Theta-head binding in the German locative alternation[1]

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Abstract. In this paper, we analyze the locative alternation of the *spray/load*-type with *be*-prefixation in German on the basis of the analysis of free datives proposed in Hole (2008, 2012, 2014). We argue that both structures involve obligatory variable binding in a local domain, triggered by a functional theta head. The core of our analysis elaborates upon Kratzer's (2009) proposal to implement reflexivity in an agent-severed system. According to this proposal, binder indices are tied to verbal functional heads (theta heads) instead of so-called antecedent DPs.

Keywords: theta head, local binding, locative alternation, argument alternation

1. Introduction

It is well known that in German, as well as in English, possessive pronouns can be used anaphorically, or they can be bound.

(1) *Der Udo zeigte dem Peter seine Tasche.* (lexical dative)
the Udo showed the $\text{Peter}_{\text{DAT}}$ his bag
(i) 'Udo showed Peter_i his_i bag.'
(ii) 'Udo_j showed Peter his_j bag.'
(iii) 'Udo_i showed Peter_j his_k bag.'

However, such an array of options is not available in every construction. In the extra-argumental ("possessor") dative construction in German (henceforth "free dative"), the binding possibilities are more restricted. Free datives obligatorily bind a possessor variable in a local domain. The possessive-marked DPs alternate freely with Bound Bridging Definites.[2]

(2) *Der Udo trat dem Ede gegen sein/das Schienbein.* (free dative)
the Udo kicked the Ede_{DAT} against his/the shin
(i) 'Udo kicked Ede_j in his_j/the_j shin.'
(ii) *'Udo_j kicked Ede in his_j/the_j shin.'
(iii) *'Udo_i kicked Ede_j in his_k/the_k shin.'

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[2] Bound Bridging Definites are definite lexical DPs which receive an interpretation equaling (or very similar to) that of the same DP with a possessive pronoun. Crucially, the possessive pronoun in such a paraphrase is locally bound (Hole 2008, 2012, 2014).

A crucial difference between (1) and (2) is that the dative argument in (1) is a lexical argument of the verb, while the dative argument in (2) is an extra argument in an applicative-like construction.

Hole (2008, 2012, 2014) suggests that free datives as in (2), unlike the lexical datives in (1), are introduced by a verbal functional head, or a theta head.[3] Given a proposal made by Kratzer (2009), this verbal functional head ties in well with the fact that free datives always concur with a bound variable further down in the co-phasal structure. According to Kratzer, "semantic binders (λ-operators represented as binder indices) are introduced by verbal functional heads, rather than by "antecedent" DPs, as assumed in Heim and Kratzer (1998), for example. Verbal functional heads, rather than DPs, are then the true syntactic antecedents for bound pronouns" (Kratzer 2009:193). Instead of verbal functional heads, we will speak of theta heads below, in order to refer to heads that introduce a theta role and host a DP in their specifier.

We would like to propose that quite a few syntactic constructions should be analyzed in terms of theta-induced binding (Geist in prep., Hole in prep.). We argue that obligatory binding of co-phasal arguments, as with free datives, also occurs in the *spray/load*-type locative alternation given in (3b), with the base alternant in (3a). In German the locative alternant normally involves prefixation of the verb with the spatial prefix *be-* (henceforth *be*-locative alternation).

(3) a. *Paula hat Eigelb auf den Kuchen gestrichen*
Paula has egg.yolk$_{ACC}$ on the cake smeared
'Paula spread egg yolk on the cake.'
b. *Paula hat den Kuchen mit Eigelb* ***be****-strichen* (*be*-locative alternation)
Paula has the cake$_{ACC}$ with egg.yolk *be*-smeared
'Paula coated the cake with egg yolk'

Similar to the free dative construction in (2), the locative alternation construction in (3b), contains a direct object *den Kuchen* 'the cake', which binds a possessor variable in a local domain. The bound variable can *salva veritate* be made explicit as in (3'). Productively prefixed *be*-verbs always involve a bound possessor/whole variable in a PP referring to the neighborhood region OUTSIDE / SURFACE.[4] Curly brackets in (3') indicate material that is, we assume, PF-optional but semantically active, irrespective of whether it is pronounced.

(3') *den Kuchen$_i$* {*an seiner$_i$ Oberfläche*} *mit Eigelb* ***be****-streichen*
the cake$_{ACC}$ on its surface with egg.yolk *be*-smear
'coat the cake with egg yolk {on its surface}'

[3] The reasons why Hole doesn't subscribe to a Pylkkänen-style analysis of free datives are laid out in detail in Hole (2012:241-242) and in Hole (2014:295-303).
[4] SURFACE and OUTSIDE are taken here to be instantiations of a single neighborhood region.

We develop an analysis of this construction on the basis of the analysis of free datives (Hole 2012, 2014). The core of our analysis elaborates upon Kratzer's (2009:194) proposal to implement reflexivity in an agent-severed system with theta heads; these heads introduce bare binder indices into the structure. The extension of the proposal beyond free datives (Hole 2014) to the *be*-marked locative alternation forms part of a larger endeavor to demonstrate the necessity of describing many well-known argument alternations as dependent on the presence of binder theta heads.

Although we are using the term "alternation", we do not subscribe to a transformational approach, specifically one that would derive the base alternant and the non-base alternant from the same underlying structure. As pointed out by Levin & Rappaport Hovav (2005:189ff), the lexical entry of the verb captures only its core meaning. This core meaning then can be combined with the event-based meanings represented by syntactic constructions, as proposed in traditional constructional approaches (e.g., Goldberg 1995, Jackendoff 1997, Michaelis & Ruppenhofer 2001). Alternatively, the core verbal meaning can be combined with positions directly in the syntax, as proposed in the so-called neo-constructionist approaches (e.g., Arad 1998, Borer 2003). We subscribe to a neo-constructionist approach, combining a syntactic analysis with an explicit compositional semantics.

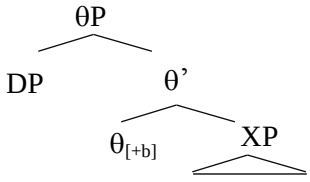
The paper is structured as follows: In section 2 we introduce our general theoretical proposal (Hole 2008, 2012, 2014). In Section 3 we apply our theoretical proposal to the *be*-locative alternation in German. Section 4 concludes.

2. Free datives: analysis and implications (Hole 2012, 2014)

2.1. The Landmark theta head with a binder feature

Hole (2008, 2012, 2014) analyzes free datives in (2) in terms of theta heads that license extra arguments, combined with reflexivization as in Kratzer (2009). This is achieved by the mechanism of a binder feature [+b] of the theta head, a mechanism upon which we will elaborate below.

(4)



One of the possible thematic contributions of the free dative DP is a locative Landmark entailment, requiring the VP eventuality to hold within the neighborhood regions of the Landmark DP referent. Another possible thematic entailment for free dative referents is the ability to perceive the VP eventuality, an entailment that Hole (2008, 2012, 2014) dubs P-Experiencerhood. Each sentence with a P-Experiencer Dative has at least one contextualized use in which the dative referent has a mental representation of the eventuality in its scope. Hence, for P-Experiencers the ability of the dative referent to perceive the eventuality is

crucial; whereas for Landmarks, the spatial relation, with the eventuality described by its sister node, is crucial. In many cases the Landmark property co-occurs with the P-Experiencer property, as in (5) and (6). However, pure Landmarkhood is also available, cf. (7).

(5) *dem Ede* θ_i *gegen* *sein*$_i$ */ das*$_i$ *Schienbein treten* (Landmark (& P-Experiencer))
the Ede$_{DAT}$ against his/ the shin kick
'kick Ede in the shin'

(6) *jedem* θ_i *streng auf* sein$_{i/*j}$ */das*$_{i/*j}$ *Steak gucken* (P-Exp (& Landmark))
everyone$_{DAT}$ strictly on his /the steak look
'look at everybody's steak in a strict manner'

(7) *Jedem Jungen* θ_i *hängt ein Taschentuch aus* *seiner*$_i$ */ der*$_i$ *Hose* (Landmark)
Every boy$_{DAT}$ hangs a handkerchief out-of his / the trousers
'A handkerchief is hanging out of every boy's trousers'

To preserve perspicuity we will confine our analysis to example (7), where the experiencer entailments are not present. The Landmark theta head θ_{LDM} responsible for the locative entailment has the following simplified semantics (cf. Hole 2012:215 for a more elaborate version):

(8) $[\![\theta_{LDM}]\!] = \lambda y. \lambda s.$ y is the landmark of s

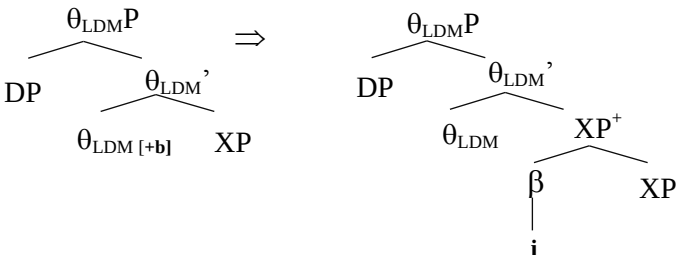
The Landmark theta head is a verbal Voice head much like Kratzer's (1996) (agentive) Voice. The free dative Voice, which always involves binding, turns out to be very similar to run-of-the-mill cases of reflexivity; those must likewise be modeled as triggered by (agentive) Voice (Kratzer 2009), under the theoretical assumptions of Kratzer's (1996) agent severance. The binding property of free datives is particularly striking with Bound Bridging Definites. Binding their implicit possessor variable across clause boundaries is impossible (9), just as between whole sentences (10a). (Anaphoric dependencies are independent of this (10b).) Local binding of Bound Bridging Definites with free datives is obligatory, however; cf. (9) again.

(9) *Klara guckte jedem* θ_i *so streng auf sein*$_{i/*j}$*/das*$_{i/*j}$ *Steak, dass* *sein*$_i$***/der***$_{*i}$ *Appetit verschwand.*
Klara looked everyone$_{DAT}$ so strictly on his /the steak that his/the appetite disappeared
'Klara was looking at everybody's steak in such a strict manner that their appetite disappeared.'

(10) a. *They passed through every small village. #The church was locked.*
b. *They arrived in a small village. The church was locked.*

We assume that the Landmark theta head comes with a binder feature [+b] which leads to structure expansion along the lines of Hole's (2014) Generalized Binder Rule in the tradition of Büring's (2005) Binder Rule; cf. (11).

(11) Generalized Binder Rule (Hole 2008, 2012, 2014)

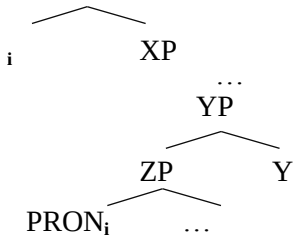


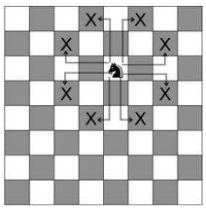
The output of (11), with the bare index c-commanding the XP, makes sure that, after Predicate Abstraction, a variable in the XP gets a value determined by the Landmark DP. (This rule, just like Büring's Binder Rule, does not conform to inclusiveness. It could easily be reformulated so as to conform to inclusiveness, however: cf. section 2.3 below for compositional details). Even though in this implementation binding is triggered by theta heads, we will continue to use the common parlance of DPs that bind variables.

2.2. Knight Move Binding

Hole (2008, 2012, 2014) shows that free datives trigger binding in a particular tree-geometric configuration. He calls this particular binding configuration "Knight Move Binding" (*Rösselsprungbindung* in German). Similar to knights in the chess game, who may only move in a specific oblique way (two squares in any non-diagonal direction, then one to the left or right), a free dative may only bind the possessor on the left branch of a prepositional co-argument. Knight Move Binding can be defined as in (12).

(12) Knight Move Binding
Binding configuration in which the binder targets the left branch of a c-commanded co-phasal DP.





If DPs and VoicePs are phases, and if derivation by phases is assumed, Knight Move Binding is a consequence of spell-out by phases. The following three observations support the idea that Knight Move Binding is the single massively-privileged binding configuration in natural language: (i) grammaticalization of reflexive pronouns are from body part DPs 'x's body part', never from representation nouns like 'picture/statue/… representing x'; (ii) bound pronouns in argument positions move to the left edge of their DPs (Reuland 2011:275); (iii) free datives and other extra arguments typically bind in a Knight Move Binding configuration (Hole 2006).

2.3. A sample derivation

This section provides an analysis of example (13a) (=(7)) along the lines of Hole (2014). In this example, the free dative argument *jedem Jungen* 'every boy_{DAT}' is introduced by a Landmark theta head, with the binder feature as discussed above, and it leads to the result that the DP in its specifier binds the possessor in the possessive DP *seiner Hose* 'his trousers'. As Bound Bridging Definites – just like possessive DPs – contain a possessor variable, they can receive the same analysis. (13b) provides the composition of the meaning of the relevant clause part, indicated by square brackets.

In this analysis, the Landmark theta head, with its binder feature, leads to the structure expansion triggered by the Generalized Binder Rule in (11). On the semantic side, this results in Predicate Abstraction over the possessor argument. The Landmark theta head combines with its complement by way of (Davidsonian) Predicate Modification.

(13) a. *dass* [*jedem Jungen* θ_i *ein Taschentuch aus seiner*$_i$ */der*$_i$ *Hose hängt*]
that every boy_{DAT} a handkerchief out-of his the trousers hangs
'that a handkerchief hangs out of every boy's trousers'

b. For any assignment g and number i:[5]

$[\![$ *jedem Jungen* θ_{LDM} i *ein Taschentuch aus der*$_i$ *Hose häng-* $]\!]^{g[i\rightarrow y]}$ =
$\lambda s.\ \forall x\ [\text{boy}(x)(s) = 1 \rightarrow s$ is a state of a handkerchief hanging out of x's trousers & x is the landmark of $s = 1]$ [FA]

$[\![$ *jedem Jungen* $]\!] = \lambda P.\ \lambda s.\ \forall x\ [\text{boy}(x)(s) = 1 \rightarrow P(x)(s) = 1]$

[DPM]

$[\![\ \theta_{\text{LDM}}$ i *ein Taschentuch aus der*$_i$ *Hose häng-* $]\!]^{g[i\rightarrow y]} = \lambda y.\ \lambda s.$ s is a state of a handkerchief hanging out of y's trousers & y is the landmark of s

$[\![\ \theta_{\text{LDM}}\ ]\!] = \lambda y.\ \lambda s.$ y is the landmark of s

[PA]

$[\![$ i *ein Taschentuch aus der*$_i$ *Hose häng-* $]\!]^{g[i\rightarrow y]} = \lambda y.\ \lambda s.$ s is a state of a handkerchief hanging out of y's trousers

[FA]

i

$[\![$ *ein Taschentuch aus der*$_i$ *Hose häng-* $]\!]^{g} = \lambda s.$ s is a state of a handkerchief hanging out of g(i)'s trousers

[5] We use the following abbreviations: DPM: Davidsonian Predicate Modification, FA: Functional Application, PA: Predicate Abstraction, DPM: Davidsonian Predicate Modification.

After the insertion of the dative DP, the result of the composition can be paraphrased as "Every boy *x* is such that *x* is the landmark of the state *s* of a handkerchief hanging out of *x*'s trousers, and *s* holds in the neighborhood of *x*'s trousers".

In the analysis (13b), we did not decompose the PP *aus der Hose* 'out of trousers'. However, for our analysis of *be*-prefixed verbs in the next section, we will decompose PPs into smaller pieces, in order to render transparent the similarity between spatial prepositions like *aus* and verbal prefixes like *be-* .

To conclude this section, Hole (2012, 2014) provides an analysis of free datives in terms of a binding voice akin to reflexivization: free datives always bind a variable in the local tense domain in the "Knight Move Binding" configuration. The binding requirement comes into the structure together with the theta head licensing the dative DP. Hole's binding account of free datives is developed in the agent-severed neo-Davidsonian Voice framework of Kratzer (1996). The bound variable in the free dative Voice is always situated at the left edge of a co-argumental possessum (or purpose) phrase. This binding configuration is called "Knight Move Binding".

3. Analysis of the locative alternation with *be*-verbs

In this section, we will apply the main ingredients of the analysis of free datives to the locative alternation with *be*-verbs in German.

3.1. General properties of the locative alternation with *be*-verbs

The locative alternation with *be*-verbs in German corresponds to the so-called *spray/load*-type locative alternation in English as described in Levin (1993:50). It involves a locatum argument – the substance or entity whose location is changed – and a location argument (Dowty 1991, Levin 1993:50, Van Valin and Lapolla 1997). This form of alternation is found with transitive verbs of directed motion relating to putting and covering.

In the base alternant of the *spray/load*-type locative alternation in German, the locative argument is realized in a PP. In the non-base alternant, in the so-called *be*-applicative, the location argument receives coding as a direct object and the verb is usually prefixed with *be-*, cf. (14/15). According to Wunderlich (1987), *be-* expresses some (external or internal) contact of the moved object with the location object (or, more generally, that the former is located in the topological proximity of the latter).

(14) *Be*-applicative: *den Kuchen*$_{\text{Location}}$ (*mit Eigelb*$_{\text{Locatum}}$) ***be-streichen***
the cake$_{\text{ACC}}$ with egg.yolk *be*-spread

(15) Base*: Eigelb*$_{\text{Locatum}}$ *auf den Kuchen*$_{\text{Location}}$ *streichen*
egg.yolk$_{\text{ACC}}$ on the cake spread

The locative alternation of the *spray/load* type in English and German has been given many descriptions and analyses in the literature. Eroms (1980) and Günther (1987) describe the

locative alternation in German as a "local phrase passive". In his semantic analysis of *be*-verbs participating in the locative alternation in German, Wunderlich (1987) considers *be*- as a preposition incorporated into the verb in the lexicon. This incorporation leads to the identification of its arguments with the arguments of the verb.

Another type of analysis, to which our analysis will be more similar, assumes no transformation or derivation of one construction from the other. Michaelis & Ruppenhofer (2000, 2001), in their analysis of *be*-verbs in the framework of Construction Grammar, suggest that *be*-verbs, which are derived not only from verbs but also nouns and adjectives, acquire a verbal argument structure pattern via combination with a particular construction. The analysis of the locative alternation of *spray/load* type in English by Rappaport & Levin (1988) goes in a similar direction. The authors assume that the alternation is the result of the verb or verbal root being associated with two different lexical semantic structures. As shown in (17), the lexical semantic structure of the locative variant (16) is part of the *with* variant.

(16) locative variant of *load:* [x CAUSE [y TO COME TO BE AT z] / LOAD]
(17) *with* variant of *load:* [x CAUSE [z TO COME TO BE IN STATE]]
BY MEANS OF [x CAUSE [y TO COME TO BE AT z] / LOAD]

The subsumption of the lexical semantic representation of the locative variant under that of the *with* variant is motivated by the intuition that the *with* variant entails the locative variant, but not vice versa. What is remarkable in the representation (17) is the double occurrence of the location argument z in the *with* variant. However, the authors do not discuss this co-occurrence from the point of view of co-argumental binding. For lack of space, we will not go into the so-called "holistic effect" frequently discussed in the context of locative alternation.

Many ingredients of the previous analyses, such as incorporation of the preposition *be*- into the verb, the composition of the meaning of locative construction and the view of the locative alternation as a "local phrase passive", are helpful, and we will integrate them in an adjusted form into our analysis. However, what should have become clear from our short overview of the analyses of locative alternations is that the phenomenon of co-argumental binding in *be*-locative constructions has not received any attention in the literature. We think, however, that co-argumental binding in *be*-constructions is a crucial ingredient of their syntax and semantics. Thus, the locative construction with the *be*-verb has hidden material in it which relates to one of the accusative referent's neighborhood regions, viz. SURFACE. The accusative location argument obligatorily binds the possessor of this neighborhood region. The bound variable can be made explicit as in (18).

(18) *den Kuchen*$_i$ {*an seiner*$_i$ *Oberfläche*} *mit Eigelb* ***be****-streichen*
the cake$_{ACC}$ on its surface with egg.yolk *be*-smear
'coat the cake with egg yolk on its surface'

In cases in which neighborhood regions other than SURFACE (typically INSIDE) co-occur with *be*-prefixed verbs, we are dealing with non-productive uses of *be-*; cf. the unpredictable behavior of cases relating to INSIDE in (19a) vs. (19b). (19c) is a case of productive *be*-prefixation, and it renders explicit the restriction to a particular substructure of the object, namely its SURFACE (Brinkmann 1997). In the base alternant of (19c) (*in/auf das Buch malen* 'paint something inside/on the book'), the object's inside or its surface could, in principle, be involved in the activity described by the verb. In the non-base alternant of the productive example (19c), however, the reading that the inside of the object is affected is excluded.

(19) a. **das Loch {innen} mit Wachs **be**-stopfen*[6]
the hole$_{ACC}$ inside with wax *be*-stuff
int.: 'stuff the hole with wax'
base: *Wachs in das Loch stopfen*

b. *den Tank {innen} mit Benzin **be**-füllen* [not productive]
the tank$_{ACC}$ inside with gasoline *be*-fill
'fill the tank with gas'
base: *Benzin in den Tank füllen*

c. *das Buch {von außen /*von innen} **be**-malen* [productive]
the book$_{ACC}$ from outside/from inside *be*-paint
'paint the book {on the outside/*on the inside}'
base: *etw. in/auf das Buch malen*

The topological restriction of the prefix *be-* to a particular substructure of the location – its SURFACE – must be part of the meaning of the *be*-locative construction. This restriction can be tied to a fact from language history. Etymologically, the prefix *be-* is related to the preposition *bi*, which denoted spatial relationships equivalent to those denoted by *bei* 'near/at', *um* 'around' and *an* 'at' (Paul 1920, Stiebels 1991); all of these involve the surface of objects.

3.2. Decomposing prepositional phrases

In our analysis of free datives in Section 2, PPs were analyzed in a traditional fashion. Because we analyze *be*-prefixed verbs in this paper, and the prefix *be-* originates from a local preposition, we will elaborate on the internal structure of prepositional phrases.

A preposition typically relates two arguments in a spatial configuration: the Figure and the Ground. The Figure argument (locatum) is the entity located with respect to the Ground argument (the reference object, relatum). An object serves as a Ground if it is combined with a preposition (cf. 20)/(21).

(20) The kids put decorations$_i$ [e$^{FIGURE}{}_i$ on the tree^{GROUND}].

[6] According to Brinkmann (1997:185), other verbs of this type: *klemmen* 'pinch/squeese', *quetschen* 'jam' and *zwängen* 'wedge/jam'. Some of them allow for *be*-prefixation, although without locative meaning, cf. *beklemmen* 'constrict/oppress'.

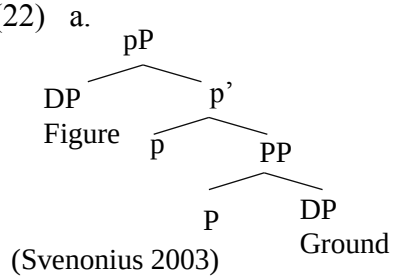
(21) [FIGURE [on GROUND]]

In order to account for the Figure/Ground distinction, and to combine this distinction with the idea of the syntactic severance of non-internal arguments (Kratzer 1996, among others), it was suggested in the syntactic literature that a prepositional phrase has a split phrase structure.

3.2.2. The split-P hypothesis (Zhang 2002, Svenonius 2003)

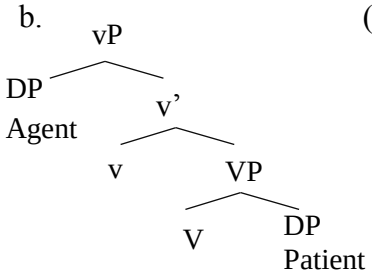
Svenonius (2003), among others, proposes a syntactic analysis of PPs, as in (22a), parallel to VPs, as in (22b). V and P decompose in similar ways and the external argument of either is introduced by a separate functional head. Little p introduces the Figure as an external argument of the preposition, parallel to Kratzer's (1996) Voice introducing the external argument of the verb, and P introduces the Ground as complement. The phrase *the book on the table* with the local preposition *on* can then be represented as in (23).

(22) a.

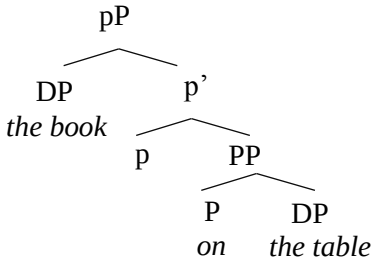


(Svenonius 2003)

b.



(23) *the book on the table*



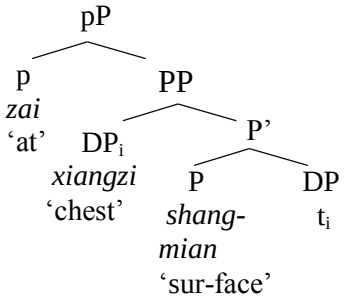
According to Svenonius, local prepositions such as *on* are inserted in P. Note that, semantically, P selects a particular spatial part of the Ground DP referent, specifically a neighborhood region. For example, *on* requires the Ground to be construed as an outside, while *in* would take a Ground construed as a container with an inside. Although neighborhood regions, such as inside or outside, are an integral part of the meaning and of the prepositional phrase structure, they are not represented in the Split-P structure of Svenonius (2003). In Chinese, such neighborhood regions are overtly specified if a preposition is used, and an optional overt relational P element *-mian* meaning 'side/face' may be used.

(24) Chinese (Zhang 2002:49)

a. zai xiangzi shang(-mian)	b. cong xiangzi xia(-mian)	c. wang xiangzi li(-mian)
at chest sur-face	from chest under	to chest in-side
'on the chest'	'from under the chest'	'in(to) the chest'

Spatial expressions like *shang(-mian)* 'sur-face' refer to what Zhang (2002) calls *place value.* She suggests that place values are merged as P, cf. the following syntactic representation for the pP in (24a):

(25) Zhang (2002) (our labels; L.G. & D.H.)



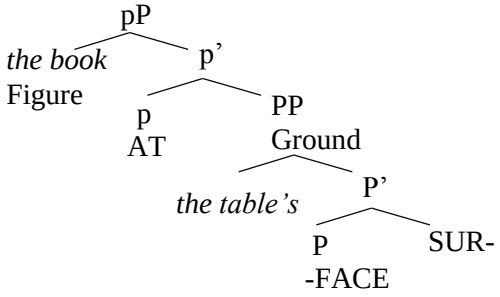
The reference object *xiangzi* 'chest' is merged as a complement of P and moves to the specifier of P.

3.2.3. The new split-P hypothesis

While we agree with Svenonius (2003) on the general idea of split phrase structure for prepositional phrases, we propose to represent neighborhood regions as explicit components of the structure, as suggested by Zhang (2002). We assume that P is realized by a relational expression, such as *side/face* corresponding to Chinese *-mian*, and that this relational expression is specified by the complement of P. The complete PP refers to a particular neighborhood region of the reference object in its specifier. The preposition *auf* in German or *on* in English can be decomposed into [AT + SURFACE], where AT expresses general spatial relatedness. One level up, AT inserted in p introduces the Figure and relates it to the Ground, specified in the complement PP of p as the SURFACE of the reference object.

(26) a. *the book on the table = "the book AT the table's SURFACE"*

b.



3.3. Analysis

As a starting point, we would like to recapitulate two properties of free datives. Property (i): free datives are introduced in the syntax. This means that free datives are extra arguments, i.e., they are not available in the base alternant, and are added in the syntax of the non-base alternant, cf. (27). Thus, if the dative argument is not realized, the entailed involvement of every boy in the event disappears, too. Property (ii): Free datives obligatorily bind a possessor variable in the local tense domain.

(27) *Jedem Jungen*$_{i}$ *hängt ein Taschentuch aus der*$_{i}$ *Hose*
every boy$_{DAT}$ hangs a handkerchief out-of the trousers
'A handkerchief hangs out of every boy's trousers'
base: *ein Taschentuch hängt aus der Hose*

To account for (i), in Section 2 it was assumed that free datives are introduced by a verbal theta head, a type of voice head called Landmark. Property (ii) was derived by assuming that the Landmark theta head has a binder feature that leads to some possessor variable in the configuration of Knight Move Binding getting bound by the DP in the specifier of the Landmark head. We would like to propose that many syntactic constructions can successfully be described by applying the mechanism of theta-induced binding by (Landmark, and other) theta heads. The locative alternation with *be*-verbs in German is one such example. As we have already shown, in *be*-constructions the location argument, i.e., the argument spatially related to the eventuality, obligatorily binds a possessor argument in the local tense domain, as shown in (28). Thus, *be*-constructions share the binding property (ii) with free datives.

(28) (=3') *den Kuchen*$_{i}$ {*an seiner*$_{i}$ *Oberfläche*} *mit Eigelb* ***be****-streichen*
the cake$_{ACC}$ on its surface with egg.yolk *be*-smear
'coat the cake with egg yolk on its surface'

Moreover, *be*-constructions share with free datives property (i), concerning the status of the binder DP. We assume that the location argument of *be*-verbs is introduced in the syntax. However, there is a difference between free datives and location arguments of *be*-verbs. In the free dative construction, the location argument is not available in the base alternant and furthermore is not entailed if omitted. In the locative construction (29), the location argument is lexically required by the verb both in the non-base and in the base alternant. It cannot be omitted (Kratzer 2006: 178). But if it is omitted in the base alternant in (29), the entailment that there is some place where egg yolk was smeared remains stable. Put differently, dropping the locative argument in the base alternant preserves the thematic entailment of the omitted PP. Hence, the location argument is lexically required by the verb.

(29) *den Kuchen mit Eigelb* ***be****-streichen*
the cake$_{ACC}$ with egg.yolk *be*-smear
'coat the cake with egg yolk'
base: *Eigelb auf den Kuchen streichen*

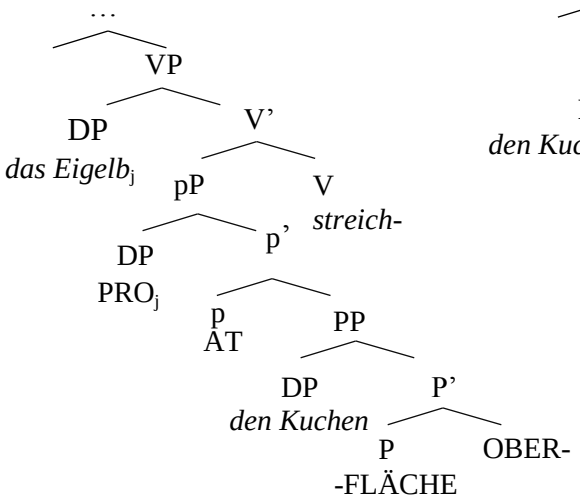
However, the realization of the location argument as a direct object with accusative case in the non-base alternant indicates its syntactic promotion from the base alternant. Note that we use the term *promotion* descriptively, without assuming a movement or a lexical derivation approach. Despite this promotion parallel, recall that we subscribe to a neo-constructionist

approach in our domain. Hence, what may be described as promotion to object in (29) is, in our analysis, just an indirect correspondence.

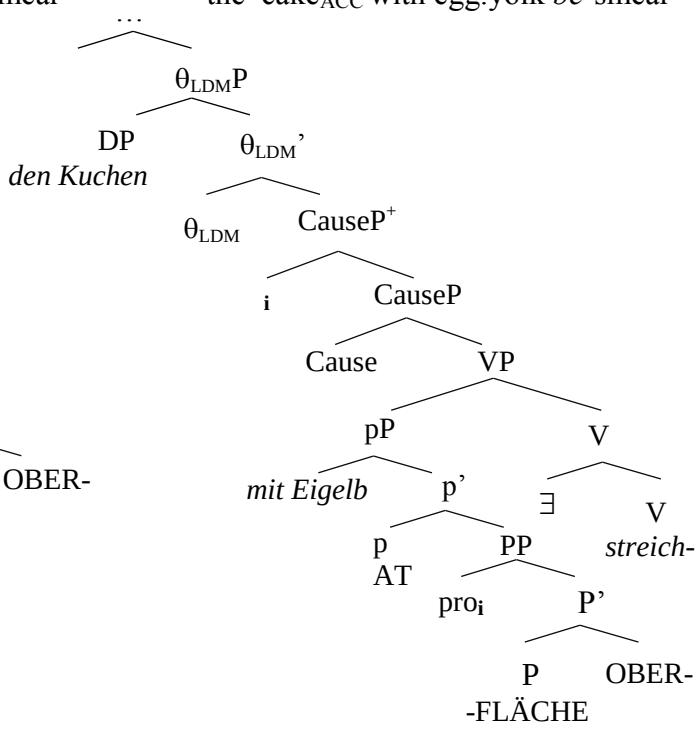
Analogous to analyses of passives which assume a passive voice head introducing external arguments (e.g., Alexiadou & Doron 2012), we assume that a special voice or theta head is responsible for the syntactic realization of the location argument in *be*-constructions, and hence for its "promotion". This is the Landmark theta head. Thus, the effect of promotion of the location argument in *be*-constructions comes from the realization as a specifier of that particular voice head.

In what follows, we provide a syntactic analysis of our example of the locative alternation with the base alternant in (30) and with the *be*-alternant in (30b).

(30) a. *das Eigelb auf den Kuchen streichen*
the egg.yolk on the cake_{ACC} smear



b. *den Kuchen mit Eigelb* ***be****-streichen*
the cake_{ACC} with egg.yolk *be*-smear



In the structure of the base alternant (30a), the preposition *auf*, decomposed as [AT OBERFLÄCHE], projects the PP relating *den Kuchen* and its surface. It is the complement of p, in whose specifier the PRO relating to the locatum *das Eigelb* is accommodated. The whole pP (or rather AspP structure; not added here to preserve perspicuity, but cf. den Dikken 2008) is taken as the directional complement of *streich-* 'smear' as its first argument. Its second argument is *das Eigelb* (the PP provides the Ground for the Figure *das Eigelb* in Spec,p). Now we turn to (30b); cf. (31) for compositional details.

(31) a. *den Kuchen mit Eigelb* ***be****-streichen*[7]
the cake$_{ACC}$ with egg.yolk *be*-smear

b. For any assignment g and number i:

θ_{LDM}P

⟦ *den Kuchen* θ_{LDM} i CAUSE (*mit*) *Eigelb be-* pro$_i$'s OBERFLÄCHE *streich-* ⟧$^{g[i\rightarrow x]}$ = [FA]
λe. ∃s [s is a state of egg-yolk being AT the surface of the cake & s is a state of something having been smeared somewhere & CAUSE(s)(e) & the cake is the landmark of e]

DP — θ_{LDM}'

⟦ *den Kuchen* ⟧ = den Kuchen

⟦ θ_{LDM} i CAUSE (*mit*) *Eigelb be-* pro$_i$'s OBERFLÄCHE *streich-* ⟧$^{g[i\rightarrow x]}$ = [DPM]
λx. λe. ∃s [s is a state of egg-yolk being AT the surface of x & s is a state of something having been smeared somewhere & CAUSE(s)(e) & x is the landmark of e]

θ_{LDM}' — CauseP^{+}

⟦ θ_{LDM} ⟧ = λx λe. x is the landmark of e

⟦ i CAUSE (*mit) Eigelb be-* pro$_i$'s OBERFLÄCHE *streich-* ⟧$^{g[i\rightarrow x]}$ = [PA]
λx. λe. ∃s [s is a state of egg-yolk being AT the surface of x & s is a state of something having been smeared somewhere & CAUSE(s)(e)]

i — CauseP

⟦ CAUSE (*mit*) *Eigelb be-* pro$_i$'s OBERFLÄCHE *streich-* ⟧^{g} = λe. [FA]
∃s [s is a state of egg-yolk being AT the surface of g(i) & s is a state of something having been smeared somewhere & CAUSE(s)(e)]

Cause — VP

⟦ cause ⟧ = λP$_{⟨s,t⟩}$. λe. ∃s [P(s) & CAUSE(s)(e)

⟦ (*mit*) *Eigelb be-* pro$_i$'s OBERFLÄCHE *streich-* ⟧^{g} = [FA]
λs. s is a state of egg-yolk being AT the surface of g(i) & s is a state of something having been smeared somewhere

pP — V

[PM] ⟦ (*mit*) *Eigelb be-* pro$_i$'s OBERFLÄCHE ⟧^{g} = λs. s is a state of egg-yolk being AT the surface of g(i)

⟦ ∃ *streich -* ⟧ = λs. s is a state of something having been smeared somewhere

[FA] ⟦ (*mit*) *Eigelb* ⟧ = Eigelb — p'

∃ — V

⟦ *be-* pro$_i$'s OBERFLÄCHE⟧^{g} = λx. λs. s is a state of x being AT the surface of g(i)

⟦ *streich-* ⟧ = λx. λy. λs. s is a state of y having been smeared on x

[FA] p — PP

⟦ *be-* ⟧ = λy. λx. λs. s is a state of x being AT y

⟦ pro$_i$'s *Oberfläche* ⟧^{g} = g(i)'s surface

[FA] DP — P'

⟦ pro$_i$ ⟧^{g} = g(i)

⟦ OBERFLÄCHE ⟧ = λz. z's surface

-FLÄCHE — OBER-

[7] A quantifier as *jeden Kuchen* 'every cake' would yield the clear binding interpretation. For lack of space we use a definite DP *den Kuchen* 'the cake' here.

Surface contact verbs, such as *streichen* ‘smear’, belong to the class of directed motion verbs with two internal arguments (Levin 2006). They describe activities. The *be*-prefixed alternant *be-streichen* goes along with a causative event structure and entails two subevents: a causing event and the resultant state. Such a causative predicate can be represented following Kratzer (2005:200) and adjusted to our conventions, as in (32), where *s* is a state and *e* an event argument. The Cause predicate is merged as a head of CauseP. The Cause head takes a VP denoting a result state as its complement.

(32) $\lambda P.\ \lambda e.\ \exists s\ [P(s)\ \&\ CAUSE(s)(e)]$

Parallel to our analysis of free datives, the location argument *den Kuchen* in (30b) is introduced by the Landmark theta head θ_{LDM}. This head enters the derivation above the CauseP. This means, then, that the cake is the landmark of the complex c-causes-s event, and not just of the result state.

The prefix *be-* with the meaning AT is merged in p. It relates the Figure *Eigelb* in its specifier to the Ground denoted by the PP. *Be-* selectionally restricts its PP-complement. It must refer to the surface of some reference object. P takes a location argument and relates it to its surface (OBERFLÄCHE ‘surface’ is decomposed into OBER- ‘sur-’ and -FLÄCHE ‘-face’, where FLÄCHE has a weak locative relational semantics).

V introduces the result state. We assume that both object arguments of the state description in V are existentially bound, and only the stative event argument is left compositionally active. When this “semantically truncated” verb combines with the locative pP, it merely contributes manner information as to the type of state in which the figure and ground argument related in the pP are involved. The arguments existentially bound in the V are indirectly identified with the arguments introduced in the pP, by way of Predicate Modification.

The Landmark function maps the referent of the DP in its specifier to its neighborhood regions and entails that the causing event and the resultant state hold within those neighborhood regions. The Landmark theta head as proposed by Hole (2012, 2014) comes with a binder feature [+b]. The binder feature requires some variable in its c-command domain to be bound by the DP in its specifier. This binding requirement leads to structure expansion of CauseP to CauseP^{+}, along the lines of the Generalized Binder Rule in (11). To arrive at the denotation of θ_{LDM}’, Davidsonian Predicate Modification in employed. The landmark DP is added. After existential closure of the event variable at the end of the derivation, (31) has the truth-conditions in (33).

(33) $\exists e\ \exists s$ [s is a state of egg-yolk being AT the surface of the cake & s is a state of something having been smeared somewhere & CAUSE(s)(e) & the cake is the landmark of e]
‘There is an event that causes the result state in which the cake is smeared with egg yolk on its surface.’

Some remarks are in order concerning the binding configuration in (31). We subscribe to the syntactic assumption of derivation by phases. This means that the binding relations discussed here must all hold within a single phase; however, the pP in (31) ought to be a phase itself. Hence, it is not immediately clear how the landmark DP may bind into the complement of p. However, den Dikken (2007) presents strong evidence that the movement of elements like *be-*, a movement that we have to assume anyway to derive the surface syntax of *be-*prefixation, leads to phase extension up to the level of VP.[8] Making use of the general idea of phase extension, we will assume an analysis that has *be-* incorporating into the verb in the overt syntax. What is more, V movement of the *be*-prefixed verb, at least up to Voice, via θ_{LDM}, will further extend the phase in such a way that the landmark DP and the bound variable end up being co-phasal at the point of spell-out. Note that the structure which gets interpreted in (33) is a representation either after reconstruction or without PF-movement, if *be*-incorporation and V movement are PF-movement. In this way, the Landmark phrase inherits phasehood via p-to-V-to-CAUSE-to-θ_{LDM} movement. As pro is on the left branch of the PP, the binding configuration within a single (extended) phase corresponds to the configuration we defined as Knight Move Binding in Section 2.

4. Conclusion and broader impact

In this paper we have shown that, just as with free datives, theta induced Knight Move Binding can be used to model the locative alternation involving *be*-prefixation in German. We think that the ingredients of our proposal can be put to use in a wide variety of alternations which we call "Location Promotion" alternations. In such alternations, the location argument serves as a subject, direct object or a dative object in the non-base alternant, whereas the base alternant typically has the location argument embedded in a pP/PP. Two examples are provided in (34) and (35).

(34) *Er nahm den* *Fisch*$_i$ *aus* [out of pro$_j$'s INSIDE]. (Particle verbs)
he took the$_{ACC}$ fish out
'He took the guts out of the fish.'

(35) *Der Gang* *steht* *voll* *mit* *Kartons*. (Stative locative alternation (Hole in prep.))
the corridor stands full with cardboard-boxes
'The corridor is [standing] full of cardboard boxes.'

Our analysis of theta induced binding laid out in this paper raises the following questions: (i) Why do theta heads and variable binding/reflexivization appear to be such a good match? (ii) Can the theta-heads-as-binders idea be generalized further? (iii) Why is Knight Move Binding such a privileged tree-geometrical instantiation of variable binding? We hope that further research in this area will shed light on these questions.

[8] For other proposals treating *be-*, and other verbal prefixes in German, as incorporated prepositions, cf. Biskup & Putnam (2009) or Wunderlich (1987).

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