

Non-canonical structure as an attention cueing mechanism

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In German, focused information can be highlighted by word order (fronting), accentuation, or focus particles. Electrophysiological (EEG) evidence suggests that focusing cues elicit an early and broadly distributed positivity resembling the P3b component for attentive processing, but has a longer latency (e.g., Bornkessel-Schlesewsky et al. 2003; Cowles et al. 2007; Dimitrova et al. 2012). The recruitment of attention mechanisms in the brain has been inferred mostly indirectly (but see Kristensen et al. 2012) and it remains unclear whether focus modulates attention in the temporal dynamics of the processing system. According to the ‘gating by inhibition’ hypothesis (Jensen & Mazaheri 2010), oscillatory activity in the alpha frequency band regulates the excitation and inhibition of underlying cortical structures by power decrease and increase respectively.

24 participants, all native German speakers (age: 23.5, age range: 18-29) read short stories with

i) inferred and given information and ii) an SVO or OVS word order (examples 1-4) and performed a comprehension task. ERPs time-locked to the critical noun showed an N400 increase for inferred information in both structures ($2/4 > 1/3$) and a Late Positivity signifying updating costs only for inferred information in SVO sentences ($2 > 1$; $3 = 4$). This latter contrast has been associated with information structural differences (non-topical vs. topical information) (Schumacher & Hung 2012). Here we tested how OVS and SVO sentences influence attention allocation to inferred vs. given information by additional time frequency analyses. We hypothesized that OVS structures cue attention to sentence initial elements due to their non-canonical structure, which should be reflected in modulations of alpha power (cf. e.g., Jensen & Mazaheri 2010).

EEG data was pre-processed in Matlab using the FieldTrip toolbox (Oostenveld et al. 2011) and re-referenced to the average of all scalp electrodes and segmented. Eye blinks and movements were removed by an independent component analysis. Time frequency analysis of power was performed using the multitaper fast Fourier transform (FFT) in a time window from 0.5s prior to 1.5s post target onset. Frequencies were tested from 2 to 30 Hz in steps of 2 Hz. A time window of 500 ms moved in 20 ms steps across the time axis and was multiplied by a Hanning taper and Fourier-transformed. Individual time-series data were grand-averaged across participants and conditions and submitted to a cluster-based permutation test. We compared OVS_inferred vs. OVS_given ($4/3$) and SVO_inferred vs. SVO_given ($2/1$).

An alpha power decrease was found for inferred vs. given information in OVS sentences ($4 < 3$), with a maximum between 800-1200 ms. No such effect was found in SVO sentences. This finding suggests an increased attention to the contrast between inferred and given information in OVS structures. Compared to canonical structures, non-canonical OVS structures evoked more attention. Importantly, the use of an initial object induces a topic shift in both cases, however, the topic shift is less expected with inferred information, because topical entities preferably represent given information (e.g., Rosengren 1993). In sum, OVS structures serve as attention regulation mechanisms, such that participants attend more to inferred information that represents a topic shift.

Examples of target sentences. Target words are underlined

(1) SVO – given:

Ein Mann sah gestern einen Bräutigam vor der Kirche. Er beneidete den Bräutigam sehr um die schöne Frau.

(2) SVO – inferred:

Ein Mann beobachtete gestern eine Hochzeitsfeier im Freien. Er beneidete den Bräutigam sehr um die schöne Frau.

(3) OVS – given:

Ein Mann sah gestern einen Bräutigam vor der Kirche. Den Bräutigam beneidete er sehr um die schöne Frau.

(4) OVS – inferred:

Ein Mann beobachtete gestern eine Hochzeitsfeier im Freien. Den Bräutigam beneidete er sehr um die schöne Frau.

English:

Yesterday, a man saw a bridegroom (1/3)/ watched a wedding (2/4) in front of the church. He envied the bridegroom for the beautiful woman.

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