# A semantics for durative adverbials

Christopher Piñón
pinon@phil-fak.uni-duesseldorf.de

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**Abstract**

Shortcomings of existing analyses of durative adverbials are reviewed and a new approach is proposed with an aim at overcoming these shortcomings. Characteristic of the new approach is that it considerably *weakens* the core semantics of durative adverbials and that it builds in a notion of *distribution* that seems essential for treating combinations of durative adverbials and frequency adverbials.

# Two analyses of durative adverbials

Examples of durative adverbials in English: *for twenty minutes*, *all day*, *the whole month*, *throughout the morning*.

Durative adverbials are familiar from the aspectual literature as a standard diagnostic for distinguishing *states* and *activities* from *accomplishments* and *achievements*:

(1) a. [Peter was sad] all day. (state)
b. [Mary swam] for forty minutes. (activity)

(2) a. #[Peter solved the homework problem] all afternoon. (accomplishment)
b. #[Mary won the race] for a fraction of a second. (achievement)

Broadly speaking, there are two analyses of durative adverbials in the literature:

- the *measure function analysis*
- the *quantificational analysis*

The measure function analysis is advocated in Krifka [5] (see Eckardt [3], de Swart [7], and Zucchi [9] for variations), and the quantificational analysis is proposed in Dowty [2] (see Hinrichs [4], Abusch and Rooth [1], and Moltmann [6] for variations).

The hallmark of the **measure function analysis** is that durative adverbials denote functions that measure the duration of events (where 'event' is used in the broad sense). Thus, the durative adverbial in (1-b) would be analyzed as asserting that the duration of the event in which Mary swam is (at least) forty minutes, as in (3), where $Min$ denotes a function that measures the duration of events in terms of minutes and $\tau$ denotes a function that maps events to their 'run times'.

(3) for forty minutes $\rightsquigarrow$
$\lambda P \lambda e[P(e) \wedge Min(\tau(e)) \geq 40]$

**Critique.** While this analysis may seem plausible for (1-b), it is much less so for examples such as the following:

(4) a. Mary swam for six months.

b. Peter slept in his office for five weeks.

On the most natural reading of (4-a), there is no event of swimming that lasted six months. Rather, what is understood that Mary swam at regular intervals over a period of six months and that there were naturally plenty of times during that period when she did not swim. Similarly, in (4-b) there is no event of sleeping that lasted five weeks—what is understood is that Peter slept in his office at regular intervals (whenever he slept) over a period of five weeks. The measure function analysis, in its insistence on measuring the duration of events, fails to account for examples like (4) where significant temporal gaps are part and parcel of the interpretation.

Another problem that the measure function analysis faces is that it is not clear why durative adverbials should be incompatible with accomplishments/achievements, as in (2). In fact, Krifka [5, p. 98] is forced to add a 'well-formedness condition' to the interpretation of durative adverbials that has the effect of explicitly excluding accomplishments/achievements:

(5) for forty minutes $\rightsquigarrow$
$\lambda P \lambda e[P(e) \wedge Min(\tau(e)) \geq 40/$
$Qmod(P, \lambda P \lambda e[P(e) \wedge$
$Min(\tau(e)) \geq 40])]$
(adapted from Krifka [5, (15), p. 98])

However, while it is always possible to add such a well-formedness condition, it would be more enlightening to have the incompatibility with accomplishments/achievements follow from the core semantics of durative adverbials. The measure function analysis falls short in this respect.

**Conclusion.** The measure function analysis, unless significantly revised, fails to satisfactorily address the problem of temporal gaps and of distinguishing states/activities from accomplishments/achievements.

The central idea behind the **quantificational analysis** is that the meaning of durative adverbials introduces a time of a certain length, universally quantifies over its temporal parts, and asserts that an event of the given type takes place at each part (where the part relation is improper). Thus, (1-b) would be analyzed as stating that there is a time lasting (at least) twenty minutes and for any temporal

part of it there is an event in which Mary swims that took place at that part:

(6) for forty minutes $\rightsquigarrow$
$\lambda P \lambda e[\exists t[P(e) \wedge Min(t) \geq 40 \wedge$
$\tau(e) = t \wedge$
$\forall t'[t' \sqsubseteq t \rightarrow$
$\exists e'[P(e') \wedge \tau(e') = t']]]]$

**Critique.** Without restricting the universal quantification over parts of the time in question, the quantificational analysis does not account for (1-b), let alone (4). Events of swimming require much longer than an instant to transpire, and so it is never literally true that there is an event in which Mary swims that takes place at an instant. However, even assuming that we somehow restrict the quantification to those times that are 'large enough', (4) is still a problem, precisely because we want to ignore a great many times that *are* 'large enough' (namely, all of those times during which Mary or Peter is engaged in something else). In other words, the quantificational analysis also fails to adequately address the problem of temporal gaps.

A positive feature of the quantificational analysis

is that it succeeds in distinguishing states/activities from accomplishments/achievements without resorting to an additional stipulation. By asserting that an event of the given type takes place at every part of the time in question, a sort of *repetition* is forced that is characteristic of states/activities but not of accomplishments/achievements. Thus, the durative adverbial in (2-a) would require that there be numerous events in which Mary solves the homework problem that took place throughout the afternoon, but this is precisely the sort of repetition that the accomplishment/achievement excludes.

However, despite this advantage, the quantificational analysis faces difficulties with examples such as the following:

(7) Mary swam frequently/regularly/twice a week for six months.

We do not understand (7) to mean that Mary swam frequently/regularly/twice a week at every part of a time lasting two years. The quantificational analysis, which requires events of the given type to fill the time in question, fails on such examples (Vlach [8] makes a similar point).

Note that examples like (7) are a problem for the measure function analysis as well, precisely because it is not the *event* in which Mary swims frequently/regularly/twice a week but rather the *time* over which Mary's swimming is distributed that lasted six months.

**Conclusion.** Although the quantificational analysis is more successful than the measure function analysis in distinguishing states/activities from accomplishments/achievements, it has the disadvantages of forcing events to occur at the shortest times, of not handling temporal gaps, and of ignoring the role of frequency adverbials.

# A new approach

The strategy of the new approach is twofold:

- to *weaken* the meaning of durative adverbials
- to build a notion of *distribution* into the meaning of durative adverbials

Preliminary domains and relations that are presupposed:

- a domain of *ordinary objects*: $x$, $y$, $z$, . . .
- a domain of *events*: $e$, $e'$, $e''$, . . .
- a domain of *times*: $t$, $t'$, $t''$, . . .
- a relation of *proper part* on all three domains: $\sqsubset$
- a relation of *abutting* on all three domains: $\bowtie$
- a relation of *temporal precedence* on events or times: $\prec$

- a *temporal trace* function from events to times: $\tau$

Moreover, it is useful to generalize over the following domains:

- the domains of events or times: $v$, $v'$, $v''$, . . .
- the domains of ordinary objects, events, or times: $a$, $b$, $c$, . . .

Several mereological definitions based on identity and proper part:

(8) a. $a \sqsubseteq b := a \sqsubset b \vee a = b$
(*a* is a part of *b*)

b. $a \circ b := \exists c[c \sqsubseteq a \wedge c \sqsubseteq b]$
(*a* and *b* overlap)

c. $\sigma(P) := \iota a[\forall b[b \circ a \leftrightarrow \exists c[P(c) \wedge c \circ b]]]$
(the sum of objects of type *P*)

d. $a \oplus b := \sigma(\lambda c[c \sqsubseteq a \vee c \sqsubseteq b])$
(the sum of *a* and *b*)

e. $Built(a, P) := a = \sigma(\lambda b[b \sqsubseteq a \wedge P(b)])$
(*a* is built out of objects of type *P*)

A couple of definitions based on identity, abutting, and proper part:

(9) a. $Con(a) := \forall b \forall c[b \oplus c = a \wedge \neg(b \circ c) \rightarrow b \bowtie c]$
(*a* is (self-)connected)

b. $Con_{Max}(a, P) := Con(a) \wedge P(a) \wedge \neg\exists b[a \sqsubset b \wedge Con(b) \wedge P(b)]$
(*a* is maximally (self-)connected relative to *P*)

**Analysis.** Central to the semantics of durative adverbials is a relation $Rep$:

(10) $Rep(e, t, P) := Built(e, P) \wedge \tau(e) \sqsubseteq t \wedge \exists e' \exists e''[e' \sqsubseteq e \wedge e'' \sqsubseteq e \wedge e' \prec e'' \wedge P(e') \wedge P(e'')]$
(*e* is repetitive under *t* relative to *P*)

The idea is that the meaning of durative *for* entails the relation $Rep$ by way of a *distribution* relation:

(11) $\text{for}_1$ (dur.; with an explicit freq. adv.) $\rightsquigarrow \lambda Q \lambda R \lambda P \lambda e[\exists t[Q(t) \wedge R(e, t, P)]]$, $= for_1$

Principles that help specify the relation $R$:

(12) a. $\forall e \forall P \forall R \forall Q [for_1(e, P, R, Q) \rightarrow Distr(R)]$
(*for*$_1$ entails that *R* is a distribution)

b. $\forall R [Distr(R) \rightarrow \forall e \forall t \forall P [R(e, t, P) \rightarrow Rep(e, t, P)]]$
(*R* entails repetition)

Frequency adverbials are analyzed as distribution relations:

(13) a. frequently $\rightsquigarrow$
$\lambda P \lambda t \lambda e [Rep(e, t, P) \wedge \neg Con(e) \wedge Card(\lambda t' [t' \sqsubseteq t \wedge S(t') \wedge \exists e' [e' \sqsubseteq e \wedge \tau(e') \sqsubseteq t' \wedge P(e')]]) > n_{Expect}]$

b. frequently on Mondays $\rightsquigarrow$
$\lambda P \lambda t \lambda e [Rep(e, t, P) \wedge \neg Con(e) \wedge Card(\lambda t' [t' \sqsubseteq t \wedge Monday(t') \wedge \exists e' [e' \sqsubseteq e \wedge \tau(e') \sqsubseteq t' \wedge P(e')]]) > n_{Expect}]$

The following example is derived by applying *for six months* first to *frequently* and then to *Mary swam* (ignoring tense):

(14) [[Mary swam] [[frequently] for$_1$ six months]] $\rightsquigarrow$

$\lambda e[\exists t[Month(t) \geq 6 \wedge$
$Rep(e, t, Mary\text{-}swim) \wedge \neg Con(e) \wedge$
$Card(\lambda t'[t' \sqsubseteq t \wedge S(t') \wedge$
$\exists e'[e' \sqsubseteq e \wedge \tau(e') \sqsubseteq t' \wedge$
$Mary\text{-}swim(e')]]) > n_{Expect}]]$

An example such as *Mary swam frequently on Mondays for six months* has a similar derivation, except that the *frequently* first applies to *on Mondays*.

As a first step in treating durative adverbials used without an explicit frequency adverbial, we define the relation $Pause$:

(15) $Pause(t', t, e, P) := t' \sqsubseteq t \wedge$
$Con_{Max}(t', Con) \wedge \tau(e) \sqsubseteq t \wedge$
$\neg\exists e'[t' \sqsubseteq \tau(e') \wedge e' \sqsubseteq e \wedge P(e')]$
($t'$ of $t$ is a pause in $e$ relative to $P$)

When *for*-phrases are used without an explicit frequency adverbial, there is an understood distribution. Describing this distribution is not straightforward. The following makes use of an undefined relation $Interrupt$:

(16) $\text{for}_2$ (dur.; no explicit freq. adv.) $\rightsquigarrow$

$$\lambda Q \lambda P \lambda e[\exists t[Q(t) \wedge Rep(e,t,P) \wedge \Diamond_{epis} \exists e'[\tau(e') = t \wedge P(e')] \rightarrow \forall t'[Pause(t',t,e,P) \rightarrow Interrupt(t',t,e,P)] \wedge \neg \Diamond_{epis} \exists e'[\tau(e') = t \wedge P(e')] \rightarrow \neg Con(e) \wedge \forall t'[t' \sqsubseteq t \wedge S(t') \wedge \exists e'[e' \sqsubseteq e \wedge \tau(e') \sqsubseteq t' \wedge P(e')]]]$$

A minor principle for interruptions (others are needed as well):

(17) $Interrupt(t',t,e,P) \rightarrow Pause(t',t,e,P)$
(interruptions are pauses)

# References


[1] Dorit Abusch and Mats Rooth. 1990. Temporal adverbs and the English perfect. *Proceedings of NELS* 20, v. 1, ed. Juli Carter, Rose-Marie Déchaine, Bill Philip, and Tim Sherer, 1–15. Amherst, MA: GLSA, Department of Linguistics.

[2] David R. Dowty. 1979. *Word meaning and Montague Grammar: The semantics of verbs and times in Generative Semantics and in Montague's PTQ*. Dordrecht: D. Reidel Publishing Co.

[3] Regine Eckardt. 1996. Wieviel Ambiguität braucht ein Lexikon? Eine Analyse der Proc-Acco-Konstruktionen. *Arbeiten des Sonderforschungsbereiches 282*, n. 89, Universität Düsseldorf.

[4] Erhard Hinrichs. 1985. *A compositional semantics for Aktionsarten and NP reference in English*. PhD dissertation, Ohio State University.

[5] Manfred Krifka. 1989. Nominal reference, temporal constitution and quantification in event semantics. Semantics and contextual expression, ed. Renate Bartsch, Johan van Benthem, and Peter van Emde Boas, 75–115. Dordrecht: Foris Publications.

[6] Friederike Moltmann. 1991. Measure adverbials. *Linguistics and Philosophy* 14: 629–660.

[7] Henriëtte de Swart. 1998. Aspect shift and coercion. *Natural Language and Linguistic Theory* 16: 347–385.

[8] Frank Vlach. 1993. Temporal adverbials, tenses and the perfect. *Linguistics and Philosophy* 16: 231–283.

[9] Sandro Zucchi. 1998. Aspect shift. *Events and grammar*, ed. Susan Rothstein, 349–370. Dordrecht: Kluwer Academic Publishers.