Distributionally Restricted Words in LRS

Frank Richter and Manfred Sailer

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1 Introduction

In this talk we will bring together two branches of research that we have been working on in the last few years: *Lexical Resource Semantics* (LRS) and a *collocation module* for HPSG. LRS is being developed in cooperation with Gerald Penn (University of Toronto). Research on the collocation module is carried out in the project *Distributional Idiosyncrasies* of the Sonderforschungsbereich 441 of the German Science Foundation.

2 A (very) short introduction to LRS

LRS enables us to

1. use identities to account for concord phenomena (negative concord, multiple interrogatives).
2. provide a more local theory of semantic selection.
3. give a natural account of discontinuity phenomena in logical forms.

2.1 Ontology

(1) Appropriateness conditions for the sort *sign*:

sign	PHON	*phonology*
	SYNSEM	*synsem*
	LF	*lrs*

Note: The logical form of a sign is not its SYNSEM LOCAL CONTENT value; instead it is a direct property of the sign itself. The SYNSEM LOCAL CONTENT value only comprises the parts of the logical form that are necessary for semantic selection.

(2) Appropriateness conditions for the sort *lrs*:

lrs	TOP	*me*
	BOTTOM	*me*
	PARTS	*list(me)*

Intuitions:

- TOP: the term that is associated with the logical form of a complete phrase.
- BOTTOM: the maximal subtree in the term tree of a phrase that is in the scope of syntactically higher semantic operators within the same head projection.
- PARTS: all nodes of the term tree of the overall logical form that are contributed by this sign.

For ease of readability, we use a shorthand such that:

$\overline{\phi}$ gives the TOP value

$\underline{\phi}$ gives the BOTTOM value

$\phi[\psi_1, \ldots, \psi_n]$: the terms $\psi_1, \ldots, \psi_n$ are subterms of the term ϕ.

2.2 Lexical specifications of logical forms

In (3) we show the description of the logical form of *book* as given in its lexical entry:

(3) *book*: $\underline{\mathsf{book}'(x)}$ and TOP $= Qx[\phi]$

$$\begin{bmatrix} \text{TOP} & \begin{bmatrix} \textit{quantifier} \\ \text{VAR } x \end{bmatrix} \\ \text{BOTTOM} & \mathsf{book}'(x) \\ \text{PARTS} & \left\langle x, \mathsf{book}'(x),\ \mathsf{book}' \right\rangle \end{bmatrix}$$

The BOTTOM value (the underlined term) is the predicate and its arguments. The TOP value is not fully specified. The PARTS list contains exactly all the subterms of the BOTTOM term. According to our specification, the TOP value is some quantifier that binds the variable x. Note that the quantifier is not introduced by the word *book*. As a consequence, it does not appear in the PARTS list but must, eventually, be introduced inside the head projection line of the noun.

(4) *some*: $\underline{\exists x}[\alpha \wedge \beta]$

$$\begin{bmatrix} \text{TOP} & \mathit{me} \\ \text{BOTTOM} & \exists x[\alpha \wedge \beta] \\ \text{PARTS} & \left\langle x,\ \exists x[\alpha \wedge \beta],\ [\alpha \wedge \beta] \right\rangle \end{bmatrix}$$

The quantifier is underlined, indicating that it is the BOT value. This term, the variable and the conjunction are also in the PARTS list. The metavariables α and β indicate that the two conjuncts are not themselves on the PARTS list.

(5) *everyone*: $\overline{\forall x}[\alpha[\underline{\mathsf{human}'(x)}] \rightarrow \beta]$

$$\begin{bmatrix} \textit{lrs} & \\ \text{TOP} & \boxed{1}\ \forall x[\alpha \rightarrow \beta] \\ \text{BOT} & \boxed{2}\ \mathsf{human}'(x) \\ \text{PARTS} & \left\langle x,\ \boxed{1},\ \boxed{2},\ \mathsf{human}',\ [\alpha \rightarrow \beta] \right\rangle \end{bmatrix} \ \&\ \boxed{2} \lhd \alpha$$

The TOP value is overlined (the universal quantifier). The BOT value is the restriction to humans. The quantifier, all underlined subterms and the implication are in the PARTS list, but not the antecedent and the consequent of the implication (the metavariables α and β). With the expression $\alpha[\mathsf{human}'(x)]$ we indicate that the term $\mathsf{human}'(x)$ is a subterm of the term denoted by α.

(6) *read*: $\exists e[\phi[\underline{((\mathsf{read}'e)y)x}]$ and $\exists e.\phi \lhd$ TOP

$$\begin{bmatrix} \textit{lrs} & \\ \text{TOP} & \boxed{1}\ \mathit{me} \\ \text{BOTTOM} & ((\mathsf{read}'e)y)x \\ \text{PARTS} & \langle e, x, y, \exists e\phi, ((\mathsf{read}'e)y)x, (\mathsf{read}'e)y, \mathsf{read}'e, \mathsf{read}' \rangle \end{bmatrix} \begin{array}{l} \&\ ((\mathsf{read}'e)y)x \lhd \phi \\ \&\ \exists e\phi \lhd \boxed{1} \end{array}$$

The BOTTOM value is the expected term. As all its subterms are specified, they occur in the PARTS list. The TOP value is not specified. However, there is an existential quantification (binding the variable e). The notation $\phi[((\mathsf{read}'e)y)x]$ states that the BOT value is a subterm of the term denoted by the metavariable ϕ. The additional constraint $\exists e.\phi \lhd$ TOP says that the existential quantification is a subterm of the TOP value. Note that neither ϕ nor the TOP value occur as elements of the PARTS list.

2.3 Principles

(7) The BOTTOM PRINCIPLE (BP):
In each *lrs*, the BOTTOM value is an element of the PARTS list and a component of the TOP value.

(8) The TOP PRINCIPLE (TP):

1. In every phrase, the TOP value of the non-head daughter is an element of its PARTS list.
2. In every utterance, every subterm of the TOP value of the utterance is an element of its PARTS list, and every element of the utterance's PARTS list is a subterm of the TOP value.

(9) SEMANTICS PRINCIPLE

In each *headed-phrase*,

1. the TOP value of the head and the mother are identical,
2. the BOTTOM value of the head and the mother are identical,[1]
3. the PARTS value contains exactly all elements of the PARTS values of the daughters,
4. the following conditions hold:
   (a) if the nonhead is a quantifier then its TOP value is of the form $Qx[\rho \circ \nu]$[2], the BOTTOM value of the head is a component of ρ, and the TOP values of both daughters are identical,
   (b) if the non-head is a quantified NP with a TOP value of the form $Qx[\rho \circ \nu]$, then the BOTTOM value of the head is a component of ν,
   (c) in a *head-marker-phrase*, the TOP value of the non-head is identical to the TOP value of the mother.
   (d) in a *head-adjunct-phrase*, the TOP value of the non-head is a component of the TOP value of the head, and
      i. if the non-head is an intersective modifier, then its TOP value is of the form $\alpha \wedge \beta$ and the BOTTOM value of the head is a component of β.
      ii. if the nonhead is a non-intersective modifier, then it is of the form $\alpha(\beta)$ and the BOTTOM value of the head is a component of β.
   (e) In a *head-filler-phrase*, the TOP value of the filler is a component of the TOP value of the head.

2.4 An Extensional Fragment

Quantifier Scope

(10) Every student read some book.

a. $\exists e \forall x[\mathsf{student'}(x) \rightarrow \exists y[\mathsf{book'}(y) \wedge \mathsf{read'}(e,x,y)]]$

b. $\forall x[\mathsf{student'}(x) \rightarrow \exists e \exists y[\mathsf{book'}(y) \wedge \mathsf{read'}(e,x,y)]]$

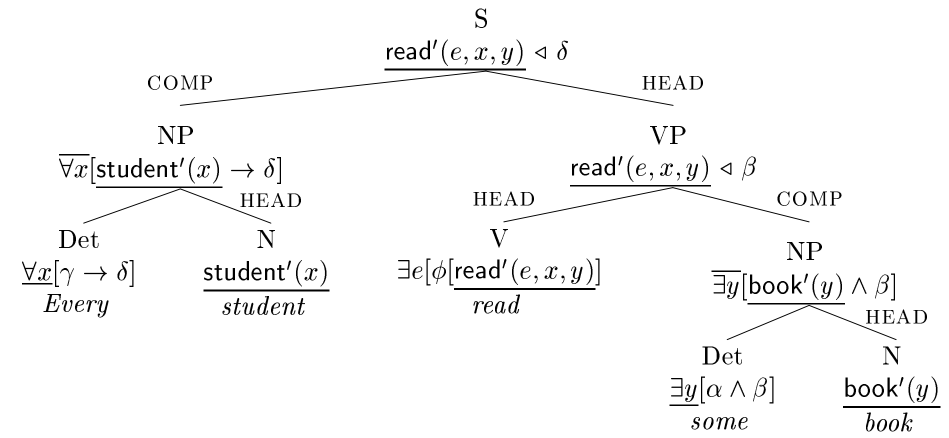
c. $\forall x[\mathsf{student'}(x) \rightarrow \exists y[\mathsf{book'}(y) \wedge \exists e[\mathsf{read'}(e,x,y)]]]$

d. $\exists e \exists y[\mathsf{book'}(y) \wedge \forall x[\mathsf{student'}(x) \rightarrow \mathsf{read'}(e,x,y)]]$

e. $\exists y[\mathsf{book'}(y) \wedge \exists e \forall x[\mathsf{student'}(x) \rightarrow \mathsf{read'}(e,x,y)]]$

f. $\exists y[\mathsf{book'}(y) \wedge \forall x[\mathsf{student'}(x) \rightarrow \exists e[\mathsf{read'}(e,x,y)]]]$

(11)



[1] Here we are assuming that quantified NPs are nominal projections.

[2] $Qx[\rho \circ \nu]$ is shorthand for the description $\begin{bmatrix} \textit{quantifier} & \\ \text{VAR} & \textit{var} \\ \text{SCOPE} & \begin{bmatrix} \textit{l-const} & \\ \text{ARG1} & \rho \\ \text{ARG2} & \nu \end{bmatrix} \end{bmatrix}$.

Recursive Modification

(12) (an) apparently simple example
$\mathsf{apparently}'(\mathsf{simple}'(x)) \wedge \mathsf{example}'(x)$

(13) Derivation:

N'
$[\mathsf{apparently}'(\mathsf{simple}'(x)) \wedge \underline{\mathsf{example}'(x)}]$

ADJ: AP
$[\mathsf{apparently}'(\underline{\mathsf{simple}'(x)})\overline{\wedge}\beta]$

- ADJ: Adv
  $\underline{\mathsf{apparently}'(\gamma)}$
  apparently
- HEAD: Adj
  $[\alpha[\underline{\mathsf{simple}'(x)}]\overline{\wedge}\beta]$
  simple

HEAD: N
$\underline{\mathsf{example}'(x)}$
example

3 Distributionally restricted words: some data

The German verb *fackeln* has two meanings: (i), *to burn*, occurring mainly with particles such as *ab-* (*flare off*); (ii), *to dither, to shilly-shally.* We will focus on the second use. In the COSMAS-I corpus (`www.ids-mannheim.de/~cosmas`), there are 280 occurrences of it. 241 (86%) are in the combination *nicht lang(e) fackeln*, illustrated in (14).

(14) Der neue Geschäftsführer fackelt nicht lange.
the new manager dithered not long 'The new manager didn't dither very long.'

The remaining 39 (14%) occurrences contain: 22 (7.86%) with *lang(e)* and other negative markers (as *ohne* (*without*), *nie* (*never*), see (15a)), 3 (1.1%) with a durational modifier and a negative element both different from *lange* and *nicht*, see (15b). In 2 (0.7%) cases *lange* occurs, but no negative element (15c). There are 9 (3.2%) instances of *nicht* and no durational modifier (15d) and 3 (1.1%) contain a negative marker different from *nicht* (*ohne* (*without*) in all these examples) but no durational modifier (15e).

(15) a. Ohne lange zu fackeln, rannte der Helfer in die Wohnung.
without long to dither ran the helper into the apartment
'The helper ran into the apartment without dithering very long.'

b. Es gebe zwei Punkte, in denen eine Politesse keine Minute fackle, ...
there are two points at which a traffic warden no minute dithers
'There are two points at which a traffic warden wouldn't dither a minute.'

c. Harsche SVP-Kritik erntete die Regierung dafür, dass sie so lange fackle ...
harsh SVP criticism reaped the government that for that it so long dithered
'The government reaped harsh criticism from the SVP for dithering so long.'

d. Aber Margret Thatcher hat nicht gefackelt.
but Margret Thatcher has not dithered 'But Margret Thatcher didn't dither.'

e. Ohne zu fackeln, zückte einer von ihnen ein Messer.
whithout to dither drew one of them a knife
'One of them drew a knife without dithering.'

We can add introspective and further corpus data to these observations. As a result, we find that the verb *fackeln* may occur with a wide range of durational modifiers and occur in many contexts that license NPIs. The defalcation of one of these requirements decreases grammaticality significantly.

(16) a. Keiner hat einen Moment gefackelt, bevor er ins Wasser gesprungen ist.
nobody has a moment dithered before he into the water jumped has
'Nobody dithered a moment before jumping into the water.'

b. ? Keiner hat gefackelt, bevor er ins Wasser gesprungen ist.
Nobody has dithered before ... ‘Nobody dithered before ... ’

c. *? Peter hat einen Moment gefackelt, bevor ...
Peter has a moment dithered before ... ‘Peter dithered a moment before ... ’

d. * Peter hat gefackelt, bevor ...
Peter has dithered before ... ‘Peter dithered before ... ’

We conclude that for its linguistic contexts of occurrence, the verb *fackeln* requires (1) to be in the scope of a durational modifier and (2) that the verb and the modifier be in the scope of an NPI licensing operator. While this generalization applies to the introspective and most of the corpus data, examples such as (15c–e) suggests that further research is needed to hone the generalizations.

4 A collocation module for HPSG

The question is whether the obligatory presence of the durational modifier can be reduced to selection, i.e., whether we can treat it as an adverbial complement as in the case of *dauern* (*take (time)*). If obligatory presence were the only criterion, the durational modifier would count as a complement. On the other hand, semantically the adverb behaves like a modifier, which is a clear difference to *dauern*. The possibility of having a durational modfier and its interpretation follow directly from classifying the verb as atelic. It is only the obligatory presence of the modifier that is special. Therefore, it should be treated as a collocational, not a selectional requirement.

Within HPSG (and similarly for frameworks such as GPSG, GB, LFG, Categorial Grammar, and even Construction Grammar) no established mechanism characterizes collocational requirements beyond selection. In other frameworks, most prominently in the London School (Firth, 1957, p. 190–215) and its descendents (Butler, 1985), a lexical element is defined and particularized by its collocational restrictions.

(17) “The defining feature of a lexical item, by which such an item is recognized, is its pattern of co-occurrence with other items, that is its *collocational* behaviour. A lexical item is recognized as different from other lexical items because its total pattern of collocation is unique.” (Butler, 1985, p. 130)

Given the obligatory presence of the durational modifier for *fackeln* we have to acknowledge the necessity of a collocation component. Following the insights of other frameworks, we now introduce the attribute COLL at the level of *sign*. The value of COLL is a list, which is empty for non-lexical signs. A lexical sign has exactly one element in its COLL value: the root sign of the utterance in which it occurs. This is enforced by the COLL PRINCIPLE, which can be easily formalized in RSRL (Richter et al., 1999; Richter, 2000).

(18) The COLL PRINCIPLE

$$\boxed{1}\big[\mathit{sign}\,\big] \Rightarrow \left(\begin{array}{l} \mathbf{A}\boxed{2}\ \mathbf{A}\boxed{3} \\ \left(\begin{array}{l} \texttt{dominate}(\boxed{1},\boxed{2}) \\ \&\ \ \boxed{2}\big[\text{COLL}\ \langle\boxed{3}\rangle\big] \end{array} \right) \Rightarrow \texttt{dominate}(\boxed{3},\boxed{1}) \end{array} \right)$$

Having introduced these prerequisites of a theory of collocations, we can now specify the requirements that the verb *fackeln* imposes on its occurrences as part of its lexical entry.

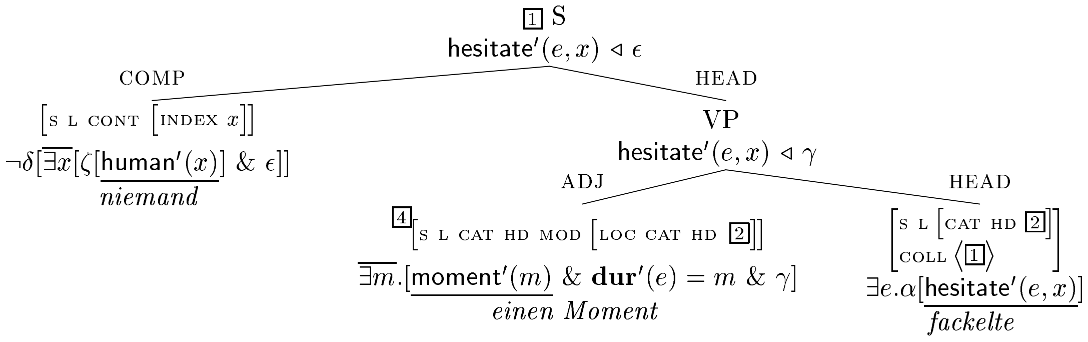


Figure 1: The analysis of *(dass) niemand einen Moment fackelte* (*(that) nobody dithered a moment*)

(19) Sketch of the lexical entry of *fackeln*:

$$\left[\begin{array}{l} \textit{word} \\ \text{PHON } \langle \textit{fackeln} \rangle \\ \text{SYNS LOC } \left[\begin{array}{ll} \text{CAT HEAD } \boxed{2}\ \textit{verb} & \\ \text{CONTENT} & \left[\begin{array}{ll} \text{INDEX} & e \\ \text{MAIN} & \boxed{3}\ \mathsf{hesitate}'(e,x) \end{array}\right] \end{array}\right] \\ \text{LF } \left[\begin{array}{ll} \text{TOP} & me \\ \text{BOT} & \boxed{3} \\ \text{PARTS} & \langle e,\ x,\ \mathsf{hesitate}',\ \mathsf{hesitate}'(e),\ \boxed{3},\ \exists e.\alpha \rangle \end{array}\right] \\ \text{COLL} \langle \boxed{1} \rangle \end{array}\right]$$

and $\boxed{3} \lhd \alpha$

and $\mathbf{E}\boxed{4} \left(\begin{array}{l} \texttt{dominates}(\boxed{1},\boxed{4}) \\ \boxed{4} \left[\begin{array}{ll} \text{SYNS LOC} & \left[\text{CAT HEAD MOD } \left[\text{LOC CAT HEAD } \boxed{2}\right]\right] \\ \text{LF} & \left[\text{PARTS } \langle \ldots,\ \mathbf{dur}'(e),\ \ldots \rangle\right] \end{array}\right] \end{array} \right)$

In (19) we specify that the sign in the COLL list must dominate a modifier which (i) modifies the verb *fackeln* and (ii) has a durational operator in its semantic representation. The first requirement is directly stated by tag $\boxed{2}$. For the second, we assume that we can identify the class of durational modifiers by their CONTENT values, i.e., their *logical form*. Following Kamp and Reyle (1993), we posit a semantic constant $\mathbf{dur}'$ whose interpretation is the duration of an event and which occurs in the logical form of all durational modifiers.

4.1 More evidence for a collocational component

In Richter and Sailer (2002) we motivate the collocational component with so called *cranberry words* (*unique elements*, *hapax legomena*). These words impose very strict restrictions on the possible contexts of occurrence. Therefore they are ideal for investigating the properties of a collocational component. Some examples:

(20) a. die Nase <u>rümpfen</u>
the nose wrinkle
"wrinkle one's nose"

b. jemandem Angst <u>einjagen</u>
someone fear in.chase
"frighten someone"

c. kein <u>Hehl</u> aus etwas machen
no secret of something make
"not to make a secret of sth."

(21) a. essen/ *futtern wie ein <u>Scheunendrescher</u>
eat/ tuck in like a barn.thresher
"eat like a horse"

b. aufpassen/ *hinschauen wie ein <u>Schießhund</u>
be alert/ watch like a shoot dog
"be on one's toes"

(22) a. klipp und klar b. kreuz und quer c. frank und frei

a. klipp und klar	b. kreuz und quer	c. frank und frei
?? and clear	cross? and crosswise	frank and free
"very clear"	"higgledy-piggledy"	"frankly"

The theoretical significance of a collocation theory for the architecture of grammar becomes evident upon considering principles of grammar such as the TRACE PRINCIPLE and the principles of Binding Theory of Pollard and Sag (1994). Being concerned with the distribution of single lexical elements (the trace, anaphora and pronouns), the principles of grammar can — and maybe should — be re-phrased in terms of collocational restrictions on these elements

(23) The TRACE PRINCIPLE (TP) of Pollard and Sag (1994):
The SYNSEM value of any trace must be a (noninitial) member of the SUBCAT list of a substantive word.

(24) The lexical entry of the trace, including the TRACE PRINCIPLE as a collocational restriction:

$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle\rangle \\ \text{SYNS } \boxed{1} \begin{bmatrix} \text{LOC} & \boxed{2} \\ \text{NONL} & \begin{bmatrix} \text{INHER} & \begin{bmatrix} \text{SL} & \{\boxed{2}\} \\ \text{QUE} & \textit{eset} \\ \text{REL} & \textit{eset} \end{bmatrix} \\ \text{TO-B} & \begin{bmatrix} \text{SL} & \textit{eset} \\ \text{QUE} & \textit{eset} \\ \text{REL} & \textit{eset} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{COLL } \langle\boxed{3}\rangle \end{bmatrix} \begin{array}{l} \& \ \texttt{dominate}(\boxed{3},\boxed{4}) \\ \& \ \boxed{4} \begin{bmatrix} \textit{word} \\ \text{SYNS LOC CAT} \begin{bmatrix} \text{HEAD} & \textit{subst} \\ \text{SBC} & \langle [\textit{synsem}], \ldots, \boxed{1}, \ldots \rangle \end{bmatrix} \end{bmatrix} \end{array}$$

5 A representational account of polarity sensitivity

The most successful theories of PI licensing rely on the entailment properties of the context in which a PI may or may not occur. Such entailment-based theories (EBT) have been proposed in Fauconnier (1975), Ladusaw (1980) and refined in Zwarts (1981, 1986, 1997). Downward entailing (DE) environments are those which allow inferences from sets to subsets. For example the sentence *Nobody likes vegetables* implies *Nobody likes carrots*, whereas *Everybody likes vegetables* does not imply *Everybody likes carrots*. The EBT allows us to group contexts created by *not*, *nobody*, *few*, *seldom* for which a purely syntactic characterization is not plausible.

(25) Elements of the Entailment-based Theory of NPI licensing (EBT):

a. An NPI must be in the scope of a downward-entailing (DE) operator.

b. An operator O is DE iff for all X and Y: $X \subseteq Y \rightarrow f(Y) \subseteq f(X)$

DE is only one of the possibly relevant entailment properties:

(26) Hierarchy of monotone decreasing functors (van der Wouden, 1997, p. 104)

mononton decreasing
$f(X \subseteq Y) \rightarrow f(Y) \subseteq f(X)$
few, seldom, hardly

antimultiplicative
$f(X \cap Y) \rightarrow f(X) \cup f(Y)$
not every, not always

anti-additive
$f(X \cup Y) \rightarrow f(X) \cap f(Y)$
nobody, never, nothing

antimorphic
$f(X \cap Y) \rightarrow f(X) \cup f(Y)$
$f(X \cup Y) \rightarrow f(X) \cap f(Y)$
not, not the teacher
Dutch: *allerminst, allesbehalve*

Not withstanding the merits of the EBT, it encounters severe problems with PI licensing in double negatives, embedded sentences, in conditionals and in questions (see Baker (1970); van der Wouden (1997); Giannakidou (1998) for discussion).

In van der Wouden (1997) a link was made from collocation theory to theories of PI licensing. Van der Wouden assumes an EBT, where the characterization of the entailment requirements is considered a collocational restriction. Given the collocation theory of Section 4, we can try to integrate van der Wouden's proposal formally. This integration is not straightforward because the architecture of a linguistic sign in HPSG does not encode its entailment properties. Thus, we would need to introduce this information in order to adopt an EBT. On the other hand, if we follow van der Wouden's insight about the connection between collocation theory and PI licensing, the theory of collocation should provide the necessary mechanisms to express polarity requirements.

Our theory of collocations in Section 3 allows us to refer to the logical form of a licenser, in the case above the durational modifier. The logical form of an utterance reveals which operators have scope over the semantic constant contributed by *fackeln.* Therefore, if we can present a characterization of the DE operators, we can formulate a representational theory of PI licensing. The table in (27) illustrates the logical form of some NPI-licensers of different strengths. If we allow some semantic decomposition at the level of logical form, as is done in von Stechow (1993, 1996) and Przepiórkowski and Kupść (1999), we can characterize all DE operators as introducing negation ("$\neg$") to the logical form of the sentence. In the case of a strong (antimorphic) negation, as introduced by *nicht* (*not*), negation is the only operator that is introduced by the licenser. For *niemand* (*nobody*) (anti-additive licenser), the negation and an existential quantifier are introduced. All anti-multiplicative licensers are of the form "*not* + universal quantifier" (*nicht jeder* (*not everybody*)). Thus, we can emulate the entailment hierarchy in representational terms.

(27)

entailment classification	example	lf characterization
antimorphic	*nicht* (*not*)	$\neg[\ldots\phi\ldots]$
anti-additive	*niemand* (*nobody*)	$\neg(\ldots)\exists[\ldots\phi\ldots]$
anti-multiplicative	*nicht jeder* (*not everybody*)	$\neg\forall[\ldots\phi\ldots]$
downward entailing	*wenige* (*few*)	$\neg\mathsf{many}'[\ldots\phi\ldots]$

Given this representational recoding of the entailment definitions, we can integrate the polarity requirements of the verb *fackeln* into its lexical entry.

(28) Sketch of the lexical entry of *fackeln*:

$$
\begin{bmatrix}
\textit{word} \\
\textsc{phon}\ \langle \textit{fackeln} \rangle \\
\textsc{syns loc}\ \begin{bmatrix} \textsc{cat head}\ \boxed{2}\ \textit{verb} \\ \textsc{content}\ \begin{bmatrix} \textsc{index}\ e \\ \textsc{main}\ \boxed{3}\ \mathsf{hesitate}'(e,x) \end{bmatrix} \end{bmatrix} \\
\textsc{lf}\ \begin{bmatrix} \textsc{top}\ \ \textit{me} \\ \textsc{bot}\ \ \boxed{3} \\ \textsc{parts}\ \langle e,\ x,\ \mathsf{hesitate}',\ \mathsf{hesitate}'(e),\ \boxed{3},\ \exists e.\alpha \rangle \end{bmatrix} \\
\textsc{coll}\langle \boxed{1} \rangle
\end{bmatrix}
$$

$$
\begin{array}{ll}
\textbf{and} & \boxed{3} \triangleleft \alpha \\
\textbf{and} & \mathbf{E}\boxed{4} \left(\begin{array}{l} \texttt{dominates}(\boxed{1},\boxed{4}) \\ \boxed{4}\begin{bmatrix} \textsc{syns loc}\ \left[\textsc{cat head mod}\ \left[\textsc{loc cat head}\ \boxed{2}\right]\right] \\ \textsc{lf}\ \left[\textsc{parts}\ \langle \ldots,\ \mathbf{dur}'(e),\ \ldots \rangle\right] \end{bmatrix} \end{array} \right) \\
\textbf{and} & \mathbf{E}\boxed{5} \left(\begin{array}{l} \texttt{dominates}(\boxed{1},\boxed{5}) \\ \boxed{5}\left[\textsc{lf}\ \left[\textsc{parts}\ \langle \ldots,\ \neg\beta,\ \ldots \rangle\right]\right] \\ \textbf{and}\ \boxed{3} \triangleleft \beta \end{array} \right)
\end{array}
$$

With this lexical entry, we can analyze a typical sentence containing *fackeln* in Figure 2. The collocational requirements of the verb are met in Figure 2: (i), the CONTENT value of sign $\boxed{1}$ contains a negation operator that has scope over the constant contributed by the verb, and (ii), the sign in its COLL list, $\boxed{1}$, dominates a durational modifier which modifies the verb.

Some more PIs with further collocation requirements:

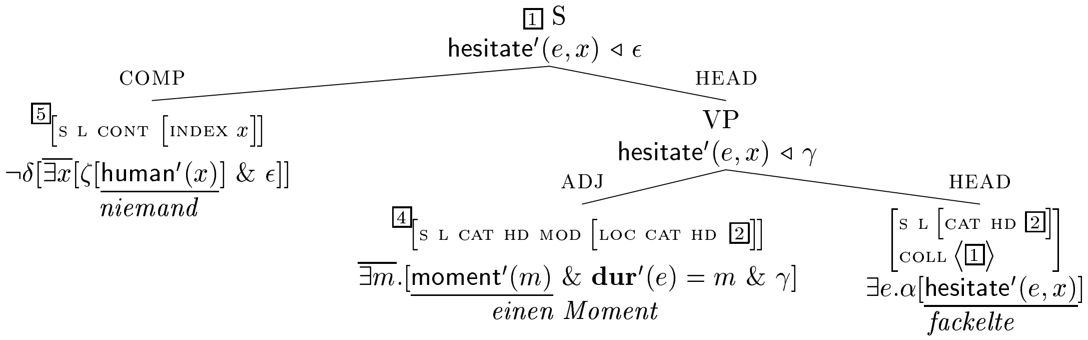


Figure 2: The analysis of *(dass) niemand einen Moment fackelte* (*(that) nobody dithered a moment*)

(29) a. Mördergrube (killer's den):

aus seinem Herzen/ Meinung/ …keine Mördergrube machen
of one's hart/ opinion/ …no killer's den make

'speak frankly about one's feelings/ opinion/ …'

b. Hehl (secret) (Richter and Sailer, 2002):

kein Hehl aus etwas machen
no secret of something make

c. ausstehen (stand) (Hoeksema, 1994):

jemanden nicht ausstehen können
someone not stand can

6 Conclusion

- LRS is a system of combinatorial semantics that combines HPSG specific analytical devices with a standard semantic representation language and techniques of semantic underspecification. As a result, we get new analyses of concord phenomena, semantic discontinuity and locality of semantic selection.
- A theory of collocations is a desideratum of most formal theories of grammar. Our architecture proposed for HPSG is a beginning to overcome this deficiency.
- The collocation theory and LRS fit well together. Their combination allows us to divide the data between "regular" or core phenomena and "idiosyncratic" or peripheral phenomena:

  Negative concord is regular
  PI licensing requirements are idiosyncratic
- A representational account of NPI licensing appears equally promising as an entailment-based account. The EBT is forced to rely on both entailment and structural notions such as "immediate scope." We, on the other hand, can arrive at predictions for NPI licensing by using logical forms alone. This seems to be a more economical approach.

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