Distinguishing Discourse Referents: A Unified DRT-Analysis of R-Loci in Sign Languages and Gender in Spoken Language
(SignRef-Poster Presentation)

Abstract: In this paper, we propose a unified analysis of referential loci (R-loci) in sign languages (German Sign Language, DGS) and grammatical gender in spoken languages (German) within a modified version of Discourse Representation Theory (DRT, Kamp 1981), building on ideas from Barberà (2012). The core idea of our approach is that spoken and sign languages use similar strategies to distinguish Discourse Referents (DRs) in the discourse semantic representation. However, while sign languages make full use of the (recursive) expressive power of the three-dimensional signing space, spoken languages are limited to fixed set of morphological markers such as gender marking. We suggest that the arising analogy mutually contributes to a better understanding of both phenomena and thereby of discourse semantics in general.

Background from Sign Language: One obvious strategy to introduce DRs in sign languages is the INDEX sign, which overtly localizes a DR in a specific area of the signing space (additional means are nonmanual markers and default strategies). In the first sentence of example (1) the first DR is introduced in the ipsilateral area (glossed as R) and the second DR is localized in the contralateral area (glossed as L). Crucially, the pronominal INDEX in the second sentence singles out the R-region thus unambiguously establishing an anaphoric link to the first DR.

(1)   P-E-T-E-R INDEX$_R$ J-O-H-N INDEX$_L$ LOVE. INDEX$_R$ LAUGH.
        'Peter loves John. He (i.e. Peter) is laughing.'

Sign languages use the geometry of the signing space to establish direct anaphoric links. Onea/Steinbach (2013) argue that the signing space can recursively be split into opposing areas thereby enabling direct anaphoric links to an arbitrary number of spatially anchored DRs but within the limits of motoric, perceptual, and processing capacities .

Background from Spoken Language: While at first glance, spoken languages, unlike sign languages, face a huge ambiguity issue, the situation is ameliorated by gender (or more general noun class) distinctions found in many spoken languages (Corbett 1991). For instance, while the German translation of (1) remains ambiguous, sentence (2) with a similar structure, is non-ambiguous due to the MASC feature on the pronoun.

(2)   Der^{MASC} Roman^{MASC} liegt auf der^{FEM} Couch^{FEM}. Er^{MASC} war teuer.
        'The book is on the couch. It (i.e. the book) was expensive.'

Standardly, in DRT, gender is used as an anaphoric disambiguation device as part of the lexical semantics of pronouns, e.g. *he* is translated as a DR *x* carrying the constraint *masc(x)*. But while this seems suitable for English, where grammatical gender matches natural gender, in German the same individual can generally be referred to by NPs with different gender features. For instance, descriptions of non-animate objects could be given using DPs with any of the following head nouns: *Ding*^{NEUTR}, *Gegenstand*^{MASC}, *Sache*^{FEM}. Predicates such as *masc(x)* therefore cover the entire space of objects and seem of little use. We therefore follow Geurts/Maier (2013), who label DRs with gender-features suggesting that gender is not a truth conditional but rather a procedural meaning component. We will, however, show that the idea can be made more explicit.
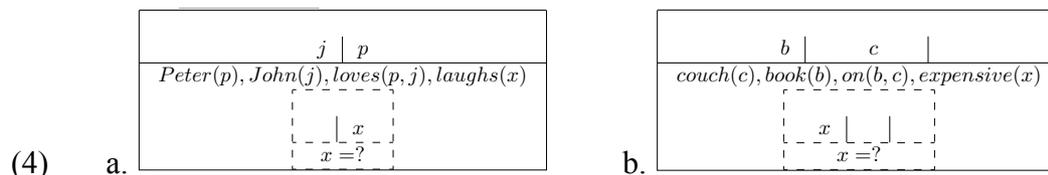
Comparison between Gender and R-Loci: The discourse semantic function of R-loci in sign languages and gender in spoken language seems to be the same: both contribute to anaphoric disambiguation. The morphosyntactic realization of R-loci in DGS and gender in German seems to be similar as well. However, due to the higher expressive power of the three-dimensional signing space, R-loci seem to be better suited for anaphoric disambiguation. We argue, partly following Barberà (2012), that INDEX is composed of an abstract INDEX-sign and a cliticized R-locus (INDEX$_R$ → INDEX + R / INDEX$_L$ → INDEX + L) thereby avoiding the problem of listing a potentially unlimited number of index signs in the lexicon. Similarly, the German determiners are composed of a determiner root and a cliticized gender marker (der → d + (e)r / die → d + ie

/ das → d + (a)s). Finally, determiners in German and INDEX in DGS perform a double duty, not only as determiners but also as pronominal elements (cf. second sentence in (1) and (3)).

(3)   Der^{MASC} Roman^{MASC} liegt auf dem^{MASC} Tisch^{MASC}. Der^{MASC} war teuer.
    'The book is on the table. It (i.e. the table) was expensive.'

Analysis: *(i) Syntax:* We suggest, following Alexiadou (2004) that gender may either stem from the lexical entry of the corresponding head noun or from natural features (such as +/-human) of the respective referent (cf. also Ritter 1993). The gender feature of the noun agrees with the determiner, where it is morphologically expressed. Hence, gender cannot be freely assigned in German. As opposed to this, the R-locus cliticized to INDEX in DGS is not determined by the lexical entry of the head noun. Its assignment is partly regulated by default constraints such as 'link the first DR to the ipsilateral area'. Hence, R-loci are only assigned in discourse.

(ii) Semantics: For (1), Onea/Steinbach (2013) define a modified version of DRT with so-called referent structures (RSs), which directly reflect the geometric properties of the signing space. In particular, the first DR in (1) is assigned to the right part of the RS. By contrast, the second DR is represented in the left part of the RS, as shown in (4a). The anaphoric INDEX of the second sentence introduces a presupposed DR *x* specified to pick an antecedent on the right thus eliminating ambiguities. Note that (4a) only has one level of left-right distinction but as mentioned above further subdivisions can be recursively created to approximate spatial structure.

(4)   a.
$$\begin{array}{|c|c|}\hline j & p \\\hline \multicolumn{2}{|c|}{Peter(p), John(j), loves(p,j), laughs(x)} \\ & x \\ \multicolumn{2}{|c|}{x =?} \\\hline\end{array}$$
    b.
$$\begin{array}{|c|c|}\hline b & c \\\hline \multicolumn{2}{|c|}{couch(c), book(b), on(b,c), expensive(x)} \\ x & \\ \multicolumn{2}{|c|}{x =?} \\\hline\end{array}$$

For the analysis of gender in German, we use exactly the same mechanism with two differences: (i) RSs are not recursive and (ii) instead of binary distinctions, gender in German introduces a fixed tripartite structure ⟨M, F, N⟩ with M being the set of the masculine DRs. The analysis of example (2) is given in (4b). Crucially, in both modalities, RSs are used in the language of Discourse Representation Structures but do not receive a semantic interpretation. We can thus capture the intuition that grammatical gender and R-loci have no meaning. Note that the oppositions in the RSs only pertain to DR and not to individuals (as semantic predicates would do).

Conclusion: We have shown interesting parallels between discourse structure and grammar in sign and spoken language. Both modalities come with a structuring device of DRs. However, while sign languages exploit the geometrical structure of the signing space productively thereby creating recursive RSs, spoken languages use grammatical gender as a single sub-division of RSs. Our approach can be seen as a first theoretical import from sign language semantics to spoken language semantics. In addition, it contributes to the view that even obvious modality-specific grammatical implementations can be analyzed with the same underlying model at the interface between syntax and semantics thus contributing to a better understanding of both modalities: The analysis of gender in German motivated by the analysis of DGS R-loci allows a more general discourse semantic implementation than the one in Geurts/Maier (2013) thereby also showing that, in a sense, sign languages are more expressive than spoken languages in this domain. On the other hand, the analogy from gender allows a more comprehensive analysis of INDEX as a determiner carrying R-loci as features.

References: Alexiadou, A. 2004. Inflectional Class, Gender and DP Internal Structure. In: Müller, G. et al. (eds.), Exploration in Nominal Inflection. Berlin: Mouton de Gruyter, 21-50; **Corbett, G.** 1991. Gender. Cambridge: CUP; **Barberà, G.** 2012. The Meaning of Space in Catalan Sign Language (LSC). Reference, Specificity and Structure in Signed Discourse. Ph.D. thesis, UPF; **Geurts, B. & E. Maier.** 2013. Layered Discourse Representation Theory. In: Capone, A. et al. (eds.), Perspectives on Linguistic Pragmatics. Berlin: Springer, 311-327; **Kamp, H.** 1981. A Theory of Truth and Semantic Representation. In: Groenendijk, J. & M. Stokhoff (eds.), Formal Methods in the Study of Language. Amsterdam: MC Tract 135, 277-322; **Onea, E. & M. Steinbach.** 2013. A DRT-Analysis of Discourse Referents and Anaphora Resolution in Sign Language. To appear in Journal of Semantics.