Adverbs of Change, Aspect, and Anaphoricity

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The puzzle Adverbs of change like quickly or slowly (also called “adverbs of space and time” in Cresswell 1978) are typically classified as manner adverbs that characterize the rate at which the described action evolves (Jackendoff 1972; Bellert 1977; Parsons 1990; Ernst 2004). For example, (1) characterizes as quick the way Selena moved her body.

(1) Selena ran quickly.

However, adverbs of change are known to give rise to a number of non-manner interpretations as well (Cresswell 1978; Travis 1988; Pustejovski 1991; Shaer 1998; Tenny 2000; Schäfer 2002; Ernst 2004; Thompson 2006; Kearns 2007; Eszes 2009; Rawlins 2013). Duration readings modify the temporal extent of the whole event (2) and anaphoric readings measure the temporal distance between (some part of) the described event and some previously mentioned event (3).

(2) Selena finished the assignment quickly.
(3) The professor walked in. Selena quickly noticed him.

There are systematic and revealing correlations between available interpretations and lexical aspect that have not been fully analyzed in the literature but give important insight into event modification and aspectual structure. When modifying activity predicates, adverbs of change can only have manner readings (1). With accomplishment predicates, such adverbs are ambiguous between manner vs. duration readings (4), and can also take on anaphoric readings (5). When modifying achievement predicates, adverbs of change are read anaphorically (3), and they are generally incompatible with stative predicates (6). Table 1 on p.3 summarizes the full pattern.

(4) Jack built the house quickly.
   a. manner: Jack moved fast while he was building the house.
   b. duration: The event of Jack’s building the house took a short period of time.
(5) The tiger walked into the room. Lenard quickly moved to the window.
(6) ?She quickly liked her job.

Previous work Cresswell (1978) proposes that quickly modifies motion predicates and measures the ratio between the distance traveled and time passed. He attributes manner/duration ambiguities to a structural ambiguity whereby quickly attaches to the verb alone or the entire VP (respectively), but fails to explain anaphoric readings. Rawlins (2013) derives the manner/duration contrast by letting adverbs of change distribute over atomic events relative to an unspecified event property, which is contextually resolved to the verb or the VP. He argues that when read anaphorically, adverbs of change modify so-called “narrative events” (eventive counterparts of Reichenbachian “reference times”), yet ignores the role of aspect. But if narrative events were real, there would be no reason why adverbs of change with activities or states cannot have anaphoric interpretations.

Proposal A dynamic semantic account can overcome the main stumbling block for previous analyses of adverbs of change, i.e. anaphoric readings. I develop a compositional update semantics that represents events in a neo-Davidsonian fashion (e.g. Parsons 1990) and facilitates discourse
anaphoric readings (cf. Muskens 1996; Bittner 2011). The derived representation for (7) is as shown ($e$ is an event discourse referent introduced through existential closure; $x$ and $P$ are referents introduced by the subject and the verb, respectively; $\land$ is read dynamically or left-to-right).

(7)  Kurt ran $\sim \exists e \land \exists x \land x = kurt \land ag(e) = x \land running(e) \land \exists P \land P = \lambda e'. \text{running}(e')$

I propose that adverbs of change modify the temporal distance between an ANCHOR and a TARGET event. The target is the culmination of the described event $e$ (marked as cul($e$)) while the anchor (marked as $a$) is resolved anaphorically and is temporally anterior to the target. Specifically, quickly measures the temporal distance ($\delta$) between two events and compares it to the arithmetic mean ($\mu$) of alternative distances, given different values for $a$ and $e$ provided by assignments in the information state (8). To derive manner readings, I assume that quickly freely combines with a covert distributivity operator $D_X$ (9), where $X$ is an unbound event predicate variable and atom($e, X$) stands for the set of atoms in $e$ that still fall under $X$. The result of composing $D_X$ with quickly is shown in (10). (11)-(12) schematize the modified VP, either directly by quickly or through the intermediaries of $D_X$. (It is assumed that in (12) $X$ resolves $P$, the variable introduced by the VP.)

(8)  quickly$_a \sim \lambda e. \delta(a, \text{cul}(e)) < \mu(a, \text{cul}(e))$

(9)  $D_X \sim \lambda P \lambda e. \forall e' (e' \in \text{atom}(e, X), \delta(a, \text{cul}(e')) < \mu(a, \text{cul}(e')))$

(10)  $D_X \text{quickly}_a \sim \lambda e. \forall e' (e' \in \text{atom}(e, X), \delta(a, \text{cul}(e')) < \mu(a, \text{cul}(e')))$

(11)  $\text{VP}^P \text{quickly}_a \sim \lambda e. \exists P \land VP(e) \land P = \lambda e'. VP(e') \land \delta(a, \text{cul}(e)) < \sigma(a, \text{cul}(e))$

(12)  $\text{VP}^P [D_X \text{quickly}_a] \sim \lambda e. VP(e) \land \exists P \land P = \lambda e'. VP(e') \land \forall e' (e' \in \text{atom}(e, P), \delta(a, \text{cul}(e')) < \sigma(a, \text{cul}(e')))$

The main claim of this paper is that the attested interpretations for adverbs like quickly naturally fall out from the temporal ontology of events with different aspectual properties (cf. Moens & Steedman 1988; Kamp & Reyle 1993; Smith 1997). This is modeled as part-whole structures (Bach 1986; Krifka 1992; Link 1998) and is graphically outlined in Figure 1 on p.3, where black dots mark culminations. First, quickly cannot compose with stative VPs (with or without a distributivity operator) because states are homogenous events that do not culminate, so cul is undefined. Next, achievements are instantaneous and (11)-(12) produce equivalent interpretations, as in (12) the distribution is over a singleton set (of the described event). The only predicted reading is thus an anaphoric one. Finally, activities represent processes and accomplishments add a culmination point. (Processes are chains of events that have the structure of accomplishments.) (11) is ruled out for activity VPs because no unique culmination exists (cul is undefined) while (12) derives a manner reading, provided that $a$ is resolved to the beginning of each $e'$. For accomplishment VPs, (11) produces an anaphoric/duration reading, depending on whether $a$ is resolved to some previous event or the beginning of the described event (respectively). (12) makes available a manner reading, if $X$ is resolved to the verb alone (not represented above). If $X$ is resolved to $P$ (the entire VP), we once again get a duration/anaphoric interpretation, depending on how $a$ is resolved.

Extensions  Since in manner readings the distributivity operator variable needs to be bound to an activity main verb, the account correctly predicts that preverbal occurrences of adverbs of change cannot naturally describe manners (cf. ?Quickly, he ran / ?He quickly ran). Also, the account offers enough flexibility to accommodate the fact that adverbs of change like slowly seem to lack anaphoric readings (cf. The professor walked in. ?Justin slowly noticed him).
<table>
<thead>
<tr>
<th>activities</th>
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<td>states</td>
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Table 1: Readings for adverbs of change with different aspectual classes

states achievements activities accomplishments

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Figure 1: Graphical representation of lexical aspect distinctions