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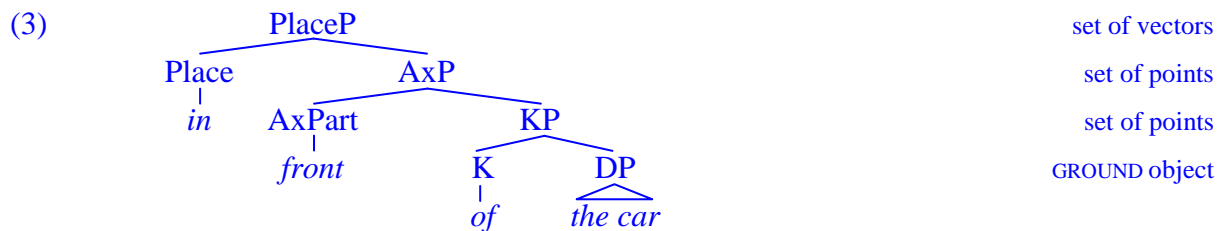**ON CROSS-LINGUISTIC COMBINATORICS OF AXIAL COMPLEXES**
GTD 2018, Utrecht, February 3, 2018

1.   BACKGROUND

Axial prepositional complexes (cf. Jackendoff 1996) are widespread cross-linguistically:

(1)   a.   El   libro   está   **de-l-ante**   **de la   mesa**.   Spanish, Fábregas 2007
        the   book   is   from-the-front   of   the   table
        The book is in front of the table.

     b.   hu   haya   **mi-taxat**   **la-bayit/ha-bayit**.   Hebrew, Botwinik-Rotem 2008
        he   was   from-bottom   to.DEF-house/ DEF-house
        He was under the house.

     c.   **S-pered-i**   **ot   dom-a**   roslo derevo.
        down.from-front-LOC   from house-GEN grew tree
        A tree grew in front of the house.   Russian, Mitrofanova and Minor 2013

(2)   Maria   a-mami   **î-gûrû ri-a   metha**.   Kîîtharaka, Muriungi 2006
      1.Maria SM1-sleep 5-top   5-AS 9.table
      Maria is sleeping/lying on top of the table.

Svenonius 2006, 2010, etc.: axial elements (AxParts) are regarded as **purely functional**:

(3)   PlaceP   set of vectors
          Place   AxP   set of points
           |
           in   AxPart   KP   set of points
                      |
                    front   K   DP   GROUND object
                                    |
                                   of   *the car*

Lots of follow-up work (Muriungi 2006, Pantcheva 2006, Fábregas 2007, Takamine 2007, Botwinik-Rotem 2008, Roy and Svenonius 2009, Romeu 2014, etc.)

2.   PROBLEMS

Three core issues:
   ➢   semantic inadequacy: regions (as sets of points or vectors) do not have axes
   ➢   lexical inadequacy: axial elements are lexical (Matushansky and Zwarts 2018)
   ➢   **descriptive inadequacy: axial complexes do not have the same syntax**

This talk: **the axial nominal squish** and **path-based axial complexes**

3.   THE NOMINAL SYNTAX OF AXPARTS

Matushansky and Zwarts 2018: axial nouns may project different levels of syntactic structure

Either of the non-lexical heads in (3) may be missing and an extra DP layer may be present

3.1.   Definite AxParts: connection to weak definites

Svenonius' core case: **a preposition with a bare AxPart**:

(4)   The cat was sitting **on top of the bed**.

Actually, quite atypical for English, where the axial noun can be definite, too:

(5)   a.   The chamber pot can be found **at the foot of the bed**.
      b.   The grandfather clock is **to the left of the wardrobe**.

Standard position of AxPart theoreticians: disregard the article
But what about possessive pronouns (*at her side*, *to his left*)?

Matushansky and Zwarts 2018: the putative **AxPs are weak definite noun phrases**
→ resistance to modification, pronominalization, pluralization and preposing (Ross 1996)
Tentatively missing: a definite axial complex without an outer preposition

3.2. Preposition-less axial complexes

Zero extension: an axial complex seems to be headed by the AxPart:

(6)   a.   Maria   a-ciat-ir-e   **rû-teere** rw-a   î-kurungu.   Kîîtharaka, Muriungi 2006
           1.Maria SM1-sweep-PRV-FV   11-side   11-AS   5-cave
           Maria swept the side of the cave.

      b.   Maria   a-ciat-ir-e   **rû-teere**.
           1.Maria SM1-sweep-PRV-FV   11-side
           Maria swept (on) the side [of something].

      c.   Maria   a-kari   **ru-ngu**   rw-a   ndagaca.
           1.Maria SM1-sit   11-under   11-AS   bridge.9
           Maria is sitting under the bridge.

No preposition, yet **the AxPart is nominal: cf. noun class agreement** in (6a, c)

English allows this too:

(7)   a.   The town is located **north of the border**.
      b.   The fountain can be found **left of the entrance**.
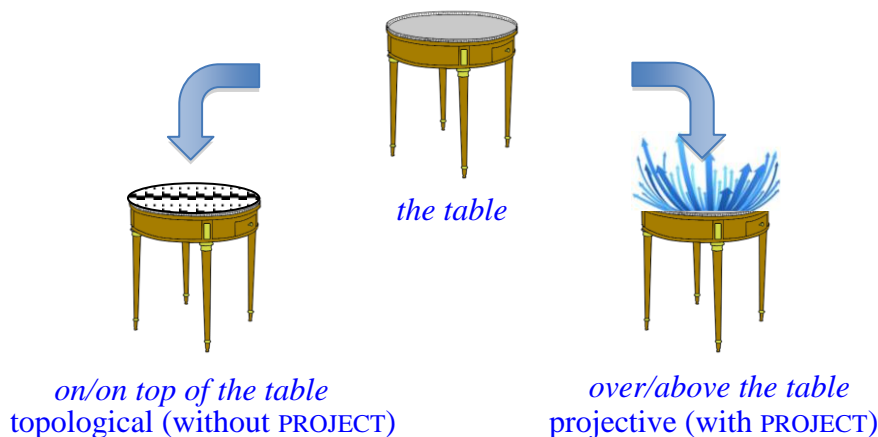
Muriungi 2006 proposes a null P
       ➤   in English: also a null D; **too much invisible structure**
       ➤   semantic reasons NOT to do this: **Duke-of-York derivation in acquisition**
Explanation (Matushansky and Zwarts 2018): **the definite article appears only with axial nouns denoting in the entity-domain** (the entity-correlate of the relevant spatial relation, a sort of **a spatial kind**). This denotation forces the presence of a preposition in order to return to a spatial denotation

3.3. The projective component

Axial complexes (like regular PPs) may also differ in their semantics, in function of whether they involve a projective component (PROJECT):

(8)   Topological vs. projective prepositions
      see Herskovits 1986 for the distinction between topological and projective prepositions

the table

on/on top of the table
topological (without PROJECT)

over/above the table
projective (with PROJECT)

Including *a-* and *be-* axial complexes (see Deacon 2015, 2017 for their analysis as (notational variants of) AxPs):

(9) a.   aboard, about, amid, among, at the foot/head, beside, between, on board, on top…

     b.   above, ahead, before, behind, below, beyond, beneath, in front, inside, outside,
          (to the) north/south/…, to the left/right …

Projective axial complexes permit measure phrases, proximate ones do not (cf. the *bounded* property in Svenonius 2008):

(10) a.   twenty meters in front of the skyscraper
     b.   *twenty meters on top of the skyscraper

The same AxPart (e.g., 'head') can give rise to the two interpretations:

(11) a.   *a-xə+x′* 'above' < *a-xə̀* 'head' + *-x′* 'in, on, at'   Abkhaz, Svorou 1994:88
     b.   *é-tá* 'on (top of) him' < *é* 'he' + *tá* 'head'   Ewe, Heine and Reh 1984:257

Even in the same language (cf. also Pérez Báez 2011):

(12) ni-ndečí   ʔn   sãã   šini-yúnu.   Chalcatongo Mixtec, Brugman 1981
     PRFV-fly   one   bird   head-tree
     a.   *A bird flew over the tree.*
     b.   *A bird flew to the top of the tree.*

Claim: it is not a matter of vagueness, this is genuine ambiguity
Evidence: in a number of languages an **overt source preposition** precedes the AxPart:

(13) a.   El   libro está **de.**l.ante   de la   mesa.   Spanish, Fábregas 2007
          the   book   is   from.the.front   of the   table
          The book is in front of the table.

     b.   hu   haya   **mi.**taxat   la-bayit/ha-bayit.   Hebrew, Botwinik-Rotem 2008
          he   was   from.bottom   DIR+DEF-house/ DEF-house
          He was under the house.

     c.   **S-**pered-i   ot   dom-a   roslo derevo.
          down.from-front-LOC   from house-GEN grew tree
          A tree grew in front of the house.   Russian, Mitrofanova and Minor 2013

Matushansky and Zwarts 2018: it is the lexicalization of the PROJECT component

3.4.   Case-assignment

Even within the same language an AxPart may assign case differently:

(14) a.   on top of the bus
     b.   on board the bus

Possible objection: *board* is not an AxPart

Counter-objection: sometimes it is precisely the lack of possessive syntax that distinguishes AxParts from the corresponding body-parts (cf. Heine and Reh 1984:257):

(15) a.   é-tá   Ewe, Heine and Reh 1984:257
          he-head
          on (top of) him

     b.   é-ƒé   tá
          he-of   head
          on (top of) him

This may be a difference not in structure but in the features of the axial noun: the ability to assign case without a marker or to compose in a morphologically unmarked construct state

3.5. Summary

The scheme in (3) is too simplistic:
- ➢ the definite article may be present (5)
- ➢ the outer preposition may be missing (6b, c), (7)
- ➢ there might be a projective component (13)
- ➢ the possessive marking may be absent (14b), (15a)

What we seem to have in reality is a nominal extended projection with varying syntactic and semantic properties of the head noun

Non-canonical nouns denoting locations are not unexpected to have **deficient extended NPs** and we are in essence **quantifying non-canonicity**

4.   THE SYNTAX OF THE GROUND: DIRECTIONALITY VS. POSSESSION

Most frequently observed: **the ground as the possessor**:
- ➢ genitive case-marking
- ➢ general possessive preposition
- ➢ construct state
- ➢ ezafe (Persian, Pantcheva 2006) or associative marker (Bantu, cf. Muriungi 2006)

However, **the ground can also behave as a source** (Russian data adapted from the corpus):

(16) a.   siŋ taŋ-ŋaha u-cuptaŋ-leŋ khim yuŋŋa.   Belhare, Bickel 1994
           wood plant-GEN 3POSS-RIGHT-DIR house is
           There is a house to the (personmorphic) right of the tree.

   b.   siŋ taŋŋ-et-nahuŋ cuptaŋ-leŋ khim yuŋŋa.
         wood plant-LOC-ABL RIGHT-DIR house is
         There is a house to the (physiomorphic) right of the tree.

(17) a.   Glotka raspoložena v.pered.i   ot   osnovnoj časti zatyločnoj kosti…
           gullet situated   in.front.LOC from main   part occipital   bone
           The gullet is situated in front of the main part of the occipital bone.

   b.   V.pered.i   každogo kolena   šla   tysjača   izrail'tjan.
         in.front.LOC each.GEN tribe.GEN went thousand Israelis
         In front of every tribe walked a thousand Israelis.

In Russian the presence of *ot* 'from' unambiguously indicates projection (but its absence does not imply anything, to the extent that it is allowed):

(18) a.   S.verx.u   i   s.niz.u   ramki byli nadpisi.
           down.from-top.GEN^2 and down.from-bottom.GEN^2 frame were inscriptions
           There were inscriptions at the top and at the bottom of the frame.

   b.   Postavim s.niz.u   ot ètogo pučka   èlektronov plastinku.
         set.1PL down.from-bottom.GEN^2 from this bundle   electrons   plates.
         Let us set a plate under this bundle of electrons.

ot 'from' is compatible with other outer prepositions and cannot correspond to PROJECT

Questions:
- ➢ How can paths become places?
- ➢ What is the compositional semantics here, as the AxPart seems to share with the inner preposition its internal argument?

Another area with the same issue: measure phrases:

(19) a. **V dvadcati metrax ot   doma** roslo derevo.
in twenty   meters   from house   grew tree
A tree grew twenty meters from the house.
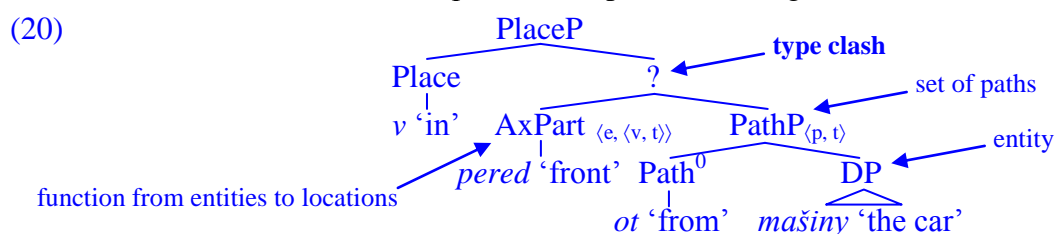
b. **Ninety-nine miles from L.A.** I kiss you.

The source of the locative semantics is clearer in Russian, but the composition isn't.

4.1. Path-encoded axial complexes

Two core issues:
- How does a PathP denote a place?
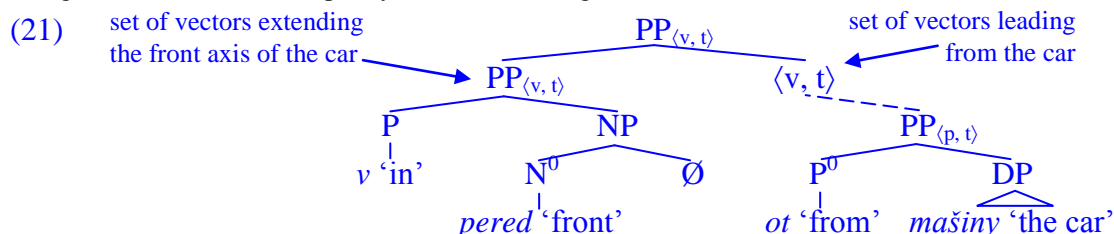- How is the ground supplied to the AxPart?

Svenonius' structure does not compose with a path-encoded ground:

(20)

PlaceP

Place   ?   ← **type clash**

v 'in'   AxPart $\langle e, \langle v, t\rangle\rangle$ PathP$_{\langle p, t\rangle}$ ← set of paths

pered 'front' Path^0 DP   ← entity

function from entities to locations →

ot 'from'   *mašiny* 'the car'

Roy and Svenonius 2009 define AxPart as a function from locations (set of vectors) to locations ($\langle\langle v, t\rangle, \langle v, t\rangle\rangle$). However, locations cannot have functionally oriented axes, such as *front*, which is even more true for locations given by paths (see below)

Intuition: what we need is modification (set intersection): **the set of vectors emanating from the ground *and* located in front of it**
Using PPs for the sake of simplicity and not indicating headedness

(21) set of vectors extending   PP$_{\langle v, t\rangle}$ set of vectors leading
the front axis of the car →   ← from the car

PP$_{\langle v, t\rangle}$ $\langle v, t\rangle$ PP$_{\langle p, t\rangle}$

P   NP   P^0 DP

v 'in'   N^0 Ø   *ot* 'from'   *mašiny* 'the car'

pered 'front'

What we have is (a) **"ungrounded" axis** and (b) set of **paths** emanating from the ground

Two key components to the solution: **contextual variables and path-to-endpoint transition**

4.1.1. Axial adverbs and the contextual variables

Mitchell 1986, Partee 1989, Martí 2003, 2006: there are implicit variables that can be bound and must be projected in syntax:

(22) a.   John thinks that restaurant is **around the corner**.
b.   Every sports fan in the country was at a **local** bar watching the playoffs.

Proposal: **the adverbial use of axial complexes involves such a contextual variable**:
And it is morpho-syntactically relevant, cf. the Spanish *delante* 'in front of' vs. *alante* 'in front' (Fábregas 2007)

(23) a.   Every house had three people **inside**.
b.   Every band was smartly dressed and a cheerleader walked **in front**.

This is cost-free: **every analysis needs an explanation for intransitive axial complexes**

4.1.2. Path reduction

To pass from a set of paths to a set of their endpoints, we appeal to the independently attested phenomenon of **path-to-endpoint reduction** (Cresswell 1978, see also Talmy 1996):

(24) a.   Arabella walks **across a meadow from Bill**.
      b.   Post Office is **over the hill**.

To achieve the right result, we need a function from a path to the vector whose starting point is the beginning of that path and whose endpoint is the endpoint of that path:
- ➢   for Cresswell, such a vector gives the final point
- ➢   for us, it allows measurement (*99 miles from LA*) and intersection with an axial projection

Assuming that a path Π is a function from the real interval $[0;1] \subset R$ to vectors (Zwarts and Winter 2000):

(25) P2E (Π) = { p(1): p is an element of Π }

P2E reduction is not a syntactic node, it is a kind of coercion that only occurs when needed (otherwise, directional PPs would be systematically ambiguous)

4.1.3. The interpretation of Ø in a source-encoded axial complex

Why is Ø always identical to the internal argument of the source PP?

Answer: otherwise the intersection of the two sets will be empty:
- ➢   the vectors resulting from an application of REDUXP2E to *from x* must have their starting point in x
- ➢   the vectors resulting from PROJECT (AXIS (y)) must originate in y
- ➢   hence x=y

Natural question: **why is it only source PPs that combine with measure phrases and axial adverbs**?

This is actually an open question: in Hebrew the ground is introduced by the preposition *le-* 'to'

5.   CONCLUSION AND FURTHER QUESTIONS

Axial complexes do not have the same cross-linguistic (or even intra-linguistic) syntax:
- ➢   varying levels of "nominality" for the AxPart
- ➢   varying semantics and the resultant PROJECT component
- ➢   the ground may be introduced as a source PP

There is no such thing as AxParts, there is "infinite use of finite means" from the existing syntactic and semantic resources in the domain of P, N and space

6.   APPENDIX: THE SEMANTICS OF AXIAL PARTS

Matushansky and Zwarts 2018: starting with the conceptual definition of an axis, assigned to to an object on the basis of its shape, function, the position of the perspective holder, etc. (cf. Herskovits 1986 and many others)

For the sake of simplicity we abstract away from the complications added by the frame of reference (intrinsic *at the top of the truck* vs. relative *to the left of the tree* vs. absolute *north of the border*), cf. Levinson 1996a, b

These axes can be represented in terms of **sets of vectors** (combining shape and orientation)

(26) TOP = $\lambda x \in D_e$. $\lambda u \in D_v$. START (u) = CENTER (x) *and* END (u) $\in$ BOUNDARY (x)
      and UP (u),
   the primitives START, END, BOUNDARY, etc., are defined as in Zwarts and Winter 2000

Spatial core of *top*: a function TOP that maps an object *x* to the **set of vectors** starting from its center, ending at the boundary and directed upward

From this spatial core we can define the **axial part object** (the object that occupies the space defined by (26)), the **axial entity-correlate** (the AxPart) and the **axial projection** (the space outside the ground directed away from the axial object)

For the **axial projection** an extra component is needed:

(27) PROJECT = $\lambda f \in D_{\langle v, t \rangle}$. $\lambda u \in D_v$. $\exists w$ [f(w) and START (u) = END (w) and DIR (u) = DIR (w)]

The set of vectors defined by PROJECT (TOP (*x*)) (equivalent to *above*, in English) might seem too broad:

(28) a.   b.   c.

house   TOP (house)   PROJECT (TOP (house))
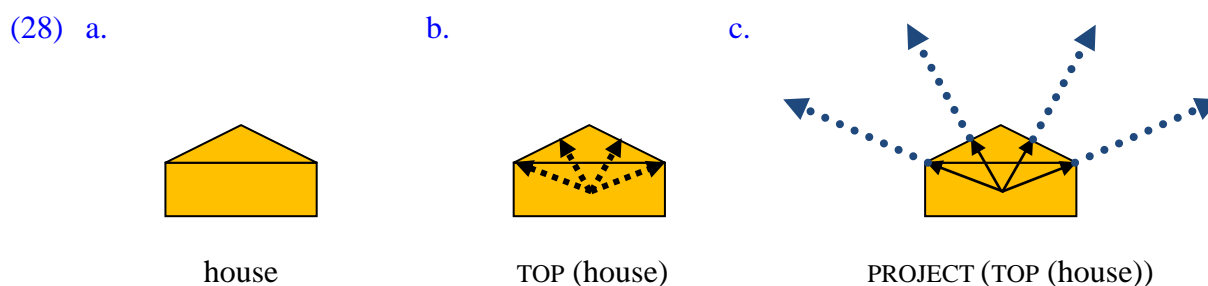
However, while the set may be contextually restricted, this happens at a higher level:

(29) a.   twenty meters in front of the house
      b.   diagonally in front of the house

Issue: despite **two meters on top of the house* nothing excludes the intersection of the vector set of the axis with the vector set introduced by a measure phrase (but there seems to be no pragmatic reason to do so – something to examine further)

7.   BIBLIOGRAPHY

Bickel, Balthasar. 1994. Mapping operations in spatial deixis and the typology of reference frames. *Max-Planck-Research Group in Cognitive Anthropology Working Paper* 31.

Botwinik-Rotem, Irena. 2008. A closer look at the Hebrew Construct and free locative PPs: The analysis of *mi*-locatives. In *Adpositions: Pragmatic, Semantic and Syntactic Perspectives*, ed. by Dennis Kurzon and Silvia Adler. *Typological Studies in Language 74*, pp. 85-114. Amsterdam: John Benjamins.

Brugman, Claudia Marlea. 1981. The use of body-part terms as locatives in Chalcatongo Mixtec. *Survey of Californian and Other Indian Languages* 4, pp. 235-290.

Cresswell, M. J. 1978. Prepositions and points of view. *Linguistics and Philosophy* 2, pp. 1-41.

Deacon, Robert Joel. 2015. Replacing Axial Part with a root-node in the extended projection of P. *Florida Linguistics Papers* 2. Available at http://journals.fcla.edu/floridalinguisticspapers/article/view/85089.

Deacon, Robert Joel. 2017. Roots in adpositional domains: Reasons to include a little *p* categorial head. In *34th West Coast Conference on Formal Linguistics*, pp. 131-140: Cascadilla Proceedings Project.

Fábregas, Antonio. 2007. (Axial) parts and wholes. *Nordlyd* 34, ed. by Monika Bašić, Marina Pantcheva, Minjeong Son and Peter Svenonius, pp. 1-32.

Heine, Bernd, and Mechthild Reh. 1984. *Grammaticalization and Reanalysis in African Llanguages*. Hamburg: Helmut Buske Verlag.

Herskovits, Annette. 1986. *Language and Spatial Cognition: An Interdisciplinary Study of the Prepositions in English*. Cambridge: Cambridge University Press.

Jackendoff, Ray. 1996. The architecture of the linguistic-spatial interface. In *Language and Space*, ed. by Paul Bloom, Mary A. Peterson, Lynn Nadel and Merrill F. Garrett, pp. 1-30. Cambridge, Massachusetts: MIT Press.

Levinson, Stephen C. 1996a. Frames of reference and Molyneux's questions: Cross-linguistic evidence. In *Language and Space*, ed. by Paul Bloom, Mary A. Peterson, Lynn Nadel and Merrill F. Garrett, pp. 109-169. Cambridge, Massachusetts: MIT Press.

Levinson, Stephen C. 1996b. Relativity in spatial conception and description. In *Rethinking Linguistic Relativity*, ed. by John J. Gumperz and Stephen C. Levinson, pp. 177-202. Cambridge: Cambridge University Press.

Martí, Luisa. 2003. Contextual Variables, Doctoral dissertation, University of Connecticut.

Martí, Luisa. 2006. Unarticulated constituents revisited. *Linguistics and Philosophy* 29, pp. 135-166.

Matushansky, Ora, and Joost Zwarts. 2018. The partial nominality of axial parts. Paper presented at *Syntax-interface meetings*, Utrecht University, January 22, 2018.

Mitchell, Jonathan. 1986. The Formal Semantics of Point of View, Doctoral dissertation, University of Massachusetts at Amherst.

Mitrofanova, Natalia, and Serge Minor. 2013. The syntax and semantics of directional axial expressions in Russian. In *Formal Description of Slavic Languages: The Ninth Conference*, ed. by Uwe Junghanns, Dorothee Fehrmann, Denisa Lenertová and Hagen Pitsch, pp. 171-190. Bern, Switzerland: Peter Lang.

Muriungi, Peter. 2006. Categorizing adpositions in Kîîtharaka. *Nordlyd* 33, pp. 26-48.

Pantcheva, Marina. 2006. Persian preposition classes. *Nordlyd* 33. *Special issue on adpositions*, ed. by Peter Svenonius and Marina Pantcheva, pp. 1-25.

Partee, Barbara H. 1989. Binding implicit variables in quantified contexts. In *Papers from CLS 25*, ed. by Caroline R. Wiltshire, Bradley Music and Randolph Graczyk, pp. 342-365. Chicago: Chicago Linguistic Society.

Pérez Báez, Gabriela. 2011. Semantics of body part terms in Juchiteco locative вescriptions. *Language Sciences* 33, pp. 943-960.

Romeu, Juan. 2014. A vs. en in Spanish locatives. In *Major Trends in Theoretical and Applied Linguistics*, vol. 1, ed. by Nikolaos Lavidas, Thomaï Alexiou and Areti Maria Sougari, pp. 459-474. Berlin, Boston: Versita.

Ross, John R. 1996. Defective noun phrases. In *CLS 31: Papers from the 31st Regional Meeting of the Chicago Linguistic Society* ed. by Audra Dainora, Rachel Hemphill, Barbara Luka, Barbara Need and Sheri Pargman, pp. 398-440. Chicago: Chicago Linguistic Society.

Roy, Isabelle, and Peter Svenonius. 2009. Complex prepositions. In *Autour de la préposition*, ed. by Jacques François, Eric Gilbert, Claude Guimier and Maxi Krause, pp. 105-116. Caen: Presses Universitaires de Caen.

Svenonius, Peter. 2006. The emergence of Axial Parts. *Nordlyd* 33. *Special issue on adpositions*, ed. by Peter Svenonius and Marina Pantcheva, pp. 49-77.

Svenonius, Peter. 2008. Projections of P. In *Syntax and Semantics of Spatial P*, ed. by Anna Asbury, Jakub Dotlacil, Berit Gehrke and Rick Nouwen, pp. 63-84. Amsterdam: John Benjamins.

Svenonius, Peter. 2010. Spatial P in English. In *The Cartography of Syntactic Structures*, vol. 6, ed. by Guglielmo Cinque and Luigi Rizzi, pp. 127-160. Oxford: Oxford University Press.

Svorou, Soteria. 1994. *The Grammar of Space*. Amsterdam: John Benjamins.

Takamine, Kaori. 2007. The Axial Part Phrase in Japanese. *Nordlyd* 33, pp. 78–97.

Talmy, Leonard. 1996. Fictive motion in language and 'ception. In *Language and Space*, ed. by Paul Bloom, Mary A. Peterson, Lynn Nadel and M. F. Garrett, pp. 211-276. Cambridge, Massachusetts: MIT Press.

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