

AXES TO GRIND

Most current approaches to **axial prepositional complexes**, such as the French *à l'intérieur de* 'inside', the Russian *v.pered.i* 'in front of', the Hebrew *mi.mul le* 'across from' and the Japanese *-no mae-ni* 'in front of', assume, following Svenonius 2006, 2010, that the **non-prepositional element** inside it belongs to a syntactic category (AxPart) that is distinct from both prepositions and nouns and that forms part of the extended projection of the PP (1). KP is taken to correspond to the function EIGEN creating a region that an AxPart operates upon.

(1) [PathP [PlaceP *in* [AxPartP *front* [KP *of* NP_{GROUND}]]]]

We are going to argue against this proposal because it leaves unexplained (a) the syntactic and semantic **connection between an AxPart and the corresponding lexical noun** (2) and (b) the **nominal syntax** of AxPart in many cases (like the article in *à l'intérieur de* and the possessive in *to my left*). Its **semantic composition** we will also show to be problematic.

(2) a. A hat is **on top of your head**. AxPart
 b. Your forehead is **at the top of your head**. noun

Compositional semantics of an axial complex: Core principles of spatial language and cognition (cf. Herskovits 1986 and many others) require that axes (like tops and fronts) are assigned to an object on the basis of its shape, function, the position of the perspective holder, etc. On the basis of that and using vector-space semantics (Zwarts 1997, Zwarts and Winter 2000) we define a variety of **axial functions** (like TOP and FRONT) of type $\langle e, \langle v, t \rangle \rangle$ that link an object to the set of vectors starting from its center (defined pragmatically, perhaps as its center of gravity), ending at its boundary and pointing in the relevant direction (3). This gives us the **axial boundary region** at a particular side. A clear example of an axial relation based on (3) is given in (4).

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

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

An axial function must apply directly to the ground entity rather than to the eigenspace region (delivered by KP in (1) per Svenonius 2006, 2010), because regions cannot have functionally defined tops and fronts. This leaves no place for a spatial KP, correctly predicting instead the possessive syntax mediating the relation between the axis and the ground.

We derive the concrete top **axial part** of an object x (5) through a general function PART (6a) that gives the maximal part of x located at the endpoints of the vectors of TOP (x), using the independently motivated LOC^- function (Zwarts and Winter 2000). The maximality in PART in (6) (derived with σ) is motivated by the way our cognitive system treats contiguous pieces of a particular side as one single object; the three-dimensionality of the space involved entails that in practice $PART(TOP(x))$ corresponds not to a surface, but to a larger 3D top part of x .

(5) **Î-gûrû i-rî ciat-ir-w-e**. Kĩtharaka, Muriungi 2006
 5-top F-SM5 sweep-PERF-PASS-FV
The top [of something] was swept.

(6) $PART = \lambda f \in D_{\langle v, t \rangle} . \lambda y \in D_e . y = \sigma(LOC^-(f))$

Axial projection: the functions in (3) and (6) do not yet explain why the FIGURE in the axial complex need not be located in the region defined by the relevant axial object: the kangaroo is inside the car in (7b), but outside it in (7a).

(7) a. The kangaroo is in **front** of the car. axial projection
 b. The kangaroo is in the **front** of the car. axial part

To capture this fact we introduce the general semantic function PROJECT (type $\langle\langle v, t \rangle, \langle v, t \rangle\rangle$), (8a), which naturally extends the internal axis f to an external region (cf. Svorou 1994 for a typological perspective). Assuming that the axial function FRONT is determined pragmatically via the direction of canonical motion of its argument (8b), we can relate the axial projection meaning of *front* (8c) to its axial part reading (8d).

- (8) a. $PROJECT = \lambda f \in D_{\langle v, t \rangle} . \lambda u \in D_v . \exists w [f(w) \text{ and } START(u) = END(w) \text{ and } DIR(u) = DIR(w)]$
 b. $FRONT = \lambda x \in D_e . \lambda u \in D_v . START(u) = CENTER(x) \text{ and } END(u) \in BOUNDARY(x) \text{ and } FORWARD(u, x)$
 c. $[[front_{PROJ}]] = \lambda x \in D_e . PROJECT(FRONT(x))$
 d. $[[front_{PART}]] = \lambda x \in D_e . PART(FRONT(x))$

As a result, PROJECT returns a set of vectors extending those given by the axial function (9a), which can sometimes be narrowed to those orthogonal to the relevant facet (9b).

- (9) a. The car is parked in front of the house.
 b. The car is parked **20m** in front of the house.

Because PROJECT relies on the vectors provided by the axial function, it correctly yields a region external to the entire GROUND object. This would be impossible if the axial projection were derived from the concrete axial part (as in Svenonius 2006, 2010). Further evidence for the syntactic presence of the projective component comes from languages that have an **overt source preposition** introducing the AxPart (10).

- (10) 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. Russian, Mitrofanova and Minor 2013
 down.from-front-LOC from house-GEN grew tree
A tree grew in front of the house.

The weak definite connection: the semantic connection established here between an AxPart and the corresponding noun makes it plausible that the AxPart is nominal, despite its locative semantics. While this naturally explains the presence of an overt definite article in (11), the question arises why this article is absent in (2a) and (7a). We propose to link this variation to the similar effect with bare weak definites, like *in bed* (Ross 1996, Stvan 1998, 2007, Aguilar Guevara and Zwarts 2010, 2013, Aguilar Guevara 2014, etc.), where the presence or absence of the article is intimately linked to the choice of the noun.

- (11) a. à l'intérieur de la cellule b. to **the** left of the moon
 at the.interior of the cell
inside the cell

Additional support for assimilating AxParts to weak definites comes from the fact that their syntax is similarly restricted (Ross 1996): modification, pronominalization, pluralization and preposing are equally broadly impossible with both, and the presence of an **outer preposition** and its rigid choice is a further indication of this similarity.

The presence and choice of the outer preposition is, however, a problem for both our analysis and Svenonius'. As is easy to see, the axial function TOP and the axial projection FRONT both define regions, so no preposition should be needed. The semantics of measure phrases with axial extensions (9b) is also problematic: the measure phrase clearly measures the vectors constructed by PROJECT, leaving no room for the additional preposition. To account for these facts, we propose that the various outer prepositions correspond to the same assertive content

(PROJECT) yet reflect differing conceptualizations of the resultant region in function of the AxPart. As we are not aware of any language where an overt source preposition co-occurs with another preposition, their complementary distribution supports this intuition.

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