



P3-1

Processing of semantic and prosodic information during spoken language comprehension:

An ERP investigation

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Few neurophysiological experiments have been aimed at understanding the role of prosodic cues in spoken language comprehension. In this study, we used Event-Related brain Potentials (ERPs) to investigate the relationship between semantic and prosodic processing in French. Namely, we wanted to determine whether a specific electrophysiological marker is associated with prosodic processing, and whether prosodic information is processed independently or in interaction with semantic information. We manipulated the semantic and the prosodic factors orthogonally, so that while all sentences had the same syntactic structure (3-syllable subject noun phrases and 3-syllable intransitive verbs starting with an unvoiced stop consonant), half the sentences were semantically congruous and half were semantically incongruous. Similarly, half the sentences were prosodically congruous and half were prosodically incongruous. The prosodic mismatch was produced by cross-splicing the beginning of Statement modalities with the end of Question modalities, and vice-versa. The sentences were spliced at the silent phase of the unvoiced stop consonant of the verbs and a global loudness smoothing was applied to avoid detectability of the signal manipulation. Durational and intensity variations were carefully controlled so that the results could be interpreted in terms of the F0 parameter only. Subjects had to decide whether the sentences were semantically or prosodically congruous over two different attention task sessions.

As expected, results showed that an N400 component was associated with semantic mismatch. We also identified an ERP component (P800), associated with prosodic processing. This component was larger in the case of prosodic mismatch, and may reflect some prosodic re-analysis phenomenon, comparable to the P600 component that has been interpreted as reflecting syntactic reanalysis. Concerning the question whether semantic and prosodic information are processed independently or in interaction, the answer appears twofold. On the one hand, the two processes seem to be independent because the two electrophysiological markers (respectively N400 and P800) are differentiated by their polarity (Negative vs. Positive), their latency (the semantic component occurs earlier than the prosodic component) and their scalp distribution (N400 is larger at Right Centro-Parietal electrodes, and P800 is larger at Temporo-Parietal electrodes). These differences may indicate that the two processes stem from different underlying generators. On the other hand, the two processes also appear to be interactive insofar as the N400 component was present even when the subjects' attention was focussed on prosody only. Moreover, our results indicate that the P800 to prosodic mismatch was larger when the sentences were also semantically incongruous. Taken together, our results thus suggest that, at least under the specific experimental conditions of our experiment, semantic information is processed predominantly with respect to prosodic information.