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Note

I've converted the original MS Word 4 (for the Macintosh) file into an OpenOffice.org 2.1 Writer file. I've taken the opportunity to correct several typos and to remove my old email address, but otherwise both the text and the total number of pages of the original remain the same (8). Needless to say, the exact line and page breaks have changed.

I now find that the title "Inside paths" isn't so great, but what to do about this thirteen years later? :- (

I also have another (longer) paper on paths, "Paths and their names" (with a nicer title), which I had written half a year earlier. It's available at <http://pinon.sdf-eu.org/covers/ptn.html>.

Inside paths

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1 Introduction

Verbs of motion like *run*, *walk*, *carry*, *crawl*, etc. take directional PPs as complements. I will call these PPs *path-oriented expressions*.

- (1) a. Linda ran to the library.
- b. Rebecca carried the letters from the department to the mailbox.
- c. Mary walked from the restaurant.

Intuitively, the sentences in (1) describe situations in which a person traverses (by running or walking) a quantity of space that extends between two locations. Let us take such a quantity of space to be a *path*. Paths are partially described by PPs. For example, the NP complement of the preposition *to* linguistically specifies the endpoint of the path, as in (1a) and (1b), whereas the complement of *from* specifies its starting point, as in (1b) and (1c).

On one reading, the sentences in (2a) and (2b) seem synonymous with those in (1a) and (1b).

- (2) a. Linda ran up to the library.
- b. Rebecca carried the letters from the department up to the mailbox.

The adverb *up* is lexically ambiguous in (2). Its two meanings are distinguished by whether or not higher spatial verticality is asserted. On the first reading of (2a), it is not necessarily the case that Linda runs upwards to get to the library. It is this reading that appears equivalent to the interpretation of (1a). On the second reading of (2a), she necessarily runs upwards to the library. The first meaning of *up* is compatible with but does not require upward movement; its second meaning,

on the contrary, does. The same considerations apply to (2b) vis-à-vis (1b).

The claim that there is an interpretation of *up* in (2) that does not assert higher vertical directionality is supported by the observation that *up* has a purely temporal use as well:

- (3) a. Linda ran up to noon today.
- b. Rebecca worked from 9am up to 7pm.

Other directional adverbs do not have such a temporal use: e.g. #*Linda ran down to noon*.

For the sake of clarity, I will distinguish ‘avertical *up*’ from ‘vertical *up*’: the former is implicated in the first reading of (2a) and (2b), and the latter, in their second reading. The aim of this paper is to elucidate the syntactic and semantic properties of avertical *up*.¹ I will confine myself to the spatial sense of avertical *up*, leaving open the question of how the temporal use illustrated in (3) should be related to the spatial one. In §2, I address the syntax of avertical *up*, arguing that *up* is a P’-adjunct, combining with a P’ to create another P’. In §3, regarding the semantics of avertical *up*, I argue that the canonical meaning of *up* is to introduce a relation between paths and events such that the paths in question are necessarily traversed.

Since I will henceforth be concerned with avertical *up*, I will drop the designation ‘avertical’ unless a point of contrast demands otherwise.

2 Syntax of *up*

Syntactically, I claim that *up* forms a constituent with the PP and not with the verb. This is evident from the diagnostics of topicalization and question formation:

- (4) a. Linda said that she would run up to the library, and up to the library she ran.

* I am grateful to Cleo Condoravdi, Makoto Kanazawa, Paul Kiparsky, Stanley Peters, Peter Sells, and Elizabeth Traugott for discussion of this material.

1 I have not been able to find any other account of avertical *up* in the literature.

- b. #Linda said that she would run up to the library, and to the library she ran up.
- (5) a. How far did Linda run? Up to the library.
- b. #How far did Linda run up? To the library.

(4)–(5) show that *up* behaves as if it formed a constituent with the PP. The caveat to be made is that examples like (4b) and (5b) are grammatical only if *up* belongs to the phrasal verb *run up*. But in this case, the meaning of *up* asserts higher spatial verticality and so there is no worry of confusing it with avertical *up*.

Coordination also indicates that *up* belongs to the PP:

- (6) a. Linda ran up to the library and (then) up to the bookstore.
- b. #Linda ran up to the library and (then) to the bookstore.

Again, (6b) is felicitous if *up* belongs to the phrasal verb asserting upward movement, but not with avertical *up*.

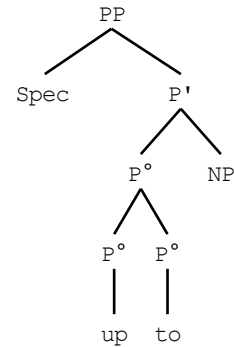
Up follows and does not precede the modifier *right*. Following van Riemsdijk (1978, 22), I analyze *right* as a PP-specifier. Disregarding the felicitous interpretation on which *up* belongs to a phrasal verb, my basic observation is that (7b) and (8b) are unacceptable with avertical *up*.

- (7) a. Linda ran right up to the library.
- b. #Linda ran up right to the library.
- (8) a. Rebecca carried the letters right up to the mailbox.
- b. #Rebecca carried the letters up right to the mailbox.

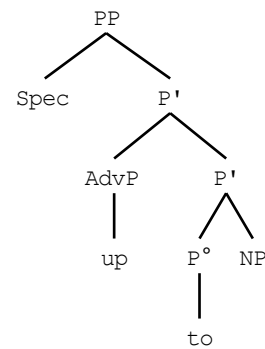
In sum, the data examined support the hypothesis that *up* forms a constituent with the PP. Nevertheless, there are two candidate analyses of the sequence *up to* that are compatible with this hypothesis. The first, a morphological account, is to think of *up to* as a compound preposition (i.e., a P°), in the way that the prepositions *into* and *onto* presum-

ably are.² The second, a syntactic account, is to treat avertical *up* as a P'-adjunct, combining with a P' to form another P'.³ Compare the structures that would be posited in each of these analyses, presented in (9a) and (9b), respectively.⁴

- (9) a. Morphological analysis



- b. Syntactic analysis



I want to offer three pieces of evidence in support of the syntactic analysis over the morphological one. To this end, it is appropriate to make direct comparisons with the compound prepositions *into* and *onto*.

The first piece of evidence is that avertical *up* is combinatorially productive (with certain semantic restrictions), occurring with the prepositions *behind*, *in front of*, *beside*, etc., as shown in (10)–(12). The intended reading of (10a), (11a), and (12a) is that the goal of motion is the small region behind Lin-

2 Quirk et al (1985, 666) treat *into* and *onto* as simple (i.e., non-phrasal) prepositions.

3 If *right* is a PP-specifier, then the analysis of *up* as a P'-adjunct ensures that the former will precede the latter.

4 Vertical *up* can be a preposition: *Linda ran up the hill*. For (9a), it is reasonable to suppose that avertical *up* could be one as well.

da, in front of Clinton, and beside the mailbox, respectively. The initial plausibility of analyzing *up to* as a compound preposition breaks down for these examples like *up behind*, etc., which call for a syntactic treatment. In contrast, *in* and *on* do not combine productively with other prepositions to form compounds, which is consistent with the claim that *into* and *onto* are lexical items.

- (10) a. Go behind Linda so that I can take your picture!
 b. Go up behind Linda so that I can take your picture!
- (11) a. Go run in front of Clinton so that he will notice you.
 b. Go run up in front of Clinton so that he will notice you.
- (12) a. Rebecca carried the letters beside the mailbox so that they could be picked up.
 b. Rebecca carried the letters up beside the mailbox so that they could be picked up.

My second piece of evidence concerns stress placement. Whereas *into* obligatorily has compound stress, the sequence *up to* allows stress on both of its elements.⁵ Sequences like *up behind* and *up in front of* are more robust in this respect, clearly lacking a compound stress pattern. I claim that the basic prosodic contrast between *into* and *up to* is that the former sequence constitutes a domain for stress placement but the latter need not. Indeed, the orthography is indicative of this prosodic distinction.

- (13) a. Linda ran íntò the library.
 b. #Linda ran íntó the library.
- (14) a. Linda ran úp tò the library.
 b. Linda ran úp tó the library.
- (15) a. *Linda ran úp behind the library.
 b. Linda ran úp behind the library.

⁵ (13b) is felicitous only on a non-compound reading of *into*. On this reading, there are two goals: the first is an interior location and the second is the library, situated somewhere within this location. It is significant, in contrast, that (14a) and (14b) with *up to* are fully equivalent.

Finally, my third argument is that sequences like *up to* pattern with other combinations in English that are amenable to the same syntactic analysis. In addition to the sequence *up to* with vertical *up*, consider the combinations *over to*, *through to*, *down to*, etc., which are not convincingly analyzable as compound prepositions.

- (16) a. Linda ran over to the library.
 b. Rebecca carried the letters through to the department chair's office.

Intuitively, such PPs contain two central pieces of information. The one part, the *to*-phrase, describes the endpoint of the path; the other part, the adverb (*up*, *over*, *through*, *down*, etc.) says something about the path traversed. For example, *over* in (16a) indicates that starting point and endpoint of the path which Linda traverses to the library are essentially on the same horizontal plane.⁶ Similarly, a vertical *up* in (2a) appears to say something about the path traversed, although it is admittedly less evident what this content is (see §3). At any rate, it is sufficient to note that *up* patterns with a class of adverbs that describe neither locations nor endpoints in path-oriented expressions. Consequently, no special syntactic rule needs to be postulated for *up* alone.

These combinations differ significantly from compound prepositions like *into* and *onto*. Gruber (1976, 67) originally noted that the meaning of *into* is better represented by the underlying order 'to in', an idea that was adopted and updated in Jackendoff (1983, 163). Thus the interpretation of (2a) is that Linda ran to the interior of the library. The compound preposition *onto* is treated in the same fashion.

However, no inversion analysis is plausible for sequences like *up to* or *over to* precisely because *up* and *over*, unlike *in* and *on*, do not refer to locations in these combinations

⁶ The whole path need not be located on the same horizontal plane. I think that (16a) could be used felicitously even if Linda had to run up and down a hill, provided that the location of the library is on the same plane as her starting point.

(e.g., ‘to up (the library)’ makes no sense at all). If such inversion is characteristic of compound prepositions in English, then this is another respect in which sequences like *up to* are not like compound prepositions.

I have argued that avertical *up* forms a constituent with the PP and yet does not form a compound P° with the head of the PP. Since *up* should follow the PP-specifier *right*, I am led to analyze *up* as a P-adjunct, as shown in (9b) and recited in (17a).

- (17) a. (avertical) *up*, AdvP: [_{P'} ___ [_{P'}]]
 b. [_{PP} [_{Spec} *right*] [_{P'} *up* [_{P'} *to* [_{NP} *the library*]]]]] (cf. (7a))

3 Semantics of *up*

In §3.1, I note five semantic properties of avertical *up* that any analysis should account for. In §3.2, I present my analysis, which is cast in an event semantics with paths.

3.1 FIVE PROPERTIES

Property one. The meaning of avertical *up*, in contrast to that of vertical *up*, does not assert higher spatial verticality. In this respect it is also quite unlike other directional adverbs, e.g., *down*.

- (18) a. Linda ran down the hill up to the library down there.
 b. #Linda ran up the hill down to the library up there.
 (19) a. Can you imagine? That ancient elevator actually went from the tenth floor up to the second floor this time!
 b. #Can you imagine? That ancient elevator actually went from the second floor down to the tenth floor this time!

(18a) describes a situation in which the library is at the bottom of the hill. This is possible precisely because avertical *up* does not require the library to be located relatively higher than where Linda begins her run. (18b), on the other hand, is contradictory, for the library cannot be both up the hill and lo-

ated lower with respect to Linda’s starting location. In other words, there is no ‘avertical *down*’. The pair in (19) illustrate the same contrast even more dramatically and subtly: *up* is used in a description of a downward moving elevator.

Property two. Avertical *up* is by no means bleached of all directional meaning. In particular, *up* adjoins to a P’ that specifies an endpoint. The sentences in (20) are unacceptable with *up* because the immediately dominated P’ does not describe an endpoint (but note that they are fine with vertical *up*).

- (20) a. #Linda walked up from the library to the café.
 b. #Linda ran up along the river.

Although (20a) contains a P’ specifying the endpoint of the path in question, *up* is adjoined to the P’ specifying the starting point. Hence the semantic restriction on *up* is strictly local.

Property three. What constitutes as the specification of an endpoint is not so straightforward. Avertical *up* cannot adjoin to a P’ headed by *towards*. This is surprising given the idea that the NP complement of both *to* and *towards* refers to a goal.⁷ (Again, (21) is acceptable with vertical *up*.)

- (21) #Linda ran up towards the library.

Evidently, that the P’ specify an endpoint is a necessary but not a sufficient condition for avertical *up*.

Property four. Relative measure expressions like *partway* or *halfway* are incompatible with avertical *up*. To guarantee the desired word order, I assume that these measure expressions are syntactically PP-specifiers.⁸

⁷ Thus, in Jackendoff’s (1991, 36) analysis, the NP complement of both *to* and *towards* refers to the positive boundary of the path.

⁸ If *partway* and *halfway* (like *right*) are PP-specifiers, a sentence like #Linda ran partway/halfway right to the library is ruled out on syntactic grounds because there is a single specifier position. Even so, I sense that this sentence is also

- (22) a. Linda ran partway/ halfway to the library.
 b. #Linda ran partway/ halfway up to the library.⁹

Interestingly, there is a close paraphrase of (22b) that is acceptable, hence it is not the notion of relative measure per se that is responsible for the anomaly of (22b).

- (23) Linda ran part/ half of the way up to the library.

In (23) the PP *up to the library* directly modifies the noun *way*. The contrast between (22b) and (23) suggests that a property specific to the expressions *partway* and *halfway* is behind the unacceptability of (22b).

In this connection, it is noteworthy that absolute measure expressions like *100 meters* are fine with avertical *up*.

- (24) a. Linda ran 100 meters to the library.
 b. Linda ran 100 meters up to the library.

Absolute measures on paths simply calculate the actual distance traversed. Relative measures (cf. (22a), (23)) calculate the distance traversed with respect to the measure of the whole path.

Property five. According to Jackendoff (1983, 168), paths can play three roles in situations: (i) an object may *traverse* a path, (ii) an object may *extend over* a path, and (iii) an object may be *oriented along* a path. My observation is that avertical *up* is incompatible with the mere orientation of an object along the path, shown in (25b). On the other hand, (26b) shows that it is compatible with the extension of an object over the path. ((25b) is acceptable with vertical *up*.)

- (25) a. The sign points to the auditorium.
 b. #The sign points up to the auditorium.

semantically problematic, exhibiting the kind of unacceptability witnessed in (18b).

⁹ In a sentence like *Linda ran up partway/ halfway to the library*, *up* belongs to the phrasal verb *run up*.

- (26) a. Rebecca's office faces to the ocean.
 b. #Rebecca's office faces up to the ocean.
 (27) a. This road leads to Harvard (and no further).
 b. This road leads up to Harvard (and no further).

Thus, for analyzing *up*, it appears that an object's traversal of or extension over a path share more in common than its orientation along a path.

3.2 PATHS

In accounting for the five aforementioned properties of avertical *up*, I want to build on the distinction underlying the following intuition:

- Some path-oriented expressions describe paths without any regard for what role these paths may play in situations; other path-oriented expressions describe paths in relation to what role these paths may play in situations.

I will claim that a path-oriented expression with *to* is of the first type and that one with *up to* is of the second type.

To flesh out this idea, let us admit *events* and *paths* (in addition to *objects* and *locations*) into the universe of discourse. Events already have a firm place as entities in event semantics (e.g., Parsons 1990). Strictly speaking, spatial paths are not primitive entities, and they can be defined as sets of unidirectional, connected, nested locations. However, for the sake of expediency, I will forego their reconstruction and simply take them as entities in their own right.¹⁰ Paths have beginning and end locations, designated by the two-place relations *beg* and *end*, respectively.

¹⁰ Jackendoff 1983 takes paths to be basic entities. See Bierwisch 1988, Wunderlich & Herweg 1991, and Verkuyl & Zwarts 1992 for three different ways of defining paths.

- (28) $\lambda p[\text{beg}(p, l)]; \lambda p[\text{end}(p, l)]$
 “The beginning (end) of path p is location l .”

Events and many objects are located in space at various times. The *spatial trace* function maps an event or object paired with a temporal interval onto a spatial location.¹¹ In the case of motion events, I assume that the locations in question are paths. Events and objects have a unique spatial trace at a given time.

- (29) a. $\lambda p \lambda e[\sigma(e, \tau(e)) = p]$
 (for motion events)
 “The spatial trace of event e at its time $\tau(e)$ is path p .”
 b. $\lambda l \lambda x[\sigma(e, t) = l]$
 “The spatial trace of object x at time t is location l .”

In the view that I will adopt, a P' -constituent headed by a directional preposition typically (but not always) refers to a set of paths. For instance, P' -constituents headed by *to* do:

- (30) $\|[_{P'} \text{ to the library}]\| =$
 $\lambda p[\text{end}(p, \sigma(\text{the-library}, t))]$
 “The set of paths p whose end location is the location of the library at time t .”

Note that (30) says nothing about what roles the denoted set of paths may play in situations. For example, whether they may be traversed or not is left open.

In one version of event semantics (Parsons 1990), verbs are analyzed as one-place predicates of events. I treat verbs of motion in this fashion.

- (31) $\|run\| = \lambda e[run(e)]$
 “The set of running events e .”

I assume that the path variable is existentially bound at the PP level. This is ensured

¹¹ I model σ after Krifka’s (1989, 200) *Lokalisierungsfunktion*. Krifka, however, does not analyze paths in any detail.

by the following thematic combinator for motion events, which operates at the PP level:

- (32) $\lambda P \lambda Q \lambda e \exists p [P(p) \wedge \sigma(e, \tau(e)) = p \wedge Q(e)]$
 Applies to a one-place predicate P of paths and to a one-place predicate Q of events and yields: “The set of events e of type Q whose spatial traces at their times $\tau(e)$ are some path p of type P .”

If we apply the thematic combinator in (32) to the path predicate in (30) and to the event predicate in (31), we get:

- (33) $\|[_{VP} \text{ run to the library}]\| =$
 $\lambda e \lambda p [\text{end}(p, \sigma(\text{the-library}, t)) \wedge \sigma(e, \tau(e)) = p \wedge run(e)]$
 “The set of running events e whose spatial traces at their times $\tau(e)$ are some to-the-library path p .”

My hypothesis is that P' -constituents containing *up to* crucially differ from plain *to*-phrases in that they refer to relations between events and paths (cf. (30)):

- (34) $\|[_{P'} \text{ up to the library}]\| =$
 $\lambda p \lambda e [\text{end}(p, \sigma(\text{the-library}, t)) \wedge \sigma(e, \tau(e)) = p \wedge \exists l \forall p' [\text{end}(p', \sigma(\text{the-library}, t)) \rightarrow \text{end}(p', l)]]$
 “The relation between events e and to-the-library paths p such that the spatial traces of e at their times $\tau(e)$ are p and there is a unique end location for all paths in the set.”

In contrast to (30), (34) states that the to-the-library paths referred to do have a prescribed role in situations, viz., they are traversed. This is guaranteed by the fact that the events standing in the relation have these paths as their spatial traces. The representation in (30) imposes no such requirement.

Abstracting away from the particular path predicate chosen in (34), we have the following logical representation for avertical *up*:

- (35) $\|[\text{AdvP } up]\| =$
 $\lambda P \lambda p \lambda e [P(p) \wedge \sigma(e, \tau(e)) = p \wedge$
 $\exists l \forall p' [P(p') \rightarrow \text{end}(p', l)]]$
 Applies to a one-place predicate P of paths and yields: “The relation between events e and paths p of type P such that the spatial traces of e at their times $\tau(e)$ are p and there is a unique end location for all paths in the set.”

The representation in (35) asserts that all the paths that the path predicate applies to have the same end location. The meaning of to-phrases clearly satisfy this requirement (cf. (30)). But phrases headed by prepositions like *from* and *along* incompatible (cf. (20)), for such P' -constituents do not refer to sets of paths that all end in the same location. Consider, for example, *from*-phrases:

- (36) $\|[\text{P}' \text{ from the library}]\| =$
 $\lambda p [\text{beg}(p, \sigma(\text{the-library}, t))]$
 “The set of paths p whose beginning location is the location of the library at time t .”

The relevant paths in (36) have different endpoints—only their starting points are required to be identical. If the formula in (35) is applied to the predicate in (36), the third conjunct of (35) will be false. Consequently, a sentence like (20a) can never express a true proposition.

P' -constituents headed by *towards* refer to paths that are parts of some *to*-path. Specifically, *towards*-phrases refer to the set of *initial partial paths* of some *to*-path. A path p' is an initial partial path of some path p iff p' is a partial path of p (i.e., is contained in p) and has the same beginning location as p . I write this as ' $p' \leq_i p$ '.

- (37) $\|[\text{P}' \text{ towards the library}]\| =$
 $\lambda p' \exists p [p' \leq_i p \wedge$
 $\text{end}(p, \sigma(\text{the-library}, t))]$
 “The set of initial partial paths p' of some path p whose end location is the location of the library at time t .”

Note that although the set of partial paths in (37) all have the same beginning location, they have many different end locations. But this means that such initial partial paths will also fail to satisfy the third conjunct of (35), just as the *from*-paths in (36). Therefore a sentence like (21) can also never express a true proposition.

I claim that a relative measure expression like *halfway* is like *up* in expressing a relation between events and paths. The meaning representation in (38) for *halfway* is somewhat complex, since we need to restrict the domain to those initial partial paths that measure half the distance of some containing path.

- (38) $\|[\text{halfway}]\| =$
 $\lambda R \lambda p' \lambda e \exists p [R(e, p) \wedge p' \leq_i p \wedge$
 $\sigma(e, \tau(e)) = p' \wedge \mu(p') \div \mu(p) = \frac{1}{2} \wedge$
 $\exists l \forall p'' [R(e, p'') \rightarrow \text{end}(p'', l)]]$
 Applies to a two-place relation R between events and paths and yields: “The relation between events e and initial partial paths p' that measure half of some path p such that the spatial traces of e at their times $\tau(e)$ are p' and there is a unique end location for all paths that stand in relation R to e .”

The problem that arises in applying the formula in (38) to the meaning of *up to the library* in (34) is that the events standing in the relation are asserted to have two non-identical spatial traces, viz., an initial partial half-path and a path twice as long containing it. That is, the resulting relation asserts the following conjunction:

- (39) $\dots \wedge \sigma(e, \tau(e)) = p' \wedge \sigma(e, \tau(e)) = p \wedge$
 \dots

But since a motion event have a unique spatial trace (cf. (29): σ is a function), the consequence is that one of the conjuncts in (39) will always be false. Consequently, a sentence like (22b) can never express a true proposition.

In conclusion, I summarize how the prop-

erties of avertical *up* discussed in the previous section are accounted for.

- *Property one*, that of not entailing higher spatial verticality, is straightforward, for nothing about the meaning of avertical *up* appeals to verticality.
- *Property two*, that of adjoining to P'-constituents that specify an endpoint, is guaranteed by requiring identity of end locations for all paths that fall in the set. Prepositions (*from*, *along*, etc.) that do not take goal complements fail to satisfy this requirement.
- *Property three*, that of incompatibility with *towards*-phrases, is accounted for by the fact that *towards*-paths do not all share the same end location. But this clashes with the requirement of avertical *up* in (35) that they do.
- *Property four*, that of incompatibility with relative measure phrases like *partway*, *halfway*, etc., is a consequence of the fact that a single event cannot have two distinct spatial traces. But this is precisely what a combination like *halfway up to the library* would require.
- *Property five*, that of avertical *up* being incompatible with the mere orientation of an object along a path (cf. (25) and (26)), follows because in such situations no event has the whole path as its spatial trace. For example, even if we allow that the pointing described in (25) is an event, it is not an event that is spatially realized on the whole path.

This leaves open the question of why (27b) is acceptable. My idea, simply to be suggested, is that traversal *sensu stricto* is not necessary for the meaning of avertical *up*. If the spatial trace of an object covers the path, as in (27b), then this should count as 'traver-

sal'. This means that *up* can also denote a relation between objects and paths such that the spatial traces of the objects are the paths. I will leave the desired generalization of (35) to (not so) future work.

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