THE MORPHOLOGY OF SPATIAL P:
A LOOK INSIDE ADPOSITIONS AND CASE

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Abstract
The goal of this paper is to offer a unified analysis of the morphological structure of spatial adpositions and spatial case markers in three languages: English, Spanish, and Finnish. This analysis combines Distributed Morphology assumptions with a Type-Logical formal treatment. Two key results emerge from this unified morpho-syntactic analysis. First, spatial adpositions (behind, encima, laelita) can be accounted as the result of merging different “types” of spatial morphemes, including spatial case markers and particles. Second, cross-linguistic syntactic phenomena involving these categories (e.g. argument demotion) can also be accounted for straightforwardly, via our analysis. We suggest that these results also support a “morphology all the way up” view of Distributed Morphology.

1 Introduction: an Overview on Spatial Adpositions and Cases*

In recent years, several works have thoroughly investigated the category known as “spatial P” (henceforth: SPs: Levinson & Wilkins 2006; Cinque & Rizzi 2010). Works belonging to distinct generative research programs have offered different fine-grained analyses of the syntactic properties of SPs. Examples include Head Phrase Structure Grammar (HPSG: Tseng 2000, 2004, 2005) and the Minimalist Program (Asbury et al. 2008). To see why this is the case, consider examples (1a)-(1e):

(1) a. The boy has gone to in front of the table
   b. The boy has arrived from on top of the hill
   c. [ to in front of [ the table ]]
   d. [ to [ in front of [the table ]]]

*I would like to thank the participants of Les Decembrettes 8 and an anonymous reviewer who gave very useful feedback on a preliminary version of this work. Thanks to my princess for the support, as always. The usual disclaimers apply.
e. [ from [on [top [ of [ the hill ]]]]]

Examples (1a)-(1b) contain the (complex) SPs *to in front of and from on top of*. In both examples, the NP *the boy* denotes a located entity or *figure*; the NPs *the table and the hill* denote the landmark objects or *grounds* of the underlying spatial relations (Talmy 2000: ch.1). Although all analyses agree on these key assumptions, they differ on the morphological structure they assign to SPs. Strongly lexicalist analyses suggest that SPs project a single syntactic head. Examples include early Government and Binding analyses (GB: van Riemsdijk 1978; Emonds 1985) and HSPG (Tseng 2000, 2004). Instead, later GB-based decompositional analyses suggest that SPs involve at least two hierarchically ordered heads. One head denotes a “directional” component of meaning (here: *to, from*). A second is a lower head denoting a locative component (*in front of, on top of*) (Jackendoff 1983, 1990; Wunderlich 1991; van Riemsdijk 1990; van Riemsdijk & Huysbregts 2007). The structures in (1c) and (1d) respectively illustrate lexicalist and decompositional analyses in a theory-neutral (i.e. label-free) format. Importantly, both structures show that these approaches tend to fail silent on one aspect of SPs: their morphological structure. One version of the minimalist program (Chomsky 1995) that partly addresses this problem is the so-called “cartographic approach”. Cartographic approaches assume that SPs, *qua* functional elements, can project a complex sequence of heads, one per identifiable morpheme (Koopman 2000; Asbury 2008; den Dikken 2010; Svenonius 2010). For instance, *to, in, front and of* form a sequence of heads that in turn form a so-called “SP field”; an example is also *on top of* in (1e). Cartographic approaches, however, fall silent on certain sub-sets of SPs data, of which we offer preliminary English and Spanish examples1:

(2) a. The boys sit a-round the chairs

b. The shop lies a-cross the road

c. The chair is out-side the room

d. *El niño esta en-cima de la casa*
   *The child is*-S in-top of the house
   ‘The child is on top of the house’

e. *El niño esta de-lante de la casa*

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1 In these examples I mark putative segments of SPs via hyphenation, as an orthographic norm used to *emphasize* word structure (Oshima & Hogue 2006: 170).
The child is S of-front of the house
‘The child is in front of the house’

Examples (2a)-(2c) include the English SPs a-round, a-cross, out-side; similar SPs are a-mong, be-hind, a-long, and so on. Examples (2d)-(2e) include some Spanish counterparts of these SPs: en-cima ‘on top’, and de-lante ‘in front’. Differently from English, these SPs must always combine with the relational (S)P de ‘of’ (Fábregas 2007). Descriptive and theoretical analyses often acknowledge that their morphological structure seems to include a prefix, and a noun-like element (English: Huddleston & Pullum 2002: ch.7; Svenonius 2010: fn. 1; Spanish: Butt & Benjamin 2004: ch.4; Fábregas 2007: §2). Nevertheless, both classes of SPs are often labeled as simple SPs, their morphological structure being still unaccounted for.

A similar problem emerges when one looks at spatial case markers (henceforth: SCMs). Cartographic approaches build on Fillmore (1968), and capture the similarities between these spatial parts of speech by treating SCMs as part of the SP field. We illustrate this assumption via Finnish, a language with a wealth of descriptive and theoretical analyses (Karlsson 1999; Kracht 2004; Asbury 2008; Caha 2009). Standard minimalist analyses suggest that SCMs act as suffixes on ground NPs, and project a Kase head (Svenonius 2007; Asbury 2008). We show this analysis in (3)-(4):

\begin{enumerate}
\item[(3)] a. \textit{Mario on huon-essa}
\hspace{1cm} Mario is house-INESS.
\hspace{1cm} ‘Mario is in the house’

\item[(4)] a. \textit{Mario on auton ed-essä}
\hspace{1cm} Mario is car-GEN front-INESS.
\hspace{1cm} ‘Mario is in front of the car’
\end{enumerate}

Example (3) shows that a Kase Phrase corresponds to a Kase head, here the Inessive SCM –essa (locative ‘in’), combined with the ground NP huon-‘house’. Example (12) shows that, when postpositional SPs such as ed-essä ‘in front’ occur in a sentence, a non-spatial case marker (the Genitive),

\footnote{We employ these glosses for Case morphemes: ESS.=essive, ACC.=Accusative, LAT.=Lative, GEN=Genitive, INS=Instructive, PAR=Partitive. We will use more fine-grained glosses for the Essive and Lative paradigms, in section 2.3.}
combines with a ground NP. The SP ed-essa bears the Inessive SCM -essa, as a suffix to the SP morpheme ede- ‘front’. Although the structures in (3b)-(4b) show that SCMs can be analyzed as part of the SP field, they do not explicitly state their status within the structure. As for English and Spanish SPs, their morphological properties seem still unaccounted for. Overall, the data and analyses discussed in examples (1)-(4) seem to rise at least three empirical questions, with respect to SPs and SCMs. A first question is whether we can offer a fully derivational account of SPs for the morphological structure of SPs such as across or encima. A second is whether this treatment can be extended to SCMs, as in the case of Finnish edessa, hence offering a unified account for SPs and SCMs. A third is whether this account can also capture the syntactic, sentence-level distributional properties of prepositions and postpositions (qua SPs) and SCMs. The goal of this paper is to answer these three questions via a unified theoretical perspective. For this purpose, we organize our paper as follows. Section 2 presents a broader set of data across these three languages, to outline our explananda. In section 3 we present our formal background: a combination of Distributed Morphology (DM: Embick & Noyer 2001, 2006) and the formal apparatus of Type Logical (TL) calculi (Moortgat 2010, 2011). In section 4, we show how this proposal can account, and actually predict the data under discussion. We conclude in section 5.

2 The Data: A Broader Picture on SPs and SCMs

2.1 The Data: The Morphological Structure of English SPs

The goal of this section is to offer a broader overview of our SPs and SCMs, starting from an analysis of simple SPs in English. We maintain this label, even if it is in part a misnomer, for mere descriptive reasons. Simple SPs can actually be conceived as the combination of at least two morphemes. One is often a noun-like element referring to a body part or axis (e.g. side, head), the other a prefix that seems to lack a specific semantics (e.g. be-, a-). Recent works have labeled these noun-like morphemes “Axpart SPs”, to highlight their ability to denote the specific “axis” of a spatial relation (Svenonius 2006, 2010; Asbury 2008). We implement this label for expository purposes, too. The fact that simple SPs appear to be bi-morphemic has not gone unnoticed in the literature. It has been observed that the prefix a- seems to originate from the Middle English counterpart of the free SP on, similarly to the morpheme be- (Svenonius 2006: 79-84, 2010: fn.1). In this regard, English (spatial) prefixes share both syntactic and phonological properties with spatial-(like) prefixes in Slavic and Romance languages (cf. Matushansky 2002; Svenonius 2004; Mateu 2008). However, etymological arguments and cross-linguistic parallels, do not offer evidence for SPs being involved in
synchronously active morphological processes. In order to solve this problem, we propose two more compelling arguments based on productivity. A first more compelling argument involve three sets of simple SPs that seem to involve active processes of word formation, but have been seldom discussed in the literature. Although apparently heterogeneous in nature, these three sets consist of SPs that include the “combination” of spatial free morphemes and affixes, in various combinations. A first set includes SPs that are the combination of some particles (up, down) or other simple SPs (in, out, on, off) with the Axpart morphemes -side and -wards. Recent works have suggested that (spatial) particles can be also considered as part of the SP field (Hale & Keyser 2002; Svenonius 2003, 2007; Cappelle 2004). Although these proposals differ with respect to their analysis on the syntactic status of particles, they converge on treating particles such as upwards as belonging to SPs, too. Thus, we include particles as part of our discussion of SPs.

We move to the other understudied SPs sets. A second set includes SPs that are the combination of particles and spatial nouns, which may denote specific locations or orientations (e.g. uphill, downstairs). A third set of data includes “cardinal” simple SPs, Axpart SPs that denote cardinal coordinates, such as North, South, North-West and so on (Levinson 1994; Levinson & Wilkins 2006; Svenonius 2006). We present two lists of examples per sub-set in (5), with the proviso that our lists can be non-exhaustive (i.e. open):

(5)  

a. –wards type={back-wards, in-wards, to-wards, up-wards,...} (1st)

b. –side type={a-side, be-side, down-side, in-side, up-side,...} (1st)

c. Particle type={up-front, down-hill, up-stairs, up-wards,...} (2nd)

d. Cardinal type={North, North-East, North-North-East,...} (3rd)

e. a-type={a-bove, a-cross, a-far, a-head, a-mong, a-round, a-top}

f. be-type={be-hind, be-low, be-neath, be-side, be-tween, be-yond}

The –wards and –side “types” in (5a)-(5b) present two connected but non-overlapping sub-sets of the first sub-set, although these sets seem to draw morphemes form common inventories of particles and prefixes (e.g. up, in). The Particle type set in (5c) is our second sub-set, and includes SPs that carry a particle as a prefix, and Axpart or a similar other noun-like element as a basic SP (e.g. hill). The Cardinal type in (5d) is the third sub-set of understudied simple SPs. The two sets in (5e)-(5f), labelled as the a- and be-
types, include amply discussed SPs that can be treated as morphologically complex, although this complexity is not synchronically active. The key unifying aspect of these data is that these three understudied sub-sets seem to be the result of simple word-formation processes. For instance, the SPs *upfront*, *downhill* and *Southwards* have emerged during the last two centuries, in standard British and American English (BNC, 2007; Davies, 2008). These processes apply to sub-sets of SPs, a category with a small set of lexical items. Thus, they seem to belong to the lower end of the productivity spectrum, as they produce few but stable forms over time (Bauer 2005; Hay & Baayen 2002). For these reasons, though, they seem to meet criteria of potential and expanding productivity (Baayen 1994, 2009). These processes seem active even if infrequent (potential productivity), resulting in the slow growth of our sub-sets, over the decades (expanding productivity). Hence, if simple SPs are actually the result of a productive morphological process, then an account of their morphological structure seems motivated. A second more compelling argument is based on a syntactic property of SPs that, however, plays a role in their morphological structure as well. All the SPs we discussed so far can (or must) undergo argument demotion, hence occur without a ground NP. This usually occurs when the interpretation of the ground NP can be recovered from the previous context (Merchant 2001: ch.2; den Dikken 2010; Svenonius 2010). So, (simple) SPs can be treated as complement phrases of the verb they combine with, as we show in (6):

(6) Mario goes behind/inside/in(to)/in front/in/North/North-West (the car)

(7) Mario walks back/backwards/up/uphill (*the hill)

Treatments of argument demotion commonly treat the remnant SP (e.g. *in front, back*) as a phrasal complement of the verb, regardless of its exact categorical status. Hence, all the SPs in (6) are treated as complement phrase of the verb *goes*. A proviso is that SPs such as *in front of, North/North-West of* involve the demotion of the relational morpheme *of*, as well, only leaving Axp or simple SPs as a result. Furthermore, *Particle* type SPs such as those in (7) cannot usually combine with ground NPs, as shown in the example. These facts show that our sub-types of SPs share two key properties, *qua* SPs. A first is their underlying morphological structure, and the second is their syntactic status as complement phrases of the verb, when argument demotion occurs. The second property, in turn, can and should be seen as the result of combining different types of spatial morphemes together, in a principled manner. Thus, simple SPs seem to be the result of different and yet related morphological processes, but also share the same syntactic properties. With these arguments in mind, we turn to Spanish.
2.2 The Data: The Morphological Structure of Spanish SPs

Our goal in this section is to provide two arguments for the morphological analysis of Spanish SPs. We focus on two known and two novel sets of data. The first argument is based on known Spanish SPs data, divided in two sub-sets. First, Spanish has two sub-sets of simple SPs that stand in complementary distribution, with respect to their syntactic properties. A first sub-set of SPs includes the prefixes de- and en-, which must combine with the relational P de ‘of’, and cannot undergo argument demotion. A second sub-set includes the prefix a- , and must involve argument demotion (Pavón 1999; Fábregas 2007; Ursini 2013a). Second, Spanish lacks an equivalent of the -side- and -wards English type of SPs. However, other simple SPs such as hacia ‘towards’ or desde ‘from’ can take simple SP phrases as their complement, to convey the same meaning. These sequences of SPs, known as preposición tras preposición ‘preposition after preposition’, in the literature (Bosque 1997; Pavón 1999), are shown in (8)-(9):

(8) El niño está de-lante/en-frente *(de la casa)  
The child is S of-front/in-front *(of the house)  
‘The child is in front of the house’

(9) El niño está a-lante *(de la casa)  
The child is S of-front *(of the house)  
‘The child is in front (of the house)’

(10) El niño ha ido hacia a-riba/a-trás *(de la casa)  
The child has gone towards up-part/behind (of the house)  
‘The child has gone upwards/backswards (of the house)’

(11) El niño ha llegado desde delante/enfrente *(de la casa)  
The child has arrived from ahead/in-front (of the house)  
‘The child has arrived from in front of the house’

The pair (8)-(9) shows the distribution of the first sub-set of Spanish simple SPs, and how the de-, en- sub-sets stand in complementary distribution to the a- set. In cases such as delante and alante, the two SPs seem to form a minimal pair with respect to their syntactic distribution, at least in Iberian Spanish (Fábregas 2007: 1-10). While delante cannot undergo argument demotion, alante must do so, lest (9) be ungrammatical. Examples (10)-(11) show, instead, how hacia ‘towards’ and desde ‘from’ can take another SP phrase as a complement. Demotion must target the ground NP of delante and enfrente ‘in front’, as (10)-(11) show. Therefore, if the morphological
structure of Spanish simple SPs affects their syntactic distribution via a form of (feature) percolation, then a morphological analysis seems to be necessary. Aside these two better understood sub-sets of simple SPs, two sub-sets are still in need of an account. A first novel sub-set includes Spanish SPs that have relatively heterogeneous meanings, but share the property of being indeed simple, or mono-morphic SPs. Examples include SPs such as fuera ‘out’, junto ‘close’, cerca ‘near’ and frente ‘ahead’. A second novel sub-set includes that of the understudied Spanish counterparts of the Cardinal type SPs (e.g. Norte ‘North’, Oeste ‘West’). We present the key lists in (12):

(12) a. de-type={de-bajo, de-trás, d-entro, de-lante, en-cima} (1st set)
    b. en-type={en-cima, en-frente, en-tre} (1st set)
    c. a-type={a-lante, a-trás, a-bajo, a-riba, a-fuera, a-dentro} (1st set)
    d. PtP type={hacia SP, desde SP, a SP, de SP, ...} (2nd set)
    e. Bare type={bajo, cerca, contra, frente, fuera, hasta, junto, lejos} (3rd set)
    f. Cardinal type={Norte, Oeste, Este, Sur, Nor-Oeste, ...} (4th set)

    g. El niño ha ido bajo/cerca/Norte *(de la casa)
       The child has gone down/near/North of the house
       ‘The child has arrived from in front of the house’

The lists in (12a)-(12c) are near-exhaustive, while those in (12d)-(12f) are not, since they include SPs that are the output of synchronically active processes. We label the second sub-set the PtP type, in reference to their label in the literature. We then label the third sub-set as the Bare type, to outline their lack of attached prefixes. We note that the a-type seems in part to correspond to the particle (up/down)-type in English. For instance, arriba and abajo roughly correspond to the English SPs ‘upstairs’ or ‘uphill’, and ‘downhill’, respectively. Aside these parallels, the distribution of these SPs is akin to the de- and en- types of SPs, since they cannot undergo demotion unless they occur within a PtP context, and combine with de (cf. (12g)). Hence, these novel sub-sets of simple SPs present an argument for a morphological analysis akin to that of their known counterparts, and that of English SPs. With this result in hand, we turn to the Finnish Data.

2.3 The Data: The Morphological Structure of Finnish SPs and SCMs
The goal of this section is to discuss the Finnish data, and outline which parallels we can find with the English and Spanish data. We first discuss some well-known facts, and then we move to two sets of understudied facts. Most works on Finnish SCMs observe that there are at least six spatial markers. Polysemy is a common trait: the Adessive case, for instance, can translate English SPs at, around, on (Nikanne, 1993; Kracht 2004). Other markers that seem to have spatial interpretations are the Genitive, Partitive, Instructive and Translative (Fong 1997; Asbury, 2008). Some authors suggest that SCMs involve “affixhaume” or “case-stacking” processes, with a “directional” marker stacked onto a “locative” marker (Kracht 2008, Svenonius 2008). The table in (32), based on Kracht (2004: 177), shows the six “pure” spatial cases and their stacked structure (cf. Kracht 2002, Asbury 2008). We will discuss this aspect in more detail in section 4.3, in which we offer our analysis to the distribution of these morphemes. The table is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Adessive</th>
<th>Ablative</th>
<th>Allative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallo-la</td>
<td>‘at the house’</td>
<td>Talo-la</td>
<td>‘to the house’</td>
</tr>
<tr>
<td>Talo-la</td>
<td>‘from the house’</td>
<td>Talo-la</td>
<td>‘to the house’</td>
</tr>
<tr>
<td>Inessive</td>
<td>Elative</td>
<td>Illative</td>
<td></td>
</tr>
<tr>
<td>Talo-s-sa</td>
<td>‘in the house’</td>
<td>Talo-s-ta</td>
<td>‘out of the house’</td>
</tr>
<tr>
<td>Talo-s-sa</td>
<td>‘from the house’</td>
<td>Talo-s-ta</td>
<td>‘out of the house’</td>
</tr>
<tr>
<td>Talo-n</td>
<td>‘into the house’</td>
<td>Talo-n</td>
<td>‘into the house’</td>
</tr>
</tbody>
</table>

Table 1: Finnish spatial case markers system.
‘side’) can combine with other SCMs, by occurring between the locative and the directional markers. A second set includes a set of SPs derived from particles, via the suffixation of one of three case markers: Ablative, Instructive and Partitive. Different particles can combine with one of these cases, to form an intransitive-like SP, like English *upwards* or Spanish *alante*. We offer a set of relevant examples in (15):

(15)  a. Mario istuu (auto-n) ed-es-sä
      Mario sits (car-GEN.) front-in-ESS.
      ‘Mario sits in front of the car’

      b. Mario on mennyt (auto-n) et-ee-n
         Mario is gone (car-GEN.) front-in-LAT.
         ‘Mario has gone in front (of the car)

      c. Mario on (huoneen) ulko-puole-la/sisa-puole-l-la
         Mario is (room-GEN.) out-side-At-ESS/in-side-at-ESS.
         ‘Mario is outside/inside the room’

      d. Lampu on (pöydän) ala-puole-l-la/ylä-puole-l-la
         Lamp is (table-GEN.) down-side-at-ESS/up-side-at-ESS.
         ‘The lamp is below/above the table’

      e. Tukholma on (Göteborgin) pohjo-puole-l-la/etelä-puole-l-la
         Stockholm is (Gothenburg-GEN.) North/South-side-at-ESS
         ‘Stockholm is North/South of Gothenburg’

      f. Mario on (*auto-n) kävelyt taka-perin/ylä-mäkeä/pohjo-see-n
         Mario is (*car-GEN.) walked back-INS/up-PAR./North-in-LAT.
         ‘Mario has walked backwards/upstairs’

      g. Axpart type={ede-, jalj-, pai-, yla-, ympär-, a-, kautta-...} (1st set)

      h. Puole- type={pohjo-, et/ed-, ulko-, sisa, etelä-...} (1st set)

      i. Particle type={taka-, ala-, alla-, ylä, läpi, ...} (1st set)

      j. Suffix type={X-PART, Y-TRANS, Z-ESS} (2nd set)

The examples in (15a)-(15b) show that SPs such *ed-es-sä* and *eteen* can be treated as different realizations of one underlying SP, translatable as ‘front’. While *ed-es-sä* corresponds to the locative (Adessive) form, *eteen* is its
directional (Illative) counterpart (*cf. to in front*). The examples in (15c)-(15e) show some SPs that involve a particle, on which SCMs and the *puole*-infix are stacked on (e.g. *ulko-puole-l-la* ‘outside’, lit. ‘out-side-at-ESS’). These examples show that not only Cardinal and Particle types SPs can act can combine with SCMs, but also that certain Axpart SPs have an equivalent structure (e.g. *ala-puole-l-la* ‘above’). Example (15f), then, shows that particle-like SPs, akin to English –wards type SPs, can be further accessed via the occurrence of one of three possible case markers (Instructive, Partitive, Illative), only one being an SCM proper (the Illative). In all of these cases, demotion is either possible or obligatory, when intransitive SPs are involved. Also, in all of these cases the ground NP combines with the Genitive case, a case that can hardly be seen as purely spatial in nature. The non-exhaustive lists in (15g)-(15j) offer a more compact overview of the two sets of understudied Finnish simple SPs that justify two arguments in favour of a morphological analysis. First, our SCM-based data show that Finnish counterparts of English and Spanish simple SPs involve a fairly complex, but relatively transparent morphological structure. As all of these SPs can or must undergo argument demotion, they also share the phrasal status of their cross-linguistic counterparts, and the fact that morphological and syntactic properties interact. Second, SPs and SCMs clearly interact in a regular way, with the further proviso that SPs seem to include different types, such as particles, but also locative, cardinal and Axpart SPs. Therefore, they offer us a further pair of compelling arguments for offering a unified analysis of SPs and SCMs, and answer our three empirical questions. For this purpose, we present our formal proposal and analysis in sections 3 and 4.

3 The Proposal: DM meets TL calculi

The goal of this section is to present the formal tools that we employ to tackle our three problems. We combine two distinct frameworks: Distributed Morphology (henceforth: DM: Embick & Noyer 2001, 2006; Harbour 2007; Harley 2010a, 2010b, 2012) and Type-Logical calculi (TL calculi: Jäger 2005; Moortgat 2010, 2011; Morryll 2011). A more thorough discussion of this integrated framework can be found in Ursini (2013a,b); Ursini & Akagi (2013a,b). Our choice is based on two reasons. First, DM is perhaps the only minimalist framework that addresses productive morphological processes, as the one discussed so far, while other approaches (e.g. Cartography) only address morpheme orders. Second, we also wish to extend this framework’s treatment of SPs, as few works have investigated a small sub-set of these data (Thomas 2001, 2004; Ursini & Akagi 2013a, b).

In order to further motivate our choice, we present the three key assumptions that underpin DM. First, morphology and syntax are taken to be a single
derivational system, which recursively combines morphemes into larger structures (words, phrases, sentences). Differently from syntax-centric views of the framework (e.g. Halle & Marantz 1993), we like to conceive this approach as “morphology all the way up”. Second, morphemes correspond to clusters/sets of features, with different combinations corresponding to categories such as SPs, NPs or other Phrases. Third, the output of the morphological system maps onto the semantic and phonological components of grammar. In this paper we mostly focus on some phonological phenomena (vocabulary insertion and fusion), leaving semantic matters.

In order to explicitly represent these assumptions, we import some core aspects of TL calculi. Since we want to give a unified account of SPs and spatial SCMs, we need a precise, formal account of their morphological properties and syntactic distribution. For this purpose, we show that some key assumptions found in TL calculi suffice to formally account the data at hand. Two such basic assumptions play a key role, which we define below.

First, in TL calculi parts of speech are mapped onto types, which can be considered as either being “complete” or “incomplete” bits of morphological information. Complete types represent derivational units (morphemes, phrases) that can stand as distinct, independent units (e.g. np for NPs as the girl). Incomplete types are units that must combine with other units, to form a complete type. For instance, an intransitive verb such as runs can be assigned type s/np. So, if it combines with an np item, the girl, then the result is the sentence the girl runs, which is assigned the type s of sentences.

Second, in TL calculi types can be combined in a principled way, via a small set of operations. We use the connectives “/” and “•” to represent the Merge and the Product operations, respectively (Moortgat 2010: § 2; Morrill 2011: ch. 1). We define Merge as a binary, associative operation, and Product as also a commutative operation. We only implement the right-associative version of merge, which we label Merge right, leaving aside other possible connectives (e.g. merge left “\”, Jäger 2005’s connective “[” for anaphors). We then assume that derivations compute information about types in a top-down manner, following psychological models of word production (Levelt 1989; Hay & Baayen 2002; Phillips 2006; Jarema & Libben 2007). For compound types, we use the Product “•” operator. This operator represents types that act as “compound” units in derivation. So, while Product explicitly represents DM’s second assumption about morphemes’ structure, Merge represents DM’s first assumption about morphemes’ combinatoric principles. We then add a novel assumption about the basic set of atomic types in our lexicon. Standard definitions of atomic types in type-logical calculi take a perhaps naïve view of parts of speech, representing them via types such as np and s (cf. Jäger 2005; Morrill 2011: ch.1). Current minimalist approaches, including DM, suggest that such traditional categories can be reconstructed
as instances of more abstract categories. For instance, Hale & Keyser (2002) analyse any “concrete” morpho-syntactic category (SPs or NPs) as abstract heads, which can also vary in valence. For instance, bare NPs (girl) are treated as heads with 0-valence: they cannot take any argument phrases. Transitive verbs (copula is), instead, are treated as heads with 2-valence. In our framework, we capture these ideas by implementing a universal type p (for “phrase”), and a set of recursive rules to derive complex types:

\[ (16) \]

\[ a. \ p \text{ is a morphological type} \]  

\[ b. \ \text{If} \ x \ \text{is a type and} \ y \ \text{is a type, then} \ x/y \ \text{is a type} \]  

\[ c. \ \text{If} \ x \ \text{is a type and} \ y \ \text{is a type, then} \ x\cdot y \ \text{is a type} \]  

\[ d. \ \text{If} \ d. \ x/y \ \text{is a type and} \ y \ \text{is a type, then} \ (x/y) \cdot y/x, \ y \cdot (y/x) \cdot x \]  

\[ e. \ \text{If} \ x/y \ \text{is a type and} \ y/z \ \text{is a type, then} \ (x/y) \cdot (y/z) \cdot x/z \]  

\[ f. \ \text{Nothing else is a type} \]

The rules read as follows. Rule a. introduces our basic type; rules b. and c. define how heads or complex morphemes are formed via Merge and Product, respectively. Rule d. defines the principle of “forward application”, which defines how Merge combines units into larger constituents (Moortgat 2010, 2011). Rule e., known as the “cut rule”, defines a special case of Merge, by which two incomplete units can be conflated/fused in a principled way. We discuss its exact import when we will discuss the data in more detail. Rule f., then, says that no other rules are found that can derive type structures. Via this set of assumptions, we can generate various type sets. For our purposes, the set \( \text{TYPE} = \{p\cdot p, p\cdot p/p\cdot p, p\cdot p/p\cdot p/p\cdot p\} \) will suffice. This is that smallest type set that can represent phrasal elements, prefixes and relational heads, respectively, hence the smallest set that allows us to capture our data. The Product type \( p\cdot p \) can involve \( n \) basic types (e.g. \( p\cdot p\cdot p\cdot p\)), but for the sake of clarity we only represent the basic binary type. We will motivate the full import of these assumptions in the next section, as their application to the data at hand will enlighten their usefulness.

We add one final aspect of our formalism. We define a simple pre-order as the pair of an interval set \( I \), and an addition operation “+”, i.e. \( <I,+> \). This pre-order represents an index set, which in turn allows to represents the steps in a derivation as ordered elements. With these formal tools at our disposal, we turn to our derivational analysis of our data.
4. The Analysis: The Data

4.1. The Analysis: The English Data

Our goal in this section is to account the data via our proposal. We start from English SPs. For reasons that will become clear in a few paragraphs, we start from *Cardinal* and *Particle*-type SPs, respectively our second and third subset of understudied simple SPs. Recall that SPs such as *North* mostly are noun-like elements that have become part of the SP field, and can undergo argument demotion (e.g. *North (of the car)*). The same reasoning can be extended to all other Axpart morphemes, too (cf. *the North, the front, the cross, etc.*). We take this fact as evidence that the “remaining” SPs act as full phrases, hence complements of a verb they merge with, like their non-demoted SP phrase counterpart. Therefore, we assign the type $p\checkmark$, the type of bundled morphemes/features and of complete phrases, to these SPs.

We then suggest that argument demotion supports a parallel analysis for both particles (e.g. *up*, *down*) and locative SPs (*in, out*). Recall that when the SPs *into* or *onto* undergo demotion, the morpheme *to* (and the ground NP) is demoted, and only *in* and *on* are spelt out. Hence, these locative SPs can also be assigned type $p\checkmark$. Recall that the first sub-set of SPs (*-wards and -side* types) follow a similar pattern: *inside* and *upwards* can and must, respectively, act as complements of a verb after demotion. Therefore, we can also assign the type $p\checkmark$ to these SPs, and hence to all SPs morphemes.

We turn to the set of “old” simple SPs, those carrying the *a- and be-* prefixes. We assume that these prefixes act as zero-derivational morphemes that turn spatial nouns into SPs (cf. Svenonius 2006, 2010). Hence, they are assigned type $p\checkmark/p\checkmark$. Our assumption captures the idea that “bare” Axpart SPs (e.g. *front, cross*) change category, from bare NPs to SPs, when they are merged in an SP morpho-syntactic context. We represent this fact by assuming that they must change feature value, type-wise (Adger 2010; Morryll 2011). Thus, while *cross* is an NP denoting an object with a given spatial structure, *across* is the SP counterpart denoting a cross-like path. In order to keep our notation readable, we represent different feature values via indexes, in derivations (i.e. $p1, p2$). With these simple assumptions about our morphemes in hand, we can offer a compact type assignment in (17), and show how our SPs in lists (8) are derived. We mark the “Merge Introduction” operation as MI, and the selection of a lexical item in a derivation as LS (Lexical selection). We present our initial derivations in (18)-(19):

\begin{equation}
\begin{align*}
\text{a. } & p\checkmark = \{ \text{up, -side, upside, North, West, in, front, in front, cross, ... } \} \\
\text{b. } & p\checkmark/p\checkmark = \{ a-, be- \}
\end{align*}
\end{equation}
The type assignment in (17) partitions all the different descriptive SP types in two sets: one for morphemes as sets of features, and one for prefix elements. In our derivational and more “dynamic” approach, prefixes are those elements that take a free morpheme (to their right) as in input, and return a phrasal element as an output. Phrasal elements, in turn, can be “simple” or complex elements, respectively particles and SPs, that can act as arguments of some other element. The derivation in (18a) says that the Merge of SPs North and West derives the SP North-West, which has the same type $p \otimes p$ of its constituting morphemes. Hence, we predict that North, West and North-West belong to same underlying type of SPs, the Cardinal-type. Via the cut rule instance of Merge, we furthermore predict that one “shared” type is removed, and the resulting type is obtained by combining the remaining types together. The same analysis can be extended to SPs belonging to the Particle type, such as uphill, and -wards types of SPs (e.g. backwards). In other words, this analysis can be applied to all three subsets of “new” SPs.

The derivation in (18b), then, shows that almost the same type of analysis can be extended to “old” simple SPs. When the prefixes a- and be- merge with Axpart SPs such as -cross, the resulting SP is predicted to be another SP, in this case across. This element is also of type $p \otimes p$, like the other simple SPs. The derivation in (19), instead, shows that we can derive the structure of “old” SPs, such as in front or on top, via the same set of assumptions that adopt for our novel data. Via the use of feature values, we can also predict the ungrammaticality of unattested combinations. Although both West and front can be represented as compound types, their feature values differ, so their merging will be ungrammatical: Cardinal types of SPs cannot combine with other sub-types of SPs (cf. *in-West). Overall, the data in examples (2)-(7) can now find a unified, principled account.

Before we discuss the other data, however, we wish to make a comment on morpho-phonological matters. We suggest that the occurrence of the cut rule
in morphological derivations can determine the assimilation (“fusion”, in DM) of the two inserted exponents (Embick & Noyer 2001, 2006). Since the morphological component “fuses” structures, the phonological component can mirror this process by producing North-West/Northwest or uphill, via fusion. We observe that there seems to be some idiosyncratic variation as to which SPs can undergo fusion: we have pairs such as *up to* vs. *into*, but also SPs such as *in front* and *ahead*. We conjecture that such cases can be seen as idiosyncrasies in orthographic norm, since there seems to lack any relevant difference among the prosodic properties of these vocabulary items. We discuss this latter aspect in the next section, after we discuss the Spanish data.

4.1. The Analysis: Spanish Data
Since we now have an analysis of the English data, our analysis of the Spanish data can follow a more compact format. Our sub-sets of novel data, involving *Cardinal* and *Bare* types of SPs (Norte, cerca respectively), can be assigned the type $p\uparrow p$ as their English counterparts. For our sub-set of old data, involving SPs including the prefixes *a-, de-, en-*, we can also extend the corresponding English analysis. We assign the type $p\uparrow p/p\uparrow p$ to prefixes, and the type $p\uparrow$ to their Axpart morphemes (e.g. *-frente, -lante*, and so on). So, the resulting SPs (e.g. *enfrente, alante* and *delante*) are now predicted to be of type $p\uparrow p$, much like their English counterparts (e.g. *be-hind*). However, to capture the Spanish argument demotion data, as well as the occurrence of the relational SP *de*, we need a further step. We need to project our morphological analysis “all the way up”, to a syntactic level of analysis. To achieve this result, we proceed in three steps. First, we assume that a minimal difference between *a- and de-* prefixes lies in the value attributed to the output type$^3$, the type $p\uparrow p$ obtained after merging with an Axpart SP. Second, we assume that *de*, as a 2-valence head, can be assigned the (relational) type $p\uparrow p/p\uparrow p/p\uparrow p$, a type that takes SPs with certain feature values on its “left”. While SPs such as *delante* match the specific (left-)type and value of *de*, SPs such as *alante* do not. The converse holds for *a-* type prefixes, such as *alante*. We then make two supplementary assumptions, in order to derive sentences and place ourselves in a position to account argument demotion data. We assign the type $p\uparrow p$ to figure NPs such as *el niño*, and the type $p\uparrow p/p\uparrow p$ to the copula *estar*, as a transitive verb and head. We offer a type assignment in (20), and key derivations in (21)-(23):

\begin{equation}
(20) \quad a. \quad p\uparrow p=\{sobre, Norte, Oeste, enfrente, cerca, el niño, arriba, riba,…\}
\end{equation}

$^3$Since we do not need a full-fledged analysis of features, we take a simplified approach to this matter (but see Kracht 2002, 2008; Adger 2010; Stabler 2013).
b. \( p \equiv \{a-, \cdot \cdot \cdot \cdot \cdot \} \)

c. \( p \equiv \{ \cdot \cdot \cdot \cdot \cdot \cdot \cdot \} \)

\begin{align*}
(21) & \quad t \cdot [\text{el niño}] \quad \text{(LS)} \\
& \quad t+1. \ [\text{estar}] \quad \text{(LS)} \\
& \quad t+2. \ [\text{el niño}] \cdot \text{[estar]} \quad \text{(MI)} \\
& \quad t+3. \ [\text{delante}] \quad \text{(LS)} \\
& \quad t+4. \ [\text{[el niño]} \cdot \text{[estar]} \cdot \text{[delante]} \cdot \text{[de]}] \quad \text{(MI)} \\
& \quad t+5. \ [\text{[de]}] \quad \text{(LS)} \\
& \quad t+6. \ [\text{[el niño]} \cdot \text{[estar]} \cdot \text{[delante]} \cdot \text{[de]}] \quad \text{(MI)} \\
& \quad t+7. \ [\text{[la casa]}] \quad \text{(LS)} \\
& \quad t+8. \ [\text{[el niño]} \cdot \text{[estar]} \cdot \text{[delante]} \cdot \text{[de]}] \quad \text{(MI)}
\end{align*}

\begin{align*}
(22) & \quad t+k \cdot [\text{[el niño]} \cdot \text{[estar]} \cdot \text{[delante]} \cdot \text{[de]}] \quad \text{(D.Cr.)} \\
(23) & \quad t+k \cdot [\text{hacia}] \quad \text{(LS)} \\
& \quad t+k+1. \ [\text{arriba}] \quad \text{(LS)} \\
& \quad t+k+2. \ [\text{[hacia]} \cdot \text{[P]} \cdot \text{[arriba]}] \quad \text{(MI)}
\end{align*}

Note that we have used use abbreviated forms (e.g. el n for el niño), for simple reasons of space. The derivation in (21), which in turn is based on (8), reads as follows. The figure NP el niño is first merged with the verb esta; the new-formed constituent el niño esta is then merged with delante. When de is merged, delante becomes the specifier of this newly merged head, since de matches the features of delante, and must attach to it as a consequence (Phillips 2006; Adger 2010). The ground NP and de are merged accordingly. Some further observations are in order, before we continue. We gloss over the structure of our verbs and figure NPs, as they are not crucial to our analysis. Also, we follow analyses of SPs’ structure such as Hale & Keyser (2002)’s “P-within-P hypothesis”, rather than cartographic-bound analyses. This is the case, since we treat our set of SPs (enfrente, alante) as elements that are merged in the specifier of a relational head, the SP de. We then

\[\text{\footnotesize \cite[fn.16]{UrsiniAkagi2013}}\]
retroactively extend this assumption to English SPs. Hence, *in front of the hill* and similar other SPs receive the same analysis as *enfrente de*. Other simple English SPs (*behind, uphill*) can receive an equivalent analysis. For instance, the underlying structure of *behind the car* would approximately be *behind (P) the car*. This analysis also entails that the merge of prefixes such as *be*- and Axp part elements such as *-hind* forms a phrasal element. Thus, we offer an analysis of this category similar to previous analyses (e.g. Svenonius 2004, 2010), although via a different theoretical trajectory.

We turn to the simplified derivations in (22)-(23). In (22) we show that when *alante* merges with *de*, their features do not match, hence causing the derivation to crash, unlike in the *delante* case. Hence, we can now predict the distribution of the different types of argument demotion in English and Spanish that we discussed in examples (6)-(11), via this analysis. This analysis can also be easily extended to the PtP types of SPs (e.g. *hacia arriba*), our second sub-set of Spanish data, as the compressed derivation in (23) shows. The SP *hacia* merges with a silent head (i.e. “(P)”) and with *arriba*, forming an SP phrase that, in turn, cannot merge with a ground NP, because of its feature values. This is the case, as *arriba* lacks the features that allow it to successfully merge with a ground NP and the relational *de*. Hence, we can now also predict the structure of the PtP sub-types of SPs.

Overall, our Spanish data in (8)-(12) can now find a unified account that can be retroactively extended to the English SP data in (1)-(7). SPs such as *in front of, on top of, North of* and several others can receive the same analysis, with respect to morphological structure and distribution. Furthermore, our examples (1a)-(1b) can now find an account, as *to in front of and from on top of* can be seen as English counterparts of the Spanish *hacia SP* types. Hence, we can now claim that we have offered a positive answer to our first empirical question: whether English and Spanish SPs can receive a unified answer. We can now move to the Finnish data, and the other questions.

4.3 The Analysis: Finnish Data

Our goal in this section is to offer an account of the Finnish data. Since we now have an account of the structure of all types of SPs, of SP phrases and the sentences they are part of, we can directly focus on offering a type assignment for SCMs. As we concluded in section 2.3, SCMs and other case markers invariably act as suffixes on either Axp part “root” SPs, or on ground NPs. In our type assignment, summarized in (24), the simplest type assignment for suffixes is \( p \mathcal{P}/p \mathcal{P} \), a type that has interesting derivational properties when it is iterated, as in our case-stacking SPs. We then offer a derivation of its SP (*ulkopuolella ‘outside’*), based on (15c), in (25):

\[
(24) \quad a. p \mathcal{P} = \{ \text{ede-, jalj-, pai-, yli-, ympä-, a-, kautta-, Mario, edessa,...} \}
\]
b. \( p \, \text{ap/p } \text{ap} = \{-s-, -l-, -0-, -puole-, -sa-, -la, -on, -ta, \ldots\} \)

c. \( p \, \text{ap/p } \text{ap} = \text{on, (P), } \ldots\) 

(25) \begin{align*}
\text{t. } [ & \text{ulko-}\] \\
\text{t+1. } [ & \text{puole-}\] \\
\text{t+2. } [ & \text{ulkopuole-}\] - [ \text{ulkopuole-} ] \\
\text{t+3. } [ & \text{l-}\] \\
\text{t+4. } [ & \text{ulkopuole-}\] [ \text{l-}\] - [ \text{ulkopuolel-} ] \\
\text{t+5. } [ & \text{la}\] \\
\text{t+6. } [ & \text{ulkopuolel-}\] [ \text{la}\] - [ \text{ulkopuolel}\] \\
\end{align*}

(26) \begin{align*}
\text{t+k. } [ & \text{Mario}\] [ \text{on}\] [ \text{huoneen}\] \\
\text{k+1. } [ & \text{(P)}\] \\
\text{k+2. } [ & \text{Mario}\] [ \text{on}\] [ \text{huoneen}\] [ \text{(P)}\] - [ \text{Mario}\] [ \text{on}\] [ \text{huoneen}\] [ \text{(P)}\] \\
\text{k+3. } [ & \text{ulkopuolel}\] \\
\text{k+4. } [ & \text{Mario}\] [ \text{on}\] [ \text{huoneen}\] [ \text{(P)}\] - [ \text{Mario}\] [ \text{on}\] [ \text{huoneen}\] [ \text{(P)}\] \\
\end{align*}

The type assignment in (24) should be straightforward to read, by this point. The derivation in (25) shows how an SP marked for Inessive case (\textit{ulkopuolella} ‘outside’) can be derived. An Axpart morpheme (\textit{ulko-}) is merged with three SCMs in a cyclical way, forming a full SP (\textit{ulko-puolella}). In other words, case-stacking can be simply treated as a derivational sequence of morphemes being merged together, in an orderly way. Ground NPs can be derived accordingly, although via only one affixal cycle (e.g. \textit{huoneen} ‘house-GEN’). Thus, we can account case stacking as a simple but principled instance of iterated merging of case suffixes.

With this result in hand, we show how our Finnish sentences emerge via the partial derivation in (26). Note that we show how an explicit ground NP is merged, whereas a derivation that would roughly “skip” steps \( t+k \) to \( k+2 \) would derive a sentence involving argument demotion (e.g. (15f)), instead. In (26), we would obtain \textit{Mario on ulkopuolella} (‘Mario is outside’) as a result. Note, furthermore, that we follow the previous literature on Finnish in also assuming a silent (P) head to take ground NP and SP as its arguments (Nikanne 1993; Kracht 2002, 2004). By this point, then, we can claim that we can offer a general account of Finnish SPs and sentences, covering examples (13)-(15). We have a full account of our data. Before we move to conclusions, however, we wish to discuss four consequences of our analysis.
First, we can assign the same type to SCMs and prefixes, *qua* members of the class of affixes. Our rule of forward application blurs the distinction between the two directions of affixation. Second, we consequently can capture different linear orders of morphemes without any additional assumptions. Intuitively, in English and Spanish the locative morphemes *in* and *en* precede their Axpart matches, *front* and *frente*. In Finnish, the (compound) Inessive case *puole-l-lä* follows the Axpart morpheme *ulko-* . In our approach, the input types and the derived type are the same across the three languages, although the linear order in English/Spanish is the mirror of the linear order in Finnish. Indeed, we can actually *predict* that two symmetrical linear realizations of the same underlying derivation (affix plus argument) may be realized as forms of cross-linguistic variation (Harbour 2007; Harley 2010b). Third, both optional and obligatory argument demotion patterns can be now explained, although we only discussed in detail the first case, for Finnish. For the second case, we suggest that the precise Case marker that occurs on an SP, when a *Suffix* type is involved, may be ultimately determined on semantic grounds (Kracht 2002, 2004). Fourth, we compress the derivation in (26) for pure reasons of space, but we assume that the intermediate steps producing sentence fragments, e.g. *Mario on huoneen ulko-...* are part of the derivation. Works on sentence production suggest that sentences including incomplete words not only can occur, but give important cues as to “where” speech production errors can occur (Levelt 1989: ch.10; Jarema and Libben 2007: ch.3; Pfau 2009). Our “morphology all the way up” motto seems more justified, given these facts. We now have a unified account of SPs and SCMs, and an analysis of key syntactic properties (demotion); hence, we have a positive answer to the second and third question, respectively.

5 Conclusions

In this paper we have presented a unified analysis of the morphological properties of English and Spanish SPs (*in front, encima*) and Finnish SCMs (*ulkopuolella*). Our analysis is couched in a combination of DM and TL calculi, thus being able to treat morphological (SP/SCM derivation) and syntactic (argument demotion) phenomena under one system. Thus, the analysis offers three positive answers to our empirical questions: first, whether English and Spanish SPs can receive a uniform analysis; second, whether SCMs fall under this analysis; third, whether the analysis can cover syntactic (demotion) phenomena. However, some problems are still outstanding: for instance, our analysis cannot currently rule out unattested SPs such as *front in, *lante-a, and *puole-l-lä-l. A more thorough analysis of feature values that we have left aside, in this paper, would perhaps solve such problems; we leave such analysis for future works, however.
References


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Fong, V. 1997 *The Order of Things: What Directional Locatives Denote.*


