

Interpreting Measure DP Adverbials

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1. Introduction

If DP adverbials such as those in (1) did not occur quite regularly in English and other familiar languages, one might be inclined to consider them a rather odd and exotic construction:

- (1) a. It had been raining *an hour*.
b. Clyde played the ukulele *every day*.
c. Floyd slept *the wrong way* again.

After all, these expressions manifest two seemingly contrary characteristics: they are simultaneously DPs and adverbial modifiers. Prototypically, DPs are not modifiers; prototypically, adverbials are not DPs. In part because of this tension, DP adverbials have long posed an analytical challenge.

The focus of this paper will be weak DP adverbials of the sort in (1a), henceforth ‘measure DP adverbials’. These constitute a natural class distinguished not only by quantificational strength but also by scope restrictions, distribution, and an Aktionsart effect. From these puzzling characteristics an argument will be woven that certain Aktionsart information is encoded in a feature in verbal functional structure responsible for licensing these adverbials. Independent evidence for this approach will be adduced from true adverbs, and some consequences for the interaction between functional structure and the semantics of modification will be explored.

Section 2 examines the essential properties of measure DP adverbials; section 3 develops the argument for encoding Aktionsart information in a modifier-licensing syntactic feature; section 4 considers more general consequences and connections to other modifiers; and section 5 concludes.

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2. Two classes of DP adverbials: some puzzles

2.1. The puzzle of obligatory narrow scope

Measure DP adverbials obligatorily take narrow scope with respect to negation, the subject, and embedding verbs. In this respect, they differ from their PP paraphrases and from strong DP adverbials.

Thus the sentences in (2) are not scopally ambiguous:

- (2) a. Clyde didn't sleep an hour. ($\neg > \text{an hour}; * \text{an hour} > \neg$)
 b. Greta couldn't stay a day. ($\neg > \text{a day}; * \text{a day} > \neg$)

In a situation in which a car alarm had kept Clyde awake all night, (2a) is true. If, however, Clyde went to bed promptly, was awakened by a car alarm at 4 a.m., and fell asleep again an hour later, (2a) is quite clearly false. Likewise, (2b) can only be understood as claiming that the duration of Greta's stay had to be shorter than a day; a reading in which there is a particular day during which Greta can't stay is impossible. This contrasts with the PP paraphrases of these sentences, which permit both scope possibilities:

- (3) a. Clyde didn't sleep for an hour. ($\neg > \text{an hour}; \text{an hour} > \neg$)
 b. Greta couldn't stay for a day. ($\neg > \text{a day}; \text{a day} > \neg$)

In the situation considered above in which a car alarm interrupts Clyde's otherwise undisturbed and lengthy sleep, (3a) is true, unlike (2a). Likewise, (3b) permits both scope possibilities.

Measure DP adverbials also require narrow scope with respect to the subject:

- (4) a. No one slept an hour. ($\text{no one} > \text{an hour}; * \text{an hour} > \text{no one}$)
 b. Few chiropractors waltzed ten minutes.
 ($\text{few chiropractors} > \text{ten minutes}; * \text{ten minutes} > \text{few chiropractors}$)

If no one experienced an hour's sleep, (4a) is true. But it cannot be used to report that there is a particular hour during which everyone's otherwise lengthy sleep was interrupted. Similarly, (4b) cannot report that during some particular ten minute interval, few chiropractors waltzed. Again, this restriction is not shared by the PP paraphrases of (4):

- (5) a. No one slept for an hour. ($\text{no one} > \text{an hour}; \text{an hour} > \text{no one}$)
 b. Few chiropractors waltzed for ten minutes.
 ($\text{few chiropractors} > \text{ten minutes}; \text{ten minutes} > \text{few chiropractors}$)

Both scope possibilities are available here – these can report interruptions in sleeping or mass waltzing (respectively) of a particular length.

Measure DP adverbials also have fixed narrow scope with respect to embedding verbs:

- (6) a. Greta wanted to talk at least two hours.
 (*wanted*>*at least two hours*; **at least two hours*>*wanted*)
 b. She feared that Clyde would yodel a few minutes.
 (*fear*>*a few minutes*; **a few minutes*>*fear*)

If what Greta desires is at least two hours of talking, (6a) is true. But if she wanted for two hours to talk for only a minute or two, this is false. Similarly, (6b) may report a fear of momentary yodeling, but not a momentary fear of lengthy yodeling. Again, this contrasts with the corresponding PPs:

- (7) a. Greta wanted to talk for at least two hours.
 (*wanted*> *at least two hours*; *at least two hours* >*wanted*)
 b. She feared that Clyde would yodel for a few minutes.
 (*fear*>*a few minutes*; *a few minutes*>*fear*)

Both scope possibilities are once again available.

Strong DP adverbials are not subject to this narrow-scope restriction:

- (8) Clyde didn't sleep the whole day. (\neg >*the whole day*; *the whole day*> \neg)

This may mean either that during the whole day, Clyde went without sleep, or that Clyde's sleep did not last the whole day.

- (9) No one slept all afternoon.
 (*no one*>*all afternoon*; *all afternoon*> *no one*)

This may mean that all afternoon, no one slept, or that no one's sleeping lasted all afternoon.

- (10) Greta wanted to talk every morning.
 (*wanted*>*every morning*; *every morning*>*wanted*)

This may mean that Greta's desire was daily, or that it was for daily talking.

2.2. The distribution puzzle

Another defining characteristic of measure DP adverbials is relatively restricted distribution. Measure DP adverbials can't front:

- (11) a. *An hour, Clyde slept.
- b. *Several minutes, it had been raining.

PPs and strong DP adverbials can:

- (12) a. For an hour, Clyde slept.
- b. For several minutes, it had been raining.
- (13) a. All afternoon, Clyde slept.
- b. The whole day, Floyd complained.

Nor can measure DP adverbials occur as modifiers of NP:

- (14) a. *Clyde's nap an hour was restful.
- b. *His vacation a week was largely wasted.

Again, this contrasts with PPs and strong DP adverbials:

- (15) a. Clyde's nap for an hour was restful.
- b. His vacation for a week was largely wasted.
- (16) a. Clyde's nap every afternoon was restful.
- b. His vacation last March was largely wasted.

2.3. The Aktionsart puzzle

Measure DPs are also distinguished by an Aktionsart effect: they impose a requirement of aspectual homogeneity¹ (Moltmann 1991). Thus they are compatible with state or activity VPs, as in (17), but not naturally with achievement or accomplishment VPs, as in (18):

- (17) a. He slept an hour.
- b. He danced an hour.

1. Following Moltmann, I will use 'homogeneity' rather than 'atelicity' or 'durativity', but nothing especially novel is intended by this use.

- (18) a. #He died an hour.
 b. #He walked to the corner an hour.

To the extent that sense can be made of the sentences in (18), coercion is required.

This sort of restriction is, of course, not unique to measure DP adverbials. It is typical of measure adverbials generally, and indeed lies at the heart of the classic distinction between *for* and *in* PPs. But with PPs, the source of this restriction, if clearly identified, is often said to be the preposition (Dowty 1979). Here, though, no overt preposition is present.

In the face of such a problem, a natural inclination may be to posit a null preposition, and in fact null or deleted prepositions have been proposed quite a number of times in the analysis of DP adverbials (Emonds 1976, 1987; Bresnan and Grimshaw 1978; McCawley 1988; Roeper, Ramos, Seymour, and Abdul-karim 2000). But in assimilating DP adverbials to PPs in this way, such approaches leave no clear means by which to account for the different scope and distribution properties that distinguish them.

It is not the case, however, that strong DP adverbials never impose a homogeneity requirement. There are, in fact, some strong DP adverbials with pretheoretically durative or ‘measuring’ semantics that do seem to have this effect:

- (19) a. All my life / my entire life / my whole life, I’ve been indifferent to rutabagas.
 b. #All my life / my entire life / my whole life, I’ve written a book about rutabagas.

Such cases are misleading – the internal semantics of the DP itself may be responsible for imposing the homogeneity requirement. The DPs in (19) are all universally quantifying (or plausibly so). To take the clearest example, *all my life* quantifies over subintervals of my life. For an eventuality to have taken place *all my life*, it must be the case that it took place at every subinterval of my life. Only a homogeneous eventuality could satisfy this requirement. Tellingly, sentences like (19) without the universally-quantifying element not only do not impose any such requirement, but are in fact ungrammatical:

- (20) *My life, I’ve been indifferent to rutabagas.

Their internal quantification, then, is crucial to the trick these adverbials perform. Strong DP adverbials that do not have this misleading characteristic do not have pretheoretically durative semantics or impose the homogeneity requirement:

- (21) a. Clyde wrote a book every year.
 b. Monday, Floyd ate a rutabaga.

This Aktionsart restriction, then, is not a characteristic of strong DP adverbials generally.

Measure DP adverbials, on the other hand, systematically impose this restriction, though it is not readily apparent from independently necessary assumptions about their internal semantics why they should.

2.4. An absent puzzle: the head noun restriction

There is a puzzle that is notable by its absence in measure DP adverbials. DP adverbials have been claimed to be subject to idiosyncratic restrictions on which nouns can grammatically head them (Larson 1985):

- (22) a. Floyd played the ukulele the wrong way / *manner.
 b. Clyde has been complaining all day / *interval.
 c. Go right this way / *orientation.

Measure DP adverbials are apparently not subject to such a restriction. Any noun that can denote a property of intervals (or of spatial regions) seems to yield a grammatical measure DP adverbial.

2.5. Spatial measure DP adverbials

Measure DP adverbials may involve spatial nouns:

- (23) a. The soap slipped several inches.
 b. On his way to Philadelphia, Clyde slept several miles.

These appear to have all of the distinguishing properties noted above.

Such measure DP adverbials should not be confused with argument spatial DPs, like the objects of *run* or even *fly*, which can passivize (cf. Kural 1996):

- (24) a. Many miles were run by Clyde.
 b. Many miles have been flown by this plane

- (25) *Seven inches were slipped by the soap.

Argument spatial DPs need not even denote distances, unlike spatial measure DP adverbials:

- (26) a. Clyde ran the race.
 b. This plane has flown this route.

(27) *The soap slipped the counter.

2.6. The facts in a nutshell

Measure DP adverbials are weak, take obligatorily narrow scope, occur only in the verbal domain quite low in the tree, and impose a homogeneity requirement.

3. Functional structure and measure DP adverbials

3.1. The core idea

The challenge measure DP adverbials present is twofold. First, an explanation is necessary of the Aktionsart requirement, which does not obviously arise from properties of the DP itself. Second, an explanation is necessary of this particular pairing of scope and distribution.

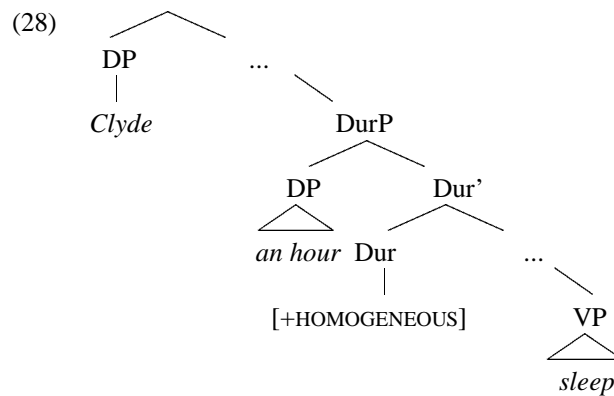
Both problems can be addressed simultaneously. If the Aktionsart information associated with a measure DP adverbial does not come from within, the natural alternative is to suppose that its source lies outside the adverbial. What might this source be?

An answer to this question may arise from the answer to the problem of scope and distribution. Given that measure DP adverbials seem to be restricted to a particular position, it is likely that they occupy a single fixed slot in the functional structure of the clause. Since they are not actually adverbs – that is, members of the category Adv – but merely adverbial modifiers, this does not follow from the common assumption that adverbs occur in fixed positions around which heads move. That it turns out, unexpectedly, to be true therefore seems important. A straightforward means is available by which modifiers of a particular class can be fixed in a particular position: the language of modifier-licensing features Cinque (1999) develops. One might suppose that a feature responsible for licensing measure DP adverbials occurs in a fixed syntactic position low in verbal functional structure.

At this stage, then, the answer to one part of the puzzle is a semantic requirement in need of a bit of syntax to call home, and the answer to another part of the puzzle is a syntactic feature with no semantic work to do. Thus it seems natural to attribute the semantics of the Aktionsart requirement to this licensing feature. So, measure DP adverbials are introduced by a verbal feature which occupies a fixed position low in the tree and imposes the homogeneity requirement.

3.2. Some syntactic concerns

A natural, though not necessary, way to spell out this syntax is in the framework of Cinque (1999), who actually proposes a functional projection in roughly the right position with a suggestive name: Dur(ative)P. Following this Cinque approach, one might suppose a structure like (28):



Although this structure reflects a distinct functional projection, along the lines Cinque advocates, this isn't really what is crucial here. One might imagine other ways of implementing the core idea above. For example, the [+HOMOGENEOUS] feature may be bundled with other features in some other functional projection, or for that matter it may be on the lexical head directly. In these cases, it could have denotations of the same type as it would in a structure such as (28), but be interpreted by function composition. Thus the question of whether this feature occupies a distinct functional projection is independent of the core idea that a semantically-contentful Aktionsart-related feature in functional structure licenses measure DP adverbials.

That said, (28) does reflect the intuition behind this approach quite naturally, and makes the prediction – which is, it will emerge, apparently useful – that measure DP adverbials occupy a left branch. And it accords with Cinque's proposal that adverbs generally are specifiers of functional projections. Moreover, a structure in which measure DP adverbials occupy a specifier of a functional head provides a means of understanding their case properties.

3.3. The denotation of [+HOMOGENEOUS]

Semantically, the [+HOMOGENEOUS] feature takes as arguments a VP denotation (a property of events) and a measure DP adverbial (a property of intervals), and imposes the homogeneity requirement:

$$(29) \llbracket [+HOMOGENEOUS]_{\text{Dur}} \rrbracket = \lambda P_{\langle s, t \rangle} \lambda Q_{\langle i, t \rangle} \lambda e . P(e) \wedge Q(\tau(e)) \wedge \forall t[t \leq \tau(e) \rightarrow \exists e' [P(e') \wedge \tau(e') = t]]$$

This formulation is roughly patterned after the denotations for measure adverbials proposed by Moltmann (1991).² Essentially, this feature contributes what *for* might be taken to contribute in PP, with the order of arguments altered. In this respect, (29) reflects the intuition that the semantic work that might otherwise have been done by *for* here must be done by the position of the modifier itself relative to verbal functional structure.

That measure DP adverbials are always weak and do not QR, and hence have fixed in situ scope, follows in light of (29) from their property interpretation.

A structure such as (28) would thus be interpreted as in (30):

$$(30) [an\ hour\ \llbracket [+HOMOGENEOUS] \rrbracket\ sleep] \\ \llbracket [+HOMOGENEOUS] \rrbracket (\llbracket sleep \rrbracket) (\llbracket an\ hour \rrbracket) = \lambda e . sleep(e) \wedge an\text{-}hour(\tau(e)) \wedge \forall t[t \leq \tau(e) \rightarrow \exists e' [sleep(e') \wedge \tau(e') = t]]$$

3.4. Scope

Since measure DP adverbials are interpreted as arguments of a feature in a fixed position, their scopal characteristics will follow from where this position is located.

Thus, to account for narrow scope relative to the subject, the licensing feature must be below the lowest subject position (say, the VoiceP of Kratzer 1996):

2. τ maps an event to its running time, and \leq is a context-sensitive part relation (that of Moltmann 1991, 1997). Though (29) is sufficient for current purposes, a more precise formulation would reflect that the homogeneity requirement is a presupposition. This reflects a quantificational approach to representing the homogeneity requirement (Dowty 1979), but I am not aware of any compelling evidence from measure DP adverbials against having taken a measure function approach (Krifka 1989).

(31) No one slept an hour.

[no one [_{DurP} an hour [[+HOMOGENEOUS] sleep]]]

To account for narrow scope relative to negation, the licensing feature must occupy a position below Neg:

(32) Clyde didn't sleep an hour.

[n't [Clyde [_{DurP} an hour [[+HOMOGENEOUS] sleep]]]]]

Since the feature is in a fixed position in functional structure, and hence above VP, internal arguments may scope below it or QR to scope above it. Thus this approach predicts that there should be no fixed scope relative to internal arguments:

(33) Greta spoke an hour about every catastrophe.

[_{DurP} an hour [[+HOMOGENEOUS] spoke about every catastrophe]
[[every catastrophe]_I [_{DurP} an hour [[+HOMOGENEOUS] spoke about t_I]]]

This is borne out – (33) is indeed scopally ambiguous between a reading in which Greta spoke about all catastrophes over the course of an hour and one in which she spoke about each catastrophe independently for an hour.

If the DP adverbial is on a left branch, as it would be in a Cinque-style implementation, low scope relative to embedding verbs will follow as well:

(34) Greta wanted to talk an hour.

Greta wanted to [an hour [[+HOMOGENEOUS] talk]]

Since the feature in (34) is in the lower clause, it will necessarily scope below *wanted*. If a measure DP adverbial and its licensing feature are introduced in the higher clause, the resulting sentence (after verb movement) would not be the one in (34):

(35) Greta wanted an hour to talk.

Greta [an hour [[+HOMOGENEOUS] wanted to talk]]

There is no way to derive (34) from (35).

3.5. True adverbs

True adverbs may provide independent support for this approach.

On syntactic grounds, Cinque associates his DurP projection with durative adverbs such as *briefly* and Italian *lungamente* 'long'. It seems reasonable, then, to suppose that such adverbs are also interpreted as arguments of the [+HOMOGENEOUS] feature.

This would predict that all adverbs of this class should impose a homogeneity requirement. This seems to be the case:

- (36) a. Clyde slept briefly.
b. Greta ran briefly.
- (37) a. #Clyde noticed the difficulty briefly.
b. #Greta died briefly.

Similar facts obtain for *momentarily*³ and the rather marginal *lengthily*:

- (38) a. Clyde slept momentarily/lengthily.
b. Greta ran momentarily/lengthily.
- (39) a. #Clyde noticed the difficulty momentarily/lengthily.
b. #Greta died momentarily/lengthily.

Without the feature proposed above, it would be necessary to encode this homogeneity requirement independently in the denotation of each of these adverbs:

- (40) a. $\llbracket \text{briefly} \rrbracket = \lambda P_{\langle s, t \rangle} \lambda e . P(e) \wedge \text{brief}(\tau(e)) \wedge \forall t[t \leq \tau(e) \rightarrow \exists e' [P(e') \wedge \tau(e') = t]]$
b. $\llbracket \text{momentarily} \rrbracket = \lambda P_{\langle s, t \rangle} \lambda e . P(e) \wedge \text{momentary}(\tau(e)) \wedge \forall t[t \leq \tau(e) \rightarrow \exists e' [P(e') \wedge \tau(e') = t]]$
c. $\llbracket \text{lengthily} \rrbracket = \lambda P_{\langle s, t \rangle} \lambda e . P(e) \wedge \text{lengthy}(\tau(e)) \wedge \forall t[t \leq \tau(e) \rightarrow \exists e' [P(e') \wedge \tau(e') = t]]$

A means of accounting for the distribution of these adverbs would still independently be required.

Instead of (40), one might suppose these adverbs simply denote properties of intervals, as in (41), and are interpreted as arguments of the feature proposed above:

- (41) a. $\llbracket \text{briefly} \rrbracket = \lambda t . \text{brief}(t)$
b. $\llbracket \text{momentarily} \rrbracket = \lambda t . \text{momentary}(t)$
c. $\llbracket \text{lengthily} \rrbracket = \lambda t . \text{lengthy}(t)$

3. When it occurs on the right, *momentarily* also has a reading paraphrasable as ‘a moment from now’. This is not the reading at issue here.

This, then, would simultaneously capture the generalizations that both durative adverbs and measure DP adverbials occur in a particular structural position and that they systematically impose a homogeneity requirement.

3.6. Overt morphology

In languages in which Cinque's Dur head is overt, it appears to have roughly the kind of semantics suggested for the [+HOMOGENEOUS] feature here. It hosts durative particles such as Guyanese Creole *de*, which 'occurs as a durative aspect marker' (Gibson 1992); Tauya *tei* 'for a long time' (MacDonald 1990), or Central Alaskan Yupi *uma* 'for long periods' (Mithun and Ali 1996).

3.7. A note on spatial measure DP adverbials

The [+HOMOGENEOUS] feature is defined in (29) to apply to properties of intervals, and it involves a temporal trace function. To extend the account to spatial measure DPs, one might formulate a denotation neutral between these.⁴ Alternatively, one might suppose that there are two distinct features that impose temporal and spatial homogeneity.

Despite appearances, though, it may be that spatial measure DPs are only apparently spatial and actually temporal. If Clyde is traveling as a passenger in a car, (42) may be true:

(42) Clyde slept several miles.

If Clyde is sleeping fitfully in bed, however, rolling back and forth, and the bed is several feet across, (43) is not true:

(43) Clyde slept several feet.

Yet it seems clear that the spatial trace of Clyde's sleeping extends several feet. Even in a pragmatically somewhat less plausible circumstance in which Clyde rolls across his bed exactly once during the course of the night, without ever retreating, (43) would not be true. (Thus even what Krifka 1998 calls 'strict movements' may not be sufficient.)

4. Perhaps what is required is something like (i), again in the spirit of Moltmann (1991), where Q is a property of intervals or regions, a is an interval or region, and at is a relation between an event and an interval or region that coincides with it (i.e., is either the temporal or spatial trace of e):

(i) $\llbracket [+HOMOGENEOUS]_{\text{Dur}} \rrbracket = \lambda P_{\langle s,t \rangle} \lambda Q \lambda e \exists a [P(e) \wedge at(e,a) \wedge Q(a) \wedge \forall b [b \leq a \rightarrow \exists e' [P(e') \wedge at(e',b)]]]$

What this may be taken to suggest, then, is that at least certain spatial measure DPs are in fact instances of spatial nouns coerced into temporal interpretations in particular circumstances that naturally support this effect.⁵

4. Some general consequences

In the approach suggested here, part of the apparent semantic contribution of a modifier – a measure DP adverbial or a *briefly*-class adverb – is attributed instead to a fixed position in functional structure. Since correlations of this sort between the position and interpretation of modifiers are quite common, perhaps this approach might fruitfully be applied to the interpretation of other modifiers.

Many modifiers, for example, change interpretation with structural position in ways other than scope: *happily* manifests this effect in *Happily, Floyd would happily have played his tuba happily* (example patterned after Jackendoff 1972). It seems natural to suppose that in such an example, each instance of *happily* has its lexical semantics supplemented by the semantics contributed by the position it occupies.

Correspondingly, modifiers belonging to a class with a particular syntactic distribution often also share semantic characteristics, in a way that must normally be stipulated individually for each modifier of the class. This was observed for *briefly* adverbs above, but also appears to be the case for subject-oriented adverbs, for example. Wyner (1998) has argued that subject-oriented adverbs, such as *deliberately* or *reluctantly*, identify the holder of an agent role in an eventuality with the experiencer of a particular state. They also occur in a restricted range of positions. If it is merely a lexical accident that all the adverbs that are sensitive to the agent role occur in these positions, one would expect there to be exceptions. Yet every subject-oriented adverb seems to have the same distribution, and there are no adverbs like subject-oriented ones that target some thematic role other than agent. Again, one may conjecture that this is because the semantics of subject-orientedness is contributed at least partly by the position these adverbs occupy rather than by the lexical semantics of the adverbs.

So there may quite generally be some benefit in supposing that part of the apparent semantics of a modifier may actually be contributed by its position through the syntactic feature that licenses it.

5. Strong DP adverbials manifest what may be a similar effect. One may claim of an assembly-line worker in a chair factory that she took a break *every third chair*.

5. A concluding remark

What has been suggested here is a means of interpreting measure DP adverbials in which their semantics arises in part directly from their position, through the feature in functional structure that licenses them. This feature imposes a homogeneity requirement, occupies a fixed low position in the clause, and is implicated in the interpretation of durative adverbs as well.

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