

# Conceptual variation in German *nach*

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This paper investigates the conceptual differences in three senses of German *nach*-PPs: TEMPORAL, ACCORDANCE and INFORMATION SOURCE by conducting an annotation mining corpus study, and proposes semantic analyses for the discussed senses. The emergence of these senses partly depends on the flexibility of the internal nominal argument denoting an event or informational content, but also on functional differences, e.g. in the special case that the preposition relates the information reported in the sentence to its source.

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## 1 The Issue

German *nach* (en. ‘*after*’) is most prominent for its temporal sense, but exhibits a range of different senses (cf. [6], [10]). We focus on two less studied senses: INFORMATION SOURCE PPs are claimed to introduce a source as a reference for reported information while ACCORDANCE PPs refer to some kind of model or rule that is complied with in an action (cf. [6]).

We admit the possibility of sense derivations (e.g. INF. SOURCE: to say sth. after s.o. else did; ACCORDANCE: to do sth. after s.o. else did or said), but don’t assume an underspecified preposition sense of *nach*, because the senses are shared by other prepositional forms (germ. *laut, gemäß*; en. *according to, in accordance with*). While [10] and [5] subsume one sense under the other, we commit to attributing them to different classes, epistemic stance (cf. [4]) and the broader class of manner adverbials, respectively, due to conceptual differences.

## 2 Senses of *nach*

To illustrate the different concepts exhibited by *nach* consider the following examples. While the TEMPORAL PP (1) posits the implementation event after the event of the test phase, ACCORDANCE (2) provides a modification of the implementation event which is said to follow Barcelona’s model. INFORMATION SOURCE (3) introduces the reports as the source of information and identifies the contents of the reports as the event described in the VP, i.e. the report is/contains that the city implements superblocks.

- (1) **Nach der Testphase** richtet die Stadt Superblöcke ein.  
after the test.phase implements the city superblocks PTKVZ  
‘The city implements superblocks after the test phase.’

- (2) **Nach dem Modell** von Barcelona richtet die Stadt Superblöcke ein.  
 after the model of Barcelona implements the city superblocks PTKVZ  
 ‘The city implements superblocks in accordance with Barcelona’s model.’
- (3) **Nach den Meldungen** richtet die Stadt Superblöcke ein.  
 after the reports implements the city superblocks PTKVZ  
 ‘According to the reports the city implements superblocks.’

Note, (3) can also be TEMPORAL. The ambiguity originates from the preposition and its internal argument. *Meldungen* (en. ‘reports’) can refer to an event of reporting, hence TEMPORAL, or to the contents of the reports which yields the INF. SOURCE sense.

### 3 Empirical observations

Our corpus study is based on two data sets of NZZ (1993-1999) newswire articles containing (i) 600 sentences with previously sense-tagged *nach*-PPs without determiner and (ii) 1000 examples of full *nach*-PPs with internal arguments which denote informational content. By investigating the preposition sense, the lexical ambiguity and the semantics of the P’s argument we identified the following generalizations for our data sets:

1. INFORMATION SOURCE PPs require an internal argument denoting informational content, like *Meldung* (‘news’), *Bericht* (‘report’), *Mitteilung* (‘announcement’).
2. Nouns denoting informational content showed huge flexibility in sortal type. They occur with TEMPORAL and ACCORDANCE *nach* as well.
3. In sentences containing an INFORMATION SOURCE PP, the propositional content referred to by the internal argument must be overtly expressed in the upper VP, underlined in (3).
4. Full PPs are more likely to be ambiguous between TEMPORAL and ACCORDANCE/INFORMATION SOURCE than determinerless PP.
5. ACCORDANCE is a modification of the VP (2) while INFORMATION SOURCE identifies the content of the information carrying noun with the event described in the VP, as in (3).

These observations indicate that the variation we face in *nach* cannot be captured within one universal analysis. Instead, we argue for semantically different representations for each of the discussed senses.

### 4 Semantic analysis

In general, prepositions denote relations between two entities (cf. [2], [8]) but this approach does not exhaust all the variations prepositional phrases exhibit. For the TEMPORAL *nach* we follow [1] in analysing temporal PPs as two-place predicates between events, as illustrated in the lexical entry of *nach* in (4)<sup>1</sup>.

<sup>1</sup> For an alternate analysis see [7].

Such an analysis cannot be extended to ACCORDANCE *nach*, since the PP does not introduce a second event. Instead, we treat the ACCORDANCE sense as an adverbial manner modification and adopt the template by [9]. In the lexical entry of *nach* in (5) MANNER is a function mapping an eventuality onto its manner and *m* is the specific manner entity, which in (2) is Barcelona’s model.

- (4)  $\llbracket nach_{temporal} \rrbracket = \lambda e_2 \lambda e_1 . \mathbf{nach}(e_1, e_2)$   
 (5)  $\llbracket nach_{accordance} \rrbracket = \lambda Q \lambda P \lambda e . P(e) \wedge \exists m [MANNER(e, m) \wedge Q(m)]$

The semantics of *nach* in the sense of INFORMATION SOURCE is not equivalent to TEMPORAL (4) nor to ACCORDANCE (5) since its role is to relate the propositional content (cf. [3]) referred to by the internal argument of the P, *Meldungen* in (3), to the event expressed in the upper VP. We suggest that the semantics of *nach* has to capture the subset relation between the upper event and the propositional content of the internal argument of the P, i.e. in (3) the reports include (among others) also the proposition about the implementation event. At the current state we are unaware of related proposals. Working out the technical details of the compositional process is still an issue for future work.

## 5 Summary and Outlook

We have argued for functional differences of ACCORDANCE and INFORMATION SOURCE PPs by studying the internal argument’s semantics and ambiguity which lays a foundation for formal analyses of these less researched senses.

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