Collocations and the Representation of Polarity

1 Introduction

We will discuss the distribution of the German verb *fackeln* (*dither*, in the sense of acting nervously or indecisively). It is a Negative Polarity Item (NPI) which must also occur within in the scope of a durational modifier. We will argue that a collocation theory is needed to account for the obligatory presence of the durational modifier. The collocational requirement must be expressed referring to the logical form of the modifier. We, then, can show that the same collocational mechanism accounts for the negation sensitivity, making reference to the logical form of the licensing context rather than to its entailment properties. We will give an analysis in the framework of Head-Driven Phrase Structure Grammar (HPSG, Pollard and Sag (1994)).

2 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 this second meaning. In the COSMAS-I corpus (`www.ids-mannheim.de/~cosmas`), there are 280 occurrences of this use. 241 (86%) are in the combination *nicht lang(e) fackeln*, illustrated in (1).

(1) 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 (2a)), 3 (1.1%) with a durational modifier and a negative element both different from *lange* and *nicht*, see (2b). In 2 (0.7%) cases *lange* occurs, but no negative element (2c). There are 9 (3.2%) instances of *nicht* and no durational modifier (2d) and 3 (1.1%) contain a negative marker different from *nicht* (*ohne* (*without*) in all these examples) but no durational modifier (2e).

(2) 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 die 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 in many contexts that license NPIs. The defalcation of one of these requirements decreases grammaticality significantly.

(3) 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 covers the introspective and most of the corpus data (94,96%), examples such as (2c–e) suggest that further research is needed to amend the generalizations to include the remaining data.

3 A Collocation Theory

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, in contrast to *dauern*. The possibility of having a durational modifier and its interpretation follow directly from classifying the verb as atelic. It is only the obligatory presence of the modifier that is idiosyncratic. 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.

> "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 will 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 a principle, the COLL PRINCIPLE:

(4) The COLL PRINCIPLE:
If a sign a dominates a sign b which has a non-empty COLL value, then the element in b's COLL value is a sign c such that c dominates a.

This principle can be easily formalized in RSRL, the underlying description language of HPSG (Richter et al., 1999).

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.

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

$$\begin{bmatrix} \textit{word} \\ \text{PHON}\ \left\langle \textit{fackeln} \right\rangle \\ \text{SYNS LOC} \begin{bmatrix} \text{CAT HEAD}\ \boxed{2}\ \textit{verb} \\ \text{CONTENT}\ \ \mathsf{hesitate}(e,x) \end{bmatrix} \\ \text{COLL}\ \left\langle \boxed{1} \right\rangle \end{bmatrix} \quad \textbf{and} \quad \boxed{1}\ \text{dominates a sign} \begin{bmatrix} \text{SYNS LOC} \begin{bmatrix} \text{CAT HEAD MOD} \begin{bmatrix} \text{LOC CAT HEAD}\ \boxed{2} \end{bmatrix} \\ \text{CONT}\ \ldots \mathbf{dur}(e) \ldots \end{bmatrix} \end{bmatrix}$$

In (5) we specify that the sign in the COLL list must dominate a modifier which (i) modifies the verb *fackeln* and (ii) has a durational semantics. 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 **dur** whose interpretation is the duration of an event and which occurs in the logical form of all durational modifiers.

4 A Representational Theory of PI Licensing

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 advances the insight that NPIs can only occur in DE contexts. The use of entailment notions allows the grouping of contexts created by *not*, *nobody*, *few*, *seldom* for which a purely syntactic characterization is not plausible. Not withstanding its merits, the EBT encounters severe problems with PI licensing in embedded sentences, in conditionals and in questions (see van der Wouden (1997) for discussion).

In the EBT, the class of DE operators is divided into several subclasses: *ultra strong* negation, as introduced by negative particles like *nicht* (*not*) is called *antimorphic* and shows further entailment properties. These additional properties can be broken down in two entailment properties which correspond to the de Morgan laws of negation. These properties are called *anti-additivity* and *antimultiplicativity*. For an anti-additive operator f (such as *niemand* (*nobody*)) the following holds: $f(X \cup Y) = f(X) \cap f(Y)$. Analogously, with an antimultipicative operator (like *nicht jeder* (*not everyone*)) the following equation can be observed: $f(X \cap Y) = f(X) \cup f(Y)$ (see Kas (1993) for details). Zwarts (1997) shows that for some NPIs, a simple DE context is enough, whereas others require contexts that are at least anti-additive (but not antimultiplicative), some even require antimorphic contexts. As pointed out in van der Wouden (1997) (pp. 134–141) there are no NPIs attested that can occur in an antimultiplicative context but not in an anti-additive context. This observation is unpredicted — and so far unexplained — within the EBT.

If we consider the logical form of the licensing operators instead of their entailment properties, there is a natural account of the antimultiplicativity problem: A PI is in the scope of an antimorphic negation if in the logical form of a sentence, there is no other semantic operator intervening between the negation and the semantic contribution of the PI. The PI is in an anti-additive context, if there is only an indefinite intervening between the negation and the PI. Finally, if there are other operators intervening, in particular "real" quantifiers the PI is in a weakly negative, i.e., simply downward-entailing context. Such contexts are created by words as *wenige* (*few*) or *kaum* (*hardly*).

To characterize all DE operators as introducing negation ("¬") to the logical form of the sentence, we allow some semantic decomposition at the level of logical form, as is done in von Stechow (1993, 1996) and Przepiórkowski and Kupść (1999). For example, the logical form of the DE quantifier *wenige* (*few*) is taken to be $\neg\mathsf{many}[\ldots]$. Thus, it meets our characterization of what constitutes a simply DE context. The table in (6) indicates the logical form of some NPI-licensers of different licensing strength.[1]

(6)

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

The representational reformulation of the hierarchy of negations fixes the antimultiplicativity problem: All antimultiplicative natural language operators are of the form "*not every-*". In the

[1]For simplicity, we encode negative indefinites as existential quantifiers. The contrast between existential and universal quantification has been amply noted in the literature (e.g., (Partee, 1987), Zimmermann (1993)).

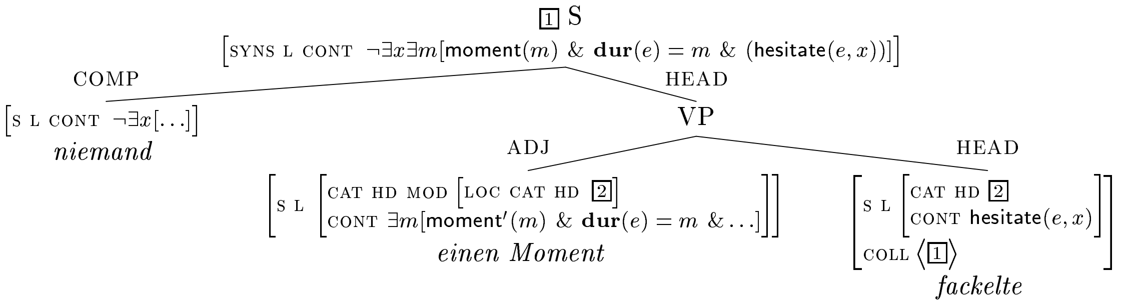

Figure 1: The analysis of *(dass) niemand einen Moment fackelte* (*(that) nobody dithered a moment*)

representational approach, these operators receive a logical form which contains a negation and a universal quantifier ("$\neg\forall$"). This representational characterization leads us to expect that these operators create contexts which form a natural class with those of simple DE-operators, i.e., contexts in which a quantifier intervenes between the negation and an NPI which is to be licensed. This observation suggests that the representational approach to NPI licensing can give a natural explanation to the lack of a class of NPIs which would be systematically predicted under the EBT.

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 3, we can attempt to integrate van der Wouden's proposal explicitly. Doing so presents complications 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, we have seen in (6) that we can reformulate the entailment notions in representational terms. 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. We would expect that reference to other operators, like negation and quantifiers, is also being made in the collocational requirements of lexical items. Thus, our theory of collocation provides the necessary means to express polarity requirements.

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

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

$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{fackeln} \rangle \\ \text{SYNS LOC} \begin{bmatrix} \text{CAT HEAD } \boxed{2}\ \textit{verb} \\ \text{CONTENT } \mathsf{hesitate}(e,x) \end{bmatrix} \\ \text{COLL} \langle \boxed{1} \left[\text{S L CONT } \ldots\neg[\ldots\mathsf{hesitate}(e,x)\ldots]\ldots\right] \rangle \end{bmatrix} \quad \textbf{and} \quad \boxed{1} \text{ dominates a sign } \begin{bmatrix} \text{S L} \begin{bmatrix} \text{CAT HEAD MOD } [\text{LOC CAT HEAD } \boxed{2}] \\ \text{CONT } \ldots\mathbf{dur}(e)\ldots \end{bmatrix} \end{bmatrix}$$

With this lexical entry, we can analyze a typical sentence containing *fackeln* in Figure 1. The collocational requirements of the verb are met: (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.

5 Conclusion

We argued that a collocation theory is needed to account for the distribution of lexical elements as the verb *fackeln*. Its requirement of a durational modifier is a classical collocational property. Once a collocation theory is introduced, we can use it to express the second distributional restriction of the verb, namely its limitation to negative contexts. We have reformulated the hierarchy of licensing strength for PIs of Zwarts (1997) in terms of the logical form of the licensers. We have seen in (6) that the representational theory is capable to make the same distinctions as the EBT and is not confronted with the antimultiplicativity problem. If time permits, we will show that its representational character enables us to address other phenomena that are problematic for the EBT as well, such as NPI-licensing under matrix verbs. Finally, studies like Hoeksema (1994) have revealed that many PIs show additional collocational restrictions. Our approach is the first to capture this observation collectively.

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