

Structural Decomposition of Spatial Adpositions

Peter Svenonius
CASTL, University of Tromsø

The Meaning of P, Ruhr Universität Bochum, November 24, 2012

1 Introduction

I'm going to talk about syntactic features in the sense detailed in Svenonius (2007b) and Adger and Svenonius (2011): Features of linguistic objects which have syntactic relevance.

For example, one could ask: is ANIMATE a syntactic feature, in English? The fact that we have a difference between *he* and *it* doesn't show anything, as it could be a lexical "conceptual" difference, like *cat* vs. *vacuum cleaner*. The simple existence of words referring to animate things like cats and other words referring to inanimate things like vacuum cleaners doesn't say anything about whether the difference is visible to the syntactic system.¹

The distinction between meaning that is relevant to the linguistic system (what I will call SYNTAX-SEMANTICS, or just SYNTAX, or just SEMANTICS for short) from what is not (what I will call CONCEPTUAL or ENCYCLOPEDIA content) was discussed at length in Chomsky (1965). One of his examples was the following:

- (1) a. Sincerity may frighten the boy.
- b. #The boy may frighten sincerity.

¹You might think that [i] *John saw himself/*itself* shows that animacy is relevant to the grammar, but notice that this kind of dependency is just as strong intersententially: [ii] *John walked in. He/*It sat down*. It is plausible that grammatical constraints cannot cross sentence boundaries, in which case gender concord among coreferential pronouns must be imposed by something other than grammar. That same extragrammatical condition could also operate in the case of anaphoric binding, in which case [i] shows nothing about whether ANIMATE is a syntactic feature.

At issue is whether (1b) is ruled out by syntax-semantics, as would be marked by “*,” or whether it is simply odd in terms of usage, as I believe and have indicated with “#.” If the former, then that could provide the basis for an argument that ANIMATE is a syntactic feature in English, because only then could a verb like *frighten* syntactically require an animate object.

Contrast (1) with (2), where a much stronger case can be made that something like LOCATIVE is selected by the verb.

- (2) a. The boy lives on the hill.
 b. *The boy lives of the hill.
 c. *The boy lives the hill.

As indicated by the stars, I believe that (2b–c) are ungrammatical, not simply infelicitous. I believe this is the consensus position, for example Smaby (1971: 39) provides a long story to show that context can ameliorate the badness of (1b).² Subcategorization for syntactic-semantic features (what Pesetsky 1982 called C-selection) is not so easily coercible, as illustrated by the following.

- (3) *The boy dug and shored up an elaborate system of terraces so that he could live the steep and uninviting hill.

Of course, a verb like *live* can be reclassified into a transitive verb, but then takes on a different meaning, as suggested by (4).

- (4) We didn’t just live *in* New York, we *lived* New York (≈thoroughly experienced the lifestyle, not the location)

Various syntactic contexts can be shown to differentiate locative and non-locative XPs, as illustrated here.

- (5) a. Where the boy lives is {in/on/at/under/beside/near/between} the trees.
 b. *Where the boy lives is {of/about/for/with/concerning} the trees.

So the animacy requirement imposed by *frighten* is rather fuzzy, which is a

²part of that story runs as follows: “... John had a special need for sincerity on the part of his clients in order to successfully negotiate for them. Upon talking to his former clients we discovered that they all complained that he began without reason to pry into their personal lives. Of course, they felt threatened and began to fabricate fictitious motives for their business dealings. The source of the problem was very simple. John frightened sincerity...” (Smaby 1971: 39).

typical characteristic of conceptual categories. On the other hand, it is not a necessary characteristic; the difference between *up* and *down* might seem rather categorical, but it is an open question whether any syntactic feature distinguishes *up* from *down*, or *above* from *below*, or *over* from *under*. E.g. is a syntactic feature +UP shared by *up*, *above*, and *over*, distinguishing them from (−UP) *down*, *below*, and *under*? I suggest that there is no such feature, so that the content of ±UP belongs to the same domain which distinguishes the meaning of *camel* from the meaning of *reindeer*, or of *walk* from *run*: the conceptual domain. That is, UP is not a syntactic feature, even if you cannot contextualize *up* to mean *down*.

To put this talk into the context of the other talks we have already heard, I would say that Ryan’s talk (Bochnak this conference) was definitely about a syntactic feature, namely the comparative, since comparatives uncontroversially have different syntactic-semantic properties from noncomparatives. Similarly, Torgrim’s analysis of the different *durch*-phrases (Solstad this conference) was cast in terms of a syntactic feature, that of being attached to the T-domain or to the V-domain, and Juan’s paper (Romeu this conference) and Antje Roßdeutscher’s (Roßdeutscher this conference) were also clearly focused on syntactic features in my terms. On the other hand, when Antje brought in an ‘up’ operator or an ‘orthogonal’ feature, those are things that I suspect are properly treated as conceptual. Similarly, some of the features that Joost (Zwarts this conference) and Lars & Dorothee (Hellan and Beerman this conference) and Antje Müller (Müller this conference) mentioned in their more exhaustive models, like the vertical feature, or ±FRONT, or 2D vs. 3D, would probably be conceptual features. I’m going to impose a strict modularity so that features like that have no place in the syntactic description, just in the conceptual structure.

As for Jessica’s analysis in terms of whether the scales are open or closed (Rett this conference), I would expect that to be a syntactico-semantic feature because it is nonfuzzy, but the proof would be that it has syntactic effects, and that is not entirely clear to me yet.³

³Kennedy and McNally (2005) show that open vs. closed bounds determine what modifiers are possible with adjectives (e.g. *very bent* vs. *completely straight*), but that kind of compatibility could be conceptual and need not be semantic.

2 Path

2.1 Path vs. Place

Path descriptions have a very different syntactic distribution from Place descriptions, for example there are verbs which select for one and the other.

- (6) a. The boy lives {in/on/at/under/beside/near/between} the trees.
b. The cat darted {into/under/to/from/toward} the trees.

Differences in position of attachment and syntactic behavior can be detected (Schweikert 2005, Tungseth 2008, Takamine 2010).

- (7) a. Among the trees lives a wolf.
b. *To the trees darted a cat.
- (8) a. Under the trees, I think I saw a deer grazing.
b. *Toward the trees, I think I saw a deer running.
- (9) a. Meet Mary ⟨in the park⟩ I did, ⟨in the park⟩.
b. Push Mary ⟨off the cliff⟩ I did, ⟨*off the cliff⟩.

Tungseth (2008) points out that paths fall under the scope of an object, as diagnosed by the binding of possessive reflexives in Norwegian, while locations do not. The locative example in (10a) and the directional example in (10b) are intonationally distinct.

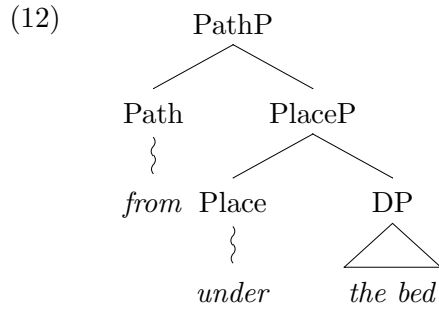
- (10) a. Jens dyttet Per i svømmebassenget sitt.
Jens pushed Per in the.swimming.pool REFL.POSS
'Jens₁ pushed Per in his₁ swimming pool' (Loc)
- b. Jens dyttet Per i svømmebassenget sitt.
Jens pushed Per in the.swimming.pool REFL.POSS
'Jens₁ pushed Per₂ into his_{1,2} swimming pool' (Dir)

It has been pointed out that the difference between Path and Place can surface as a difference in order (e.g. in Dutch, den Dikken 2010, Zwarts 2010).

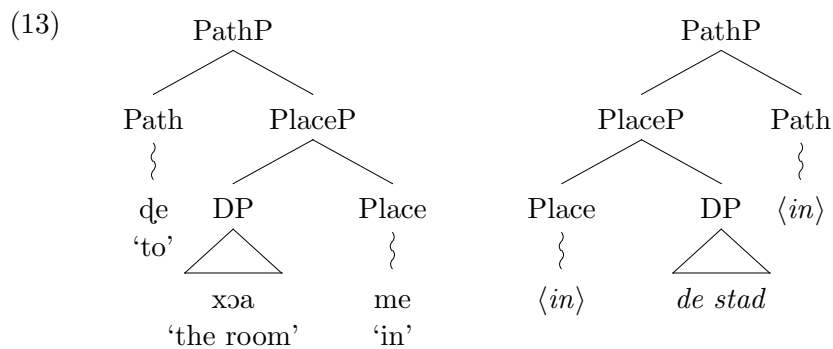
- (11) a. in de stad
in the city
'in the city' (Loc)
- b. de stad in
the city in
'into the city' (Dir)

2.2 Path over Place

These facts have been recognized and formalized by positing two distinct categories, Path and Place, where Path dominates Place syntactically, when both are present (Jackendoff 1983, Koopman 2000, van Riemsdijk and Huybregts 2002, den Dikken 2010, etc.).



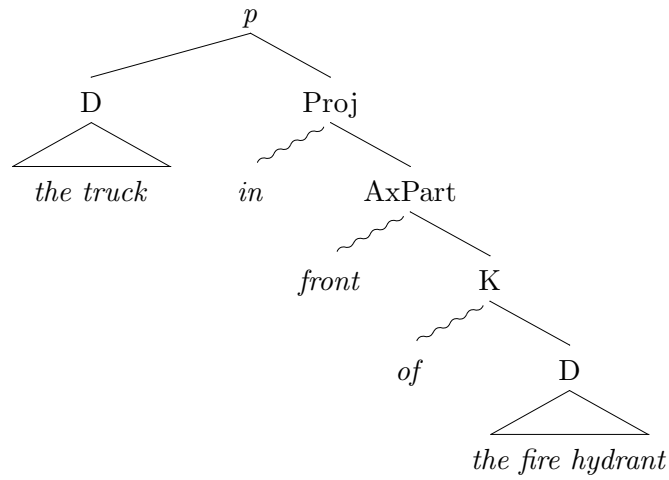
In that case the Path–Ground–Place word order in Chinese, or in Ewe as mentioned by Lars & Dorothee, is simply modeled with different headedness for the two projections, and the Dutch case is something like the inverse of that.



So P is decomposed into multiple projections, Path and Place. Extending that line of thinking, I am going to argue that Place is further decomposed into multiple projections, like the ones seen here (see Svenonius 2010 for my decomposition of Place, Pantcheva 2011 for a detailed deconstruction of Path). The projection *p* (Svenonius 2003; 2007a) gives the topological configuration between the figure and the ground, which is why it is sometimes called Config, as in Juan’s talk.

(14) Park the truck in front of the fire hydrant.

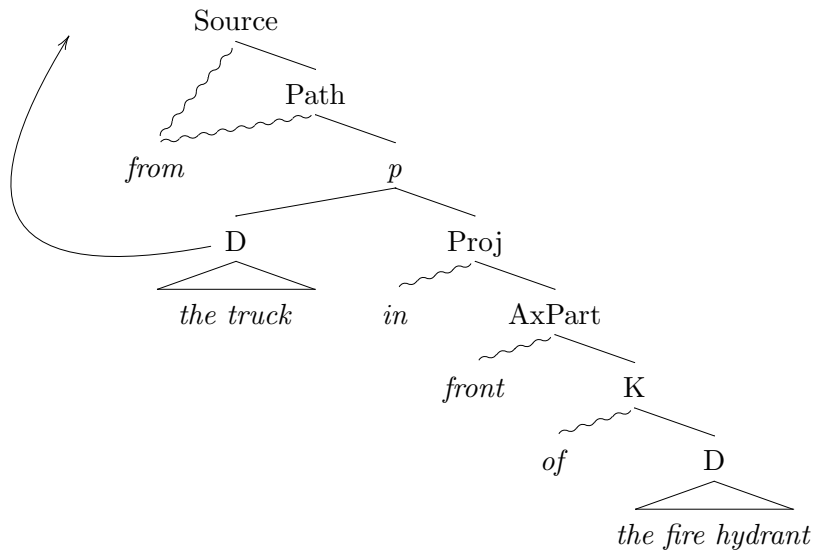
(15)



This structure is also present in Path expressions, just lower down. The figure raises from the specifier of p up into the direct object position.

(16) Move the truck from in front of the fire hydrant.

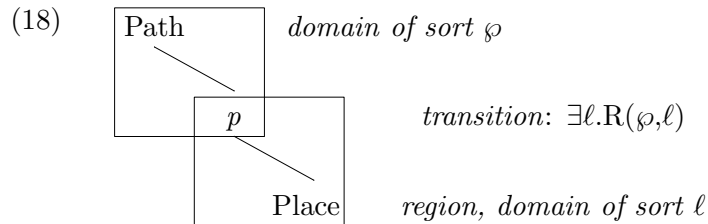
(17)



2.3 Path and Place: Cognitive underpinnings

I believe that the difference between Path and Place is a deep one, motivated by extralinguistic cognition. This is represented in the following diagram,

where the Place domain is a description of a region, which I model as an entity of sort ℓ (for ‘location’), and the Path domain is a description of a different sort of entity (taking SORT in the formal sense, see e.g. Chierchia and Turner 1988), sort \wp . The p represents the transition from one to the other, hence denotes a relation between a thing of sort ℓ and a thing of sort \wp , plus the closure of the region description.

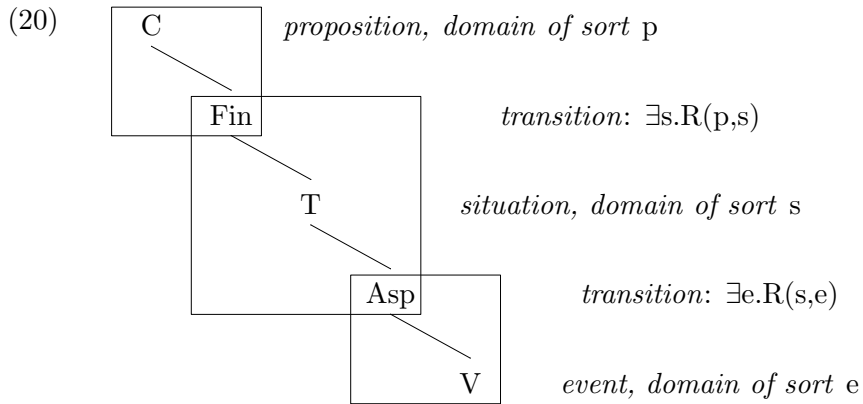


The distinction between two different sorts is motivated by the different conceptual primitives which underlie the two domains. Places are modeled in terms of topographic relations like containment and support, plus geometric notions like regions and vector spaces (e.g. Zwarts and Winter 2000, Kracht 2002; 2008), while Paths involve different primitives such as transitions or adjacency structures (goal and source, as modeled in Fong 1997 or Krifka 1998, but also route paths like *along*, *across*, *through*), directions (*up*, *down*, *toward*, *eastward*, etc.), and other primitives.

Despite the distinct conceptual primitives, there are some notions which can be expressed in either domain, such as measure.

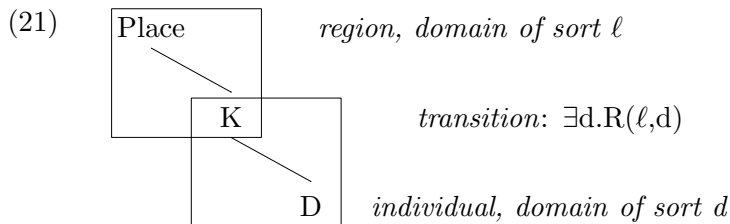
- (19)
- a. They ran to fifty feet inside the tunnel.
(Place: Located at a point fifty feet from the entrance; but the path could have been shorter)
 - b. They ran fifty feet into the tunnel.
(Path: The motion must cover at least fifty feet)

This is analogous to modals, which can be interpreted in either of two places in the C/T system, in the proposal of Ramchand and Svenonius (to appear). There, we distinguish events and situations from propositions, as distinct sortal domains, and identify transitional relational heads between each pair of domains.



2.4 D/N vs. P

Just like T, P is also sortally bounded at the bottom, by the DP. Jackendoff and Landau (1991) and Landau and Jackendoff (1993) discuss the cognitive differentiation between object descriptions and space descriptions, as reflected in linguistic structure (they refer to the “what” system and the “where” system), and that is the same kind of distinction that we take to motivate a fundamental ‘sortal’ distinction between categories.



3 AxParts

But now I am going to discuss categorical differences within a sortal domain, the sortal domain of regions or Place. One syntactic feature we find is frame of reference, which distinguishes some kinds of Places from other expressions.

For example, in the context of an overturned hat, (22a) is ambiguous, but (22b) is not.

- (22)
- a. There’s a lizard on top of the hat.
 - b. There’s a lizard on the top of the hat.

More explicitly, either example can refer to the hat’s intrinsic top, i.e. its

crown, which is at the bottom of an overturned hat. But only (22a) is natural if the intention is to refer to the part of the ground object which is its top only as seen from a viewer’s perspective, i.e. the underside of the brim of an overturned hat. This is what is often called the ‘relative’ frame of reference (see e.g. Levinson 2003).

I suggest that the possibility of a relative frame of reference is a syntactico-semantic fact, and thus there is a syntactico-semantic feature distinguishing expressions like (22a) from expressions which don’t allow relative frame of reference. Call this feature AxPart, based on Jackendoff’s (1996) discussion of ‘axial parts’ in the calculation of the front, back, top, bottom, and sides of an object, as employed in spatial language.

The definite article in (22b) shows that *top* is a noun there, and nouns don’t contain AxParts (Svenonius 2006).

The same fact can be seen in (23).

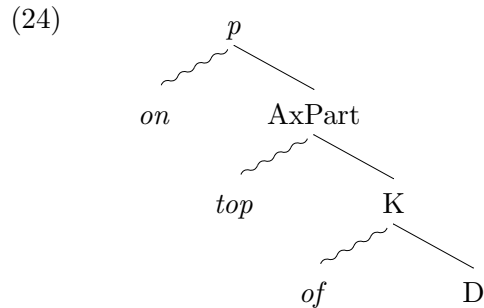
- (23) a. There’s a lizard behind the car.
 b. %There’s a lizard in back of the car.
 c. There’s a lizard in the back of the car.

The example in (23a) is ambiguous in the expected way if there is an AxPart: the lizard can either be located in a space projected from the car’s intrinsic back, or else from the far side of the car as seen from a viewer’s perspective. The example in (23b), which is apparently restricted to US English, has the same properties. The example in (23c), on the other hand, has a definite article betraying a noun use of the word *back*, and no possibility of a relative frame of reference. In fact, since the ‘back’ is a part of the car, and *in* implies containment, the most natural interpretation is that the lizard is located inside the back part of the car, while the natural ‘intrinsic’ interpretation of (23a–b) is that the lizard is in a space projected from the back of the car. I suggest that this is because there is an AxPart feature in those examples even when the favored frame of reference is intrinsic; an AxPart simply gives the *option* of a relative frame of reference.

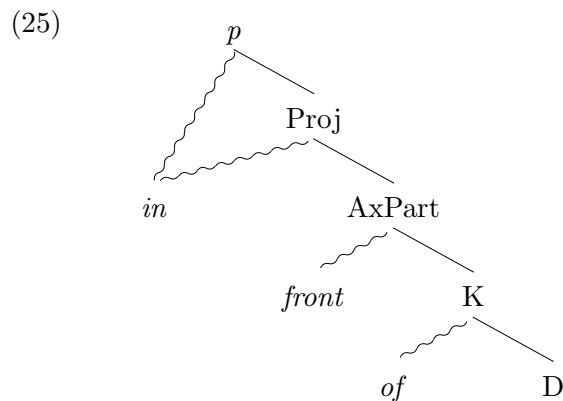
Notice that the number of words lexicalizing the Place expression is not important: *in back of* is prosodically three words, while *behind* is one, but they have the same semantics, hence the same syntax (at least that must be the default assumption).

I represent the structure of *on top of* as follows: the category labels are the syntax-semantics, and the straight lines are the syntactic dependencies. I use squiggly lines for lexical insertion, to underscore that the phonological and conceptual information contained in the exponents is in a different

modular domain from the syntax-semantics.



I assume that for the language learner, multiple morphemes are a clue to complex syntactic structure, but not vice-versa. That is, a morpheme boundary implies a category label,⁴ but the absence of a morpheme boundary does not imply the absence of a category label: multiple categories can be spelled out by a single morpheme (a PORTMANTEAU, in the sense of Hockett 1947; see Svenonius 2012). So I will eventually argue that *in* in the collocation *in front of* spells out two heads, as in the following tree.



I will stick to the principle that identical syntactic distribution motivates identical structure, so since *in back of* and *behind* have the same distribution as *in front of* (ignoring irrelevant conceptual information), they must have the same structure, so that the single word *behind* also lexicalizes the four projections K (for Kase), AxPart, Proj[ection], and *p*.

⁴I might be persuaded to make an exception for uninterpretable features like case and agreement, but that is a topic for another paper.

4 Morpheme Boundaries

In this section I briefly attempt to motivate the assumption that morpheme boundaries are evidence for syntactic structure. The argument is based on the fact that additional morphemes (setting aside problematic examples of case and agreement) tend to add meaning which can be associated with syntactic structure.

Take for example the following pair of sentences, which most speakers would judge to be synonymous.

- (26) a. Page five is between pages four and six.
b. Page five is in between pages four and six.

This might suggest that the idiomatic collocation *in between* means the same thing as *between*, i.e. that the word *in* contributes nothing. But the following data set disconfirms this.

- (27) a. India is between Europe and Australia.
b. #India is in between Europe and Australia.
c. India is in between Bangladesh and Pakistan.

So it turns out that **in** adds a topographic relation, something like containment, essentially what it means when it doesn't cooccur with *between*. So the conceptual content is still there, and in fact it is arguably linked to semantic content in the same way as when it is a stand-alone preposition, suggesting that *in between* is structurally as well as conceptually complex.

Similarly, even bound morphemes signal meaning and structure. A data set like the following makes it seem as if *in* and *inside* mean the same thing.

- (28) a. The book is in the box, or
b. The book is inside the box.

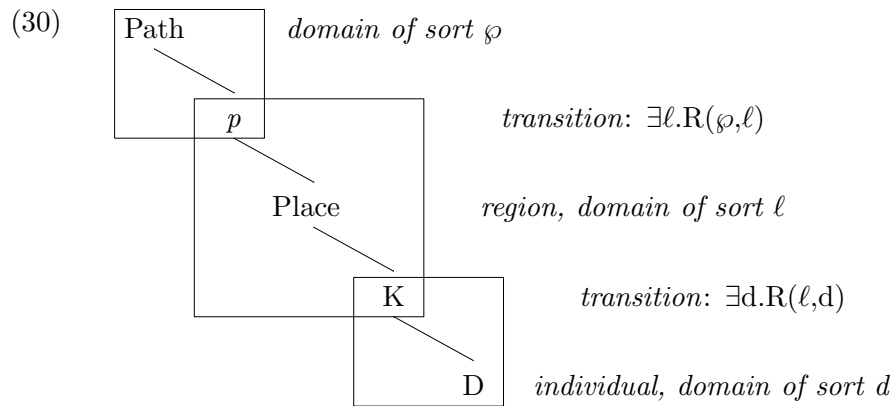
But the following shows that they are different.

- (29) a. There is a plane in the sky
b. #There is a plane inside the sky

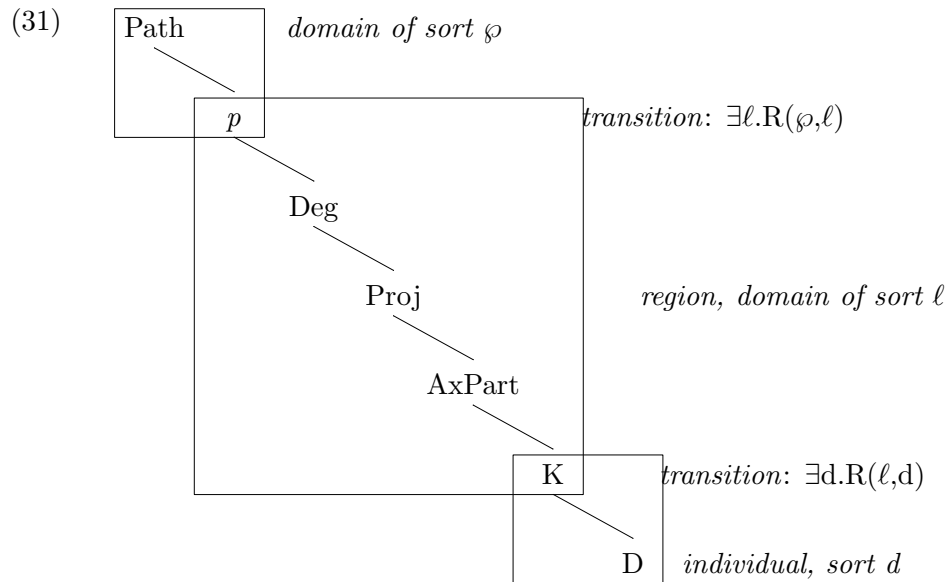
So **side** adds axial structure, i.e. the ground must have “sides” for the figure to be ‘inside’ it, and this in turn implies that there is an AxPart projection. Even though *inside* is a listed collocation just like *in between*, it is essentially compositional. I suggest that this is because the learner attends to morpheme boundaries and uses them as a guide; morphological complexity

implies syntactic complexity.

When we put the different sortal regions that I have suggested together, we get the following picture, with a domain for paths, a domain for places, and below that the various domains for the noun phrase.



The decomposition of Place that I am proposing is intended as an articulation of a single domain. That is, even if I posit additional structure like AxPart and Proj and Deg (as in Svenonius 2008; 2010), they are based on the same cognitive space and so constitute a single domain, as suggested by the big box here.



The features that I posit here are common crosslinguistically, as evidenced

by morphologically overt functional structure. Kham, a Nepalese language (Watters 2002), has relators which show the order AxPart- p (topological configuration), reflecting the hierarchy $p > \text{AxPart}$. The AxPart component of meaning names a part of the ground element, and the p element describes the topographic relation between the figure and the AxPart.

(32)	Kham	literal gloss	translation
	<i>jĩ:-lə</i>	inside-in	‘inside of’
	<i>dũ:h-lə</i>	beneath-in	‘underneath’
	<i>ŋah-kə</i>	front-PROJ	‘in front of’
	<i>chĩ:-kə</i>	behind-PROJ	‘behind’
	<i>chyo:-ŋə</i>	edge-at	‘at the edge of’
	<i>leo-ŋə</i>	whereabouts-at	‘at the place of’
	<i>tər-tə</i>	top-on	‘on top of’
	<i>sora:-tə</i>	line-on	‘above, in line with’

Similarly, Lezgian (Haspelmath 1993), a Daghestanian language, shows Path $> p/\text{AxPart} > \text{K}$.

(33)			
	adessive	<i>sew-re-w</i>	at the bear
	adelative	<i>sew-re-w-aj</i>	from the bear
	addirective	<i>sew-re-w-di</i>	toward the bear
	superessive	<i>sew-re-l</i>	on the bear
	superrelative	<i>sew-re-l-aj</i>	off the bear
	superdirective	<i>sew-re-l-di</i>	onto the bear
	inessive	<i>sew-re</i>	in the bear
	inelative	<i>sew-r-äj</i>	out of the bear
	indirective	<i>sew-re-z</i>	into the bear
	postessive	<i>sew-re-q^h</i>	behind the bear
	postelative	<i>sew-re-q^h-aj</i>	from behind the bear
	postdirective	<i>sew-re-q^h-di</i>	to behind the bear
	subessive	<i>sew-re-k</i>	under the bear
	subelative	<i>sew-re-k-aj</i>	from under the bear
	subdirective	<i>sew-re-k-di</i>	to under the bear

The syntactic structure that I propose on the basis of semantic decomposition also directly determines morphological structure, as reflected in the morpheme order. Just as p is outside AxPart in Kham, Path is outside p in Lezgian.

The structure also constrains portmanteaux. In Lezgian, there is an irregularity in the system at what Haspelmath calls ‘indirective,’ which is

what other grammarians would call an illative, i.e. it means roughly ‘into.’ Instead of ending in *-di* like all the other goal expressions, it ends in *-z*, which I take to be a portmanteau for *p* and Path.

For *p* and Path to be expressed by a portmanteau, they must be structurally adjacent (as I argue more generally in Svenonius 2012), as expressed in the structure in (31). Zwarts (2010) observes that there is crosslinguistically a closer relation between Path and the topological adpositions ‘in’ and ‘on’ (which I take to lexicalize *p*) than there is between Path and projective prepositions ‘under’ and ‘behind’ (which I take to lexicalize AxPart and a projection above that, Proj, but below *p*). The closer relation is realized as suppletion in languages like English, where there are suppletive forms for *in+from* (*out*) and *on+from* (*off*), but not for *behind+from* or *under+from*.

(34)		Loc	Source	Goal	Route
	AT	at	from	to	via
	IN	in	out of	into	through
	ON	on	off	onto	across
	UNDER	under	from under	under	under
	BEHIND	behind	from behind	behind	behind

Joost suggests more of a cline (you’re more likely to have suppletion at the top of the table) but I am suggesting a sharper cut-off (you can have suppletion only of adjacent heads).

The same situation seen in Lezgian is found in Finnish (which is unrelated) (data from Karlsson 1977).

(35)		Place:	IN		ON
	<u>Path</u>		<i>-s</i>		<i>-l</i>
	LOC	<i>-CA</i>	inessive:	<i>-s-sA</i>	adessive: <i>-l-lA</i>
	FROM	<i>-tA</i>	elative:	<i>-s-tA</i>	ablative: <i>-l-tA</i>
	TO	<i>-Ce</i>	illative:	<i>-en</i>	allative: <i>-l-le</i>

Here, again, it is the ‘into’ form which is suppletive, as illustrated below.

- (36)
- a. talo-s-*s*
house-IN-LOC
‘in the house’
 - b. talo-s-*t*
house-IN-FROM
‘out of the house’
 - c. talo-en
house-ILL

‘into the house’

Suppletion is relatively natural here because p is at the top of the Place domain, so it is always adjacent to Path. Other Place functors are further away. If we look at a postposition meaning ‘behind,’ what we see is that the AxPart meaning component is constant (*tak-*), and that there is a portmanteau for Path+(p)+Proj.

- (37) a. talo-n tak-ana
 house-GEN *behind*-PROJ.LOC
 ‘behind the house’
 b. talo-n tak-aa
 house-GEN *behind*-PROJ.FROM
 ‘from behind the house’
 c. talo-n taak-se
 house-GEN *behind*-PROJ.TO
 ‘to behind the house’

This suggests that there could in principle be a suppletive form which took the AxPart with it, but only if it also gobbled up all the projections in between AxPart and Path.

To sum up the discussion at this point, I have suggested a precise relation between morphological exponence and compositional semantic meaning, mediated by syntactic structure. Each syntactic node is assigned a specific semantic contribution, and syntactic dependency translates directly into semantic composition, in a strictly local way (I step through some lambda-theoretic formalizations in the next section). Each syntactic node is spelled out by a morpheme, but one morpheme can spell out more than one syntactic node (a portmanteau), as long as the nodes stand in a tight local relation to each other (a span).

What this means is that a learner may posit syntactic structure on the basis of morphological structure, but may also infer syntactic structure on the basis of meaning, in the absence of morphological evidence. This allows a fair amount of surface variation in how spatial expressions are realized overtly.

The relative crosslinguistic uniformity of the underlying syntactic structure of spatial expressions is due in part to the universal hierarchy of the cognitive notions which give rise to the sortal domains (e.g. \wp over ℓ). Other factors contribute as well (such as the nature of the biases which give rise to the positing of additional categorical distinctions), but there is no space to go into them here.

5 Spatial P: Projective

As discussed by Herskovits (1986), one important class of spatial prepositions can be called PROJECTIVE, as they involve the projection of a region from a ground object. I argue that syntax is sensitive to this property, hence it is a syntactic feature, which we can call Proj (I have been assuming this already in some of the previous diagrams). One way in which the syntax is sensitive to the presence of the feature Proj is in the distribution of measure phrases: If Proj is present, then a direct measure phrase is possible.

- (38) a. There's a tree twenty feet in front of the house.
b. There's a wind vane a foot above the house.

The prepositions *behind* and *on top of* contain AxPart, as diagnosed by variable frame of reference, but they don't have Proj, since they don't allow measure phrases.

- (39) a. There's a tree (*five feet) beside the house.
b. There's a wind vane (*a foot) on top of the house.

It is important to note that the incompatibility of measure and *beside* must be syntactic-semantic, not conceptual (Svenonius 2008). Recall that conceptual information tends to have fuzzy boundaries and to be contextually flexible, as we saw for #*The boy frightened sincerity*. No such thing is true for direct measure and *beside*. Context is totally irrelevant. In fact, measurement is fine with *beside*, just not direct measurement:

- (40) There's a tree beside the house at a distance of five feet.

In other words there is no conceptual incompatibility between being beside something and being a precise distance from it. Instead, the badness of the direct measure expression in (39a) is something which grammar must explain.

In English, the distinction is highly lexicalized, so that e.g. *behind* is measurable and *beside* is not, and there is no productive morphological way to express a nonmeasurable version of 'behind' or a measurable version of 'beside.' But some other languages have productive morphological indications of the distinction, e.g. the Dravidian language Kannada (see also Bašić 2007 for similar arguments from Serbian). In Kannada, AxParts with *-e* and with *-gaḍe* allow flexible frame of reference (Amritavalli 2007).

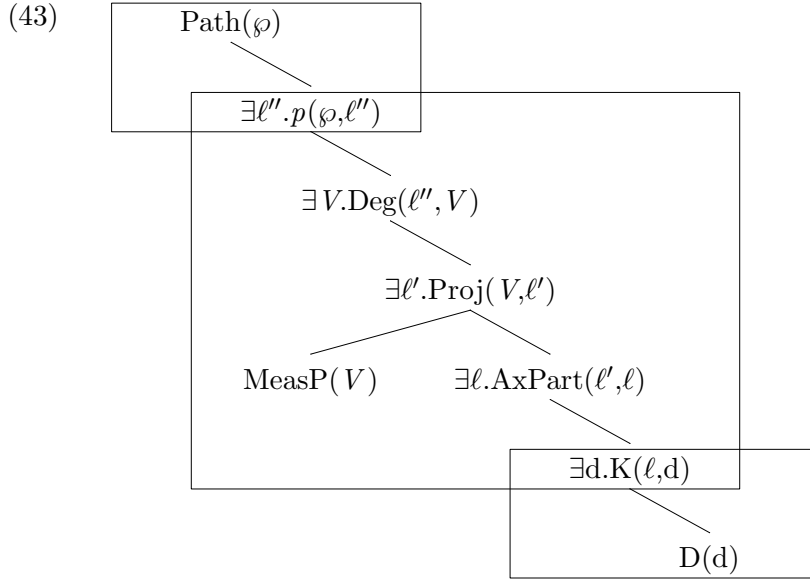
- (41) a. *kaar-ina mund-e*
car-GEN front-PROJ
 ‘in front of the car’
 b. *kaar-ina mundu-gaḍe*
car-GEN front-PLACE
 ‘in front of the car’

Only *-e* allows direct MeasureP modification; *-gaḍe* does not.

- (42) a. *kaar-ina ippattu aḍi mund-e*
car-GEN twenty feet front-PROJ
 ‘twenty feet in front of the car’
 b. **kaar-ina ippattu aḍi mundu-gaḍe*
car-GEN twenty feet front-PLACE
 (‘twenty feet in front of the car’)
 c. *kaar-ina mundu-gaḍe*
car-GEN front-PLACE
ippattu aḍi-ya duurad-alli
twenty feet-GEN distance.GEN-LOC
 ‘at a distance of twenty feet in front of the car’

Thus, there is functional morphology expressing the featural difference. However, given that I have suggested there can be crosslinguistic variation of category inventories inside sortal domains, we can still ask whether *English* treats ‘Proj’ as a feature or a category. If it’s a feature, it is a feature of a category or set of categories; and if there is no structure between AxPart and *p*, then it is a feature of one or the other. The head *p*, it will be recalled, denotes a Figure–Ground configuration (a \wp), at which point the region description (ℓ) is closed ($\exists \ell.p(\wp, \ell)$). At that point, it is too late to measure a dimension of the region description (you can only measure the path traveled by the Figure).

Here is the structure I have suggested (Svenonius 2008), building on the vector-based analysis of Zwarts and Winter (2000).

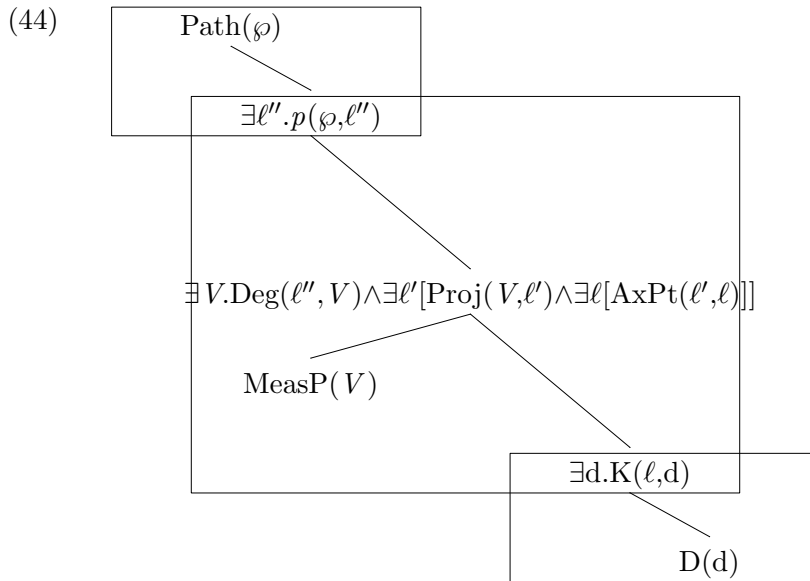


K gives the eigenplace of the ground object d . At every level, strict locality of modification is enforced by existential closure, so at the level of K , d is closed with the result that modifiers of the DP cannot appear in the P domain. The eigenplace is an object of sort ℓ , a region. The AxPart head picks out a new region on the basis of an axial structure with a chosen orientation (based on a frame of reference). In the syntax, there is no difference between *in front of* and *behind* and so on, so there is no indication of what the AxPart relation is, but usually it is a part relation. Again, the variable corresponding to the eigenplace is closed off here and hence is no longer accessible to modification.

At the next level, Proj (corresponding to Zwarts and Winter’s “Loc”) creates a vector space based on the axial part, projecting vectors away from the appropriate facet of the ground. This is where a measure expression fits: It simply restricts the lengths of the vectors, by intersection.

But a location is not a vector space, so another region needs to be computed on the basis of the vector space. To this end, Zwarts & Winter posit a functor Loc^- , and I suggest that this is represented in the syntax in a head which I call Deg . Here, the vector space is closed, so measurement is no longer possible. Since Deg outputs a region, formally a set of things of sort ℓ , p can combine with it semantically just as it would combine with an eigenplace (as in *at*) or an AxPart (as in *on top of*).

A competing analysis would be the following, where the vector space is computed as before but not syntactically decomposed.

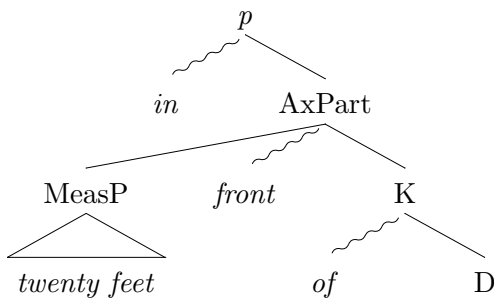


Here, the restriction imposed by Meas would be coordinated in under the scope of the existential closure of V , and the semantic result would be the same as in the more fully decomposed representation. So a legitimate question is, how much evidence do I have for the full decomposition? Could this more compact syntactic representation be more accurate?

Here, even a trimorphemic preposition like *in front of* could be accommodated, because *in* could lexicalize p , *of* could lexicalize K , and the word *front* could lexicalize the middle part.

The problem with that is that it would predict, falsely, that the measure phrase should follow *in*.

(45) *in twenty feet front of the house

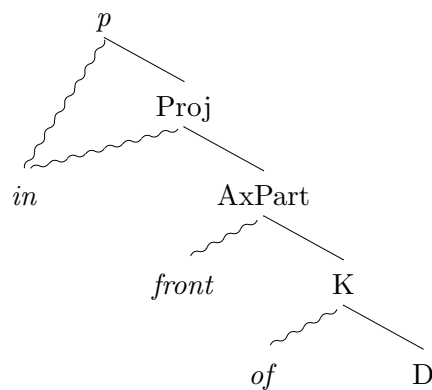


That is, given that morpheme order and prosodic structure are read directly off the syntactic tree, the higher head p must be peripheral to the

AxPart projection, and in a head-initial structure like that found in English PPs, must precede it. If the p head were to lower (see Brody 2000a;b for this possibility), then it should be suffixed to *front*. Conceivably, the measure phrase could raise, but there is no independent motivation for it to raise. Instead, I suggest, the measure phrase is in situ, and that means that *in* must lexicalize a head at least as low as the head hosting the measure phrase (since specifiers precede their heads, as argued by Kayne 1994, Brody 2000a;b). Given that heads can lower, and morphemes can spell out more than one head, the morpheme *in* might also spell out a higher head, but it must at the very least spell out the head hosting the measure phrase.

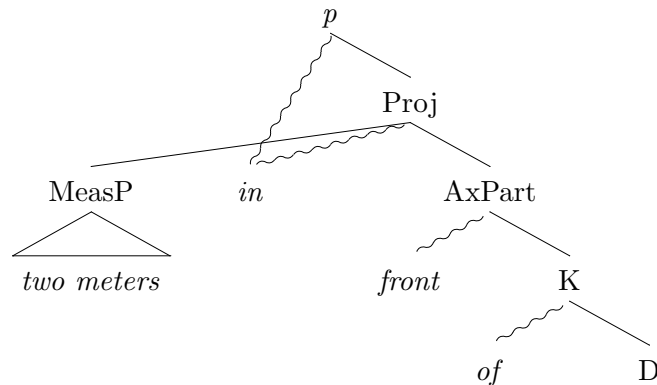
Since the vector space is existentially closed at the p level, the measure phrase must attach below that, hence there must be a head between p and AxPart (the head lexicalized by *front*). This head is where the Proj feature is located. Since there is no other motivation for this head, it can be identified with Proj, as in the following tree.

(46)



A measure phrase is then attached between p and this phrase; the attachment site could be an additional projection, Deg, as I suggested in Svenonius (2008), but if we make the more conservative assumption that there is a single head between p and AxPart, then we can assume that the measure phrase is attached to Proj.

(47)



Given this representation, there are two possible linearizations of the head *in* and the measure phrase. A typical head-movement type configuration would have the head linearized to the left of the lower specifier, whereas an in-situ configuration would have the specifier preceding the head. Empirically, it is clear that we need the latter, though I do not at present have a more principled reason for *in* to linearize in the lower of the two heads which it lexicalizes (see Brody 2000a;b on this as an option).

6 Conclusion

I have argued here in favor of a model of grammar which is highly modular, but at the same time makes strong predictions about the precise form of the interaction among the different modules.

Syntax determines a certain aspect of meaning, the aspect I call semantic, distinct from another aspect of meaning which I call conceptual (this distinction is also supported by Bierwisch 1986, Bouchard 1995, Emonds 2000, Talmy 2000, Borer 2005, and many others). Syntactic combination (merge) is associated with semantic composition (either function application, as in Frege 1879, or conjunction, as suggested by Pietroski 2005). Relations in syntax are extremely local, something which I have enforced by positing existential closure at each level. Thus semantic interpretation can be taken as evidence for syntactic structure.

Conceptual and phonological information is linked to exponents, which are associated to syntactic representations by lexical insertion. Linearization is enforced by a trivial algorithm, along the lines of Kayne's (1994) and Brody's (2000a, 2000b) suggestions. Thus, morpheme order (whether the morphemes are bound or unbound) provides strong clues to underlying

syntactic structure.

I have suggested that these considerations motivate a rather fine-grained decomposition of some relatively ordinary spatial adpositions in English and other languages. The uniformity of the systems is striking, though I have suggested that it is not absolute (unfortunately I do not have space here to go into detail).

In particular, I have argued for projections AxPart and Proj in addition to the relational head *p*, in some but not all Place expressions.

References

- Adger, David and Peter Svenonius. 2011. Features in minimalist syntax. In *Oxford Handbook of Linguistic Minimalism*, edited by Cedric Boeckx, pp. 27–51. Oxford University Press, Oxford.
- Amritavalli, R. 2007. Parts, axial parts, and next parts in Kannada. In *Tromsø Working Papers on Language and Linguistics: Nordlyd 34.2*, Special issue on Space, Motion, and Result, edited by Monika Bašić, Marina Pantcheva, Minjeong Son, and Peter Svenonius, pp. 86–101. University of Tromsø, Tromsø. CASTL, Tromsø. Available at <http://www.ub.uit.no/baser/nordlyd/>.
- Bašić, Monika. 2007. Serbian Ps with and without *iz* and the Superset Principle. In *Tromsø Working Papers on Language and Linguistics: Nordlyd 34.2*, Special issue on Space, Motion, and Result, edited by Monika Bašić, Marina Pantcheva, Minjeong Son, and Peter Svenonius, pp. 300–319. University of Tromsø, Tromsø. Available at <http://www.ub.uit.no/baser/nordlyd/>.
- Bierwisch, Manfred. 1986. On the nature of semantic form in natural language. In *Human Memory and Cognitive Capabilities: Mechanisms and Performances*, edited by F. Klix and H. Hagendorf, pp. 765–784. North-Holland, Amsterdam.
- Bochnak, Ryan. this conference. Innovating locative comparisons. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.
- Borer, Hagit. 2005. *Structuring Sense: An Exo-Skeletal Trilogy*. Oxford University Press, New York.

- Bouchard, Denis. 1995. *The Semantics of Syntax: A Minimalist Approach to Grammar*. University of Chicago Press, Chicago.
- Brody, Michael. 2000a. Mirror Theory: Syntactic representation in Perfect Syntax. *Linguistic Inquiry* 31 1: 29–56.
- Brody, Michael. 2000b. Word order, restructuring, and Mirror Theory. In *The Derivation of VO and OV*, edited by Peter Svenonius, pp. 27–43. John Benjamins, Amsterdam.
- Chierchia, Gennaro and Raymond Turner. 1988. Semantics and property theory. *Linguistics and Philosophy* 11 3: 261–302.
- Chomsky, Noam. 1965. *Aspects of the Theory of Syntax*. MIT Press, Cambridge, Ma.
- den Dikken, Marcel. 2010. On the functional structure of locative and directional PPs. In *Mapping Spatial PPs: Cartography of Syntactic Structures, vol. 6*, edited by Guglielmo Cinque and Luigi Rizzi, pp. 74–126. Oxford University Press, Oxford.
- Emonds, Joseph. 2000. *Lexicon and Grammar: The English Syntacticon*. Mouton, Berlin.
- Fong, Vivienne. 1997. *The Order of Things: What Directional Locatives Denote*. Ph.D. thesis, Stanford.
- Frege, Gottlob. 1879. *Begriffsschrift, eine der arithmetischen nachgebildete Formelsprache des reinen Denkens*. Halle a/S, Hildesheim.
- Haspelmath, Martin. 1993. *A Grammar of Lezgian*. No. 9 in Mouton Grammar Library. Mouton de Gruyter, Berlin.
- Hellan, Lars and Dorothee Beerman. this conference. Semantics of spatial prepositions in a computational typed feature structure system. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.
- Herskovits, Annette. 1986. *Language and Spatial Cognition: An Interdisciplinary Study of the Prepositions in English*. Cambridge University Press, Cambridge.
- Hockett, Charles F. 1947. Problems of morphemic analysis. *Language* 23 4: 321–343.

- Jackendoff, Ray. 1983. *Semantics and Cognition*. MIT Press, Cambridge, Ma.
- Jackendoff, Ray. 1996. The architecture of the linguistic-spatial interface. In *Language and Space*, edited by Paul Bloom, Mary A. Peterson, Lynn Nadel, and Merrill F. Garrett, pp. 1–30. MIT Press, Cambridge, Ma.
- Jackendoff, Ray and Barbara Landau. 1991. Spatial language and spatial cognition. In *Bridges between Psychology and Linguistics: A Swarthmore Festschrift for Lila Gleitman*, edited by Judy Anne Kegl and Donna Jo Napoli, pp. 145–169. Lawrence Erlbaum, Hillsdale, NJ.
- Karlsson, Fred. 1977. *Finsk grammatik*. Suomalaisen Kirjallisuuden Seura, Helsinki.
- Kayne, Richard S. 1994. *The Antisymmetry of Syntax*. MIT Press, Cambridge, Ma.
- Kennedy, Christopher and Louise McNally. 2005. Scale structure and the semantic typology of gradable predicates. *Language* 81 2: 345–381.
- Koopman, Hilda. 2000. Prepositions, postpositions, circumpositions, and particles. In *The Syntax of Specifiers and Heads*, edited by Hilda Koopman, pp. 204–260. Routledge, London.
- Kracht, Marcus. 2002. On the semantics of locatives. *Linguistics and Philosophy* 25: 157–232.
- Kracht, Marcus. 2008. The fine structure of spatial expressions. In *Syntax and Semantics of Spatial P*, edited by Anna Asbury, Jakub Dotlačil, Berit Gehrke, and Rick Nouwen, pp. 35–62. John Benjamins, Amsterdam.
- Krifka, Manfred. 1998. The origins of telicity. In *Events and Grammar*, edited by Susan Rothstein, pp. 197–235. Kluwer, Dordrecht.
- Landau, Barbara and Ray Jackendoff. 1993. “what” and “where” in spatial language and spatial cognition. *Behavioral and Brain Sciences* 16 2: 217–265.
- Levinson, Stephen C. 2003. *Space in Language and Cognition: Explorations in Cognitive Diversity*. Cambridge University Press, Cambridge.
- Müller, Antje. this conference. Spatial interpretations of German prepositions. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.

- Pantcheva, Marina. 2011. *Decomposing Path: The Nanosyntax of Directional Expressions*. Ph.D. thesis, University of Tromsø.
- Pesetsky, David. 1982. *Paths and Categories*. Ph.D. thesis, MIT, Cambridge, Ma.
- Pietroski, Paul M. 2005. *Events and Semantic Architecture*. Oxford University Press, Oxford.
- Ramchand, Gillian and Peter Svenonius. to appear. Deriving the functional hierarchy. *Language Sciences* .
- Rett, Jessica. this conference. Locative Ps and scale structure. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.
- van Riemsdijk, Henk and Riny Huybregts. 2002. Location and locality. In *Progress in Grammar: Articles at the 20th Anniversary of the Comparison of Grammatical Models Group in Tilburg*, edited by Marc van Oostendorp and Elena Anagnostopoulou, pp. 1–23. Meertens Instituut, Amsterdam. www.meertens.knaw.nl/books/progressingrammar/.
- Romeu, Juan. this conference. Cartography and polysemy of spatial Ps: The case of *in* in English. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.
- Roßdeutscher, Antje. this conference. Prepositional elements in a DM/DRT-based syntax-semantics interface. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.
- Schweikert, Walter. 2005. *The Order of Prepositional Phrases in the Structure of the Clause*. John Benjamins, Amsterdam.
- Smaby, Richard M. 1971. *Paraphrase Grammars*. Reidel, Dordrecht.
- Solstad, Torgrim. this conference. Interpretational variation and the influence of contrast. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.
- Svenonius, Peter. 2003. Limits on P: *filling in holes* vs. *falling in holes*. *Nordlyd, Tromsø Working Papers on Language and Linguistics. Proceedings of the 19th Scandinavian Conference of Linguistics* 31 2: 431–445.

- Svenonius, Peter. 2006. The emergence of axial parts. In *Nordlyd, Tromsø Working Papers in Language & Linguistics: 33.1, Special Issue on Adpositions*, edited by Peter Svenonius and Marina Pantcheva, pp. 49–77. University of Tromsø, Tromsø. Available at <http://www.ub.uit.no/baser/septentrio/index.php/nordlyd/>.
- Svenonius, Peter. 2007a. Adpositions, particles, and the arguments they introduce. In *Argument Structure*, edited by Eric Reuland, Tanmoy Bhattacharya, and Giorgos Spathas, pp. 71–110. John Benjamins, Amsterdam.
- Svenonius, Peter. 2007b. Interpreting uninterpretable features. *Linguistic Analysis* 33 3-4: 375–413.
- Svenonius, Peter. 2008. Projections of P. In *Syntax and Semantics of Spatial P*, edited by Anna Asbury, Jakub Dotlačil, Berit Gehrke, and Rick Nouwen, pp. 63–84. John Benjamins, Amsterdam.
- Svenonius, Peter. 2010. Spatial prepositions in English. In *Mapping Spatial PPs: Cartography of Syntactic Structures, vol. 6*, edited by Guglielmo Cinque and Luigi Rizzi, pp. 127–160. Oxford University Press, Oxford. Prepublication draft available at <http://ling.auf.net/lingBuzz/000001>.
- Svenonius, Peter. 2012. Spanning. Ms. University of Tromsø, available at ling.auf.net/lingBuzz/001501.
- Takamine, Kaori. 2010. *The Postpositional Hierarchy and its Mapping to Clause Structure in Japanese*. Ph.D. thesis, University of Tromsø.
- Talmy, Leonard. 2000. *Toward a Cognitive Semantics*. MIT Press, Cambridge, Ma.
- Tungseth, Mai Ellin. 2008. *Verbal Prepositions and Argument Structure: Path, Place, and Possession in Norwegian*. John Benjamins, Amsterdam.
- Watters, David E. 2002. *A Grammar of Kham*. Cambridge University Press, Cambridge.
- Zwarts, Joost. 2010. A hierarchy of locations: Evidence from the encoding of direction in adpositions and cases. *Linguistics* 48 5: 983–1009.
- Zwarts, Joost. this conference. Mapping the meanings of prepositions. Paper presented at *the Meaning of P* conference in November 2012 at Ruhr Universität Bochum.

Zwarts, Joost and Yoad Winter. 2000. Vector space semantics: A model-theoretic analysis of locative prepositions. *Journal of Logic, Language, and Information* 9: 169–211.