

## Right or left? An ERP study on discourse referents in German Sign Language

### SignRef

**Background:** In sign languages, discourse referents (DRs) are introduced and referred back to by means of referential locations (R-loci), i.e. regions in the horizontal plane of the signing space, which are identified either by overt grammatical (manual or non-manual) localization strategies such as pointing, body movement, and eyegaze or by covert default strategies (Sandler & Lillo-Martin 2006, Barberà 2012, Geraci 2013, Steinbach & Onea 2015). Hosemann (2015) and Hänel-Faulhaber et al. (2014) are the first studies on the processing of R-loci with agreement verbs. Note, that in both studies, the R-loci have been overtly introduced by the pointing sign INDEX. However, the default constraints on the assignment of DRs to R-loci and the resolution of spatial anaphora in sign languages have not been investigated from an experimental perspective so far. The present event-related potential (ERP) study on German Sign Language (DGS) investigates the hypothesis that signers assign distinct and contrastive R-loci to different DRs even in the absence of any overt localization strategy. Following the DRT-analysis developed in Steinbach & Onea (2015), we assume that signers systematically exploit the signing space to distinguish DRs. That is, in case of two DRs, the signing space is divided into two contrastive areas. We further assume that the first DR (i.e. the referent mentioned first in the examples used in our experimental study) is assigned by default to the ipsilateral area of the signing space (which is assumed to be the right side for right-handed signers). By contrast, the second DR (i.e. the second mentioned referent in our examples) is assigned to the contralateral area of the signing space.

**The present study:** We conducted a classical ERP study based on Kutas & Hillyard, (1980) to elicit an N400 component by manipulating the sentence-final predicate to either fulfill or violate the semantic expectation created in the two-sentence context (cf. Hosemann et al. 2013, Hänel-Faulhaber et al. 2014 for comparable studies on DGS). Hence, we used a mismatch-design and constructed sentence sets (see example 1) containing two DRs without any overt localization in the first sentence and a pronoun (INDEX) at the beginning of the second sentence followed by a predicate clearly identifying one of the two DRs. According to our expectations, example (1ad) should be felicitous sentence sets because MAN is linked by default either to the right (1a) or left (1d) area of the signing space and the anaphoric relation established by the pronominal pointing signs INDEX<sub>R</sub> in (1a) and INDEX<sub>L</sub> in (1d) does not violate the semantic expectation, henceforth match condition. By contrast, the examples in (1bc) should not be felicitous since the anaphoric relation creates a mismatch (henceforth ‘mismatch condition’). In (1b) for example, the pronoun INDEX<sub>L</sub> establishes an anaphoric link to the second referent WOMAN but the following predicate is only acceptable with the first referent MAN. Thus, the two groups of conditions are expected to show different effects on the sentence-final nominal predicate BEARD in the second sentence (‘R’ stands for right and ‘L’ for left).

- (1) a. MAN WOMAN FLIRT. INDEX<sub>R</sub> HAVE BEARD.  
b. MAN WOMAN FLIRT. INDEX<sub>L</sub> HAVE BEARD.  
‘A man flirts with a woman. She/he has a beard.’  
c. WOMAN MAN FLIRT. INDEX<sub>R</sub> HAVE BEARD.  
d. WOMAN MAN FLIRT. INDEX<sub>L</sub> HAVE BEARD.  
‘A woman flirts with a man. She/he has a beard.’

160 stimuli (40 for each condition) were video-recorded with two right-handed professional deaf signers of DGS, digitized, and then presented to the participants at the rate of natural signing. The stimuli were controlled for non-manuals, verb types and the semantic relation the sentence-final predicate establishes. Given that even the transition phase between two signs can already provide sufficient information about the next sign to evoke neurophysiological correlates (Hosemann et al., 2013), three different points in time (including the time window before sign onset) of the predicate (henceforth 'description part') were manually coded for the later analysis. In total 21 right-handed deaf native signers of DGS (12 female, 9 male, age range: 20-51 years) participated in this study. The participants were acquired from different regions of Germany, had a least high school education level, and learned DGS before the age of three. We recorded ERPs while participants watched the pre-recorded videos and judged the presented sentence sets according to their well-formedness. Additional tests were conducted to check the understanding of the signs used in the stimuli.

**Results:** For the analysis we compared the match and mismatch condition. The data show a difference on the description in the second sentence between 500 and 600 milliseconds over central and centro-parietal regions on the left hemisphere. This is in line with our hypothesis that signers of DGS use default strategies for assigning DRs to R-loci if the DRs are not linked to R-loci overtly. Additionally, the data show that in case of two DRs, they are assigned to the contrastive areas in the signing space. This study is the first attempt to investigate the processing of DRs and anaphora resolution in DGS experimentally and thus adds a new picture to our understanding of discourse processing in sign languages in particular and natural human languages in general.

## References

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