

## Incomplete bounded paths. Experimental data from German

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**1. Introduction.** Manner-of-motion verbs (*run, walk, etc.*), which are atelic, as well as verbs of directed-motion (*come, go, etc.*), which are telic, may take various directional PPs as complements, see (1).

- (1) a. Mary ran to the library.                      b. Mary came towards the library.

(Dynamic) PPs refer to paths, understood as quantities of space that extends between two locations (Jackendoff 1993, Piñón 1993, Zwarts 2005 a.o.). Directional *to*-DP-paths are *bounded*, for they include their endpoint  $l$ , and *complete* relative to DP, for their endpoint  $l$  must be the location of the DP's referent, see (2a) (from Piñón 1993). In (2a), End and Beg denote functions from paths to their endpoints and starting points  $l$  and  $l'$ , construed as locations (Loc) of objects  $u$  and  $u'$ . In contrast, directional *towards*-DP-paths are (initial) *partial* parts of *to*-DP-paths (Verkuyl & Zwarts 1992, Piñón 1993). They are *unbounded*, for they do not include the endpoint which binds them, and *incomplete* relative to DP, for they are partitive of a path whose endpoint is the location  $l$  of the DP's referent; see (2b). One of our goals is to establish (on the basis of German data) that this typology of directional paths must be extended so as to also include incomplete bounded paths.

- (2) a.  $\llbracket \text{to the library} \rrbracket = \lambda p [\text{End}(p) = l \wedge l = \text{Loc}(tu[\text{library}(u)], t) \wedge \exists l' [\text{Beg}(p) = l']]$  'The set of paths which extend between some implicit starting point  $l'$  and the location of the library.'
- b.  $\llbracket \text{towards the library} \rrbracket \rightsquigarrow$   
 $\lambda p' \exists p [p' \leq p \wedge \text{End}(p) = l \wedge l = \text{Loc}(tu[\text{library}(u)], t) \wedge \exists l' [\text{Beg}(p) = l']]$  'The set of initial partial paths of a path  $p$  that extends between some implicit starting point and the location of the library.' (Piñón 1993)
- c.  $\lambda p \lambda e [\sigma(e, \tau(e)) = p]$  'The spatial trace of event  $e$  at its time  $\tau(e)$  is path  $p$ .'
- d.  $\lambda e \exists p [\text{run}(e) \wedge \text{Loc}(e, \tau(e)) = p \wedge \text{End}(p) = l \wedge l = \text{Loc}(tu[\text{library}(u)], t) \wedge \exists l' [\text{Beg}(p) = l']]$  'The set of running events which are mapped (relative to their temporal trace) into some path  $p$  that extends between some implicit starting point and the location of the library.' (Piñón 1993)

A representation of the VP in (1a) must also capture that the path is traversed by running. This is ensured by the *spatial trace* function, which maps an event  $e$  paired with a temporal interval into a path (the spatial location of  $e$ ), see (2c). The meaning of the VP in (1a) is in (2d). The analysis sketched in (2) accounts for the fact that if a PP referring to a unbounded (resp. bounded) path combines with an atelic predicate, the resulting VP is atelic (resp. telic), see (3a).

- (3) a. Mary walked **towards/#to** the library **for ten minutes**. (Piñón 1993)

**2. Directional paths in German.** It is often assumed that German *zu*-PPs denote bounded and complete paths just like *to*-PPs, see, e.g., Haselbach 2017. Though we agree that the 'complete path' interpretation is preferred if the context does not go against it, we hypothesized that *zu*-PPs can also denote initial *incomplete* paths relative to DP. However, the 'complete path' interpretation seems much more robust with verbs of directed-motion such as *kommen* 'come'.

**3. Experiment.** We ran a questionnaire in German to assess the strength of the '**complete path**' inference (henceforth I) (i.e., the inference that Mary reached the library in (1a)). The questionnaire probed participants' level of certainty that the end of the path (the critical referent arriving at their destination) had been achieved. We manipulated two variables in the questionnaire. One variable, manipulated within-participants and within-items, was the VERB TYPE: manner (*radeln* 'bike') or directed motion (*kommen* 'come'). A second manipulation within items but between participants was the presence or absence of a clause introducing an event that could have prevented the path from being completed, but critically did not exclude that the path was completed. We call this the 'doubt' clause. We manipulated the PRESENCE OR ABSENCE OF 'DOUBT' between participants to avoid pushing both of the without-doubt conditions to ceiling, potentially washing out an underlying difference between verb types. *3.1 Method.* Eighty participants took part in the experiment, recruited via Prolific Academic, and limited to native speakers of German. Four were excluded prior to analysis due to self-reported non-native speaker status, and an additional 5 participants were excluded on the basis of having less than 2 points difference on the scale for our 'anchor' filler items. *3.2. Materials.* Fourteen experimental item sets as in (4) were created, and were intermixed with 82 filler items, of which some served to anchor the scale at its endpoints.

- (4) a. Gestern hatte Paul eine Matheprüfung, aber er war nicht gut vorbereitet. Er Yesterday have.SP.3SG Paul a math exam but he be.SP.3SG not well prepared he ist mit dem Fahrrad zur Schule gefahren/gekommen, {aber auf dem Weg hat er ein is with the bike to-the school driven/come but on the way has he a Paar gute Freunde getroffen, die auf dem Weg zum Schwimmbad waren.} couple good friends met who on the way to-the swimmingpool were ‘Yesterday Paul had a math test but he was not well prepared. He biked/went to the school, but on the way he met a couple of good friends who were on their way to the swimming-pool.
- b. Wie sicher können Sie schlussfolgern, dass Paul die Schule erreicht hat? how sure can you conclude that Paul the school reached has “How surely can you conclude that Paul reached the school?”

3.3. *Procedure.* The questionnaire required participants to rate how safely they can conclude from the test sentence that the DP’s location was reached by the agent of the motion event on a scale from 1 (not at all safely) to 7 (very safely). The experiment was presented using Ixwebfarm. The question and rating scale were presented directly under the critical sentence, and there was no time limit to respond.

4. **Results & discussion.** The results are summarized in the boxplot in Figure 1. The effects of doubt and verb class were significant in an ordinal model. Certainty of the inference I was rated lower in the doubt-condition than in the no doubt-condition (each condition was tested with different participants, but fillers were introduced to check against for overall bias). Besides, the verb class difference is about the same size regardless of the presence of doubt. These results suggest that the ‘complete path’ inference is implied but not entailed by motion verbs combined with *zu*-PPs, although it is more robust with *come*-verbs in the two conditions.

5. **Analysis.** We propose that two factors are at the source of the weakening of the ‘complete path’ inference I triggered by German sentences built with a motion verb and a *zu*-PP. Firstly, in our test items, the German present perfect (e.g., *ist gekommen*) can not only be interpreted as a perfective (translating *came*), but also as an imperfective in the ‘doubt’-test sentences (which contain two clauses), translating *was coming*; see, e.g., Schilder 1997, Schaden 2011, Bott & Hamm 2014. This first factor is the single one at play for *kommen*-verbs, which explains why I is more robust with these verbs. Secondly, we propose that *zu* is in fact not an exact counterpart of ‘to’ as analysed in (2), but rather semantically overlaps both ‘to’ and ‘towards’. Like *to*-paths, *zu*-paths include their endpoint (*zu*-PP form telic VPs, see Haselbach 2017). But like *towards*-paths, *zu*-paths can be incomplete; see (5).

- (5)  $\llbracket \text{zur Bibliothek} \rrbracket = \lambda p' \exists p [p' \leq p \wedge \text{End}(p) = l \wedge l = \text{Loc}(tu[\text{library}(u), t]) \wedge \exists l' [\text{Beg}(p) = l'] \wedge (\text{End}(p') = l \vee \exists l'' [\text{End}(p') = l''])]$  ‘The set of initial partial paths  $p'$  of a path  $p$  which extends between some implicit starting point  $l'$  and the location of the library, and whose endpoint is either the location of the library, or some implicit endpoint  $l''$ .’

The ‘complete path’ inference (with  $\text{End}(p') = \text{End}(p) = l$ ) is triggered in a default context, for (i) this endpoint is explicitly named (while the alternative endpoint  $l''$  is not) and (ii) it is the inference to the best explanation (see Gyarmathy & Altshuler’s 2019 on the culmination inference of non-culminating accomplishments). But this inference can be overridden (as by the continuation in our ‘doubt’-condition), in which case the VP describes a bounded but incomplete path. This option, however, is not available for verbs of directed motion such as *kommen*, which are achievement verbs denoting punctual events. The path  $p$  into which these punctual events are mapped is therefore punctual, too, and thus have no other part than itself. The complete path inference is thus forced with these verbs, unless the present perfect *is gekommen* is interpreted as an imperfective.

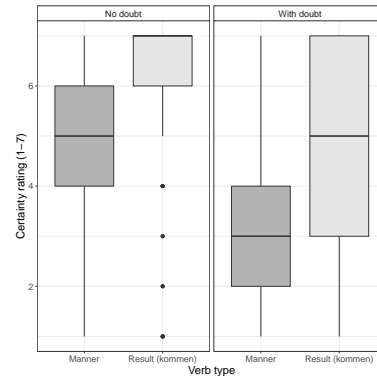


Figure 1: Results of the experiment (boxplot).