From motion perception to Bob Dylan.
A Cognitivist attentional semantics of directionals*

Kai-Uwe Carstensen (Siegen)

Abstract

Directionals like *from New York*, *through the tunnel*, *into the dark* represent a major class of spatial expressions, typically associated with locomotion (verbs). Semantically, many of their aspects are notoriously difficult to characterize, among them their characteristics (classification, typology), their relation to locatives (e. g. *in New York*, *in the tunnel*, *in the dark*), and their composition with verbs (especially in non-locomotion contexts). Cognitively, there is a big theoretical gap to fill between aspects of low-level motion perception and the conception of static situations in terms of non-actual (loco)motion.

This paper first critically discusses Zwarts' explicit formal account of directionals, then introduces a Cognitivist attentional semantics and finally applies the Cognitivist approach to directionals. It will be shown that attention-based conceptual representations are necessary components in directional semantics and explanatory for the mentioned aspects.

1 Introduction

> *All along the watchtower, princes kept the view*
> BOB DYLAN

The dichotomy "location vs. direction" (also: "locative/local/locational" vs. "directive/directional") serves to characterize a salient contrast in spatial semantics, as exemplified by locative prepositions like *in*, *on*, *at*, *above* vs. directional prepositions like *from*, *into*, *through*, *along*, *onto*, *to*:

> 'Locals' will be called those expressions [...] that serve the localization of objects or events. [...] 'Directionals' will be called those expressions that express the change of localization of an object (hence a change of place) [...].
>
> (Wunderlich/Herweg 1991: 759, my translation)

Accordingly, "[l]ocative prepositions correspond to places (where something is), directional prepositions to paths (where something is going)" (Zwarts 2008: 79). In this paper, I will focus on aspects of directionals,[1] even though this term with its variants is a source of confusion:

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[1] See Carstensen (2015) for an attentional approach to the semantics of locative prepositions.

"The term ‚directional' turns out to be a bit of a misnomer, because we find prepositions in this class that actually lack directionality" (Zwarts 2008: 95), for example *through the jungle* or *along the river*.

Directionals are closely associated with expressions of actual motion (better: **locomotion** or **translational** motion; contrary to most of the literature, I will use *locomotion* here because it implies the change of place that directionals presuppose). It has often been observed, however, that they also appear in non-locomotion contexts (cf. (1)). This has been called "subjective motion" (Langacker, Matsumoto) or "fictive motion" (Talmy, Matlock) as instances of "abstract motion" (Langacker) (cf. Langacker 1991, Matsumoto 1996, Talmy 2000:99-176, Blomberg/ Zlatev 2014, 2015, Matlock/Bergman 2015). Blomberg/Zlatev point out correctly that there are different motivations for the use of such constructions, and propose to use the term "non-actual", which I will do here with "non-actual locomotion" for expressions like those in (1).

(1)   Non-actual locomotion (Matsumoto 1996: 183)
        a.   The highway runs through the mountains
        b.   The mountain range goes from Canada to Mexico

Historically, such cases have led some to believe that spatial concepts in general are the source of abstract, non-spatial linguistic structure:

> But spatial concepts may well be more deeply integrated with linguistic structure, including grammatical constructions. In the 1970s, some linguists went a considerable distance along this road under the banner of 'localism', treating grammatical categories such as tense and aspect as spatially grounded [...]. Although the term 'localism' is no longer used, many approaches in cognitive linguistics are consistent with this idea.
>
>   (Evans/Chilton 2010: 4)

Others take up a slightly more abstract position by characterizing paths or changes of place in terms of "topology, algebra, or set theory" (Wunderlich/Herweg 1991: 785, my translation). It will turn out, however, that there is an even different (more Langackerian) conception, according to which actual and non-actual uses share some aspects of mental processing, which explains their common structure.

After acknowledging the advances made in spatial semantics given the multitude of interdisciplinary approaches (cf., e. g., van der Zee/Slack 2003), Zwarts/Gärdenfors point out that "this also raises the much less investigated question whether and how meanings of [directionals, Carstensen] are constrained, that is, how all the different spatial and other factors come together in such a way that they can be learned, represented, and used by human beings" (Zwarts/Gärdenfors 2015: 110). Ultimately, this is required for deciding whether or how Dylan's phrase above can be understood.[2]

The present paper is concerned with directional semantics from (such) a **Cognitivist** point of view (cf. Carstensen 2011). Complementing the approach to locational semantics of Carstensen

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[2] "'All Along the Watchtower' [...] is simply a mistake from the title on down: a watchtower is not a road or a wall, and you can't go along it." (Dave Van Ronk, The Mayor of Macdougal Street, ISBN 978-0-306-81479-2).

(2015), it offers a new approach to spatial directional semantics in which **aspects of attention** are regarded as essential for an explanatory non-localist account of directionality phenomena.

After clarifying basic terminology in spatial semantics, I will discuss the currently most elaborated approach to spatial directionality by Joost Zwarts (Zwarts 2005, 2008, 2013, Zwarts/Gärdenfors 2015). This will be complemented by presenting further aspects of and challenges for directionals semantics. I will then motivate the Cognitivist Attentional Approach (*CAA*) in general, and finally apply it to the semantics of directionals.

2 Location and direction in spatial semantics

According to a widespread view (which I will preliminarily adopt), locatives like *in the jungle* denote sets of places. In the simplest case, the verb semantically provides the mapping from object to place-of-object (verbs of location like *to be located*, *stand*, *lie*, *live* for sentences like *Tarzan lives in the jungle*) while in other cases this mapping is indirect or implicit.[3]

(2) shows two simplified options for the semantic forms of verbs like *stand, sit, lie* corresponding to representative proposals for incorporating the local argument (cf. Jackendoff 1990, Wunderlich/Kaufmann 1990). Here, the first semantic component specifies the location of x, while the $MODE_{Pos}$ (or manner) predicate represents the mode of position, i. e. the characteristic property differentiating the semantics of these verbs. (2)a and (2)b differ in that the spatial verb argument L is used referentially in the former (as denoting a spatial region) and as a predicate of a place in the latter ('loc(x)' maps to the place of x).

(2)   Spatial semantics of location verbs / verbs of position
    a. $\lambda L\,\lambda x\,\lambda s\,[BE(x,L)\ \&\ MODE_{Pos}(x)](s)$
    b. $\lambda L\,\lambda x\,\lambda s\,[L(loc(x))\ \&\ MODE_{Pos}(x)](s)$

Functionally, a local PP serves as a **place description** and characterizes a **location**. Note that locatives are characterized by not conceptualizing a change of place in some reference system (hence a man described as *standing in a train* where the train arrives at the station cannot be described as **man standing to the station*[4], although there is objective movement and change of place), and there can be *falling stars in the sky* although they change place by definition.

Directionals like *into the jungle* are often assumed to denote sets of **paths**. Again, in the simplest case the verb semantically provides the mapping from object to some relevant path-of-object (verbs like *run, point, extend*) while in other cases this mapping is indirect or implicit, cp. *man from the jungle, door into the garden*. (3) shows representative options for the semantic forms of locomotion verbs comprising the information that there is movement (MOVE), the specific type of motion (e. g., $MODE_{walk}$), and the path information. Jackendoff's proposal in (3)a merges movement and path information in one predicate/function.[5]

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[3] That is, the PP in *man in the jungle* does not necessarily apply directly to *man*, cp. *man in his funny shorts*. See Maienborn/Schäfer (2011) for further arguments and a generalized treatment of indirect modification.

[4] The asterisk is used to mark ungrammatical expressions.

[5] Note that the examples in (3) show the semantic entries for verbs of so-called satellite-framed languages in which the path information is expressed by a complement of the verb.

(3)   Spatial semantics of locomotion verbs / verbs of locomotion
       a.   λP λx λe [GO(x,P) & MODE$_{Move}$(x)](e)
       b.   λP λx λe [P(path(x)) & MOVE(x) & MODE$_{Move}$(x)](e)

Functionally, a directional PP serves as a **path description** and characterizes a **route** (a sequence of locations).[6] The paths described by directionals are conceived as sequences of place, even if there is no actual change of place, as in non-actual locomotion. Jackendoff assumes different functions (the GO and ORIENT functions in (4)) for relating entities and paths in actual and non-actual locomotion, respectively.

(4)   Jackendoff´s path functions (Jackendoff 1983, 1990)
       a.   *Peter went north*:   [$_{Event}$ GO ([$_{Thing}$ PETER],[$_{Path}$ NORTH])]
       b.   *The sign points north*:   [$_{State}$ ORIENT ([$_{Thing}$ SIGN],[$_{Path}$ NORTH])]

This view of directionals as denoting paths (as arguments or semantic components of verbs) is not shared by all authors, however. I will come back to this (and to further puzzles in directional semantics) further below.

3   Basic aspects of directionals and direction

3.1   Classifying directionals

Zwarts (2008) gives a comprehensive overview of a standard formal treatment of directional expressions. It is based on the assumption that paths can be defined as a continuous function p from the real interval [0,1] to some domain S of places, p(0) and p(1) being the start-and endpoint of the path, respectively. It also captures the common observation that paths can be subclassified by the **phases** into which a path is divided. These phases are determined by whether a spatial property holds (positive, + + + +) or not (negative, – – – –), resulting in a characteristic pattern for each directional (or at least for most of them). (5) lists the main classes of path-denoting directionals as proposed by Zwarts, each by its name, its phase pattern (in brackets), and an example for the specific semantics of some directional phrase denoting a certain set of paths.

(5)   Zwarts´ classes of directionals (Zwarts 2008)
       a.   Source expressions (from X, out of X, . . .)
             i.   [+ + + + + + – – – – – –]
             ii.   ⟦ from under the bridge ⟧ = { p: there is a proper subinterval I of [0,1] that includes 0 and that consists of all the i ∈ [0,1] for which p(i) is under the bridge }
       b.   Goal expressions (to X, into X, . . .)
             i.   [– – – – – – + + + + + +]
             ii.   ⟦ into the house ⟧ = { p: there is a proper subinterval I of [0,1] that includes 1 and that consists of all the i ∈ [0,1] for which p(i) is inside the house }
       c.   Route[7] expressions (past X, over X, . . .)
             i.   [– – – – + + + + – – – –]

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[6] "Route" is also a term for a type of directional (see next section), and path descriptions are normally called "route descriptions".

[7] Personally, I find "Via" as used by, e. g., Jackendoff (1983) the better term for this class.

      ii.   ⟦ over the fence ⟧ = { p: there is an interval I of [0,1] that that does neither include 0 nor 1 and that consists of all the i ∈ [0,1] for which p(i) is on/above the fence }

   d.   Comparative expressions (towards/away from X, up, down, . . .)

      i.   [+ + + + + + + + + + + + +]

      ii.   ⟦ towards the gate ⟧ = { p: p(1) is nearer$_F$ to the gate than p(0), "F" being some frame of reference }

   e.   Constant expressions (along X, through X, . . .)

      i.   [+ + + + + + + + + + + + +]

      ii.   ⟦ through the park ⟧ = { p: for all i ∈ [0,1] p(i) is in the park }
           ⟦ along the river ⟧ = { p:p is parallel to the major axis of the river }

   f.   Geometric expressions (around X, . . .)

      i.   (no pattern diagram)

      ii.   ⟦ around the house ⟧ = { p: for every i, j ∈ [0,1] p(i) and p(j) have the same length, only p(1) = p(0) and for every direction there is an i such that p(i) is pointing in that direction}

Zwarts also defines "Periodic" prepositions/expressions like *around and around*, *up* and *down* as denoting corresponding sequences of paths. Pantcheva (2010) extends this set even further by proposing the two additional types of directionals denoting **delimited** paths in (6):

(6)   Additional directionals after Pantcheva (2010)

   g.   Egressive expressions (starting from X, . . .)

      i.   [+ − − − − − − − − −]

      ii.   ⟦ starting from under the bridge⟧ ={ p: only p(0) is under the bridge}

   h.   Terminative expressions (up to X, ...)

      i.   [− − − − − − − − − +]

      ii.   ⟦ up to the house ⟧ ={ p: only p(1) is at the house }

Zwarts' approach towards directionals is exceptional in its coverage and structural systematicity.[8] In spite of that, there are some points that deserve discussion. For example, the classification of directionals other than those marked with *from* and *to* is not straightforward. Some, like *under the bridge* as in *go under the bridge*, are not marked as a directional[9] but are typically interpreted/used as a Goal expression (while use as a Route or Constant expression is less common). With *over*, this is similar (with respect to unmarkedness) but different: it is typically used as a Route (perhaps as a Constant), but scarcely as a Goal preposition. *Through* is classified as a Constant preposition by Zwarts, although expressions like *walk through the door* typically have a Route interpretation. Besides that, Zwarts himself discusses the common "endpoint focus" uses of the Constant and Geometric prepositions in *Alex lives around/ across/past the corner/road/railway station*. Finally, expressions like *up the hill* can be both classified as a Comparative and as a Goal. Therefore, although Zwarts explicitly acknowledges "multiple meanings" of directionals, his classifying expressions (instead of just offering different types of path) may lead to confusion.

Related to this aspect is the Constant/Geometric distinction. Note that the examples for Constants, *through* and *along*, are different: while for *through*, some property holds for each place

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[8] Many aspects are already discussed in Wunderlich/Herweg (1991), though.

[9] They can also have a locative interpretation.

of the path (i. e., being in the landmark), this is not the case with *along* (or *around*). This observation can be generalized: while Source, Goal, Route, Comparative and Constant are defined by the characteristics of the **phase** of a spatial property, this is different with *along* and Geometrics. Disregarding Zwarts' vector-based proposal for the denotation of *around*, one could group (or at least cluster) these expressions by the common characteristic of qualifying the **gestalt** (cf. Lang/Carstensen/Simmons 1991) or **form** aspects of the (whole) path relative to the landmark.[10]

Wunderlich/Herweg (1991) observe that directionals are heterogeneous with respect to coordination. While most directionals can be coordinated to construct a complex path description like the one in (7)a, this is not the case with the bare use of from and to as Source/Goal expressions shown in (7)b. Note that Egressives and Terminatives can be coordinated again, however. These and other asymmetries of to and from (for example, the different acceptabilities of leaving out one of the directionals in (7)b) are notoriously hard to explain.

(7)   Coordination of directionals
        a. *The ball rolled away from/ out of the house (and) into/ towards the hole.*
        b. *The ball rolled from the hilltop (*and) to the tree.*

There is some evidence for the assumption of Pantcheva's additional types. In German, the Egressive is marked with an additional postpositional element *aus* (*von Hamburg aus*, lit. 'from Hamburg out'), the Terminative with an additional prepositional element *bis* (*bis nach Hamburg*, lit. 'until/up to Hamburg'). For Pantcheva, it seems to be clear what their denotations are ("[d]elimited paths are thus transitional paths that explicitly indicate a boundary of the path", Pantcheva 2011: 26).

Unfortunately, however, I do not see that this informal characterization can be formally represented just by noting a single "+" (or the corresponding condition wrt. $p(0)/p(1)$, cp. "Terminative and Egressive paths differ from their non-delimited counterparts in the number of plusses in their positive phase", Pantcheva 2011: ibid.). Intuition (which finds support in Wunderlich/Kaufmann 1990) tells me that the transition expressed by Egressives and Terminatives is first and foremost a transition on the event (description) level. For example, the difference between stating (8)a and (8)b seems to be that the former can be followed by *and then further to Prague*, while the latter requires some change as in *and then (continued) by bus to Prague*. Evidently, this cannot be modelled by the number of plusses on the spatial phase pattern level.

(8)   Goal vs. Terminative
        a. *We drove by car to Berlin*
        b. *We drove by car up to Berlin*

The special status of delimiting directionals can be illustrated with Dylanesque **static** descriptions. Consider first multiple situation descriptions as in (9) (Ironman Hawaii context). With

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[10] Ewald Lang never grew tired of telling me the difference: gestalt properties are gradable (*long, longer, longest*), as opposed to form properties (**rounder, *roundest*). I. e., there must be some roundness of the path for *around* to be applicable, and there must be a salient major axis of the landmark for *along* (**along the sphere*), in a certain relation to the path (compare *across*).

up, a situation is described where water bottles are offered along an abstract path ending at the turning point. Without it, the linearity of bottle offerings does not appear.[11]

(9)   *Water bottles were offered *(up) to the turning point.*

Conversely, even if the telephone line ends at the White House in (10)a and even if door and garden are clearly abutting in (10)b, these examples show that factual linearity or contextual directionality do not suffice for a delimiting directional. The data exemplified by (9) and (10) are therefore in conflict with the assumption that delimited paths are *special cases* of Source/Goal paths.

(10)   Goal (*Terminative)
       a.   *the telephone line (*up) to the White* House
       b.   *the door (*up) into the* garden

In general, I have a problem with the terminology used for the classification. I have already mentioned Route and Geometric. In Comparatives, no comparison is expressed, but rather a source/goal "direction" (as it is called by Jackendoff).[12]

Overall, leaving Periodics, Egressives and Terminatives aside, there is reason to make a distinction between Source, Route, Goal, Constant and Comparative on the one hand, and Geometric on the other hand. The former are defined by some spatial property applying to parts of the path (**inherent** characteristic), while the latter are defined by some global property (**exherent** characteristic, as is the case with *along*, *across* and *around*).

3.2   Typology of directional and verbs

Zwarts (2008) uses his classification only to investigate more abstract properties of paths aiming at a typology of directional expressions. For this, he considers "connectedness", "reversability" and "cumulativity".[13] With these criteria, he coins four types of directionals (transitions, cycles, progressions, continuations), shown in his Table 1.

	Source, Goal	Route, Geometric	Comparative	Constant, Periodic
Connected	no	yes	yes	yes
Cumulative	no	no	yes	yes
Reversible	no	yes	no	yes
	Transitions	**Cycles**	**Progressions**	**Continuations**

Table 1: Typology of directionals (Zwarts 2008)

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[11] In German, the egressive marker *bis* can occur both with locatives and directionals. In a nonlinear context (e. g., people standing around up to some point), linearity occurs only with directionals.

[12] Note also that the shading in Zwarts' definition of Comparatives in (5)d is hard to interprete. There is no vagueness involved.

[13] Shortly: if X is the denotation of some directional (i. e., a set of paths), then X is connected iff for $p,q \in X$, $p(1)=q(0)$; X is reversible iff for every $p \in X$, then $\sim p$ (the reversal of p) $\in X$; X is cumulative iff for all $p, q \in X$, if $p+q$ exists, then $p+q \in X$ (for details cf. Zwarts 2008).

Completing the typology of directionals, Zwarts shows that continuations and progressions can be bounded by distance phrases (e. g., *ten miles through the woods, 10 feet up the hill*), continuations and cycles can be directed by corresponding modifiers (e. g., *up along the ladder, clockwise around the room*).

Finally, Zwarts shows that the conditions setting up this typology also apply in the verbal domain, suggesting how to "view the semantics of verbs in *spatial* terms, as places and paths in conceptual spaces" (Zwarts 2008: 98, his emphasis), the basic idea being "that the events that verbs refer to have a particular 'shape', a trajectory or contour in a conceptual space, that can be modeled as a path".

The relevant classes in the verbal domain are **achievements** (dynamic, nonextended telic events like *entering a house*), **accomplishments** (dynamic extended telic events like *running a marathon*), **activities** (dynamic extended non-telic events), **semelfactives** (dynamic non-extended telic events like *hopping*), and what Zwarts calls "**degree achievements**" (he mentions *brighten, widen, rise, cool*). By using (non)cumulativity and (non)-reversibility as classifying features he arrives at the raster shown in Table 2 that covers all classes and furthermore relates corresponding verbal and directional classes having the same "shape".

	Non-reversible	**Reversible**
Non-cumulative	Transitions: Achievements, Accomplishments	Cycles: Semelfactives
Cumulative	Progressions: Degree Achievements	Continuations: Activities

Table 2: Typology of dynamic verbal classes (Zwarts 2008)

Although very reasonable on first sight, there are some problems with the typology proposed by Zwarts. For example, omitting connectedness (specifically, the first row in Table 1) still yields a distinctive characterization of the proposed directional types, rendering this property superfluous, which is corroborated by the fact that it is not used for the typology in Table 2.

Then, again, there are misleading terms (or even misnomer) here. The term "Cycle", probably adapted from Talmy, is awkward. If we assume that *cycle* has at least 'circularity' and 'regular recurrence' in its meaning, it might be adequate for the Geometric *around*. Routes, however, fail to show either one of these aspects. Instead, according to Zwarts, they involve a double change/transition in which a spatial condition is somehow reestablished again (→ Reestablishment). In Geometrics, however, nothing is reestablished. Not only is *Cycle* therefore an inadequate term for the corresponding type, the class Cycle itself is also incoherent. Besides that, Cycles are inappropriately related to semelfactives (in Table 2): as punctual events, semelfactives are far from being reestablished, circular or regularly recurrent *per se*.

"Transitory" (as used by Kracht 2006) might therefore be a better term for "Cycle". Note also that bounded activities, having the same properties as semelfactives, are missing in Table 2. This points to a reconsideration of Transitions and Cycles. First, although Accomplishments involve a transition (better: a **change**), they are bounded activities, too. Hence they should be Cycles (which would be in conflict with reversibility). Second, a simple change (as a **boundary** between phases/states) seems to be the common property of Source/Goal and Achievement.

Hence, **boundedness** is the common property of Transition/Change and Cycle/Transitory and probably a more salient characteristic that cumulativity.

Progressions are related to "Degree Achievements" in Table 2. This is at least confusing, because as achievements, the latter clearly relate to the Transitions. The source of the confusion can be found in the literature where verbs like *widen, cool* have been proposed to involve a change to a final state (cp. *The soup cooled* and *The gap widened 6 inches*.). Lin points to the problem that the term "degree achievement" is actually somewhat of a misnomer and that such verbs are actually accomplishments (cf. Lin 2004), and recent accounts are more differentiated in that respect, accordingly (e. g. Kennedy/Levin 2008). Since Zwarts uses 'Directed continuation' as a type anyway, **directedness** (perhaps defined via reversibility) could be used as a characteristic property. Correspondingly, "Degree achievements" should better be named "Directed activities".

Taking stock, the properties proposed by Zwarts are only of limited help for an abstract typology of paths. For inherently defined paths, they might be replaced by boundedness and directedness. Exherently defined paths are different, anyway. Disregarding them (Geometric and Periodic) for the typology still leaves a transparent four-column Table 1 and results in a new combined typology (cf. Table 3). Yet there remains the problem with Accomplishments, which overall puts this two-property-based typology into question. In the proposal made below, boundedness and directedness will reappear, but will figure differently in a spatial typology.

	directed	**Non-directed**
bounded	Change: Achievements	Transitory: Semelfactives Bounded activities
unbounded	Progressions: Directed activities	Continuations: Activities

Table 3: Typology of dynamic verbal classes, corresponding to directional classes, revised

3.3 Whats's (in) a direction?

Zwarts (2013) observes that while the **shape** of a path is invariant under spatial transformations, the **direction** of a path depends on the spatial context (e. g., reference frames). Focussing on actual paths of locomotion, he asks how we would, given the path depicted in Figure 1, "describe the direction in which that object is moving".
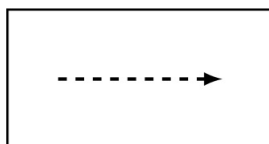

Figure 1: The path of a moving object

He proposes to distinguish five types of directions (reflexive, phasal, modal, centripetal and reciprocal), described by reference to certain axes (defined in terms of vectors) and by whether the moving figure alone or both figure and ground (reference object) are relevant. In the following, I will give a short overview of this system with Zwarts' examples. Paths have a **reflexive direction** if it depends on the moving figure only, and on a static axis, as in (11).

(11) Reflexive direction
      a. *to go north/ up / to the* back (absolute reference frame)
      b. *He walked backwards from the Queen* (intrinsic reference frame)
      c. *I saw the tornado move to the right* (relative reference frame)

Paths have a **phasal direction** if it depends on the direction of a previous "phase", which still involves only the figure, but another dynamic axis as reference entity, as in (12).

(12) *to go straight ahead/ back* (phasal direction)

Paths have a **modal direction** if it is determined by figure and ground, and by the static axis of their spatial relation. (13) shows examples with Source directionals (but Zwarts also lists Route and Goal examples).

(13) Modal direction
      a. *The mouse came from under the table* (Source, absolute)
      b. *The mouse came from under the table* (Source, absolute)
      c. *The cat came from behind the tree* (Source, relative)

Zwarts' **centripetal direction** is described as motion towards an implicit point of view (i. e., is determined by figure and ground and by the static axis of their spatial relation), as in (14).

(14) Centripetal direction
      a. *A voice came from behind*
      b. *The tree was approached from the left*
      c. *a northerly wind* (i. e. coming from the north)

Reciprocal direction results if both figure and ground move and the path of the ground provides the reference frame (a dynamic axis) for the path of the figure (see (15)).

(15) Reciprocal direction
      a. *Esau rende [Jakob tegemoet].*   ('Esau ran to meet Jacob.')
      b. *Laban ging [achter Jakob aan].* ('Laban went after Jacob.')
      c. *Lea ging [voor Jakob uit].*   ('Lea went ahead of Jacob.')

Table 4 shows the corresponding typology of directions. I will not present Zwarts' formal treatment in terms of vector space semantics here. Suffice it to say that he gives proof of the formalizability of his typology.

	Only figure	**Figure and ground**
Static axis	Reflexive direction	Modal and centripetal direction
Dynamic axis	Phasal direction	Reciprocal direction

Table 4: Types of direction (Zwarts 2013)

To begin with, Zwarts gives a vector space semantics account of direction by defining the involved axes, directions and spatial relation as vectors. Most importantly, he defines an axis as a function that assigns to an object a free unit vector at a time t. This seems to be an implementational-level definition of axes which concerns in some sense the least interesting information-system level in Marr's tri-level hierarchy (cf. Marr 1982). On a higher level more relevant for linguistic semantics, axes can be regarded as non-vectorial linear constructs, only half-axes being vectorial. Ordered pairs of points on an axis then determine a direction. Landau (2003)

presents evidence that (information about) axes and directions may be represented separately in cognition.

Overall, it is interesting to note that there seems to be more to directionality than merely directionals (which seem to be covered by the "modal" type for the most part). However, the collection of types proposed by Zwarts is quite inhomogeneous. First, the restriction to movable objects is unfortunate. What about other directions (as involved in, e. g., *hanging down*)?

I have also problems understanding the type "reflexive direction". If (11)b is not categorized as a modal Source, this must be because of *backwards*. However, this expression marks the directedness of the figure (its *orientation*), not of the path (it should probably be *back(ward)* here).

While "phasal direction" is a clear concept, it seems to be more general, as it both applies to locomotion direction (*turn (to the) right*) and to non-locomotion directedness/ orientation (*tilting* and *turning*).[14]

"Modal direction" should correspond to the above directionals. It is therefore astonishing that Zwarts restricts this concept to only Source, Route and Goal, and only to projective spatial relations (those involving directed axes from ground to figure). But what about Comparatives? They are clearly modal according to Kracht (2006). Yet it is hard to see a "static axis" of the ground here. A similar problem arises from the fact that modal direction can be specified by what is called "topological" in the locative domain (*from, to, past*) where there is no axis by definition.

Zwarts motivates distinguishing "centripetal direction" from modal direction by referring to the difference of *to be approached from behind* vs. *to be approached from behind a tree*. While they look different superficially, however, this results only from the fact that they involve unusual reference frames (of implicit grounds or points of view) and/or passive voice. This is corroborated by the observation that centripetal direction is co-classified with modal direction in Table 4.

In "Reciprocal direction", I find the term "reciprocal" misleading: although (15)a seems to have similarity to *Esau and Jacob ran towards each other*, there can be just a **constant**, non-reciprocal relationship between figure and ground (cf. (15)b, (15)c). Interestingly, and similar to Dutch, this type of direction can be systematically marked in German by an additional particle *her* to a locative construction, or a corresponding adverb (expressing the relation of figure and (implicit) ground), as in (16)a and (16)b.[15]

(16) Relative direction (Carstensen)
    a. *Das Auto fuhr hinter/vor/neben/unter dem Kran her*
       'The car went after/before/alongside/under the crane'
    b. *Das Auto fuhr hinterher/voran/nebenher*
       'The car went afterward/ahead/alongside'
    c. *The street and the railway tracks run alongside each other for 100 miles*

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[14] While English uses the same verb *turn* in both cases for horizontal change, German differentiates between *abbiegen* and *(sich) drehen*.

[15] Yet there are lexical gaps: there is no **unterher* or **überher* (and there is *entgegen* ('against'), but no **gegenher* for Dutch *tegemoet*). *Vorher* is strictly temporal ('before').

While the ground is moving in typical cases, examples like (16)c show that non-actual locomotion is possible in some cases. This is similar to using the verb *to follow* (cf. Carstensen 1995). Apart from non-actual locomotion uses like those in (16)c, the semantic core of the verb must at least be compatible with a non-movement-of-ground sense (cp. *the seamen followed the North star*), where the figure-to-ground direction determines the overall direction. This in turn discloses a remarkable resemblance to Comparatives/Progressions in which the ground is also static (but non-modal). In any case, Reciprocal (or better: **Relative**) direction might rather be defined via some dynamic **constant** spatial relation of figure and ground than as a movement-of-ground-or even time-based one (note the *afters* and *befores* in Zwarts' translation in (15)).

Summing up, the direction of a path may perhaps be (better) characterized by the distinction of **inherent/intrinsic** and **exherent/extrinsic** criteria. The former are constituted by the changes of location of the figure wrt. given or implicit ground or by a constant relation of both (relative direction). The latter are given by the relation of figure's path to some other path/axis, e. g. involving figure's previous path (phasal[16] direction) or an axis of the ground (*along/ across the street*), or by properties of figure's path (*around the house*).

4 Further apects of directionals and direction

4.1 Wunderlich/Kaufmann's phase semantics of directionals

Wunderlich/Kaufmann (1990) argue that although causative position verbs (*put, set, place, lay*) require a directional complement, they semantically represent only a **change of position** (involving no paths). Correspondingly, distance expressions (as in, e. g., *put the lamp one meter behind the table*) must be analyzed as specifying the goal relation, not as the measure of the putting-event's path. They also point to the fact that expressions like *put on the table* have to be categorized aspectually as punctual achievements and not, as could be expected from a path description, as extended bounded accomplishments. Recent cross-linguistic research seems to corroborate these observations by showing that some languages even linguistically code locomotion as **change of state** (cf. Bohnemeyer 2010).

Wunderlich/Kaufmann therefore analyze directionals in terms of how changes of spatial states (i. e., phases of spatial predicates along some dimension) are expressed in language. They propose semantic forms like the ones shown in (17) (notationally adapted to the examples above). Note that the spatial arguments in (17)a and (17)b each apply to the **place** of x (loc(x)), as the directional semantics in (17)c and (17)d involve a change to some corresponding *location* (*CHANGE* here is the non-temporal equivalent of the well-known BECOME operator).

(17) Verbs and directionals according to Wunderlich/Kaufmann (1990)
    a. 〚 *to walk* 〛:
        $(\lambda P)\ \lambda x\ \lambda e\ [\ P(loc(x))\ \&\ MOVE(x)\ \&\ MODE_{WALK}(x)\ ](e)$
    b. 〚 *to put* 〛 (Change of position verb):
        $\lambda P\ \lambda y\ \lambda x\ \lambda e\ [\ CAUSE(x,(P(loc(y))\ \&\ MODE_{Pos}(x)))\ ](e)$

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[16] Being an exherent aspect, this should better be called "e-phasal" to be distinguished from inherently phasal (**"i-phasal"**), modal aspects of paths/directionals, see the next section.

    c. ⟦ *to, into…* ⟧ (goal directional):
        $\lambda z\ \lambda x\ CHANGE(LocPP_{at,in…}(x,loc(z)))$
    d. ⟦ *to put the vase on the cupboard* ⟧:
        $\lambda x\ \lambda e\ [\ CAUSE(x,(CHANGE(ON(loc(VASE),loc(CUPBOARD))$
              $\&\ MODE_{Pos}(x)))) \ ](e)$

There is another aspect in favor of such an **i-phasal** account of directionals. Wunderlich/Kaufmann show that Terminatives can be analyzed along the lines of the treatment in (17). They discuss the German Terminative expressions marked by *bis* ('up to') (see (8)-(10)). (18)a shows one of their examples (which – similar to Dylan's phrase – lacks motion aspects), (18)b and (18)c the corresponding slightly adapted semantic representations of their proposal.

(18)   Terminatives according to Wunderlich/Kaufmann (1990)

    a. *In der Auffahrt standen die Diplomatenwagen bis direkt vor das Haus*
       'In the driveway, the diplomat cars stood up to directly in front of the house'
    b. ⟦ *bis* ⟧:
       $\lambda P_{([+DIR])}\lambda s\ [P(Fin(s))]$[17]
    c. ⟦ *bis vor das Haus* ⟧ ('up to in front of the house'):
       $\lambda s\ [CHANGE(IN\_FRONT\ (loc(Fin(s)),\ loc(HOUSE)))]$

This proposal is based on the idea of a changing end of a situation (Fin(s)), which can be traced back to ideas of Manfred Bierwisch. This **dynamicity** does not result from the plurality of the sentence's subject alone, but requires, or is induced by, the Terminative marker (see also (9) and (10)).

While such a concept seems to be adequate for situations expressed by *spread*, *disperse*, *extend* etc., I find it counterintuitive as a general solution, however. The most compelling reason for that is the treatment of the corresponding Egressive (the German *aus* as in *von Hamburg aus* ('starting from Hamburg')). By analogy, it would require a changing initial of the situation, which not only runs counter to intuition but also to Bierwisch's proposal (pers. comm.) that was based on an asymmetry: only the end of the situation was supposed to change.

4.2   Relating the semantics of verbs and directional: The spatial mapping

An important aspect of spatial semantics is accounting for the composition of the verb's and the spatial PP's semantic contributions. This involves relating conceptual-level verbal semantics and spatial-level PP semantics by some kind of mapping between corresponding representations. Doing without paths, Wunderlich/Kaufmann use a loc() function for this (see (17) and (18)) and treat directional expressions semantically as predicates of spatial referents/places of the subject/object.

(3) already showed approaches according to which objects are mapped to paths. Others, like Zwarts (2005), propose a TRACE function that links **events** and paths, as shown in his characterization in (19).

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[17] Note that directionality of the argument P is optional, as it can be realized by a **local** PP, even though this is according to Wunderlich/Kaufmann (1990: 239) only acceptable with verbs of position.

(19) $[\![\,V\ PP\,]\!] :\{e \in [\![\,V\,]\!] : TRACE(e) \in [\![\,PP\,]\!]\}$

One reason for this is the **aspectual** influence of directionals on the composed semantic structure, evident for example in the applicability of the adverbials in (20)a and (20)b. Conversely, there are aspectually specific verbs which only allow certain directionals, see for example the atelic German *verlaufen* in (20)c.

(20)   Directionals and further adverbials
   a.   *He ran (in)to the house within/*for five minutes*
   b.   *He ran towards the house *within/for five minutes*
   c.   *Die Straße verläuft entlang des Flusses / *zur Kirche / *nach Norden*
        'The street goes/runs along the river / *to the church / *to the north'

The *TRACE* function is therefore conceived as a structure preserving mapping, based on the requirement that the path inherits the cumulativity property of the event. While the *TRACE* function normally acts as a thematic relation of the event, Zwarts briefly discusses the following aspects complicating such a view of this mapping. First, although in some cases the subject of the sentence is the theme of the path, it might be the object (*kick the ball*) or even an implicit participant (the bullet in *Alex shot the pianist through the window*). Second, expressions like those in (21) apparently require a mapping from objects to paths.

(21)   Directionals as nominal adjuncts
   a.   *the road/bus to the station*
   b.   *the door into the garden*

Thus, Zwarts tries to model the contribution of the PP to the aspectual characteristics of the whole VP/sentence by a constraint of cumulativity properties. Not only is this transfer hidden in the mapping, however, the relationship between the verbal and the prepositional domain also seems to be even more complex and complicated. For example, although the directional in (22) is atelic, it is compatible both with atelic and telic verbs. Besides that, it is not at all relevant for the aspectual characteristics of the VP ("§" marks inacceptability of the temporal adverbial for the "one-kick" reading; it is acceptable for the "iterative-kicking" reading, of course).

(22)   Atelic vs. telic verbs
   a.   *Alex dragged the sack towards his friend for some seconds*
   b.   *Alex kicked the Hacky Sack towards his friend §for some seconds*

It can also be argued that a homomorphic mapping with respect to cumulativity is only part of the semantic composition. Combining a telic verb with directionals yields a differentiated picture: inacceptability despite common non-cumulativity in (23)a, and acceptability despite incongruent cumulativity properties in (23)b. These and examples like (23)c show that there seem to be other aspects involved, anyway.

(23)   Telic verb and directionals
   a.   *He left the house *to the centre of the town*
   b.   *He left the house towards the centre of the town*
   c.   *He left the house via the fire escape/ through the back door*

4.3   On the problem of directionality without locomotion

Recall that most approaches to directionality in spatial semantics basically agree on the semantic components of locomotion verbs: The fact **that** there is movement (MOVE(x)), the mode of movement (e. g., WALK(x), ROLL(x)), and the phasal or path information about the displacement of some theme. Leaving out non-actual locomotion for a moment, there seems to be an important relationship between the components: only if there is **MOVEment** then there can be a path. The movement (or is it the **Mode**?) is further restricted, however. Only for **LOCO-movement** there is a path (*He *trembles/*shakes/?nods into the room*), even if merely parts of the theme are involved (*He reached into the hole.*). But then, what is locomovement other than displacement? Therefore, is MOVE(x) necessary as a semantic component at all?[18]

The situation gets more complicated with examples lacking motion aspects. While in (24)a the directional is incompatible with a verb of position describing a static situation, the same situation can be described directionally with a different, non-locomotion verb in (24)b. In contrast to these cases, the verb in (24)c even allows both types of spatial complements. Note that objectively, at least in this context, 'looming' implies 'standing' and is merely in directional opposition to 'hanging'. In addition to the question of why there are directionals in non-locomotion contexts at all, their distribution is left unexplained.

(24)   Verbs of position and directionals
   a.   *Der Wolkenkratzer steht auf sicherem Grund/ *in den Himmel*
        The skyscraper is standing on secure ground/ *into the sky
   b.   *Der Wolkenkratzer ragt *auf sicherem Grund/ in den Himmel*
        The skyscraper is looming *on secure ground/ into the sky
   c.   *Der neue Vorhang hängt an der linken Wand/ auf den Boden*
        The new curtain is hanging on the left wall/ onto the ground

To some extent, this theoretical lacuna can certainly be remediated by postulating specific conceptual functions that allow paths without movement, and by adapting the lexical semantic entries accordingly, which is what Jackendoff does: GO, EXTEND, ORIENT and similar semantic elements are considered conceptual-level, amodal innate primitives. Yet this only shifts the problem to the unexplained source of these functions. Such a critical attitude towards apparently disembodied/ungrounded representations has become one of the traits of modern cognitive linguistics and cognitive science (cf. Lakoff 1987, Barsalou 1999, Kemmerer 2010, Kiefer/ Barsalou 2013), according to which conceptual (and ultimately semantic) representations are grounded in modal perceptual systems and tasks like language comprehension are assumed to involve partial reenactments of sensorimotor states (so-called "simulation framework").

Research on fictive (Richardson/Matlock 2007, Matlock/Bergmann 2015) and metaphorical motion (Gibbs/Perlman 2006) in this framework seems to have demonstrated locomotion reenactments and corresponding influences for descriptions of static situations: for sentences like *The road goes through the desert*, Richardson/Matlock showed that their presentation in exper-

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[18] The question of necessity also concerns the path information. Note that one can *run on the spot*. Interestingly, there is a general theoretical debate about the complement status of locationals/directionals.

iments resulted in systematic dynamic eye movement patterns of the participants. The conclusions drawn by the authors are not uncontroversial, however (see the dispute in Weiskopf 2010a, Gibbs/Perlman 2010, Weiskopf 2010b), one aspect being the question whether sensorimotor reenactment is **sufficient** for conceptual representations. Correspondingly, this account still does not fully answer the question where the specific directionality in static descriptions comes from, and somehow directly contradicts the observations made wrt. (24).

In (25), finally, there is directionality with and without locomotion. Interestingly, for the additional Terminative, the roles of figure and ground, and the path of movement are somehow reversed: the situation is conceived as if the boundary of the chest is moving along the knife up to the hilt. As far as I can see, such **inverse directionality** is beyond the explanatory range of all theories.

(25) *Er stach das Messer in die Brust./ Das Messer steckte bis zum Heft in der Brust.*
      He stuck the knife into the chest./ The knife stuck up to the hilt in the chest.

The use of Terminatives like this is nothing but common (*to be up to the knees in the water*), even in metaphors (*to be up to one's ears in debt*). The point to be made with respect to cases like (25) is that directionality does not ultimately depend on moving objects and their changes of location, as is suggested by the reenactment framework. Evidently, one needs a more abstract source of directionality for this.

5   A précis of the Cognitivist attentional approach (CAA)

5.1   General aspects

Carstensen (2011) gives a detailed motivation for and account of Cognitivism as a general stance in the Cognitive Science community (cf. also Carstensen 2013, 2015). I will therefore only summarize the main distinctive aspects of a Cognitivist semantics here.

As an inherently interdisciplinary approach, the *CAA* has a language oriented focus on semantics, epistemology and ontology. It generalizes over the various cognitive disciplines (psychology, neuroscience etc.) and linguistic subdisciplines (e. g. Cognitive linguistics, Cognitive/Conceptual Semantics). From this general viewpoint, and in the tradition of, e. g., Miller/Johnson-Laird (1976) and Landau/Jackendoff (1993), its distinctive value is respecting empirical data about cognitive processing and representation as constraints for particular theories and models.

As a semantic modelling approach, the *CAA* is intermediate between formal semantics and cognitive semantics. While the usual formal theory denies the relevance of cognitive considerations and emphasizes compositional structure, the usual Cognitive linguistic theory dismisses formality in favor of verbal or imagistic descriptions. While the former often designs semantics as a (one-step) mapping from (formal) language to possibly complex, but simplistic models of the world, the latter typically provides a mapping to imagistic representations. This has historic reasons: Originally, semantics operated with language-like propositional representation alone (be it logics or semantic markers). Formal semanticists found model-theory as a solution to infinite interpretational regress, and still stick to this solution. With the "discovery" of imagery

as non-propositional code (cf. the dual-code theory of Paivio 1986), Cognitive semanticists were glad to have a non-external, non-objectivist reference code (and still rely on that).

Subsequent research in Cognitive Science in the debate about the role of imagery (cf. e. g., Finke 1989, Posner/Raichle 1994, Kosslyn 1994) showed, however, that **selective attention** is a necessary link relating propositional and imagistic representations (cf. also Campbell 1997). Converging evidence (for a recent overview of visual attention cf. Rensink 2013, 2014) indicates that selective attention is necessary for further processing (representation, language, action) of some perceived, preprocessed input. Phenomena like 'inattentional blindness' or 'neglect' exemplify the impairment of this important cognitive function. It is also well-known that the operation of attention (i. e., its 'orienting') can be influenced both bottom-up, or stimulus-driven, and top-down, or goal-driven.

Although there are early references to attentional perspectivation in Cognitive Semantics (cf. Langacker 1987, Matsumoto 1996, Talmy 2000), respecting the central role of attention in cognitive models is distinctive for the *CAA*. Correspondingly, Cognitivist semantics is interested in the representations that are constructed by the working of selective attention at various sites and different levels in the cognitive system. Unlike image schemata, these representations are assumed to be categorical, i. e. propositional.

Cognitivist semantics is cognitive in the sense that it does not define its notions with respect to objective criteria, but with respect to the properties of mental structure (cf. Lakoff 1987, Jackendoff 2011). It aims at explanatory adequacy (cf. Chomsky 1965), while most of formal semantics is descriptively adequate at best.[19] By assigning **attention** a central role in cognition and for semantics, it has a close relationship to Marchetti's **attentional semantics** (cf. Marchetti 2006, Marchetti et al. 2015) and Talmy's Cognitive Semantics with its recent focus on attention phenomena (Talmy 2010). However, it also emphasizes the role of formality in modelling these aspects (as in Artificial intelligence and Computational linguistics).

Cognitivist semantics is, therefore, formal in the sense that it uses propositional notations for (compositional) semantic modelling. Different from formal semantics, the symbols of these notations are not interpreted model-theoretically with respect to the "world", but with respect to their relation to the "perceptual world" (cf. Jackendoff 1983). At least for some of the postulated semantic components, it is assumed that they are neuroscientifically identifiable as corresponding **convergence zones** (cf. Kemmerer 2010).

As a Cognitive Science approach, the *CAA* is in accord with "embodied cognition" accounts that highlight the role of attention as a link between different levels of representation and as constitutive for schematic experience-based conceptual representations (cf. Barsalou 1999, Pezzulo et al. 2013, Webb/Graziano 2015; but cf. Chatterjee 2008 for qualifications). It differs in emphasizing the **(micro-)sequential** aspects of attention which are considered essential not

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[19] Yet the *CAA* is not merely **interpretative** (a characteristic feature of Chomskyan and most formal approaches) but in line with Conceptual semantics (cf. Jackendoff 2007, 2011) regards semantics as a bi-directional interface between linguistic and conceptual structures, and furthermore distinguishes semantic interface representations and conceptual structure proper (so-called "Two-level semantics", cf. Lang/Maienborn 2011).

only for analyzing directionals but also for locationals (here, Barsalou still follows the image-schematic approach of Langacker; cf. Carstensen 2015 for details), hence, also for static situations.

With respect to the contrast of Realist and Conceptualist stances on ontologies discussed in Smith (2004), the *CAA* neither assumes a Realist objective structure of the world independent of cognitive considerations, nor does it approve the Conceptualist's disregard of a referential relation to the "world outside". Instead, it proposes to view ontology as a structure dependent directly on perception and only indirectly on the real world. Accordingly, the key assumption of the *CAA* is that perceptual information modulated by attention leads to **ontologies from human perspective**, hence cognitivist ontologies. Conceptualist attentional ontologies as concept hierarchies are assumed to be based on Cognitivist ontological distinctions.

In the following subsections I will try to show why and how selective attention is relevant on different levels (ontology, concepts, semantics) and therefore essential for a comprehensive Cognitivist theory of a semantic of directionals.

5.2 Cognitivist attentional ontologies

In a nutshell, the working of selective attention can be described as follows: salient discontinuities of some perceptual input in some cognitive domain attract attention ("**focused** attention"), leading to intensified processing of that input and its selection for recognition and action. Else (in case of missing contrasts/discontinuities), attention is **distributed**.[20] Empirical data also show that selective attention operates both on a **global** and a **local** level (cf. Carstensen 2011 for details). However, while most research in this field (only) addresses the important **processing** aspects of attention, the *CAA* highlights the fact that attention to items at different scales and sites in the cognitive system also gets **represented** (cf. Sperling/Wurst 1991 for the very short-term visual memory case). From this point of view, aspects of selective attention can be regarded as defining for very general types of **entities from human perspective**, which is sketched in this subsection (for an in-depth discussion cf. Carstensen 2011).

The fundamental notion used in the characterization of aspects of the world from human perspective is that of a "**frame**". A frame in the *CAA* is –analogously to a snapshot in video processing– understood as a temporally and spatially bounded representation of processed cognitive content at some level and within some domain. Unlike most ontological approaches, the *CAA* assumes that using this notion for the definition of ontologies leads to an important bifurcation shown in Figure 2 (this and the following figures are simplified and slightly altered versions of the ones in Carstensen 2011): entities are either defined wrt. a single frame, or wrt. multiple frames (this is similar, but not equivalent, to the typical object/event dichotomy).
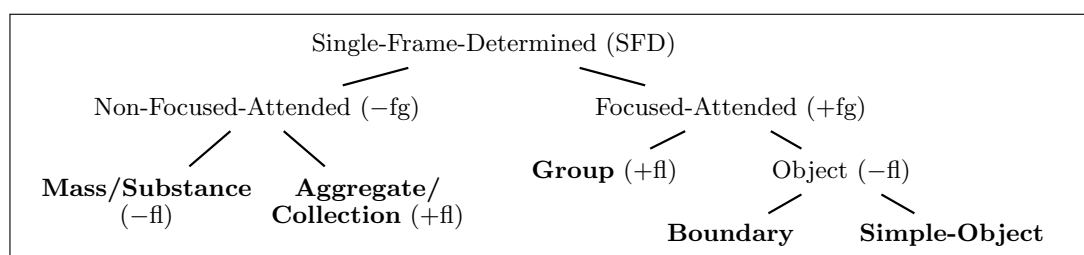

Frame-Determined

Single-Frame-Determined   Multi-Frame-Determined

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[20] This distinction, in turn, relates to **boundedness**: attention is focused if there are salient boundaries in the perceptual input.

Figure 2: Coarse distinction in *CAA* ontologies

SINGLE-FRAME-DETERMINED (**SFD**) entities are defined on the basis of attentional operations *within* a frame. For this, the above distinctions of focused/distributed attention and global/local level are represented by two binary properties/features: **focused attention on global level** (±fg) and **focused attention on local level** (±fl).

Figure 3 shows how these features can be used to construct an ontological tree that comprises the main basic ontological types for (sorting the entities denoted by expressions of) the nominal domain, MASS/SUBSTANCE (*money, water*), AGGREGATE/COLLECTION (*people, chairs*), GROUP (*team, government*), BOUNDARY (*side, border, peak*), SIMPLE-OBJECT (*chair*). Note that this part of an upper ontology is more general than the usual sorting of objects (as non-temporals): it can also be used to classify temporal entities corresponding to event nouns (*talk* (+fg,–fl), *talks*(–fg,+fl), *talking*(–fg,–fl), *chitchat*(+fg,+fl)).

Figure 3: Within(single)-frame distinctions

MULTI-FRAME-DETERMINED (**MFD**) entities are defined on the basis of attentional operations on a **succession of frames** (FS). Evidently, this level of representation implies some kind of temporality (and therefore prominently includes situation types). Again, relevant distinctions depend on whether there are boundaries (here: salient **changes** in the stream of frames) or not, as these constitute salient situation types. Correspondingly, there is a division into continuous UNBOUNDED-FRAME-SUCCESSION entities (STATES and PROCESSES/ACTIVITIES) and non-continuous BOUNDED-FRAME-SUCCESSION entities (the bounded types of Table 3). Figure 4 shows the corresponding part of the ontological tree.[21]
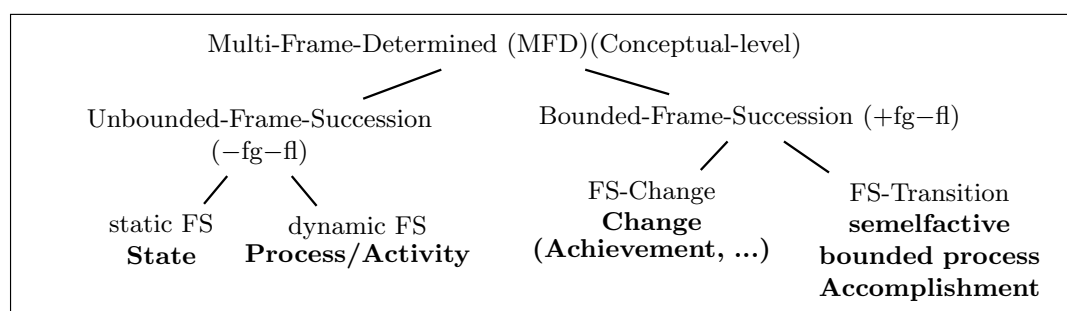
Figure 4: Between(multi)-frame distinctions

It is now interesting to compare the MFD types both to the typology in Table 3 and to the SINGLE-FRAME-DETERMINED types. While the *CAA* types correspond to the well-known Vendlerian aspectual classes, 'State' is missing in Table 3. Zwarts' Progressions and Continuation in return are conflated into one *CAA* type. This shows that **boundedness** is indeed the

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[21] Note that "Transition" has the "Transitory"-sense here.

primary criterion for sorting here, whereas **directedness** is of lesser importance: it applies only to **dynamic** unbounded entities, while the distinction between the Change/FS-CHANGE and Transitory/FS-TRANSITION types are better explained by whether attention is oriented toward boundaries or whole objects. This is corroborated by the observation that Accomplishments as bounded, but extended, activities are categorized like bounded processes as FS-TRANSITIONS. Like semelfactives, they are treated as situational whole objects ("blobs") different from the situational boundary-type FS-CHANGE.

Overall, there is a striking dissimilarity of SINGLE-FRAME-DETERMINED and MULTI-FRAME-DETERMINED entities. Observe that BOUNDED-FRAME-SUCCESSION corresponds to OBJECT (as there are no verbal GROUPS), and that UNBOUNDED-FRAME-SUCCESSION corresponds to MASS/SUBSTANCE (as there are no verbal AGGREGATES). While SINGLE-FRAME-DETERMINED entities are characterized by attentional operations on two levels, MFD entities evidently are restricted to −fl constellations only. This is in stark contrast to the assumptions of those who propose an integrating ontological structure for both objects and events (as discussed in Carstensen 2011).

5.3   Concepts as attentional schemata: the case of (loco)motion

The structure of the fundamental aspects of "what-there-is" in general determines and is directly related to the conceptual structure that is built from experience (cf. also Kiefer/Barsalou 2013). Concepts in general can, correspondingly, be seen as specifications of represented upper-level ontological notions in various domains and/or by associating information from different sources on various levels (compatible with the notion "convergence zone", cf. Kemmerer 2010), which I will discuss here for the case of (loco)motion concepts.

In motion perception research, there is a well-accepted divide between low-level aspects (distributed, pre-attentive detection of motion and direction at boundaries) and high(er)-level aspects (attention-based recognition of "global" movement patterns, e. g. "biological" (human) motion, cf. Anstis 2003; attentive tracking of objects, cf. Cavanagh 1992). This corresponds to the above semantic components **that** there is motion on the one hand, and the **mode** (which is nothing but a characteristic pattern of motion) and **path** of movement.[22] Most importantly, Cavanagh's experiments seem to demonstrate that "the perception of motion during attentive tracking can arise independently of low-level motion responses and may be derived from the internal signals that **move the focus of attention**" (Cavanagh 1992: 1563, my emphasis).

Neuroscientifically, aspects of motion perception are processed at different, but connected cortical sites. As to the path/mode distinction, it was found that "motion perception, traditionally considered as a dorsal ‚where' visual attribute, further segregates into dorsal path and ventral manner attributes" (Wu et al. 2008: 704). By investigating apparent motion, Battelli et al. (2007) could show that the time-related recognition of mere displacement of objects is associated with a so-called "when"-pathway that brain-topographically runs *between* the ventral occipito-temporal "what"-and the dorsal occipito-parietal "where"-pathway (cf. Landau/Jackendoff 1993).

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[22] Unfortunately, while linguists are primarily interested in path information, most research effort in neuroscience and psychology is spent on motion proper (low-level motion and, mostly, biological motion). Cf. Kemmerer (2010) for a review of the few convergent findings.

With regard to non-actual motion, Chatterjee indeed found "evidence suggesting that motion is processed with a concrete to abstract gradient along the posterior to anterior lateral temporal lobe" (Chatterjee 2008: 227).

For experience-based *concepts* of motion in general, the following aspects seem to be involved: motion (i. e., displacement of parts, MOVE(x)), locomotion (L – MOVE(x)), mode of (loco)motion (Mode$_{TREMBLE}$(x), Mode$_{WALK}$(x)), and path. Higher-level (linguistic) event concepts may combine/bind these aspects on different levels of abstraction.

Barsalou points to the fact that attention is **necessary** for the creation of concepts ("selective attention focuses on aspects of perceived experience and stores records of them in long-term memory, which later function as symbols", Barsalou 1999: 585), which applies both to tracking moving objects or attending to non-moving ones. But attention operates in time and space also for static scenes. For example, Ullman identified "curve/boundary tracing" as one of his "visual routines": given a display with two curves and two X's, "the time to detect that the two X's lay on the same curve increased monotonically, and roughly linearly, with their separation along the curve" (Ullman 1984: 140). Similarly, axes must be regarded as the results of applying visual routines (or, in modern terms, **cognitive programs**, cf. Tsotsos/Kruijne 2014)[23] which probably exploit aspects of symmetry in two-or three-dimensional objects. This is relevant for the conceptual structures underlying the semantics of the whole range of dimensional adjectives (*long*, *high*, *wide* etc., cf. Lang/Carstensen/Simmons 1991) and prepositions (*above*, *behind*, *left of* etc., cf. Carstensen 2015), and furthermore for directional prepositions like *along* and *across*.

5.4   Cognitivist attentional semantics

The lesson to be learned from the previous subsections is that cognitive processing and representation provides relevant information for the characterization of non-objectivist semantic distinctions. Above all, selective attention turns out to be a unifying aspect relevant for the analysis of different kinds of conceptual/semantic phenomena.

Being concerned with higher-level representations, the *CAA* assumes that the working of attention is reflected in schematic attentional representations that constitute the most general concepts and most abstract semantic components conceivable. Among these are concepts of some x being statically attended (ATT(x)) or dynamically scanned (SCAN(x)), either tracked or traced (with TRACK(x) and TRACE(x) as corresponding subtypes). Necessarily, therefore, every experience-based concept is also an attentional concept of actively or passively engaged attention (routines). Correspondingly, the attentional predicates appear as **additional** components in Cognitivist semantic specifications. Thus, every *standing* involves static attending, every *running* or *rising* dynamic scanning (which is spatially specified as UPWARD in *rising*). This view has important implications for the semantics of non-actual locomotion expressions.[24]

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[23] See also the hierarchy of routines in Cavanagh (2004).

[24] Note that there are non-canonical uses of locomotion verbs, like *The nose is running*, that probably have to be analyzed as a diathesis (rather than via some meaning shift), i. e., a modification of the verb's argument structure

First, unlike what is proposed in the localist tradition, it is **not necessary** to assume an actual, even if only remotely present, locomotion basis or source for their semantic analysis. Instead, non-canonical senses of words like *go, rise, point, extend* can be viewed as reductions/abstractions (*go by car*: no mode; *the clock doesn't go*: no mode, no path, but motion) to the core of mere scanning (*the road goes…, the sign points…, the mountain rises…, the valley extends…*) preserving some spatial aspects (e. g., verticality, direction) or functional aspects (e. g., of directing the addressee's gaze in pointing). Accordingly, metaphorical senses are not regarded as resulting from some mapping from the spatial to some other domain, but rather from a unification of the attentional structures in both domains. There may be additional congruent spatial structure in the target domain: for example, classical temperature scales are vertically oriented (with more being up), which explains *rising/falling temperature*. Otherwise, spatial aspects of the source domain expression are **imposed** corresponding to a **perspectivation/conceptualization** of the target domain (*rising anger, to fall in love, to go mad, to come to terms*).[25]

Second, it is not **sufficient** to assume modality-specific reenactments as explanation for the specifics of non-actual locomotion constructions, and the sensorimotor activities found can also be explained as the **consequence** of corresponding top-down attentional control (cf. also Weiskopf 2010b). The a- or transmodal attentional representations postulated by the CAA can be expected to be the source of such top-down activation.

6   The Cognitivist attentional approach to directionals

6.1   The ontology of directionals

How do directionals fit in the system of Cognitivist representations? In the discussions above, we have seen that **boundedness** and **dynamicity** are highly relevant, both for the classification of events and attention. Presupposing dynamicity, we saw that "Change" and "Transition/ Transitory" appeared as subtypes of bounded phenomena. With further explanation following: if we plot these insights about multi-frame-determined phenomena analogously to the ontological structures above, yet for spatial level phenomena, we end up with the ontological tree depicted in Figure 5.
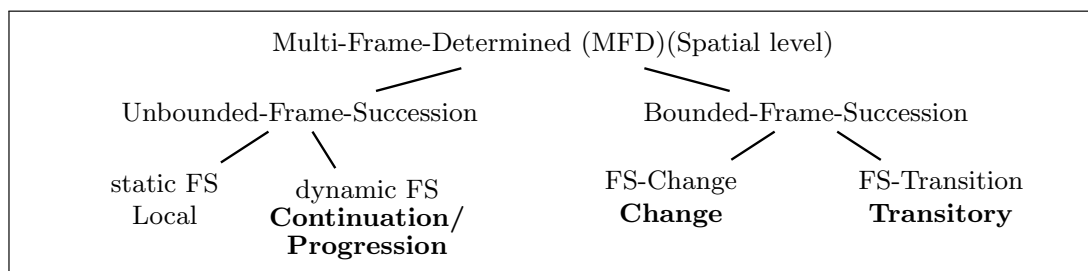
Figure 5: Directionals in a Cognitivist ontology

The bold-faced ontological types in this figure directly correspond to the categories of the typology in Table 3 and to the ontology in Figure 4, with **boundedness** playing a primary sorting

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and hence a different way of expressing the same conceptual content (as a reviewer tells me, best glossed as: 'Th[is] nose is [a nose liquid is] running [out of]').

[25] Compare also the analogous metaphorical use of verbs of position, e. g., *the clock/time stood still*.

role: CONTINUATION and PROGRESSION, and CHANGE and TRANSITORY are grouped as unbounded and bounded types, respectively. Evidently, however, **directedness** is not that relevant here. On the one hand, CONTINUATION and PROGRESSION differ in directedness, but share dynamicity therefore constituting a single ontological node. On the other hand, CHANGE and TRANSITORY differ in the **phasal characteristics** establishing the boundaries that attract attention. Geometric, as predicted, does not appear as a separate type at all.

Now note the striking similarity (even isomorphism) to the conceptual-level MFD ontology. Different from other approaches – e. g., the system of Zwarts –, locals and directionals are placed in a comprehensive system (with LOCALS appearing as the analogs of verbal STATES), and the ontological nodes are not specifically stipulated but motivated by general principles applying to multi-frame phenomena. Accordingly, the *CAA* proposes to view spatial expressions not as denoting places or paths, but spatial-level MFD. Correspondingly, the above discussed compatibility phenomena of verbs and directionals need not be explained by a stipulated mapping of type-different entities (events and paths), but can be traced back to (violations of) mapping isomorphic structures in different domains.

6.2   The spatial mapping: the semantics of locomotion verbs

There are two parameters that capture the variance in modelling the spatial mapping in the semantics of directionals. First, the source of the mapping can be an object or an event. Second, the denotation of the directional can be conceived of as a set of paths or not. Table 5 shows the placement of relevant approaches in the corresponding matrix of options.

Source of mapping ↓	Denotation of directional →	**Paths**	**Non-paths**
Object		Jackendoff	Wunderlich/Kaufmann
Event/situation		Zwarts	CAA

Table 5: Spatial mapping: approaches

Evidently, the CAA assumes that directionals (also) require a mapping of events (situations), rather than merely objects, to spatial entities. Like Wunderlich/Kaufmann, however, it models their semantics decompositionally as lexicalized conceptual content (and does not treat them as paths but as situation-like MFD-type entities with a phasal structure). It differs from their approach in granting directionals a referential semantics by regarding LINK as a bi-directional mapping between conceptual-level and spatial-level MFD entities that preserves attentional structure. According to that, spatial verbs select for a spatial argument p, and spatial PPs provide such a variable as their referential argument (this is unconventional, but follows directly from the previous considerations).

(26) is supposed to exemplify the advantage of such a treatment: the simplified semantic specifications clearly demonstrate that a directional will specify the spatial referent of the *walking* event in (26)a, of a subevent of atelic *dragging* in (26)b, and of a subsubevent of telic *kicking* in (26)c. Note that WALK(x), and MOVE(x) are templates/abbreviations for the predicates of the involved components, i. e. "WALK(x)" = "L – MOVE(x) & TRACK(x) & Mode$_{WALK}$(x)" and "MOVE(x)" = "L–MOVE(x) & TRACK(x)" (i. e., no mode for the movement of *x* specified). "TRACK(x)" represents conceptual-level dynamic attention to x as a whole,

and is the basis for directionality (it must be assumed to be absent in *run on the spot*). As to the arguments of the verbs, e, x, p are the referential variables of the event, subject, and locatives/directionals, respectively.

(26) Atelic/Telic verbs
    a. ⟦ *to walk* ⟧:
        λp λx λe [[WALK(x)](e) & LINK(e, p)]
    b. ⟦ *to drag the sack* ⟧:
        λp λx λe [[MOVE(s)](e1) &
                [CAUSE(x,e1) & Mode$_{DRAG}$(x)](e) & LINK(e1, p)]
    c. ⟦ *to kick the Hacky Sack* ⟧:
        λp λx λe [[CHANGE([MOVE(hs)](e2))](e1) &
                [CAUSE(x,e1) & Mode$_{KICK}$(x)](e) & LINK(e2, p)]

Accordingly, the differential applicability of the PPs in (20) and (22) above can be explained by the fact that the temporal PP applies to the outermost event variable, while the spatial PP applies to the variable related to different events. Evidently, such an account is in line with the basic tenet of Two-level semantics "that the *internal* decompositional structure of lexical items determines their *external* combinatorial properties" (Lang/Maienborn 2011: 723, their emphasis).

6.3   Non-actual locomotion expressions

As the examples in (24) have shown, spatial structure does not **determine** verb semantics (i. e., linearity alone does not license the use of directionals).[26] Rather, it is the aspects of attentional engagement **motivated** by spatial structure that are conventionally fixed/grammatically coded for a verb and defining for conceptual/spatial (sub)event types. Therefore, while German *stehen* expresses static attention to an object ("ATT (x)") that has a characteristic alignment to the Vertical, *ragen* (only) expresses dynamic scanning along the maximal, vertically oriented axis of x in some reference frame. *Hängen* is conventionally used to express both global attending and local scanning (and is correspondingly polysemous). An initial proposal[27] for the semantic entries of these verbs is shown in (27).

(27) Verbs of position
    a. ⟦ *stehen* ('to stand') ⟧:
        λp λx λe [[ATT (x) & Mode$_{STAND}$(x)](e) & LINK(e, p)]
    b. ⟦ *ragen* ('to loom') ⟧:
        λp λx λe [[TRACE(x)](e) & LINK(e, p) & p$_{||}$MAX(x) & p$_{||}$VERT]
    c. ⟦ *hängen* ('to hang') ⟧:
        i.   λp λx λe [[ATT (x) & Mode$_{HANG}$(x)](e) & LINK(e, p)]

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[26] In general, this also supports Bohnemeyer (2010)'s point that locomotion may be expressed only by state-change verbs in some language, exemplifying the distinction of non-linguistic and linguistic representations.

[27] Of course, an adequate treatment requires a more detailed analysis, for example of whether or how 'support from above' in *hängen* has to be represented (Kaufmann 1995 points to hammocks where this is not given) or why *ragen* can be applied to horizontal extensions (I like Kaufmann's first ideas of a **secondary orientation space** in that respect). It would probably also include proper indexes of formal items for the respective levels/domains of representation.

ii.   λp λx λe [[TRACE(x)](e) & LINK(e, p) & p∥VERT⁻]

In (27), "∥" signifies alignment of the spatial referent of a scanning event to some axis, and "MAX(x)" the maximal axis of an object. Note that "Mode$_{STAND}$(x)" and "Mode$_{HANG}$(x)" have to be spelled out in terms of local axis alignment and tracing conditions close to the verb senses in (27)b and (27)c.ii, respectively. Cf. Lang/Carstensen/Simmons (1991) for non-attentional aspects of these conditions involving object schemata and relevant axes, e. g. the VERTical, the OBServer, the LATeral and the MAXimal axes of objects and/or reference frames. Different from that work, VERT⁻ is assumed here as the half axis opposite to VERT⁺ (cf. also Carstensen 2015).

As to non-actual locomotion, the phylogenesis of pertinent verb senses is proposed to be roughly as follows. First, there is a MFD event of scanning an object and an intent to communicate that event. Second, there is not yet any verb sense categorizing this event (and there is no intent to coin a new word due to linguistic economy). Third, the event is matched with a salient/relevant/prototypical locomotion verb sense. Fourth, agentivity and/or locomotion (mode) components are removed. Fifth, the resulting semantic specification is used as a new verb sense.

For example, to describe an increasing height of a landscape in situational terms (unlike *the height of the landscape increases*), the corresponding VERTically oriented scanning event matches *rise* (as in *the sun rises*), leading to *the landscape gently rises*. Similarly, the non-actual locomotion senses of *going*/*running* (horizontal MAXimal axis), *pointing* (OBServer axis), *spreading* (LATeral axis) and *extending* (some axis) can be reconstructed, correspondingly. Such attention-based representations evidently render Jackendoff's GO, EXTEND, ORIENT primitives obsolete.

Suffice it to say that languages differ in how much morphological information is used to distinguish non-actual locomotion expressions (for example, <u>verlaufen</u> is the non-actual locomotion term for German *laufen* ('run'); German <u>sich ausdehnen</u>, lit. 'expand oneself', corresponds to non-actual *expand*). Similar cross-linguistic differences appear in finer aspectual distinctions (for example, non-actual unbounded *run along* corresponds to German *verlaufen entlang*, non-actual bounded *run from...to* to German *sich erstrecken von...(bis) nach*).

6.4   Cognitivist semantics of directionals

On this theoretical foundation, it is now possible to spell out the *CAA* proposal for the semantics of directionals. Like locationals, they denote attentionally determined spatial-level MFD entities (in the Cognitivist sense of *denote*). Both differ in **dynamicity**, which corresponds to the distinction of either static attending to or scanning the thematic entity or figure (ATT/SCAN(x)). This is shown in (28), where the same spatial predicate appears in the semantics of different (senses of) locative and directional prepositions. Observe that Locals and Constants lack **changes** (and are correspondingly unbounded). Both spatial types are distinguished by the fact that locatives are characterized by static attention to figure and ground while the

Constant directionals involve scanning of both arguments.[28] As can be seen in the following examples, the distribution of attentional predicates, both on the conceptual and on the spatial level, is characteristic for directional types according to the *CAA*.

(28)   Locals and Constants
  a. ⟦ *in/over* ⟧ (locative (sense)):
   λ*z* λ*p* [LINK(z,zsr) & ATT(z) & [ATT (x) & IN/OVER(x,zsr)](p)]
  b. ⟦ *through/over* ⟧ (directional/**Constant** (sense)):
   λ*z* λ*p* [LINK(z,zsr) & TRACE(z) &
     [SCAN(x) & SCAN(zsr) & IN/OVER(x,zsr)](p)]

As the discussion of inherent and exherent criteria above has shown, directionals have to be treated heterogeneously. Inherent criteria concern **i-phasality**, i. e., given that there is dynamicity, how the phase of a spatial predicate is characterized. (29) specifies the semantics of **Source, Goal** and **Route** expressions which involve changes as boundaries in a multi-frame context. I have generalized the CHANGE predicate from only specifying a/the resulting state, to specifying a sequence of states in which the position of a predicate characterizes its phase in the state-change complex, thereby defining a certain type of event.

(29)   Source, Goal, and Route
  a. ⟦ *from/ out of the house* ⟧ (**Source**):
   λp [∃ h,hsr [house(h) & LINK(h,hsr) & ATT(h) &
     [SCAN(x) & CHANGE([AT/IN(x,hsr) & ATT(hsr)], _)](p)]]
  b. ⟦ *to/ into the house* ⟧ (**Goal**):
   λp [∃ h,hsr [house(h) & LINK(h,hsr) & ATT(h) &
     [SCAN(x) & CHANGE(_ ,[AT/IN(x,hsr) & ATT(hsr)])](p)]]
  c. ⟦ *past/through/over the house* ⟧ (**Route**):
   λp [∃ h,hsr [house(h) & LINK(h,hsr) & ATT(h) &
     [SCAN(x) & CHANGE(_ ,[AT/IN/OVER(x,hsr)],_)](p)]]

(28)b already gives the semantics of Constant/Continuation preposition(sense)s in which there is no change. Recall that Relative/Reciprocal direction has also been identified as being expressed by terms of this type. Their semantics has to comprise an additional element representing conceptual dynamicity with respect to the ground, see (30).

(30)   ⟦ *ahead/alongside* ⟧ (**Relative Constant**):
  λz λp [LINK(z,zsr) & TRACK(z) &
   [SCAN(x) & SCAN(zsr) & InFrontOf /BESIDE(x,zsr)](p)]

In Carstensen (2002, 2015), it was shown that the semantics of locative prepositions must be based on an attentional relation of represented attentional changes between figure and ground as explicit **micro-perspectivations** of the implicit spatial relation. I introduced **reference polarity** as an important feature of this relation: an actual microperspective is positive reference polar, if the reference object (ground) is the source of the change, it is negative reference polar, if it is the goal of the change. These attentional aspects and other spatial parameters (e. g., type

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[28] *z* is the argument variable for the reference object (ground), p is the referential variable of the PP. Observe that according to this treatment, the spatial link to the spatial referent of z (zsr) is explicitly provided for, while x is a free variable for the spatial referent of the thematic conceptual element (implicitly bound by the verbal link).

of reference frame, reference axis, and spatial objects involved) served to model/explain the differentials in locative preposition semantics.

Now consider such an attentional change between figure and ground, a bare attentional relation ("ATTREL"), also as the core of a Constant directional, but with figure and ground conceived as dynamic and static, respectively. There should be an asymmetry in reference polarity, the only difference to locatives being the dynamic conception of the figure. In fact, this is observed in the pair *away from/towards*: being non-modal, the spatial-level dynamic MFD is not characterized by a certain location phase. Instead, it is exclusively determined by the roles the figure x and the ground z play in the semantic predicate, and the directionality results from the order of x and z, see (31).

(31) **Comparative Constant**
    a. $[\![$ *away from* $]\!]$: $\lambda z\, \lambda p\, [$ LINK(z,zsr) & ATT(z) &
                                            [SCAN(x) & ATTREL(zsr,x)](p)]
    b. $[\![$ *towards* $]\!]$: $\lambda z\, \lambda p\, [$ LINK(z,zsr) & ATT(z) &
                                            [SCAN(x) & ATTREL(x,zsr)](p)]

Such a Cognitivist view of Comparatives is heavily underspecified (as opposed to objectivist characterizations using distances, as in (5)d). However, it is supported by examples that dissociate aspects of directionality and distance: *We moved towards the enemy but never came nearer (he retreated accordingly)*.[29]

While a Constant view of *away from/towards* (and others like *westwards*, *mountainwards*) seems to be reasonable, other Comparatives lend themselves to be treated **exherently**. Consider again locative prepositions like *above/below,in front of/behind*. These pairs must be distinguished by reference to general (directed) axes like VERT, OBS. For directional adverbs like *up, down*, this would involve an *alignment of the path* to such contextually given directions, as in (32)a. Similarly, the directional prepositions *along, across* in (32)b refer to some intrinsic axis of the ground (*MAX, LAT*). Different from that, the definition of *around* in (32)c is only partially exherent: it involves a spatial-level dynamic MFD with figure and ground, and specifies a form property of its path.[30] A similar treatment seems to be adequate for the Comparatives in (32)d.

(32) **(Partially) Exherent Directional**
    a. $[\![$ *up/down* $]\!]$: $\lambda p\, [$ [SCAN(x)](p) & $p_{\|}$VERT$^{+/-}$]
    b. $[\![$ *along/across* $]\!]$: $\lambda z\, \lambda p\, [$ LINK(z,zsr) & TRACE(z) &
                                         [SCAN(x)](p) & $p_{\|}$MAX/LAT(zsr)]
    c. $[\![$ *around* $]\!]$: $\lambda z\, \lambda p\, [$ LINK(z,zsr) & TRACE(z) &
                                         [SCAN(x) & ATTREL(x,zsr)](p) & ROUND(p)]

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[29] There are well-known semantic shifts between these spatial types. For example, *away from* can also be used as a locative (e. g., *This is far away from here.*), which might be the result of an end-of-path mapping (as in *He lives over the hill*, cf. also Talmy's access paths, Talmy 2000: 137).

[30] While the roundness of a path may be abstract, it is certainly motivated by the property of balls, curves etc. I therefore do not see the necessity of a separate definition as in (5)f.ii.

    d. ⟦ *up/down the hill* ⟧: λp [∃ h,hsr [HILL(h) & LINK(h,hsr) & TRACE(h) &
                                 [SCAN(x) & SCAN(hsr) &
                                 ATTREL(x,hsr)](p) & p∥VERT$^{+/-}$(hsr)]]

Regarding Egressives/Terminatives, the above discussion has shown that they require a treatment in terms of **delimiting an unbounded dynamic situation/process**. As the binary distinction is most explicit in German, (33) shows the *CAA* proposal for the postposition *aus* (*von Hamburg aus*, 'starting at Hamburg') and the preposition *bis* (*bis nach Berlin*, 'up to Berlin'). So, in (33)c, there is a process of driving in a VW that gets delimited (on both sides), resulting in a bounded process. While the process is linked to an atelic spatial-level dynamic MFD entity ('along the A24'), both delimitations are linked to corresponding spatial changes (note that there could be links into other domains, as expressed with *until* for the temporal).

(33) **Egressive/Terminative**
    a. ⟦ *aus* ⟧: λp λs$_{Process}$ λe [[CHANGE(_,s)](e) & LINK(e, p)]
    b. ⟦ *bis* ⟧: λp λs$_{Process}$ λe [[CHANGE(s,_)](e) & LINK(e, p)]
    c. *Wir fuhren von Hamburg aus bis nach Berlin entlang der A24 in einem VW*
        'We drove from Hamburg up to Berlin along the A24 in a VW'

Table 6 summarizes the main characteristics of the treatment of directionals as presented here. It shows that both locals and directionals can be captured by a comprehensive system that uses mainly attentional criteria for the categorization of the spatial expressions.

linguistic expressions (senses)	standard type	Dy-namicity of attention wrt. LO	MFD-category	exherent property	Dynamicity of attention wrt. RO
Locationals	Place	ATT	Local	no	ATT
through/over/towards	(Compara-tive) Constant	SCAN	Continuation	no	ATT
along/up/around/ alongside	Geometric/ Constant	SCAN	Continuation	yes	TRACE
alongside/ahead of	Relative Constant	SCAN	Continuation	no	TRACK
from/to/ into/ out of	Source/Goal/ Egressive/ Terminative	SCAN	Change	no	ATT
past/over	Route	SCAN	Transitory	no	ATT
across	Route	SCAN	Transitory	yes	TRACE

Table 6: Overview of directionals according to *CAA*

(34) shows two more elaborate examples of the straightforward composition of verb and PP, with a Goal expression in (34)a and an Egressive expression in (34)b. Note while both result from simple functor-argument application of verb and PP semantics, they also involve non- or half-compositional aspects by some kind of unification. For example, the *CHANGE*-predicates in (34)b must match in order to reflect the fact that the process ends in the corresponding local state of the sack (see the discussion of (8)) – which is the whole idea of the structure-preserving role of the *LINK*-predicate of the event. Also, the predicate "LINK(s,ssr)" has been added non-

compositionally (although it could have been provided for in the semantic specification of the verb). How these latter aspects are ultimately accounted for is a matter of further research.

(34) Atelic verb and directionals
a. ⟦ *drag the sack into the house* ⟧:
λx λe [∃ s,h,p,e1,hsr,ssr [house(h) & sack(s) & [MOVE(s)](e1) &
[CAUSE(x,e1) & Mode$_{DRAG}$(x)](e) & LINK(e1, p) & LINK(h,hsr) &
LINK(s,ssr) & ATT(h) &
[SCAN(ssr) & CHANGE(_,[IN(ssr,hsr) & ATT(hsr)])](p)]]

b. ⟦ *drag the sack up to the house through mud* ⟧:
λx λe [∃ s,m,h,p1,p2,e1,e2,ssr,msr,hsr [house(h) & sack(s) & mud(m) &
[MOVE(s)](e1) & [CAUSE(x,e1) & Mode$_{DRAG}$(x)](e2) &
LINK(e2, p1) & LINK(m,msr) & LINK(s,ssr) & TRACE(m) &
[SCAN(ssr) & IN(ssr,msr)](p1) & [CHANGE(e2,_)](e) &
LINK(e, p2) & LINK(h,hsr) & ATT(h) &
[SCAN(ssr) & CHANGE(_,[AT(ssr,hsr) & ATT(hsr)])](p2)]]

Cases of **inverse directionality**, like those in (25), can be analyzed along the same lines. For the Terminative, which selects for a process, to apply, the event of 'sticking-into' must be coerced accordingly, i. e., to a process of "iterative partially-sticking-into" (cf. Dölling 2014 for a formal treatment of different kinds of coercions). When conceived in this way, this seems to involve a shift in perspective from knife-as-figure (chest-as-ground) to boundary-of-chest-as-figure (part-of-knife-as-ground) that resembles, and therefore might be motivated by, **induced movement.**

So far the *CAA* treatment does not capture the cases in (21) and (23). On some level, the requirement of homomorphy must therefore be weakened: instead of necessarily having the same structure, both specifications should at least be **compatible**. The *CAA* proposes to implement this by assuming **implicit** intervening relations and events, licensed by typical knowledge and restricted by the actual context and the granularity of its conception.

As to the inacceptability of *He left the house *to the center of the town* in (23)a, although somebody's path may actually start in a house and end in the centre of the town, the granularities of 'leaving house' and 'going to town centre' seem to be different, so that this situation would rather have to be explicitly described as in (35)a. In (35)b, (35)c and (35)d, possible expressions of inferrable implicit material are underlined. In fact, all cases of **spatial modification** are assumed to be **indirect**, as there must be some verbal information providing the attentional and linking aspects. Finally, (35)e (35)e shows that some threshold of typicality must be exceeded for a deviating expression to be acceptable.

(35) Indirect modification
a. *He left the house and went to the centre of the town*
b. *He left the house heading towards the centre of the town*
c. *He left the house and that happened by going via the fire escape/ through the back door*
d. *the door that leads into the garden*
e. **the snake that wiggled/extended into the living room*

7   Conclusion

Approaches to the semantics of directionals have to account for a variety of phenomena, among them their relation to locatives (e. g., *through* as "dynamic, constant *in*"), their classification (which types there are), their denotation, and their relation to and compositionality with verbs (including their contribution to the aspectuality/aktionsart of the VP). While influential proposals analyze directionals in terms of paths and their properties (most recently exemplified in the work of Zwarts), this paper has presented a Cognitivist, attentional approach (*CAA*) to directionals, according to which they rather have situational (MFD) properties. It was shown that this fits the observation that directional types bear close similarities to verbal types and situational ontologies, that this corresponds to a different semantic treatment of directionals (they express spatial dynamicity with constant or changing locative properties), and that such a conception accounts for their aspectual contribution to the semantics of the VP.

Approaches to the semantics of directionals differ in their (sub)disciplinary treatment of the phenomena. While typical formal approaches emphasize modelling the compositional aspects with objectively defined truth conditions, typical cognitive approaches use image schemata and shy away from objective criteria (cf. especially Lakoff 1987). Computational and neuroscientific/cognitive approaches roughly cling to each of these camps, respectively. The interdisciplinary Cognitivist attentional approach is intermediate in these respects: it is formal, but non-objectivist, it is cognitive, but propositional.

The *CAA*'s unique feature is emphasizing the role of attention in the cognitive system. It was shown that attention has a general impact on our conception of what there is (Cognitivist ontologies), of what we know about what there is (concepts as attentional schemata), and of semantics (linking propositional and imagery-based modelling). More specifically, it turned out that attentional scanning is the distinctive aspect characterizing dynamic spatial-level MFD.

According to the *CAA*, then, directionals express such dynamic spatial attentional representations ("dynamic spatial events") that are associated with conceptual event representations. Since they are only "perceptually spatial", they are not dependent on actual locomotion and related paths – which explains their occurrence with verbs of position and in cases of non-actual locomotion, and which therefore allows a non-objectivist, non-localist, non-reenactment/non-simulation account of these phenomena. The basic, conceptually represented, distinction of "attending to" and "scanning" is assumed to be the general divide between things (or their parts) conceived as "static" or "dynamic", respectively. Scanning-based dynamicity is regarded as the source for non-actual use of directionals. Both within languages (e. g., *stand* vs. *loom* vs. *hang*) or between them (e. g., *run* vs. *verlaufen*), there can be differences as to which conceptual aspects are lexically encoded, and how, both for actual and non-actual aspects. Furthermore, experiential motivations for the use of both actual and non-actual locomotion expressions (cf. (23) and (35)) cannot be underestimated (cf. Matsumoto 1996, Blomberg/Zlatev 2015).

As to Dylan's phrase, we have seen that non-actual locomotion must be involved there: princes may have kept the view along the rim of a watchtower (which would, admittedly, be a strange use of the directional), or along a tilted one. However, we would rather come to the conclusion that Dylan just dropped the plural *s* to add tension to his already opaque song, well aware that *all along the watchtowers* would have been the correct form (being a perfect example of non-

actual locomotion based on scanning a line of watchtowers and the corresponding linearly distributed plurality of princes). Anyway, no reason to get excited.

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