Adverbs of Change and Dynamicity

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Abstract

This paper makes two contributions, one empirical and one theoretical. The empirical focus is 'adverbs of change'—i.e., modifiers like *quickly*, *slowly*, *immediately*, and (more tentatively) *gradually*, which single out dynamic predicates and characterize the change described by such predicates as fast or slow (Cresswell 1978; Rawlins 2013; a.o.). The paper develops a semantic account that is uniform both across and within such adverbs. That is, I argue that adverbs of change share a common semantic core, which selects for dynamic predicates and measures out event duration. I also argue that individual adverbs of change are not lexically ambiguous, in spite of their being able to take on different readings—i.e., rate, extent, narrative, or illocutionary. Rather, the different readings arise through interaction with aspectual structure and are further restricted by idiosyncratic attachment possibilities. The proposed account of adverbs of change has theoretical implications for the aspectual notion of dynamicity. It implies that dynamicity is built directly into the mereological structure of events. More concretely, dynamic predicates are assumed to refer to 'transitions', a kind of complex events that label the change that has occurred (cf. von Wright 1963: ch.2; Landman 1991: ch.5; Pustejovsky 1991; Beavers 2013; Krifka 2014). Overall, the paper aims at laying the groundwork for a general theory of verbal change that can do justice to the richness of the linguistic data.

Keywords: adverbs of change, dynamicity, lexical aspect, event mereology, event measurement

1 Introduction

Change is a fundamental part of the human experience and, unsurprisingly, it is amply represented in natural language. The most direct way of representing change in language is through so-called 'dynamic' predicates (Vendler 1957; Comrie 1976: ch.2; Dowty 1979; Smith 1997; Kearns 2000: ch.9; Rothstein 2004; a.m.o.). Roughly, these are verbal predicates that are drawn from the aspectual classes of activities, like *run* or *push a cart*, accomplishments, like *paint a picture* or *deliver a sermon*, and achievements, like *spot the plane* or *reach the summit*. Notably, dynamic predicates exclude states, like *believe* or *love*, which—as their name suggests—are static and do not express change.

There is a class of verbal modifiers that characterize the nature of the change described by dynamic predicates as fast (e.g., *quickly*, *rapidly*, *swiftly*, *immediately*, *instantly*) or slow (e.g., *slowly*, *sluggishly*, *glacially*, and perhaps *gradually* and *progressively*). I dub such modifiers 'adverbs of change', somewhat in line with prior labels such as 'motion adverbs' (Cresswell 1978),

'celerative adverb' (Cinque 1999), 'rate adverbs' (Tenny 2000; Kearns 2007), 'aspect-manner adverbs' (Ernst 2004), or 'adverbs of time and change' (Rawlins 2013). In this paper, I will discuss *quickly*, *slowly*, *immediately*, and (to some extent) *gradually*, while mentioning in passing a few other adverbs. These four modifiers are carefully chosen in order to establish the commonalities and differences that exist across adverbs of change, especially regarding their interaction with the aspectual notion of dynamicity.

The starting observation is that adverbs of change presuppose dynamicity. This is easiest to see with *quickly*, the most versatile exemplar of such adverbs. The basic pattern is that *quickly* may not modify stative predicates but is acceptable with predicates from all other major aspectual classes (activities, accomplishments, achievements), arguably because it selects for dynamic predicates. This is illustrated in (1).

(1) a. ?Justin loved Selena quickly. (state)
b. Selena ran quickly. (activity)
c. Selena ran to the park quickly. (accomplishment)
d. The boy quickly spotted the plane. (achievement)

Notice that while (1a) is marked as degraded, there are cases where *quickly* is able to felicitously combine with stative predicates. However, in such combinations the stative predicate is coerced into conveying an inchoative reading (e.g., *Justin went to bed and quickly was asleep* ≈ 'Justin went to bed and soon fell asleep'). That is, in such combinations the modified eventuality is no more a state because it is bounded by a starting point. The mechanism at work that coerces atelic predicates (states or activities) into conveying an inchoative meaning will be made explicit in Section 5.4.

Since adverbs of change may characterize rates, they have often been classified as a kind of manner adverbs (e.g., Jackendoff 1972: ch.3; Parsons 1990: ch.4; Ernst 2004: ch.2; Maienborn and Schäfer 2011; Morzycki 2016: ch.5). However, such adverbs display a wide variety of seemingly unrelated readings and should better be viewed as constituting a class in its own right. For example, *quickly* can measure the rate of change, the duration of the entire described event, the narrative time between the current event and some prior event, or the illocutionary time between asking and answering a question. This is demonstrated in (2).

(2) a. Selena ran quickly. (rate)
b. Harry read the book quickly. (extent)
c. The professor walked in and the student quickly noticed her. (narrative)
d. Quickly, what is the capital of Uganda? (illocutionary)

In spite of this apparent polysemy, I will claim that adverbs of change are not lexically ambiguous. Rather, such adverbs always measure event duration and the different readings hinge on the kind of event that is being targeted.

As a benchmark for all other adverbs of change, I will propose the semantics for *quickly* in (3), here stated somewhat informally (see Sections 4 and 5 for details). According to it, *quickly* composes with dynamic predicates and distributes over event structure, stating that every minimal event that falls under the modified predicate is of a relatively short duration (cf. Cresswell 1978; Rawlins 2013).

(3) QUICKLY (informal)

i. $[\![\text{quickly}]\!](P)$ is defined only if P is a dynamic predicate.

ii. If defined, $[\![\text{quickly}]\!](P)$ is the set of all events e in P with the following property: for all minimal subevents e' of e which fall under P, the temporal duration of e' meets the relevant standard for short events of P-ness.

Given the proposal in (3), here is a preliminary sketch of how the four readings in (2) will be derived (see Section 5 for details). The extent reading in (2b) constitutes the most straightforward case. A common assumption in the aspectual literature is that telic predicates (accomplishments and achievements) denote events which lack proper parts that fall under the same predicate (Krifka 1989). Because of this property, any minimal subevent will coincide with the described event, and so *quickly* will end up characterizing as short the entire described event. Deriving the readings in (2c) and (2d) requires an extrapolation of this same idea to covert predicates that refer to abstract events. That is, in (2c) *quickly* characterizes as short a narrative event, one that spans the time between a previously mentioned event and the described event (Rawlins 2013). In turn, (2d) has *quickly* modifying an illocutionary event that spans the time between the speech event itself and the event of the addressee's answering the question. Example (2a) is the only case where the distribution over event structure does some real semantic work. The crucial assumption here is that the denotation of activities contains not just maximal events but also subevents of a certain size, so that the denotation of activities is 'divisible' down to minimal parts (cf. Bennett and Partee 1972; Dowty 1979; Bach 1981; Krifka 1989; Landman and Rothstein 2012a, 2012b; Champollion 2017). This assumption forces *quickly* to distribute over the minimal meaningful parts of the described process, implying that all such parts are of a relatively short duration and giving rise to the intuition of a fast rate.

Providing explicit semantic analyses for other adverbs of change suggests a general characterization of the whole class of such adverbs. That is, we can say that all adverbs of change measure the temporal duration of dynamic events. More specifically, *slowly* will be argued to have a similar semantics to that of *quickly*, except that the duration of the measured event has to meet the standard for long (not short) events of the same kind (see Section 6.2). In turn, *immediately* will be claimed to inherit the core semantics of *quickly* minus the distribution over event structure (see Section 6.3). Finally, although I will not attempt to give an explicit semantics for *gradually*, I will suggest that this adverb shares core properties with *slowly* but applies to development stages (see Section 6.4). In spite of these commonalities, two points of variation among adverbs of change are their gradability and their attachment possibilities. For example, *quickly* is grammatically gradable while *immediately* seems to lack this property (cf. *more quickly than* / **more immediately than* and *very quickly* / ?*very immediately*). Moreover, e.g. *quickly* may attach to any available position, while *slowly* must attach low and exhibits a more restricted set of possible interpretations.

The proposed semantics for adverbs of change presupposes a fine-grained understanding of the aspectual notion of dynamicity, as well as its interaction with other fundamental aspectual notions, like telicity and durativity. By way of making the notion of dynamicity formally explicit, I will propose that dynamicity is built directly into the mereological structure of events, where the term 'event' is used for an eventuality of any kind (Bach 1986). More concretely, I will assume that dynamic predicates refer to 'transitions', i.e., complex events labeled by a description of the change that has occurred (cf. von Wright 1963: ch.2; Landman 1991: ch.5; Pustejovsky 1991; Beavers 2013; Krifka 2014). The technical innovation that I introduce in order to represent transition events

is the 'arrow' operator $\rightarrow$. This operator takes a prior event e, a successor event e' and an event description Q, and creates the transition $e \xrightarrow{Q} e'$. Intuitively, transitions like these capture the idea that Q—and no other unrelated change—comes about between e and e'. This will be enforced by the three conditions listed in (4) (see Section 2.1 for details).

(4) ARROW (informal)
A transition event $e \xrightarrow{Q} e'$ is defined only if
i. Q holds of e' but Q does not hold of e,
ii. no other change unrelated to Q occurs between e and e', and
iii. e' follows immediately upon e.

For example, if s is the state of Jill's being outside the room, s' is the state of Jill's being inside the room, and Q is the property of Jill's being in the room, then the transition $s \xrightarrow{Q} s'$ may represent Jill's entering the room.

The arrow constructor is specifically targeted at mereologies of events and enriches standard mereologies which may include entities of any kind (Leonard and Goodman 1940; Link 1983, 1991; Simons 1987; Krifka 1989, 1998; Casati and Varzi 1999; Hovda 2009; Champollion and Krifka 2016; Varzi 2016; Champollion 2017: ch.2; a.o.). Standard mereologies employ the 'sum' operator $\oplus$ (sometimes called 'fusion' or 'join') as their main tool for constructing wholes from parts. That is, if e and e' are events, $e \oplus e'$ is their sum, or the minimal event that contains e and e'. The additional expressive power conferred by the arrow constructor is needed for at least two reasons. First, proper parts of transition events may be targeted by covert aspectual operators, such as inchoative operators (see Section 5.4). This means that without representing the structure of transitions explicitly it will be hard to define the meaning of such operators. Second, spelling out transition events broadens our understanding of the relationships between dynamicity and the aspectual notions of telicity and durativity. That is, as will be shown in Section 2.2, dynamic predicates can be telic or atelic (although telicity is a subcase of dynamicity), and durative or punctual (although punctuality seems to be a subcase of dynamicity).

The rest of the paper is structured as follows. Section 2 introduces an enriched mereology that includes transition events and spells out the aspectual notion of dynamicity and its relationship to telicity and durativity. Section 3 discusses the semantic distribution of *quickly*, while emphasizing the important role of the aspectual profile of the modified predicate for the interpretation. Section 4 grounds the semantic analysis by focusing on the gradability properties of adverbs of change. Section 5 presents the main proposal about *quickly*, making a crucial use of our explicit assumptions about event type and aspectual class. Section 6 discusses *slowly*, *immediately*, and *gradually*, and also tries to establish a tentative typology. Section 7 critically evaluates two previous accounts of adverbs of change (i.e., these of Cresswell 1978 and Rawlins 2013), and Section 8 is the conclusion.

2 Dynamicity and lexical aspect

This section serves as a theoretical background for the proper semantic analysis of adverbs of change to come. It proposes to revise standard event mereologies such that dynamicity is directly built into the structure of events. Extending prior work, the section goes on to provide explicit

representations for different event types and to formally define three key distinguishing features of aspectual class, i.e., dynamicity, telicity, and durativity. The proposed definitions of these features not only play a crucial role in the lexical semantics of adverbs of change but also predict the correct entailment relations between major aspectual classes.

2.1 Revising the event mereology

Formal treatments of lexical aspect typically draw a categorical distinction between events proper and states (e.g., Davidson 1967; Bach 1986; Parsons 1990; Kamp and Reyle 1993: ch.5; Rothstein 2004; Wellwood 2019). The guiding intuition behind this distinction is that events proper are dynamic and imply some sort of change, while states are static and do not imply any change. The issue with doing things this way is that it obscures the important question of what exactly aspectual change amounts to, and this further hampers the linguistic analysis. In particular, since events proper are unanalyzed entities, it is difficult to distinguish between different types of change, such as telic vs. atelic change or punctual vs. durative change (Comrie 1976: ch.2; Dowty 1979: 3.8; Beavers 2013). Moreover, aspectual operators may target the different components of change (see Section 5.4), which suggests that these components are explicitly represented in language.

In order to address the issue of aspectual change, I will reimagine the dualistic picture just described and will propose to build change directly into the mereological structure of events. In doing so, I will adopt what Landman calls the 'filmstrip' model of change (Landman 1991: 212). This model is based on the metaphor of how moving pictures are created from the fast movement of static frames. That is, in traditional filmmaking each frame is flashed on a screen for a split of a second and then is immediately replaced by a slightly different frame. Since persistence of vision blends the frames together, the viewer is left with the illusion of a moving picture. In a similar way, we can conceive of aspectual change as a sequence of shifting states.[1]

In order to flesh out the filmstrip model of change, I assume that an event e can be of one of two types: a state s or a transition t. Starting with states, these are the fundamental building blocks of all events and may be put together to form larger states. That is, any sum of prior states is also a state, as stipulated in (8).

(5) STATES
If s and s' are states, then their sum $s \oplus s'$ is also a state.

In turn, transitions are built from states and the arrow operator as follows. A simple transition is constructed through the arrow operator from two prior states and a predicate. In turn, a complex transition is any event that contains a transition as one of its parts. This is formalized in (6), where $\sqsubseteq$ is the 'parthood' relation.

(6) TRANSITIONS
i. If s and s' are states and Q is an event predicate, then $s \xrightarrow{Q} s'$ is a transition.
ii. If t is a transition and $t \sqsubseteq t'$, then t' is also a transition.

To put it plainly, whether an event is a state or a transition will depend on the absence or presence of arrows in it, respectively. That is, states contain no arrows and transitions contain at least one

[1] Landman complains that the filmstrip model is too static, in the sense that change itself is removed from it. However, I fail to see why change should be decomposed into notions that are themselves dynamic.

arrow. This makes sense if we keep in mind that only transitions (but not states) are dynamic, and that dynamicity is encoded by the arrow operator.

The formal properties of the sum operator $\oplus$ are well known from prior work on mereology (e.g., Champollion and Krifka 2016).[2] But we need to impose certain restrictions on the application of the arrow operator $\rightarrow$ as well. This is done in (7), which follows similar ideas outlined in von Wright (1963: ch.2), Landman (1991: ch.5), Pustejovsky (1991), Beavers (2013), and Krifka (2014). The symbol $\triangleleft$ marks the temporal adjacency or 'abutment' relation between two events (Kamp and Reyle 1993: 573).

(7) ARROW (formal)
If e, e' are events and Q is a property of events, the transition $e \xrightarrow{Q} e'$ is defined only if
i. $\neg Q(e)$ and $Q(e')$,
ii. for all event properties Q': if $Q \not\subseteq Q'$ then $Q'(e) = Q'(e')$, and
iii. $e \triangleleft e'$.

Let me comment on the three definedness conditions in (7). Starting with (7i), this is the central condition on the arrow operator. What this condition does is enforce the intuition that Q comes about between e and e', in the sense that Q is false of e but true of e'. Moving on to (7ii), this condition imposes a minimality restriction on the change expressed. It states that nothing that is not entailed by Q changes between e and e'. The idea is that, while several other contingent changes may have occurred at the moment when Q comes about, these should be conveyed by events that are distinct from the transition $e \xrightarrow{Q} e'$.[3] Finally, (7iii) requires not just that e precede e' but also that these two events be temporally adjacent, or that they 'abut' each other, in the sense that there is no third event that falls in between.[4] What this means in more practical terms is that, according to our model, change takes no time. That is, there is no 'moment of change' during which the change is partially but not fully in place (for discussion, see Landman 1991: ch.5). While a given change may be preceded or followed by a long and complex process, the change itself occurs instantaneously. Notice also that both (7i) and (7iii) entail that the arrow operator is anticommutative, or that change is always 'directed'. That is, if $e \xrightarrow{Q} e'$ is defined, it is never the case that $e' \xrightarrow{Q} e$ is defined as well.

In sum, I have reimagined the classical event mereology by applying two major revisions. Classical event mereology is based on two qualitatively distinct kinds of entities, i.e., events proper vs. states, and it uses the sum operator as its only tool for constructing wholes from parts. In contrast to that, I have proposed that all events are constructed from states by means of not one but two operators, i.e., sum and arrow. The distinction in dynamicity between states (which are static) and transitions (which are dynamic) now boils down to the absence or presence of the arrow operator, respectively.

[2] At a minimum, the sum operator is assumed to be commutative, associative, and idempotent.

[3] For example, if at the very moment when Jill walks into the room she is overcome by a feeling of happiness, the two changes will be represented by two different transition events with their labels corresponding to *be inside the room* and *be happy*.

[4] More formally, where $<$ is the strict precedence relation, $e \triangleleft e'$ iff $e < e'$ and there is no e'' such that $e < e''$ and $e'' < e'$.

2.2 Event types

With this revised event mereology in place, we can now spell out well-known differences in event type. Ever since Vendler (1957), the aspectual literature has distinguished between four main event types, i.e., states, activities, accomplishments, and achievements (Kenny 1963: ch.8; Comrie 1976: ch.2; Taylor 1977; Mourelatos 1978; Dowty 1979; Bach 1986; Moens and Steedman 1988; Parsons 1990: ch.3; Pustejovsky 1991; Kamp and Reyle 1993: ch.5; Smith 1997; Kearns 2000: ch.9; Rothstein 2004; Beavers 2013; a.o.). Differences in event type have reflexes in linguistic behavior and have been assumed to follow from differences in internal make-up. I will now demonstrate how the shared intuitions about the four main event types can be explicitly represented.

Starting with states, these are the kind of things referred to by predicates like *know*, *love*, *be asleep*, etc. States have been assumed to be 'divisible', in the sense that they consist of smaller states that are of the same kind (cf. Bach 1981; Krifka 1989; Landman and Rothstein 2012a, 2012b; Champollion and Krifka 2016).[5] While divisible, states do not express change, and so they must be built through the sum operator alone. This is schematized in (8).

(8) STATES: $s = s_1 \oplus \cdots \oplus s_n$

Moving on to achievements, these are the type of events referred to by predicates like *notice the plane* or *reach the top*. Although achievements always constitute transitions, Bach (1986) distinguishes between two kinds of achievements, i.e., 'happenings' and 'culminations'. Happenings are referred to by predicates like *notice the plane*. They constitute simple transitions from a prior state to a follow-up state and thus take no preparation in order to occur. In contrast, culminations are described by predicates like *reach the top*. These events constitute complex transitions, in the sense that they are preceded by a preliminary process. This is schematized in (9), where the structure of the preliminary process in (9b) will be further specified in (11b) below.

(9) ACHIEVEMENTS (preliminary)

a. HAPPENINGS: $t = s \xrightarrow{Q} s'$

b. CULMINATIONS: $t = t' \xrightarrow{Q} s$

Notice that a transition label, marked as Q in (9), need not coincide with the description of the entire event. In fact, since such labels only apply to (follow-up) states, they will differ from the description of the entire transition. At the same time, the two predicates are tightly linked, in the sense that an achievement description will entail the label predicate. For example, the achievement description *notice the plane* entails the label predicate *be aware of the plane*, where the former is dynamic and applies to transitions while the latter is non-dynamic and applies to states. Similar remarks can be made about other kinds of transitions, like activities and accomplishments, to be discussed below.

I now discuss activities. Activity events are described by predicates like *walk* or *drive a car*. Just like states, activities are divisible into smaller parts that are of the same kind. Unlike states though, activities are not sums of smaller states, but sums of simple achievement-like transitions. Their structure is schematized in (10), which exemplifies a sum of simple transitions from s_0 to s_1, from s_1 to s_2, and so on up to s_n.

[5] I will put aside the question of whether states are infinitely divisible. This question is linked to the more general issue of whether event mereologies are atomic, atomless, or perhaps fall somewhere in between.

(10) ACTIVITIES: $t = (s_0 \xrightarrow{Q_1} s_1) \oplus (s_1 \xrightarrow{Q_2} s_2) \oplus \cdots \oplus (s_{n-1} \xrightarrow{Q_n} s_n)$

It is important to stress that the labels within any specific activity need not be the same. For example, given an activity described by *walk*, appropriate labels could include *have taken one step*, *have taken two steps*, etc. As with achievements, all of these predicates will be entailed by the description of the entire activity, i.e., *walk*.

Having provided an elaborate structure for activities, we can now spell out the structure of culminations, which was left open in (9). I will assume that the preliminary process of this kind of achievement is simply an activity, i.e., a sum of simple transitions. This is made explicit in (11).

(11) ACHIEVEMENTS (final)

a. HAPPENINGS: $t = s \xrightarrow{Q} s'$

b. CULMINATIONS: $t = ((s_0 \xrightarrow{Q_1} s_1) \oplus (s_1 \xrightarrow{Q_2} s_2) \oplus \cdots \oplus (s_{n-2} \xrightarrow{Q_{n-1}} s_{n-1})) \xrightarrow{Q_n} s_n$

Finally, accomplishments are typically conceived as activity-like processes that reach a certain point and are followed by a state. Sometimes their initial segment is called a 'preparatory phase', their final segment is called a 'consequent' (or 'result') state, and the change itself is called a 'culmination point' (cf. Moens and Steedman 1988; Kamp and Reyle 1993: 5.3.2). In spite of this intuitive complexity, I will assume that accomplishments are just sums of simple transitions. This is shown in (12), where intuitively the preparatory phase corresponds to the chain of transitions from s_0 through s_{n-1}, the consequent state corresponds to s_n, and the culmination point corresponds to the final transition from s_{n-1} to s_n.

(12) ACCOMPLISHMENTS: $t = (s_0 \xrightarrow{Q_1} s_1) \oplus (s_1 \xrightarrow{Q_2} s_2) \oplus \cdots \oplus (s_{n-1} \xrightarrow{Q_n} s_n)$

Notice that (12) displays the exact same structure as the one proposed for activities in (10). One general motivation for this assumption is that the very same event can be felicitously described by, say, the activity predicate *run* or the accomplishment predicate *run to the store*. More to the point, in Section 3 we will see that when an adverb of change like *quickly* modifies accomplishment predicates, it can describe the rate of the action, just like when *quickly* modifies activity predicates.

In spite of this internal similarity between accomplishments and activities, one salient difference is that accomplishments but not activities are felt to be oriented toward a goal, or to be telic. However, following Krifka (1989) and much subsequent work, I take it that this contrast in telicity is encoded not within individual events but rather in the way the denotations of the corresponding predicates are structured.[6] That is, the denotation of accomplishment predicates is 'quantized', in the sense that no event is a proper part of another event. In contrast, the denotation of activity predicates is 'cumulative', i.e., the sum of any two events in the denotation is also included in the denotation. This will be made explicit in Section 2.3.

Comparing (12) with (11b), one might wonder why the significant structural difference between accomplishments and culminations, given that these event types share some intuitive similarity. That is, both an accomplishment predicate like *run to the store* and a culmination predicate like *win the race* are felt to refer to events that start with a preliminary process, reach a culmination

[6]This means that, strictly speaking, the terms 'accomplishment' and 'achievement' should only be applied to predicates (or predicate denotations). In spite of that, I will follow common practice and use these terms to refer to individual events as well.

point, and end in a consequent state. However, in spite of this similarity, Bach (1986) points out that culminations are like happenings and unlike accomplishments in that they behave like punctual predicates. For example, only the former allow for modification by temporal point adverbials like *at 3 p.m.* (see Section 2.3). It is thus important to keep culminations and accomplishments apart.

In sum, we have demonstrated how our revised event mereology can represent different event types. According to this mereology, all events are constructed from the same basic building blocks. Event types only differ in the way they are constructed, i.e., in the way the sum and the arrow operators put together simple states to form complex structures. This means that event types are hierarchically structured, so that more complex event types are built from simpler event types. More specifically, states are made of smaller states, happenings are transitions from one state to another state, activities and accomplishments are sums of happening-like transitions, and culminations are complex transitions from activities to states.

Before closing this section, let me stress that the event typology developed here is by no means intended to be exhaustive. One event type that is missing is what is referred to by predicates like *tap*, *knock*, or *flap*. On their 'semelfactive' reading these predicates denote achievement-like events, while on their 'iterative' reading their denotation is similar to that of activities (Comrie 1976: ch.2; Smith 1997; Rothstein 2008). Also missing from the above typology are 'degree achievements', i.e., events described by deadjectival verbs like *widen* or *darken* (Dowty 1979: 2.3.5; Hay et al. 1999; Kennedy and Levin 2008; Piñón 2008; Rothstein 2008; Kennedy 2012). These two event types are challenging because they are ambivalent with regard to their telicity and durativity properties (see the literature just cited). However, their aspectual properties are not crucial for the main task at hand, i.e., the semantic analysis of adverbs of change (but see Section 6.4). This is why I will put these event types aside, hypothesizing that the proposed formalism can be extended to represent these more complex event types as well.

2.3 Dynamicity, telicity, durativity

The internal structure of each event type projects certain properties that only partially determine its membership to a given aspectual class. The mapping from internal event structure to aspectual class is partial because sometimes the very same event may be viewed as belonging to two different aspectual classes. For example, as mentioned in the previous section, a given running event may be conceptualized as an activity or an accomplishment (cf. *run* vs. *run to the store*). This brings up the question of what properties event predicates may have that are not encoded in single events. More generally, we might wonder what properties carve out the logical space in which aspectual classes reside.

Work on lexical aspect has traditionally relied on a small number of distinctive features that generalize attested commonalities and differences across aspectual classes. One very popular triad of features is that of dynamicity, telicity, and durativity (e.g., Comrie 1976: ch.2; Mourelatos 1978; Smith 1997; Kearns 2000: ch.9; Rothstein 2008; Beavers 2013). I will adopt this triad as a basis for aspectual classification. I will first rehearse the established empirical picture on how these three features describe the main aspectual classes, and then will go on to formally define dynamicity, telicity, and durativity. The proposed definitions will be partially based on the event typology spelled out in the previous section and will be fed directly into the semantics of adverbs of change and various aspectual or discourse operators (see Section 5).

I start with the dynamicity feature. Dynamicity is about the intuition that certain verbal predicates convey change. However, to the best of my knowledge, this intuition has not been supported by a systematic empirical diagnostic. Typically, a host of diagnostics are employed to distinguish between stative predicates, on the one hand, and activity/accomplishment/achievement predicates, on the other hand, and then the latter class of predicates are simply called 'dynamic'. Here I will take felicitous modification by adverbs of change as the prime diagnostic for dynamicity.[7] That is, among the four major aspectual classes, only stative predicates reject modification by adverbs of change (barring the possibility of a repair reading through aspectual coercion). The data in (13) involves *quickly* and is repeated from (1) above.

(13) a. ?Justin loved Selena quickly. (state)
b. Selena ran quickly. (activity)
c. Selena ran to the park quickly. (accomplishment)
d. The boy quickly spotted the plane. (achievement)

The reason why adverbs of change select for dynamic predicates is simple and will be discussed in detail in Sections 5 and 6. Foreshadowing, the lexical semantics of such adverbs presupposes that the modified predicate is dynamic and further specifies the nature of this dynamicity.

As for telicity, this feature captures the intuition that accomplishments and achievements are naturally bounded and cannot progress beyond a given point. This contrasts with states and activities, which lack natural boundaries. The standard test employed in the literature for diagnosing telicity involves the contrast between temporal *in*- and *for*-adverbials, where telic predicates take *in*-adverbials and atelic predicates take *for*-adverbials. This is shown in (14).

(14) a. John liked Mary { *in a year / for a year }. (state)
b. Pedro walked { ?in an hour / for an hour }. (activity)
c. Bertha painted a picture { in an hour / ?for an hour }. (accomplishment)
d. Kim noticed the painting { in a few minutes / ?for a few minutes }. (achievement)

Why do *in*-adverbials go with telic predicates and *for*-adverbials go with atelic predicates? The usual explanation given is that *for*-adverbials distribute over event structure while *in*-adverbials modify maximal events (cf. Dowty 1979: ch.7; Landman and Rothstein 2012a, 2012b; Champollion 2017: ch.5). If only atelic predicates are assumed to make available event parts, the pattern in (14) falls out.

Finally, the durativity feature has to do with the intuition that states, activities and accomplishments are presented as taking time, while achievements are presented as being punctual. This feature can be diagnosed by temporal *at*-adverbials, which single out achievements, as demonstrated

[7] Notice though that not all possible combinations are felicitous, due to idiosyncratic restrictions on syntactic attachment for different adverbs (see Sections 5 and 6).

in (15).[8]

(15) a. *John hated Mary at 3 p.m. (state)
b. ?The man walked in the park at 3 p.m. (activity)
c. ?Pat cleaned the house at 3 p.m. (accomplishment)
d. The gas main exploded at 3 p.m. (happening)
e. We reached the summit at 3 p.m. (culmination)

A natural explanation for the pattern observed in (15) is that *at*-adverbials refer to instants rather than temporal intervals (cf. Vendler 1957; Bennett and Partee 1972). If durative predicates are assumed to refer to events that stretch over intervals, such predicates are expected to be incompatible with *at*-adverbials.

We have arrived at the aspectual classification summarized in Table 1. There are two important generalizations to be gleaned from it as to how dynamicity is logically related to telicity and durativity. The first generalization is that, while dynamic predicates can be telic or atelic, all telic predicates are dynamic (cf. Rothstein 2008). The second generalization is that a punctual predicate (i.e., an achievement) is always telic, and thus—by our first generalization—also dynamic (see Comrie 1976: 50). These two generalizations are something that any theory of lexical aspect should be able to capture. And indeed, they will be accounted for by the analysis of dynamicity, telicity, and durativity presented at the end of this section.

aspectual class	dynamic	telic	durative
states	−	−	+
activities	+	−	+
achievements	+	+	−
accomplishments	+	+	+

Table 1: Classification of aspectual classes in terms of dynamicity, telicity, and durativity.

Our final and most important task in this background section is to provide model-theoretic definitions for the three aspectual features of dynamicity, telicity, and durativity. Dynamicity is the most important feature for our purposes because it is directly selected by adverbs of change. Dynamicity is usually analyzed in terms of heterogeneity (cf. Vendler 1957; a.m.o.), i.e., events referred to by dynamic predicates are viewed as having parts that do not anymore fall under the same predicate. For example, an event described by the activity predicate *waltz* may have parts—say, single steps—that are too small to still count as waltzing. In contrast, non-dynamic predicates are assumed to refer to homogenous events, in the sense that all event parts fall under the same predicate. The relevant formal property that spells out homogeneity and contrasts it with heterogeneity is that of 'divisibility' (Bennett and Partee 1972; Taylor 1977; Dowty 1979; Bach 1981; Krifka 1989; Landman and Rothstein 2012a, 2012b; Champollion and Krifka 2016). One version of it is stated in (16).

[8] Another diagnostic includes inceptive and terminative operators, like *began*/*start* or *finish*/*stop*. Barring the possibility of a habitual interpretation, these operators reject punctual predicates and are only acceptable with durative predicates (Dowty 1979: 2.2; Smith 1997: ch.3).

(16) DIVISIBILITY
P is *divisible* iff for every two events e and e' such that $P(e)$ and $e' \sqsubset e$, it holds that $P(e')$.

However, characterizing non-dynamic predicates as divisible and dynamic predicates as non-divisible faces at least two problems—especially when working with traditional event mereologies, where the sum operator is the only way to construct wholes from parts. Empirically, we predict that static activities like *watch TV*, *sleep*, or *wait*—call them 'stativities'—are divisible, while dynamic activities like *drive a car* are non-divisible. This seems dubious since both kinds of activities seem about equally divisible, in the sense that any (sufficiently large) proper part will count as an event of the same kind.[9] Theoretically, the divisibility property appears to require too much of an ontological commitment regarding the way certain event types are structured. For example, we need to stipulate that achievement events, while instantaneous, have proper parts that do not fall under the given predicate. Without this assumption, achievement predicates will vacuously satisfy the divisibility property and will count as non-dynamic.

In contrast to these difficulties, the event typology proposed in Section 2.2 is tailor-made to characterize dynamicity. We can just say that dynamic predicates are those that apply to transitions, where transitions are defined as in (6) above, i.e., as events that contain the arrow operator. This is stated in (17), which makes activities, accomplishments, and achievements dynamic.

(17) DYNAMICITY
P is *dynamic* iff *P* only applies to transition events.

Notice that non-divisibility falls out from dynamicity. That is, since transition events are fundamentally built from states, a dynamic predicate will always refer to events which have parts (i.e., states) that do not fall under the that predicate.

Moving on to telicity, one simple characterization of this feature is in terms of the quantization property, which is about the way a predicate denotation is structured (Krifka 1989, 1992). A predicate counts as quantized when its denotation contains only complete events, i.e., when it does not contain any two events such that one is a proper part of the other. This is stated in (18).

(18) QUANTIZATION
P is *quantized* iff there are no events e and e' such that $P(e)$, $P(e')$, and $e \sqsubset e'$.

The characterization of telicity in terms of quantization has been relaxed in later work, typically due to concerns about how the intuition of a culmination point arises and the role of verbal objects in it (Krifka 1998; Kratzer 2004; Filip and Rothstein 2006; Beavers 2012; a.o.). Here I will set these concerns aside and accept that quantization is a key part of the notion of telicity, pointing out that even this strict characterzation does not link telicity with dynamicity tightly enough. That is, the quantization property provides no clue as to why telic predicates are dynamic (recall the first generalization about Table 1). It allows for the possibility of a telic predicate that is static—and it is unclear what such a predicate would look like in view of the fact that telic predicates are oriented toward a goal and are inherently dynamic. In order to address this issue, I will simply assume that telicity requires both quantization and dynamicity. This is codified in (19).[10]

[9] For example, if Lisa watched TV from 3 to 4 p.m., she must also have watched TV from 3:20 to 3:40 p.m. Similarly, if Lisa drove her car from 3 to 4 p.m., she must also have driven her car from 3:20 to 3:40 p.m.

[10] Eventually, we might want to see a definition of telicity that entails dynamicity not by stipulation but by providing some added explanatory value. I leave this issue to future research.

(19) TELICITY
P is *telic* iff *P* is both quantized and dynamic.

Assuming that the denotations of accomplishments and achievements are quantized but those of states and activities are not, this definition correctly singles out the former group of predicates as telic.

Finally, I discuss the durativity feature. To start with, it is hard to try to define durativity—and its opposite punctuality—in terms of temporal instantaneity or event atomicity. That is, if events were punctual because they only last for an instant, the question of punctuality is merely shifted from the realm of events to the realm of time (cf. Freed 1979: 3.1; Engelberg 2000). And if events are perceived as punctual because they are atomic, it would be unclear why achievements (the only punctual event type in our event typology) can convey change at all (but see Piñón 1997). Here I will take a different tack that follows the filmstrip model of change (see Section 2.1). Building on the intuition that minimal change happens instantaneously, I will assume that punctual predicates are just those that refer to 'direct' transitions, i.e., transition events whose main connector is the arrow operator and thus are of the form $e \xrightarrow{Q} e'$. Recalling the structure of different event types laid out in the previous section, this correctly singles out achievements as the only type of punctual predicates. In turn, durative predicates are defined as being non-punctual, i.e., as those which apply to events that do not have the arrow operator as a main connector (states and activities/accomplishments). The formal definitions are given in (20).[11]

(20) PUNCTUALITY / DURATIVITY
i. *P* is *punctual* iff for every event e in *P* there are events e', e'' and an event property Q such that $e = e' \xrightarrow{Q} e''$.
ii. *P* is *durative* iff *P* is not punctual.

Notice that, according to this definition, punctual predicates are dynamic, owing to the fact that they refer to transition events. Assuming that the denotation of punctual predicates is quantized, we also make the more specific prediction that such predicates are telic. This derives the second generalization about Table 1, i.e., that punctuality entails telicity.

With the formal analysis of dynamicity, telicity and durativity in place, we can now turn to adverbs of change and their semantics.

3 Data on *quickly*

This section presents the main data on *quickly*. It looks into the compatibility of this adverb with predicates from different aspectual classes and catalogues the resulting interpretations.

The empirical properties of *quickly* have been previously discussed in Cresswell (1978), Pustejovsky (1991), Tenny (2000), Thompson (2006), Kearns (2007), Rawlins (2013), and Wellwood

[11] Beavers (2008, 2012, 2013) is one place in the literature where the notions of punctuality/durativity are directly linked to the mereological complexity of events. For him, a punctual event is one that consists of just two atoms (a beginning and an end), while a durative event is one that consists of more than two atoms (a beginning, a middle part, and an end). However, it is dubious that the two major parts of a punctual event are mereological atoms. In the case of happenings, these two parts are states that can be arbitrarily long and may be complex. In the case of culminations, the first part is a process and so it cannot be atomic.

(2019: 6.3.3), a.o. *Quickly* turns out to be by far the most flexible of all adverbs of change, combing with all kinds of dynamic predicates (activities, accomplishments, achievements) and giving rise to four different interpretations, i.e., 'rate', 'extent', 'narrative', and 'illocutionary'.[12] These interpretations are typically tied to the aspectual properties of the modified expression, as I now show.

A rate reading for *quickly* arises with activities and entails that the described action progresses fast. For example, (21) entails that Selena moved through space at a faster rate than whatever the standard rate is for a running event of this kind.

(21) Selena ran quickly.

The rate reading of *quickly* is sometimes characterized as—or even contrasted with—a 'manner' reading (e.g., Cresswell 1978; Pustejovsky 1991; Tenny 2000; Thompson 2006). In the above example, a manner reading would presumably amount to describing as fast the way Selena moved her body parts while running. However, it is dubious whether such a reading is really accessible. That is, (21) may describe a situation in which Selena runs with a jet pack on her back and is barely moving her legs but, due to the thrust from the jet pack, she is advancing with a high velocity. In contrast, (21) cannot easily describe the reverse situation, e.g., one in which Selena runs on ice and is moving her legs fast but, because of the lack of friction, she is advancing with a low velocity.[13] This is why I will put aside the possibility of an independent manner reading for *quickly*.

The extent reading of *quickly* arises with accomplishment predicates and measures the temporal extent of the entire described event. For example, (22a) describes the temporal extent of the book-reading event as being short relative to some appropriate standard. The same kind of reading seems to arise with achievement predicates as well, and more specifically with culminations.[14] This is illustrated by the web example in (22b), where what is described as relatively short is the event of the zipper winning the historical race against the button.

(22) a. Elaine read the book quickly.
b. In the 1930s, the zipper won the race [against the button] quickly and decisively.

Notice that while achievement predicates are punctual, an extent reading of *quickly* with such predicates is unsurprising. This is because, on the current account, all events have temporal extent, irrespective of whether they are denoted by durative or punctual predicates. That is, a punctual predicate refers to events that constitute a direct transition (have the form $e \xrightarrow{Q} e'$), not events that lack temporal extent.

Cresswell (1978)—followed by Pustejovsky (1991), Shaer (1998), Thompson (2006), and Rawlins (2013)—claims that, when modifying accomplishments, *quickly* is actually ambiguous between an extent and a rate reading. As just mentioned, the extent reading in such cases describes the duration of the whole event. In turn, a rate reading would modify the intensity of the underlying process. For example, in Cresswell's own words, the extent reading of (23) says that John's walking was a quick walking to the station, while the rate reading of (23) says that John walked quickly and his walking was to the station.

[12] Although to a large extent these labels are my own, they are conceptually in line with existing descriptions of these readings in the literature.

[13] See also Lakoff (1973), who makes a related point about *slowly*.

[14] I leave it open whether an extent reading for *quickly* is also possible with happenings, like *hit* or *notice the plane*.

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

Rawlins (2013: 154) additionally argues that the extent vs. rate readings of *quickly* with accomplishments can be distinguished by the distribution of measure phrases inside comparative forms. As empirical support, he cites the examples in (24).

(24) a. Alfonso ran to the park 2 minutes more quickly than Joanna. (extent)
b. Alfonso ran to the park 2 miles per hour more quickly than Joanna. (rate)

According to Rawlins, in (24a) *2 minutes* measures the difference in temporal extent between the two running events, whereas in (24b) *2 miles per hour* measures the difference in rate between these two events. However, while (24a) is uncontroversial, some of the English speakers I consulted find (24b) unacceptable, perhaps due to the rather technical nature of the notion 'miles per hour'. Notice also that when the extent reading is explicitly denied in a follow-up clause, as in (25), the rate reading is not easily accessible, although it does not seem to be completely out either.

(25) a. ?Alfonso ran to the park quickly, but it took him a long time to get there (he picked the longer path).
b. ?The plane fell to the ground quickly, but it took a long time before it crashed (the plane was flying very high).

What is important here is that the semantic proposal in Section 5 is compatible (though it does not require) a rate reading for *quickly* with accomplishment predicates. That is, whether or not *quickly* has this reading will be a matter of attachment site. Here I will tentatively assume that—at least for some speakers—such a reading is accessible.

The rate and the extent readings of *quickly* are purely semantic, in the sense that both comment on the event denoted by the modified expression. In this they differ from narrative and illocutionary readings, which are in some sense pragmatic. That is, what is intuitively measured in the latter two readings is the temporal distance between two different events, such as two narrative events or two utterance events. Starting with the narrative reading, it most obviously arises with achievements. As illustrated below, *quickly* appears to measure the distance between the prior walking-in event and the ensuing noticing event in (26a), and the distance between the event of taking a lead and the event of winning the race in (26b).

(26) a. The professor walked in and the student quickly noticed her.
b. Harry took an early lead and quickly won the race.

The same kind of reading seems possible with other telic predicates, i.e., accomplishments. Two examples are cited in (27); the second example is from COCA (Davies 2008).

(27) a. A low sound came from the direction of the bed, and Kazuko quickly moved to the window.
b. When war broke out, they quickly built a false wall in one of their barns and hid the truck.

In both (26) and (27), it may be difficult to tell apart the claimed narrative reading from a more regular extent reading. Although I will not offer an empirical diagnostic to tell apart these two

readings of *quickly* with telic predicates, notice that the possibility of a narrative reading is in line with the common assumption in the literature on narrative discourse (e.g., Kamp and Rohrer 1983) that telic predicates move the 'reference time' forward and thus create some temporal distance that can be targeted by adverbs of change (see Section 5.4 for more analytical details).

Finally, the illocutionary reading of *quickly* is special because it is not sensitive to the aspectual properties of the modified form—e.g., it is also available with stative predicates, which are generally out with adverbs of change (see (1)/(13)). One place the illocutionary reading pops up is in questions, where intuitively *quickly* modifies the time between the speaker's utterance event and the projected reaction to that utterance, i.e., the anticipated event of the hearer's answering the question. An example of this reading is given in (28).

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

Another place where an illocutionary reading seems to arise is in imperatives. Rawlins (2013: 174) cites as example *Quickly, talk to Alfonso*, where intuitively *quickly* measures the time between the utterance event and the projected event of obeying the command. Although my proposal in Section 5 will ignore this last guise of the illocutionary reading, I submit that it can be analyzed along similar lines as the case of questions.

Before closing, notice that *quickly* is generally unacceptable with non-dynamic predicates, at least out of the blue, see (29a). However, in the right context such combinations can be coerced into an inchoative achievement-like reading, as demonstrated in (29b). What such a coercion amounts to is a narrative reading, where *quickly* measures the temporal distance between the beginning of the described event (the realization that something is wrong) and a previous salient event (the client's calling back).

(29) a. #Justin slept quickly.
b. The client called back and the operator quickly knew something was wrong.

In summary, *quickly* is compatible with all kinds of dynamic predicates and gives rise to a set of readings determined to a large extent by the aspectual properties of the modified expression. It is thus important to keep in mind which reading is compatible with which aspectual class, and ask what this tells us more generally about the selectional restrictions of adverbs of change regarding the features of dynamicity, telicity, and durativity. Table 2 lists the available combinations for *quickly* as they look from a purely descriptive perspective. That is, a rate reading requires predicates that are dynamic and durative, an extent reading requires predicates that are telic (and thus dynamic; see Section 2), a narrative reading requires telic predicates, and an illocutionary reading imposes no aspectual restrictions. In Section 5, I will argue that some of these aspectual restrictions fall out from the semantics of adverbs of change and need not be explicitly encoded, while at the same time more restrictions are introduced by covert aspectual or discourse operators.

4 Gradability

This section takes a first stab at the semantics of adverbs of change. It looks at gradability and proposes preliminary entries for *quickly* and *slowly*, to be further developed and built on in Sections 5 and 6.

reading	aspectual class	features
rate	activity, accomplishment	dynamic + durative
extent	accomplishment, achievement	telic
narrative	accomplishment, achievement, inchoative state or activity	telic
illocutionary	(any)	(none)

Table 2: Compatibility of different readings for *quickly* with different aspectual classes and features.

Several linguistic analyses treat adverbs of change as grammatically gradable (e.g., Heim 2006; Rawlins 2013; Wellwood 2019: 6.3.3). This is clearly true of *quickly* and *slowly*. For example, these adverbs may occur in the comparative and also accept intensifiers like *very*. This is illustrated in (30).

(30) a. Jill ran to the park more $\left\{ \begin{array}{c} \text{quickly} \\ \text{slowly} \end{array} \right\}$ than Jack (did).

b. Jill ran to the park very $\left\{ \begin{array}{c} \text{quickly} \\ \text{slowly} \end{array} \right\}$.

A common way of capturing grammatical gradability is the assumption that gradable expressions encode measure functions whose value is compared to some appropriate standard (Cresswell 1976; a.m.o.). Here I will follow this line of analysis. Specifically, I will assume that *slowly* and *quickly* measure event duration and compare the resulting value to some standard duration. Preliminary entries for these modifiers are given in (31).

(31) SLOWLY / QUICKLY (preliminary)

a. $[\![\text{slowly}]\!] = \lambda d \lambda P \lambda e\,.\,P(e) \wedge d \preceq \textbf{long}(e)$

b. $[\![\text{quickly}]\!] = \lambda d \lambda P \lambda e\,.\,P(e) \wedge d \preceq \textbf{short}(e)$

Looking at these entries, we see that both adverbs carry over the meaning of the modified predicate (first conjunct) and compare the duration of the described event to some degree of length (second conjunct). The only difference lies in the specific measure function encoded in each case. That is, according to (31a), *slowly* encodes the measure **long**. This measure maps events to degrees of temporal duration such that higher degrees on the scale correspond to longer events.[15] As shown in (31b), *quickly* has a similar semantics, except that it encodes the measure **short**. This measure reverses the direction of comparison such that higher degrees on the scale now correspond to shorter events. Thus, while both functions measure event duration, $\textbf{long}(e) \prec \textbf{long}(e')$ means that e' lasts longer than e, whereas $\textbf{short}(e) \prec \textbf{short}(e')$ means that e' lasts shorter as e.[16]

The degree argument made available by gradable expressions is manipulated by degree constructions or degree modifiers. In the case of *quickly* and *slowly*, this argument is manipulated by comparative morphemes like *more* or intensifiers like *very*. Existing literature provides semantic accounts of adjectival versions of *more* (Cresswell 1976; von Stechow 1984; Heim 1985; Kennedy

[15]The function **long** can be composed from Krifka's (1989) 'temporal trace' (or 'run time') function, which maps events to the intervals they occupy, plus the 'temporal extent' function, which maps intervals to their temporal extent (see Rawlins 2013). The same comment applies to the function **short**, discussed below.

[16]In other words, $\textbf{long}(e) \prec \textbf{long}(e')$ just in case $\textbf{short}(e') \prec \textbf{short}(e)$.

1999; Wellwood 2019; a.o.) and *very* (Klein 1980; Kennedy 1999; a.o.). Here, I extend these accounts to the adverbial counterparts $more_{Adv}$ and $very_{Adv}$ by adding to the original entries an extra adverbial argument.

Let us first consider $more_{Adv}$. This morpheme simply states that the modified adverbial applies to the event described by the matrix clause to a higher degree than it applies to the event described by the comparative clause. This is formalized in (32).

(32) $[\![\text{more}_{Adv}]\!] = \lambda A \lambda d' \lambda P \lambda e . \exists d [A(d)(P)(e) \wedge d' \prec d]$

To illustrate, let us assume with Heim (1985) that comparative clauses denote the maximal degree to which the gradable predicate they contain applies. Then the bracketed structure in (33a) amounts to the meaning in (33b), where d_{comp} abbreviates the degree denoted by the comparative clause.

(33) Jill ran to the park more slowly than Jack (did).

a. Jill [run to park [[more slowly] [than Jack ~~run to park slowly~~]]]

b. $\lambda e . \exists d [run.to.park(e) \wedge d \preceq \textbf{long}(e) \wedge d_{comp} \prec d]$
$= \lambda e . run.to.park(e) \wedge d_{comp} \prec \textbf{long}(e)$

After factoring in the agent argument, we will get a meaning according to which the length of Jill's running to the park exceeded the length of Jack's running to the park. This accords well with what (33) actually says.

Let us now consider $very_{Adv}$. Intuitively, $very_{Adv}$ states that the modified adverbial applies to a degree that is higher than average. There are two proposals in the literature about how this intuition arises. One idea is that the standard of comparison itself is raised, due to the fact that $very_{Adv}$ additionally restricts the comparison class to entities that fall under the modified predicate (Wheeler 1972; Klein 1980; von Stechow 1984; Kennedy and McNally 2005; Heim 2006). On this view, the comparison class for e.g. *run to the park* $very_{Adv}$ *slowly* would not be the set of all events of running to the park, but rather the set of all slow such events. An alternative idea is that $very_{Adv}$ does not manipulate the standard of comparison, but rather mandates that the degree to which the modified predicate applies exceeds this standard by a large amount (Kennedy 1999: 3.2.2; Barker 2002; Katz 2005; Morzycki 2016: 3.5.6). For specificity and ease of comparison, here I will adopt this latter view, taking $d \prec\prec^c d'$ to mean that d' exceeds d by some amount that counts as large in the context c. The relevant entry for $very_{Adv}$ is spelled out in (34). According to it, the degree of comparison is selected by the standard function **std** on the basis of the adverbial meaning A and the modified property P, which is appropriately restricted by the context c.[17]

(34) $[\![\text{very}_{Adv}]\!]^c = \lambda A \lambda P \lambda e . \exists d [A(d)(P)(e) \wedge \textbf{std}(A, P^c) \prec\prec^c d]$

Composing (34) with the entries in (31a) and (31b), we get the meanings for $very_{Adv}$ *slowly* and $very_{Adv}$ *quickly* as shown in (35a) and (35b), respectively. Both degree modifications end up stating that the duration of the described event exceeds the relevant standard by some contextually large amount. The only difference is that in the case of *slowly* the comparison is along the 'longness' scale, while in the case of *quickly* the comparison is along the 'shortness' scale.

(35) a. $[\![\text{very}_{Adv}\ \text{slowly}]\!]^c$
$= \lambda P \lambda e . \exists d [P(e) \wedge d \preceq \textbf{long}(e) \wedge \textbf{std}([\![\text{slowly}]\!], P^c) \prec\prec^c d]$
$= \lambda P \lambda e . P(e) \wedge \textbf{std}([\![\text{slowly}]\!], P^c) \prec\prec^c \textbf{long}(e)$

[17] The resulting set, P^c, is the comparison class.

b. $[\![\text{very}_{Adv}\ \text{quickly}]\!]^c$
$= \lambda P\lambda e.\exists d[P(e) \wedge d \preceq \textbf{short}(e) \wedge \textbf{std}([\![\text{quickly}]\!], P^c) \prec\!\prec^c d]$
$= \lambda P\lambda e.P(e) \wedge \textbf{std}([\![\text{quickly}]\!], P^c) \prec\!\prec^c \textbf{short}(e)$

It is instructive to compare the meanings in (35) to the case when *slowly* and *quickly* lack overt degree morphology, thus exhibiting their 'positive' form. The usual assumption about this case is that the degree argument is manipulated by the covert positive morpheme POS (Cresswell 1976; a.m.o.). This morpheme has a semantics that is similar to that of *very*. However, unlike *very*, this morpheme requires that the degree to which the modified predicate applies exceed the standard by any amount, not that it do so by some large amount. Here I build on prior proposals about the semantics of adjectival POS (e.g., Kennedy and McNally 2005) and extend these to the adverbial counterpart POS_{Adv}. I assume the entry in (36).[18]

(36) $[\![\text{POS}_{Adv}]\!]^c = \lambda A\lambda P\lambda e.\exists d[A(d)(P)(e) \wedge \textbf{std}(A, P^c) \prec d]$

As shown in (37), the resulting meanings for $\textit{POS}_{Adv}$ *slowly* and $\textit{POS}_{Adv}$ *quickly* are very similar to those for $\textit{very}_{Adv}$ *slowly* and $\textit{very}_{Adv}$ *quickly* in (35). However, the meanings in (37) require that the relevant standard be exceeded simpliciter and correctly predict that they are semantically weaker versions of the meanings in (35).

(37) a. $[\![\text{POS}_{Adv}\ \text{slowly}]\!]^c$
$= \lambda P\lambda e.\exists d[P(e) \wedge d \preceq \textbf{long}(e) \wedge \textbf{std}([\![\text{slowly}]\!], P^c) \prec d]$
$= \lambda P\lambda e.P(e) \wedge \textbf{std}([\![\text{slowly}]\!], P^c) \prec \textbf{long}(e)$

b. $[\![\text{POS}_{Adv}\ \text{quickly}]\!]^c$
$= \lambda P\lambda e.\exists d[P(e) \wedge d \preceq \textbf{short}(e) \wedge \textbf{std}([\![\text{quickly}]\!], P^c) \prec d]$
$= \lambda P\lambda e.P(e) \wedge \textbf{std}([\![\text{quickly}]\!], P^c) \prec \textbf{short}(e)$

I close this section with one important point about the semantics of *slowly* and *quickly*. It is that the measures encoded by *slowly* and *quickly* must be truly different. That is, one might suggest that we can stick with a single measure of event duration—call it **dur**—and simply reverse the direction of the ordering relation across *slowly* and *quickly*, as previously proposed in e.g. Heim (2006). This idea is formalized in (38).

(38) SLOWLY / QUICKLY (to be rejected)
a. $[\![\text{slowly}]\!] = \lambda d\lambda P\lambda e.P(e) \wedge d \prec \textbf{dur}(e)$
b. $[\![\text{quickly}]\!] = \lambda d\lambda P\lambda e.P(e) \wedge d \succ \textbf{dur}(e)$

However, (35) already tells us that this would be a mistake. That is, since intensifiers like *very* move up the degree to which the modified predicate applies, we need to ensure that (38) buy us the required strengthening. (38a) is indeed unproblematic. It correctly predicts that $\textit{very}_{Adv}$ *slowly* conveys a stronger meaning than does $\textit{POS}_{Adv}$ *slowly*. For example, *Maryam wrote her dissertation*

[18] This entry is likely a simplification since the positive morpheme is sensitive to the nature of the modified predicate. That is, the proposed semantics for POS_{Adv} treats all gradable adverbs as 'relative' predicates, i.e., as coming with vague standards taken from the middle of the scale. 'Absolute' predicates differ in that they take as standards the minimum or the maximum of the scale. Since the distinction between relative and absolute predicates has centered on gradable adjectives (Yoon 1996; Rotstein and Winter 2004; Kennedy and McNally 2005), here I will put aside its potential relevance to gradable adverbs.

very$_{Adv}$ *slowly* is predicted to asymmetrically entail *Maryam wrote her dissertation* POS$_{Adv}$ *slowly*. The reason is that the former sentence requires a longer event duration than the latter sentence, and thus—according to (38a)—if the former sentence meets the standard, so will the latter sentence. But (38b) is truly problematic. As it turns out, it predicts no specific entailment relation between *Maryam wrote her dissertation very*$_{Adv}$ *quickly* and *Maryam wrote her dissertation* POS$_{Adv}$ *quickly*, where the clear intuition is that the former sentence makes a stronger statement than does the latter sentence. The reason for this lack of entailment is that, even though *very*$_{Adv}$ raises the degree to which *quickly* must apply, (38b) states that the duration of the described event is shorter than said degree and thus no strengthening ensues.

In sum, the gradability properties of *quickly* and *slowly* naturally fall out from a conservative extension of a standard degree semantics that was originally developed for gradable adjectives. Following this tack not only provides the first step toward a realistic semantics for adverbs of change but also sheds light on the kind of measures that such adverbs encode.

5 Deriving the available interpretations of *quickly*

Section 4 has outlined a semantics for *quickly* and *slowly* that captures their gradability properties. However, this semantics is still lacking in two important respects. First, we know from Section 3 that adverbs of change impose selectional restrictions on the aspectual profile of the modified predicate. Yet nothing said so far prevents adverbs of change from composing with predicates of any aspectual class. Second, according to our preliminary semantics, adverbs of change measure event duration. While this assumption directly captures the extent reading of such adverbs, it remains unclear how the rate, narrative, and illocutionary readings are to be derived. In order to address these two issues, the current section will develop a full-blown account of *quickly* and the next section will extend this account to *slowly*, *immediately*, *gradually*, and their kin.

5.1 A semantics for *quickly*

I propose to enrich the preliminary entry for *quickly* in (31b) in two respects, i.e., by imposing restrictions on the aspectual profile of the modified predicate and by letting the underlying measure distribute over event structure. Starting with the former enrichment, Section 3 has established that *quickly* typically selects for dynamic predicates.[19] I will thus impose dynamicity as a definedness condition on the lexical entry for *quickly*. The latter enrichment is needed in order to derive the rate reading of *quickly*. Following Cresswell (1978) and Rawlins (2013), I will assume that the measure encoded by *quickly* distributes over event structure, targeting the minimal parts of the described event that still fall under the modified predicate.

The final entry for *quickly* is stated in (39). Recall from (17) that a dynamic predicate is one that only applies to transitions, i.e., events that contain the arrow operator, the bearer of aspectual change. Moreover, the set of P-atoms of an event e contains all minimal parts of e that still fall under P. This set is defined in (40).[20]

[19] While the illocutionary reading of *quickly* looks like an exception in failing to restrict the aspect of the underlying lexical predicate, I will propose below that deriving this reading involves a covert discourse operator that in fact provides dynamicity.

[20] Notice that if P is quantized, none of the events it applies to will be proper parts of each other. In this case, the set

(39) QUICKLY (final)
$[\![\text{quickly}]\!] = \lambda d \lambda P \lambda e : \mathbf{DYN}(P) . P(e) \wedge \forall e' \in \mathbf{atom}(e,P)[d \preceq \mathbf{short}(e')]$

(40) $\mathbf{atom}(e,P) = \{e' \in P \mid e' \sqsubseteq e \wedge \neg \exists e'' \in P[e'' \sqsubset e']\}$

I now demonstrate how this semantics for *quickly* derives the attested readings (rate, extent, narrative, illocutionary). The basic idea behind the analysis is that all readings involve measurement of event duration and that the differences in interpretation arise from the kind of events that are being measured.

5.2 The rate reading

The rate reading of *quickly* may arise with activity predicates and implies that the described action evolves fast. This reading is derived in (41), where the bracketed part of (41a) results in the meaning in (41b).

(41) Selena ran quickly.
   a. Selena [run [POS_{Adv} quickly]]
   b. $\lambda e . run(e) \wedge \forall e' \in \mathbf{atom}(e, run)[\mathbf{std}([\![\text{quickly}]\!], run^c) \prec \mathbf{short}(e')]$

The resulting meaning states that the minimal parts of the relevant running event that still count as runnings are of a shorter duration than the standard duration for running events of this kind. Depending on the context, these atoms may correspond to short stretches of running, individual steps, or perhaps even smaller motions. Either way, we get the intuition of a fast rate.

It is worth pausing for a while to comment on the nature of the atomic events that the measure of *quickly* distributes over when deriving the rate reading. The point is that talking about atomic events of a certain kind would normally bring in the 'minimal-parts problem', i.e., the issue of when event parts become too small to still satisfy an atelic predicate (see Taylor 1977; Dowty 1979: 7.3; Moltmann 1991; Vlach 1993; Landman and Rothstein 2012a, 2012b; Champollion 2017: ch.5; a.o.). However, since my account builds dynamicity directly into event structure, the problem of minimal parts does not really arise, at least not for the case of activities. That is, recalling Section 2.2, activity predicates denote simple transitions of the form $s \xrightarrow{Q} s'$ and their sums. This means that the minimal parts are explicitly represented in the denotation and distribution over them can readily apply. Moreover, although such minimal events are direct transitions which count as punctual in aspectual terms (see Section 2.3), assigning to them temporal duration is quite unproblematic. This is because, on the current account, the temporal notion of duration and the aspectual notion of durativity are kept separate. That is, all events have a positive temporal duration, punctual events including.

5.3 The extent reading

The extent reading of *quickly* arises with telic predicates and targets the temporal duration of the described event. In order to derive it, we need to ensure that *quickly* composes with the entire verb phrase. Since the property denoted by telic verb phrases is quantized (it contains no two events

of P-atoms of e will amount to the singleton $\{e\}$.

such that one is a proper part of the other), the distribution over event structure in this case is trivial and *quickly* ends measuring the duration of the entire described event. This is illustrated in (42).

(42) Selena quickly ran to the park.

a. Selena [[POS$_{Adv}$ quickly] [run to park]]

b. $\lambda e\,.\,run(e) \wedge \mathbf{goal}(e) = park \wedge$
$\forall e' \in \mathbf{atom}(e, [\![\text{run to park}]\!])[\mathbf{std}([\![\text{quickly}]\!], [\![\text{run to park}]\!]^c) \prec \mathbf{short}(e')]$
$= \lambda e\,.\,run(e) \wedge \mathbf{goal}(e) = park \wedge \mathbf{std}([\![\text{quickly}]\!], [\![\text{run to park}]\!]^c) \prec \mathbf{short}(e)$

Quickly with accomplishment predicates may also characterize the rate of the underlying process. In this case, it is crucial to assume that *quickly* composes with the activity verb first, and then the resulting complex is composed with the object phrase. This is illustrated in (43), where the rate reading arises from distribution over the minimal running events of the underlying process, just as in (41).

(43) Selena ran quickly to the park.

a. Selena [[run [POS$_{Adv}$ quickly]] to park]

b. $\lambda e\,.\,run(e) \wedge \forall e' \in \mathbf{atom}(e, [\![\text{run}]\!])[\mathbf{std}([\![\text{quickly}]\!], [\![\text{run}]\!]^c) \prec \mathbf{short}(e')] \wedge \mathbf{goal}(e) = park$

Notice that there are diverging claims in the literature about how the surface position of *quickly* in accomplishment sentences restricts available interpretations. Although these claims are not fully consistent with each other, the consensus seems to be that a postverbal position conveys a preference for the rate reading and a preverbal position conveys a preference for the extent reading (e.g., Pustejovsky 1991; Thompson 2006; Kearns 2007). Here I will not attempt to state specific surface restrictions for *quickly*, my only point being that the rate and the extent readings are both possible with accomplishments and arise from different scope relations.

Finally, recall from Section 3 that a rate reading arises with dynamic predicates that are durative. That is, it arises with activities or accomplishments but not with achievements, which are punctual. We now have an explanation for why that is. The reason is that only activities and accomplishments make available the atomic structure of the underlying process—although, in the case of accomplishments, the object phrase eventually filters out all non-maximal events and makes the final denotation quantized. In contrast, achievement predicates refer to direct transitions and their denotations are quantized at any point of the semantic composition. Importantly, the restiction of the rate reading to durative predicates need not be explicitly stated, as it arises from the distributivity of *quickly* and the denotation of achievement predicates.

5.4 The narrative reading

The narrative reading of *quickly* arises with telic predicates (i.e., accomplishments or achievements). The pre-theoretic intuition about this reading is that it says something about the temporal distance between the described event and some prior event. In order to do justice to this intuition, I will assume with Rawlins (2013) that what is being measured in this case is the duration of a 'narrative event', an eventive counterpart of 'reference time' (Reichenbach 1947: §51). Reference time is a theoretical construct whose main role is to determine the temporal relations between the events introduced in narrative discourse (Kamp and Rohrer 1983; Partee 1984; Dowty 1986; Hinrichs 1986; Kamp and Reyle 1993: ch.5; Parsons 2002; Bary and Haug 2011; Altshuler 2012; a.o.).

Rawlins offers a novel implementation of this same idea, proposing instead that narrative discourse is chunked into narrative events, which enter into analogous relations with described events as do reference times on the standard view.

More specifically, I will assume that narrative events are introduced by a covert NARR operator. This operator does two things. It selects for telic predicates, as only such predicates are felt to advance the narration time. This operator also states that the narrative event introduced by it contains the described event as a final segment. An entry for NARR is given in (44), where e is a narrative event, e' is a described event, $<$ is the relation of strict temporal precedence over events, and $\textbf{FIN}(e',e)$ says that e' is a final segment of e.

(44) a. $[\![\text{NARR}]\!] = \lambda P \lambda e : \textbf{TEL}(P) . \exists e' [P(e') \wedge \textbf{FIN}(e',e)]$

b. $\textbf{FIN}(e',e)$ iff $e' \sqsubseteq e \wedge \neg \exists e'' [e'' \sqsubseteq e \wedge e' < e'']$

An illustration of the narrative reading of *quickly* is provided in (45). In order to derive it, we need two additional assumptions. The first assumption is that the property produced by application of NARR is quantized. If so, distribution over it will be trivial and *quickly* will end up characterizing as short the entire narrative event. The second assumption is that narrative events are closely aligned with each other, which follows a similar assumption about reference times made in the literature on narrative discourse. Overall then, (45) entails that the narrative event—which contains the described event as a final segment and which immediately follows upon a prior narrative event—is of a shorter duration than the standard duration for quick narrative events of this kind. This derives the intuition that the event of Mark opening the door happens shortly after the previously described event, whatever that might be.

(45) ... Quickly, Mark opened the door.

a. [[POS_{Adv} quickly] [NARR [Mark open door]]]

b. $\lambda e . \exists e' [open(e') \wedge \textbf{theme}(e') = door \wedge \textbf{agent}(e') = mark \wedge \textbf{FIN}(e',e)] \wedge$
$\textbf{std}([\![\text{quickly}]\!], [\![\text{NARR [Mark open door]}]\!]^c) \prec \textbf{short}(e)$

Recall that, in the right context, a narrative reading may also arise with underlyingly atelic predicates (i.e., states or activities). Such cases are plausibly analyzed as involving aspectual coercion, i.e., an aspectual shift triggered by a covert operator and needed to repair an aspectual conflict (e.g., De Swart 1998). For the case at hand, I will assume that the narrative reading is facilitated by a covert inchoative operator INC. What this operator does is take an atelic predicate and turn it into an achievement predicate by adding to each event in the denotation a prior state, thus building change into its structure. A preliminary semantics for this operator is stated in (46).[21]

(46) $[\![\text{INC}]\!] = \lambda P \lambda e : \neg \textbf{TEL}(P) . \exists s, e', Q [P(e') \wedge e = s \xrightarrow{Q} e']$ (preliminary)

With the possibility of coercing atelic predicates into telic ones like this, the narrative operator may apply as usual and give rise to a narrative interpretation. The structure in (47) provides an illustration and the semantic analysis closely follows that in (45).

[21] The inchoative predicate that results from application of INC may appropriately be called a 'reverse culmination' (cf. Mourelatos 1978; Piñón 1997). That is, while both regular and reverse culmination predicates refer to events of the form $e \xrightarrow{Q} e'$, the intuition about the former kind of events is that the moment of change completes the action while the intuition about the latter kind of events is that the moment of change starts the action.

(47) ... Quickly, Jill was asleep.

a. [[POS$_{Adv}$ quickly] [NARR [INC [Jill asleep]]]]

b. $\lambda e\,.\,\exists e',e'',s,Q[be.asleep(e'')\wedge \mathbf{exp}(e'')=jill\wedge e'=s\xrightarrow{Q}e''\wedge \mathbf{FIN}(e',e)]\wedge$
$\mathbf{std}([\![\text{quickly}]\!],[\![\text{NARR [INC [Jill asleep]]}]\!]^c)\prec \mathbf{short}(e)]$

One thing that we should be careful about when composing NARR and INC is how much of the described event is to be included in the narrative event. The entry for NARR in (44) states that the entire described event must be included in the narrative event (as its final segment). This accords well with intuition when it comes to accomplishments and regular achievements (happenings or culminations), where the narrative reading of *quickly* seems to characterize as short the distance between the end of the described event and some prior event (cf. *They moved next door and quickly built a mill to grind corn*). However, when it comes to inchoative predicates, the issue is less clear. That is, what seems to be measured by the narrative reading of *quickly* in this case is the distance between the beginning of the underlying event and some prior event. For example, in (47) the state of Jill's being asleep may stretch over a long period of time and it would be enough for *quickly* to target just some initial segment of that state. In order to account for this intuition, I will weaken the semantics for INC in (46), now only requiring that an initial segment of the described event makes up the inchoative event. This is stated in (48), where $\mathbf{INI}(e'',e')$ says that e'' is an initial segment of e'.

(48) a. $[\![\text{INC}]\!] = \lambda P\lambda e : \neg\mathbf{TEL}(P)\,.\,\exists s,e',e'',Q[P(e')\wedge \mathbf{INI}(e'',e')\wedge e=s\xrightarrow{Q}e'']$ (final)

b. $\mathbf{INI}(e'',e')$ iff $e''\sqsubseteq e'\wedge\neg\exists e'''[e'''\sqsubseteq e'\wedge e'''<e'']$

Overt inchoative operators, like *begin* or *start*, give rise to similar coercion effects as INC and may be analyzed along similar lines.

5.5 The illocutionary reading

Finally, I discuss the illocutionary reading of *quickly*. This reading concerns the metalinguistic component of the question–answer dynamic and intuititvely measures the time between two utterance events. In order to derive it, I will follow a similar tack to that of the analysis of the narrative reading. That is, I will assume that discourse interaction is chunked into performative events of asking and answering questions (cf. van Kuppevelt 1995; Ginzburg 1996, 2012; Büring 2003; Roberts 2012). Here I implement this idea by proposing that the illocutionary reading involves interaction of *quickly* with a covert performative operator called ANS. This operator introduces an abstract event of the addressee answering the question, where the duration of the answering event is further specified by an adverb of change. The semantics of ANS is defined in (49), where $\mathbf{ad}^c$ stands for addressee of the context c.[22]

(49) $[\![\text{ANS}]\!]^c = \lambda A\lambda Q\lambda p\lambda e : A(\lambda e'.answer(e',\mathbf{ad}^c,p))(e)\,.\,Q(p)$

[22]One might wonder whether performative operators like ANS and overt verbs of communication are related in some way. Although I will not stake out a position, one reasonable view is that verbs of communication have a uniform semantics throughout, but when used performatively in questions, they compose with an appropriate operator and produce the meaning in (49). That is, this meaning may be thought to arise from the following two components: $[\![\text{ANSWER}]\!] = \lambda e\,.\,answer(e)$ and $[\![\text{OP}]\!]^c = \lambda P\lambda A\lambda Q\lambda p\lambda e\,.\,A(\lambda e'.P(e)\wedge \mathbf{agent}(e')=\mathbf{ad}^c\wedge \mathbf{theme}(e')=p)(e)\wedge Q(p)$.

The result of composing ANS with *quickly*, and then factoring this complex meaning into the standard question partition (see Hamblin 1973), is shown in (50).

(50) Quickly, it is raining?

a. [[ANS [POS$_{Adv}$ quickly]] [Q raining]]

b. $\lambda p \lambda e : \mathit{answer}(e, \mathbf{ad}^c, p) \wedge \mathbf{std}([\![\text{quickly}]\!], [\![\text{ANS}]\!]^c) \prec \mathbf{short}(e)$.
$p = \lambda w.\mathit{rain}(w) \vee p = \lambda w.\neg \mathit{rain}(w)$

The most important thing to notice about this meaning is that the argument of *quickly*—the property of the addressee's answering the question—is assumed to be telic, i.e., dynamic and quantized. Dynamicity is needed because it is directly selected by the meaning of *quickly*. In turn, quantization is needed because it entails that distribution over event structure is vacuous. Given these two properties, *quickly* ends up measuring the full answering event, stating that this event is of a shorter duration than usual. This accounts for the sense of conversational urgency associated with the illocutionary reading of *quickly*. Moreover, since *quickly* targets the metalinguistic property of answering and not to the descriptive content of the question, the analysis captures the empirical observation from Section 3 that the illocutionary reading of *quickly* is blind to the aspectual properties of the lexical predicate inside the question.

5.6 Summary

We have derived the four attested readings (rate, extent, narrative, illocutionary) from the very same semantic content of *quickly*. We have claimed that the apparent divergence in meaning arises from a combination of three main factors: (i) the aspectual properties of the selected lexical predicate, (ii) interaction with covert aspectual and discourse operators, and (iii) the possibility that *quickly* attaches to different positions in the syntactic structure. As we will see in the following section, limiting the possible attachment sites for other adverbs of change results in a smaller set of available interpretations.

6 More adverbs of change

The discussion so far has mostly centered on *quickly* as a prime example for an adverb that modifies aspectual change. But English has a large number of adverbs with similar properties. In this section, I will suggest that adverbs of change are of four major types. These include the 'quickly' type (like *quickly* or *rapidly*), the 'slowly' type (like *slowly* or *sluggishly*), the 'immediately' type (like *immediately* or *instantly*), and—much more tentatively—the 'gradually' type (like *gradually* or *steadily*). In each case, I will focus on the adverb that serves as an eponym for the entire class, while briefly touching on other members of the same class.

6.1 *Quickly* and its kin

The semantics of *quickly* was discussed at length in Sections 3–5. In short, *quickly* was argued to select for dynamic predicates and distribute over event structure, stating that the targeted events are of a relatively short duration.

Quickly shares semantic properties with adverbs like *rapidly*, *swiftly*, *hastily*, *speedily*, etc. These last adverbs too select for dynamic predicates and characterize the targeted event as being relatively short. In addition, they share with *quickly* most of its readings. A quick check confirms that they are able to convey rate, extent, and narrative readings in similar contexts as those we encountered for *quickly* in Section 3. In spite of this overlap in meaning, none of the above adverbs appears able to convey an illocutionary reading. The general paradigm is illustrated for *swiftly* in (51), where the first three examples are from COCA.

(51) a. A light infantryman ran swiftly toward Zebulon and Elsa. (rate)
b. You rose swiftly to national fame and opened your own restaurant, *Stars*, in San Francisco in 1984. (extent)
c. She muttered a quick dismissal of his concern, managed a brief smile, and swiftly returned her attention to the masked man. (narrative)
d. #Swiftly, do you want to come with me? (#illocutionary)

Given this somewhat restricted empirical picture, we can tentatively assume that such adverbs have a similar semantics to that of *quickly*. The fact that they cannot convey an illocutionary reading can be attibuted to their inability to attach to the high left-peripheral position required for this reading. Such idiosyncratic attachment restrictions are common among adverbs of change, as we will see in the following few sections.

6.2 *Slowly* and its kin

Slowly only partially overlaps in available interpretations with its antonym *quickly*. Just like *quickly*, when modifying an activity, *slowly* gives rise to a rate reading. (52) states that Selena traversed space at a lower rate than the usual rate for a comparable running event.

(52) Selena ran slowly.

Slowly can also acquire an extent reading, e.g., in modifications of accomplishment predicates. (53) below can be taken to mean that it took Tyson a considerable amount of time to climb the hill.

(53) Tyson slowly climbed the hill.

As discussed in Section 3, *quickly* with accomplishments has been claimed to be ambiguous between an extent and a rate reading (Cresswell 1978; Pustejovsky 1991; Shaer 1998; Thompson 2006; Rawlins 2013). The question then arises as to whether *slowly* with accomplishments is ambiguous in the same way. Since the judgments in (24)–(25) for *quickly* seem to work in a similar way for *slowly*, I will apply the same reasoning and assume that *slowly* is ambiguous between an extent and a rate reading in such contexts as well.[23]

In spite of these similarities, *slowly* is more restricted than *quickly* when it comes to pragmatic interpretations. That is, *slowly* does not give rise to a narrative reading. For example, to the extent

[23] Pustejovsky (1991) actually claims that *slowly*—in contrast to *quickly*—only produces a rate reading when modifying accomplishments like *walk to the store*. I do not know what to make of this claim, especially in view of the parallelism between *slowly* and *quickly* just mentioned. Notice that the semantic account to be presented below is compatible with either option for *slowly*, owing to the fact that adverbs of change may vary in attachment possibilities.

that it is interpretable, (54) appears to coerce an inherently punctual event into a durative, slow-motion-like event. Notably, (54) cannot receive a narrative interpretation, whereby the noticing event took just a moment but occurred long after the walking-in event took place.

(54) The professor walked in and Selena slowly noticed him.

Another piece of the evidence for the lack of a narrative reading involves co-occurrences of *slowly* and *quickly*. The idea here is that, if these two adverbs felicitously occur in the same clause, they must take on two different readings in order to avoid a logical contradiction. What the empirical contrast in (55) shows is that it is natural to read *quickly* narratively and interpret *slowly* as a rate modifier, but not vice versa. This is compatible with the claim that *slowly* lacks a narrative reading.

(55) a. Zelda left the house. Quickly, she started running slowly.
b. Zelda left the house. ?Slowly, she started running quickly.

Notice also that *slowly*, unlike *quickly*, appears to lack an illocutionary reading.

(56) ?Slowly, what is the capital of Uganda?

In short, *slowly* is much more restricted in its semantic distribution. It shares with *quickly* a rate and an extent reading, yet it lacks a narrative or an illocutionary reading.

I propose that *slowly* has a similar semantics to that of *quickly*. That is, it selects for dynamic predicates and distributes over event structure, measuring event duration. Moreover, just like *quickly*, *slowly* is grammatically gradable and interacts with degree morphology. The only lexical difference between the two adverbs is that *quickly* measures event duration on a 'shortness' scale, while *slowly* measures event duration on a 'longness' scale, as argued in Section 4. The final entry for *slowly* is given in (57) and builds on the preliminary proposal in (31a).

(57) SLOWLY (final)
$[\![\text{slowly}]\!] = \lambda d \lambda P \lambda e : \mathbf{DYN}(P) . P(e) \wedge \forall e' \in \mathbf{atom}(e, P)[d \preceq \mathbf{long}(e')]$

This meaning makes *slowly* a perfect antonym of *quickly*, since the two adverbs only differ in the direction of their scale of measurement. However, what still needs to be explained is why the former adverb displays a much more restricted set of readings, lacking a narrative and an illocutionary reading. This gap in the paradigm of *slowly* would be surprising on a purely semantic story, if *slowly* differs from *quickly* only in scale direction. I will thus propose that the gap in available interpretations has to do not with the semantics of *slowly* per se, but rather with its attachment possibilities. Recall from Section 5 that the rate and the extent readings require low attachment, i.e., attachment to the verb or the VP, respectively. If such low attachment is available for *slowly*, this adverb can readily produce these two reading in the same way as does *quickly*. In contrast, the narrative and the illocutionary readings require high attachment, i.e., attachment to high functional projections in the left periphery of the sentence.[24] If *slowly* cannot attach to high positions like these, a narrative and an illocutionary reading for it will be blocked. In sum, if *slowly* can only attach low, it is correctly predicted to give rise to a subset of its logically possible interpretations.

[24]This is quite obvious in the case of the illocutionary reading, which requires the adverb of change to attach even higher than the Q morpheme, which is standardly assumed to sit in CP.

Slowly has as synonyms adverbs like *sluggishly* or *glacially*. Just like *slowly*, these adverbs characterize the relevant event as being longer, not shorter than usual. In addition, these adverbs seem to share all attested interpretations that *slowly* has. More specifically, they can take on rate or extent interpretations and entirely lack narrative or illocutionary interpretations. What this suggests is that their semantics and attachment possibilities are very similar to these of *slowly*.

6.3 *Immediately* and its kin

Just like *quickly* and *slowly*, *immediately* expresses a graded notion, as the occurrence of events may be more immediate or less immediate. But this adverb is not obviously grammatically gradable. As demonstrated in (58), *immediately* is not natural in comparative constructions or with *very*.

(58) a. *Selena left the room more immediately than Justin (did).
b. *Selena left the room very immediately.

In spite of such data, occasional examples of *immediately* occurring in the comparative or with *very* are found in the wild. (59) lists two such examples culled from COCA.

(59) a. The greatest challenge to both engineers and managers is that many corporate leaders feel pressure from stockholders and other stakeholders more immediately than they do the urgency of safety or engineering obligations.
b. Now, there is also a fair amount of funding being held up in Washington right now that the Egyptians need very immediately.

However, it seems clear that these examples convey a shift in meaning. That is, in (59a) *more immediately* amounts to 'more directly' (or perhaps 'more strongly'), and in (59b) *very immediately* amounts to 'very urgently'. This is why—without elaborating on the precise mechanism behind such meaning shifts—I will tentatively assume that *immediately* is not grammatically gradable, i.e., it lacks a degree argument. That said, notice that this assumption is quite inessential for the account proposed below. In fact, treating all adverbs of change as grammatically gradable would make for a more uniform analysis, albeit one that fails to pay close attention to the data.

In view of this discussion, I will assume that *immediately* measures event duration and compares the resulting value to some standard duration. A preliminary entry is given in (60).

(60) IMMEDIATELY (preliminary)
$[\![\text{immediately}]\!]^c = \lambda P \lambda e\,.\,P(e) \wedge \textbf{std}(\mathit{immediately}, P^c) \prec \textbf{short}(e)$

This entry suggests that *immediately* is like *quickly* in that it characterizes a given target event as being relatively short (as contrasted to being relatively long). However, *immediately* turns out to only compose with telic predicates and give rise to a narrative reading. The examples in (61) provide an illustration for the case of happenings, culminations and accomplishments, respectively.

(61) a. I stopped using my phone before bed and immediately noticed four huge changes to my well-being.
b. Kim took out her gun and the officer immediately exited his patrol car.

c. When Columbus arrived back in Spain, he immediately wrote a letter announcing his discoveries.

A rate reading for *immediately* with activity predicates is clearly not available. For example, (62a) cannot describe the running event as unfolding at a fast rate. However, such combinations are sometimes coerced into a narrative reading, where *immediately* characterizes as short the narrative time between the onset of the underlying event and some previously mentioned event. This use is illustrated in (62b).

(62) a. ?Valentina ran immediately.
b. I jumped up and Valentina ran immediately toward the fire.

Immediately lacks an extent reading as well. For example, (61c) above does not characterize the letter-writing event itself as short. Rather, it states that, upon returning to Spain, it did not take long for Columbus to write the letter in question, whatever the speed of writing might have been. Similar comments apply to (61a) and (61b), where the described event need not be of a shorter duration than usual. Finally, an illocutionary reading for *immediately* seems to be missing too, as shown in (63).

(63) #Immediately, where is the key for the house?

We have established that *immediately* lacks a rate, an extent, or an illocutionary reading, and may give rise to a narrative reading alone. The unavailability of a rate reading suggests that the semantics of *immediately* does not involve distribution over event structure. Thus, I will assume that—in contrast to *quickly*—*immediately* lacks a quantificational component. Moreover, we know from Section 5.4 that the narrative reading arises with telic predicates. In principle, there are two ways to single out telic predicates, i.e., these could be selected directly by *immediately* or by the covert operator NARR defined in (44). However, the first option is a non-starter. It would not explain why *immediately* may not compose with telic predicates and give rise to an extent reading, something that is very natural for *quickly*. I will thus pick the second option, whereby telicity is selected by the narrative operator and *immediately* just requires dynamicity. In view of these considerations, I propose the final entry in (64).

(64) IMMEDIATELY (final)
$[\![\text{immediately}]\!]^c = \lambda P \lambda e : \mathbf{DYN}(P).\, P(e) \wedge \mathbf{std}(immediately, P^c) \prec \mathbf{short}(e)$

Given this semantics, the narrative reading of *immediately* arises through interaction with NARR, just as in the case of *quickly* (see Section 5.4). The other readings must then be missing because of the very limited attachment possibilities of *immediately*—although, the rate reading is also excluded by the stipulated lack of quantification over events.[25] That is, I assume that *immediately* can only attach to the specific high attachment site associated with a narrative interpretation. If all other possible attachment sites are unavailable for *immediately*, we correctly predict that these readings are missing.

[25] One general consideration to still assume a quantificational component for *immediately* is the idea of keeping the semantics of different adverbs of change as similar as possible. This would put the explanatory burden for the missing rate reading on the lack of low attachment alone. That said, it is hard to argue for the presence of a quantificational component if it is never going to do any real semantic work for us.

Turning now to other adverbs from the same class, *immediately* is very similar in meaning to *instantly*. The latter, just like the former, seems only able to convey a narrative reading, and thus presumably shares the same semantics. That said, both of these modifiers should be distinguished from *suddenly* or *abruptly*, which only superficially resemble *immediately* and *instantly*. Let us focus here on *suddenly* as the more frequent adverb. This adverb does interact with aspect in that it requires punctuality (cf. *The door suddenly opened* vs. *#The priest suddenly delivered a sermon*).[26] Despite appearances though, *suddenly* does not produce a narrative reading and instead conveys a sense of surprise. To see this, consider the contrast in (65).

(65) We sat down and waited for hours. { #Immediately / Suddenly }, the door opened and we heard a voice.

Since here the temporal distance between the sitting-down event and door-opening event is explicitly stated to be large, *immediately* is out due to a clash with its lexical semantics stated in (64), which requires that this distance be small. In contrast, *suddenly* is licensed and merely conveys a sense of surprise or unexpectedness. In light of this contrast, it remains unclear whether *suddenly* measures temporal duration and can be classified as an adverb of change at all.

6.4 *Gradually* and its kin

Finally, *gradually* seems to be the most complicated case of a potential candidate for an adverb of change. It has as apparent synonyms modifiers like *steadily*, *continuously*, *progressively*, or *incrementally* and describes an event development that unfolds in stages (Piñón 2000). The potential problem with classifying *gradually* as an adverb of change is that this modifier imposes no particular restrictions on the selected predicate in terms of dynamicity. As Piñón points out, *gradually* is generally out with all major aspectual classes. This is shown in (66).

(66) a. *Peter loved Mary gradually. (state)
b. *Selena ran gradually. (activity)
c. *Selena ran to the store gradually. (accomplishment)
d. ?I gradually opened the door. (happening)
e. ?The train gradually arrived at the station. (culmination)

As it turns out, *gradually* most naturally occurs with degree achievements, i.e., predicates that express incremental change (Dowty 1979: 2.3.5; Hay et al. 1999; Kennedy and Levin 2008; Rothstein 2008; Piñón 2008; Kennedy 2012). One example of this use is cited in (67).

(67) The river gradually widened.

Gradually may also occur with predicates from other aspectual classes, provided that the development stages of the target event are being made salient by adding *more and more* or by the presence of a direct object that conveys degrees of complexity. The contrasts in (68)–(69) are taken from Piñón (2000) and make the point.

[26] Notice that the required punctuality can also be derived through inchoative coercion, as in *She suddenly knew the answer* or *He suddenly ran*.

(68) a. Peter gradually loved Mary *(more and more) as he grew older.
b. I gradually drank *(more and more) wine at the party.

(69) a. The lifeguard gradually rescued { ?Peter / the children } at the beach.
b. Mary gradually bought { ?the house / the houses } in that street.

This kind of distribution contrasts sharply with other, more clear-cut instants of adverbs of change, which select for dynamic predicates and modify change. It may suggest that *gradually* does not measure event duration but just requires the presence of event development stages. In spite of this, there is a rough intuition that *gradually* has a similar meaning to that of *slowly* (on the latter, see Sections 4 and 6.2). However, while gradualness is typically taken to imply slowness, this implication is apparently not a logical entailment (Rawlins 2013). As the web examples in (70) demonstrate, gradual actions can sometimes be characterized as 'not slow', or even as 'quick'.

(70) a. The book develops gradually, but not slowly.
b. The infection begins in a branch or twig in the crown and gradually but quickly spreads through the entire elm.

One idea is that *gradually* requires that individual stages—rather than the event as a whole—be of a longer-than-usual duration. For example, in (70b) the infection of the entire tree may undergo just a few stages, and thus the full spread of the disease need not take a long time. I leave the more detailed study of *gradually* (and its kin) and how it compares with regular adverbs of change to future work.

6.5 Summary

Based on the semantics of *quickly* proposed in Section 5, this section has analyzed *slowly*, *immediately*, and (to a limited extent) *gradually*. The overall proposal is uniform both across and within adverbs. That is, I argued that different adverbs of change share a common semantic core, in the sense that all such adverbs select for dynamic predicates and measure event duration. I also argued that individual adverbs are not lexically ambiguous. Rather, the different readings arise through interaction with aspectual structure and are restricted by idiosyncratic attachment possibilities. I leave to further research the explication of the assumed restrictions on attachment possibilities, here just stressing two points. Empirically, there are certain weak positional effects (cf. Section 5.3) that provide suggestive evidence for the assumed restrictions on attachment site. Theoretically, in the absence of such restrictions, it would be hard to maintain any sort of semantic uniformity across and within adverbs of change.

7 Previous accounts

This section critically evaluates two previous accounts of adverbs of change, i.e., Cresswell (1978) and Rawlins (2013), which anticipate several of the components of my own account. While there are other explicit proposals on the market (e.g., Heim 2006; Morzycki 2016: 5.4.1; Wellwood 2019: 6.3.3; a.o.), the former two offer the most theoretical depth and make more specific predictions.

7.1 Cresswell (1978)

Cresswell's (1978) seminal paper pioneered the idea that adverbs of change distribute over the minimal parts of the described action. Centering his analysis on *quickly*, his main claim is that this adverb modifies motion predicates and compares the distance traveled by the agent during most minimal intervals to some average value. Cresswell thus takes the rate—or 'manner'—reading of *quickly* as fundamental, writing the following:

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

Cresswell's formalization is couched in the language of time intervals, not in event semantics. His proposed meaning for *quickly* is presented in a simplified form in (71). The notion of a 'minimal subinterval' is further specified in (72).

(71) If P is a motion property, a is an individual, and t is a time interval, then $[\![\text{quickly}]\!](P)(a)$ is true at t iff
   i. $P(a)$ is true at t, and
   ii. for most minimal subintervals t^* of t relative to $P(a)$: the distance covered by a during t^* while P-ing exceeds the average distance for P-ing during t^*.

(72) If a sentence ϕ is true at an interval t, then t^* is a *minimal subinterval* of t relative to ϕ iff
   i. t^* is a subinterval of t,
   ii. ϕ is true at t^*, and
   iii. there is no proper subinterval of t^* at which ϕ is true.

The main merit of Cresswell's account is that it derives the rate/extent contrast for *quickly* by factoring in the aspectual properties of the modified predicate. The rate reading follows immediately. For example, the account predicts that *John walked quickly* entails that John walked and that for most minimal subintervals of John's walking, John covered a longer distance than the average distance covered during walkings of such length. The duration reading is also predicted, as long as the modified predicate is telic. For example, *John walked quickly to the station* entails that, during most minimal subintervals, John covered more distance than the average distance covered by a walking to the station during such intervals. Since this distance is fixed, the only way the above statement can be true is by virtue of the fact that most minimal intervals of John's walking to the station are shorter than the minimal intervals for an average walking to the station. Crucially, since due to telicity any interval of walking to the station is maximal, this entails that the single interval of John's walking to the station is of a shorter duration than the relevant average. This is just the extent reading of *quickly*.

In addition to deriving the rate/extent contrast, Cresswell also touches on the narrative reading of *quickly*. He suggests that in this case *quickly* characterizes as short the interval over which the underlying sentence becomes true and explicitly points to aspectual structure. Moreover, Cresswell

recognizes the gradability of *quickly* and provides a simple extension of his analysis to capture it. His account thus anticipates all major issues around the semantics of *quickly*.

In spite of these virtues, Cresswell's account is quite restricted both empirically and conceptually. Empirically, it only discusses *quickly*, thus leaving out any variation within the larger class of adverbs of change. Conceptually, the analysis is limited to motion predicates. Needless to say, this is too coarse-grained a characterization of the selectional restrictions of *quickly.* As argued in previous sections, the relevant notion here is 'dynamicity', which is much wider in scope than that of physical motion.

7.2 Rawlins (2013)

Rawlins (2013) translates Cresswell's (1978) insights into a modern neo-Davidsonian semantics, while adding several new insights of his own. Rawlins' main claim is that adverbs of change denote degree functions and distribute over event structure. The resulting interpretation for adverbs of change is very similar to my own proposal, although the pieces of meaning are assembled somewhat differently. Glossing over technical complexities, the core proposal for e.g. *quickly* is that this adverb denotes just a measure function of events on a scale of shortness, as stated in (73a).[27] The distribution over event structure is introduced by a covert distributivity operator D (cf. Landman 2000: ch.5). The semantics of this operator is stated in (73b), where C_H is a contextually salient property of events that are homogeneous in some respect (see Rawlins 2013: 7.4.1.2 for details). Finally, the standard of comparison is introduced by POS_{Adv} and is based on C_C, a comparison class of events, as shown in (73c). The result of composing these three morphemes is given in (74).

(73) a. $[\![\text{quickly}]\!] = \textbf{short}$

b. $[\![\text{D}]\!] = \lambda f \lambda P \lambda e . \forall e' \in \textbf{atom}(e, C_H)[f(P)(e')]$

c. $[\![\text{POS}_{Adv}]\!] = \lambda P \lambda e . \textbf{std}(P, C_C, e) \preceq P(e)$

(74) $[\![[\text{D POS}_{Adv}]\text{ quickly}]\!] = \lambda e . \forall e' \in \textbf{atom}(e, C_H)[\textbf{std}([\![\text{quickly}]\!], C_C, e') \preceq \textbf{short}(e')]$

One difference between this semantics and my own proposal in Section 5.1 is that here *quickly* ends up denoting a property of events, not a modifier of such a property. This necessitates that the resulting meaning be composed with the verbal meaning through intersection (or 'predicate modification') rather than through function application, as on my proposal. This seemingly minor technical difference turns out to have significant consequences for the actual analysis. That is, the set of event atoms that the measure of *quickly* distributes over is no more selected compositionally on the basis of the modified predicate but it is determined pragmatically. More specifically, the rate/extent reading contrast is not anymore a matter of syntactic scope but a matter of contextual salience. For example, in order to derive the rate vs. extent ambiguity of *quickly* with accomplishment predicates, the account requires that both the event as a whole and its atomic parts be contextually salient. Rawlins touts this feature of his account as an improvement over Cresswell (1978)—and, by extension, over my own account—since the occurrence of *quickly* in the same surface position may be compatible with a rate and an extent reading. While doing things this way indeed requires fewer theoretical assumptions, it is unclear how a pragmatic story like this could

[27] See Kennedy (1999, 2007) for a comprehensive proposal that gradable expressions denote measure functions rather than relations between degrees, entities, and—in the case of adverbs—properties of such entities.

capture reading variation across different adverbs of change. That is, we know from Section 6 that *slowly* lacks a narrative and an illocutionary reading, and that *immediately* only gives rise to a narrative reading. Other adverbs of change may display yet different patterns. Thus, without making assumptions about available attachment sites for specific adverbs, it would remain a mystery where such idiosyncratic interpretational restrictions come from, assuming that the contextual salience of event parts is uniform across adverbs.

The main advantage of Rawlins' account is that it proposes explanations for large swaths of the rich interaction between adverbs of change and lexical aspect. For example, the account not only derives the rate vs. extent reading ambiguity, but also offers an ingenuous story about the narrative reading of adverbs of change, one that I have adopted. It also recognizes the illocutionary reading of such adverbs. Although no explicit analysis of this last reading is given, my proposal in Section 5.5 may be regarded as a straightforward extension of Rawlins' analysis of the narrative reading.

The main issue with Rawlins' account, as I see it, is that it disregards the aspectual notion of dynamicity, which is crucial for stating correctly the selectional restrictions of adverbs of change. Rawlins' main strategy here is to view adverbs of change as sortally restricted to events proper, and thus as excluding states. However, a categorical distinction like this is not fine-grained enough and turns out to overgenerate. That is, barring cases of inchoative aspectual coercion (see Sections 3 and 5.4), adverbs of change are compatible with a proper subset of eventive predicates. One kind of predicates that are excluded are stativitities like *sleep*, *watch TV*, or *wait*. Such predicates behave like bona fide activities—e.g., in episodic contexts they occur in the progressive and not in the simple present. And yet, they are incompatible with adverbs of change, see (75).

(75) *Jill $\left\{\begin{array}{c}\text{slept}\\ \text{watched TV}\\ \text{waited}\end{array}\right\}$ $\left\{\begin{array}{c}\text{quickly}\\ \text{slowly}\end{array}\right\}$.

In contrast to such difficulties, a restriction like this is fully expected on the current account. All we have to say is that stativity predicates are not dynamic. That is, they refer to events that do not express transitions.[28]

8 Conclusion

Adverbs of change select for dynamic predicates and measure out the duration of the events referred to by such predicates. These adverbs give rise to a number of readings and may characterize the rate of change, the duration of the entire described event, the narrative time between a previously mentioned event and the current event, or the illocutionary time between two utterance events. In spite of this apparent semantic diversity, adverbs of change are not lexically ambiguous. Rather, the different readings arise through interaction with aspectual structure and may be restricted by idiosyncratic attachment possibilities.

A predictive semantics for adverbs of change requires a detailed analysis of the aspectual notion of dynamicity, which is presupposed by such adverbs, as well as a basic understading of the interaction of dynamicity with telicity and durativity. One simple idea is that dynamicity is built

[28]This leaves open the question of what distinguishes stativity predicates from state predicates, given that both are non-dynamic. I leave this issue to future research.

directly into the mereological structure of events. Specifically, dynamic predicates refer to transitions, a kind of complex events that explicitly represent and label aspectual change.

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References

Altshuler, D. (2012). Aspectual meaning meets discourse coherence: A look at the Russian imperfective. *Journal of Semantics 29*(1), 1–70.

Bach, E. (1981). On time, tense, and aspect: An essay in English metaphysics. In P. Cole (Ed.), *Radical Pragmatics*, pp. 63–81. New York: Academic Press.

Bach, E. (1986). The algebra of events. *Linguistics and Philosophy 9*, 5–16.

Barker, C. (2002). The dynamics of vagueness. *Linguistics and Philosophy 25*, 1–36.

Bary, C. and D. Haug (2011). Temporal anaphora across and inside sentences: The function of participles. *Semantics & Pragmatics 4*(8), 1–56.

Beavers, J. (2008). Scalar complexity and the structure of events. In J. Dölling and T. Heyde-Zybatow (Eds.), *Event Structures in Linguistic Form and Interpretation*, pp. 245–265. Berlin: Mouton de Gruyter.

Beavers, J. (2012). Lexical aspect and multiple incremental themes. In V. Demonte and L. McNally (Eds.), *Telicity, change, and state: A cross-categorial view of event structure*, pp. 23–39. Oxford: Oxford University Press.

Beavers, J. (2013). Aspectual classes and scales of change. *Linguistics 51*(4), 681–706.

Bennett, M. R. and B. H. Partee (1972). Toward the logic of tense and aspect in English. Technical report, Indiana University Linguistics Club.

Büring, D. (2003). On d-trees, beans, and b-accents. *Linguistics and Philosophy 26*(2), 511–545.

Casati, R. and A. C. Varzi (1999). *Parts and places: The structures of spatial representation*. Cambridge, Massachusetts: MIT Press.

Champollion, L. (2017). *Parts of a Whole: Distributivity as a Bridge Between Aspect and Measurement*. Oxford: Oxford University Press.

Champollion, L. and M. Krifka (2016). Mereology. In P. Dekker and M. Aloni (Eds.), *Cambridge Handbook of Semantics*, pp. 369–388. Cambridge, England: Cambridge University Press.

Cinque, G. (1999). *Adverbs and Functional Heads. A Cross-Linguistic Perspective*. Oxford: Oxford University Press.

Comrie, B. (1976). *Aspect*. Cambridge: Cambridge University Press.

Cresswell, M. J. (1976). The semantics of degree. In B. Partee (Ed.), *Montague Grammar*, pp. 261–292. New York: Academic Press.

Cresswell, M. J. (1978). Adverbs of space and time. In F. Guenthner and S. J. Schmidt (Eds.), *Formal Semantics and Pragmatics for Natural Languages*, pp. 171–199. Reidel: Dordrecht.

Davidson, D. (1967). The logical form of action sentences. In N. Rescher (Ed.), *The logic of decision and action*, pp. 81–95. Pittsburgh, PA: University of Pittsburgh Press.

Davies, M. (2008). The Corpus of Contemporary American English (COCA). URL = https://www.english-corpora.org/coca/.

De Swart, H. (1998). Aspect shift and coercion. *Natural Language & Linguistic Theory 16*(2), 347–385.

Dowty, D. (1979). *Word Meaning and Montague Grammar*. Dordrecht: Reidel.

Dowty, D. (1986). The effects of aspectual class on the temporal structure of discourse: Semantics or pragmatics? *Linguistics and Philosophy 9*, 37–61.

Engelberg, S. (2000). The magic of the moment: What it means to be a punctual predicate. In *Proceedings of Berkeley Linguistics Society 25*, pp. 109–121.

Ernst, T. (2004). *The Syntax of Adjuncts*. Cambridge: Cambridge University Press.

Filip, H. and S. Rothstein (2006). Telicity as a semantic parameter. In *Proceedings of Formal Approaches to Slavic Linguistics 14*, pp. 139–156.

Freed, A. F. (1979). *The Semantics of English aspectual complementation*. Reidel: Dordrecht.

Ginzburg, J. (1996). Interrogatives: Questions, facts, and dialogue. In S. Lappin (Ed.), *The Handbook of Contemporary Semantic Theory*, pp. 385–422. Oxford: Blackwell.

Ginzburg, J. (2012). *The Interactive Stance*. Oxford: Oxford University Press.

Hamblin, C. L. (1973). Questions in Montague English. *Foundations of Language 10*, 41–53.

Hay, J., C. Kennedy, and B. Levin (1999). Scalar structure underlies telicity in "degree achievements". In *Proceedings of Semantics and Linguistic Theory 9*, pp. 127–144.

Heim, I. (1985, May). Notes on comparatives and related matters. Technical report, University of Texas at Austin.

Heim, I. (2006). *Little*. In *Proceedings of Semantics and Linguistic Theory 16*, pp. 35–58.

Hinrichs, E. (1986). Temporal anaphora in discourses of english. *Linguistics and Philosophy 9*, 63–82.

Hovda, P. (2009). What is classical mereology? *Journal of Philosophical Logic 38*(1), 55–82.

Jackendoff, R. (1972). *Semantic Interpretation in Generative Grammar*. Cambridge, Massachusetts/London, England: MIT Press.

Kamp, H. and U. Reyle (1993). *From Discourse to Logic. Introduction to Modeltheoretic Semantics of Natural Language, Formal Logic and Discourse Representation Theory*. Dordrecht: Kluwer.

Kamp, H. and C. Rohrer (1983). Tense in text. In Bäuerle, S. C. R., and von Stechow A. (Eds.), *Meaning, Use and Interpretation in Language*, pp. 250–269. Berlin: De Gruyter Linguistik.

Katz, G. (2005). Attitudes toward degrees. In *Proceedings of Sinn und Bedeutung 9*, pp. 183–196.

Kearns, K. (2000). *Semantics*. Houndmills and London: MacMillan Press.

Kearns, K. (2007). Telic senses of deadjectival verbs. *Lingua 117*, 26–66.

Kennedy, C. (1999). *Projecting the Adjective: The Syntax and Semantics of Gradability and Comparison*. Garland Press: New York.

Kennedy, C. (2007). Vagueness and grammar: The semantics of relative and absolute gradable adjectives. *Linguistics and Philosophy 30*(1), 1–45.

Kennedy, C. (2012). The composition of incremental change. In V. Demonte and L. McNally (Eds.), *Telicity, Change, State: A Cross-categorical View of Event Structure*, pp. 103–121. Oxford: Oxford University Press.

Kennedy, C. and B. Levin (2008). Measure of change: The adjectival core of degree achievements. In L. McNally and C. Kennedy (Eds.), *Adjectives and Adverbs: Syntax, Semantics, Discourse*, pp. 156–182. Oxford: Oxford University Press.

Kennedy, C. and L. McNally (2005). Scale structure, degree modification, and the semantics of gradable predicates. *Language 81*(2), 345–381.

Kenny, A. (1963). *Action, Emotion, and Will*. London: Routledge & Kegan Paul.

Klein, E. (1980). A semantics for positive and comparative adjectives. *Linguistics and Philosophy 4*, 1–45.

Kratzer, A. (2004). Interpreting focus: Presupposed or expressive meanings? a comment on Geurts and van der Sandt. *Theoretical Linguistics 30*, 123–136.

Krifka, M. (1989). Nominal reference, temporal constitution and quantification in event semantics. In R. Bartsch, J. van Benthem, and P. von Emde Boas (Eds.), *Semantics and Contextual Expression*, pp. 75–115. Dordrecht.

Krifka, M. (1992). Thematic relations as links between nominal reference and temporal constitution. In I. Sag and A. Szabolcsi (Eds.), *Lexical Matters*, pp. 29–53. Stanford University Press.

Krifka, M. (1998). The origins of telicity. In S. Rothstein (Ed.), *Events and Grammar*, pp. 197–235. Dordrecht: Kluwer.

Krifka, M. (2014). Embedding illocutionary acts. In T. Roeper and M. Speas (Eds.), *Recursion: Complexity in Cognition*, pp. 59–87. Springer.

Lakoff, G. (1973). Notes on what it would take to understand how one adverb works. *The Monist 57*(3), 328–343.

Landman, F. (1991). *Structures for Semantics*. Dordrecht/Boston/London: Kluwer.

Landman, F. (2000). *Events and Plurality: The Jerusalem Lectures*. Springer.

Landman, F. and S. Rothstein (2012a). The felicity of aspectual *for*-phrases. *Language and Linguistics Compass 6*(2), 85–96.

Landman, F. and S. Rothstein (2012b). Incremental homogeneity. *Language and Linguistics Compass 6*(2), 97–112.

Leonard, H. S. and N. Goodman (1940). The calculus of individuals and its uses. *Journal of Symbolic Logic 5*(2), 45–55.

Link, G. (1983). The logical analysis of plurals and mass terms: A lattice-theoretical approach. In R. e. a. Baeuerle (Ed.), *Meaning, Use, and Interpretation of Language*, pp. 302–323. Berlin: De Gruyter.

Link, G. (1991). Plural. In A. von Stechow and D. Wunderlich (Eds.), *Semantik: Ein internationales Handbuch der zeitgenossischen Forschung*, pp. 418–440. Berlin: De Gruyter.

Maienborn, C. and M. Schäfer (2011). Adverbs and adverbials. In K. von Heusinger, C. Maienborn, and P. Portner (Eds.), *Semantics: An international Handbook of Natural Language Meaning, vol. 2*, pp. 1390–1420. Berlin/Boston: Walter de Gruyter.

Moens, M. and M. Steedman (1988). Temporal ontology and temporal reference. *Computational Linguistics 14*(2), 15–28.

Moltmann, F. (1991). Measure adverbials. *Linguistics and Philosophy 14*(6), 629–660.

Morzycki, M. (2016). *Modification*. Cambridge, UK: Cambridge University Press.

Mourelatos, A. P. D. (1978). Events, processes, and states. *Linguistics and Philosophy 2*(3), 415–434.

Parsons, T. (1990). *Events in the Semantics of English: A Study in Subatomic Semantics*. Cambridge, MA/London, England: MIT Press.

Parsons, T. (2002). Eventualities and narrative progression. *Linguistics and Philosophy 25*, 681–699.

Partee, B. (1984). Nominal and temporal anaphora. *Linguistics and Philosophy 7*, 243–286.

Piñón, C. (1997). Achievements in an event semantics. In *Proceedings of Semantics and Linguistic Theory 7*, pp. 276–293.

Piñón, C. (2000). Happening gradually. In *Proceedings of Boston Linguistic Society 26*, pp. 445–456.

Piñón, C. (2008). Aspectual composition with degrees. In L. McNally and C. Kennedy (Eds.), *Adjectives and Adverbs: Syntax, Semantics, Discourse*, pp. 183–219. Oxford: Oxford University Press.

Pustejovsky, J. (1991). The syntax of event structure. *Cognition 41*, 47–81.

Rawlins, K. (2013). On adverbs of (space and) time. In B. Arsenijevic, B. Gehrke, and R. Marin (Eds.), *Studies in the Composition and Decomposition of Event Predicates*, pp. 153–193. Springer & Dordrecht.

Reichenbach, H. (1947). *Elements of Symbolic Logic*. London: Dover Publications.

Roberts, C. (2012). Information structure: Towards an integrated formal theory of pragmatics. *Semantics & Pragmatics 6*(5), 1–69.

Rothstein, S. (2004). *Structuring Events*. Oxford: Blackwell.

Rothstein, S. (2008). Two puzzles for a theory of lexical aspect: Semelfactives and degree achievements. In J. Dölling, T. Heyde-Zybatow, and M. Schaefer (Eds.), *Event Structures in Linguistic Form and Interpretation*, pp. 175–198. Berlin: Mouton De Gruyter.

Rotstein, C. and Y. Winter (2004). Total adjectives vs. partial adjectives: scale structure and higher-order modifiers. *Natural Language Semantics 12*, 259–288.

Shaer, B. (1998). Adverbials, functional structure, and restrictiveness. In *Proceedings of the North East Linguistics Society 28*, pp. 391–407.

Simons, P. (1987). *Parts: A study in ontology*. Oxford: Clarendon Press.

Smith, C. (1997). *The Parameter of Aspect*. Dordrecht/Boston/London: Kluwer.

Taylor, B. (1977). Tense and continuity. *Linguistics and Philosophy 1*, 199–220.

Tenny, C. L. (2000). Core events and adverbial modification. In C. Tenny and J. Pustejovsky (Eds.), *Events as Grammatical Objects*, pp. 285–334. Stanford: CSLI.

Thompson, E. (2006). The structure of bounded events. *Linguistic Inquiry 37*(2), 211–228.

van Kuppevelt, J. (1995). Discourse structure, topicality and questioning. *Journal of Linguistics 31*, 109–147.

Varzi, A. C. (2016). Mereology. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy*. URL = http://plato.stanford.edu/archives/win2016/entries/mereology/.

Vendler, Z. (1957). Verbs and times. *The Philosophical Review 66*(2), 143–160.

Vlach, F. (1993). Temporal adverbials, tenses and the Perfect. *Linguistics and Philosophy 16*(3), 231–283.

von Stechow, A. (1984). Comparing semantic theories of comparison. *Journal of Semantics 3*, 1–77.

von Wright, G. H. (1963). *Norm and Action: A Logical Enquiry*. London: Routledge & Kegan Paul.

Wellwood, A. (2019). *The Meaning of More*. Oxford: Oxford University Press.

Wheeler, S. C. (1972). Attributives and their modifiers. *Noûs 6(4)*, 310–334.

Yoon, Y. (1996). Total and partial predicates and the weak and strong interpretations. *Natural Language Semantics 4*, 217–236.