Atelicity and Measure Phrases: Licensing Measure Phrase Modification Across AP, PP, and VP

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1. Introduction

This paper relates two questions normally considered separately. The first of these is why certain temporal adverbials can normally be predicated only of atelic eventualities. That this is so, of course, is a classic observation, and a generally familiar one—it is exemplified in (1):

(1) Floyd $\left\{\begin{array}{l}\text{slept}\\ \#\text{built a bridge}\\ \#\text{died}\end{array}\right\}$ $\left\{\begin{array}{l}\textit{for 20 minutes}\\ \textit{several hours}\end{array}\right\}$.

The second question is why measure phrases can occur with some APs and PPs but not with others:

(2) The enormous vulture is *3 feet* $\left\{\begin{array}{l}\text{long}\\ \#\text{short}\\ \text{above the barn}\\ \#\text{near the barn}\end{array}\right\}$.

At least with respect to the PP cases, this is a bit less familiar.

The goal of this paper, apart from merely linking these two questions, is to give them the same (partial) answer: that Aktionsart restrictions imposed by a particular class of temporal adverbials are a special case of a more general restriction on measure-phrase modification, the Modification Condition of Winter (2001, 2005) and Zwarts and Winter (2000). I will also pursue an understanding of the cross-categorial syntax and semantics of measure phrase modification that blunts a principal argument for enrichments to the ontology they advocate. Section two discusses the Modification Condition; section three argues that a class of temporal adverbials are simply verbal measure phrases; and section four relates these adverbials and measure phrase licensing and considers some broader consequences.

2. Vector Space Semantics and the Modification Condition

In order to get off the ground, it will be necessary to offer a few words about Vector Space Semantics, the framework in which the Modification Condition is couched. The key idea is the introduction of vectors—directed line segments—as primitives into the ontology. This makes it possible to suppose that locative PPs denote properties of vectors representing spatial relationships (Zwarts 1997, Zwarts and Winter 2000) and that APs denote properties of vectors that represent degree (Faller 1998, 2000, Winter 2001, 2004).[1] A PP such as *above the barn*, for example, is true of vectors that start at the barn and point upward (i.e., that end at some point above it):

(3) $[\![\textit{ above the barn }]\!] = \lambda v \left[\begin{array}{l}v \text{ starts at the location of the barn} \wedge\\ v \text{ points upward}\end{array}\right]$

For (4) to be true, then, it must be the case that the bird is located at the *end* of one of these vectors:

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[1] For ease of exposition, I will take a number of liberties in characterizing this framework more informally; things are rigorously formalized in the papers cited. Vectors are indicated with the variables $v, v', v'', v''', \ldots$

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(4) $[\![\textit{The bird is above the barn}]\!] = \exists v \left[\begin{array}{l} v \text{ starts at the location of the barn} \wedge \\ v \text{ points upward} \wedge \\ v \text{ ends at the location of the bird} \end{array}\right]$

At this point, one is forced to make an additional assumption: to go from (3) to (4) compositionally, a type-shift is necessary by which a property of vectors is mapped to a property of individuals located at the endpoints of those vectors.

Near the barn can be interpreted in the same spirit, except that a restriction is placed not on the direction of the vectors but on their length:

(5) $[\![\textit{near the barn}]\!] = \lambda v \left[\begin{array}{l} v \text{ starts at the location of the barn} \wedge \\ v \text{ is short} \end{array}\right]$

Faller (2000) proposes an analogous approach to comparative adjectives, loosely reflected in (6):

(6) $[\![\textit{taller than Clyde}]\!] = \lambda v \left[\begin{array}{l} v \text{ starts at Clyde's height (his location on the height scale)} \wedge \\ v \text{ points upward} \end{array}\right]$

The difference between *taller than Clyde* and *shorter than Clyde* on this view is that the latter involves vectors that point downward. Positive (i.e., non-comparative) forms are necessarily a bit more complicated. Winter (2001, 2005) proposes denotations like (7), where s indicates a contextually-supplied standard (construed as a vector starting at the bottom of the scale):

(7) $[\![\textit{tall}_s]\!] = \lambda v \left[\begin{array}{l} v \text{ starts at the bottom of the height scale (a height of 0)} \wedge \\ v \text{ points upward} \wedge \\ v \text{ is at least as long as } s \end{array}\right]$

The difference between *tall* and *short* would be that *short* involves vectors shorter than the standard s.

One of the really nice properties of the Vector Space approach to these constructions is that they make possible an intersective and very intuitive analysis of measure phrase modification. Zwarts (1997) proposes an analysis of modified locative PPs as in (8–9), which Faller (2000) extends to comparatives as in (10):

(8) $[\![\textit{two feet}]\!] = \lambda v \ .\ v$ measures 2 feet

(9) $[\![\textit{two feet above the barn}]\!]$
$= \lambda v \ .\ [\![\textit{two feet}]\!](v) \wedge [\![\textit{above the barn}]\!](v)$
$= \lambda v \left[\begin{array}{l} v \text{ measures 2 feet} \wedge \\ v \text{ starts at the location of the barn} \wedge \\ v \text{ points upward} \end{array}\right]$

(10) $[\![\textit{two feet taller than Clyde}]\!]$
$= \lambda v \ .\ [\![\textit{two feet}]\!](v) \wedge [\![\textit{taller than Clyde}]\!](v)$
$= \lambda v \left[\begin{array}{l} v \text{ measures 2 feet} \wedge \\ v \text{ starts at Clyde's height (his location on the height scale)} \wedge \\ v \text{ points upward} \end{array}\right]$

Modulo some complications, positive adjectives with measure phrases can also be interpreted this way.

The Vector Space Semantics approach to these constructions has another significant advantage. It brings to light an important generalization about the contrast exemplified in (2) between APs and PPs that license measure phrases and ones that don't: all the expressions that allow an measure phrase have denotations that *include vectors of every non-zero length*, and in this sense are upward and downward monotonic. To illustrate, suppose a bird is *above the barn* (hence at the end of some vector that starts at the barn). Raising or lowering the bird (changing its vector) cannot render it false that it is *above the barn*. This contrasts with *near the barn*—if a bird that is *near the barn* is raised far enough, it will no longer be *near the barn*. Similar reasoning ensures that comparatives irrespective of polarity (e.g., both *taller*

and *shorter*) license measure phrases. For positive adjectives, again a complication: for the reasoning to go through as intended, it is necessary to assume that these adjectives must be evaluated in a context in which the standard for height is 0[2] With this in place, though, one can increase or decrease arbitrarily the extent to which Floyd exceeds the standard for tallness and he will remain *tall*. This contrasts with *short*, because all the vectors in its extension are no longer than the standard.

This generalization, then, is (one incarnation of) Zwarts and Winters' Modification Condition:[3]

(11) MODIFICATION CONDITION (Winter 2005)
An expression that is associated with a set of vectors W can be modified by a measure phrase only if W is non-empty, upward and downward monotone and does not contain zero vectors.

This works quite elegantly and makes correct predictions. One of these is that for certain adjectives, both opposing pairs should support measure phrases even in the positive (non-comparative) form:

(12) Floyd's flight was two hours $\left\{\begin{matrix}\text{early}\\\text{late}\end{matrix}\right\}$.

Because any amount of earliness or lateness would render the flight *early* or *late*, this is expected.

3. Measure Phrases in VP

3.1. The Cast of Characters

The Modification Condition is intended as a deep and cross-categorial property of measure-phrase modification. We should therefore expect that if VPs could support measure phrases, they should be constrained by it here just as in PP and AP. The aim of this section is to argue that certain adverbial DPs *are* VP measure phrases (recapitulating Morzycki 2004)—not merely similar to them, but the verbal reflex of precisely the same construction. Some of the relevant adverbial DPs—or, in Larson (1985)'s perhaps more familiar term, 'bare NP adverbs'—are as in (13):

(13) a. He slept $\left\{\begin{matrix}\textit{several hours}\\\textit{eight hours}\\\textit{two days}\end{matrix}\right\}$.

b. It had been raining $\left\{\begin{matrix}\textit{an hour}\\\textit{a month}\\\textit{several weeks}\end{matrix}\right\}$.

There is a prima facie connection here: these expressions have a 'measuring' interpretation of some sort. There is also a prima facie difference: wrong surface word order. Measure phrases in English (and related languages) occur on in pre-head positions. Not all adverbial DPs are VP measure phrases, of course:

(14) a. Erma pronounced my name *the wrong way*.
b. Clyde got too little sleep *Tuesday*.

But there is a single natural class of adverbial DPs distinguished by a tell-tale constellation of characteristics.

3.2. A Natural Class

SCOPE Perhaps the most notable of these identifying characteristics is that the these adverbial DPs obligatorily take narrow scope. This can usually be observed by comparing them to their *for* PP

[2]This would be, of course, a pretty weird context. This assumption is necessary to account for the 'neutralizing effect' of measure phrases (see Kennedy 1997 and references there). What *requires* this zeroing-out in the presence of a measure phrase is (11) itself.

[3]The intuition that some notion of monotonicity is relevant to measure phrase licensing also crops up in Schwarzschild (2002) and Moltmann (1991).

paraphrases, which are not subject to this constraint. Such adverbial DPs obligatorily scope under negation, as (15a) illustrates:

(15) a. Clyde didn't sleep an hour. ($\neg \prec$ *an hour*; **an hour* $\prec \neg$)
b. Clyde didn't sleep for an hour. ($\neg \prec$ *an hour*; *an hour* $\prec \neg$)

If, for example, a car alarm kept Clyde awake all night, (15a) is true. If, however, Clyde went to bed promptly at midnight, was awakened by a car alarm at 4:00 in the morning, and fell asleep again an hour later, (15a) is quite clearly false; it does not have a reading in which it asserts that there was an hour during which Clyde was awake. The low-scope effect persists with respect to quantified arguments:

(16) a. Few chiropractors waltzed ten minutes. (*few chiro.* $\prec$ *10 min.*; **10 min.* $\prec$ *few chiro.*)
b. Few chiropractors waltzed for ten minutes. (*few chiro.* $\prec$ *10 min.*; *10 min.* $\prec$ *few chiro.*)

It is not possible to take (16a) to assert that there was a particular ten-minute interval during which few chiropractors waltzed. The scope facts are similar with respect to aspectual morphology:

(17) a. Clyde swam a year. (GEN $\prec$ *a year*; **a year* $\prec$ GEN)
b. Clyde swam for a year. (GEN $\prec$ *a year*; *a year* $\prec$ GEN)

The most natural reading for (17a) is a counterpragmatic one in which Clyde spent a year in the water. A reading that simply characterizes him as being a swimmer for a year is unavailable, in contrast to (17b). Most oddly, perhaps, these adverbials take narrow scope with respect to embedding verbs:

(18) a. Greta wanted to talk a few minutes. (*wanted* $\prec$ *a few minutes*; **a few minutes* $\prec$ *wanted*)
b. Greta wanted to talk for a few minutes. (*wanted* $\prec$ *a few minutes*; *a few minutes* $\prec$ *wanted*)

If what Greta desires is a few minutes of talking, (18a) is true. If she has been wanting for a few minutes to talk for some other length of time, (18a) is not true.

LOW STRUCTURAL POSITION The same measure-phrase-like adverbial DPs are restricted to low structural positions. This can be observed overtly:

(19) a. Clyde slept an hour every day.
b. *Clyde slept every day an hour.

(20) a. Clyde usually slept less than six hours for a year.
b. *Clyde usually slept for less than six hours a year.

NO HEAD NOUN RESTRICTION Many adverbial DPs are subject to idiosyncratic restrictions on what their head noun can be (Larson 1985), as in (21):

(21) Floyd played the ukulele $\left\{ \begin{array}{l} \text{the wrong way} \\ \text{*the wrong manner} \end{array} \right\}$.

The adverbial DPs identified in this section, though, can grammatically occur with any head noun with the appropriate lexical semantics.

QUANTIFICATIONAL FORCE All the the adverbial DPs identified in this section are quantificationally weak. Strong ones don't manifest the same properties—for example, they can scope high:

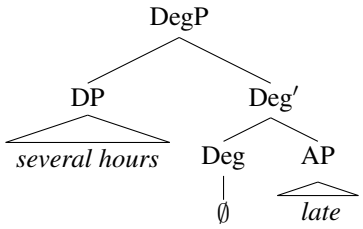
(22) Clyde didn't sleep the whole day. ($\neg \prec$ *the whole day*; *the whole day* $\prec \neg$)

AKTIONSART EFFECT And notably, of course, all these adverbial DPs impose an atelicity requirement.

3.3. Adverbial DPs as Measure Phrases

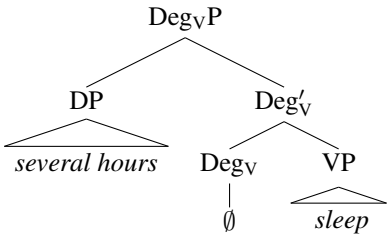
One standard structure for measure phrases (though not the one Zwarts 1997 and Zwarts and Winter 2000 adopt) places them in a specifier position—in contemporary incarnations, typically the specifier of a functional head, as in (23) (this version is that of Kennedy 1997, who is following Abney 1987, Corver 1990, Grimshaw 1991):

(23)



If weak DP adverbials are themselves measure phrases, and the structure in (23) is cross-categorial, the expected structure would be as in (24):

(24)



But this, of course, is not the surface order. But assuming that verb movement is present in English though short (Johnson 1991 and others), this structure will independently lead to the surface order without anything further being said, as illustrated in (25):

(25) sleep$_i$ [$_{\text{Deg}_V\text{P}}$ several hours Deg$_V$ [$_{\text{VP}}$ t_i]]

The only reason these expressions do not appear more obviously to be VP measure phrases, then, is that their true nature is obscured by verb movement and so can be observed only indirectly.

This immediately accounts for the obligatorily low scope of these expressions—even with respect to embedding verbs, which would be a particularly difficult fact to capture if these expressions weren't on a left branch. It also accounts for the overtly observable aspects of their low structural position, as well as for their quantificational force (all measure phrases are weak). This sort of structure also has independent motivation for certain adverbial DPs: Pereltsvaig (2000) argues that accusative-marked adverbial DPs in Slavic and Finnish have a structure like (24), chiefly on the basis of facts about case.

4. The Modification Condition and Atelicity

4.1. Vectors in the Ontology of Time

If there are VP measure phrases, then, are they subject to the Modification Condition? What would it mean for them to be, exactly? In order to address this, it is necessary to develop a way of talking about temporal semantics using vectors. This would be a significant change to the standard conception. I know of no independent argument for using vectors in this domain apart from any benefits it might have with respect to measure phrases. But the parallelism in how measure phrases work seems reason enough to explore this possibility.

The first step in this enterprise will be to suppose that time is a scale, essentially like the scale of height, say. Just as degrees (or intervals/extents) can be reconceptualized as vectors, so too temporal intervals can. It is not possible, though, to just straightforwardly extend the analogy from PPs and APs. Locative PPs could denote sets of vectors because their meaning essentially doesn't contribute anything

but spatial information. APs could denote sets of vectors because adjectives could still be distinguished from each other on the basis of what *scale* or dimension (Kennedy 1997, 2001) the vectors in its extension are located on. But for VPs, the situation is more complicated. More is involved than just one scale, more than just time. It wouldn't be plausible to simply think of the V *sleep* as having a denotation like (26), for example (where τ is the running-time function):

(26) $[\![\textit{sleep}]\!] = \lambda v \,.\, \exists e[e \text{ is a sleeping} \wedge \tau(e) = v]$

Existentially closed in this way, the event argument is of no compositional use—nothing higher in the tree would have access to it. So at a minimum, what would be required is something like (27):

(27) $[\![\textit{sleep}]\!] = \lambda v \lambda e \,.\, e \text{ is a sleeping} \wedge \tau(e) = v$

It's not obvious that this is desirable either, though—it would interfere with the standard intersective interpretation of manner adverbials, for example.

What seems to be needed here is some means by which properties of events (VP denotations) can be mapped to properties of (temporal) vectors higher in the extended VP. This is exactly the sort of role that has independently been attributed to aspectual morphology by Kratzer (1998) (and less formally, Klein 1994). Translating this to vectors, one might assume that part of an aspect morpheme's denotation—represented here schematically, drained of the parts of meaning that distinguish one aspect morpheme from another—is as in (28):[4]

(28) $[\![\text{Asp}]\!] = \lambda f_{\langle s,\, t\rangle} \lambda v \,.\, \exists e[f(e) \wedge \tau(e) = v]$

The verb itself, then, could continue to have its standard denotation, and no novel predictions are made about its behavior with respect to modifiers that occur below this level in the tree.

Something like (26) would now be built up compositionally. At the level immediately above the aspect node, the denotation would be a property of vectors:

(29) $[\![\text{Asp } [\textit{ Floyd sleep }]]\!] = \lambda v \,.\, \exists e[e \text{ is a sleeping by Floyd} \wedge \tau(e) = v]$

This could combine with a measure phrase intersectively:

(30) $[\![\textit{two hours}]\!] = \lambda v \,.\, v \text{ measures two hours}$

(31) $[\![[\text{ Asp } \textit{Floyd sleep }] [\textit{ two hours }]]\!] = \lambda v \left[\begin{array}{l} \exists e[e \text{ is a sleeping by Floyd} \wedge \tau(e) = v] \wedge \\ v \text{ measures two hours} \end{array} \right]$

But there is a problem: This approach does not square with the observation made in the previous section that VP measure phrases scope below aspectual morphology. This difficulty may be a hint that in fact, the mode by which measure phrases are introduced into the semantics requires some further examination.

4.2. Satisfying the Modification Condition

Before addressing complications that interpreting measure phrases intersectively at this point gives rise to, though, it bears articulating a bit further how this sort of intersective interpretation would work. In the preceding section, the denotation of aspect morphology was represented very schematically without much content.

Here is an example of a 'real-life' bit of aspectual morphology (Klein 1994, Kratzer 1998):[5]

(32) $[\![\text{PERFECTIVE}]\!] = \lambda f_{\langle s,\, t\rangle} \lambda v \,.\, \exists e[f(e) \wedge \tau(e) \subseteq v]$

[4] The type of events here is s.

[5] This is a *highly* convenient selection of aspects—indeed, crucial. Other aspect morphemes would in various ways yield undesirable results here. This can be set aside for the moment, though, as further revisions will shortly render it moot.

This ensures that after the application of perfective aspect morphology, an atelic predicate like *sleep* will give rise to a denotation like (33):

(33) $[\![\text{PERFECTIVE } [\textit{ Floyd sleep }]]\!] = \lambda v \,.\, \exists e[e \text{ is a sleeping by Floyd} \wedge \tau(e) \subseteq v]$

This is true of temporal vectors that contain the running time of an event of Floyd sleeping. Importantly, this kind of denotation satisfies the Modification Condition. This rests crucially on the fact that atelic verbs have the subevent property (Dowty 1979)—any part of a sleeping is itself a sleeping, so for any vector that represents the running time of a sleeping event, there are vectors of every shorter length that represent the running times of the subevents of sleeping.

A telic predicate such as *die*, on the other hand, will fail to satisfy the Modification Condition. After the application of aspect morphology, it would have a denotation similar to (33):

(34) $[\![\text{PERFECTIVE } [\textit{ Floyd die }]]\!] = \lambda v \,.\, \exists e[e \text{ is a dying by Floyd} \wedge \tau(e) \subseteq v]$

This is true of temporal vectors that contain the running time of an event of Floyd dying. The difference is that (34) is not downward monotonic. Telic eventualities don't have the subevent property—it's not the case that any subevent of a dying is itself a dying, so it's also not the case that for any vector that represents the running time of a dying event, there are vectors of every shorter length that represent the running times of the subevents of dying. Thus telic predicates systematically fail to satisfy the Modification Condition because they impose a minimum length on vectors: they require vectors at least as long as the running time of the event. This is point significant: It is the core of the connection between the Modification Condition and telicity.

4.3. How are Measure Phrases Introduced into the Semantics?

This story as it stands is a bit too simple, though—and in another sense, too complicated. It is too simple in that it predicts in a fairly direct way that measure phrases should scope above aspectual morphology. If Asp is responsible for yielding properties of vectors and measure phrases are interpreted intersectively, measure phrases should occur only above Asp. Thus they should scope below aspect—but as (17), repeated here, shows, the opposite is true:

(35) a. Clyde swam a year. (GEN $\prec$ *a year*; **a year* $\prec$ GEN)
b. Clyde swam for a year. (GEN $\prec$ *a year*; *a year* $\prec$ GEN)

In another sense, this story is too complicated. On the view advocated in section 3, measure phrases both in the extended VP and in more familiar positions are not sisters to the expression they modify, but rather specifiers of a degree head. But if measure phrases are in fact interpreted intersectively, what semantic role might the degree head play?

An answer suggests itself in considering the role such degree heads play in AP (and may play in PP as well). If the structures by which measure phrases are introduced are parallel across categories, as the reasoning here suggests, the degree head in VP is the verbal exponent of a cross-categorial class of degree heads, and we might expect it to be similar to these. Kennedy (1997) suggests that in positive APs, degree heads take measure phrases as arguments, thereby introducing them into structures where for type-theoretic reasons they could not have been interpreted intersectively. Generalizing this approach, the verbal degree head can straightforwardly be used to interpret measure phrases below Asp:

(36) $[\![\text{Deg}_\text{V}]\!] = \lambda f_{\langle s,\,t\rangle} \lambda m_{\langle v,\,t\rangle} \lambda e \,.\, f(e) \wedge m(\tau(e))$

(37) $[\![[_{\text{Deg}_\text{V}\text{P}} \textit{ two hours } [\text{Deg}_\text{V} \textit{ sleep }]]]\!] = \lambda e \,.\, e \text{ is a sleeping} \wedge \tau(e) \text{ measures two hours}$

This simply encodes an intersective interpretation, but makes it possible for measure phrases to occur lower in the tree, as seems to be empirically necessary.

At this point, this is largely type-theoretical calisthenics. But developing this a bit further, it can actually do some work—work that in Vector Space Semantics must be done by other means. One

important semantic contribution such a degree head can make is to eliminate the need for a type shifting rule. As already mentioned, to predicate e.g. *above the barn* of an individual, Vector Space Semantics resorts to a type shift that maps from a property of vectors to a property of individuals located at the end of those vectors. This type shift must be invoked in every instance of predicating any AP or PP of an individual on this view. Having degree heads available obviates the need for such type-shifting: this could be taken instead to be (part of) the semantic contribution of the degree morpheme itself.

Second, in addition to relieving the need for a type shift, this approach makes it possible to locate the Modification Condition in a single place. For Winter (2005), the Modification Condition is derived from a complex interplay of semantic and pragmatic factors that relies on triviality filter, one whose applicability to this construction must be stipulated. Here, though, it could be captured as a simple semantic fact by taking it to be a presupposition imposed by degree morphology.

Finally, this takes some initial steps in the direction of cross-categorial denotations for degree morphemes. Including the Modification Condition in the denotations as a presupposition (and abbreviating it using the predicate MOD-COND), denotations for such heads in V, A, and P might be as in (38):

(38) $[\![\text{Deg}_\text{V}]\!] = \lambda f_{\langle s,\, t\rangle} \lambda m_{\langle v,\, t\rangle} \lambda e : \text{MOD-COND}(\ \lambda v\ .\ \exists e'[f(e') \wedge \tau(e') \subseteq v]\ )\ .$
$f(e) \wedge m(\tau(e))$
$[\![\text{Deg}_\text{A}]\!] = \lambda f_{\langle v,\, t\rangle} \lambda m_{\langle v,\, t\rangle} \lambda x : \text{MOD-COND}(\ f\ )\ .\ f(v) \wedge m(v) \wedge x$ is located at the end of v
$[\![\text{Deg}_\text{P}]\!] = \lambda f_{\langle v,\, t\rangle} \lambda m_{\langle v,\, t\rangle} \lambda x : \text{MOD-COND}(\ f\ )\ .\ f(v) \wedge m(v) \wedge x$ is located at the end of v

These are of course non-identical, but the difference between Deg_V and the other Deg morphemes seems systematic in a way that might lead to something revealing.

4.4. Reconsidering Vectors

There is, though, another and perhaps more profound sense in which the proposal as it has so far been developed may be too complicated. Among the motivations for adopting vectors in a theory of the semantics of PPs and APs is that they yield intuitively satisfying representations. Particularly in the case of directional prepositions, this may be a very compelling consideration on its own.

But probably the most elegant argument for adopting vectors, and the argument that Zwarts (1997) in his original proposal gives particular attention to, is that they make possible the intersective interpretation of various PP modifiers. This includes measure phrases, of course, but also expressions such as *diagonally* in *diagonally across the street*. This intersective mode of interpretation could not suffice if the objects being manipulated were line segments rather than vectors. The difficulty has to do with how individuals are ultimately located in space. Suppose that *above the barn* simply denoted the set of line segments one of whose ends is at the barn. A measure phrase such as *six feet* could now be interpreted intersectively with it perfectly sensibly, thereby yielding only line segments that are six feet long and one of whose ends is at the barn. The next step would be to locate an individual with respect to the barn. But there would be no adequate way to do this. Because line segments are not directed, there is no way to distinguish *which* end of the line segment an individual should be located at. A line segment simply doesn't encode enough information.

This argument does not go through, however, if one sacrifices the idea that measure phrases are interpreted intersectively. Treating them instead as arguments of a degree head makes it possible for the necessary information to be passed up the tree, 'skipping over' the measure phrase position. Measure phrases can thereby still be constrained in the right way type-theoretically. In light of this, it is not clear that vectors are necessary at all to accomplish the essential aims here. They seem to be equally attainable on more conventional ontological assumptions. The denotations of the degree morphemes, for example, could have been as in (39), where APs and PPs are both treated as relations:

(39) $[\![\text{Deg}_\text{V}]\!] = \lambda f_{\langle s,\, t\rangle} \lambda m_{\langle i,\, t\rangle} \lambda e : \text{MOD-COND}(\ \lambda t\ .\ \exists e'[f(e') \wedge \tau(e') \subseteq t]\ )\ .$
$f(e) \wedge m(\tau(e))$
$[\![\text{Deg}_\text{A}]\!] = \lambda f_{\langle e,\, dt\rangle} \lambda m_{\langle d,\, t\rangle} \lambda x : \text{MOD-COND}(\ \lambda d\ .\ \exists x[f(x)(d)]\ )\ .\ \exists x[f(x)(d) \wedge m(d)]$
$[\![\text{Deg}_\text{P}]\!] = \lambda f_{\langle e,\, dt\rangle} \lambda m_{\langle d,\, t\rangle} \lambda x : \text{MOD-COND}(\ \lambda d\ .\ \exists x[f(x)(d)]\ )\ .\ \exists x[f(x)(d) \wedge m(d)]$

There is a fundamental trade-off here. The genius of the vector-space approach is in large part that it makes possible an extremely simple syntax. This comes at the cost of a richer and more complicated ontology and additional principles of semantic composition (the necessary specialized type shifts). The alternative developed here makes it possible to maintain a simpler ontology—there don't need to be objects in the model that inherently encode direction—at the price of a more complicated syntax. Here, of course, considerations of theoretical taste unavoidably arise: Is it better to complicate the ontology or the syntax? How objectionable is proliferating syntactic nodes? How objectionable is proliferating rules of semantic composition?

Yet the choice between these two options should not be made on aesthetic grounds alone if they can be distinguished empirically—and indeed they can. The more articulated syntax is in fact *independently* preferable. In AP, this kind of structure—one in which a measure phrase occupies a specifier position—has a well-established pedigree, and has been advocated for a variety of reasons. The VP measure phrase facts examined here are further evidence that such a structure is needed. Because of this independent empirical motivation, the simpler syntax—however pretty it might be—cannot be preferred simply on the grounds of parsimony. Without this, an important pillar of the case for vectors falls away.

5. Final Remark

The core aim here was to relate the question of what licenses measure phrases in AP and PP to the question of how temporal modifiers impose Aktionsart restrictions on the predicates they modify. I argued that certain adverbial DPs are actually VP measure phrases, and that the atelicity restriction they impose is a special case of the cross-categorial Modification Condition. A secondary goal was to address some syntactic and ontological issues that relating these questions gives rise to. I proposed a syntax and semantics that calls into question whether it is necessary to adopt vectors to capture the insights behind the Modification Condition. Foremost among the many relevant questions this paper leaves open is to what extent might the Modification Condition account for how other adverbial modifiers—most notably in English, *for* PPs—impose an atelicity requirement. The similarity may, of course, be accidental, but one might suspect a deeper explanation.

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