Structural Modalities for Binding Domains

In this paper we formalize the complementary distribution between bound pronouns and reflexives in English by imposing structural modalities on the left rule for the pronominal type-constructor | of **LLC** [3]. We also sever pronominals from reflexives by letting the right rule of **LLC** to be applied only to the former.

1 Introduction

In the **LLC** calculus, personal and reflexive pronouns are uniformly assigned the syntactic type $n|n$ with the semantic $\lambda x.x$. Consequently, **LLC** does not guarantee the complementary distribution between reflexives and bound pronouns predicted by the Principles A and B of the Government and Binding Theory [1]. Roughly, an anaphora must be bound in its governing category (Principle A), whilst a pronoun must be free within it (Principle B). In **LLC**, contrarily, we may obtain the grammatical and also the ungrammatical readings for *him* and *himself* in a sentence like (1).

1. [John$_1$'s father]$_2$ loves him$_{1/*2}$/himself$_{*1/2}$.

LLC extends the Lambek calculus **L** [4] by adding the anaphoric type-constructor | and the following (simplified version of) left and right rules:

$$\frac{Y \Rightarrow A \qquad X, A, Z, B, W \Rightarrow C}{X, Y, Z, B|A, W \Rightarrow C}|L \qquad\qquad \frac{X, B_1, Y_1, \ldots, B_n, Y_n \Rightarrow C}{X, B_1|A, Y_1, \ldots, B_n|A, Y_n \Rightarrow C|A}|R$$

Figure 1: Left and Right rules for |

Since the left rule does not impose a locality condition into the antecedent for the anaphor, in **LLC** not only a pronoun but also a reflexive may be bound from outside its syntactic domain:

2. John$_1$ said he$_1$/*himself$_1$ loves Mary.

Bracket and normal modalities have been applied in Type-Logical Grammar to delimit syntactic domains. The normal modality $\Box$ has been used, for example, to prevent a reflexive pronoun within a propositional complement from binding [2]. The bracket modality $\langle\ \rangle$, in turn, has found a use for formalizing the subject condition (that is, the constraint that bars the extraction from subject nominals) [5].

2 Proposal

We aim to present a more accurate treatment for personal pronouns, taking as a starting point the pronominal connective | from [3] and the intuition behind its logical rules. However, unlike Jaeger's proposal, our own approach does not intent to be uniform: we assign different syntactic types for pronouns and reflexives, we restrict the scope for the right rule to be applied and we propose different left rules for pronouns and reflexives. We identify different syntactic domains for binding by using the (lexical) structural modality $\langle\ \rangle$ of [5] and analogously, for our $\lceil\ \rfloor$; and we impose structural conditions into the pronominal left rule of **LLC** by using the corresponding (syntactic) structural modalities [ ] and { }. Firstly, we present our treatment for subject-oriented anaphors.

As an example, consider the following structured rules for subject-oriented anaphors within a non-propositional complement domain (Fig. 2) and within propositional complement domain (Fig. 3), with the following side conditions: $i \neq n$, if $X_n = Y_n = \epsilon$ or $X_2 \neq \epsilon$ in $[\|]\mathrm{L}_a$; $Z_3 \neq \epsilon$ in $\{|\}\mathrm{L}_a$. Note that the rule in (Fig. 2) allows us to deal with ECM-verbs as well.

$$\frac{Y \Rightarrow A \qquad X, [A], Z_1, [Z_2, B], W \Rightarrow C}{X, [\![Y]\!], Z_1, [Z_2, B|A], W \Rightarrow C}[|]L_a$$

$$\frac{[X_1, A_1, Y_1], Z_1, \ldots, [X_n, A_n, Y_n], Z_2, [Z_3, B], W \Rightarrow C}{[X_1, A_1, Y_1], Z_1, \ldots, [X_n, A_n, Y_n], Z_2, [Z_3, B\|A_i], W \Rightarrow C}[\|]L_a$$

Figure 2: Rules for (subject-oriented) anaphors within a [ ] domain

$$\frac{[X_1, A, X_2], Z_1, \{Z_2, [Z_3, B], W\} \Rightarrow C}{[X_1, A, X_2], Z_1, \{Z_2, [Z_3, B \parallel A], W\} \Rightarrow C}\{|\}\, L_a \quad \frac{[X_1, A, X_2], Z_1, \{Z_2, [Z_3, B], W\} \Rightarrow C}{[X_1, A, X_2], Z_1, \{Z_2, [Z_3, B \parallel A], W\} \Rightarrow C}\{\|\}\, L_a$$

Figure 3: Rules for bound pronouns and reflexives within a { } domain

Secondly, we deal with object-oriented anaphors in double-object constructions and prepositional phrases. Since our proposal strongly depends on the syntactic types assigned to the lexical items into the lexicon, the correctness of our proposal for anaphoric items in these domains mainly rests on the type assigned to the different classes of verbs. For their treatment we define then a continuous hierarchical non-commutative $\oslash$ type-constructor and a commutative $\otimes$ one.

$$\frac{[X] \Rightarrow A \qquad [Y] \Rightarrow B}{[X, [Y]] \Rightarrow A \oslash B}[\oslash]R \qquad \frac{[X] \Rightarrow A \qquad [Y] \Rightarrow B}{[X, [Y]] \Rightarrow A \otimes B}[\otimes]R_1 \qquad \frac{[X] \Rightarrow B \qquad [Y] \Rightarrow A}{[[X], Y] \Rightarrow A \otimes B}[\otimes]R_2$$

Figure 4: Right rules for for non-commutative $\oslash$ and commutative $\otimes$ asymmetrical product

For object-oriented reflexives we propose the rule in (Fig. 5) below:

$$\frac{X_1, [X_2, A, Z_1, [Z_2, B]], W \Rightarrow C}{X_1, [X_2, A, Z_1, [Z_2, B|A]], W \Rightarrow C}[|]L_a$$

Figure 5: Rule for object-oriented reflexives

From the following lexicon, then we may obtain the correct binding relation for pronouns and reflexives in sentences like (3-10) below, and (1-2) above:

he/him: $n \parallel n$

himself: $n|n$

see/love: $((\langle n \rangle \backslash s)/\, \langle n \rangle)$

glance: $(\langle n \rangle \backslash s)/pp$

show/give/present/send: $(\langle n \rangle \backslash s)/(\langle n \rangle \oslash \langle n \rangle)$

invite/give/send: $(\langle n \rangle \backslash s)/(\langle n \rangle \oslash \langle pp \rangle)$

talk: $(\langle n \rangle \backslash s)/(\langle pp_{to} \rangle \olessthan \langle pp_{about} \rangle)$

say/believe: $(\langle n \rangle \backslash s)/\, \lceil s \rfloor$

believe/expect: $(\langle n \rangle \backslash s)/s$

3. John_1 saw himself_1/$\text{him}_{*1/2}$.

4. John_1 saw *himself_1's mother.

5. [The father of $\text{John}_1]_2$ loves $\text{him}_{1/3}$/himself_2.

6. John_1 glanced behind himself_1/$\text{him}_{1/2}$.

7. Mary showed/presented John_1 himself_1.

8. a. John_1 talked to Mary_2 about herself_2/himself_1.
   b. *John talked about Mary_1 to herself_1.

9. a. John_1 believes himself_1 to kiss Mary.
   b. *John_1 believes himself_1 kisses Mary.
   c. John_1 expects Peter_2 to like $\text{himself}_{*1/2}$.

10. Max_1 said the queen invited both Lucie and himself_1/$\text{him}_{1/2}$ for tea.

3 Conclusions

Our proposal cover several syntactic domains, such as nominal complements, prepositional complements, prepositional adjunct clauses and double-object constructions. In addition, it preserves the prominence condition on the binder for reflexives: the binder may not be an argument lower in the hierarchy neither it may be part of an argument higher in the hierarchy. Further, our rules evidence that free and anaphoric pronouns on the one hand, and bound pronouns on the other, are generally processed in different steps into a proof: if $X_n = X_n = \epsilon$, then free pronouns and reflexives, but not bound pronouns, can be inserted into a derivation. Our proposal also incorporates the previous modal categorial analysis for propositional complements of *say/believe* in terms of structural modalities, in accordance with our overall proposal, and differentiate two entries for *believe*: the ECM and also the propositional form.

References

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