An ERP study of semantic processing in Austrian sign language (ÖGS): The case of antonyms and classifiers

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One of the main issues in human sentence processing is the question to what degree language processing strategies can be regarded as universal strategies applicable to all languages or whether processing strategies are guided by language-specific information. Despite this typological approach almost all experimental studies are based on spoken languages and moreover to an overwhelming degree on English. In contrast, investigation of sign language is still in its very infancy. Indeed, there are only few studies investigating online processing with event-related potentials (ERPs) and only recently researchers started to use videos for stimulus presentation to assure a natural rate of signing (Capek et al., 2009; Hoseman et al., 2011).

Starting from earlier findings that lexical-semantic N400 effects in sign language are similar to spoken language (cf. Capek et al. 2009) the aim of our study was to investigate whether one can also find similarities with respect to ERP correlates of predictive processing strategies. Roehm et al. (2007) showed that distinct parsing strategies due to task demands and/or semantically restrictive contexts influenced semantic processing. In a sentential context involving antinomies (e.g. The opposite of black is …) participants showed a P300 for the sentence-final word in the antonym condition ("white"), in contrast to graded N400s for the related ("yellow)" and non-related ("nice") conditions. The authors suggested that the P300 reflects the match between the parsers' prediction of an incoming element (pre-activated representation) and the target stimulus.

In this experiment we tried to replicate these findings in Austrian Sign Language (ÖGS). To this effect, three antonym conditions in which the final sign either fulfilled the semantic expectation (A1=antonyms), or violated the expectation (A2=related; A3=unrelated signs) were presented to 15 deaf native ÖGS signers in real time videos. In addition, we presented two conditions in which the sentence final classifier sign either was correct (B1) or incorrect (B2). In order to detect the exact point in time of lexical access we defined several triggers reflecting different parameters in sign production: (i) offset of the pre-critical sign, (ii) handshape, i.e. the first frame where the handshape information of the critical sign was clearly visible, (iii) frame where an additional parameter (e.g. correct position, mouth shape) was added, and (iv) frame where the intended sign was uniquely identifiable.

Similar to previous ERP studies (Capek et al., 2009) semantically deviant structures elicited an N400-effect that showed the most typical peak latency distribution with respect to trigger (ii) and (iii). For the antonym conditions the N400 was more pronounced for the non-related (A3) in comparison to the related (A2) condition. More interestingly, in the same time window antonyms (A1) showed a P300 for semantically congruent words, thereby indicating a prediction-based parsing strategy. Yet, unlike spoken language, an N400 for antonyms (A1) can be observed even before stimulus onset (handshape information), thus indicating lexical access before the critical sign is uniquely identifiable. By contrast, incorrect compared to correct classifiers elicited an LAN / P600 pattern which typically shows up for morphosyntactic violations in spoken language.

A) BLACK _____wh
OPPOSITE+PART WHAT WHITE / *YELLOW / *NICE.
*The opposite of black is (1) white / (2) *yellow / (3) *nice.*

B) * MOTORBIKE B-CL _____wh
OPPOSITE+PART WHAT MOTORBIKE B-CL.
upward-movement
palm vertical
downward-movement
(1) palm vertical / *(2)* * pronated
A motorbike goes uphill is the opposite of a motorbike goes downhill.

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