deflection observed in both the gaze cue and noun regions can be interpreted as an integration process of the provided information about the discourse-relevant object. In the absence of a preceding gaze cue, the integration of the noun into the mental representation of the situation can only be done on the noun itself. A preceding gaze cue however allows the integration at this (earlier) point in time.

In sum, we provide evidence that speaker gaze towards a referent is processed much like verbal mentioning of the referent itself: Unexpected gaze cues and nouns result in similar ERP effects, while the presence of a gaze cue eliminates effects on the subsequent noun.

References: [1] Meyer et al., 1998; [2] Griffin and Bock, 2000; [3] Kreysa, 2009; [4] Staudte and Crocker, 2011; [5] Staudte et al., 2014; [6] Connolly and Phillips, 1994; [7] Hagoort and Brown, 2000