Propositional Relative Clauses in German

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1 Introduction

Aims of the talk:

- Present intriguing relative clause data from German which point to an apparent mismatch between the syntactic structure and the logical form.
- The data can be analyzed without further stipulations under the assumption of a semantic formalism which uses techniques of underspecification.
- Combine the non-constructional analysis of German relative clauses from Kiss (2004) with *Lexical Resource Semantics* (LRS, Richter and Sailer (2004a)).
  (The analysis could be re-stated in constructional terms — and maybe also by using a different semantic formalism such as MRS (Copestake et al., 2003).)

2 Data

2.1 Propositional Relative Clauses in informal terms

Duzfuß (*informal.foot*) is a bound word:

(1) a. mit jemandem auf (dem) Duzfuß stehen
with someone on the informal.foot stand
'be on informal terms with someone'

b. jemandem das Du/ *den Duzfuß anbieten
someone the you(informal)/ the informal.foot offer
'to offer someone to switch to informal terms'

The expression in (1-a) is decomposable (i.e., an *idiomatically combining expression* in the sense of Nunberg et al. (1994)).

(2) Duzfuß $\mapsto$ informal terms

The expression in (1-a) cannot be modified (a) nor pronominalized (b):

(3) a. Joschka steht mit dem Kanzler auf (* gutem/ intimem) Duzfuß$_i$.
Joschka stands with the chancellor on good/ intimate informal.foot

b. *... und auch Angela steht mit Schröder darauf$_i$/ auf ihm$_i$.
and also Angela stands with Schröder there-on/ on it

But, the following example has been found in the corpora of the *Institut für Deutsche Sprache*, Mannheim, quoted from Soehn (2003):

(4) Eine beliebte Variante ist das Bruderschafts-Dropping, bei dem man geschickt Vornamen wie Thomas, Viktor, Ioan, Otti etc. einflicht, um den anderen den Duzfuß ahnen zu lassen, [**auf dem man mit den Spitzenkräften steht**].
'A popular variant is the "friendship dropping" through which one drops first names such as Thomas, Viktor, in order to make the other one suspect that one is on informal terms with the top executives.'

(5) a. Eine beliebte Variante ist das Bruderschafts-Dropping, bei dem man geschickt Vornamen wie Thomas, Viktor, Ioan, Otti etc. einflicht, …
'A popular variant is the "friendship dropping" through which one drops first names such as Thomas, Viktor, … '

b. um den anderen den Duzfuß ahnen zu lassen, [auf dem man mit den
in order to the other the informal.foot suspect to let on which one with the
Spitzenkräften steht].
top executives stands

Being a bound word, *Duzfuß* cannot occur as an NP complement of *ahnen* without the relative clause.

(6) *um den anderen den Duzfuß ahnen zu lassen.
in order * to the other the informal.foot suspect to let

But (5-b) and (7) have the same meaning:

(7) um den anderen ahnen zu lassen, dass man mit den Spitzenkräften auf Duzfuß steht.
in order to the other suspect to let that one with the top executives on informal.foot stands

Since the noun and the relative clause in (5-b) are interpreted as if they were a complement clause, we will refer to this kinds of relative clauses as *Propositional Relative Clause.*

2.2 Putting an end to doubts: more examples

Other bound words: Analogous example with the bound word *Garaus*:

(8) a. jdm. den Garaus machen
to someone the ?? make
'kill s.o.'

b. Einzig Vera Kutters im Treppenhaus gehängtes und 1999 enstandenes Negativfoto der Wiener Secession bleibt als Hinweis auf den Garaus, [**den die Nazis der in ihren Augen "entarteten Kunst" machten**].
'Only Vera Kutter's … picture of the Vienna Secession remains as an indication of the fact that the Nazis destroyed what to their eyes was "degenerated art"'[1]

c. … bleibt als Hinweis darauf, dass die Nazis der in ihren Augen "entarteten Kunst"
remains as indication of the fact that the Nazis to the in their eyes "degenerated art"
den Garaus machten
the ?? made

PRCs are not possible with non-decomposable expressions:

[1]Found by Jan-Philipp Soehn on: http://www.taz.de/pt/2001/11/30/a0123.nf/text.

(9) a. Maulaffen feilhalten
mouth.monkeys keep for sale
'stand gaping'

b. *Mich erbosten die Maulaffen, die die Passanten feilhielten.
Me made angry the mouth.monkeys which the passers-by kept for sale
intended meaning: 'It made me angry that the passers-by stood gaping.'

(10) a. den Löffel abgeben
the spoon away.give
'die'

b. *Ich bedauerte den Löffel, den er abgegeben hatte.
I regretted the spoon that he away.given had
intended meaning: 'I regretted that he had passed away.'

PRCs with free words: PRCs are not restricted to bound words: if a verb semantically requires a propositional argument but is syntactically compatible with either an S or an NP, an NP with a PRC can fulfill the requirements.

(11) a. Hans bedauerte, dass er beim Spiel das Vermögen verloren hatte.
Hans regretted that he had lost the fortune at the game.

b. Hans bedauerte den Verlust (des Vermögens)
Hans regretted the losing of the fortune

PRCs are possible with *bedauern* (*regret*):

(12) a. Hans bedauerte das Vermögen, das er beim Spiel verloren hatte.
Hans regretted the fortune that he at the game lost had
'Hans regretted that he had lost the fortune at the game.'

b. *Hans bedauerte das Vermögen.
Hans regretted the fortune

2.3 What PRCs are not

2.3.1 An argument for a "head internal" analysis of relative clauses

Vergnaud (1974), Carlson (1977), Valentina (2000) and others propose a analysis of relative clauses according to which the head noun is moved out of the relative clause.

(13) a. make headway/ progress
b. *The headway was satisfactory.
c. The headway [that Mel made] was satisfactory.

Common features of the approaches:

- the head noun originates inside the relative clause
- the matrix determiner does not belong to the head noun, but rather to the entire NP.

But:

- Syntactic arguments against such structures: Borsley (1997, nd).
- Semantics: some RelS denote individuals, others proposition!
  - A homogenous syntactic structure leads to a conflict.
  - Two distinct structures cannot be motivated on syntactic grounds.

2.3.2 Reinterpretation phenomena à la Egg (2002)

(14) a. Amélie played the sonata for ten days.
b. beautiful dancer

In (a) an iterative operator needs to be inserted. In (b) the modifier only scopes over a part of the semantics of the head noun.

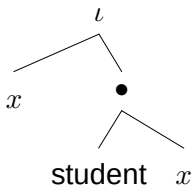
3 Lexical Resource Semantics

3.1 General Remarks

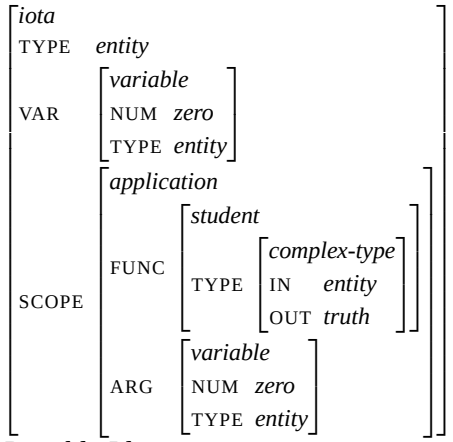
- LRS uses techniques of *underspecified semantics* (Reyle, 1993; Bos, 1996), but the logical form of a sentence is a single, disambiguated expression of the semantic representation language.
- Previous LRS publications discuss scope ambiguity (Richter and Sailer, 2001; Bouma, 2003), and multiple exponence of semantic operators, such as in negative concord (Richter and Sailer, 2004b), multiple wh-interrogatives in German (Richter and Sailer, 2001) and multiple tense marking in Afrikaans (Sailer, 2004).
- Richter and Sailer (2004a) provides an introduction to LRS.
- A prototype of an LRS implementation for the grammar development environment TRALE has been developed (joint work with Frank Richter and Gerald Penn, presented at the workshop on *Semantics in Grammar Engineering*)

The logical form of a sentence is an expression of some typed semantic representation language (here: Ty2 (Gallin, 1975)).

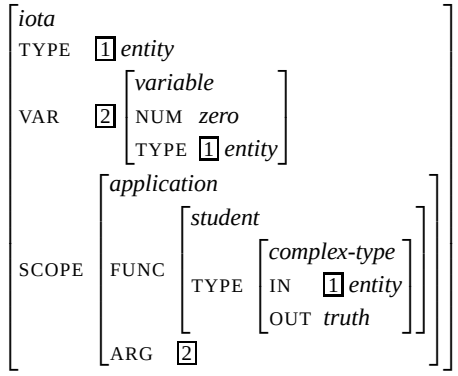
(15) a. The student: $\iota x(\mathsf{student}(x))$
(For each variable x of type τ and for each ϕ of type t, $\iota x(\phi)$ is an expression whose denotation is an individual a of type τ such that $[\![\lambda x.\phi]\!](a) = 1$ if there is exactly one such individual, otherwise the denotation is undefined.)
b. Subexpression structure:



(16) a. HPSG encoding:



b. Possible Identities:



There are two paths which lead to the expression x_e: VAR and SCOPE|ARG.

3.2 Brief Outline of LRS

(17) The sort *lrs*

lrs	EX(TERNAL-)CONT(ENT)	*me*
	IN(TERNAL-)CONT(ENT)	*me*
	PARTS	*list(me)*

Intuitions behind the attributes:

- PARTS: List of all subexpression which are contributed by the given sign.
- INCONT: The scopally lowest subexpression contributed by the lexical head of a phrase.
- EXCONT: The expression associated with the maximal projection of the head.
  - Utterance: the logical form of the utterance
  - NP: the quantifier which binds the referential variable of the head noun.

(18) The INCONT Principle:

a. In every *lrs*, the INCONT value is a subexpression of the EXCONT value.
b. In every *lrs*, the INCONT value is an element of the PARTS list.

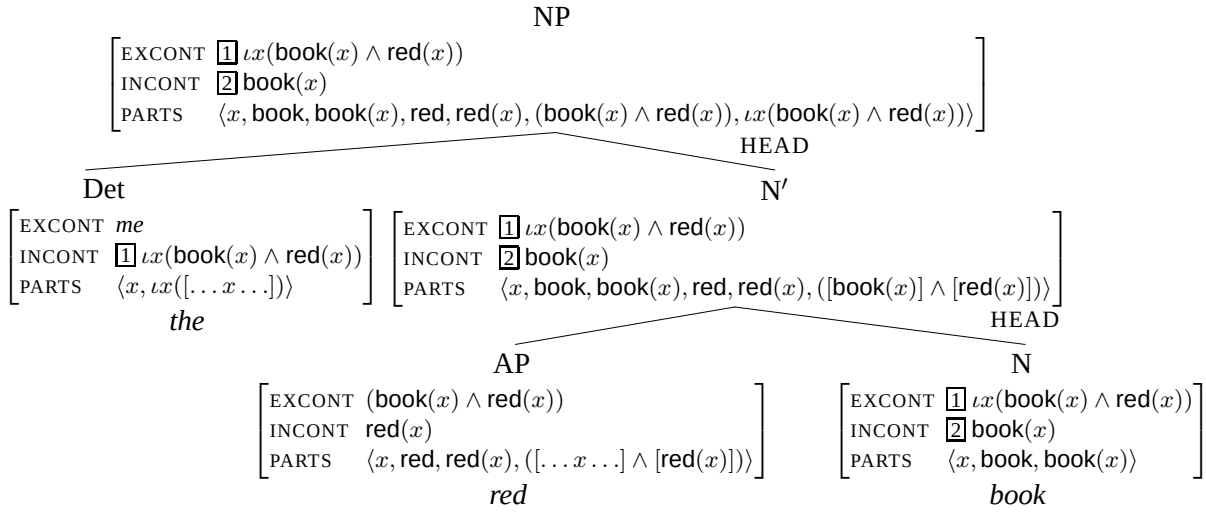
(19) a. The red book
$\iota x(\mathsf{book}(x) \wedge \mathsf{red}(x))$

b. $\begin{bmatrix} \textsc{excont} & \iota x(\textsf{book}(x) \wedge \textsf{red}(x)) \\ \textsc{incont} & \textsf{book}(x) \\ \textsc{parts} & \langle x, \textsf{book}, \textsf{book}(x), \textsf{red}, \textsf{red}(x), (\textsf{book}(x) \wedge \textsf{red}(x)), \iota x(\textsf{book}(x) \wedge \textsf{red}(x)) \rangle \end{bmatrix}$

(20) a. Meaning contributions:

the	$\underline{\iota x}(\textsf{book}(x) \wedge \textsf{red}(x))$
red	$\iota x(\underline{\textsf{book}(x)} \wedge \underline{\textsf{red}(x)})$
book	$\iota x(\underline{\textsf{book}(x)} \wedge \textsf{red}(x))$

b. Structure:



(21) The EXCONT PRINCIPLE:

In every utterance, every subexpression of the EXCONT value of the utterance is an element of the utterance's PARTS list, and every element of the utterance's PARTS list is a subexpression of its EXCONT value.

(22) The SEMANTICS PRINCIPLE:

a. EXCONT and INCONT are shared along a head projection.

b. If the nonhead is an intersective modifier which modifies a sign X, then the modifier's EXCONT is of the form $\alpha \wedge \beta$, and X's INCONT is a subexpression of α.

c. If the nonhead is a determiner, then the nonhead's INCONT and the head's EXCONT are identical, and the head's INCONT is a subexpression of the nonhead's restrictor.

4 Analysis

(23) Regular relative clause:

a. dass Peter das Photo betrachtete, das Maria knipste.
that Peter the picture looked.at which Maria took

b. $\lambda w.\exists e(\textsf{look-at}(w, e, p, \iota x(\textsf{picture}(w, x) \wedge \exists e'(\textsf{take}(w, e', m, x)))))$

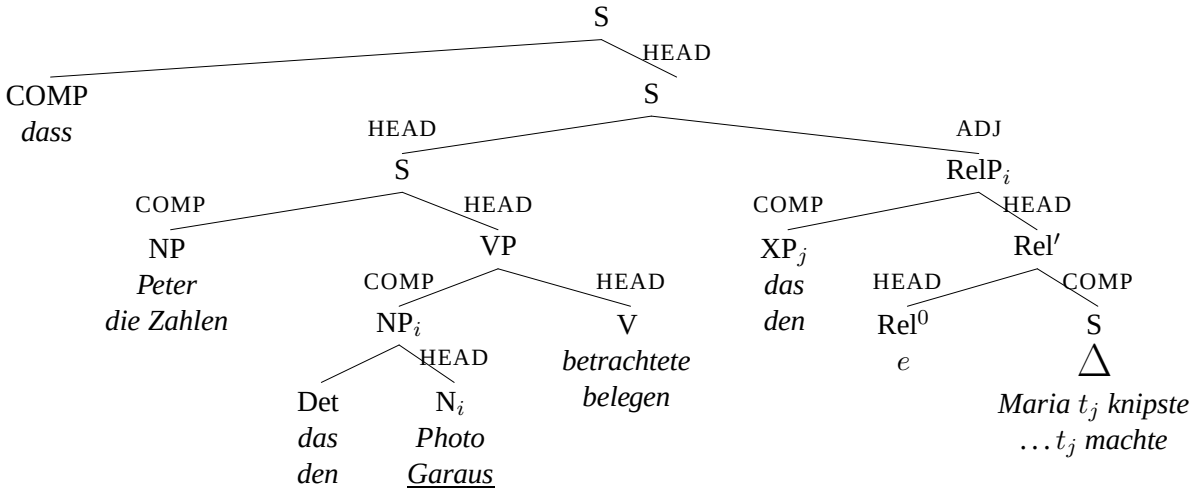
(24) Propositional relative clause:

a. dass die Zahlen den Garaus belegen, den die Globalisierung dem Kleinbetrieb
that the numbers the ??? prove which the globalization to the small business
machte.
made

b. $\lambda w.\exists e(\textsf{prove}(w, e, \textsf{Z}, \lambda w.\exists e'(\textsf{make}(w, e', \textsf{G}, \textsf{K}, \iota x(\textsf{garaus}(w, x))))))$

(25) Syntactic structure:

[COMP [$_S$ [$_S$ Subject [$_{VP}$ [$_{NP}$ Det Noun] Verb]] [$_{RelP}$ XP [Relativizer S]]]]



4.1 The "normal" case

(26) Outline of the lexical entry of *betrachten* (*look at*):

$$\begin{bmatrix} \text{PHON } \langle \textit{betrachten} \rangle \\ \text{SYNS LOC} \begin{bmatrix} \text{CAT ARG-ST} \left\langle \left[\text{LOC CONT INDEX VAR } y\right], \left[\text{LOC CONT INDEX VAR } x\right] \right\rangle \\ \text{CONT} \left[\text{INDEX VAR } e\right] \end{bmatrix} \\ \text{LF} \begin{bmatrix} \text{EXCONT } \textit{me} \\ \text{INCONT } \textsf{look-at}(w, e, [\ldots y \ldots], [\ldots x \ldots]) \\ \text{PARTS } \langle w, e, y, x, \textsf{look-at}, \lambda w.\alpha, \exists e\beta, \textsf{look-at}(w, e, [\ldots y \ldots], [\ldots x \ldots]) \rangle \end{bmatrix} \end{bmatrix}$$

and look-at $\triangleleft \beta$

and $\exists e\beta \triangleleft \alpha$

(27) The lrs of *Peter das Photo betrachtete*:

$$\begin{bmatrix} \text{EXCONT } \textit{me} \\ \text{INCONT } \textsf{look-at}(w, e, p, [\iota x([\textsf{picture}(w, x)])]) \\ \text{PARTS } \langle w, e, p, x, \lambda w \ldots., \exists e(\ldots), \textsf{look-at}, \textsf{look-at}(w, e, p, [\ldots x \ldots]), \\ \qquad \textsf{picture}, \textsf{picture}(w, x), \iota x([\textsf{picture}(w, x)]) \rangle \end{bmatrix}$$

(28) The lrs of *Mary* t *knipste* (*Mary took* t):

$$\begin{bmatrix} \text{EXCONT } \textit{me} \\ \text{INCONT } \textsf{take}(w, e', m, x) \\ \text{PARTS } \langle w, e', m, x, \lambda w \ldots., \exists e'(\ldots), \textsf{take}, \textsf{take}(w, e', m, x) \rangle \end{bmatrix}$$

(29) The empty relativizer (adapted from (Pollard and Sag, 1994, p. 216)):

$$\left[\begin{array}{l}\textit{word}\\ \text{PHON}\ \langle\,\rangle\\ \text{S}\left[\begin{array}{l}\text{L}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HD}\left[\begin{array}{l}\textit{rltvzr}\\ \text{MOD}\left[\begin{array}{l}\text{L}\left[\begin{array}{l}\text{CAT HD }\textit{noun}\\ \text{CONT INDEX }\boxed{1}\left[\text{VAR }x\right]\end{array}\right]\\ \text{NP}\left[\text{TB REL}\left\{\boxed{1}\right\}\right]\end{array}\right]\end{array}\right]\\ \text{SUBCAT}\left\langle\left[\begin{array}{l}\text{L }\boxed{4}\left[\text{CONT INDEX VAR }z\right]\\ \text{NL INHER REL}\left\{\boxed{1}\right\}\end{array}\right],\left[\begin{array}{l}\text{L}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{ll}\text{HD} & \textit{verb}\\ \text{MARKING} & \textit{unmarked}\\ \text{SUBCAT} & \langle\rangle\end{array}\right]\\ \text{CONT INDEX VAR }e'\end{array}\right]\\ \text{NL}\left[\text{INHER SLASH}\left\{\boxed{4}\right\}\right]\end{array}\right]\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{INDEX VAR }x\\ \text{MAIN }\alpha\wedge\beta\end{array}\right]\end{array}\right]\\ \text{NL}\left[\text{TB SLASH}\left\{\boxed{4}\right\}\right]\end{array}\right]\\ \text{LF}\left[\begin{array}{ll}\text{EXC} & \alpha\wedge\beta\\ \text{INC} & \alpha\wedge\beta\\ \text{PARTS} & \langle x,\alpha\wedge\beta\rangle\end{array}\right]\end{array}\right]$$

and $x \lhd \alpha$ (x occurs in the first conjunct)
and $z \lhd \alpha$ (z occurs in the first conjunct.
Since there is no pied-piping in our example $z = x$)
and $x \lhd \beta$ (x occurs in the second conjunct)
and $e' \lhd \beta$ (e' occurs in the second conjunct)

(30) The lrs of the relative clause:

$$\left[\begin{array}{ll}\text{EXCONT} & [\ldots x\ldots]\wedge[\exists e'([\mathsf{take}(w,e',m,x)])]\\ \text{INCONT} & [\ldots x\ldots]\wedge[\exists e'([\mathsf{take}(w,e',m,x)])]\\ \text{PARTS} & \langle w,e',m,x,\lambda w.\ldots,\exists e'(\ldots),\mathsf{take},\mathsf{take}(w,e',m,x)\rangle\end{array}\right]$$

If we combine the RelS with the rest of the sentence:

- The RelS has the same INDEX VAR value as the head noun (x). This value must appear in both conjuncts:
  $[\ldots x\ldots]\wedge[\exists e'([\mathsf{take}(w,e',m,x)])]$
- According to (b) of the SEMANTICS PRINCIPLE the INCONT value of the noun must be a subexpression of the first conjunct:
  $[\ldots \mathsf{picture}(w,x)\ldots]\wedge[\exists e'([\mathsf{take}(w,e',m,x)])]$
- In order to bind all occurrences of x the entire conjunction must be a subexpression of $\iota x(\ldots)$:
  $\iota x([\ldots \mathsf{picture}(w,x)\ldots]\wedge[\exists e'([\mathsf{take}(w,e',m,x)])])$
- $\iota x(\ldots)$ is of type e and, thus, of the appropriate type for the argument position of look-at.

(31) The lf of (23):

$\lambda w.\exists e(\mathsf{look\text{-}at}(w,e,p,\iota x(\mathsf{picture}(w,x)\wedge\exists e'(\mathsf{take}(w,e',m,x)))))$

4.2 The propositional case

(32) Propositional relative clause:

a. dass die Zahlen den Garaus belegen, den die Globalisierung dem Kleinbetrieb
that the numbers the ??? prove which the globalization to the small business
machte.
made

b. $\lambda w.\exists e(\mathsf{prove}(w, e, \mathsf{Z}, \lambda w.\exists e'(\mathsf{make}(w, e', \mathsf{G}, \mathsf{K}, \iota x(\mathsf{garaus}(w, x))))))$

(33) The lrs of *die Zahlen den Garaus belegen*:

$$\begin{bmatrix} \textsc{excont} & \textit{me} \\ \textsc{incont} & \mathsf{prove}(w, e, Z, [\iota x([\mathsf{garaus}(w, x)])]_{st}) \\ \textsc{parts} & \langle w, e, Z, x, \lambda w. \ldots, \exists e(\ldots), \mathsf{prove}, \mathsf{prove}(w, e, Z, [\ldots x \ldots]), \\ & \mathsf{garaus}, \mathsf{garaus}(w, x), \iota x([\mathsf{garaus}(w, x)])\rangle \end{bmatrix}$$

(34) The lrs of *die Globalisierung dem Kleinbetrieb t machte*:

$$\begin{bmatrix} \textsc{excont} & \textit{me} \\ \textsc{incont} & \mathsf{make}(w, e', G, K, [\ldots x \ldots]) \\ \textsc{parts} & \langle w, e', G, K, x, \lambda w. \ldots, \exists e'(\ldots), \mathsf{make}, \mathsf{make}(w, e', G, K, [\ldots x \ldots])\rangle \end{bmatrix}$$

(35) The lrs of the relative clause:

$$\begin{bmatrix} \textsc{excont} & [\ldots x \ldots] \wedge [\exists e'([\mathsf{make}(w, e', G, K, [\ldots x \ldots])])] \\ \textsc{incont} & [\ldots x \ldots] \wedge [\exists e'([\mathsf{take}(w, e', G, K, [\ldots x \ldots])])] \\ \textsc{parts} & \langle w, e', G, K, , x, \lambda w. \ldots, \exists e'(\ldots), \mathsf{make}, \mathsf{make}(w, e', G, K, [\ldots x \ldots])\rangle \end{bmatrix}$$

If we combine the RelS with the rest of the sentence:

- The RelS has the same INDEX VAR value as the head noun (x). This value must appear in both conjuncts:
  $[\ldots x \ldots] \wedge [\exists e'([\mathsf{take}(w, e', G, K, [\ldots x \ldots])])]$
- According to (b) of the SEMANTICS PRINCIPLE the INCONT value of the noun must be a subexpression of the first conjunct:
  $[\ldots \mathsf{garaus}(w, x) \ldots] \wedge [\exists e'([\mathsf{make}(w, e', G, K, [\ldots x \ldots])])]$
- **But:** *Garaus* cannot be modified, i.e., the coordination cannot be in the scope of ιx.
- **Solution:** the semantics of the relative clause:
  $\lambda w.\exists e'((\mathsf{make}(w, e', G, K, \iota x(\mathsf{garaus}(w, x))) \wedge \mathsf{make}(w, e', G, K, \iota x(\mathsf{garaus}(w, x)))))$
- This expression is of type st and can, thus, be used as the semantic argument of $\mathsf{prove}(w, e, Z, [\ldots x \ldots])$:
  $\lambda w.\exists e(\mathsf{prove}(w, e, Z, \lambda w.\exists e'((\mathsf{make}(w, e', G, K, \iota x(\mathsf{garaus}(w, x))) \wedge \mathsf{make}(w, e', G, K, \iota x(\mathsf{garaus}(w, x))))))))$

(36) HPSG encoding of the expression using identities:

$$\begin{bmatrix} \textit{coordination} \\ \text{C1} \ \boxed{1}\, \mathsf{make}(w, e', G, K, \iota x(\mathsf{garaus}(w, x))) \\ \text{C2} \ \boxed{1} \end{bmatrix}$$

5 Reflections

Identities in LRS

- Concord: two words contribute the same semantic operator.

  (37) a. Janek **nie** pomaga **nikomu** (Polish)
  Janek NM helped nobody
  'Janek didn't help anyone.'
  b. Jan **wou** gebel **het** (Afrikaans)
  Jan wanted called have
  'Jan wanted to call.'

  $\Longrightarrow$ Identities lead to simpler logical forms.

- "Doubling": a particular subexpression is used several times.
  $\Longrightarrow$ Identities lead to more complex logical forms.

  Possible because the conjunction introduced by the relativizer needs two conjuncts. Both conjuncts are of the same semantic type, so we can just use the same conjunct twice.

  The full expressions must be identical, i.e., it does not cover the potential of the so-called *equality-up-to*-constraints in Pinkal (1996) or Egg et al. (2001).

Potential further cases of doubling
Nonrestrictive relative clauses:

(38) a. I have not seen Omen II, which is playing at the Bijou. (Sells, 1985)
$\neg\mathsf{see}(i, \iota x(\mathsf{omen2}(x))) \wedge \mathsf{play\text{-}at\text{-}the\text{-}bijou}(\iota x(\mathsf{omen2}(x)))$
b. Every student is assigned a tutor, who is responsible for the student's well-being in college.
$\forall x(\mathsf{student}(x) \rightarrow \exists y(\mathsf{tutor}(y) \wedge \mathsf{be\text{-}ass}(x, y)) \wedge \mathsf{responsible}(\iota y(\mathsf{tutor}(y) \wedge \mathsf{be\text{-}ass}(x, y))))$
c. Contribution of the relativizer:
$\alpha \wedge \ldots \iota x(\delta) \ldots$ (where α contains a subexpression of the form $Qx\delta$)

6 Conclusion

- Data with bound words are a valuable empirical resource. The analysis is compatible with any account of bound words (Riehemann, 2001; Richter and Sailer, 2003; Soehn and Sailer, 2003).
- The approach is compatible with a lexical as well as with a constructional analysis of the syntax of relative clauses.
- The availability of a PRC reading is correctly restricted to certain matrix predicates.
- LRS allows for a homogenous syntactic analysis of relative clauses which can still account for the intriguing semantic phenomena which seem to motivate a Raising Analysis.

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