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.*

   he was from-bottom to.DEF-house/DEF-house
   *He was under the house.*

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

(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) \[
   \begin{array}{c}
   \text{PlaceP} \\
   \text{in} \quad \text{AxPart} \\
   \text{front} \quad \text{K} \\
   \text{of} \quad \text{DP} \\
   \text{AX} \quad \text{of} \quad \text{the \ car}
   \end{array}
   \]


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:

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

\[(9)\]  
\(\begin{align*}
  &\text{a. aboard, about, amid, among, at the foot/head, beside, between, on board, on top…} \\
  &\text{b. above, ahead, before, behind, below, beyond, beneath, in front, inside, outside, (to the) north/south/…, to the left/right …}
\end{align*}\]

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

\[(10)\]  
\(\begin{align*}
  &\text{a. twenty meters in front of the skyscraper} \\
  &\text{b. *twenty meters on top of the skyscraper}
\end{align*}\)

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

\[(11)\]  
\(\begin{align*}
  &\text{a. }a\text{-xә+x’ ‘above’ < }a\text{-xә ‘head’ }+\text{ -x’ ‘in, on, at’} \\
  &\text{b. }é\text{-tá ‘on (top of) him’ }<\text{ é ‘he’ }+\text{ tá ‘head’}
\end{align*}\)

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

\[(12)\]  
\(\begin{align*}
  &\text{ni-ndečí ?n sāḥ śni-yūnu.} \\
  &\text{PRFV-fly one bird head-tree}
\end{align*}\)

\(\begin{align*}
  &\text{a. A bird flew over the tree.} \\
  &\text{b. A bird flew to the top of the tree.}
\end{align*}\)

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:

\[(13)\]  
\(\begin{align*}
  &\text{a. El libro está de.lante de la mesa.} \\
  &\text{the book is from.the.front of the table}
\end{align*}\)

\(\begin{align*}
  &\text{b. hu haya mi.taxat la-bayit/ha-bayit.} \\
  &\text{He was from.bottom DIR+DEF-house/ DEF-house}
\end{align*}\)

\(\begin{align*}
  &\text{c. S-pered-i ot dom-a rosol derevo.} \\
  &\text{down.from-front-LOC from house-GEN grew tree}
\end{align*}\)

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:

\[(14)\]  
\(\begin{align*}
  &\text{a. on top of the bus} \\
  &\text{b. on board the bus}
\end{align*}\)

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):

\[(15)\]  
\(\begin{align*}
  &\text{a. é-tá ‘on (top of) him} \\
  &\text{he-head}
\end{align*}\)

\(\begin{align*}
  &\text{b. é-fé tá ‘he-of head} \\
  &\text{on (top of) him}
\end{align*}\)
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 təŋ-ŋa u-cuptaŋ-leŋ kihm yuŋŋ. Belhare, Bickel 1994
   wood plant-GEN 3POSS-RIGHT-DIR house is
   There is a house to the (personomorphic) right of the tree.

   b. siŋ təŋ-ŋet-nahunŋ cuptaŋ-leŋ kihm yuŋŋ.
   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 zatyročnoj 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.GEN2 and down.from-bottom.GEN2 frame were inscriptions
   There were inscriptions at the top and at the bottom of the frame.

   b. Postavim s.niz.u ot ètogo pučka èlekrtonov plastinku.
   set.1PL down.from-bottom.GEN2 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 røslo derevo.
in twenty meters from house grew tree
A tree grew twenty meters from the house.


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)

function from entities to locations

PlaceP

v ‘in’

AxPart ⟨(v, t)⟩

PathP ⟨(p, t)⟩

DP

pered ‘front’

entity

set of paths

type clash

Roy and Svenonius 2009 define AxPart as a function from locations (set of vectors) to locations (⟨⟨v, t⟩⟩, ⟨v, t⟩). 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 the front axis of the car

PP⟨(v, t)⟩

PP⟨(v, t)⟩

set of vectors leading from the car

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 \([0;1] \subset \mathbb{R}\) to vectors (Zwarts and Winter 2000):

(25) \[ P2E(\Pi) = \{ p(1); \ p \text{ is an element of } \Pi \} \]

**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 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)
On cross-linguistic combinatorics of axial complexes

(26) \[ \text{TOP} = \lambda x \in D_e . \lambda u \in D_v . \text{START} (u) = \text{CENTER} (x) \text{ and END} (u) \in \text{BOUNDARY} (x) \text{ and UP} (u) , \]

the primitives \text{START}, \text{END}, \text{BOUNDARY}, etc., are defined as in Zwarts and Winter 2000

Spatial core of \text{TOP}: a function \text{TOP} that maps an object \( x \) to the \text{set of vectors} starting from its center, ending at the boundary and directed upward

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

For the \text{axial projection} an extra component is needed:

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

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

(28) a. \[ \text{TOP} \text{ (house)} \]

\[ \text{PROJECT} \text{ (TOP} \text{ (house)}) \]

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


