EFFECTS OF BEAT GESTURE AND PITCH ACCENT ON THE PROCESSING OF WORDS IN CONTEXT

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Speech is organized according to *information structure*: important information (focus) is highlighted and distinguished from less important information (non-focus). Previous studies suggest that listeners process accented information more elaborately. Information can be emphasized non-verbally too, for instance by beat gestures, which are rhythmic hand movements without semantic meaning (McNeill, 1992). ERP studies have shown that beat gestures facilitate phonological, syntactic and semantic processing (Biau, & Soto-Faraco, 2013; Holle et al., 2012; Wang & Chu, 2013). The questions arise whether beat gestures and pitch accents show a similar neural signature due to their similar functionality, and whether listeners expect beat gestures to be aligned with the focus of the message.

In the present ERP study we investigated how beat gestures modulate the processing of accented-focused vs. unaccented-non focused words in context. 29 Dutch native speakers watched movies consisting of short dialogues (see examples below). In the accent condition (1), the target was accented and in focus, and it was accompanied by (i) a beat gesture, (ii) a control hand movement (self-touching movement) or (iii) no gesture (speaker stood silently). In the no accent condition (2), the target was unaccented and not in focus and was combined with the same gesture conditions. Gestures started 520 ms prior to target word and reached their maximal extension at the onset of the target. All gesture parameters (hand shape, naturalness, duration, alignment) were tested in behavioural tests.

ERPs were time-locked to the gesture onset and analyzed. We performed a cluster-based random permutation tests to test for main effects and interactions of the factors. We found a main effect of pitch accent at 300 ms post target onset: accented words elicited a positivity relative to unaccented words. Gesture triggered a main effect too. Words accompanied by a beat gesture or by a control movement elicited a frontal positivity and a centro-parietal negativity at gesture onset (0-300 ms), relative to words without a gesture. The gesture effect continued as a positivity (300-800 ms). After 800 ms, control movements elicited a negativity relative to words without a gesture. We found interactions of each gesture condition and pitch accent. Accented words with a beat gesture elicited a positivity relative to accented words without a gesture (300-800 ms post target onset). No positivity was found in the same time window for unaccented words with vs. without a beat gesture. Accented words with a control movement triggered a positivity and a negativity relative to accented words without a gesture (300-800 ms post target onset). Unaccented words with a control movement elicited only a positivity relative to unaccented words without a gesture.

Our findings are in line with the ERP literature (Wang & Chu (2013). Our data indicate that listeners integrate beat gestures with speech and do not perceive beats on non-focused information as a mismatch. The negativity for control hand movements suggests that they may increase processing difficulty relative to words without gestures. We conclude that beat gestures play a unique role in the processing of accented words in context, presumably because more attentional resources are allocated at focus information in context.

Examples of experimental stimuli
 (1) *Q: Did the student buy the books or the magazines via Amazon?*
   A: He bought the <u>BOOKS</u> via Amazon.
 (2) *Q: Did the student buy the books via Amazon or via Marktplaats?*
   A: He bought the <u>books</u> via AMAZON.
Note: Target words are underlined, accented focused words are in capitals.