Revisiting route prepositions: NON-INITIAL, NON-FINAL paths at the interfaces

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Morphosyntactic Variation in Adpositions
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Route prepositions denote undirected spatial paths that directly relate to the reference object (Ground, Talmy 2000)

(1) a. John drove through a forest.
   b. Hans fuhr durch einen Wald.

(2) a. John ran around a house.
   b. Hans rannte um ein Haus.

(3) a. John flew over a lake.
   b. Hans flog über einen See.

(4) a. John walked along a river.
   b. Hans lief einen Fluss entlang.

(5) a. John swam past an island.
   b. Hans schwamm an einer Insel vorbei.

Focus on morphologically simplex route prepositions in German

Relation to locative prepositions:
durch ~ in (in) and aus (out of), um ~ an (on), über ~ auf (upon)
Introduction

- **Axiomatic algebraic approach to spatial paths** denoted by route prepositions in terms of mereological structure

- So far, axiomatic algebraic approaches to spatial paths (Krifka 1998, Beavers 2012) take source and goal prepositions into account, but they lack a treatment of route prepositions

- Spatial paths denoted by route prepositions have a tripartite structure

  (6)  
  a. John ran **through** a park.
  b. Hans rannte **durch** einen Park.

- **Parsimonious, perception-driven model of space** accounting for the minimal commitments of spatial PPs (Kamp and Roßdeutscher 2005) (unlike rich vector space model advocated by Zwarts 1997, 2005, a.o.)

- **Syntactic derivations** and **instructions at LF (and PF) interfaces**

![Diagram of spatial prepositions]

- **Place prepositions** denote static locations (locative prepositions)
- **Path prepositions** denote spatial paths
  - goal and source prepositions are directed path prepositions
    → derived locative prepositions
    → Krifka’s (1998: 205) **directed path structure**
  - route prepositions are undirected path prepositions
    → non-locative prepositions
    → initial and final states are indistinguishable (semelfactive-like)
    → Krifka’s (1998: 203) **(plain) path structure**
• **Spatial prepositions can relate to abstract geometric concepts**

• **Abstract concept of **interiority**:**
  
  ◦ **Place prepositions**
    
    (7)  
    a. John stood *in* a forest. 
    b. Hans stand *in* einem\textsubscript{DAT} Wald.

  ◦ **Goal prepositions**
    
    (8)  
    a. John ran *into* a forest  
    b. Hans rannte *in* einen\textsubscript{ACC} Wald.

  ◦ **Source prepositions**
    
    (9)  
    a. John ran **out of** a forest.  
    b. Hans rannte **aus** einem\textsubscript{DAT} Wald.

  ◦ **Route prepositions**
    
    (10)  
    a. John ran *through* a forest.  
    b. Hans rannte *durch* einen\textsubscript{ACC} Wald.

• **Other abstract geometric concepts:**  
  
  *contiguity* for *um* (around) and *verticality* for *über* (over)
1. Introduction

2. Properties of route prepositions

3. Model of the grammar

4. Spatial paths

5. Structure of spatial prepositions
Properties of route prepositions

Lexical aspect

- Route prepositions are ambiguous with regard to lexical aspect
- Goal and source prepositions: telic or atelic interpretation

(11) a. John ran **to** the park in/?for 5 minutes.
    b. John ran **towards** the park for/?in 5 minutes.

- Route prepositions: telic and atelic interpretation (Piñón 1993)

(12) John ran **through** the park in/for 5 minutes.

- Systematic ambiguity
  - Bounded **through the park** ≈ ‘into and out of the park’
  - Unbounded **through the park** ≈ ‘within the park’
Properties of route prepositions
No result state

- **Route prepositions do not entail a result state**

- Interpretation with *again* (DE: *wieder*)
  Indicating repetition, *again/wieder* can give rise to two readings:
  - **repetitive reading**: event is repeated
  - **restitutive reading**: result state is restored

- **Goal and source prepositions**: repetitive and restitutive reading

  (13)  
  b. John ran *into* the park *again*.

- **Route prepositions**: repetitive reading only (Ramchand 2012)

  (14)  
  a. Hans rannte *wieder durch* den Park.  
  b. John ran *through* the park *again*. 
Properties of route prepositions
Modifiers of underived nominals

• Route prepositions do not commit to direction

• Route prepositions: felicitous modifiers of underived nominals that are conceptualized as undirected

  (15) a. Die Mauer **durch** die Stadt wurde niedergerissen.
          b. The wall **through** the city has been torn down.

  (16) a. Der Zaun **um** das Gebäude war hoch.
          b. The fence **around** the building was high.

• Goal and source prepositions: infelicitous modifiers of such nouns

  (17) a. ?Die Mauer **aus** der Stadt wurde niedergerissen.
          b. ?The wall **out of** the city has been torn down.

  (18) a. ?Der Zaun **an** das Gebäude war hoch.
          b. ?The fence **to** the building was high.
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Model of the grammar

Lexicon (in the broader sense)

- Lexicon: The *generative* items of a language
- Content: The *non-generative, contentful* items of a language

Numeration ← Syntax → Spell-Out

- Morphology
  - Vocabulary: Instructions for *pronouncing* terminal nodes in context
  - Phonological Form (PF)
    - Articulatory-Perceptual Interface
- Semantics
  - Logical Form (LF)
    - Conceptual-Intensional Interface
  - Encyclopedia: Instructions for *interpreting* terminal nodes in context

Lexicon (in the broader sense)

Vocabulary: Instructions for *pronouncing* terminal nodes in context

Lexicon:
The *generative* items of a language

Content:
The *non-generative, contentful* items of a language

Encyclopedia:
Instructions for *interpreting* terminal nodes in context
Model of the grammar

- **Morphology**
  - *Distributed Morphology* (DM) (Halle and Marantz 1993, Embick 2015)
  - Vocabulary Items (VIs) are inserted late into terminal nodes of syntax on the basis of context.
  - A VI’s feature specification must meet a subset of the terminal nodes feature specification (cf. Subset Principle by Halle 1997)

- **Semantics**
  - *Discourse Representation Theory* (DRT) (Kamp and Reyle 1993, 2011)
  - Interpretation in DRT involves a two-stage process (Kamp et al. 2011: 7):
    1. the construction of semantic representations, referred to as Discourse Representation Structures (DRS) [= LF-representation],
    2. and a model-theoretic interpretation of those DRSs
  - Encyclopedic Items (EIs) are DRS-fragments that are inserted late into terminal nodes of syntax on the basis of context (→ decorated trees)
  - Semantic composition bottom-up along syntactic structure
  - Unification-based semantic construction rules
  - Parsimonious, perception-driven model of space (Kamp and Roßdeutscher 2005, Lang 1990)
• **Lexicon**: The generative items of a language
  ○ Bundles of features from Universal Grammar (UG) (Chomsky 1995)
  ○ Categories and syntacticosemantic (synsem) features (Embick 2015)

• **Content**: The non-generative, contentful items of a language
  ○ Content features relating to **abstract spatial concepts**
<p>|</p>
<table>
<thead>
<tr>
<th>interiority</th>
<th>contiguity</th>
<th>verticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>place</td>
<td>path</td>
<td></td>
</tr>
<tr>
<td>in (in)</td>
<td>an (on)</td>
<td>auf (upon)</td>
</tr>
<tr>
<td>aus (out of)</td>
<td>von an (from on)</td>
<td>von auf (from upon)</td>
</tr>
<tr>
<td>in (into)</td>
<td>an (onto)</td>
<td>auf (up onto)</td>
</tr>
<tr>
<td>durch (through)</td>
<td>um (around)</td>
<td>uber (over)</td>
</tr>
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</table>

  ○ Primary Merge (De Belder and Van Craenenbroeck 2015) generates insertion sites (Root positions) for Content insertion at Spell-Out

• **NB**: This talk does not address
  ○ projective prepositions (e.g. EN: *under*, DE: *unter*),
  ○ non-geometric prepositions (e.g. EN: *to*, DE: *zu*), and
  ○ morphologically complex prepositions (e.g. EN: *inside*, DE: *innerhalb*)
1. Introduction
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• Axiomatic formulations in terms of **mereological structure** provide a controlled way of asking and answering the question concerning the **strength of the structural representations**

• **Part structures** contain sets of entities for which we can define
  - the part relation \( x \leq y \),
  - the mereological sum operation \( x \leq y \iff x \oplus y = y \),
  - the proper part relation \( x < y \),
  - the overlap relation \( x \odot y \).

• A **(plain) path structure** is a part structure including
  - the adjacency relation \( x \bowtie y \).

• A **directed path structure** is a plain path structure including
  - the precedence relation \( x \prec y \).

• An **event structure** is a path structure that involves
  - a time structure, which is a directed path structure, and
  - the temporal trace function \( \tau \) mapping eventualities to their run times.
  \[ \Rightarrow \text{Event structure inherits temporal order from time structure.} \]
• **Spatial paths** are conceptualized as
  - one-dimensional rectilinear line segments that are
  - elements of a plain path structure

• **Prepositional aspect** (Zwarts 2005: 751, 753):

  (19) A set of spatial paths $P$ is **cumulative** iff
  - a. there are $x, y \in P$ such that $x \oplus y$ exists and
  - b. for all $x, y \in P$, if $x \oplus y$ exists, then $x \oplus y \in P$

  (20) a. A PP is **unbounded** iff it has cumulative reference.
  b. A PP is **bounded** iff it does not have cumulative reference.

• **Concatenation** ($x \otimes y$)
  - Natural sum operation over spatial paths
  - The mereological sum for non-overlapping elements
- Direction is essential for goal and source prepositions
- Spatial paths denoted by goal and source prepositions are inherently $\theta$-related (movement relation) to event structure
- Example: *run into the park*

![Diagram showing spatial paths and goal and source prepositions]

- A spatial path $w$ enters region $r$ in event $e$, i.e. $\text{ENTER}(w, r, e)$, iff
  - $w$ is contained in $r$ and
  - $w$ is $\theta$-related to the minimal final $e < e^0$ such that $e^0$ is $\theta$-related to $w^0$

- Goal and source prepositions: part structure < plain path structure < **directed path structure**
How much structure do we need for route prepositions? **Do we need direction for route prepositions?**

All route paths have two indistinguishable tails
  - Bounded *through the park* ≈ ‘into and out of the park’
  - Unbounded *through the park* ≈ ‘within the park’

My answer:

*No, we don’t want the richness of directed path structures for the modeling of route prepositions. Direction is not appropriate.*

Route prepositions:
  - part structure < **plain path structure** < directed path structure
Route prepositions denote route paths $w$ that have a **tripartite structure**. They consist of:
- a **non-initial, non-final** subpath $v$, the **NINF-path**, and
- two peripheral subpaths $z', z''$, the **tail paths**.

- NINF and route paths are visible at LF; tail paths are not
- **Geometric predication** over NINF-paths at LF
• **Model-theoretic** definition of the LF-predicate $\text{NINF}^\pm(v, w)$:

$\forall v, w \ [\text{NINF}^\alpha(v, w) \iff$

“Spatial path $v$ is a $\alpha$ **NINF-path** of spatial path $w$ iff”

a. $v < w \land B(v)$

“$v$ is a proper subpath of $w$ and $v$ satisfies the predicate $B$”

b. $\land \exists!z' \exists!z'' [z', z'' < w \land \text{MINIMAL}(z', w) \land \text{MINIMAL}(z'', w)]$

“and there are exactly two paths $z', z''$ that are minimal proper subpaths of $w$”

c. $\land w = z' \oplus v \oplus z'' \land z' \bowtie v \bowtie z''$

“and $w$ is the mereological sum of $z', v, z''$, and $v$ is adjacent to $z'$ and to $z''$”

d. $\land \alpha B(z') \land \alpha B(z'')[z', v, z''$, and $v$ is adjacent to $z'$ and to $z''$”

“and $z', z''$ are indistinguishable with respect to the predicate $B$.”

(22) $\alpha$ is negative: $\text{NINF}^- (v, w)$

(23) $\alpha$ is positive: $\text{NINF}^+ (v, w)$
• **Geometric relations** between line segments \( v \) and material objects \( x \)

• **Boundary conditions** (NINF and tail paths, \( B \))

\[ (24) \text{internal line segments: } \text{INT}(v, x) \]

\[ (25) \text{external line segments: } \text{EXT}(v, x) \]

\[ v \]

\[ x \]

• **Configurational conditions** (NINF-path only)

\[ (26) \text{spear-like line segments: } \text{SPEAR-LIKE}(v, x) \]

\[ (27) \text{L-shaped line segments: } \text{L-SHAPED}(v) \]

\[ (28) \text{plumb-square line segments: } \text{PLUMB-SQ}(v, x) \]

\[ v \]

\[ \text{down} \]

\[ x \]
Non-initial, non-final paths
Abstract Content features

- **Interiority** \[\mathbb{N}\]

<table>
<thead>
<tr>
<th>LF model of space</th>
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<tbody>
<tr>
<td>route P DURCH'(v, x) ↔ INT(v, x) (\land) SPEAR-LIKE(v, x)</td>
</tr>
<tr>
<td>locative P IN(r, x) ↔ “r is internal region of Ground x”</td>
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- **Contiguity** \[\mathbb{D}\]

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<td>route P UM'(v, x) ↔ EXT(v, x) (\land) L-SHAPED(v)</td>
</tr>
<tr>
<td>locative P AN(r, x) ↔ “r is external region of Ground x and every Figure y that is placed in r has spatial contact with x”</td>
</tr>
</tbody>
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L-shape \(\sim\) contiguity:
In order to keep contiguity, a spatial path must change its direction.
A right angle (L-shape) is a minimal model of change of direction.

- **Verticality** \[\mathbb{G}\]

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<td>route P ueber'(v, x) ↔ EXT(v, x) (\land) PLUMB-SQ(v, x)</td>
</tr>
<tr>
<td>locative P AUF(r, x) ↔ “r is external region of Ground x and every Figure y that is placed in r is supported from below by x”</td>
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### Non-initial, non-final paths

**LF-predicates**

<table>
<thead>
<tr>
<th></th>
<th>DURCH′(v, x)</th>
<th>UM′(v, x)</th>
<th>UEBER′(v, x)</th>
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<tr>
<td><strong>NINF−(v, w)</strong></td>
<td><img src="Diagram1" alt="Diagram" /></td>
<td><img src="Diagram2" alt="Diagram" /></td>
<td><img src="Diagram3" alt="Diagram" /></td>
</tr>
<tr>
<td>NINF-path:</td>
<td>INT(v, x) ∧ SPEAR-LIKE(v, x)</td>
<td>EXT(v, x) ∧ L-SHAPED(v)</td>
<td>EXT(v, x) ∧ PLUMB-SQ(v, x)</td>
</tr>
<tr>
<td>Tail paths:</td>
<td>¬ INT(z′, x) ∧ ¬ INT(z′′, x)</td>
<td>¬ EXT(z′, x) ∧ ¬ EXT(z′′, x)</td>
<td>¬ EXT(z′, x) ∧ ¬ EXT(z′′, x)</td>
</tr>
</tbody>
</table>

| **NINF+(v, w)** | ![Diagram](Diagram4) | ![Diagram](Diagram5) | ![Diagram](Diagram6) |
| NINF-path: | INT(v, x) ∧ SPEAR-LIKE(v, x) | EXT(v, x) ∧ L-SHAPED(v) | EXT(v, x) ∧ PLUMB-SQ(v, x) |
| Tail paths: | INT(z′, x) ∧ INT(z′′, x) | EXT(z′, x) ∧ EXT(z′′, x) | EXT(z′, x) ∧ EXT(z′′, x) |

\(v\) : NINF-path, \(w\) : route path, \(z′, z′′\) : tail paths, \(x\) : reference object, Ground
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Structure of spatial prepositions

Categories and synsem features

- **Big P**
  - introduces the *Ground* argument,
  - can host $[\text{loc}]$ for locative prepositions or $[\pm \text{NINF}]$ for route prepositions.
  - Primary Merge: Root position for Content (De Belder and Van Craenenbroeck 2015)

- **Optional light preposition Q derives**
  - goal prepositions $[+\text{TR}]$ or
  - source prepositions $[-\text{TR}]$.

- **Little p**
  - introduces the *Figure* argument (Split P Hypothesis, Svenonius 2003),
  - can host $[\text{PLACE}]$ for place prepositions (stative localization relation LOCALIZE) or $[\text{PATH}]$ path prepositions (Figure-Path Relation FPR, Beavers 2012).

**Content features** in Root position

- Interiority $[\exists]$
- Contiguity $[\exists]$
- Verticality $[\exists]$

Figure

- $p^\circ$ (QP)
- $p^\circ$ (Q\°)
- $p$ (PP)
- $p'$ (DP)
- $p^\circ$ (DP)
- $p^\circ$ (Ground)
- $\sqrt{p^\circ}$ (Ground)
(29) Hans$_i$ stand \([_{pp} t_i \text{ in einem Wald }] \).
Hans stood in a.DAT forest

- Big P
  - introduces Ground
  - hosts \([\text{LOC}]\)
- Abstract Content feature
  - interiority \([\aleph]\)
  - IN-region
- Little \(p\)
  - introduces Figure
  - hosts \([\text{PLACE}]\)
  - localization relation
(30) Hans rannte \([_{pp} \ t_i \ \textbf{in} \ \textit{einen Wald}]\).
Hans ran \textit{into a ACC forest}.

- **Big P**
  - introduces Ground
  - hosts \([\text{LOC}]\)
- **Abstract Content feature**
  - interiority \([\aleph]\)
  - IN-region
- **Light preposition Q**
  - derives goal preposition
  - hosts \([+\text{TR}]\)
- **Little p**
  - introduces Figure
  - hosts \([\text{PATH}]\)
  - Figure-Path Relation
Morphology (PF)

- Q° lowers to and fuses with P°
- Vocabulary Items:
  \[(31) P \leftrightarrow /\text{aus}/ \rightarrow _[\text{LOC}, \aleph, -\text{TR}]\]
  \[\leftrightarrow /\text{m}/ \rightarrow _[\text{LOC}, \aleph]\]
  \[\leftrightarrow /\text{an}/ \rightarrow _[\text{LOC}, \beth]\]
  \[\leftrightarrow /\text{auf}/ \rightarrow _[\text{LOC}, \beth]\]

- Prepositional case:
  - Morphological case
    (Marantz 1991, McFadden 2004)
  - Composite case features
    (Halle and Vaux 1997, a.o.)
    - accusative: [+INF]
    - dative: [+INF, +OBL]
  - Big P inherently assigns dative case features:
    \(D^\circ \rightarrow D^\circ [+\text{INF}, +\text{OBL}] / [P^\circ \text{ DP} \ldots ]\)
  - Impoverishment of oblique case features in goal context:
    \([+\text{OBL}] \rightarrow \emptyset / [+\text{TR}]\)

Semantics (LF)

- Encyclopedia Items:
  \[(32) P \leftrightarrow \begin{array}{|c|c|}
  \hline
  r & /_\text{LOC}, \aleph \n  \hline
  \text{IN}(r, \bar{x}) & /_\text{LOC}, \aleph \n  \hline
  r & /_\text{LOC}, \beth \n  \hline
  \text{AN}(r, \bar{x}) & /_\text{LOC}, \beth \n  \hline
  \text{AUF}(r, \bar{x}) & \n  \hline
  \end{array}\]
  \[(33) Q \leftrightarrow \begin{array}{|c|c|}
  \hline
  r & /_\text{LOC}, \beth \n  \hline
  \text{LEAVE}(\bar{r}, \bar{w}, \bar{e}) & /_\text{LOC}, \beth \n  \hline
  \text{ENTER}(\bar{r}, \bar{w}, \bar{e}) & /_\text{LOC}, \beth \n  \hline
  \end{array}\]
  \[(34) p \leftrightarrow \begin{array}{|c|c|}
  \hline
  w & / _\text{PATH}\n  \hline
  \text{FPR}(\bar{y}, \bar{w}, \bar{e}) & / _\text{PATH}\n  \hline
  \hline
  \end{array}\]
  \[\text{LOCIZE}(\bar{y}, \bar{r}) / _\text{PLACE}\]
(35) Hans rannte \([_{pp} \, t_i \, durch \, einen \, Wald]\\). Hans ran through a.ACC forest

- **Big P**
  - introduces Ground
  - hosts \([\pm \text{NINF}]\\)

- **Abstract Content feature**
  - interiority \([\aleph]\\)
  - DURCH'-path

- **Little p**
  - introduces Figure
  - hosts \([\text{PATH}]\\)
  - Figure-Path Relation

- **Light preposition Q does not project**
Morphology (PF)

- Update P’s Vocabulary Items:

\[(36)\ P \leftrightarrow \text{/aus/} \quad / _{[\text{LOC, }^N, -\text{TR}]}
\leftrightarrow \text{/dorç/} \quad / _{[\pm \text{NINF, } ^N]}
\leftrightarrow \text{/um/} \quad / _{[\pm \text{NINF, } \varnothing]}
\leftrightarrow \text{/y:bə/} \quad / _{[\pm \text{NINF, } ^G]}
\leftrightarrow \text{/m/} \quad / _{[\text{LOC, } ^N]}
\leftrightarrow \text{/an/} \quad / _{[\text{LOC, } ^G]}
\leftrightarrow \text{/auf/} \quad / _{[\text{LOC, } ^G]}
\]

- Prepositional case:
  - Extend application of Impoverishment of oblique case features to route context:
    \[+\text{OBL} \rightarrow \emptyset / [+\text{TR}], [\pm \text{NINF}]\]

Semantics (LF)

- Update P’s Encyclopedia Items:

\[(37)\ P \leftrightarrow \left(\begin{array}{|c|}
\hline
\text{v} \\
\hline
\text{DURCH}’(v, \bar{x}) \\
\text{NINF}^\pm(v, \bar{w}) \\
\hline
\end{array}\right) / _{[\pm \text{NINF, } ^N]}
\leftrightarrow \left(\begin{array}{|c|}
\hline
\text{v} \\
\hline
\text{UM}’(v, \bar{x}) \\
\text{NINF}^\pm(v, \bar{w}) \\
\hline
\end{array}\right) / _{[\pm \text{NINF, } ^G]}
\leftrightarrow \left(\begin{array}{|c|}
\hline
\text{v} \\
\hline
\text{UEBER}’(v, \bar{x}) \\
\text{NINF}^\pm(v, \bar{w}) \\
\hline
\end{array}\right) / _{[\pm \text{NINF, } ^G]}
\leftrightarrow \left(\begin{array}{|c|}
\hline
\text{r} \\
\hline
\text{IN}(r, \bar{x}) \\
\hline
\end{array}\right) / _{[\text{LOC, } ^N]}
\leftrightarrow \left(\begin{array}{|c|}
\hline
\text{r} \\
\hline
\text{AN}(r, \bar{x}) \\
\hline
\end{array}\right) / _{[\text{LOC, } ^G]}
\leftrightarrow \left(\begin{array}{|c|}
\hline
\text{r} \\
\hline
\text{AUF}(r, \bar{x}) \\
\hline
\end{array}\right) / _{[\text{LOC, } ^G]}\]
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Selected references


