'Into doing something': Where is the Path in event predicates?

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1 Introduction

Directional prepositional phrases or locatives (henceforth DLs) headed by 'into' and 'out of' are usually regarded as denoting bounded PATHS (Jackendoff 1990, 1996; Verkuyl and Zwarts 1992; Nam 1995a,b, among others). Based on their occurrence with verbs of motion, especially in examples such as (1a), where the DLs contribute to telic, change of location interpretations (contrast (1b)), this would seem the obviously correct characterization.

    (1)   a. Chris danced into/out of the room.
                b. Chris danced.

The same pattern is observed in Finnish, where DLs are marked with directional locative cases, illative 'into' and elative 'out of':

    (2)   a. Toini tanssi huonee-seen/ huonee-sta.[1]
                    Toini danced room-ill   room-ela
                    'Toini danced into/out of a/the room.'

                b. Toini tanssi.
                    Toini danced
                    'Toini danced.'

The puzzle comes with examples (3) and (4). These sentences appear to have nothing to do with spatial meanings, yet the predicates are marked with DL case.

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[1] The following abbreviations are used in the glosses:
abl - ablative; all - allative; ela - elative; ill - illative; inf - infinitive; poss - possessive; 1sg - first person singular; 3sg - third person singular.

(3)   a.   Toini   rupeaa luke-ma-an/   *luke-ma-sta.
             Toini   begins read-inf-ill   read-inf-ela
             'Toini begins reading (lit. 'Toini begins into reading').'

       b.   Toini   lakkaa luke-ma-sta/   *luke-ma-an.
             Toini   stops   read-inf-ela   read-inf-ill
             'Toini stops reading (lit. 'Toini stops out of reading').'

(4)   a.   Sointu kehoitti   Toinia laula-ma-an/   *laula-ma-sta.
             Sointu encouraged   Toini sing-inf-ill   sing-inf-ela
             'Sointu encouraged Toini to sing (lit. 'Sointu encouraged Toini into singing').'

       b.   Sointu kielsi Toinia poltta-ma-sta/ *poltta-ma-an.
             Sointu forbade Toini smoke-inf-ela   smoke-inf-ill
             'Sointu forbade Toini to smoke (lit. 'Sointu forbade Toini out of smoking').'

These examples show that in Finnish, verbs like 'begin' only allow 'into', and verbs like 'stop' only allow 'out of'. The same asymmetry is found with verbs like 'encourage' and 'forbid': 'encourage' only allows 'into' predicates, and 'forbid' only allows 'out of' predicates. In contrast, manner of motion verbs can occur with either 'into' or 'out of' DLs. The same phenomenon is also found in English. Notice that the English equivalents of (3) and (4) sound odd with the insertion of DLs (see literal translation in brackets), although examples such as those in (5) below, though rare, are attested.[2]

(5)   a. ''Tis Cain Ball,' said Gabriel, **pausing from** whetting his reap-hook. (Hardy, *Far From the Madding Crowd*)
       b. He **forbade** both men and women **from** entering them (OED: *Arabian Nights*, 1841)

There is a further puzzling fact about the behavior of DLs. As modifiers of concrete nouns, DLs in both Finnish and English have spatial interpretations: they specify the orientation of the object in (perspectival) space:

(6)   a.   silta   San Francisco-on
             bridge San Francisco-ill
             'a/the bridge into San Francisco'

       b.   silta   San   Francisco-sta
             bridge San   Francisco-ela
             'a/the bridge out of San Francisco'

(7)   a.   '…They brought you to my shop, which is the first on **the road into town**…' (Burroughs, *The Mad King*)

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[2] In this paper, I assume 'out of' and 'from' to be equivalent.

b. **The road out of Tafelberg** wound upward among tall trees toward the pass… (Burroughs, *The Mad King*)

This is different from the interpretation of DLs when they occur with motion verbs, where they express change of location (see (1) and (2)). So, prepositions and case markers that express CHANGE OF LOCATION when used with verbs of motion, also double up to express ORIENTATION without change of location when used with nouns.

This set of data raises several questions:

(8) • What has a Path interpretation got to do with the beginning and stopping of events (as denoted by verbs like 'begin' and 'forbid'), and with orientation?

• What is the proper representation of events involving verbs such as 'begin'/ 'encourage' versus 'stop'/ 'forbid' that captures their selection of illative versus elative predicates, respectively, in Finnish?

• How can we explain the range of meanings associated with DLs cross-linguistically?

In this paper, I propose an analysis of DLs that explains the parallels between space and events. Building on earlier work (Fong 1997a,b), I argue that DLs must be analyzed as abstract ordered structures, which can then be interpreted either spatially or temporally. This accounts for the observed distribution of DL predicates in two genetically unrelated languages, Finnish and English, by tracing the several possible meanings in question back to a single relatively more abstract meaning for directional prepositions/ DL cases. In addition, I show how the proposed semantics of these prepositions/ cases accounts for the co-occurrence patterns of verbs and DL predicates in Finnish.

The paper is organized as follows. Section 2 details the proposal that DLs are to be analyzed as ordered structures. Section 3 examines the lexical semantics of verbs like 'begin'/ 'stop', and 'encourage'/ 'forbid', and shows how the selection of DL predicates is constrained by a requirement that the ordered structure of DLs match the event structure of the verbs. Section 4 considers the predictions of this analysis for other classes of verbs, and section 5 concludes the paper.

2 DLs as ordered structures

The first step is to provide a semantics for directional prepositions/ cases that unifies their spatial and temporal uses. It seems that the underlying semantics of DLs has to be more abstract than that of a Path, if by Path we mean a collection of points in space. In earlier work (Fong 1997a,b), I have proposed that DLs denote ordered structures, and that they require their domain of interpretation to consist of two phases. Given an ordering of phases $\sim p < p$, the 'out of' predicate is evaluated in the first phase $\sim p$, while the 'into' predicate is evaluated in the second phase p. For example, if points $p_{-n}\ldots p_0$ constitute a

first phase, and points $p_0...p_n$ a second phase, then the intervals in which the DLs hold are given in (9) below:

(9)   Intervals in which DLs hold:

		Holding at interval
ILLATIVE/ 'into'	ALLATIVE/ 'onto'	$p_0...p_n$
ELATIVE/ 'out of'	ABLATIVE/ 'off of'	$p_{-n}...p_0$

Crucially, such ordered structures are independent of spatial and temporal interpretations. The spatial or temporal interpretation of DL predicates will depend on whether the directional preposition/ case occurs with a nominal spatial term, or with a verbal event predicate. This is in line with Bierwisch's (1996) idea that a preposition like *in* is a basic spatial term only if it relates to 'I-space' (the internal representation of space and the knowledge underlying it), but not if it relates to time, or to some abstract entity like pain (e.g. *in pain*). In earlier work, Gruber (1965) and Jackendoff (1972) have also made similar observations (see also Jackendoff 1983 and Di Sciullo 1997, 2000).

        As illustration, I will outline below an analysis of DLs as modifiers of concrete nouns.

## 2.1 Example: DLs modifying concrete nouns

Jackendoff (1992, 1996) and Verkuyl and Zwarts (1992) argue that a three-dimensional object can be seen as one-dimensional because it can be partitioned into a set of parts, where the parts are linearly ordered. Adopting this idea, we introduce a function σ that gives a spatial trace of an object. The function σ takes an object *o* as its argument and returns parts of *o* as a one-dimensional spatial ordering:

(10) $\sigma(o_x) = s_x$

We also assume that the function σ preserves part structures – in other words, the result of joining two parts of an object in space is identical to the join of the two subparts:

(11) $\forall o \forall o' [\sigma(o) \oplus \sigma(o') = \sigma(o \oplus o')]$

        An object construed as being one-dimensional can have an orientation or direction. Imagine a bridge that straddles the San Francisco Bay, with one end in San Francisco. The parts of the bridge that are outside of San Francisco constitute one phase (call it ~*p*) and the parts that are within San Francisco constitute the other phase (*p*) (see (12)). In other words, phases are defined in terms of locations occupied by the parts of the bridge as it spans out in space.

(12)

~*p*   *p*
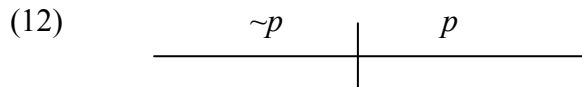
Bridges are inherently a-directional. A bridge has no intrinsic front/back, or left/right coordinate system of its own. Whether a bridge can be called a bridge 'into San Francisco' or 'out of San Francisco' depends on the narrator's/speaker's perspective in fixing the point of origin of the bridge.

We are able to figure out the ordering of phases from knowing the location of San Francisco in relation to parts of the bridge and a given narrative perspective. With 'a bridge out of San Francisco', the point of origin is fixed at San Francisco, and the part of the bridge that is located in San Francisco is ordered *before* the part located outside of the city. With 'a bridge into San Francisco', the point of origin is fixed outside of San Francisco, and the part of the bridge that is located in San Francisco is ordered *after* the part located outside of the city.

Let the phase p be defined in terms of the location predicate applying to San Francisco, such that p contains parts of the spatial trace of the bridge that are within San Francisco (see (13)):

(13) $p(s_x) = 1$ iff $\exists b_x [\sigma(b_x)=s_x \wedge \text{LOC-IN}(s_x, \text{san francisco})]$

Suppose we order the phases p and $\sim p$ as follows: $\sim p < p$. This is depicted in (14) with the axis pointing to San Francisco.

(14)   into San Francisco:
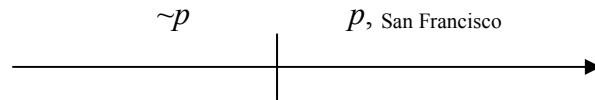
In (14), we have an ordering in which there is a monotonic phase change from $\sim p$ to p. This monotonic phase change is what we will require as the ADMISSIBLE INTERVAL for interpreting the DL cases. The definition of an admissible interval I for the evaluation of DLs is adapted from Löbner (1989):

(15)   Any admissible interval starts with a phase of not-p and is monotone in terms of p; starting with points s for which p(s)=0, it may extend to later points s' with p(s')=1, but must not contain yet later points s" with p(s")=0 again.

Assuming that the semantics of both the Finnish and English expressions are the same, we define the truth conditions for *a bridge into San Francisco/ silta San Franciscoon* in (16):

(16)   a. 'a bridge into San Francisco'

    b. $\exists a(bridge(a))$ and
       (i) I is an interval, which is the range of $\sigma(a)$, and contains a phase change
           ($\sim p < p$); and
       (ii) $\exists s \in I \; \forall y \in I((y<s) \rightarrow \neg \text{LOC-IN}(y, \text{SF})) \land$
            $\exists s' \in I \; \forall z \in I(s'<z) \rightarrow \text{LOC-IN}(z, \text{SF}))$

Condition (i) is satisfied by a well-defined admissible interval, as described in (15). Condition (ii) says that if one part, y, of the spatial trace of the bridge, is early enough in the ordering, it should be located outside of San Francisco, and a later part, z, if it is late enough in the ordering, should be in San Francisco. This condition ensures that the bridge that we are talking about is neither wholly outside of San Francisco, nor wholly inside, but rather, the bridge has to straddle the two regions.

Conversely, *a bridge out of San Francisco/ silta San Franciscosta* would have the ordering of phases $p<\sim p$, if we keep p as the location predicate applying to San Francisco.[3] The ordering is different because the perspective is switched – see (17), where the axis points away from San Francisco. So, we would evaluate the truth of the elative predicate at p, which is now the first of two phases.

(17)   out of San Francisco:

Several consequences follow from this analysis. First, (16) reflects the real world indeterminacy of what constitutes the transition from $\sim p$ to p for objects like bridges. In real life, the Golden Gate Bridge links San Francisco and Marin County. Drivers going from Marin to San Francisco can see a sign that says 'welcome to San Francisco' before crossing the bay.[4] So, while one might think that the coastline of northern San Francisco should be the phase-transition point for the Golden Gate bridge being described as 'the bridge into San Francisco', it need not be strictly so. Notice that we capture this intuition in condition (ii) of (16b): we specify a 'early enough' part of the bridge, and a 'late enough' part of the bridge in terms of ordering of parts. But exactly which part of the bridge is the transition point is left vague.

Second, in this account, the meaning of DLs is not tied to the idea of fictive motion. Fictive motion is invoked by Langacker (1987), Matsumoto (1996a,b), and Talmy (1996), among others, for linguistic expressions that do not express a real, physical motion of the Subject, but rather some sort of subjectively conceptualized notion

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[3] Note that it is not imperative to keep p as the location predicate applying to San Francisco, and switch the ordering of phases. However, I am doing this to make a subsequent point about the difference between DLs modifying objects versus DLs modifying events (see section 3.4).
[4] Vignette courtesy of Henriëtte de Swart.

of motion. For example, in (18a) and (18b), the road/ the mountain range is depicted as 'moving'.

(18)   a. This road goes from Modesto to Fresno.
        b. That mountain range goes from Mexico to Canada. (Talmy 1996)

The 'movement' in these examples can be attributed to the verb *go*. However, this does not account for the examples in (6)-(7), where DLs are modifiers of nouns, and do not involve motion verbs. Neither can the orientational reading of the DLs in (6)-(7) be attributed to stative verbs inducing the stative/orientational interpretation (cf. Nam (1995a,b)), unlike the examples below[5], where directional prepositions like *across* and *through* have a stative reading when they occur with stative verbs like *sit* and *see*:

(19)   a. The cat is sitting across the street.
        b. Chris saw the cat through the window.

Since the data in (6)-(7) involve neither verbs of motion nor stative verbs, the present account of DLs provides an interpretation that applies within the domain of objects.

To summarize, DL modification of concrete nouns is interpreted in terms of ordered structures. The 'into' versus 'out of' distinction is related to whether the interpretation is in the later or earlier parts, respectively, of the ordered structure. This approach is compatible with Krifka's (1998) idea that paths must be abstract part structures with an adjacency property. However, while Krifka treats paths as elements that are convex and linear (a notion that is enforced by an adjacency condition on path structure – see Krifka 1998:203), the current approach allows for a 'fuzzy' concept of ordering, which is useful given the real-life indeterminacy of what constitutes the transition from $\sim p$ to p for objects like bridges, as discussed above.

2.2 Semantic representation of directional prepositions/ DL cases

In representing directional prepositions or DL cases, I adopt Wunderlich's (1991) treatment of PP modifiers:

> The external argument of the modifier must be bound by the referential argument of some host phrase… The binding of the modifier's external argument can be explained by unification… Given the predicates $\lambda xP(x)$ and $\lambda yQ(y)$, we automatically get the conjunct $\lambda x(P(x)$ and $Q(x))$ by unification. (Wunderlich 1991:605)

This treatment allows a modifier to conjoin with its head phrase. For instance, in an attributive modification like [$_{NP}$ NP PP] (e.g. 'the book in the kitchen'), the PP 'in the kitchen' conjoins with 'book' as in (20):

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[5] These cases will not be further discussed in this paper.

(20)   'book in the kitchen': λx (BOOK(x) ∧ LOC-IN(x, KITCHEN))

The preposition 'in' has the representation in (21):

(21)   'in': λvλu (LOC-IN(u,v))

Given our analysis of 'a bridge into San Francisco' in (16) above, the representation of 'into'/ 'out of' will involve more than just a LOC-IN predicate. The representation of 'bridge into SF' is given in (22):

(22)   'bridge into SF':
        λx(BRIDGE(x) ∧ ∃s∈σ(x) ∀y∈σ(x)((y<s) → ¬LOC-IN(y, SF)) ∧
        ∃s'∈σ(x) ∀z∈σ(x)((s'<z) → LOC-IN(z, SF)))

The semantic representations of directional prepositions/ DL cases are the lambda expressions in (23):

(23)   Semantic representation of directional prepositions/ DL cases:

        a. 'into'/ 'onto':
           λQλw(∃s∈ℳ(w) ∀y∈ℳ(w)((y<s) → ¬Q(y)) ∧
           ∃s'∈ℳ(w) ∀z∈ℳ(w)((s'<z) → Q(z)))

        b. 'out of'/'off of':
           λQλw(∃s∈ℳ(w) ∀y∈ℳ(w)((y<s) → Q(y)) ∧
           ∃s'∈ℳ(w) ∀z∈ℳ(w)((s'<z) → ¬Q(z)))

           Q is substitutable with a nominal or verbal predicate, giving location (LOC-IN/ON) or event interpretations (following Bierwisch 1996), respectively.
           ℳ is a spatio-temporal trace function operating on w giving spatial traces for objects or temporal traces for events (see below).

        In the representation of 'into' (see (23a)), Q(x) holds over the later half of the ordering. Assuming an arbitrary transition point k where Q(x) holds, 'into' predicates are bound on the LEFT by the point k, and hold for points ordered after k. In the representation of 'out of' (see (23b)), Q(x) holds over the earlier half of the ordering. 'Out of' predicates are bound on the RIGHT by the point k, and hold for points ordered before k. To simplify the exposition in the rest of this discussion, I will use the abbreviatory labels [LEFT/RIGHT BOUND] to refer to the semantic representations of directional prepositions/ DL cases, as in (24):

(24)   a. 'into'/ 'onto':   [LEFT BOUND]
        b. 'out of'/ 'off of':   [RIGHT BOUND]

3 The lexical semantics of verbs

This section examines the semantics of aspectual verbs like 'begin' and 'stop', and speech act verbs like 'encourage' and 'forbid'. I will attempt to capture their selection of DL predicates using the above analysis where DLs denote ordered structures independent of temporal/spatial dimensions. The selection of DL predicates by different classes of verbs hinges on one constraint: The event structure of verbal predicates and DL cases must match in their left/right bound specifications.

3.1 Aspectual verbs

Aspectual verbs such as 'begin'/ 'start' have been treated variously as achievements that initiate a state (Vendler 1957; Mittwoch 1991), and as transitions terminating an off-state and starting an on-state of the same type (ter Meulen 1995). Jackendoff (1992) proposes that such verbs, together with 'stop'/ 'pause', are events that serve as boundaries of other events. A similar proposal is formalized in Piñón 1997, where achievements are analyzed as denoting left or right boundaries of eventualities. More specifically, according to Piñón (1997), a boundary happening begins (ends) an eventuality of type X, just in case there is no eventuality immediately preceding (following) it such that the sum of the two eventualities is of type X.

What all these approaches have in common is that they treat the event denoted by such verbs as involving two phases – phases that comprise two different states, or states of affairs. I term these event structures as DIPHASIC (Fong 1997a,b). Crucially, both phases must be visible to the function $\mathcal{M}$ in mapping out the temporal trace of the event (see also Fong in prep).

For example, the event of 'begin reading' starts at a time t_0, and reading continues into some time t, $t_0 < t$. Crucially, at any time before t_0, the expression entails no reading event. Verbs like 'begin' are thus LEFT BOUND happenings, in the sense of Piñón (1997). The representation of 'Toini begins reading' is given in (25) below. Here, we treat names as constants, and the verb 'begin' as a raising verb (see Jacobson 1990; Pustejovsky 1995).

(25)   'Toini begins reading':
$\lambda e \lambda t_0 [\text{BEGIN}(\text{READ}(a,t_0,e)) \wedge \forall t_y \in \mathcal{M}(e)((t_y < t_0) \rightarrow \neg\text{READ}(a,t_y)) \wedge$
$\forall t_z \in \mathcal{M}(e)((t_0 < t_z) \rightarrow \text{READ}(a,t_z))]$

Conversely, the event of 'stop reading' culminates at t_0. At a time t, $t < t_0$, reading was happening, and no reading happens after t_0. Verbs like 'stop' are RIGHT BOUND happenings.

(26)　‘Toini stops reading’:
$\lambda e\lambda t_0[\text{STOP}(\text{READ}(a,t_0,e)) \wedge \forall t_y \in \mathcal{M}(e)((t_y<t_0) \rightarrow \text{READ}(a,t_y)) \wedge$
$\forall t_z \in \mathcal{M}(e)((t_0< t_z) \rightarrow \neg\text{READ}(a,t_z))]$

　　　　An event like 'begin reading' is [LEFT BOUND]: READ(a,t) (expressed by the infinitival complement) holds in the later half of the ordered structure. In Finnish, 'begin' takes only the 'into' case. The 'into' case is [LEFT BOUND] (see (24)). Hence, I propose the following principle:

(27)　**Principle**: The event structure of verbal predicates and DL cases must match in their left/right bound specifications.

It follows then that infinitival complements of 'begin' can only take [LEFT BOUND] illative case (as in (28a)), and not the [RIGHT BOUND] elative case. Those of 'stop' can only take [RIGHT BOUND] elative case (as in (28b)).

(28)　a.　Toini　rupeaa luke-ma-an/　　*luke-ma-sta.
　　　　　Toini　begins read-inf-ill　　　read-inf-ela
　　　　　'Toini begins reading (lit. 'Toini begins into reading').'

　　　　b.　Toini　lakkaa luke-ma-sta/　　*luke-ma-an.
　　　　　Toini　stops　read-inf-ela　　　read-inf-illative
　　　　　'Toini stops reading (lit. 'Toini stops out of reading').'

3.2 Speech act verbs

Verbs like 'encourage' and 'forbid' are speech act verbs. Rohrbaugh (1995) treats speech act verbs as deontic operators, where ENCOURAGE(φ) and FORBID(φ) make possible φ worlds deontically acceptable or unacceptable, respectively. Modulo the deontic contexts introduced by speech act verbs, the event structure of 'encourage' and 'forbid' are similar to 'start' and 'stop'. However, because of the deontic contexts introduced by these speech act verbs, the events will have to be interpreted as ideal or admissible states of affairs, which we will not formalize here.

　　　　The left/right bound distinction is applied to these speech act verbs as follows. The situation that arises from the speech act of 'forbid y to smoke' is such that 'y smoking' is right bound: y smoking may happen before the event of forbidding, but all possible worlds where y smokes following the speech act are unacceptable. This motivates describing events depicted by 'forbid' as [RIGHT BOUND]. This predicts that in Finnish, the VP complement of 'forbid' can only take [RIGHT BOUND] elative case marking:

(29)   Sointu   kielsi Toinia poltta-ma-sta/ *poltta-ma-an.
        Sointu   forbade Toini smoke-inf-ela   smoke-inf-ill
        'Sointu forbade Toini to smoke (lit. 'Sointu forbade Toini out of smoking').'

Other speech act verbs of the same type as 'forbid', such as *kieltäytyä* 'refuse' and *varoittaa* 'warn' also behave as predicted: their infinitival complements take elative case.

(30)   Kieltäydy-n   laula-ma-sta.
        sing-1sg   sing-inf-ela
        'I refuse to sing (lit. 'I refuse out of singing').'

(31)   Sointu   varoitti   Toinia   laula-ma-sta.
        Sointu   warned   Toini   sing-inf-ela
        'Sointu warned Toini not to sing (lit. 'Sointu warned Toini out of singing.').'

        As for 'encourage *y* to sing', the situation that arises from such a speech act is [LEFT BOUND] – the event of 'encouraging' opens up, as it were, all possible worlds where *y* sings. That is, all possible worlds where *y* sings are acceptable after the event of encouraging. This predicts that the VP complement of 'encourage' can only take [LEFT BOUND] illative case marking:

(32)   Sointu   kehoitti   Toinia laula-ma-an/   *laula-ma-sta.
        Sointu   encouraged   Toini sing-inf-ill   sing-inf-ela
        'Sointu encouraged Toini to sing (lit. 'Sointu encouraged Toini into singing').'

Speech act verbs similar to 'encourage', such as *käskeä* 'command' and *neuvoa* 'advise', also behave in the same way, and take illative infinitival complements.

(33)   Sointu   käski   Toinia laula-ma-an.
        Sointu   commanded   Toini sing-inf-ill
        'Sointu commanded Toini to sing (lit. 'Sointu commanded Toini into singing.').'

(34)   Sointu   neuvoi   Toinia laula-ma-an.
        Sointu   advised   Toini sing-inf-ill
        'Sointu advised Toini to sing (lit. 'Sointu advised Toini into singing.').'

3.3 Motion verbs

We now turn to motion verbs, and discuss how the above analysis also captures the occurrence of DL predicates with spatial (Path) meanings:

(35)   a. Chris danced into/out of the room.

      b. Toini   tanssi huonee-seen/ huonee-sta.
          Toini   danced room-ill   room-ela
          'Toini danced into/out of a/the room.'

Motion verbs denote events that take place in time, but in addition, such events are closely related to space as well. In other analyses of motion events (Bierwisch 1988, Verkuyl and Zwarts 1992, Piñón 1993, Nam 1995a,b, among others), the spatio-temporal mapping of motion events is what defines the notion of Path as change of location. In Verkuyl and Zwarts (1992), for example, a prepositional phrase headed by 'to' is interpreted as an atemporal spatial path $P_{to} = \langle p_1, \ldots p_i, \ldots, p_s \rangle$. Motion events involve a GO function, which provides a temporal structure $\langle t_1, \ldots t_i, \ldots, t_s \rangle$. The application of the GO function to the spatial path will be a mapping from the atemporal spatial Path into the temporal Path, creating a new spatio-temporal path $\langle (t_1, p_1), \ldots (t_i, p_i), \ldots \rangle$.[6]

In the present analysis, it would be wrong to assume that the DLs under consideration refer to paths directly, since with objects and non-motion verbs, no change of location is involved. Motion events involve change of location through time. Let the spatio-temporal trace function $\mathcal{M}$ operate on events to give spatio-temporal traces for motion events:

(36) $\mathcal{M}(e_x) = (s_{x,tx})$

For motion 'into a room', for example, the part of the spatio-temporal trace of the motion event that occurs outside the room can be one phase (call it $\sim p$), and the part that is within the room can be another (p). The ordering of phases is $\sim p < p$. Let the phase p be defined in terms of the location of the mover being located in the room.

(37) $p(s_x, t_x) = 1$ iff $\exists e_x [\mathcal{M}(e_x) = (s_x, t_x) \land$ LOC-IN $(a, room, (s_x, t_x))]$

The interpretation of a sentence like *Chris danced into the room*, abstracting away from tense, is given in (38):

(38)   a. 'Chris danced into the room.'

        b. $\exists e$(Dance(Chris,e)) and
           (i) I is an interval, which is the range of $\mathcal{M}(e)$, and contains one phase change ($\sim p < p$) with respect to the location of Chris in the room at some time; and
           (ii) $\exists (s,t) \in I \; \forall (a,b) \in I((a,b) < (s,t) \rightarrow \neg$LOC-IN(Chris,room,(a,b))) $\land$
              $\exists (s',t') \in I \; \forall (x,y) \in I((s',t') < (x,y) \rightarrow$ LOC-IN(Chris,room,(x,y)))

I do not claim that all dancing motions have a trajectory that yields this ordering of positions. Dancing can well trace random lines/ curves in space, and yet not have a

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[6] But see Krifka's (1998) objection to this 'film-strip' like conception of motion.

trajectory that gives a change of location from ~*p* to *p*. For example, in one dancing event, a dancer can be dancing all around a ballroom, without actually moving out of the ballroom. In this case, the dancing event can be given a spatio-temporal mapping, but the mapping does not yield a structure where the dancer is in the ballroom in one phase, and not in the ballroom in the second phase. However, all we need is this: if dancing involves a trajectory that crosses a spatial boundary (say, moving across the ballroom door), we get the right structures for defining possible phases; and DLs can only be interpreted given this particular structure. Therefore, the analysis predicts that when dancing has some other configuration, the event is incompatible with DL interpretation.

A related issue (also raised by Löbner (1989)) is that given the definition of admissible intervals as being monotone in terms of *p*, a dancing event (for example, dancing a tango) that involves going in and out of the room, or that involves backtracking, will have to be ruled out in this model. In such cases, the entire event is correctly predicted to be incompatible with the description 'dancing into the room'. But if we allow the event to be broken down into small enough chunks, that is, if we relativize the points in space/time where there is a trajectory involving one phase change, then that smaller event chunk can be described with the DL. Witness the well-formed description with a DL predicate in (39), in a context where a couple dances the tango all over the house, going in and out of various rooms:

(39)   While performing the tango in the house, the couple **danced into the kitchen**.

Let us look briefly at 'dancing out of the room'. Keeping the phases *p* as location inside the room, and ~*p* as location outside the room, the ordering of phases is *p*<~p. The interpretation of a sentence like *Chris danced out of the room*, abstracting away from tense, is given in (40):

(40)   a.   'Chris danced out of the room.'

        b.   ∃e(Dance(Chris,e)) and
             (i) *I* is an interval, which is the range of $\mathcal{M}$(e), and contains one phase change (*p*<~*p*) with respect to the location of Chris in the room at some time; and
             (ii) ∃(s,t)∈I ∀(a,b)∈I((a,b)<(s,t) → LOC-IN(Chris,room,(a,b))) ∧
                  ∃(s',t')∈I ∀(x,y)∈I((s',t')<(x,y) → ¬LOC-IN(Chris,room,(x,y)))

To summarize, motion events like 'dance into/ out of a room' get left/ right bound specification based on the spatio-temporal trace of the motion event. Depending on whether the dancer's location in the room is at the earlier phase (the location is right bound) or in the later phase (left bound), the appropriate directional preposition or case-marking is used.

3.4 Differences between objects and events

The above treatment of objects and events predicts how objects and events are different. For motion events, the ordering of spatial positions, and also the ordering of phases, are dependent on the progression of the motion event through time, and time has an inherent direction. One logical consequence of the spatio-temporal mapping of motion events pursued here is that two expressions such as 'dancing into the kitchen' and 'dancing out of the (same) kitchen' cannot describe the same event in a given time interval. That is, at a given time t, dancing in the kitchen cannot be both a phase p and a phase $\sim p$, in our model. Rather, the two expressions must be interpreted either as (i) describing consecutive events – for example, dancing into the kitchen at time t, and dancing out of the kitchen at time t' ($t<t'$), or vice versa; or (ii) describing two separate events (i.e., with different participants) that take place at the same time t.

On the other hand, recall that the axis representing the spatial ordering of parts of objects has two possible directions, depending on the perspective taken. A bridge is independent of change over time, and so perspective shift can occur at any point, and any time. Thus, 'a bridge into San Francisco' and 'a bridge out of San Francisco' can describe the same bridge, depending on the perspective taken. But perspective shift cannot be invoked for the manner-of-motion events (denoted by verbs of manner of motion like 'dance', 'run', etc). As discussed above, 'dancing into the kitchen' and 'dancing out of the (same) kitchen' cannot describe the same event at the same point in time.

Even if manner-of-motion verbs do not allow perspective shift, what about verbs like 'come' and 'go', which are deictic verbs of inherently directed motion? Are they susceptible to a similar treatment with objects? The answer is still no.

I described perspective shift for objects as the speaker placing a particular point of origin on a part of the object. Depending on where the point of origin is, a bridge can be described as either 'a bridge into X' (when the point of origin is outside of X) or 'a bridge out of X' (when the point of origin is inside X). But deictic verbs of inherently directed motion (e.g. 'go', 'come') are perspectival in a different way. The speaker places the deictic center either at the point of origin of the motion ('go'), or at the end point ('come'). The example in (41) shows how the same motion event can be described with both the verbs 'go' (41a) and 'come' (41b), with the same DL predicates (the same holds for English (see (42)). The context for interpreting the following examples is one where Sointu/Tracy leaves the house, and steps into the garden.

(41)   a. Sointu menee talo-sta   puutarha-an.
            Sointu goes   house-ela   garden-ill
            'Sointu goes out of the house into the garden.'

       b. Sointu tulee   talo-sta   puutarha-an.
            Sointu comes house-ela   garden-ill
            'Sointu comes out of the house into the garden.'

(42) a. Tracy goes out of the house, into the garden.
      b. Tracy comes out of the house, into the garden.

In (41) and (42), both the (a) and (b) sentences depict motion out of the house, into the garden. Even though 'come' and 'go' have different deictic centers, this does not affect the spatio-temporal mapping of the motion event, which determines the direction of movement. That is why the DL predicates remain constant in both the (a) and (b) examples. In this way, the semantic model developed here reveals the difference between perspective-taking for object description and for event description.

The above discussion has shown how the present analysis captures the difference between the use of DLs as modifiers of concrete nouns, and as modifiers of motion events. The difference falls out from the ontological properties of time versus space, which we exploit in our temporal and spatial trace functions.

3.5 Summary

This section examined the lexical semantics of aspectual verbs, speech act verbs, and motion verbs. I showed that with aspectual and speech act verbs, the verbs fall into two classes, best described by the ordering of phases in their diphasic event structure. The constraints on the type of DL complements that these two classes of verbs can take necessitate our recognizing two classes of verbs: a [LEFT BOUND] class, and a [RIGHT BOUND] class.

That DLs, when they denote bounded paths, contribute to telicity in event structure (see (1) and (2) above) is well known. The preceding discussion reveals another connection between these DLs and event structure. Assuming a more abstract semantics for DLs, we see what constrains the selection of DL cases by different classes of verbs: the left/right bound specifications of verbal predicates and DL cases must match.

Crucially, Finnish DLs and their English equivalents behave the same way with motion verbs. But Finnish differs from English in allowing DL predicates to be interpreted in non-spatial (i.e. temporal) domains more freely, as seen in examples (3)-(4). To put it differently, Finnish DL case marking can occur more freely with verbal (event) predicates than their English counterparts.

While DL predicates are rare with speech act verbs in English, Jackendoff (1983:200) provides examples of 'circumstantial' verbs (see also Gruber 1965) in English that subcategorize for subordinate clauses with directional prepositions *into/ from*:[7]

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[7] In Jackendoff's (1983) approach, 'from' in (40b) has to be represented as NOT AT, and in (40c) as FROM, which, he acknowledges, fails to show the relatedness of the two uses of 'from'. In our approach, such a DL denotes an abstract ordered structure, and gets a temporal interpretation because of its association with an event predicate. This allows us to show how the verbs in (40b) as well as (40c) behave alike – we

(43) a. Sue forced/ pressured/ tricked/talked Jim into singing.
      b. Sue kept/ restrained/ prevented/ exempted Jim from singing.
      c. Sue released Jim from singing.

In (44), I give a list of left/right bound verbs in Finnish. These verbs take DL complements of the predicted types.

(44) List of left/right bound verbs in Finnish:

left bound		right bound	
houkutella	'lure'	*estää*	'keep from'
käskeä	'command'	*kieltää*	'forbid'
kehoittaa	'encourage'	*kieltäytyä*	'refuse'
neuvoa	'advise'	*lakata*	'stop'
olla kova	'be keen on'	*luopua*	'give up'
oppia	'learn'	*pelastaa*	'save'
patistaa	'exhort'	*säästyä*	'be spared'
pyrkiä	'attempt'	*varoa*	'beware of'
päätyä	'end up'	*varoittaa*	'warn'
ruveta	'begin'	*välttyä*	'avoid'

4 Predictions

In the discussion above, we found that verbs whose infinitival complements take DL case marking show differences in case selection. We examined the temporal structure of the events depicted by such verbs, and noted that their event structure is diphasic. We motivated a [LEFT/RIGHT BOUND] description of such verbs. By requiring the [LEFT/RIGHT BOUND] description of the verb to match with that of the DL case, we can account for the co-occurrence restrictions between the verbs and the DL cases.

The analysis makes the following predictions. First, verbs that do not have diphasic event structures will not exhibit systematic selections for particular DL predicates. State verbs are precisely a class of this type: they cannot be said to have either left or right bound event structures. In Finnish, sense-perception verbs (e.g., *haista* 'smell', *kuulostaa* 'sound', *näyttää* 'seem, look', *maistua* 'taste', *tuntua* 'seem, feel') take complements that are marked with DL cases. Interestingly, they may take either allative ('onto', [LEFT BOUND]) or ablative ('off of', [RIGHT BOUND]) directional cases, although the ablative is more common in Standard Finnish (Karlsson 1987):

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predict that they take 'out of'/ 'from' predicates, because the event of 'singing' holds in the first half of the ordered structure (i.e. the event structure is RIGHT BOUND).

(45) a. Tämä näyttää kumma-lle/ kumma-lta.
  this looks odd-all odd-abl
  'This looks odd.'

  b. Ruoka maistui huono-lle/ huono-lta.
  food tastes bad-all bad-abl
  'The food tastes bad.' (Karlsson 1987)

Second, we predict that locative predicates denoting the resultant state in change-of-state constructions must take illative/ allative case marking in Finnish, and not elative/ ablative. Verbs of change of state (e.g. *väsyä* 'get tired', *eksyä* 'get lost') have two phases in their event structures: a prior state and a resultant state. Locative predicates that denote the resultant state are left bound by the transition point, and are only compatible with [LEFT BOUND] illative/ allative case marking, as shown in (46)-(48).

(46) Ukko väsyi tie-lle/ *tie-ltä.
  old-man got.tired road-all road-abl
  'An/The old man got tired on (lit. 'onto') the road.' (Hakulinen 1961)

(47) Tallella on koti-i-nsa/ *kodi-sta-nsa eksynyt.
  safe is home-ill-poss-3sg home-ela-poss-3sg got.lost
  'The one is safe who got lost in (lit. 'into') his home.'
  (Proverb, in Hakulinen 1961)

(48) Muurahainen eksyi tie-lle.
  ant got.lost road-all
  'An/The ant got lost on (lit. 'onto') the road.'

In contrast, if we change the case marking to elative/ ablative, we get a crucially different reading. The example in (49) forms a minimal pair with (48) above. While (48) depicts an ant that ended up lost on the (perhaps extremely wide or windy) road, (49) depicts an ant that was originally traveling on the road, ending up lost, away from the road.

(49) Muurahainen eksyi tie-ltä.
  ant got.lost road-abl
  'An/The ant got lost off of the road.'

So, in (48), the allative predicate depicts the result state, and in (49), the ablative predicate depicts the prior state.

5 Conclusion

In this paper, I have provided an analysis of the occurrence of DLs with different classes of verbs. I have argued for an analysis of DLs as ordered structures that are more abstract than Path as a collection of points in space. In addition, the elaboration of the lexical

semantics of verbs as having LEFT/RIGHT BOUND properties further explains why only certain classes of verbs are compatible with certain DL predicates.

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