

Adverbs of Change



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Abstract Adverbs of change like *quickly* or *slowly* are known to give rise to a number of interpretations. For example, *Selena ran quickly* says that the rate of running is high while *Selena quickly noticed the plane* implies that the distance between the event of noticing the plane and some previous event is short. Existing accounts (e.g., Cresswell in Formal semantics and pragmatics for natural languages. Reidel, pp 171–199, 1978; Rawlins in Studies in the composition and decomposition of event predicates. Springer, Dordrecht, pp 153–193, 2013) take rate readings as primary but struggle to derive additional interpretations. By contrast, I argue that adverbs of change measure the temporal distance between two salient events (or event parts) that are compositionally or contextually available. The main claim of the paper is that adverbs of change have a single if underspecified semantics and that the different interpretations arise through interaction with aspectual and discourse structure.

Keywords Adverbial modification · Change · Aspect · Underspecification
Context · Event semantics

1 The Class of Adverbs of Change

Change is a fundamental part of the human experience and not surprisingly it is amply represented in natural language. Languages can express change directly, i.e., by means of verbal predicates with certain aspectual properties, or indirectly, e.g., by building narratives or specifying how discourse interaction evolves. This paper investigates the semantics of change through the lens of one understudied class of adverbs, which modify the dimensions of change and offer a unique window into the different ways this notion is grammatically or pragmatically encoded.

Modifiers like *quickly*, *rapidly*, *fast*, *swiftly*, *hastily*, *slowly*, *sluggishly*, *glacially*, *suddenly*, *abruptly*, *instantaneously*, *immediately*, *gradually*, etc. are typically classified as manner adverbs (Jackendoff 1972; Travis 1988; Parsons 1990; Ernst 2004;

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26 Maienborn and Schäfer 2011; Morzycki 2015). This paper argues that such adverbs
 27 display interpretations that barely count as “manner” and should rather be viewed as
 28 constituting a class in its own right. Intuitively, such modifiers add some dimension
 29 to the change explicitly or implicitly implied by the sentence, e.g., by characterizing
 30 the rate at which the described action evolves, by measuring the time until change
 31 occurs, or by specifying the nature of the change as instant or gradual. I thus call
 32 such modifiers **adverbs of change**, somewhat in line with Rawlins’ (2013) term
 33 “adverbs of time and change”. Other names include “adverbs of space and time”
 34 or “motion adverbs” (Cresswell 1978), “celerative” adverbs (Cinque 1999), “rate
 35 adverbs” (Tenny 2000; Kearns 2007), or “aspect-manner adverbs” (Ernst 2004).

36 I will not try to do justice to the entire class of adverbs of change but will rather
 37 focus on *quickly* and *slowly*, and offer a few suggestions about *suddenly* and *grad-*
 38 *ually*. I will propose that modifiers like *quickly* or *slowly* measure the temporal
 39 distance between a point of change and some salient event, e.g., a previously men-
 40 tioned event or the event of uttering the sentence. The main claim of the paper is that
 41 adverbs of change are not ambiguous, despite their many readings. Rather, they have
 42 an underspecified yet uniform semantics that interacts with aspectual and discourse
 43 structure.

44 The paper is structured as follows: Section 2 sorts out the range of possible inter-
 45 pretations for adverbs of change. Section 3 demonstrates that the availability of these
 46 interpretations heavily depends on the aspectual properties of the modified predi-
 47 cate. Section 4 critically evaluates previous work, and Sect. 5 presents the proposal.
 48 Section 6 is the conclusion.

49 2 The Range of Available Interpretations

50 It has been noticed that adverbs of change can give rise to a wide range of interpreta-
 51 tions (Cresswell 1978; Travis 1988; Pustejovski 1991; Shaer 1998; Tenny 2000;
 52 Schäfer 2002; Ernst 2004; Thompson 2006; Kearns 2007; Eszes 2009; Rawlins
 53 2013). Although there is little agreement on what these interpretations are, they seem
 54 to fall into the following categories (although not necessarily under the same labels):
 55 (i) **rate**, (ii) **duration**, (iii) **narrative**, and (iv) **deictic/indexical**. A rate reading for
 56 *quickly* is illustrated below.

- 57 (1) Selena ran quickly.

58 Rate readings are sometimes called “manner” readings, but it is unclear whether these
 59 are two distinct readings or perhaps two labels for one and the same reading. Under
 60 a manner reading, (1) characterizes as fast the way Selena moved her body parts;
 61 under a rate reading, (1) describes as high the speed at which Selena moved through
 62 space. In principle, these two readings are logically independent, and when they are
 63 empirically distinguished the “rate” characterization seems more appropriate.

64 (2) *Selena ran on ice. She was moving her legs fast, but due to the little friction*
 65 *she was advancing with a low velocity.*

66 Selena ran $\left\{ \begin{array}{l} ?\text{quickly}_{\text{manner}} \\ \text{slowly}_{\text{rate}} \end{array} \right\}$.

67 (3) *Selena ran with a jet pack on her back. She was moving her legs slowly, but*
 68 *due to the thrust from the jet pack she was advancing with a high velocity.*

69 Selena ran $\left\{ \begin{array}{l} \text{quickly}_{\text{rate}} \\ \#\text{slowly}_{\text{manner}} \end{array} \right\}$.

70 Since only the rate component of the running event in (2)–(3) appears accessible
 71 to modification by an adverb of change, I will prefer the “rate” terminology as
 72 empirically more adequate.

73 Duration readings concern the temporal extent of whole events.¹ For example,
 74 (4) describes as short the temporal extent of the complete assignment-writing event,
 75 relative to some contextually given standard. Two naturally occurring examples of
 76 duration readings are given in (5)–(6).

77 (4) Harry completed the assignment quickly.

78 (5) Recently, emphasis on EST sequencing has waned due to the advent of next
 79 generation sequencing techniques that can quickly dissect a transcriptome.

80 (COCA)

81 (6) Students were instructed to complete the maze as quickly and as accurately
 82 as possible. (COCA)

83 Notice that rate and duration readings need not depend on one another, even when the
 84 relevant sentences describe the same event. For example, *John drove quickly* (a rate
 85 reading) does not entail *John drove quickly from Los Angeles to Denver* (a duration
 86 reading); the first will be true and the second false if John drove at speed limit but
 87 passed through San Francisco. Also, *John wrote his dissertation quickly* could be
 88 true without *John wrote quickly* being true, so duration readings do not entail rate
 89 readings either.

90 Unlike the previous two interpretations, which target a single event, narrative
 91 readings connect two different events (Shaer 1998). The sentence in (7) carries the
 92 implication that the time interval between the event described by the first clause
 93 and the one described by the second clause was short. The adverbs of change in the
 94 naturalistic examples in (8)–(9) receive a similar interpretation.

95 (7) The professor walked in and Selena $\left\{ \begin{array}{l} \text{quickly} \\ \text{immediately} \end{array} \right\}$ noticed him.

96 (8) A low sound came from the direction of the bed, and Addy swiftly moved to
 97 the window. (COCA)

¹Such readings are given different names in the literature, including “ratio” (Cresswell 1978), “whole event” (Thompson 2006), or “extent” readings (Rawlins 2013).

- 98 (9) Sam pulled over but immediately realized that whatever he had hit was behind
 99 him, in an area where it was too dark for him to see. (COCA)

100 Finally, indexical (or deictic) uses of adverbs of change arise with nonassertive
 101 speech acts and modify the time between the current speech event and some projected
 102 discourse-relevant move, e.g., the act of fulfilling a promise, answering a question,
 103 obeying a command, etc.

104 (10) I promise to quickly write you back.

105 (11) Quickly, what were the main causes of the Russian Revolution?
 106 (Shaer 1998: 13)

107 (12) Quickly, talk to Alfonso. (Rawlins 2013: 174)

108 To summarize, adverbs of change can take on different interpretations: rate, dura-
 109 tion, narrative, indexical. These interpretations seem to describe properties of change
 110 along some concrete or abstract dimension, yet otherwise appear to have little in com-
 111 mon. Below, I will argue that this puzzling semantic diversity does not arise through
 112 lexical ambiguity but rather is due to interaction with aspectual and discourse factors.

113 3 Interaction with Aspect

114 There are systematic and revealing interactions of adverbs of change with aspectual
 115 factors. I first briefly introduce the traditional aspectual classes and then discuss how
 116 predicates with different aspectual properties restrict available interpretations.

117 Aspect refers to the “different ways of viewing the internal temporal constituency
 118 of a situation” (Comrie 1976: 3) by means of verbal predicates which differ across
 119 properties like cumulativity, divisibility, quantization, telicity, durativity, homogene-
 120 ity, dynamicity, agentivity, scalar change, etc. (Vendler 1957; Kenny 1963; Dowty
 121 1979; Bach 1981, 1986; Krifka 1989, 1992; Parsons 1990; Smith 1997; Rothstein
 122 2004; Beavers 2013; a.o.). Ever since Vendler (1957), the denotations of verbal pred-
 123 icates are traditionally divided into four major classes: **activities**, **accomplishments**,
 124 **achievements**, and **states**.² Activity predicates like *run*, *push the cart*, *sleep*, *watch*
 125 *TV* refer to processes without specified initial or terminal points but have crisp inter-
 126 nal structure, consisting of chains of minimal events which share certain properties.
 127 Accomplishments are described by predicates like *run a mile*. These are protracted
 128 events that end in a culmination. Achievements are instantaneous events and are
 129 described by predicates like *spot a plane*.³ Finally, states are expressed by verbs like

²I put aside degree achievement predicates like *melt*, *freeze*, *widen*, which express a change of state and can be telic or atelic (Dowty 1979; Hay et al. 1999; Kearns 2007; Kennedy and Levin 2008; Rothstein 2008) as well as semelfactive predicates like *knock* or *cough*, which refer to achievement-like events but can be iterated (Smith 1997; Rothstein 2008).

³Ignored here are Bach’s (1986) “culminations”, i.e., predicates like *win the race* or *reach the summit*, which have the properties of Vendler’s achievements but include preliminary stages.

130 *love* or *know*. Like activities they set no specific boundaries, but unlike them they
 131 are homogeneous, i.e., lack minimal parts.⁴

132 Aspect has a distinct effect on available interpretations for adverbs of change.
 133 When modifying activity predicates, such adverbs can only have rate readings. As
 134 Thompson (2006) points out, (13) means that John moved fast while pushing the cart
 135 and cannot have, say, a durative interpretation, whereby the action of pushing the
 136 cart took a short period of time. Rawlins (2013) makes similar remarks about (14).

137 (13) John pushed the cart quickly. (Thompson 2006: 219)

138 (14) Alfonso ran quickly as compared to Joanna. (Rawlins 2013: 155)

139 What these authors fail to notice, though, is that not all activity predicates can be
 140 modified by adverbs of change. For example, *sleep* or *watch TV* cannot.

141 (15) John slept $\left\{ \begin{array}{l} \text{?quickly} \\ \text{\#slowly} \end{array} \right\}$.

142 (16) Alfonso watched TV $\left\{ \begin{array}{l} \text{\#quickly} \\ \text{\#slowly} \end{array} \right\}$.

143 What semantic property is responsible for the contrast in judgment between (13)–
 144 (14) and (15)–(16)? One potential explanation is that adverbs of change draw a
 145 line between **motion** versus **non-motion** predicates. Cresswell (1978), for example,
 146 explicitly states that adverbs of change select for motion predicates (for discussion,
 147 see Sect. 4.1 below). While this is clearly false for non-activity predicates (e.g.,
 148 *complete the assignment* does not express physical motion but can be modified by
 149 adverbs of change), the processes in (13)–(14) indeed fall into this category. However,
 150 processes described by *talk* or *eat* are not tied to motion in any obvious way and yet
 151 are acceptable with adverbs of change (cf. *Lucy ate slowly*).

152 Another idea is that adverbs of change are sensitive to the homogeneity of the
 153 modified eventuality. It is generally accepted that states and processes are divisible,
 154 in the sense that they can have proper parts that are of the same kind (Bennett and
 155 Partee 1978; Dowty 1979; Bach 1981; Krifka 1989; Champollion and Krifka 2016),
 156 while accomplishments or achievements are not. However, Landman and Rothstein
 157 (2012) claim that activities are only “incrementally” homogeneous, as they take
 158 time to develop, whereas states are strictly homogeneous and can be true at instants.
 159 Within the former class, Taylor (1977) and Dowty (1979) draw a distinction between
 160 activities that are **heterogeneous** (or divisible down to some contextually determined
 161 granularity; e.g., *walk* or *talk*) versus activities that are **homogeneous** (or endlessly
 162 divisible; e.g., *move* or *fall*). So perhaps adverbs of change can modify heterogeneous
 163 activities, as in (13)–(14), but not homogeneous activities, as in (15)–(16). But in
 164 fact adverbs of change readily attach to homogeneous predicates like *move* or *fall*
 165 (cf. *The car moved quickly*).

⁴Alternatively, states may be assumed to have minimal parts that are unstable, underdetermined or vague, and thus difficult to individuate (cf. Chierchia 2010; Rothstein 2010).

166 I argue that the relevant notion here is change rather than homogeneity. I propose
 167 that there are two types of activity predicates, **dynamic** (e.g., *run, move, talk*) versus
 168 **non-dynamic** (e.g., *sleep, watch TV, rain*), and that only those of the former type
 169 can be modified by adverbs of change, the intuitive reason being that only the former
 170 predicates express change. As far as I know, the distinction between dynamic versus
 171 non-dynamic activities has not been much explored in the aspectual literature.⁵ What
 172 is crucial is that this distinction is not just a stipulation; linguistic processes like
 173 adverbial modification can be sensitive to it.

174 Cresswell (1978), Thompson (2006) and Rawlins (2013) claim that, when combined
 175 with accomplishment predicates, adverbs of change are ambiguous between
 176 rate versus duration readings. According to Cresswell, the rate reading of (17) says
 177 that John walked quickly and his walking was to the station, while the duration
 178 reading of (17) says that John's walking was a quick walking to the station.

179 (17) John walked quickly to the station. (Cresswell 1978: 181)

180 Rawlins (2013: 154) seconds this claim and additionally argues that rate and duration
 181 readings can be distinguished by different measure phrases inside comparative forms,
 182 citing the following examples.

183 (18) Alfonso ran to the park quickly.

184 a. Alfonso ran to the park 2 miles per hour more quickly than Joanna. (rate)
 185

186 b. Alfonso ran to the park 2 minutes more quickly than Joanna. (duration)

187 In (18a), *2 miles per hour* modifies the rate of the running while in (18b) *2 minutes*
 188 tells us something about the temporal extent of the entire event. However, while (18b)
 189 is uncontroversial, some English speakers I consulted do not find (18a) acceptable.
 190 Notice also that when the extent reading is explicitly denied in a follow-up clause, a
 191 rate reading is not readily available.

192 (19) ? Alfonso ran to the park quickly, but it took him a long time to get there.

193 (20) # The plane fell to the ground quickly, but it took a long time before it
 194 crashed.

195 Given the hesitance of English speakers with data as in (18a), (19) and (20), I will
 196 tentatively assume that adverbs of change lack rate readings with accomplishment
 197 predicates.⁶

198 Accomplishment sentences also give rise to narrative interpretations.

199 (21) The tiger walked into the room. Kazuko quickly moved to the window.

⁵But see Beavers (2013) for the assumption that only dynamic predicates are associated with what he calls a "scale of change". Maienborn (2007: ft.4) calls predicates like *sleep* or *wait* stative, due to the fact that they have homogeneous reference. However, such predicates display the distributional properties of activity predicates, e.g., occur in the progressive in episodic present tense uses.

⁶It is possible that rate readings are available with some but not other accomplishment predicates.

Table 1 Readings for adverbs of change with different aspectual classes

	Rate	Duration	Narrative	Deictic
Activities (dynamic)	✓			✓
Activities (non-dynamic)				✓
Accomplishments		✓	✓	✓
Achievements			✓	✓
States				✓

200 When combined with achievement predicates, adverbs of change give rise to
 201 narrative readings. The sentence below is repeated from (7) above.

202 (22) The professor walked in and Selena { quickly } noticed him.
 { immediately }

203 Finally, stative predicates are generally unacceptable with adverbs of change
 204 (Thomason and Stalnaker 1973; Katz 2003; Rawlins 2013). If at all acceptable,
 205 (23) can only mean that the person in question started to like her job shortly after
 206 some implied event, i.e., we get a coerced inchoative reading. Other, more natural
 207 cases of state coercion are cited in (24)–(25).

208 (23) ? She quickly liked her job.

209 (24) He { suddenly } realized his mistake.
 { quickly }

210 (25) John sat in his chair going over the day’s perplexing events again in his
 211 mind. Suddenly, he was asleep. (Dowty 1986: 38)

212 Deictic interpretations of adverbs of change are in principle possible with pred-
 213 icates of all aspectual classes, although some predicates may be more natural than
 214 others in particular speech acts. What matters here is the properties of the action
 215 implied by the speech act performed, not necessarily the aspect of the depicted pred-
 216 icate. For example, (11) above contains a stative predicate but is fully natural with
 217 *quickly* because it can target the anticipated event of answering the question.

218 A summary of the empirical findings, excluding cases of aspectual coercion, is
 219 given in Table 1. (Unavailable interpretations are left unmarked.)

220 In this section, I have shown that the range of available interpretations for adverbs
 221 of change is heavily restricted by the aspectual properties of the modified predicate
 222 and also interacts with discourse structure. The task then is to make sense of the
 223 puzzling multitude of interpretations by combining insights from the aspectual and
 224 discourse literature. After critically evaluating two previous proposals in Sect. 4, I
 225 will present my own account in Sect. 5.

226 4 Previous Work on Adverbs of Change

227 Cresswell (1978) was the first to propose a semantic analysis for adverbs of change.
 228 This paper develops a formal account of rate and duration readings for *quickly*,
 229 and also recognizes the existence of narrative readings. Subsequent research has
 230 tried to attribute available readings to structural or lexical ambiguities (Travis 1988;
 231 Pustejovski 1991; Tenny 2000; Schäfer 2002; Ernst 2004; Thompson 2006; Kearns
 232 2007; Eszes 2009). Rawlins (2013) offers the most elaborate discussion to date and
 233 systematically investigates the interaction between adverbs of change and aspectual
 234 class. In this section, I critically evaluate Cresswell's and Rawlins' accounts, as these
 235 authors offer the most theoretical depth. I point out several empirical and theoretical
 236 deficiencies and suggest avenues for improvements.

237 4.1 Cresswell (1978)

238 Cresswell's (1978) main claim is that adverbs of change modify motion predicates
 239 and compare the ratio between the distance traveled and the time passed to some
 240 average value. Cresswell takes rate readings as basic (although he calls these "man-
 241 ner" readings) and assumes that adverbs of change modify not the duration of the
 242 described event as a whole but rather the duration of its minimal parts. He writes:

243 The manner sense of *quickly* [when applied to *walk*] involves, I claim, not taking the distance
 244 of the whole walk and comparing it with the time taken, but rather taking the minimal
 245 subintervals of that interval which are intervals of walking and saying that the ratio of
 246 distance to time in most of them is above average for walkings occurring during intervals of
 247 that length. (Cresswell 1978: 180)

248 Cresswell fleshes out this idea by making precise the notions of a minimal subinterval,
 249 path, spatial distance, and temporal duration as follows. If a sentence ϕ is true at an
 250 interval t , then $t^* \subseteq t$ is a **minimal subinterval** of t relative to ϕ iff ϕ is true at t^*
 251 and there is no proper subinterval of t^* at which ϕ is true. Also, for an individual a
 252 and a time interval t , let $\pi(a, t)$ stand for the **path** of a during t , $\delta(\pi(a, t))$ stand for
 253 the **spatial distance** between the beginning and the endpoint of $\pi(a, t)$, and let $\delta(t)$
 254 stand for the **temporal duration** of t . The semantic rule for *quickly* then requires
 255 that the modified sentence be true at the time of evaluation and that for most minimal
 256 subintervals the distance/time ratio be above average.⁷

257 (26) If P is a motion property, a is an individual, and t is a time interval, then
 258 $[[\text{quickly}]](P)(a)$ is true at t iff

⁷In order to ensure uniformity throughout this paper, I slightly adapt Cresswell's original notation. In particular, I drop reference to possible worlds as nonessential.

- 259 ● $P(a)$ is true at t , and
- 260 ● for most minimal subintervals t^* of t relative to $P(a)$:
- 261
$$\frac{\delta(\pi(a, t^*))}{\delta(t^*)} > \mathbf{avg} \left\{ \frac{\delta(\pi(x, t'))}{\delta(t')} \mid \delta(t') = \delta(t^*) \wedge P(x) \text{ is true at } t' \right\}$$

262 This rule predicts that *Jim walked quickly* entails that Jim walked and that for most
 263 minimal subintervals relative to *Jim walked* it holds that Jim walked a longer distance
 264 than the average of some relevant comparison class of walkings during intervals
 265 of the same length. Notice that this rule only requires that most (not all) minimal
 266 subintervals of walking have the specified property: Jim’s walk would count as quick
 267 even if occasionally he slows down.⁸ While Cresswell’s paper exclusively focuses
 268 on *quickly*, a semantic rule for *slowly* would presumably look as in (26) but will have
 269 the greater-than sign (>) substituted with a less-than sign (<).

270 One issue with Cresswell’s semantic rule for *quickly* is that the comparison class
 271 is based on minimal subintervals relative to the described action, and this may lead to
 272 problems. Assume that nothing smaller than a step counts as walking and imagine that
 273 Jim, an Olympic champion in race walking, just performed the quickest walk ever, in
 274 the sense that most of his steps were faster than any steps previously performed. We
 275 would certainly want to say that Jim walked quickly. However, since the comparison
 276 is based on the intervals of Jim’s steps, which are too short to comprise any other
 277 person’s steps, the comparison class will consist of Jim’s distance/time ratios alone.
 278 This means that at most one half of Jim’s ratios will be greater than his own average
 279 and Jim cannot be said to have walked quickly, contrary to intuition.⁹ What seems to
 280 be needed here is a comparison between the duration of Jim’s steps and the duration
 281 of walking steps in general. In other words, we can dispense with ratios or paths
 282 traveled and directly compare times. An alternative semantic rule for *quickly* that
 283 does that and does not inherit the problem just mentioned is given below.

284 (27) If P is a property of individuals, a is an individual, and t is a time interval,
 285 then $[[\text{quickly}]](P)(a)$ is true at t iff

- 286 ● $P(a)$ is true at t , and
- 287 ● for most minimal subintervals t^* of t relative to $P(a)$ and any individual x :
- 288 the duration of t^* is less than the average duration of minimal subintervals
- 289 t' of t relative to $P(x)$.

290 This modified definition has some additional empirical advantages. It accounts
 291 for uses of adverbs of change that are not based on motion in space.

292 (28) John ran quickly on the treadmill.

293 (29) The water heated slowly. (Rawlins 2013: 161)

⁸Alternatively, one could assume universal quantification over minimal subintervals and attribute the few exceptions to the specified condition to vagueness.

⁹If one tries to somehow exclude Jim’s walking when constructing the comparison class, we will produce the empty set and the average value cannot be computed.

294 (30) Alfonso solved the problem quickly. (Rawlins 2013: 161)

295 The main merit of Cresswell’s analysis is that it can capture duration readings by
 296 using a uniform meaning for adverbs of change and making certain natural assump-
 297 tions about the semantics of telic predicates. Cresswell thus proposes to derive the
 298 duration reading of *John walked quickly to the station* by letting *quickly* modify
 299 the entire verb phrase and assuming the following semantic rule for directional *to*-
 300 phrases.¹⁰

301 (31) If a, b are individuals and P is a motion property: $[[to]](b)(P)(a)$ is true at t
 302 iff

- 303 • $P(a)$ is true at t ,
- 304 • there is no interval t' such that $t \subset t'$ and $P(a)$ is true at t' , and
- 305 • t has a last moment m such that $\pi(a, m)$ and $\pi(b, m)$ overlap.

306 According to (31), *John walked to the station* is true at t iff *John walked* is true at t ,
 307 there is no proper superinterval of t at which *John walked* is true, and John’s location
 308 and the location of the station overlap at the last moment of t . The sentence *John*
 309 *walked quickly to the station* then says that most minimal intervals of John’s walking
 310 to the station are shorter than an average walking to the station. Since the semantics
 311 for *to* requires that any interval of walking to the station be maximal, this amounts
 312 to saying that the single interval of John’s walking to the station is shorter than some
 313 relevant average. This is just the duration reading for *quickly*.

314 Cresswell acknowledges the existence of narrative uses for adverbs of change. He
 315 contends that what is being modified in such uses is the interval during which the
 316 expressed proposition becomes true. On this view, *Someone quickly entered* implies
 317 that *Someone entered* became true fast. This idea makes narrative uses somewhat
 318 similar to duration uses, but it is unclear how it can be fleshed out or derived com-
 319 positionally.

320 In summary, Cresswell’s (1978) proposal captures rate and duration readings, and
 321 also recognizes the existence of narrative readings for adverbs of change. The main
 322 disadvantage, though, is that his account does not really engage with aspect and also
 323 does not mention indexical readings.¹¹ A more comprehensive analysis needs to take
 324 into consideration all readings and explain their aspect-sensitivity.

¹⁰The sentence *John walked quickly to the station* is assumed to also have a rate reading (or a “man-
 ner” reading, in Cresswell’s terminology), attributed to a parsing whereby *quickly* modifies the verb
 alone. However, in view of the discussion in Sect. 2, I disregard rate readings with accomplishment
 predicates as dubious.

¹¹To be fair, Cresswell does say that rate and duration readings arise with predicates of a “different
 logical kind” (p. 184). What he presumably has in mind is the distinction between activity and
 accomplishment predicates, respectively.

4.2 Rawlins (2013)

According to Rawlins (2013), adverbs of change denote functions that distribute over event structure and measure out temporal duration. Thus, *Alphonso ran quickly* will be true just when Alphonso ran and the duration of the atomic running events is shorter than some contextually supplied standard. Although framed in a neo-Davidsonian event semantics (e.g., Parsons 1990), the core idea behind this analysis is similar to Cresswell's (1978):

The intuition for e.g., “runs quickly” is that we look at the minimal parts of a running event that are still runnings [...] and check whether they are all shorter than typical comparable minimal runnings [...]. For a running event, these atoms naturally correspond to something like individual steps or motions [...]. (Rawlins 2013: 170–171)

Rawlins proposes that adverbs of change have the same meaning throughout, and derives different readings by interaction with event structure, including aspect and narrative discourse. The main advantage of this account is that it engages and explains, at least to some extent, the dependence of available interpretations on lexical and discourse structure.¹²

Rawlins assumes that the events in the denotation of verbal predicates are mereologically structured into join semilattices (Bach 1986; Krifka 1989, 1992; Link 1998; Zucchi 2001). Adverbs of change quantify over the relevant atoms of such domains and compare their duration to some contextually provided standard. This is formally achieved by means of the following definitions. Given an event e and an event property P , $\mathbf{lat}(e, P)$ is the maximal set of parts of e that fall under P and form a join semilattice relative to the part-of relation \sqsubseteq . $\mathbf{atoms}(e, P)$ is the set of atomic parts of e that fall under P , where \sqsubset is the proper part-of relation. The set of homogeneous P -atoms of e , $\mathbf{hatoms}(e, P)$, is then defined as the set of atomic parts in $\mathbf{lat}(e, P)$. This is the set that adverbs of change distribute over.¹³

$$(32) \quad \mathbf{lat}(e, P) = \mathbf{max}\{E \mid \forall e' \in E [e' \sqsubseteq e \wedge P(e')] \wedge \langle E, \sqsubseteq \rangle \text{ is a join semilattice}\}$$

$$(33) \quad \mathbf{atoms}(e, P) = \{e' \sqsubseteq e \mid P(e') \wedge \neg \exists e'' [e'' \sqsubset e' \wedge P(e'')]\}$$

$$(34) \quad \mathbf{hatoms}(e, P) = \mathbf{lat}(e, P) \cap \mathbf{atoms}(e, P)$$

Quickly expresses a property of events that distributes over the set produced by \mathbf{hatoms} and requires that the duration of its elements be shorter than some contextually given standard. A simplified interpretation rule is given below, where τ is the temporal trace function (a function from events to temporal intervals), $|\cdot|$ is the temporal extent function (a function from intervals to nonnegative numbers), σ is a standard function, C_H is some contextually supplied property of events, and C_C is a comparison class of relevant events.

¹²This account also makes predictions about the distribution of measure phrases in sentences with adverbs of change. Here, I ignore this part of Rawlins' account.

¹³I take the freedom of significantly simplifying these definitions. Importantly, the set of homogeneous atoms $\mathbf{hatoms}(e, P)$ is generated from $\mathbf{atoms}(e', P)$ and $\mathbf{lat}(e', P)$, where e' is an immediate (but not necessarily proper) part of e . This is intended to capture the alleged duration ($e' = e$) versus rate ($e' \sqsubset e$) ambiguity of adverbs of change with accomplishment predicates.

361 (35) $[[\text{quickly}]] = \lambda e. \forall e' \in \mathbf{hatoms}(e, C_H) [|\tau(e')| < \sigma(C_C)],$
 362 provided that $\mathbf{hatoms}(e, C_H)$ is non-empty

363 Adverbs from the opposite part of the scale (e.g., *slowly*) will reverse the direction of
 364 the comparison and require that each homogeneous atom be above standard length.

365 This semantics correctly predicts several cases of interaction with aspect. First,
 366 Rawlins assumes that adverbs of change are sortally restricted to events proper,
 367 and thus cannot modify stative predicates. Achievement predicates would be ruled
 368 out as well if we assume that the events in their denotations, which are felt to be
 369 instantaneous, have no duration. In that case it would be impossible to satisfy the
 370 requirement that the duration of the events modified by adverbs of change be strictly
 371 bigger or strictly smaller than a standard of zero.¹⁴

372 Activity predicates give rise to rate interpretations because adverbs of change
 373 distribute over the atoms of the lattice structure, provided that C_H is equated with the
 374 denotation of the activity predicate. Recalling (15)–(16) though, this account does
 375 not explain why only some activity predicates can be modified by adverbs of change.
 376 If both dynamic and non-dynamic activities are underlined by atomic parts, there is
 377 no principled reason why adverbs of change cannot measure those parts.

378 Although not explicitly discussed in Rawlins (2013), his account can derive the
 379 duration readings for adverbs of change with accomplishment predicates. If we let
 380 C_H be the denotation of an accomplishment predicate, the distribution would be
 381 over complete events and we would measure events in their entirety.¹⁵ This account
 382 follows the spirit of Cresswell (1978) but captures the rate versus duration readings
 383 for adverbs of change by the context sensitivity of C_H rather than by recourse to a
 384 structural ambiguity.

385 In order to explain narrative readings, Rawlins borrows from the literature on
 386 temporal progression the idea that events are temporally ordered by their relation-
 387 ship to “reference times” (Reichenbach 1947; Kamp and Rohrer 1983; Partee 1984;
 388 Dowty 1986; Hinrichs 1986; Lascarides and Asher 1993; Klein 1994) but modifies it
 389 in various ways. Specifically, Rawlins makes the following three assumptions. First,
 390 narrative discourse is chunked not into reference times but rather into **narrative**
 391 **events**, which have the aspectual properties of accomplishments. Second, sequenced
 392 narrative events are closely aligned to each other. Third, described events are tempo-
 393 rally contained and right-aligned with the narrative event. Given these assumptions,
 394 Rawlins’ main claim is that narrative readings are just duration readings in disguise;
 395 they arise when adverbs of change modify narrative events. The first assumption
 396 about narrative discourse is then needed because adverbs of change are taken to
 397 modify events rather than times. The second and the third assumptions ensure that
 398 the duration of the current narrative event determines the distance between the current
 399 event and some previously described event. For example, *quickly* in the sentence *The*

¹⁴If, to the contrary, achievements are assumed to have a positive if very short duration, then there would be no reason why such events cannot be measured by adverbs of change.

¹⁵I once again ignore alleged rate readings with accomplishment predicates. If real, these can be derived if the set of homogeneous atoms is computed relative to the verb alone rather than the entire verb phrase.

400 *professor walked in and Selena quickly noticed him* modifies not the event described
 401 by the second clause but the narrative event associated with that clause, implying that
 402 this latter event has a short duration. By the second assumption, the narrative event
 403 of the second clause is closely aligned with the narrative event of the first clause;
 404 and by the third assumption, the two described events are right-aligned with their
 405 respective narrative events. It then follows that the temporal distance between the
 406 two described events is small.

407 One serious wrinkle with this story is that it does not predict any specific interac-
 408 tion between narrative readings and aspect. If narrative events were real, an adverb of
 409 change should be able to pick them out independently of the aspectual properties of
 410 the predicate inside the clause. This incorrectly predicts that (in narrative discourses)
 411 adverbs of change are fully natural with all sorts of predicates, including stative pred-
 412 icates. In reality, this is not the case, cf. *He sent her flowers and ?she quickly loved*
 413 *him*. I conclude that this proposal makes no reasonable predictions about narrative
 414 readings of adverbs of change, at least not without significant modifications.

415 Overall, Rawlins' account explains a great deal about the interaction of adverbs
 416 of change and aspect. At the same time, it leaves a lot to be desired. It does not draw
 417 a distinction between dynamic and non-dynamic activity predicates, it ignores the
 418 aspectual properties of verbal predicates in narrative readings for adverbs of change,
 419 and it does not engage with deictic readings. In addition, stative predicates are ruled
 420 out by stipulation, which may not seem explanatory. My own proposal, developed
 421 in the following section, tries to address all those issues.

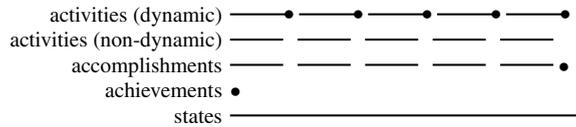
422 5 Proposal

423 Existing accounts take rate readings of adverbs of change as primary and try to work
 424 their way from there toward explaining additional interpretations. The key idea is that
 425 these modifiers measure the spatial and/or temporal parameters of minimal instances
 426 of the described action and compare these parameters to some appropriate standard.
 427 Under this view, adverbs of change measure single events. By contrast, I propose that
 428 adverbs of change modify the temporal distance between two instantaneous events
 429 (or event parts), called an **anchor** and a **target**, where the former temporally precedes
 430 the latter. The target event is compositionally available and is intrinsically linked to
 431 the aspectual properties of the sentence. It is invariably what I call a **culmination**, or
 432 an "event which the speaker views as punctual or instantaneous, and as accompanied
 433 by a transition to a new state of the world" (Moens and Steedman 1988: 16).¹⁶ In
 434 turn, the anchor event is underspecified. It is drawn from a set of contextually salient
 435 events and can be resolved anaphorically or deictically.

436 As already mentioned in Sect. 3, verbal predicates (or their denotations) are typ-
 437 ically divided into four major classes: activities, accomplishments, achievements,

¹⁶Since such transitions can occur inside composite events, this notion of a culmination is not a label for a specific eventuality type, in contrast to Bach's (1986) "culmination" achievements.

Fig. 1 Graphical representations of major eventuality types



438 and states. I have also argued that adverbs of change are sensitive to the distinction
 439 between dynamic versus non-dynamic activity predicates (e.g., *ride a bike* versus
 440 *watch TV*, respectively), in that they can only modify the former but not the latter
 441 type. We thus arrive at the aspectual typology in Fig. 1, where graphical representa-
 442 tions are to be read as evolving in time from left to right. I use a dashed line to mark
 443 processes, a straight line to mark states, and black dots to mark what I have called
 444 culminations, i.e., instantaneous events that signal change.

445 States illustrate the simplest case, as they are homogeneous and hold over time;
 446 they do not express change and include no culminations. Unlike states, activities are
 447 segmented into larger chunks, as they take time to develop. Activities also allow for
 448 gaps, i.e., intervals at which the process is “put on hold” (Landman and Rothstein
 449 2012). I assume that the difference between dynamic versus non-dynamic activities
 450 is that the former but not the latter type effectuate change and thus their minimal
 451 segments culminate. Accomplishments are composite and consist of processes that
 452 end in a culmination.¹⁷ Finally, achievements are instantaneous and consist of a single
 453 culmination.

454 The just outlined aspectual typology predicts quite well the range of available
 455 interpretations for adverbs of change, if it is assumed that such modifiers target
 456 culmination points. First, stative and non-dynamic activity predicates are not accept-
 457 able with adverbs of change because they provide no suitable targets. Achievement
 458 predicates give rise to narrative interpretations because the target is the achievement
 459 event itself and the underspecified event (the anchor) is some temporally anterior
 460 event. When modifying accomplishment predicates, adverbs of change target the
 461 culmination point while the anchor is resolved to some salient previous event. It
 462 seems plausible to assume that two such events are the initial part of the described
 463 event (which derives a duration reading) or some previously mentioned event (which
 464 derives a narrative reading). In order to explain rate readings, we let adverbs of
 465 change distribute over the minimal parts of the dynamic process. This idea is bor-
 466 rowed from Cresswell (1978) and Rawlins (2013), and what is measured here is the
 467 distance between the culmination of each minimal part and its beginning. Finally,
 468 deictic readings are derived by relating the projected action described or implied
 469 by the utterance and the current speech event. Since such projected actions can be

¹⁷What is ignored here is that processes inside accomplishments can be dynamic (e.g., *run the race*) or non-dynamic (e.g., *sleep until noon*). This distinction is less relevant here because of the assumption, made in Sect. 3, that adverbs of change with accomplishment predicates lack rate readings. The semantics below will be set up in such a way that the underlying process in accomplishments cannot be accessed.

470 conceptualized as instantaneous or at least ending in a culmination, they are good
471 targets for adverbs of change.

472 I now demonstrate how this analysis can be made formally precise. First, let
473 us define the culmination of a P -eventuality e to be the final segment of e if that
474 segment expresses change relative to P (36). The final segment of e is one that is
475 not temporally followed by another segment of e and that is contained in any other
476 final segment of e (37).¹⁸ A segment e' expresses change relative to a property P and
477 eventuality e iff there is some relevant property Q that e' has but that no prior segment
478 of e has (38). Here I leave the nature of Q unspecified, although it seems clear that Q
479 is intrinsically linked to the type of change expressed by P . In the definitions below,
480 \sqsubseteq is the part-of relation, τ is the temporal trace function, $<$ is a strict precedence
481 order over times, and \sim is a relevance relation.

$$482 \quad (36) \quad \mathbf{cul}(e, P) = \iota e' \left[\begin{array}{l} P(e) \wedge \\ e' \sqsubseteq_f e \wedge \\ \text{CHA}(e', e, P) \end{array} \right]$$

$$483 \quad (37) \quad e' \sqsubseteq_f e \text{ iff } \left[\begin{array}{l} e' \sqsubseteq e \wedge \\ \neg \exists e'' \sqsubseteq e [\tau(e') < \tau(e'')] \wedge \\ \forall e''' \sqsubseteq e [\neg \exists e'''' \sqsubseteq e [\tau(e''') < \tau(e''')] \rightarrow e' \sqsubseteq e'''] \end{array} \right]$$

$$484 \quad (38) \quad \text{CHA}(e', e, P) \text{ iff } \exists Q \sim P[Q(e') \wedge \forall e'' \sqsubseteq e [\tau(e'') < \tau(e') \rightarrow \neg Q(e'')]]$$

485 As under previous accounts, I will assume that adverbs of change distribute over
486 eventuality structure. In order to provide a quantificational domain for adverbs of
487 change, we need to single out the relevant atoms with a given property. This can be
488 achieved by means of Krifka's (1989, 1992) P -atom property.¹⁹

$$489 \quad (39) \quad \mathbf{atom}(e, P) = \{e' \sqsubseteq e \mid P(e) \wedge \mathbf{ATOM}(e', P)\}$$

$$490 \quad (40) \quad \mathbf{ATOM}(e', P) \text{ iff } P(e') \wedge \neg \exists e'' \sqsubseteq e' [P(e'')]$$

491 A semantic rule for *quickly* is given below. Here A_c is a set of contextually salient
492 events from which anchors are chosen, $\delta(e_1, e_2)$ stands for the temporal distance
493 between e_1 and e_2 (only defined if e_1 temporally precedes e_2), $n <_{\varepsilon_c} m$ states that n
494 is at least ε_c -smaller than m (i.e., $n + \varepsilon_c \leq m$), and σ_c is some contextually supplied
495 standard distance.

$$496 \quad (41) \quad \llbracket \text{quickly} \rrbracket^c = \lambda P \lambda e. P(e) \wedge \forall e' \in \mathbf{atom}(e, P) \exists a \in A_c [\delta(a, \mathbf{cul}(e', P)) <_{\varepsilon_c} \sigma_c]$$

497 This rule is in line with previous accounts but it differs in several important respects.
498 The first difference is that adverbs of change target the culminations of the rel-
499 evant atoms, which is crucial for barring *quickly* from modifying states or non-
500 dynamic activities. Another difference is that what is measured is the temporal dis-
501 tance between two disjoint events (or event parts), where the anchor event a is left

¹⁸Notice that the existence of a unique final segment presupposes an atomic domain of eventualities.

¹⁹It may seem unrealistic that the size of such atoms is fixed by the model once and for all, as different contexts may require different levels of granularity. We could thus relativize (39)–(40) to contexts c and require that only events of a minimum duration of i_c are considered. Schwarzschild (2015) offers an excellent discussion of potential restrictions on mereologically structured domains.

502 unspecified. This feature is best seen at work in narrative or deictic interpretations,
 503 where the anchor is not part of the described event. Finally, the said distance needs
 504 to be not just smaller but *significantly* smaller than the provided standard; the signif-
 505 icance level is modulated by the parameter ε_c . Indeed, if the duration of Jack's steps
 506 is just above or below some standard duration for walking, his activity would hardly
 507 count as a quick or slow walking.

508 The rule in (41) derives the attested readings for *quickly* with predicates with
 509 different aspectual properties as follows. First, notice that the culmination function
 510 will be undefined on stative or non-dynamic activity predicates, the reason being that
 511 the relevant atoms inside the denotations of such predicates (mereological atoms in
 512 the former case, bigger chunks in the latter case) contain no culminations. This
 513 explains why *quickly* cannot modify predicates with these aspectual properties.

514 Dynamic activities differ from non-dynamic ones in that their atoms end in cul-
 515 mination points. Rate readings with such eventuality types then can be explained by
 516 assuming that *quickly* measures the temporal distance between the beginning and the
 517 culmination of each atomic part. Technically, this is achieved by letting the choice
 518 of an anchor event covary with the atomic events quantified over in such a way that
 519 it is always the beginning of the relevant atom.

520 Since accomplishment or achievement predicates refer to quantized events, the
 521 set of relevant atoms will contain complete events only, i.e., no two events in the
 522 denotation of such predicates will stand in a proper part-of relation to one another.²⁰
 523 With accomplishment predicates, *quickly* will target the unique culmination and
 524 could be anchored to its beginning (in duration readings) or some previous event (in
 525 narrative readings). With achievement predicates, *quickly* will target entire events and
 526 will be anchored to some previous event, thus producing narrative interpretations.
 527 In all those cases distributivity plays no role and the meaning for *quickly* in c boils
 528 down to $\lambda P \lambda e. P(e) \wedge \exists a \in A_c [\delta(a, \mathbf{cul}(e, P)) <_{\varepsilon_c} \sigma_c]$.

529 A reviewer asks what prevents adverbs of change with (dynamic) activities from
 530 obtaining narrative readings as well, citing the following example.

531 (42) The crowd roared. John quickly ran.

532 As the reviewer points out, (42) can mean that the temporal distance between the
 533 roaring of the crowd and the beginning of John's running was short.²¹ This type
 534 of narrative reading can be derived if *run* is assumed to compose with an inchoative/inceptive operator like $[[INC]]^c = \lambda P \lambda e. \exists e' [P(e') \wedge e = \mathbf{ini}(e')]$, which singles out the initial part of the described action and effectively coerces an activity predicate into an achievement predicate (cf. Homer 2011; Rawlins 2013). However, the question is what prevents (42) from also meaning that the temporal distance between the roaring and the culmination of each atom of the running activity was short, a type of plural narrative reading that is not attested. While I will not attempt

²⁰For example, if John built three houses and noticed four planes, the **atom** function will produce three nonoverlapping events for *John built a house* and four nonoverlapping events for *John noticed a plane*.

²¹Similar examples were discussed in (23)–(25).

541 to give a detailed answer here, I suggest the lack of such reading might be due to
 542 the difficulty of finding an appropriate standard of comparison. It is indeed difficult
 543 to make sense of the notion of a standard temporal distance between an atom of a
 544 given action and some specific previous event, given that this distance will drastically
 545 vary for different atoms. Zooming out from this particular example, it is important to
 546 acknowledge that due to the choice of anchor the account is based on underspecific-
 547 ation and as such has the potential to generate a number of unattested readings. The
 548 overall strategy for dealing with such overgeneration would be to try to find general
 549 cognitive or discourse principles that block such undesired readings.

550 As for the deictic readings of *quickly*, I will focus on examples as in (43) because
 551 these represent the most extreme case, in the sense that the event of the hearer
 552 answering the question that is targeted by the adverb of change is left implicit.
 553 I assume that (43) has the Logical Form in (43a), where *SAY* is a silent speech
 554 act operator and *Q* is a polar question operator that turns propositions into sets of
 555 propositions. The meaning in (43b) expresses a relation between propositions of the
 556 form *It is raining* or *It is not raining* and events of the hearer of *c* (marked as \mathbf{hr}_c)
 557 uttering one of those propositions shortly after some unspecified event *a*. If we let
 558 *a* be the speech event of producing (43) itself, we get a deictic interpretation: the
 559 hearer is being urged to answer the question quickly.²²

560 (43) Quickly, is it raining?

561 a. [*SAY* quickly] [*Q* raining]

562 b. $\lambda p \lambda e. \left[\begin{array}{l} \text{say}(e, \mathbf{hr}_c, p) \wedge \\ \exists a \in A_c [\delta(a, \mathbf{cul}(e, \lambda e'. \text{say}(e', \mathbf{hr}_c, p)) <_{\varepsilon_c} \sigma_c) \wedge \\ [p = \lambda w. \text{rain}(w) \vee p = \lambda w. \neg \text{rain}(w)] \end{array} \right]$

563 The meaning in (43b) can be compositionally derived by assuming the propositional
 564 meaning for *raining* in (44), a meaning for *Q* as in (45), and a meaning for *SAY* as
 565 in (46).

566 (44) $[[\text{raining}]]^c = \lambda w. \text{rain}(w)$

567 (45) $[[Q]]^c = \lambda q \lambda p. [p = \lambda w. q(w) \vee p = \lambda w. \neg q(w)]$

568 (46) $[[SAY]]^c = \lambda R \lambda Q \lambda p \lambda e. R(\lambda e'. \text{say}(e', \mathbf{hr}_c, p))(e) \wedge Q(p)$

569 A reviewer wonders how this semantics relates to cases in which the perfor-
 570 mative verb is made explicit (as in *Say quickly, is it raining?*), pointing out that
 571 according to (46) *SAY* takes *quickly* as an argument while overt verbs of say-
 572 ing are assumed to denote properties of events and thus are arguments of *quickly*.
 573 One possible response is that verbs of saying have a uniform and simple seman-
 574 tics throughout but when used performatively in interrogatives they compose with
 575 an appropriate silent operator to produce a meaning as in (46). We can assume
 576 the following: $[[\text{say}]]^c = \lambda e. \text{say}(e)$ and $[[OP]]^c = \lambda P \lambda R \lambda Q \lambda p \lambda e. R(\lambda e'. P(e') \wedge$
 577 $\mathbf{agent}(e') = \mathbf{hr}_c \wedge \mathbf{theme}(e') = p)(e) \wedge Q(p)$.

²²Since a predicate of saying has the aspectual properties of achievements, here I make use of the simplified meaning for *quickly* stated in the paragraph that precedes the previous one.

578 In the last part of this section, I briefly address the typology of adverbs of change.
 579 We have seen that *quickly* lends itself to four different readings: rate, duration, nar-
 580 rative, and deictic. Since *quickly* and *slowly* appear to be antonyms, a first thought is
 581 that *slowly* has a similar semantics but one where the direction of the comparison is
 582 reserved, i.e., we require that the distance between the anchor and the target events
 583 be larger than the standard. However, Pustejovski (1991) and Ernst (2004) notice
 584 that *slowly* has a more restricted distribution.²³ Indeed, *slowly* seems to lack narra-
 585 tive or deictic uses. For example, sentences that describe achievements are generally
 586 restricted to narrative readings and are natural with *quickly* but not with *slowly*.

587 (47) The professor walked in and Selena $\left\{ \begin{array}{l} \text{quickly} \\ \text{?slowly} \end{array} \right\}$ noticed him.

588 Another piece of the evidence involves co-occurrences of two adverbs of change. If
 589 both *quickly* and *slowly* felicitously appear in the same clause, they have to take on
 590 two different readings in order to avoid a contradiction. The data below shows that
 591 it is natural to read *quickly* narratively and interpret *slowly* as a rate modifier, but not
 592 vice versa.

593 (48) a. Mark left the house. Quickly, he started running slowly.
 594 b. Mark left the house. ?Slowly, he started running quickly.

595 Notice also that *slowly*, unlike *quickly*, lacks deictic readings.

596 (49) $\left\{ \begin{array}{l} \text{Quickly} \\ \text{\#Slowly} \end{array} \right\}$, what is the capital of Uganda?

597 We can explain the missing narrative and deictic readings by assuming that *slowly*
 598 modifies a single event. This can be formally modeled by requiring that the anchor
 599 is invariably the initial portion of the target event. The semantic rule below would
 600 produce a rate or duration reading only, depending on the aspectual properties of the
 601 modified predicate.

602 (50) $[[\text{slowly}]]^c = \lambda P \lambda e. P(e) \wedge \forall e' \in \mathbf{atom}(e, P) [\delta(\mathbf{ini}(e'), \mathbf{cul}(e', P)) >_{\varepsilon_c} \sigma_c]$

603 I close this section with a few short remarks on other adverbs of change. While
 604 modifiers like *quickly* or *slowly* tell us something about the duration of the change
 605 described or implied by the sentence, other modifiers from the same class may impose
 606 different restrictions on the type of change expressed. For example, *gradually* implies
 607 stepwise change (cf. Piñón 2000) that seems oriented toward a specific goal. This
 608 modifier thus selects for predicates that are both durative and telic, including accom-
 609 plishments (cf. *She gradually built a career in advertising*), and excluding (instan-
 610 taneous) achievements as non-durative (cf. *?He gradually noticed the plane*) or pro-
 611 cesses as atelic (cf. *\#John gradually ran*). Notice that *gradually* can also occur with

²³I do not fully agree with the specific claims made or the plausibility of the provided examples in the cited works, and thus I do not discuss these here. However, I do believe that the general observations pull in the right direction.

612 degree achievement predicates (cf. *The road gradually widened*), which is unsurpris-
 613 ing, as such predicates are known to have telic uses (cf. *The soup cooled in an hour*;
 614 see Hay et al. 1999; Kearns 2007; Kennedy and Levin 2008; Rothstein 2008). While
 615 *gradually* entails moderate change, on the opposite side of the spectrum are modifiers
 616 like *suddenly* or *abruptly*, which imply instantaneous change. These modifiers thus
 617 select for achievements (cf. *She suddenly realized she was lost*) but exclude durative
 618 events (cf. *?He abruptly wrote a sentence on the blackboard*). I leave the precise
 619 semantic analysis of these modifiers to future research.

620 6 Conclusion

621 This paper was devoted to explaining the different interpretations of verbal modi-
 622 fiers of change. I argued that adverbs of change have a single meaning and that the
 623 different interpretations arise through interaction with aspectual or discourse struc-
 624 ture. I focused on *quickly* and *slowly*, which were argued to measure the temporal
 625 distance between two events that are salient and are compositionally or contextually
 626 accessible in the given linguistic environment. While the proposed account was able
 627 to explain all major readings for adverbs of change, it did so by factoring in under-
 628 specification. Since it was left open how anchor events are resolved, the proposed
 629 account can lead to overgeneration. What is then still missing is a fully worked out
 630 theory of what parts of the event structure are or are not relevant to the semantics of
 631 change.

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 636 event semantics. A previous version of this paper appeared in the Proceedings of Semantics And
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