Studies in the Composition and Decomposition of Event Predicates

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Studies in the Composition and Decomposition of Event Predicates

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Chapter 1
The (De)composition of Event Predicates

Boban Arsenijević, Berit Gehrke, and Rafael Marín

1.1 Subatomic Semantics of Event Predicates

The aspectual classification established by Vendler (1957) half a century ago is still valid today and constitutes the basic ontological inventory of event predicates in current aspectual theory. The way we conceive of the internal configuration of such predicates, however, has changed more profoundly. On the one hand, increasingly greater richness of detail has been added to the logical representations for event predicates, from Davidson's (1967) use of event arguments and so-called Neo-Davidsonian approaches (e.g. Higginbotham 1985; Parsons 1990), to representations which focus on the relation between eventualities and their parts and to the decomposition of event predicates, often referred to in terms of 'event structure' (e.g. Pustejovsky 1995). On the other hand, the models for event semantics have been enriched, for example, by imposing a mereological structure (e.g. Krifka 1989; Lasersohn 1990), hence focusing on compositional aspects of event predicates.

Mereological approaches are closely related to so-called aspectual composition, which investigates the contribution of the verb and other argument(s) to the aspectual value of predicates. For example, to determine whether a predicate is telic

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or not, not only the verb has to be taken into account, but also (at least) the internal argument, particularly its quantificational properties (Verkuyl 1972). More recently, definitions of telicity based on the notion of a scale have been advanced (starting with Hay et al. 1999), according to which it is not necessarily the quantificational properties of the internal argument that determine the telicity of a predicate but rather a scale, a linearly ordered set of points, that can be associated with the verb, the internal argument or other elements in the clause. Thus, when dealing with aspectual composition we have to decide which is the most suitable level of aspectual analysis: the verb, the VP or the whole sentence; and this leads us directly to argument structure and thematic roles (Krifka 1989; Tenny 1994).

While decomposition and composition are at times treated as two competing ways to deal with the semantics of event predicates, we believe they can actually be seen as two sides of the same coin, as essential parts of the subatomic semantics of event predicates (to borrow Parsons' 1990 term). Along with decompositional and mereological approaches, the two main axes that articulate this volume, there is an additional ingredient concerning the subatomic semantics of event predicates: adverbial modification. An important argument in favor of introducing eventualities into the ontology came from the possibility to treat certain adverbial modifiers intersectively, as modifying an eventuality. Furthermore, there are adverbs which serve as diagnostics for the structural complexity or for particular properties of eventualities, such as (a)telicity or scalarity.

In traditional grammar, the meanings of different aspectual forms have typically been accounted for in terms of temporal relations. Aspect[1] was taken as a specification of the viewpoint on the situation described by verbal predicates (predicates expressed by the VP). Formal semantic accounts grew from this approach, and more or less explicitly took events as temporal intervals of such predicates. A milestone in this type of approaches was Reichenbach (1947), who proposed a system of three types of temporal intervals, event time, reference time and speech time, whose mutual relations were specified by different grammatical aspects and tenses, with restrictions parametrically varying across languages. In a similar vein we find early treatments of the semantics of verbal predicates, such as the work of Bennett and Partee (1972) or Verkuyl (1972). Their approach to the semantics of events, where 'event' is merely a descriptive notion, without implications for the domain of semantic types and ontology, is still represented in the work of semanticists who deny that the introduction of events as a type is beneficiary for the semantics in the respective domain, such as Verkuyl (2000).

The Davidsonian turn, i.e. the introduction of event arguments and of events as a separate type in the ontology of semantic objects, brought about a different approach to the subject. Events are now treated as objects, which are described

[1]It is common to distinguish between two different notions of aspect, grammatical aspect (viewpoint aspect, e.g. (im)perfective or aspectual meanings associated with progressive and perfect tenses) vs. lexical (predicational) aspect (also Aktionsart), associated with (a)telicity. While the notion of aspect here deals with viewpoint aspect, in the remainder of this introduction we will mainly be concerned with lexical aspect.

by event predicates and referred to by expressions with a deictic capacity and which include descriptions, similar to nominal reference. Properties of events are properties included in event predicates – predicates applying to event arguments and enabling their reference to objects of the type of events. While most of the current volume takes the perspective of event semantics, some papers are either independent of this division or even written in a temporal semantics perspective.

This introduction, which aims at outlining the state of the art of current semantic theory of events and providing a general background for the main issues addressed in the volume, is structured as follows. In Sect. 1.2, we discuss issues related to aspectual composition, such as the contribution of the verb itself, its arguments, as well as the notion of scale. In Sect. 1.3, we turn to adverbial modification, which has been used as a main argument for introducing the event argument, as well as diagnostics for the structural complexity or particular properties of event predicates or their underlying scale. Section 1.4 addresses psycholinguistic investigations into event predicates. Finally, Sect. 1.5 concludes.

1.2 Aspectual Composition

Vendler (1957) based his four-way distinction between states, activities, accomplishments, and achievements, on two main criteria, the (in)compatibility with particular temporal adverbials and the (in)compatibility with the Progressive in English. First, accomplishments and achievements pattern together in that they are incompatible with *for*-adverbials (aka durative adverbials), but compatible with *in*-adverbials (aka temporal frame adverbials) ((1)).

(1) a. I ran a mile *for/in an hour.
b. You reached the summit *for/in an hour.

Vendler notes that accomplishments and achievements are not homogeneous, since they have a 'set terminal point'. This property is commonly associated with telicity. States and activities, on the other hand, behave like atelic predicates, since they are compatible with *for*-adverbials, but not with *in*-adverbials ((2)).

(2) a. He stood in the corner for/*in an hour.
b. She ran for/*in an hour.

The second diagnostics groups states and achievements together, which are unacceptable in the progressive ((3a)), whereas activities and accomplishments are good inputs for the progressive ((3b)).

(3) a. *She was seeing a spider.
*He was finding a key.
b. You were running.
I was building a house.

This fact is often derived from the intuition that the progressive needs to apply to predicates that are dynamic and durative, allowing extension in time. States are not dynamic, however, and achievements are thought of as taking place at instants and thus not allowing for duration.[2]

Most of the literature on eventualities takes Vendler's division as a starting point, although it has been modified in several directions. For instance, Bach (1981, 1986) or Verkuyl (1993) make a three-way-distinction between states, processes (Vendler's activities ACT), and events (Vendler's accomplishments and achievements). Discourse theories such as Kamp and Reyle (1993) or ter Meulen (1995) usually distinguish between events and states (at the discourse level), and it is less clear where to locate processes/activities in such approaches (but see de Swart 1998). Others have added more classes, such as semelfactives (see, e.g., Comrie 1976; Smith 1991; Rothstein 2004), or degree achievements (in the sense of Dowty 1979; see, e.g., Hay et al. 1999). Much debate is found on the class of states, sometimes leading to a two-way division under different labels, e.g. static vs. dynamic states (Bach 1981, 1986, see also Dowty 1979; Maienborn 2005), or to denying that states belong to the classes of events altogether, for example in not (at least not all) being associated with an event argument (e.g. Katz 2003, 2008; Maienborn 2005).[3]

Martin (Chap. 4 in this volume) adds to the discussion about states. Given that the availability of manner modification has been treated as a hallmark of event predicates, she tries to give a finer analysis of particular types of manner modifiers that do or do not apply to states. She shows that in most cases the relevant facts are not related to the stative nature of the predicate, but to other independent properties. We will come back to the details of her proposal in Sect. 1.3, when we discuss adverbial modification. Fleischhauer (Chap. 6 in this volume), and to some extent also Mittwoch (Chap. 2 in this volume), tackle the issue of whether degree achievements are a separate class, and what their distinctive properties are.

Vendler's classification, though probably not intended as such, has often been criticized as classifying verbs without taking into account the role of the argument(s) or other elements in the sentence. The received view nowadays is that to determine which class a predicate belongs to or whether it is telic, at least the semantic properties of the internal argument of the verb has to be taken into account as well, making the VP the relevant level to look at. Others have argued that the notion of telicity, a semantic property of predicates of different degrees of complexity, should be dissociated from the structural properties associated with different classes of event predicates (e.g. Rothstein 2004).

[2]Since Vendler, more tests have been proposed to distinguish between different classes of event predicates and in particular to distinguish telic from atelic predicates, such as the compatibility with certain degree modifiers, the potential for ambiguity with modifiers like *almost*, *again*, among others. Many of the diagnostics taken in isolation, including the two tests mentioned here, are problematic. In Sect. 1.2.4, we will come back to this issue.

[3]See also Kratzer (1995), who proposes that only stage level but not individual level predicates, in the sense of Carlson (1977), contain an event argument in their argument structure.

The literature on eventualities has been divided with respect to the relevant property that determines whether an eventuality is telic or not. The decompositional camp takes this to be the endpoint (aka culmination, termination, telos, result, phase transition): a discrete stage (state) that the situation needs to reach in order to be truthfully described by the respective predicate (Parsons 1990; Pustejovsky 1991, 1995, and many others). Eventualities with an endpoint (those that describe a definite change of state, in the sense of Dowty 1979) are telic, those without it (that do not describe a definite change of state) are atelic. The quantity camp, on the other hand, considers properties of quantity as a necessary and sufficient semantic property in the definition of aspect (Bennett and Partee 1972; Verkuyl 1972; Krifka 1989, among others). Eventualities can or cannot have the subinterval property, they can have an unbounded or bounded quantity, or more generally they can be homogeneous or quantized, and this corresponds to the two major aspectual classes: the atelic and telic eventualities.[4]

In Sects. 1.2.1, 1.2.2, and 1.2.3 we will sketch this development and different approaches to telicity. We will address elements that have been argued to contribute to the aspectual interpretation of a sentence, such as the verb, its argument(s), and some more abstract, explicit or implicit element like a scale. In Sect. 1.2.4 we will return to the diagnostics that have been proposed to distinguish between telic and atelic predicates and address some of the problems they face.

1.2.1 Event-Argument Homomorphism

Verkuyl (1972, and subsequent work) was probably the first to systematically deal with the contribution of the verb's argument(s) to the overall aspectual interpretation of a given sentence. In his theory, a predicate is telic (terminative under his terminology) if the verb is dynamic (or additive, as specified by a +ADDTO feature) and if its relevant argument is specified for quantity (+SQA) ((4a), as diagnosed by the *for/in*-adverbial test discussed above). As soon as either the verb is −ADDTO ((4b)) or the argument is −SQA ((4bc)) or absent altogether ((4d)), the predicate is atelic.[5]

[4] An event predicate has the subinterval property if when it holds of a temporal interval, then it also holds of all the parts of this interval (perhaps to the exclusion of those reaching the atomic level of the event predicate in question). Predicates with the subinterval property are atelic.

[5] Verkuyl dubs this the Plus Principle. Following the order of composition of the verb and its arguments, he furthermore observes an asymmetry between the arguments, in the sense that the quantificational properties of the internal argument are to be taken into account first. He postulates a higher aspectual level, at which external arguments participate in the calculation of telicity, so that a −SQA external argument leads to an atelic interpretation at this higher level (e.g. *Children ate the cake for an hour*). In the remainder of this section, we will abstract away from the role of the external argument by only using definite singular noun phrases, in order to flesh out the contribution of VP-internal material.

(4) a. Lisa ate$_{[+\text{ADDTO}]}$ [the cake]$_{[+\text{SQA}]}$ (*for/in an hour).
b. Lisa saw$_{[-\text{ADDTO}]}$ [the elephant]$_{[+\text{SQA}]}$ / elephants$_{[-\text{SQA}]}$ (for/*in an hour).
c. Lisa ate$_{[+\text{ADDTO}]}$ cakes$_{[-\text{SQA}]}$ (for/*in an hour).
d. Lisa ate$_{[+\text{ADDTO}]}$ (for/*in an hour).

Relating this proposal to the Vendler classes, we see that −ADDTO verbs lead to states, the combination of +ADDTO verbs with a −SQA or no argument to activities ('processes' in Verkuyl's terms), and the combination of +ADDTO verbs with +SQA arguments to accomplishments or achievements (which Verkuyl unites under the label 'events').

Krifka (1989, and subsequent work) proposes a mereological treatment of the aspectual composition of verbs and their arguments, cast in an event semantics framework. He takes the locus of the aspectual value to be in the thematic roles, which express relations between the description of an eventuality, i.e. the predicate contributed by the verb and its modifiers, and the description of the participants in the eventuality, i.e. the predicates contributed by the expressions introducing the arguments of the verb. These relations are defined in terms of a homomorphic mapping between the two predicates, also known as event-argument homomorphism. Mapping can take place in both directions, from predicates of events to predicates of arguments and vice versa. The two predicates entering mapping, however, are in an asymmetric relation, reflected for instance in the fact that event predicates are assigned temporal intervals, but predicates of arguments are not.

In (5), for example, the verb *to run* introduces a thematic role which maps between the reference type of the eventuality it semantically specifies and that of its direct object. If a participant with this thematic role is not provided, the eventuality will be atelic, as in (5a). If such a participant is available, then similarly to Verkuyl's theory, the relevant properties of quantity (in this case of the distance denoted) will be mapped onto the eventuality. This gives us the telic eventuality in (5b) and the atelic one in (5c).

(5) a. John ran.
b. John ran a mile.
c. John ran miles.

The central property for Krifka's definition of telicity is the property of quantization. A predicate is quantized if and only if whenever it holds of two entities, x and y, these two entities do not stand in the proper part relation, as specified in (6).

(6) Quantization: $\forall P.QUA(P) \iff [\forall x, y.P(x) \,\&\, P(y) \Rightarrow \neg (x<y)]$

Predicates of events are telic when they are quantized. Non-quantized (cumulative) predicates of events are atelic. There are different ways to compositionally derive a quantized predicate, one of which is described above: when the thematic role maps between a quantized argument and the event predicate.

It is important to note a major difference between Verkuyl's and Krifka's theory, however. For Verkuyl, the quantificational properties of any argument are taken

into account when calculating the aspectual properties of a predicate, whereas Krifka explicitly states that this is the case only with arguments bearing a particular thematic role, basically those that Dowty (1991) called incremental themes. Hence, his theory initially only captured cases involving incremental theme verbs, such as *eat*, *drink*, *write*. In Krifka (1998) he extends his theory to include motion verbs and change of state verbs (parallels between the ways in which a telic reading comes about with these verb classes had already been noted in Mittwoch 1971; see also Ramchand 1997). For example, goals and sources may entail boundaries for an eventuality and therefore make it quantized, by other means than mapping. Krifka defines these two particular roles in terms of adjacency of intervals applying to all the initial and final subintervals of an eventuality. In order to have its initial and final subintervals adjacent with some other interval, an eventuality needs to be bounded, and is therefore telic as well.

Borer (2005), who proposes an essentially syntactic account for aspectual and argument-structural effects, argues for a modification of Krifka's definition. Still using a mereological approach, she notes that in Krifka's terms, an eventuality that is only bounded on one side, e.g. only with respect to its final subintervals (right-bounded), but not to its initial subintervals (left-unbounded), should be atelic. She provides arguments that this prediction is not empirically met. One of her arguments uses examples as in (6).

(6) run to the square

The eventuality described here is specified for a goal, which imposes a right bound, and is unbounded, as she argues, at its other end. The predicate holds of all the final subintervals of the eventuality it describes: each of the final subintervals is also running to the square. Borer concludes that the relevant property is not quantization, but rather homogeneity (close to Dowty's 1979 views; homogeneity is also defined in Krifka's work), i.e. that it is not telic eventualities that should be defined, but the atelic ones. In her theory, atelic eventualities are defined as those with homogeneous predicates, as defined in (7), and all the other eventualities are telic.

(7) **Homogeneity**: $\forall P.HOM(P) \iff CUM(P) \wedge DIV(P)$
(a predicate is homogeneous if it is cumulative and divisive)
Cumulativity: $\forall P.CUM(P) \iff [\forall x, y.\ P(x) \wedge P(y) \Rightarrow P(x + y)]$
(a predicate is cumulative if when it holds of two entities, it also holds of their sum)
Divisiveness: $\forall P.DIV(P) \iff [\forall x, y.\ P(x)\ [\exists y.\ y<x \wedge P(y)] \wedge [\forall x, y.\ P(x) \wedge y<x \wedge P(y) \Rightarrow P(x - y)]]$
(a predicate is divisive if when it holds of an entity, it also holds of some parts of that entity, and when it holds of a part of an entity, it also holds of its remaining part)

Arsenijević (2006) gives a yet different view, arguing that all event predicates are either quantized or homogeneous, the former being telic and the latter atelic. He argues that in any context in which these properties can be tested, predicates like the

one in (6) involve telic eventualities that come with a context-given starting point, whereas atelic eventualities do not pick one up from the context. More generally, he argues that explicit bounding of one side of the event triggers a contextual bounding of the other.

In the next section, we will see how the idea of event-argument homomorphism receives a new spin, if we assume that the homomorphism involved is one between the eventuality and scalar structures, provided by the verb, its argument, directional PP or other elements.

1.2.2 Scales, Degrees, Generalized Paths

In the previous section we saw that Krifka's (1989) initial theory only covered incremental theme verbs, but that in his 1998 paper he extends the empirical domain to include directed motion and change of state verbs. Hay et al. (1999) open up another way of calculating the aspectual properties of event predicates by introducing the notion of scales, linearly ordered structures associated with event descriptions, and this idea is refined in Kennedy and Levin (2008). In a nutshell, scales can be open/unbounded or closed/bounded (on either side), and this leads to the event being atelic or telic (see also Kearns 2007). The authors focus on degree achievements, a class of verbs that have been notoriously difficult to subsume under any of the Vendler classes, since they commonly show variable behavior with respect to standard telicity tests ((8)).

(8) The soup cooled in/for ten minutes.

They relate the interpretation of the eventuality as atelic or telic to the semantics associated with the adjectival core typically underlying degree achievements. The semantics of adjectives has been treated relying on the notion of degrees or scales (e.g. von Stechow 1984; Kennedy 1999; Rotstein and Winter 2004; Kennedy and McNally 2005; Sassoon 2010). Kennedy and McNally (2005), for example, argue that the semantics of gradable adjectives involves three elements, a measure function, a particular domain in which the measure is occurring, and an ordering relation on that domain. For adjectives that do not appear with degree morphology or modifiers, they posit a covert degree operator 'pos' that measures its argument along a particular dimension in comparison to some standard (see also von Stechow 1984). The properties of the underlying scales, then, lead to a classification of adjectives into closed-scale ones (having minimal and maximal values on the scale, e.g. *full*, *invisible*) and open-scale ones (lacking minimal and/or maximal values, e.g. *long*, *old*), diagnosed by the (in)compatibility with particular degree modifiers like *half* or *mostly*. This, in turn, leads to the interpretation of eventualities described by degree achievements derived from such adjectives as atelic (e.g. *fill*) or telic (e.g. *lengthen*), at least by default.

The scale underlying the event description in degree achievements can thus be interpreted as open or closed due to the lexical semantics of the adjectival core of

such verbs, but this interpretation can also be affected by context or conventional knowledge. For example, in (9a) the lengthening eventuality is interpreted as telic but in (9b) as atelic, because pants usually come with some standard bounded length, whereas exams can be of any random length (examples from Hay et al. 1999).

(9) a. The tailor almost lengthened the pants.
b. The teacher almost lengthened the exam.

The different interpretations here are diagnosed with the adverbial modifier *almost*, which is ambiguous in the telic example a. (the entire eventuality almost took place, or the pants almost became long) but not in the atelic example b. (which only has the first kind of reading) (see also Sect. 1.3).

Hay et al. (1999) argue that this scalar account can be extended to incremental theme verbs, where it is actually not the theme argument itself that participates in the event-argument homomorphism, but rather a particular property of the theme (e.g. size, shape, or others), which then provides a scale again. Similarly, Piñón (2005, 2008) and Caudal and Nicolas (2005) propose degree-based accounts of aspect, which they apply to different predicates. Caudal and Nicolas, for instance, distinguish two types of degree scales, a quantity scale (with incremental theme verbs, diagnosed by, e.g., *partially* in *Yannig ate the cake partially*) and an intensity scale (accessed by degree modifiers such as *perfectly* or *extremely*). We can also think of a scale as a kind of path structure, leading to the idea that the properties of generalized paths provided by the semantics of verbs, their arguments, or particular prepositional phrases, which then also includes motion events (see, for instance, Jackendoff 1996; Zwarts 2006).

Three papers in this volume explicitly base their accounts on degree-based or scalar approaches to aspect and provide good introductions to this topic. Bochnak, for example, picks up Caudal and Nicolas' (2005) observation that there is a need to distinguish between two kinds of scales, when he discusses two readings the English modifier *half* can have, an eventive and an evaluative reading. Fleischhauer, in turn, discusses degree gradation of German change-of-state verbs by *sehr* 'very' and, following Kearns (2007), argues for the need to distinguish between a standard telos (associated with non-maximal degrees) and a maximum telos. Finally, Rawlins analyzes English manner adverbs such as *quickly* or *slowly* as involving degree predication, along the lines of Kennedy and McNally's (2005) analysis of the semantics of adjectives. We will come back to the details of these three analyses in Sect. 1.3, when we talk about adverbial modification.

Levin and Rappaport Hovav (2006, and subsequent work) argue that the notion of telicity can in general be associated with scalar change. Also in this volume, they make a distinction between scalar change associated with particular verbs (their result verbs), which are basically change of state verbs such as *break* or *open*, and non-scalar change (their manner verbs). In the latter case, however, a scale can be introduced by the internal argument (e.g. with incremental theme verbs, on which see also Kennedy 2012) or by a path phrase (with motion events). Again, if the scale is bounded, the eventuality is interpreted as telic. Beavers (2008) builds on this system and adds the important observation that scales can be simple (a transition

between two states with no intermediate states, as in achievements) or complex (as in accomplishments). We will return to Levin and Rappaport Hovav's approach in the following section.

1.2.3 The Contribution of the Verb vs. Other Elements

Although the concentration has been shifted mainly to the aspectual contribution of internal arguments since Verkuyl's work, properties of the verb itself still have to be taken into account as well. For example, Rothstein (2004) argues that a given verbal predicate licenses a particular event structure, proposing different semantic event structure templates for the four Vendler classes and providing an event semantic implementation of Dowty's (1979) idea to decompose predicates. She takes telicity to be a purely semantic property of predicates at different levels and thus dissociates the Vendler classes from telicity altogether. We will come back to event structure approaches and their merits in Sect. 1.3.

Event templates, associated with particular verbs, are also employed by Levin and Rappaport Hovav (Chap. 3 in this volume and previous work). They make a principled distinction between lexicalized meaning, which belongs to the verb itself and is entailed in all its uses, independent of context, contextual meaning, which additionally arises in a particular context, and conventional meaning, conditioned by world knowledge. In previous work (1991, 2006 and Rappaport Hovav and Levin 2010) they argue for a particular constraint on what a verb root can lexicalize, which has come to be known as manner/result complementarity. In particular, they propose that a single verb root can lexicalize manner (non-scalar change) or result (scalar change), but not both at the same time. In the contribution to this volume, the authors underline that this complementarity is a constraint rather than a tendency, and they discuss two cases, which have been brought forwards as counterexamples to the manner/result complementarity, namely *cut* and *climb*.

Cut is treated as lexicalizing the meaning of result, for which, however, a prototypical manner is often inferred from the context or by convention. In addition, this verb also has clear manner uses, and in these cases Levin and Rappaport Hovav show that the result component is dropped. Conversely, *climb* is analyzed as a manner verb, with a scalar meaning associated with upward movement resulting from the general context or by convention. They show that *climb* has some additional uses as a result verb, in which case the manner component is lost entirely. Hence, to conform to their characterization of lexicalized meaning as those components of meaning that are entailed in all uses of a particular verb, they have to analyze verbs like *cut* and *climb* as polysemous between manner and result verbs. Once this is done, though, these verbs comply with the manner/result complementarity, and given that there are only few such verbs with multiple senses, this step is argued not to be too costly either.

The two-way distinction between verbs lexicalizing either manner or result (a scalar change) is directly linked to the typological distinction between

verb-framed and satellite-framed languages, proposed by Talmy (1985, and subsequent work). Talmy observes that verb-framed languages (e.g. Spanish) typically express the path of a directed motion event on the verb while leaving the manner unexpressed or specified in an adjunct ((10a)). Satellite-framed languages (e.g. English), on the other hand, in describing a directed motion event, typically combine manner of motion verbs with some non-verbal predicate expressing the path (a 'satellite', e.g. prepositional phrases or particles) ((10b)).

(10) a. La botella **entró** a la cueva (flotando).
The bottle entered to the cave (floating)
'The bottle entered the cave floating.'
b. The bottle floated **into** the cave.

If we take paths as particular scalar structures (e.g. Zwarts 2005), the correlation with Levin and Rappaport's manner/result complementarity is as follows: A language like Spanish typically makes use of result verbs to describe a directed motion event, whereas a language like English typically employs manner verbs and expresses scalar change in directed motion events by means of PPs or particles (though, as the translation of (10b) shows, English also has result verbs in the motion domain).

Talmy's observations generated various lines of research to determine whether this typological distinction is a mere tendency or a principled difference between the languages in question. Snyder (2001, 2012), for example, proposes the Compounding Parameter as the relevant parameter and argues that a positive setting makes available a particular rule of semantic composition (Generalized Modification in Snyder 2012) which allows a language to create novel endocentric root compounds ((11a)), to combine manner verbs with secondary resultative predicates into one complex predicate associated with an accomplishment interpretation ((11b)), or to have separable particles ((11c)).

(11) a. faculty lab space committee
b. We hammered the metal flat.
c. They lifted the box up.

Such constructions are possible in English but not in Spanish. Snyder furthermore shows that in English they are also acquired at around the same time. Further implementations of this or related ideas and extensions to various languages can be found in Beck and Snyder (2001), Beck (2005), and Gehrke (2008).

Furthermore, it has been suggested that languages of the Spanish type lack directional prepositions altogether (e.g. Folli 2002; Folli and Ramchand 2005; Gehrke 2008), so that these languages naturally employ result verbs to express directed motion events. In addition, it has been proposed – similar to Snyder and the works building on his ideas mentioned above – that particular semantic composition principles or syntactic mechanisms to glue together two predicates into a complex accomplishment predicate are available in satellite-framed languages but not in verb-framed languages (e.g. Mateu and Rigau 2002; McIntyre 2004; Harley 2005; Zubizarreta and Oh 2007). Finally, it has been suggested that languages differ in

the ways they distribute lexical material over the necessary ingredients of such complex accomplishment predicates (semantically and/or syntactically) (Fábregas 2007; Gehrke 2008; Son and Svenonius 2008). Gehrke (2008), for example, argues that for a verb and an adjectival or prepositional phrase to combine into a complex predicate with an accomplishment interpretation (e.g. (10b), and (11b), but also *put the pen in the box*) at least one of the two has to express incrementality, i.e. a scale, and that furthermore, in languages of the Spanish type, the scale has to be provided by the verbal predicate. Hence, whereas a language like Spanish does not have strong resultatives or cases like (10b), it still has weak resultatives (e.g. *render someone crazy*, see also Fong 1997 for respective data from French) or verbs of directed motion combining with locative PPs that merely specify the final location of the movement (of the type *arrive at the station*), both cases where the verb is essentially a result verb in Levin and Rappaport Hovav's terminology.

1.2.4 Aspectual Tests, Coercion, Quantified Incremental Arguments

The picture of aspectual composition and aspectual classifications we have painted so far seemed rather neat and clear. However, several important issues have arisen time and time again, such as the validity of the diagnostics to test whether a predicate is telic or not, the influence of the overall context and possible mechanisms to repair aspectual mismatches, also known as coercion, or the fact that event-argument homomorphism models work well when we are dealing with (in)definite or bare nouns, but get more complicated when we take quantified NPs into account.

Returning to the temporal adverbial test exemplified in (2), it has been noted that under certain contexts the particular adverbials are acceptable with classes that otherwise do not allow them. For example, iterative contexts make *for*-adverbials acceptable with accomplishments and achievements. This has been captured by the intuition that an iteration of otherwise bounded (or telic) events can be seen as unbounded overall, in which case a *for*-adverbial is applicable again. Furthermore, with some telic predicates the *for*-adverbial can take scope not over the entire event, but only over the consequent state, as in (12).

(12) She lent him the book for two days.

Inchoative or bounded reinterpretations of states and activities, in turn, render *in*-adverbials acceptable again. Such reinterpretations are commonly treated as instances of coercion (in the sense of Moens and Steedman 1988; see, for instance, de Swart 1998). Coercion alters the interpretation that is lexically associated with a given predicate in some way so to fit the requirements of the particular adverbials. This is usually done by adding something to the event description, such as an initial and/or final bound, or also a preparatory phase, as we will see in some of the following examples.

Furthermore, it has been noted that while accomplishments and achievements both allow *in*-adverbials, the effects are quite different. Whereas with accomplishments, these adverbials intuitively measure the time the event took ((13a)), with achievements, it measures some time preceding the actual event ((13b)).

(13) a. run a mile in an hour
b. reach the summit in an hour

Hamm and van Lambalgen (2005) therefore argue that also achievements undergo aspectual coercion in order to be compatible with *in*-adverbials, which adds a preparatory phase to the event ('additive coercion' in their terminology).

Bott (Chap. 8 in this volume) provides a good introduction to the phenomenon of aspectual mismatches, which can be repaired in some cases (resulting in coercion), but lead to ungrammaticality in other cases. In order to determine at what level of the sentence an atomic event unit is constructed, he investigates the processing of particular aspectual mismatch and coercion cases, such as the combination of achievements and accomplishments with *for*-adverbials, as well as achievements with *in*-adverbials. Coercion is also addressed in Martin (Chap. 4 in this volume).

Also the progressive test is not perfect, since in some contexts and in particular with some predicates, the progressive is more acceptable with classes that should otherwise not allow it. For example, the achievement in (14a) is not as bad as (3a), repeated here as (14b).[6]

(14) a. ?They are arriving at the station.
b. *He was finding a key.

Rothstein (2004) proposes that in such cases achievements are coerced into accomplishments by adding a preparatory phase, which is similar to Hamm and van Lambalgen's (2005) additive coercion discussed above. Furthermore, state predicates like *sit*, *stand*, *lie*, which Dowty (1979) calls interval statives and Bach (1986) dynamic states, are fully acceptable with the Progressive. Defining the class of states is notoriously difficult and has led to different proposals how to handle them, as was briefly discussed in the previous section (see also Mittwoch 2005).

Mittwoch (Chap. 2 in this volume) provides a critical survey of the criteria used to distinguish between accomplishments and achievements, including the two discussed here, as well as other tests, such as entailment patterns with progressive and simple tenses, ambiguity with *almost*, modification by *halfway*, or the notions of telos, result state, and subinterval property. She argues that accomplishments and achievements are distinguished at the level of VP, whereas the status of states

[6]This difference follows from analyses of the progressive that build volitionality or intentionality into its semantics: one can intentionally arrive somewhere but one cannot intentionally find something (see Portner 2011 for a summary of different approaches to the semantics of the progressive). Furthermore, if no control by an agent is taken as one of the defining features of achievements (e.g. in Dowty 1979), the predicate in (10a) should not count as an achievement, although it is commonly assumed to be one, since an arrival takes place instantaneously.

and achievements is determined at the level of the verb alone. Based on Parsons' (1990) and Kratzer's (2004) analyses, Mittwoch shows that the subinterval property criterion (Bennett and Partee 1972), which is supposed to draw the line between activities and accomplishments, needs revision since in fact accomplishments are homogeneous up to culmination, which is similar to the point raised by Borer (2005) above. In addition, activities delimited by cardinal quantifiers are shown to also lack the subinterval property. The criterion of indirect measurement of temporal extent by *in*- and *for*-adverbials is argued not to sufficiently distinguish between accomplishments and activities either, as we have already seen in some examples above, but also in (15).

(15) The doctor examined the patient (for/in an hour).

Moreover, *in*-adverbials may be problematic with predicates whose incremental arguments have vague quantifiers (e.g. *some*, *a few*, *many/a lot of*, *at most*, *at least*), and Mittwoch argues that the predicates with such selected non-specific DPs are defective accomplishments. Already Zucchi and White (2001) noted that while particular quantified DPs do not meet the formal definitions of quantizedness, they nevertheless seem to bring about a telic interpretation of the predicate involved. In order to provide some answers as to why such conflicts and irregularities arise, Mittwoch also discusses the similarities, differences and mutual relations between activities and accomplishments as well as between activities and achievements, especially in the so-called coerced readings where achievements behave like accomplishments.

We will now turn to adverbial modification in the domain of eventualities.

1.3 Adverbial Modification

One of the main motivations for Davidson (1967) to introduce the event argument came from adverbial modification, since this move allowed to interpret such modifiers intersectively, as modifiers of the event itself, and to capture particular entailment patterns between sentences with and without adverbials. These insights were preserved under the so-called Neo-Davidsonian turn, starting with Higginbotham (1985) and Parsons (1990). Their innovations include the addition of event participants via thematic roles, the association of non-action predicates, such as states and non-verbal predicates, with an event variable, and the breaking down of events into subevents, in particular processes, states and combinations of these (see also Rawlins, Chap. 7 in this volume, for a good introduction to Neo-Davidsonian event semantics).

Parsons (1990), for example, observes that his innovations still capture the entailment relations between sentences like those in (16).

(16) a. Brutus stabbed Caesar in the back with a knife.
b. Brutus stabbed Caesar in the back.
c. Brutus stabbed Caesar with a knife.
d. Brutus stabbed Caesar.

(16a) entails the conjunction of (16b) and (16c), but not vice versa. Either of (16b) or (16c) by themselves entails (16d). These facts logically follow from Parsons' representation of the respective sentences in (17).

(17) a. (∃e)[Stabbing(e) &Subj(e,B) &Obj(e,C) &In(e,b) &With(e,k)]
b. (∃e)[Stabbing(e) &Subj(e,B) &Obj(e,C) &In(e,b)]
c. (∃e)[Stabbing(e) &Subj(e,B) &Obj(e,C) &With(e,k)]
d. (∃e)[Stabbing(e) &Subj(e,B) &Obj(e,C)]

Breaking down events into subevents and having adverbial modifiers access different subevents opens up the way to treat ambiguities with particular adverbial modifiers in terms of scope and thus as structural instead of lexical ambiguities. Such ambiguities arise, for example, with *almost* (e.g. Pustejovsky 1991; von Stechow 1995; Rapp and von Stechow 1999; see also (9)), *again* (e.g. von Stechow 1996, 2003; Beck 2005), adverbs of space and time (e.g. Rawlins, Chap. 7 in this volume, see Sect. 1.3.3), or also *for*-adverbials (see (1) vs. (12)) and locative PPs (e.g. Gehrke 2008).

Decomposing predicates goes back to Dowty (1979) who did not make use of event arguments, though. Dowty proposes three predicates, DO, CAUSE, BECOME, which are combined in different ways to arrive at the four Vendler classes. States are treated as simple predicates involving none of these three predicates, activities additionally involve DO (i.e. the immediate control of an agent), achievements BECOME (i.e. a change of state), and accomplishments all three (i.e. an agent causing a theme to undergo a change of state). His idea of decomposing predicates has been reformulated in event semantic terms, so that an event (the macroevent) can be structurally complex and decomposable into particular subevents. Subevents are associated with CAUSE, DO or BECOME predicates, or related notions such as preparatory phase, initiating state, process, transition, culmination, consequent, result(ant), or target state and the like (see Moens and Steedman 1988; Parsons 1990; Pustejovsky 1991; von Stechow 1996; Higginbotham 2000; Rothstein 2004; Kratzer 2005; Beck 2005; Ramchand 2008, among many others).

For example, under Parsons' (1990) bi-eventive analysis of causatives, a modifier like *behind the museum* in (18a) can modify either the causing subevent (e), meaning Mary was behind the museum and flew her kite, or the caused subevent (e′), meaning Mary flew her kite, which ended up behind the museum.

(18) a. Mary flew her kite behind the museum.
b. (∃e)[Agent(e,Mary) & (∃e′)[Flying(e′) & Cul(e′) & Theme(e′,Kite) &Behind(__,museum) & CAUSE (e,e′)]].

This is captured in the analysis in (18b) by leaving the event argument position of *behind* unspecified.

A similar example of ambiguity with modified bi-eventives arises for *again*. Here, the ambiguity is between a repetitive ((19a)) and a restitutive reading ((19b)) (examples from von Stechow 1996).

(19) Clyde cleans his boots again.
  a. . . . and Clyde has cleaned his boots before.
  b. . . . and his boots were clean before.

Von Stechow (1996) proposes an event structure account of this ambiguity, under which *again* has the same lexical semantics (roughly meaning something like repetition), but different scope with respect to the subevents associated with the predicate in question. Under the restitutive reading, *again* is taken to modify the lower subevent (the result state), which leads to the interpretation that the boots have been in a clean state before, whereas under the repetitive reading, it modifies the higher causing subevent, leading to the interpretation that Clyde has performed the action of cleaning his boots before. With activities, only the repetitive reading is attested, which follows automatically, if activities only have one subevent (the one associated with a process) (but see also Jäger and Blutner 2003 for a criticism of this account, and von Stechow 2003 for a reply).

Hence, we see that adverbial modifiers can be used as a diagnostics for the structural complexity of a given eventuality. Under the assumption that accomplishments are telic, modifiers like *again* and *almost* have also been used to diagnose whether an eventuality is telic or not, since the ambiguity then only arises with telic eventualities (see also Mittwoch, Chap. 2 in this volume). We have already seen that other adverbial modifiers, such as *in*- and *for*-adverbials serve the same purpose. In the following, we will describe how papers in this volume make use of adverbial modifiers to diagnose for particular properties of eventualities.

1.3.1 Interaction with Event Structure

In Sect. 1.2, we mentioned that there is much debate about the status of states, and especially whether they contain an event argument in their argument structure. Based on the unavailability of manner modifiers with (most) states, among other diagnostics, Katz (2003, 2008) and Maienborn (2005) argue that states should not be associated with an event argument. Furthermore, it is often assumed that non-agentive achievements (e.g. *find*) do not allow particular types of manner modifiers, precisely because they lack agentivity. Martin (Chap. 4 in this volume) addresses the issue that nevertheless, combinations of achievements as well as object experiencer verbs, a subclass of states, with dispositional adverbs (e.g. *cleverly*) and psychological adverbs (e.g. *sadly*), two subclasses of manner modifiers, are widely attested in corpus data ((20)).

(20) a. He won the race quite cleverly.
b. Pierre a asticieusement intéressé ses étudiants à la logique.
Pierre has craftily interested his students to the logic

Mostly based on data from French, Martin argues that such verbs are weakly agentive, rather than non-agentive, and proposes a more fine-grained analysis of the adverbs in question, by distinguishing transparent from neutral dispositional or psychological adverbs (e.g. *patiemment* 'patiently'/*anxieusement* 'anxiously', and *intelligemment* 'intelligently'/*tristement* 'sadly', respectively). Transparent adverbs are argued to lexically encode a mental state in all their uses, whereas lexical adverbs express it only optionally and can thus have a pure manner reading (and sometimes also a result reading). She shows that neutral adverbs are less problematic with weakly agentive verbs, since they can express pure manner or result readings. More problems arise with transparent adverbs, and Martin argues that in these cases, achievement predicates are coerced into durative (and agentive) predicates ((21a)), whereas object experiencer verbs get a causative (and agentive) reading ((21b)).

(21) a. He patiently found the download link.
b. He cleverly interested the investors in his product.

What we can conclude from this paper is that by disentangling manner from agentivity, the argument against event arguments for states becomes much weaker, since it shows that states (e.g. those associated with object experiencer verbs) might be incompatible with agentivity or causation, but not necessarily with manner per se. It furthermore stresses the need to question each diagnostics and what it actually diagnoses for, and possibly to include some additional tests for properties like causation, intention, agentivity, manner, result etc.

Adverbs have also been employed to diagnose for different scale structure underlying eventualities. We now turn to such approaches.

1.3.2 Interaction with Scales

Focusing on VPs headed by incremental theme verbs and on the degree modifier *half* in English, Bochnak (Chap. 5 in this volume) argues that there are two distinct sources of scalarity within the verb phrase, a quantity scale and a quality scale. These are diagnosed by two readings of the modifier *half*, namely the eventive ((22a)) and the evaluative one ((22b)) (our descriptions).

(22) John half ate the apple.
a. John ate half of the apple.
b. What John did, can only halfway be described as an apple-eating eventuality.

Bochnak argues that eventive *half* is possible only when a telic interpretation of the sentence is also possible, hence with a quantized incremental theme. This is so because the eventive use of *half* requires a bounded nominal argument on which to base a fully closed scale structure. In particular, eventive *half* functions as a degree term that targets a quantity-based scale and which is tightly related to nominal part structure, since it measures out the quantity of the incremental argument (e.g. the quantity of apple parts that are eaten). Evaluative *half*, on the other hand, functions as a degree term that makes a comment about the degree to which the eventuality represents a prototypical eventuality (e.g. eating), hence it targets a quality-based scale. Assuming that non-quantized (cumulative) incremental themes yield atelic eventualities, Bochnak shows that evaluative *half* is unmarked for telicity, given that this reading is still available with such event descriptions. Since quality scales are lexicalized by incremental theme verbs, evaluative *half* combines directly with the verb to create a compound verb with a meaning of *half* V. In other cases, it is argued that a null verbal pos morpheme supplies the degree argument with a contextual standard (see Sect. 1.2.2 for the adjectival counterpart).

Another way to use adverbs to diagnose for the type of underlying scale is found in Fleischhauer (Chap. 6 in this volume). Based on Bolinger (1972), he distinguishes extent gradation, measuring the duration or frequency of the event, and degree gradation, measuring a gradable property lexicalized by the verb. He discusses the fine structure of the boundaries of telic eventualities taking a scalar approach, and argues that there are two types of such boundaries, namely those introducing a standard value, and those corresponding to an extreme value of the relevant property or degree. In particular, he shows how aspect interacts with degree gradation of change of state verbs, i.e. verbs that express a change in a certain dimension of the referent of the theme argument.

Fleischhauer focuses on the German degree modifier *sehr* 'very', and to a lesser extent on items with the same meaning in Russian (*očen*') and French (*beaucoup*). Unlike in English, these items can also apply to verbal predicates, then meaning something like 'very much, a lot', and the effect on the interpretation of gradation of change of state verbs is the same: *sehr* changes the truth conditions and the referential properties of a predication. The author assumes a subdivision of accomplishments into gradable and non-gradable ones (similar to the distinction between simple and complex scales in Beavers 2008; see Sect. 1.2.2) and shows that there is a distinction between telicity (potential endpoint) and boundedness (temporal limitation of an eventuality) of graded degree achievements and of accomplishments. He rejects the analysis of telicity in terms of a maximal scale value (e.g. Caudal and Nicolas 2005), and, following Kearns (2007), distinguishes two types of telos: a standard telos, which is an endpoint on a scale or the onset of a result state, and a maximum telos, which is a maximal scale value. Among accomplishments, only those can be modified by *sehr* that have their telos on the same scale along which they are graded, hence the scale targeted by *sehr*, and moreover, their aspectual type is related both to the standard and to the maximal value on the scale. In the following section, we see another way in which adverbs can interact with eventualities, namely when we take a look at Rawlins' account of adverbs of space and time.

1.3.3 Interaction with Temporal Structure

Rawlins (Chap. 7 in this volume) discusses English adverbs like *slowly* and *quickly*, which Cresswell (1977) dubbed adverbs of space and time. He observes that these adverbs allow two kinds of measure phrases in the comparative, characterizing a ratio reading ((23a)), which he essentially treats as a manner reading, and a temporal extent reading ((23b)).

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

He notes that this is an unusual pattern, given that adjectives only allow one type of measure phrase modification, which is determined by the dimension of the particular adjective, and ideally this should also hold for the related adverbs.

To account for the data in a way that does not treat the adverbs as ambiguous but rather analogous to the respective adjectives, he proposes that they are distributive degree predicates of events, which measure its temporal extent only. He argues that the different readings (ratio/manner vs. extent) and hence the availability of different measure phrase modifiers follow from the interaction of distributivity with the particular lexical aspect of the verbal predicate involved, in cases the adverb attaches low, or with narrative discourse, in cases the adverb attaches high.

For instance, achievements (as well as semelfactives) only allow the extent reading ((24a)), whereas activities only allow the manner/ratio reading ((24b)). Accomplishments, in turn, allow both readings ((23)).

(24) a. Alfonso reached the peak {10 minutes/*2 miles per hour} more quickly than Henry.
b. *Alfonso ran {*10 minutes/10 miles per hour} more quickly than Joanna.

Rawlins explains this pattern by arguing that distributivity needs to apply to atoms. For the extent reading to be possible, the distribution takes place over the event structure, in which case the entire event is measured, which in the case of (24a) is trivial. The ratio/manner reading, in turn, distributes over the (unstable) atoms of a running (driving etc.), rather than over the entire event, which is not an atom with activities of the type in (24b), since it is not quantized. This reading gives the impression of a manner modification, since it tells us more about the agent involved in the process. Accomplishments allow both readings, since they combine a process (with unstable atoms) with a culmination (the whole event is atomic, since it is quantized).[7,8]

[7]Thus, this treatment of the ambiguity as a structural rather than a lexical one is essentially along the lines of that of the ambiguity with *again* and other modifiers discussed in the beginning of this section.

[8]Rawlins notes that states do not allow for adverbs of space and time altogether (with or without measure phrase modifiers) and suggests that this can be explained under an analysis like Katz's (2003), though he remains agnostic as to the question whether or not states are associated with an event argument.

High-attached adverbs of space and time, in turn, modify a whole clause and only allow extent readings and modifiers. Rawlins argues that these adverbs measure the time from some previous event until the event described in the modified sentence, which is why they are odd out of context, e.g. as the first sentence in a discourse ((25)).

(25) #Slowly, the instructor set up his computer.

He calls such events in discourse 'narrative events', which include at least the described event, and conjectures that narrative events are always quantized. This explains why they only allow the extent reading: the event has a consistent part-whole structure that is determined independently of lexical aspect. Ordering and immediateness are two characteristics of narrative discourse that may explain the distribution of these adverbs. The former means that the temporal order of events described in a narrative discourse matches the utterance order, while the latter means that if e_1 precedes e_2 in a narrative event sequence, by default e_2 closely or immediately follows e_1.

In the next and final section of this introduction, we take a look at psycholinguistic investigations into the domain of events.

1.4 Experimental Studies of Event Predicates

Apart from investigations into the acquisition of phenomena related to aspect and to the syntax and semantics of events in general (see, for instance, Slabakova 2001; van Hout 2008), there are only few psycholinguistic studies of such issues, and this is a fairly new field.

Previous processing studies aimed at providing evidence for the assumption that eventualities can differ in structural complexity (McKoon and MacFarland 2000, 2002; Gennari and Poeppel 2003; Mobayyen and de Almeida 2005). Gennari and Poeppel (2003), for example, compare the processing speed of eventive (e.g. *inspect*, *explore*, *criticize*, *invent*) versus stative verbs (e.g. *dislike*, *appreciate*, *admire*) in a lexical decision paradigm, employing a self-paced reading technique. They start out from the assumption that eventive predicates have a more complex semantics and syntax, in the sense that eventive predicates entail simpler conceptual units such as CAUSE, BECOME, or CHANGE and resulting STATE, corresponding to the event's internal dynamics they denote, whereas stative verbs lack such entailments. The results indicate that eventive verbs take longer to process than stative verbs.

There is also some, though not fully conclusive evidence that coercion and type shifting operations in the domain of events add additional processing complexity (Traxler et al. 2005; Piñango et al. 2006, Bott 2008; Brennan and Pylkkänen 2008). Bott (Chap. 8 in this volume) provides a good introduction to this topic and follows up on his previous research in this domain. The overall aim of his paper is to facilitate the choice between two hypotheses with regard to the way

lexical aspect is computed: (i) incrementally, i.e. word by word, according to the Incremental Aspectual Interpretation Hypothesis (IAIH), or (ii) when the verb has all its arguments, according to the Late Aspectual Interpretation Hypothesis (LAIH).[9] He conducts an off-line study, two self-paced reading experiments and an eyetracking experiment to test the effects of aspectual mismatch and coercion in German, which arise with particular temporal adverbials in combination with accomplishment and achievement predicates (as outlined in Sect. 1.2.4). To test the size of the domain in which mismatch and coercion effects arise, different word orders were employed, where the stimulus for the mismatch or coercion appeared either after the verb and all its arguments, or at some point before. The results demonstrate that LAIH is the most suitable hypothesis: Aspectual mismatches were detected only after the complete verb-argument structure was processed, whereas no mismatch or coercion effects were found when the verb had not received all its arguments. Bott argues that the results further show that there are in fact two types of incrementality: immediate processing (which is the case for mismatch and coercion) and word-by-word processing (what is commonly assumed in the literature on processing). As for lexical aspect, it seems to be determined at a more global, rather than the lexical level, as it depends on a bigger processing domain than the word.

Bott's findings also fit previous behavioral studies of subatomic event semantics, which have suggested that verbal telicity is not purely semantic because telic verbs (e.g., *catch*, *fall*) activate specific syntactic (or event structure) templates. As a matter of fact, it seems that telic verbs prime or re-activate the patient argument, be they intransitive/unaccusative, transitive, or ambitransitive (Tenny 1987; van Hout 2001). Moreover, they provide a temporal reference point for further aspectual computations and they imply the existence of an affected event participant.

Malaia et al. (Chap. 9 in this volume) address certain questions which have been left unanswered by previous behavioral studies, such as the exact relation between online comprehension and verbal event structure, the influence of the semantic and syntactic properties of the verb in the assignment of thematic roles, and the continuous or sequential nature of this processing during comprehension. They conducted two experiments, whose results show, on the one hand, that telic verbs activate a syntactic structure with an obligatory internal argument, which serves as a salient cue for thematic role assignment during online linguistic computations. On the other hand, the study reveals that the priming of the patient by telic verbs has to do with neurocognitive processes related to the attention and cognitive load, while the event templates evoked by telic verbs are utilized simultaneously with word-category assessment.

[9] A third hypothesis, the Complete VP Hypothesis, is introduced at a later point but we will ignore it here, since in the conclusion it turns out to be incorrect and overall less relevant.

1.5 Conclusion

This chapter introduced the current state of the art of event semantics and provided background information on issues addressed in the papers of this volume, sketching in how far they relate to one another. As we have shown, the contributions included here are concerned with one central issue, the subatomic semantics of event predicates, in at least one of the three following subjects: aspectual composition, decompositional approaches to aspect and adverbial modification. We hope you are now prepared to dive into the nitty bitty details of each paper individually.

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Chapter 2
On the Criteria for Distinguishing Accomplishments from Activities, and Two Types of Aspectual Misfits

Anita Mittwoch

2.1 Introduction

Ca. half a century ago three articles appeared that were to have a profound influence on the study of aspect and the lexicon in generative linguistics. Two of these were by philosophers, Vendler (1957/1965) and Kenny (1963); the third by the linguist, Garey, appeared in the same year as the original version of Vendler's article. To the best of my knowledge, the three authors were not acquainted with each other's work.

The terms 'activity' and 'accomplishment' in the title of this paper stem from Vendler. To Garey we owe the terms 'telos', '(a)telic' and 'telicity'. I shall occasionally use Garey's terms, ignoring the fact that 'atelic' includes states as well as activities, and 'telic' includes achievements as well as accomplishments.

The title of Vendler's paper suggests that each of his four classes applies to verbs. While this is indisputable for states and achievements it is by no means obvious for the distinction between activities and accomplishments, since nearly all verbs that appear in accomplishments also appear in activities (but not vice versa). Vendler has phrasal examples for both activities (*push the cart*) and accomplishments (*run a mile*). But he does not give us a single example of a verb with a non-quantized (bare NP) object, let alone a minimal pair, as in (1).

(1) a. John ate porridge/peanuts.
    b. John ate a plum/three plums.

nor does he address the aspectual difference between *run* and *run to thebus-stop*;.

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Garey was well aware of the contribution of the complements of the verb. He compared *jouer du Mozart* 'play some Mozart' and *jouer un concerto de Mozart* 'play a Mozart concerto', observing "the verb, considered by itself, remains atelic; it is only the complement that puts a term to the activity, which itself does not change essentially while it goes on" (1957:108).

Some verbs only occur in predicates that have the aspectual properties of activities (ignoring secondary predications) – *laugh*, *weep*, *wave*, *fidget*, *rain*, *purr*, *howl*, *roar*, *shriek.* Their denotation includes repetitive movement within a confined space or protracted sound, but they lack internal development. They are not compatible with the adverbs *quickly/slowly* when these are used to indicate a position on the scale of speed – a property that makes them akin to states. Others, e.g. *swing*, *breathe*, *exercise*, *doodle*, allow *quickly*, but are otherwise like the first group. Neither group goes with the adverb *gradually.* All these are undisputed 'activity verbs'.

The verbs that go with *gradually* (as well as *quickly*) occur in both activities and accomplishments. They involve scalar change (Piñón 2000): They come in three varieties (Tenny 1994):

(a) verbs that have incremental theme arguments, e.g. *build* (a house), *eat* (a sandwich), *read* (a book)
(b) verbs of motion (change of location), e.g. *fly* (from Barcelona to Paris), *dive* (to the bottom of the pool)
(c) verbs denoting a change of state e.g. *ripen*, *widen*, *cool.*

It is for these verbs, especially verbs with incremental themes, that there is disagreement. The position adopted here is that for English the distinction between activities and accomplishments is mainly located at the level of the VP or predicate.[1] Ideally it would be desirable to characterize all the verbs in question by a different term, such as durative dynamic verbs.

Section 2.2 contains a critical survey of the criteria that have been used for the distinction between activities and accomplishments. Section 2.3, entitled 'Accomplishments entail activities' explores the consequence of this claim, specifically in relation to the Progressive. There follow two sections that discuss examples that are problematic for the usual classification of durative predicates as either activities or accomplishments.

[1] Similarly Kratzer (2004), Rappaport Hovav (2008) and Filip (2008). Rappaport Hovav mentions a handful of verbs that are limited to accomplishments. Filip draws a distinction between verbs of scalar change, which she calls 'strictly incremental', and verbs like *laugh, cry*, etc., for which she retains the term 'activity' verbs. The view that incremental verbs are basically 'accomplishment' verbs is defended in Rothstein (2008a, b).

2.2 Criteria for the Distinction Between Activities and Accomplishments

2.2.1 Telos

An accomplishment has a set or inherent terminal point, or climax (Vendler 1957). Garey (1957) speaks of "an action tending towards a goal", which he terms telos. According to Comrie (1976:44) the situation described by a telic sentence "has built into it a terminal point"; when this point is reached the situation automatically terminates. What is clear from descriptions like 'inherent' or 'built in' is that for these authors the telos must be implicitly there right from the beginning. The endpoint belongs to the situation as a whole. Though it need not be directly expressed in the description of the situation (except for goal of motion arguments), it can be inferred from the description. One and the same situation can be expressed by

(2) a. Liz played the piano.
b. Liz played a sonata.

The accomplishment sentence (2b) tells us that at the last note or chord the playing of the sonata must have come to an end.

Recent scholars follow Parsons (1990) in using the term 'culmination'; when the telos is reached, the accomplishment is said to 'culminate'.

On reaching the telos an accomplishments doesn't just *stop*; in ordinary language it is said to *be* or *have finished* (Vendler).

2.2.2 The Subinterval Property (Homogeneity) and Cumulativity

Activities, like states, have the subinterval property (Bennett and Partee 1972); if an activity sentence like (1a) *John ate porridge* is true for an interval I it is true for every subinterval of I, subject to a proviso that does not apply to states: depending on context, the interval has to be sufficiently large, and may also permit pauses (Dowty 1979; Landman and Rothstein 2010). An accomplishment sentence like (1b) *John ate three plums* does not have this property. An alternative way of putting this criterion is to say that activities are homogeneous, accomplishments are not homogeneous.

Activities are also cumulative (Krifka 1998). Two related activities of the same kind, (typically, but not exclusively, temporally adjacent) e.g. two activities of reading letters, can be summed into one activity of that kind. But two accomplishments of the same kind, e.g. reading three letters, cannot be summed into one accomplishment of reading three letters. Cumulativity looks like the mirror image of homogeneity, but there are certain differences, some of which will be taken up in Sect. 2.5.

2.2.3 *Specifying Temporal Extent*

This criterion is more frequently used in the literature than any of the others, since it involves a selection restriction rather than being purely semantic.

(3) a. Bill worked on two books (together) for one year.
b. Bill wrote two books in one year.
(4) a. Meg walked for ten minutes.
b. Meg walked half a mile/to the bus-stop in ten minutes.

The temporal extent of activities (strictly speaking their traces) can be measured directly. Temporal *for*-adverbials carry a presupposition of homogeneity. But measure adverbials cannot be applied to predicates that are already measured in another dimension or quantized in some other way.[2] Normal measuring presupposes the possibility of alternatives; (3a) does not entail that Bill finished the two books; he could have worked on them longer. (3b) has this entailment in English (Mittwoch 2010a, b).[3]

Accomplishments are measured indirectly by measuring the intervals which can contain them; the interval, unlike the accomplishment event, is homogeneous. In Mittwoch (2010a, b) the adverbials in question are called container adverbials. This indirect way of measuring involves a reversal of the usual scale for entailments from measure phrases. (4a) entails the weaker (5a′), and does not entail (5a′′), which makes a stronger claim. But for (4b), (5b′) would make a stronger claim; it is not entailed. Instead, (4b) entails the weaker (5b′′):

(5) a.′ Meg walked for five minutes.
a.′′ Meg walked for fifteen minutes.
b.′ Meg walked half a mile in five minutes.
b.′′ Meg walked half a mile in fifteen minutes.

When two activities are summed they can be in the scope of one *for*-adverbial. This follows from the cumulativity of activities; if Bill has written a book in two non-adjacent semesters, this can be described by (6a), but not by (6b):

[2]Cf, Tenny (1987:190) "There may be at most one delimiting associated with a verb phrase". *For one year* is a delimiting phrase. Hence *Bill wrote two books for one year* would violate this generalization.

[3]The sharp distinction drawn in English between activities and accomplishments, as manifested in the fact that accomplishment sentences in the simple past tense entail completion, is not universal. Singh (1998) discusses examples from Hindi and Japanese where this entailment does not always apply. For some speakers of Modern Hebrew the sentence below leaves it open whether the house was completed:

(i) hem banu et ha-bayit ʻeser šanim
they built OM the house ten years

(6) a. He worked on the book for two semesters.
b. He wrote the book in two semesters.

Another way of measuring an accomplishment indirectly is by means of the *take* construction:

(7) It took Bill one year to write two books.[4]

2.2.4 *Entailments Between Simple Tense and Progressive Sentences*

An activity sentence with a verb in the present progressive entails a corresponding one with the simple past:

(8) Jim is reading → Jim read.[5]

For an accomplishment sentence there is no such entailment:

(9) Jim is reading your article -/→ Jim read your article.

Vendler has the simple past here. Kenny (1963) and many linguists expressed this criterion with a present perfect instead of a simple past tense. For Kenny there is not just the absence of an entailment to a sentence in the perfect, but an entailment denying the truth of such a sentence:

(10) Jim is reading your article → ∼(Jim has read your article).

Kenny also points out that there is no entailment to the future perfect either;

(11) Jim is reading your article -/→ Jim will have read your article.

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[4]There are considerable differences between the two strategies for indirectly measuring the length of accomplishments. For a discussion see Mittwoch (2010a, b).

[5]The test exemplified in (8) fails for predicates headed by verbs of creation, with bare plural NP or mass noun objects:

(i) a. The developer is building houses near our village.
b. The government is building affordable housing for first-time buyers.
c. This carpenter is making furniture for our neighbours.

(ia and b) do not entail the corresponding simple past tense (or present perfect) sentences, which would not be appropriate as long as not a single housing unit is finished. Maybe the developers or the government are just preparing the ground for a large project, Similarly the carpenter in (ic) may just be cutting up the wood, or making the legs of all the chairs. The reason for the failure of the entailment is that the arguments of verbs of creation are temporally opaque (von Stechow 2001). The (finished) object created exists only after the telos is reached. In contrast to (ic) the entailment would go through for *The carpenter is painting furniture*.

The failure of the entailment from the present progressive to the simple past (or perfect) is what Dowty (1979) calls the 'imperfective paradox', which was to have an important consequence for his influential analysis of the English progressive.

The criterion relies on the fact that utterance time is punctual. It picks a moment out of the interval in which an imperfective eventuality goes on. The test therefore works regardless of whether a language has a progressive or not. In the past tense it works less well in languages that do not have a grammaticalized imperfective/perfective distinction, as in the German example below:

(12) a. Als wir ankamen machte er Kaffee.
When we arrived made he coffee
When we arrived he made coffee.

b. Als wir ankamen machte er gerade Kaffee.
When we arrived made he just coffee
When we arrived he was just making coffee

Finally Kenny points out that for past tense accomplishments there is an entailment in the opposite direction:

(13) Jim read your letter → Jim was reading your letter.

This entailment will be discussed at length in Sect. 2.3.

2.2.5 Result States

Accomplishments result in states that can be predicated of the theme argument (Dowty 1979; Kenny 1963:177 "Performances are brought to an end by states"). Dowty's BECOME operator in his analysis of accomplishments is based on this principle. If Mary walks to the post-office, at culmination she is at the post office, and if she cooks a stew, there will be a stew.

Dowty (p. 168) points out that the criterion as it stands (and as it is still often presented) does not distinguish accomplishments from activities. Activity predicates headed by incremental/scalar verbs also imply change. An object that is moving is constantly changing its position. And while I eat peanuts, the quantity of peanuts in front of me is diminishing; when I stop, there will be fewer peanuts than before I started; if I eat up the peanuts, the process culminates: the quantity will be zero. If a liquid that has been boiled is left to cool, its temperature changes constantly; when it reaches room temperature the process culminates. These are the incremental changes that processes undergo and that may, but need not, culminate. At any point in the process the referent of the theme will be in a state, however evanescent, that distinguishes it from preceding points. Dowty draws the distinction in terms of indefinite versus definite change; if an endpoint is reached the change is definite.

Not all accomplishment predicates yield result states as straightforwardly as the examples above. Consider *Mary read a book*. The book does not change (barring

possible coffee stains or dog-ears) and is not a normal theme argument. It has been claimed that *read* and a few other verbs are exceptions to the result state criterion.

However, if we take a less simplistic view of thematic roles we are not forced to accept this claim. Dowty (1991) proposes that rather than the traditional discrete thematic roles there are two proto-roles, Agent and Patient, each with a set of contributing properties; arguments of verbs display these properties to a greater or lesser extent, and "some arguments could qualify partially but equally for both proto-roles". If so, the subject of *read* could display both agent and theme properties. Mary is not only an agent but also a patient inasmuch as her eyes and mind travel along the lines and pages of the book, and at culmination are focused on the last word or phrase she reads – ideally at the end of text on the last page, but possibly elsewhere, if the reading follows a more convoluted path. (It may also contain loops, if she rereads parts of the text.) This result fades when she shuts the book. Insofar as the reading process has created a memory of the text, this is a more solid result state. The object has no part in the result state; the book in the sense of text is an incremental path theme, which contributes to the Patient proto-role.[6]

There is one exception to the result state criterion, not mentioned in the literature to the best of my knowledge. It occurs if the track for a mile-run is circular (or corresponds to some other closed figure), so that on culmination the runner is back where she started. Being back at the starting point can hardly be called a legitimate result state. The accomplishment involves an indefinite change as it unfolds, but arguably there is no definite change on culmination.

2.2.6 Iteration

After an activity stops it can be repeated. Rothstein (2008a, b), following work by Hans Kamp, claims that culminated accomplishments cannot be immediately repeated. Assuming that an accomplishment involves a change from α & $\sim\beta$ to β, "it can never be followed by an event of the same type with the same participants since ... two events of change from $\sim\beta$ to β must be separated by a change back from β to $\sim\beta$ .... The same house (or puzzle) cannot be constructed twice unless it is taken to pieces after the first event and before the second event begins." And if Mary walks from the post office to the police station, she cannot do so again without first returning to the post office.

But again there are some problem cases. Consider

(14) Mary copied/recited the poem.

[6]Similarly Rappaport Hovav (2008). For Dowty's analysis of *read a book* see his discussion of examples (22) and (23) in the article.

Read can be a punctual verb, as when one absorbs a road sign, perhaps also when a child learns to recognize one letter at a time.

These events seem to be instantly repeatable with the same participants (unless for copying we count the movement of the eyes from the end to the beginning of the poem). The only way we could make them conform to Rothstein's claim, is by invoking the paraphrases *make a copy of the poem*, ?*make/give a recital of the poem*, in which case we could argue that different copies or recitals have been produced.

Next consider a scenario in which a runner who has run a mile decides at culmination that she is going to run another mile. (Note that in this scenario the runner could have finished running a mile without having stopped running.) If the limitation to the same participant demands that it must be the same mile, i.e. the same stretch of ground, we could incorporate the circular track from the previous subsection in the scenario. Thus we have at least one situation in which an accomplishment can be iterable. The telos of the first mile would be the beginning of the second mile, which has its own telos, but is not the telos of a two-mile run.

A second example might be a person who sets out to sing or play one (or more) ascending and descending scales; when s/he gets to the last note s/he decides to repeat the exercise, and s/he can do so seamlessly.

2.2.7 Accomplishments Can Have Two Readings Where Activities Have Only One

(15) a. John almost painted a picture.
b. John almost walked. (Dowty 1979:58)

In (15a.) *almost* can target the whole event, implying that John did not even start painting a picture, or only the culmination – he didn't finish. (15b) has only the first meaning.

2.2.8 Partial Completion

(16) a. #She halfway translated books.
b. She halfway translated the book.

Only situations that are capable of completion, can be said to be partially completed. This criterion does not work for predicates with arguments quantized with cardinal numbers:

(17) She halfway translated six books.

(17) can only mean that she translated each of the books halfway, not that she translated three books.

2.3 Accomplishments Entail Activities

There are two very different ways in which we can visualize entailments from accomplishments to activities. The first applies to most accomplishments, but not all:

In many cases we can report the same situations by means of an atelic or a telic predicate, using the same verbal form: In answer to (18a) we can say either 18(b) or (18c).

(18) a. What did you have/eat for lunch.
b. I had/ate bread and cheese.
c. I had/ate three slices of bread and a hunk of cheese.

(18c) entails (18b); it is more informative. It adds information about quantity. There is a similar relationship between

(19) a. They widened the road.
b. They widened the road two meters.

In (20a) it is only the telos that is lacking.

(20) a. The log floated towards the sea.
b. The log floated to the sea.

The second way in which accomplishments might entail activities is more controversial, as least for English. I shall introduce it with a quotation from Vendler's version of criterion 2 above, regarding homogeneity; the crucial point is the underlined clause at the end:

"If it is true that someone has been running for half an hour, then it must be true that he has been running for every period within that half hour. But even if it is true that a runner has run a mile in 4 min, it cannot be true that he has run a mile in any period that is a real part of that time, although it remains true that he was ... engaged in running a mile, during any substretch of those four minutes."[7]

Vendler is here saying that the accomplishment entails an activity, call it mile-running, which is essentially the same as the accomplishment minus the end-point.

Such an entailment would have two related consequences. The first is obvious. It would apply to all accomplishments. It would therefore entirely do away with any possible lexical distinction between activities and accomplishments, i.e. between two classes of verbs (apart from the fact that some verbs do not enter into accomplishment predicates at all). The distinction would have to belong to a higher projection, and to locate it additionally in the verb would be redundant. There would be one class of durative dynamic verbs.

[7] What Vendler actually wrote, including the omitted words, is "that he was running, or that he was engaged in running a mile, during any substretch of those four minutes". This is equivocal. Are the alternatives 'running' versus 'engaged in running a mile' or did Vendler forget to put a comma after the second occurrence of 'running' so that the first alternative would be 'running a mile'?

The second consequence is related to how we analyze the English progressive. A number of scholars have argued that the progressive operator has scope over a base sentence that is an activity (Bennett and Partee 1972; Vlach 1981; Mittwoch 1988; Parsons 1990). In that case there would be no 'imperfective paradox'; the failure of entailment from the present progressive to the simple past or present perfect of the base sentence for accomplishments would be explained by the fact that the base sentence would denote a homogeneous situation, whereas the simple past in English would imply a telos.

This is Parson (1990:171)'s translation for the sentence *Agatha crossed the street*, where 'Cul' stands for 'culminates':

(21) (∃t)[t<now &(∃e)[crossing(e) & Subject (e,Agatha) and Object (e, the street) & Cul (e,t)]]

His translation of *Agatha was crossing the street* is the same except for the last conjunct:

(22) (∃t)[t<now &(∃e)[crossing(e) & Subject (e, Agatha) and Object (e, the street) & Hold(e, t)]]

Parsons points out that according to this analysis there is no 'imperfective paradox', "since saying of an event that it holds at a given time does not imply that it culminates at that time or any other time".

Kratzer (2004) introduces a number of refinements into Parsons analysis. She fleshes out the notion of culmination in two ways. She introduces a culmination condition, illustrated by the two examples in (23a and b), and a culmination requirement (c), consisting of the feature [telic]: R stands for a relation between the event argument of a verb and an internal argument of the verb.[8]

(23) a. *shoot-* λxλe[shoot-at(x,e) & [culminate (x,e) ↔ hit(x,e)]]
b. *climb* λxλe[climb-up (x,e) & [culminate (x,e) ↔ climb-to (top-of x),e]]
c. [telic] λRλxλe[R(x,e) & culminate (x,e)] (=K(4))

Whereas in (21) culmination is a one-place predicate, a property, Kratzer makes it into a two-place predicate, a relation between an event and whatever it is that gets measured out in that event (Tenny 1987). For *climb* it is a path to the top of x, a mountain in her scenario, and thus at least part of the object; for *cook a stew* (with *cook* interpreted as a creation verb) the path would include washing and cutting up the ingredients, mixing them putting them into a casserole, etc.

An event culminates when the activity described by the verb has affected all the relevant parts of what is measured – including the final part, as shown in (24):

(24) [telic] = λRλxλe[R(x,e) & $\underline{\forall x'[x' \leq x \rightarrow \exists e'[e' \leq e \ \& \ R(x',e')]]}$] (= K(7))

[8]Kratzer does not consider agentive subjects to be arguments of their verbs.

Strictly speaking, x in (24) stands for the path, rather than the mountain. In Parson's example of *crossing the street*, it would actually be the internal argument of the verb itself, the street, that gets measured out. (Cf. Hallman 2009).[9]

Kratzer later suggests that "the atelic meaning component of accomplishment verbs ... might very well be basic" and "... telicity might be constructed from atelic verb stems in interaction with an inflectional head that imposes culmination ..." This head, which is silent, would be in complementary distribution with the progressive. It would be responsible for the fact that accomplishment sentences in the simple past must be telic in English, i.e. they entail culmination.

As pointed out by Kratzer and others, many predicates can be interpreted as atelic or telic, as shown by the fact that they are compatible with both of the temporal adverbials discussed in Sect. 2.2.3 above:

(25) a. The doctor examined the patient (for/in an hour).
b. The stew cooked in the oven (for/in forty-five minutes).
c. Bill cleaned the kitchen (for/in half an hour).
d. I read the paper (for/in twenty minutes).
e. John wrote a sequence (for/in ten minutes).[10]

Clearly the predicates in these sentences are not specified for a feature [telic]. Out of the blue and without the bracketed adverbial they show no indication of telicity, though the context or extra-linguistic expectations might lead hearers to read a telos into them even so. With the *for*-adverbial there can be no doubt that they are atelic. A speaker's choice of the *in*-adverbial indicates that s/he has a process with a set end-point in mind: the doctor proceeds through an orderly set of questions and hands-on procedures; the stew is done; the kitchen is clean; I read all I wanted or needed to read from the paper; the sequence has specific first and last elements. It seems that just as *for*-adverbials presuppose that the modified sentence is homogeneous, *in*-adverbials presuppose culmination, which in these cases might have to be accommodated by the hearer. But as we shall see in the next section, such a presupposition would itself depend on there being no obstacle to interpreting the base sentence as telic.[11]

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[9] Kratzer later emends (23) to her (8):

[telic] = $\lambda R \lambda x \lambda e[R(x,e) \& \exists f$ [measure (f) & $\forall x'[x' \leq f(x) \rightarrow \exists e'[e' \leq e \& R(x',e')]]]]$

[10] Since the count noun *sequence* refers homogeneously, like mass nouns, *John wrote a sequence for 10 minutes* should be well-formed; nevertheless its grammaticality has been called into question (Zucchi and White 2001) or denied outright (Rothstein 2004). Pace these authors, I consider it an impeccable sentence. Here are two scenarios that would made it appropriate: (a) John has been disruptive in class; the teacher makes him stay in after school and tells him he must write a sequence of numbers divisible by three – without setting an endpoint either on the numbers or as a temporal term. After 10 min he tells John to stop. (b) John uses writing a sequence to steady his nerves. After 10 min he falls asleep.

[11] The choice between *stop* and *finish* might also indicate whether a predicate is thought of as an activity or as an accomplishment. I have found both of the following on the web: *I have stopped growing* and *I have finished growing*. The choice of *finish* seems to imply that the end of the process of growing is preprogrammed.

As noted above, Parsons explicitly denies the imperfective paradox (criterion 4); a past progressive sentence does not entail the corresponding non-progressive sentence, since the latter contains one additional element of meaning: the culmination. Both Parson's and Kratzer's analyses imply that accomplishment predicates are in fact homogeneous up to culmination. Criterion 2, the subinterval property, would have to be modified accordingly: only culminated accomplishments would be distinguished from activities by being non-homogeneous.

2.4 Delimited Situations Without a Predetermined Telos

2.4.1 The Problem

Our first criterion for accomplishments was that they have a telos, a specified endpoint beyond which they cannot go, and which is implied to be there right from the beginning; it is predetermined. Consider the following sentences:

(26) John built a house.

(27) a. Jack and Jill walked five miles.
b. Jim drank five pints of beer.

One would hardly embark on any of the various tasks involved in building a house without aiming at a completed house. But one may well set out on a walk without deciding in advance how far or how long one is going to walk; in fact, out of the blue this would be the more salient interpretation of (27a). Likewise, when ordering the first pint of beer one need not have determined how many pints are to follow. These examples, therefore, seem to be similar to those we encountered in (25), inasmuch as according to context they can be interpreted as telic or not.

But whether the end-point is predetermined or not does not in this case affect the way the temporal length of the event is assessed. According to criterion 3, the predicates pattern with accomplishments in either case.

(28) a. Jack and Jill walked five miles in/#for an hour and a half.
b. Jim drank five pints of beer in/#for an hour.

The fact that the *for*-adverbial option is ruled out is hardly surprising. It would violate the well-established constraint against double measurement, in this case measuring the temporal trace of an event that is already quantized.

The examples discussed so far involve situations that could have been planned in advance or not. In (29) our knowledge of the world would normally preclude the possibility of planning.

(29) a. The level of the lake rose two meters (in one month).[12]
b. The floods destroyed all the bridges in ten days.

As noted above, the distinction between *for*- and *in*-adverbials usually serves as the main diagnostic for telicity in the literature. We are thus confronted with a clash between criteria 1 and 3. In spite of the absence of a predetermined telos, the quantized predicates are not normal atelics. Does that mean that they must be telic? Is the appropriateness of *in*-adverbials a sufficient condition for characterizing an event as telic? I shall come back to this question after reviewing the other criteria listed in Sect. 2.2.

Criterion No. 2 in the form given in Sect. 2.2 also puts the predicates together with telics; if the lake rose 2 m in a month, it did not rise 2 m in any proper subinterval of that month. But in the modified form given at the end of the previous section, where homogeneity only fails for culminated accomplishments, it is not clear whether it would apply to an event without a predetermined telos, since such an event could not culminate. Skipping criterion 4 (entailments between progressive and simple past sentences) for the moment, we find that for 5, the result state, it makes no difference in absolute terms whether the endpoint is predetermined or not. In both cases the result state will be the final location of the walkers, which means that this is what Dowty calls a definite change. Criterion 6, iteration, is meaningless in the absence of a telos. Regarding criterion 7 and 8, (30) cannot mean that the level of the lake almost began to rise, and would have risen 10 ft if it had risen at all.

(30) The level of the lake almost rose 10 meters.

and (31) is nonsensical

(31) The level of the lake rose 10 meters halfway.

Thus, in the absence of a telos, (29) turns out to be negative for at least three more of the criteria singling out accomplishments.

If we now try criterion No. 4, the purported 'imperfective paradox', we draw a blank. We find that the test cannot be applied. One of the most striking characteristics of predicates with cardinal numerals like those in (28) under the no-predetermined-endpoint interpretation and those in (29) is that they are not compatible with progressive. The sentences in (32) are only well-formed on the assumption that the full extent of the events was planned in advance:

(32) a. John was drinking three cups of tea (when I entered his office). (adapted from Declerck 1979).
b. John was working for two hours. (Mittwoch 1988)
c. Jack and Jill were walking five miles when I saw them.

[12](29a) has been discussed in the literature under the assumption that the event referred to is due to natural causes. It would be rather unnatural to describe an event in which the lake was artificially raised by means of locks. For such an event is best described by (i) below:

(i) The level of the lake was raised two meters in one month.

An appropriate scenario for (32a) would be that I saw three cups of tea or a teapot holding three cups on John's desk. (32b) suggests a 2-h shift or a prior announcement by John of his intention. Where our knowledge of the world rules out the possibility that the events are planned, the progressive is banned:

(33) a. It is raining for two hours.
b. The level of the lake is rising two meters.

(34) a. It was raining for two hours when I arrived.
b. The level of the lake was rising two meters when I arrived.[13]

Similarly the aspectual verbs *start/begin* and *stop* are incompatible with the predicates in question (assuming that no endpoint is implied in the context for (35a and b)):

(35) a. #Jack and Jill started to walk five miles.
b. #John stopped drinking three cups of tea.
c. #The level of the lake started/stopped rising two meters.

If the Progressive operator has scope over a base sentence that is an activity, as argued by Parsons and Kratzer, we can say the same for these aspectual verbs; they define the endpoints of intervals in which activities go on. Unsurprisingly, *finish*, which marks the point of culmination, is also ruled out:

(36) #The level of the lake finished rising two meters.

Thus, if a situation that lacks a telos is represented as measured, it cannot at the same time be represented as being in different stages of development.

The above discussion has shown that the criteria for accomplishments listed in Sect. 2.2 do not all point in the same direction. If we want to categorize the problematic predicates as telic, this would be, paradoxically, telicity without a telos, or at best with a retrospective telos. Of the two criteria according to which these predicates are like accomplishments, criterion 2, the subinterval property, is problematic, as explained above. That leaves the aspectual adverbial. But recall that *in*-adverbials are containers. It is in the nature of containers that there is a limit to what they can contain or hold. Consider

(37) This box holds twenty-four pralines.

Out of the blue there is a strong tendency to interpret the numeral exhaustively; one is likely to infer that the box does not hold more than 24 pralines. The *in*-adverbial has the same delimiting effect; it suggests that after rising 2 m the lake stopped rising. Of course this effect also applies to (29a) without the adverbial; but it is more pronounced with the adverbial, since these adverbials suggest a tight fit between the

[13]Unsurprisingly, the progressive of example (i) from the previous note is unproblematic.

event and the containing interval (Mittwoch 2010a, b). I conclude that the sentences in question are not telic. They fall between the cracks. We can call them delimited atelics.[14]

The rest of this section deals with the question of what stops the problematic sentences from appearing in the progressive.

2.4.2 Hallman's Solution

Hallman (2009) answers this question by a condition that he imposes on the progressive, namely that the situation has to be internally homogeneous. This means essentially that what can be said of the whole can be said of its relevant parts; the subintervals of the process have to be of the same kind as the process as a whole. Hallman's definition of the progressive, expressed in terms of situation semantics, is given in (38):

(38) $\forall\phi\subseteq S\ [[\text{PROG}\ (\phi)]]^w = \lambda s{\leq}w\ \forall s'{\leq}s\ R(s',s) \rightarrow \phi\ (s')(=$ H. (15))

"The progressive form of a predicate describes a situation s in the valuation world whose every subpart s′ which is related to s in the appropriate fashion R . . . validates ϕ." Predicates with cardinal quantifiers like those in (29) do not meet this condition. None of the initial subparts of the level of the lake's rising 2 m validate the predicate. Progressive also presupposes cumulativity. Again, sentences like (29) do not meet this presupposition.

This explanation is reminiscent of criterion 2, the subinterval property, in its original version, i.e. including culmination. Parsons and Kratzer solved the problem for ordinary accomplishment predicates by shaving off culmination. That could obviously not work for the non-telic predicates in (29).

But it could not work either for the predicates in (27), on the assumption that the events were planned in advance. John's drinking three cups of tea culminates when he takes the last sip from the third cup, but drinking three cups of tea is not a homogeneous process. Why then are the quantized progressive sentences in (32) well-formed on the assumptions that the events were planned in advance? Hallman's answer (p.c.) is that in these examples the quantized argument or measure phrase is bundled into a collective singular; drinking three cups of tea would become a three-

[14] Higginbotham (2004:343) denies that (31b) is telic. He assigns it the analysis

i) rise (the lake, e) & $\mu_{\text{feet}} = 10$ (where μ stands for measure)

According to Depraetere (2007) the sentences in question are atelic and bounded. She attributes the ill-formedness of (35b) to the incompatibility between the progressive, an unbounding operator, and the numerical NP, a bounding operator. Additionally, she suggests that intentionality might be necessary for telicity. A similar suggestion is made by an anonymous reviewer. In Sect. 2.4.3 further examples will be given of progressive sentences that have to be construed telically but that do not involve agents that can be said to have intentions.

cup-drinking event; walking five miles a doing-a-five-mile-walk (cf also Rothstein (2008a, b), note 6). Fred Landman (p.c.) suggests that in that case the predicates may behave like V + bare NP predicates, with the NP incorporated into the verb, as has been suggested for bare NPs in general (van Geenhoven 1998). This is an attractive proposal, but it might still be problematic for examples with definite NPs, as in

(39) I was grading the last ten exams when you phoned.

It would also be problematic for further data that have not been mentioned so far. There are sentences that behave like (29a), but do not contain a cardinal quantifier. Instead, they have an explicit upper bound.

(40) The level of the lake was rising to the upper red line when I arrived.

Assuming that the rising of the level of the lake was caused by natural forces, (40) is inappropriate, and would fall under Hallman's explanation; none of the initial subparts of the lake's rising would validate the predicate. But again, in a context that assumes a man-made cause (40) would be fine, and so would (41)

(41) The level of the lake was being raised to the upper red line when I arrived. (cf. notes 12 and 13)

The problem raised by (32), (39) and (41) within the framework of Hallman's solution still awaits a fully worked out analysis.

2.4.3 A Pragmatic Explanation

The progressive is partitive. It picks out a subinterval (typically a moment) from the larger interval in which an eventuality unfolds. This subinterval is either overtly specified, for example *at that time*, or as in the *when* clauses in several of my examples, which denote punctual events; or it is determined by previous context. The subinterval serves as a reference time; the base sentence must be evaluable in the first instance for this subinterval. For an accomplishment the potential evaluator must at this point be in a position to perceive an ongoing process, which, if not aborted, will lead to a predetermined and knowable telos.

But who can be the evaluator? The answer to this question depends on context. In the simplest case, if the event denoted by the sentence has a human agent who is responsible for the telos, the agent would normally be a possible evaluator. Additionally, an observer could be an evaluator if the event is of a kind where the telos could easily be inferred. If you see a child playing with Lego pieces, at a certain configuration of the pieces you could confidentially assert that he is building a castle. But if you see someone running there may not be any clues that would tell you whether the run is limited by a telos (distance or goal or terminal time), and if so, its numerical value or goal. For events that do not involve human agents an observer alone may be the evaluator. Thus a knowledgeable birdwatcher might say

(42) The birds were flying 10,000 kilometers when I spotted them.

On the other hand, if this observer only has enough knowledge to identify the birds but is not familiar with the beginning and end points of their migration, the evaluation might depend on another person who does have this knowledge, and who can therefore say

(43) The birds were flying 10,000 kilometers when you spotted them.

Here the actual evaluation might be done a long time after the reference time for the progressive; what matters is that a sufficiently well-informed observer could have done it at reference time. Similarly,

(44) The tadpoles were metamorphosing into frogs when I/you saw them.

In the above examples a speaker who utters the tensed sentence is, in fact, directly involved in the evaluation at the reference time for the progressive. But that is due to the deictic pronouns in the *when* clause; it is by no means a necessary condition for a potential evaluator. The speaker's knowledge of the situation that obtained at that time could be second-hand, something that she heard or read about.

In the problematic example (34b) the observer at reference time is also the speaker (assuming that on arrival she takes an interest in the lake). But at the past reference time this person in her capacity as observer can only know how much the lake has risen so far; she cannot know how much further it will rise, hence how much it will have risen once it stops rising.[15] In her capacity as speaker she may possess this knowledge, but she cannot legitimately use it retroactively to describe the situation at the past reference time. This, I suggest, is what makes (34b) inappropriate in the normal context.

In support of this proposal, consider

(45) The level of the lake was rising two meters when I arrived, but I couldn't know that at the time.

The coda in (45) is an acknowledgement by the speaker that her choice of the progressive sentence is based on hindsight with reference to the simple past sentence (29a) *The level of the lake rose two meters.* (45) is not flawless but it is better than (34b). The coda represents a repair strategy.

This explanation for what is wrong with (34a) would work equally if, instead of a spatial measure of the rise in the level of the lake, we had a temporal measure, as in (46) and in (34a):

(46) The level of the lake was rising for two months/until the middle of May when I arrived.

It also has a wider relevance, particularly to the discussion in the literature of examples where one telos is replaced by another in mid-event. Higginbotham (2004)

[15]This point is also made in Zucchi (1999).

presents a scenario in which Mary takes a plane in New York bound for London: the plane is hijacked en route and flown to Havana. Why is (47) false ("no matter when asserted")?

(47) Mary is flying to London and to Havana.

In (47) the reference time for the progressive is the moment of utterance. The obvious answer is that in this scenario there have to be two distinct evaluation times for the progressive, which is impossible in the present tense. (48a) is true before the hijacking, (48b) afterwards.

(48) a. Mary is flying to London.
b. Mary is flying to Havana.

Each has its own telos. The fact that Mary did not intend to go to Havana is irrelevant; the hijackers determine the telos. But why could the hijackers themselves not say (47) at a time when the plane is still bound for London? Because either they are not sure that their plan will succeed, in which case they cannot assert the second conjunct, or, if they assume that it will, then they must also assume that the first conjunct is false.

Using a past tense, it would not be sufficient to replace *is* by *was* in (47); we would still need two separate reference points. But we could use a gapped conjunction:

(49) At five o' clock she was flying to London, at six to Havana.

If an agent changes her mind in mid-action the facts are similar but less clear-cut. Suppose that Mary starts writing an article and after a time decides to turn it into a monograph. In describing the situation from a point in time prior to the change of mind she can not say (50a), but (50b) would also be misleading. She would be well-advised to eschew telicity and settle for (50c).

(50) a. I was writing a book
b. I was writing an article
c. I was working on an article that turned into a book

2.5 Predicates with Selected Non-specific DPs

2.5.1 (Unstressed) Some, a Few, Many/a Lot Of

Consider

(51) Mary wrote some/a few/many/a lot of text messages.

Let us assume that Mary had a vague plan about the number of messages she wanted to write, so that there is a telos of some sort, but this telos is not fully specified;

it covers a range of numbers. The following table suggests that in other respects *some* is nearest to being part of an activity, *many/a lot of* to being part of an accomplishment. The symbol +/− is meant to exclude singulars. The symbol ± points to a vague middle ground. If we sum two instances of 'a few plums' once, the result may or may not be 'a few plums'; if we iterate summing several times we are bound to reach a stage at which the plums would no longer count as 'a few'. Conversely, if, say, 10 children in a family counts as 'many' or 'a lot', the same might be true of nine and eight, but definitely not of two.

	homogeneous	cumulative
some	+/−	+
a few	+/−	±
many	±	+

The table shows that, regarding criterion 2, incremental predicates with these determiners are not straightforwardly telic. Like Zucchi and White (2001) and others, I do not consider sentences in which such predicates appear with *for* adverbials fully grammatical;

(52) # John wrote some/a few/many letters for fifteen minutes.

For adverbials with *some*-DPs are not crashingly bad (Mittwoch 1971, 1982). The reason that they are somewhat problematic is, I suggest, as follows. Bare NPs are incorporated and interpreted as predicates of internal arguments of the verb. They can never be specific. DPs are not incorporated, and therefore *some* + NP can have wide scope in contrast to bare NPs (van Geenhoven 1996, 1998). Consider

(53) a. Mary learnt some poems by heart and so did John.
b. Mary learnt poems by heart and so did John.

I think that marginally (53a) has a reading where John must have learnt the same poems by heart that Mary learnt, a reading that (53b) lacks (though it does not, of course, exclude a situation where this is the case). *A few* behaves similarly.

At the end of Sect. 2.4.1 I pointed out that *in*-adverbials have a strong tendency to impose an exhaustive reading on the quantifiers in their scope. It is in the nature of vague quantifiers that they are not capable of being interpreted exhaustively. The range of numbers they cover is determined by contextual factors. For this reason I think, contra Zucchi and White (2001), that *in*-adverbials are also somewhat problematic with predicates whose incremental arguments have vague quantifiers (Mittwoch 1971, 1982).

Some and *a few* can be particularly awkward with *in*-adverbials:

(54) a. ? Mary wrote some/a few text messages in ten minutes.
b. Mary dashed off some text messages in two minutes.

This contrast is due to a further characteristic of these adverbials: they have a strong preference for large quantities packed into short intervals; they suggest speed. (Mittwoch 2010a, b) For the same reason they are better with *many* and *a lot of*:

(55) a. John wrote a lot of text messages in ten minutes.
b. Mary crossed an infinite number of points in 10 seconds.
(Rothstein 2008a, her (38a and b))

2.5.2 At Most, at Least

(56) a. John ate at most three plums → John ate 3 v 2 v 1 v 0 plums.
b. John ate at least three plums → John ate 3 v 4 v 5 v . . . plums.

Unlike predicates with fully specified cardinal numerals (56a) is homogeneous, and ± cumulative: the sum of any two plum-eating events that together involve no more than three plums is an event of eating at most three plums. (56b) is neither homogeneous nor cumulative.

(56a) can be said to have a telos, in the sense of a point beyond which the process cannot go, but it is a very unusual and rather trivial one, since the process may never have begun, and if it did begin, but did not reach the telos the sentence would still be true. (56b) perhaps has a provisional telos, three plums, but it is not a point beyond which the process cannot go.

Both go with *in*-adverbials, and are incompatible with *for*-adverbials:

(57) a. John answered at most three questions in/#for one hour.
b. John answered at least three questions in/#for one hour.

This is not surprising, since both entail that there is a natural number n such that John answered n questions (in 1 h). However the absence of a specified n is more critical for the adverbial in (57a) than the one in (57b), since *at most* suggests a low value, whereas *at least* suggests a high value.

To sum up, my verdict would be that the predicates discussed in this section are all, to varying degrees, defective telics.

2.6 Conclusion

In my beginning is my end. T.S. Eliot

The one necessary and sufficient condition for accomplishments is the telos, the built-in or inherent endpoint that is there from the outset as the goal of a process in development, and that culminates, if not interrupted. Two other conditions that have been regarded as criterial, lack of the subinterval property (a.k.a. homogeneity) and indirect measurement by container adverbials are not confined to accomplishments; they are also found in certain contexts in predicates that lack a telos but are delimited by cardinal quantifiers or goal phrases. These predicates, the first ‘misfits’, cannot be classified as either telic or atelic. They are also unique inasmuch as they cannot

be represented in development but solely in retrospect. This peculiarity is attributed to a pragmatic constraint on the felicitous use of the progressive. At the reference time the further development of the accomplishment predicate up to culmination must be evaluable. The telos is usually taken to be a point; in predicates with indefinite quantifiers, the second 'misfits', it ranges over a longer, vaguely defined interval, with the result that these predicates do not meet all the normal criteria for accomplishments.

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Chapter 3
Lexicalized Meaning and Manner/Result Complementarity

Beth Levin and Malka Rappaport Hovav

3.1 Manner/Result Complementarity: A Constraint on Verb Meaning?

What belongs in the meaning of a verb? Certainly, the meaning of a verb determines the range of situations in the world that it can be used to describe; however, when a verb is used in a sentence describing an event, it is only one element in that description, with other elements in the sentence contributing to the description of the event as well. How, then, can we determine what the verb contributes—that is, what is truly the verb's own meaning? It is not easy to tease the exact contribution of the verb apart from the contribution of other sentential elements such as the verb's arguments since we typically do not think of a verb outside of sentences which describe prototypical events associated with that verb. We believe, however, that it is indeed possible to distinguish facets of meaning which are strictly contributed by the verb from other facets of meaning which may be derived either by the choice of argument or from particular or prototypical uses of that verb in context. We refer to the former as elements of LEXICALIZED MEANING, taken to comprise a verb's core meaning. We suggest that the criterion for lexicalized meaning is constancy of entailment across all uses of a verb. Crucially, a verb's lexicalized meaning is to be distinguished from additional facets of meaning that can be inferred from a particular use of that verb in context and from the choice of noun phrases serving as arguments of the verb.

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The notion of lexicalized meaning can perhaps be best understood by considering an example. The verb *open* specifies a change of state that an entity undergoes, but the precise change is not fully determined by the verb itself; rather, it depends on the choice of object as well. Opening a jar or a bottle means removing its lid or cap, while opening a door or window means moving the door or window so that the aperture it is blocking is now unblocked (see Levison 1993 on opening containers vs. conduits). These variations in the precise change described, however, are not part of what is lexicalized by *open*. What this verb lexicalizes is removing an obstruction to allow access to a formerly inaccessible space, but exactly how the obstruction is removed varies depending on the actual physical object involved.

Once lexicalized meaning is distinguished from nonlexicalized meaning, it becomes possible to unify under a single sense of a verb uses which are attached to rather different real world events. If this distinction is not made, however, it may become necessary to posit considerable polysemy in the lexicon. We assume, however, that natural language tries to minimize polysemy. That is, in the default, a verb should have a single sense, and concomitantly what it lexicalizes should be kept constant across all its uses. Although this assumption may turn out to be incorrect, we believe that it is desirable to use it as a starting point because it forces us to ask whether what appear to be two distinct senses of a verb actually are two instantiations of a single sense.

Distinguishing a word's lexicalized meaning from those facets of meaning attributable to context will prove to be worthwhile if it allows the statement of generalizations inherent in the lexicon and its interfaces with other components of grammar. In this paper, we present a relevant case study. In Levin and Rappaport Hovav (1991, 2006) we make an observation about the distribution of certain types of lexicalized meaning across verbs.

(1) MANNER/RESULT COMPLEMENTARITY: Manner and result meaning components are in complementary distribution: a verb lexicalizes only one.

In Rappaport Hovav and Levin (2010: 25), we suggest that this complementarity follows from the way roots are associated with event schemas—predicate decomposition representations of verb meanings. Specifically, we propose that a verb root can only be associated with a single position in an event schema, and since manner and result roots are associated with distinct positions, manner/result complementarity must follow.[1] We also propose that the notions of scalar and nonscalar change can be used to identify manner and result meaning components; see Sect. 3.2.

[1]On our approach manner/result complementarity emerges because manner and result roots are compatible with distinct event schema. Alternate approaches are possible. For example, Mateu and Acedo-Matellán (2011) propose that manner/result complementarity emerges from properties of the syntactic configurations roots are found in, which for them approximate what we call event schema. On this approach, the roots themselves are not classified as manner or result, a move that Mateu and Acedo-Matellán see as preferable because it avoids redundancy that they find inherent in our approach.

In this paper, we do not explore the origins of manner/result complementarity; rather, we focus on counterexamples cited in the literature. We demonstrate how carefully distinguishing lexicalized meaning from other facets of meaning that are determined by context is crucial to understanding how the verbs which have been cited as counterexamples to manner/result complementarity turn out not be so. In particular, we look at two English verbs, *climb* and *cut*.

In Sect. 3.4, we show that when lexicalized and nonlexicalized meaning components are distinguished, *cut* turns out to be basically a result verb. The result it lexicalizes is typically brought about in a certain manner, and the verb, in some uses, lexicalizes this manner. Crucially, in these manner uses, the result component drops out. This distribution of meaning components is expected if manner/result complementarity holds, but not otherwise. We show in Sect. 3.6 that this phenomenon is not restricted to *cut*. It is important to note that such manner-only uses need to be recognized as instantiations of a different, though related, sense of the verb. Thus, while our approach to distinguishing lexicalized from nonlexicalized elements of meaning allows us to unify different uses of a verb under a single sense, it also allows us to appropriately identify those instances in which a verb does indeed have more than one sense: precisely when there is no element of meaning which is constant across all uses. Although we do recognize polysemy in certain instances, it is possible to delineate the circumstances which give rise to such polysemy, thus contributing to a better understanding of just how polysemy arises.

In Sect. 3.5, we show that *climb* is essentially a manner verb and the result—upward direction—said to be understood in some of its uses is not lexicalized, but is inferred due to the nature of its lexicalized manner. As we discuss, *climb*'s lexicalized manner has often been misidentified in the past; however, once its meaning is properly identified and the contribution of the context to the interpretation of particular uses is clearly delineated, it becomes clear that *climb* does not lexicalize a result along with the manner. However, just as *cut* has some uses where the manner becomes lexicalized and the result meaning component is lost, so too *climb* has a restricted set of uses in which the result is lexicalized, but with the manner component being lost. Thus, we recognize a limited degree of polysemy here as well.

3.2 Manners, Results and the Relation Between Them

To set the stage, we elaborate on the importance of distinguishing lexicalized from inferred meaning in the context of manner and result. A careful study of the English verb lexicon reveals that within particular semantic domains there can be verbs that describe bringing about results and others that describe carrying out activities—manners of doing. Often verbs specify results brought about using a conventionally associated manner, but do not strictly entail the manner. Similarly, the actions characterized by the particular manners denoted by other verbs are

typically performed to bring about a conventionally associated result state, but the verbs do not entail this result. These points are illustrated in (2).

(2) a. I just wiped the table, but it's still dirty/sticky/covered in crumbs.

b. I cleaned the dress by soaking it in hot water/pouring bleach over it/saying "abracadabra".

Since the entailed meaning is what is lexicalized and the conventionally associated meaning is not, these observations suggest manner/result complementarity is a hallmark of verb meanings.[2]

The observation that manner/result complementarity is manifested in the verb lexicon can be turned into an empirical claim only if we can provide clear and testable criteria for the notions of manner and result. In Levin and Rappaport Hovav (2006) and Rappaport Hovav and Levin (2010), we suggest that result roots specify scalar changes and manner roots specify nonscalar changes. This proposal is motivated by the observation that manner/result complementarity is most obviously manifested in two domains: change of state verbs and motion verbs. In each domain, there are result verbs—verbs denoting a change of state, as in (3a), or motion in a specified direction, as in (3b).

(3) a. break, crack, fill, empty, melt, open, shatter, . . .

b. arrive, come, enter, exit, fall, go, rise, . . .

In each domain, there are also manner verbs. In the change of state domain, these verbs denote activities that might, but need not be used to bring about changes of state, while in the motion domain, they describe manners of motion that might, but need not be used to bring about displacement in a particular direction, as in (4).

(4) a. hit, kick, pour, shake, shovel, slap, wipe, . . .

b. amble, crawl, hop, jog, limp, run, swim, walk, . . .

In Levin and Rappaport Hovav (2006), Rappaport Hovav (2008) and Rappaport Hovav and Levin (2010), we suggest that the semantic notion which unifies directed motion and change of state is scalar change. A scalar change in an entity involves

[2]We distinguish between what we term a verb's 'contextually associated' meaning and its 'conventionally associated' meaning. We use the first term to refer to those elements of a verb's meaning that are understood from its use in a particular sentence, derived from the specific arguments it takes in the sentence and also from the more general discourse context in which the sentence is used. We intend the second term to refer to those inferences that are associated with a sentence using that verb outside of any particular context. A verb's conventionally associated meaning is essentially that represented by a prototypical instance of the event described by the verb, such as opening a can with a can-opener rather than, say, by poking holes around the top with some sharp-bladed instrument or cleaning a floor with a broom or mop rather than, say, by reciting a magic spell. As Rosch (1978:43) points out, prototypes are essentially a reflection of our default expectations in a particular context. Thus, the two notions "conventionally associated" and "contextually associated" are ultimately related.

a change in the value of one of its attributes in case these values form a scale: a set of degrees—points or intervals indicating measurement values—ordered on a particular dimension (e.g., cost, length, temperature; Kennedy 2001). Result verbs, including directed motion verbs, denote events of scalar change and lexically entail an associated scale (e.g., Beavers 2008; Borer 2005; Hay, Kennedy and Levin 1999; Kennedy and Levin 2008; Krifka 1998; Ramchand 1997; Rappaport Hovav 2008; Tenny 1994). With directed motion verbs, the contiguous points making up the path of motion constitute a scale, with the ordering relation defined by the direction of motion; the order can be fully lexicalized in the verb, or determined in conjunction with an external reference point. Scalar change can be contrasted with nonscalar change, which does not involve a directed change or ordering relation; manner verbs lexicalize nonscalar changes. Manner/result complementarity, then, becomes a claim that the lexicalization of a scalar change is in complementary distribution with the lexicalization of a nonscalar change; see Rappaport Hovav and Levin (2010) for further discussion.

3.3 Putative Counterexamples to Manner/Result Complementarity

Despite the pervasiveness of manner/result complementarity, apparent counterexamples are raised in the literature (Cifuentes Férez 2007:122; Goldberg 2010:48–49; Koontz-Garboden and Beavers 2012; Mateu and Acedo-Matellán 2011; Zlatev and Yangklang 2004:167–168). They call into question whether manner/result complementarity is indeed the consequence of a lexicalization constraint, rather than just a tendency regarding verb meanings. Space considerations prevent us from dealing with all the counterexamples that have been mentioned in the literature.[3] Rather, we now carefully examine two distinct counterexamples. In the next section we examine a potential counterexample from the change of state domain, the English verb *cut*, and in the following section we examine a potential counterexample from the directed motion domain, the English verb *climb*. In each instance, we suggest that distinguishing between lexicalized and contextually derived meaning provides the appropriate basis for understanding the behavior of the verb.

[3] In particular, Koontz-Garboden and Beavers (2012) argue that verbs of cooking and verbs of manner of death represent counterexamples to manner/result complementarity. Nevertheless, we believe that they do not adequately distinguish between what the verbs lexicalize and what listeners know from the use of these verbs in context, though this is necessary to fully resolve the status of these verbs. Our own sense is that the verbs in both classes are somewhat heterogeneous, containing both manner and result verbs, as well as a few verbs, which are polysemous, with distinct manner and result senses, as we argue here for *cut* and *climb*. In fact, Arsenijević (2010) presents arguments that verbs of manner of death do not counterexemplify manner/result complementarity.

3.4 A Potential Counterexample from the Change of State Domain

Guerssel et al. (1985) and Levin (1993:8) provide the verb *cut* with a meaning which includes both manner and result meaning components. If the definition they suggest is accurate, then the verb constitutes a counterexample to manner/result complementarity. Intuitively, this suggestion makes sense as the event described involves the production of an incision with clean edges, which requires the use of an appropriate instrument, which is usually manipulated in a particular way. To capture this insight, Guerssel et al. propose that the lexical conceptual representation for the verb *cut* is as in (5).

(5) *cut* LCS: x produce CUT on y, by sharp edge coming into contact with y (Guerssel et al. 1985:51, (11))

Several types of evidence can be cited to support the claim that *cut* is a result verb. First, its zero-related nominal, *a cut*, refers only to a result, a property *cut* shares with other result verbs, as in (6). In contrast, nominals zero-related to clear manner verbs, as in (7), lack a result interpretation; they necessarily refer to the action and not the physical result of the action, which can be perceived in some instances, but only after the action is over.

(6) break_{V}/a break_{N}, crack_{V}/a crack_{N}, split_{V}/a split_{N}

(7) (give it) a wipe, (give it) a kick, (go for) a walk/run

Nevertheless, there is also reason to claim that *cut* is a manner verb. It is found in the conative construction, as in (8)—a property it shares with manner verbs, such as those in (9a), but not with result verbs, such as those in (9b).

(8) a. Finally, she got the blade pulled out and started **cutting at** the tape on Alex . . .
(www.authorhouse.com/BookStore/ItemDetail∼bookid∼28127.aspx)

b. It had been a stupid act on her part, I thought to myself as I **cut at** the rope with my knife, aware that Sarnian Lady was sinking further . . .
(www.etext.org/Fiction/Warlady/unzipped/warlady-2/2565-62)

(9) a. claw, hit, kick, pull, splash, . . .

b. bend, break, crack, shatter, split, . . .

Furthermore, *cut* is frequently cited as lacking anticausative uses, a property typically exemplified with sentences such as (10a). However, a majority of result verbs show anticausative uses, as in (10b), although such uses are never found with verbs with clear manner components of meaning, as in (10c).

(10) a. * The cake cut. (cf. The waiter cut the cake.)

b. The window broke. (cf. The boy broke the window.)

c. * The table wiped. (cf. The waiter wiped the table.)

Taken together, the evidence cited suggests that *cut* lexicalizes both manner and result. Nevertheless, we argue that *cut* does indeed conform to manner/result complementarity: it lexicalizes a notion of result in most uses, but has some uses where it lexicalizes a notion of manner; thus, we claim it lacks uses which simultaneously lexicalize both manner and result. If we are correct, then, any single use of *cut* meets the lexicalization constraint. Our discussion will also clarify the conditions which give rise to a verb which has uses lexicalizing different meaning components.

First, we show that in its basic use *cut* lexicalizes only a result—a clean separation—despite the evidence cited above that it lexicalizes manner. Our strategy is to show that the manner component is inferred and not lexicalized. Although a cutting event is usually understood as being brought about by the use of a sharp-edged instrument, this perception is due to the nature of the lexicalized result state; the instrument is not lexicalized in the meaning of the verb.[4] An examination of cutting events shows that *cut* specifies neither the instrument, nor the action that the instrument is involved in; specifically, an agent need not wield the instrument. This insight is reflected in Bohnemeyer's discussion of the meaning of *cut* and similar verbs:

(11) "Cut verbs, too, are rather flexible about the action performed and the instrument used (I can *cut* an orange using anything from a knife or axe to a metal string or laser beam, and I can do it by bringing the blade to bear on the fruit or by dropping the fruit onto the blade from sufficient height)." (Bohnemeyer 2007:159)

What emerges from this quote is that the verb supports a wide range of actions on the part of the agent in performing an event of cutting.[5] As mentioned, a hallmark of manner verbs is their lack of anticausative uses, and indeed, *cut* usually is not found in anticausative uses. However, despite received wisdom such uses may be found, as in (12).

(12) a. . . . the rope **cut** on the rock releasing Rod on down the mountain. (http://www.avalanche-center.org/Incidents/1997-98/19980103a-Montana.php)

b. The sheath of the rope had **cut** on the edge of the overhang and slid down 2 ft. (www.rockclimbing.org/tripreports/elnino.htm)

c. The rope cut and the climber landed on his feet, stumbled backward and fell . . . (http://rockandice.com/articles/how-to-climb/article/1092-rope-chopped-by-carabiner)

d. Suddenly, the rope **cut** and he fell down the well. (http://www.englishforfun.bravehost.com/wishingwell.htm)

[4] A reviewer asks whether *cut* does lexicalize manner, proposing that otherwise there is no way to distinguish a cut entity from a torn one. We disagree. We believe that the actions denoted by two verbs give rise to distinct results: that is, it is possible to tell a cut edge from a torn one. Consider, for instance, a piece of bread that is cut from a loaf and a piece that is torn from a loaf.

[5] In this respect, *cut* contrasts with verbs which really lexicalize an instrument and not a result, such as *knife*, *rake*, and *shovel*.

Most likely, the anticausative uses of *cut* were overlooked as most instances of cutting such as those involving food—the patient in most linguistic examples—violate a constraint on anticausatives: the event must happen without the agent's continued involvement (Haspelmath 1993; Levin and Rappaport Hovav 1995; Rappaport Hovav and Levin 2012).

(13) * The bread cut. (cf. The waiter cut the bread.)

As we elaborate in Rappaport Hovav and Levin (2012), the conditions allowing an anticausative use of a verb are not determined purely by its lexical properties, but also depend on properties of the event described in a sentence with the verb. Drawing on this study, we propose that (13) is not ruled out due to lexical properties of *cut*, but rather because it is not an appropriate description of an event in which bread is cut. That is, the verb itself does not specify the particular kind of action which brings about a cut; rather, this action is more or less dictated by the choice of argument as direct object. An anticausative use of *cut* is available precisely when the event involves a theme which can be cut without requiring the continued involvement of an agent. Most often, such instances involve a taut rope-like entity which snaps (cuts) with a clean separation under extreme tension. Since such uses of the verb need not involve the activity of an agent at all, there is certainly no manner component: the verb's meaning involves only a notion of result.[6]

Summarizing, we have shown that in its basic use, the verb *cut* lexicalizes a result. For this reason, it has a result meaning for its zero-derived noun, like other result verbs, is compatible with a range of actions on the part of the associated agent, and can display an anticausative use with the right choice of argument. Therefore, the specifications of manner which are understood with result uses of the verb do not arise from the lexicalized meaning of the verb, but rather are inferred from context.

Although we have argued that in its basic transitive use *cut* does not strictly lexicalize a manner, some instances of this verb necessarily involve a particular manner. It is striking, however, that in such examples, the verb does not entail any result. This happens when the verb is in the conative construction, as in (14). This and comparable examples crucially do not entail a result, but simply the handling of a sharp-bladed instrument in the way necessary to fulfill its intended use.

(14) Flint virtually forgot the two whales as he **cut** at the net with increasing fury. (M. Harris, "Gray Whale Cove", *Orange Coast Magazine*, March, 1990, p. 148; http://books.google.com/)

[6]As a reviewer notes, the (a) and (b) sentences in (12), which were the only examples cited in an earlier version of this paper, include PPs specifying a sharp edge, which cuts the rope. Although the preponderance of examples involving ropes and comparable entities involve such PPs, some examples lack them, such as those cited as the (c) and (d) sentences of (12). Such PPs are occasionally found with more prototypical causative alternation verbs, such as *break* in *The stick broke against the rock*; however, it seems that such PPs do not have to be expressed or even implied with *break*, as they are with *cut*. We have also found anticausative uses of *cut* with the XP *loose*, as in *The tow rope cut loose*. We leave further investigation of the factors licensing such anticausative uses and their significance for future research.

In examples such as these, there is no entailment that a cut was actually made, though the sentence may be used to describe such a situation.

In fact, studies of the conative construction propose that it is licensed by motion and contact meaning components (e.g., Goldberg 1995:63–64; Guerssel et al. 1985:59; Levin and Rappaport Hovav 1991:135; van der Leek 1996)—i.e. some type of manner—and, indeed, as just mentioned, in the conative *cut* entails handling a sharp instrument in a particular way. Although as cited above, Bohnemeyer (2007:159) notes that *cut an orange* can be used when "dropping the fruit onto the blade from sufficient height", this scenario, which does not involve actually wielding as instrument, cannot be described by *cut at an orange*, even if an orange were repeatedly dropped. Thus, the conative uses of *cut* are consistent with the lexicalization constraint: they involve a specific manner—motion and contact—but not a result meaning component.

Thus, we suggest that *cut* has a manner use and a result use, with no meaning component constant across both. Crucially, as our examination of the conative examples shows, when *cut* encodes the manner, the result is no longer entailed, as predicted by the lexicalization constraint.[7] Equally significant, to date our corpus investigations of conative uses of *cut* have not uncovered any examples where the action of cutting is carried out by a machine. It seems to us that a machine can "cut at" only if it is designed to perform the same form of motion and contact that a person does.

What allows *cut* to have a manner use? We suggest that it is so strongly associated with a particular way of handling a specific type of instrument that it is sometimes used to encode a manner. Prototypical cutting events involve instruments such as knives and scissors, which are associated with a specific type of action when they are manipulated. When there is a tight association between a result and the manner in which it is brought about, the relevant result verb may take on a second, manner sense.

Summarizing, the verb *cut* is associated with a conventional manner of bringing about the result it lexicalizes; consequently, it can lexicalize the manner, giving rise to a new sense associated with this word. When this happens, the result meaning component drops out, and the verb can then appear in the conative construction. That the manner is entailed only when the result component of meaning drops out is strong evidence for the manner/result complementarity hypothesis.

[7] A question that arises is whether there are transitive uses of *cut* which illustrate its manner sense. A reviewer suggests that *Terry cut a hole in the ice* might exemplify such a use. In fact, in this example the object is not subcategorized by *cut*, a property which we take to be a hallmark of manner verbs (Rappaport Hovav and Levin 1998). We leave it for future research to determine whether this example truly instantiates a transitive manner use. If such uses turn out not to exist, their absence will need an explanation.

3.5 A Potential Counterexample from the Motion Domain

An even more widely discussed potential counterexample to manner/result complementarity exists in the motion domain: the English verb *climb*. It has been claimed that this verb expresses both manner ('clambering') and direction ('upward') in some uses (Fillmore 1982:32; Jackendoff 1985). Thus, in (15), Kelly is understood to be using her limbs to pull her body upward along the trunk of the tree.

(15) Kelly climbed the tree.

Despite the example in (15) in which manner and direction appear to be jointly entailed, Kiparsky (1997:490) argues, as we do, that particular uses of the verb *climb* lexicalize only one meaning component—either manner or direction. He formulates a lexicalization constraint similar to ours in (1), and as support for it, he notes that *climb* displays what he calls "disjunctive meaning": although the concept of climbing includes both a notion of direction ('upward') and a notion of manner ('clambering'), any single use of the verb involves only one of these. As an illustration, he gives (16), claiming that in (16a) only manner is lexicalized and in (16b) only direction is lexicalized.

(16) a. John climbed down the mountain.

b. The train climbed up the mountain.

In (16a) not only is the direction specified outside of the verb, but this direction is downward; therefore, unlike in (15), upwardness cannot be part of the verb's meaning in this example, suggesting that here direction is not lexicalized in the verb. Further support is provided in (17), where still other directions are expressed outside the verb.

(17) a. Kelly climbed through the gap in the hedge.

b. Pat climbed under the wire fence.

As trains are inanimate, they lack the limbs needed to clamber; thus, *climb* must lexicalize direction only in (16b). Such direction only uses would set this verb apart from most other manner of motion verbs (e.g., *crawl, jog, limp, ride, run, swim, trudge*). Further evidence that in some instances *climb* must contribute direction comes from examples as in (18).

(18) a. The plane/elevator climbed.

b. Smoke climbed slowly and the falling sun was coloring it through . . .
(books.google.com/books?isbn=0595002692)

As Jackendoff (1985:275) notes, despite the lack of an overt indication of direction, the motion in these examples is still understood as upward, and, again, planes, elevators, and smoke, like trains, lack the limbs needed to clamber.

Although there are undoubtedly manner-only and direction-only uses of *climb*, any account of this verb must deal with sentences such as (15), in which manner

and direction appear to be jointly entailed. Kiparsky does not make reference to such sentence types in arguing for disjunctive meaning, though others have used such sentences to argue against manner/result complementarity (Fillmore 1982:32; Jackendoff 1985:274–279). Therefore, we examine *climb* more closely in an attempt to account for all the sentence types.

We will, as mentioned in Sect. 3.1, argue that a closer examination of *climb* suggests that in its basic use this verb lexicalizes manner and not direction, and, furthermore, that the lexicalized manner is not 'clambering', but rather, as Geuder and Weisgerber (2008) argue, 'force exertion against gravity'. Given this reidentification of the manner, we argue that the examples in (16b) and (18), though purported to lexicalize direction only, actually lexicalize manner only. Again following Geuder and Weisgerber, we argue that in (15), the verb lexicalizes manner and not direction as well. Like them, we claim that the nature of the lexicalized manner allows it to be associated with a default direction of motion. It is this association, most likely, that has made it difficult to determine precisely which meaning components are lexicalized in some uses of *climb*.

Finally, we point out in Sect. 3.5.4 that previous work has been correct in identifying uses of *climb* that lexicalize direction only, but we propose that they are the uses found in sentences like *The temperature climbed*. As we discuss, these uses represent the inverse of the phenomenon illustrated with *cut*: *climb* basically encodes a manner, which has a contextually determined direction; consequently, it can acquire a second use in which the default direction is lexicalized and the manner is not.

3.5.1 The Manner Lexicalized by Climb

Fillmore (1982:32) and Jackendoff (1985:276) describe the manner that *climb* lexicalizes as 'clambering': using the hands and feet to propel one's body. Since this manner involves the limbs, uses of *climb* predicated of either animate or inanimate entities that lack limbs should lexicalize direction, i.e. upwardness, only. This prediction is taken to explain the contrast in (19).

(19) a. The train climbed.

b. ?? The train climbed down the mountain.
(Jackendoff 1985:278, (14a), (15a))

Upward direction is understood in (19a) because direction is lexicalized, and since it is upwardness that is lexicalized, it cannot be denied, explaining the unacceptability of (19b).

However, as Geuder and Weisgerber (2008; Geuder 2009) point out, there are uses of *climb* with a downward direction expressed outside the verb that are predicated of inanimate entities lacking hands and feet and, thus, unable to clamber.

(20) Before noon the train **climbed** down to a green valley which contained a cluster of Swiss chalets . . . (www.accessmylibrary.com/.../albuquerque-n-m-homeowner.html)

(21) By the time the ATC informed them about the altitude of the Boeing, the plane had **climbed** down to 14,496 ft. (skyscrapercity.com/archive/index. php/t-143494-p-2.html; cited in Geuder and Weisgerber 2008)

(22) Once the bus **climbed** down the ghat, we all were in the Kokan region and few kilometres away is Chiplun. (cablog.rediffiland.com/blogs/2006/08/23/Guhagar-.html)

Our own explorations suggest that sufficient examples of this kind are attested that they need to be included in any analysis of *climb*.

Since the direction is specified as downward in such examples, and this direction is not compatible with the direction that the verb is purported to lexicalize, Geuder and Weisberger suggest that even with inanimate themes, *climb* can lexicalize a manner. If so, the characterization of the manner cannot, as Fillmore and Jackendoff suggest, involve a particular movement of limbs. Rather, these examples support Geuder and Weisberger's proposal that the manner is 'force exertion against gravity'.[8] On this analysis, when the motion is downward, *climb* is still applicable if there is "the presence of an upward force on certain points of the path", manifested in "controlled, stepwise descent" (Geuder and Weisgerber 2008:26). That is, in these instances, climbing is what allows downward movement without falling. This characterization of the manner component of *climb*'s meaning better captures the actual range of uses of this verb, including its applicability to certain types of downward motion: these uses, like the upward uses of *climb*, require motion that resists the pull of gravity.

If *climb*'s meaning encodes a manner which allows movement via force exertion in order to resist the pull of gravity, it lexicalizes neither clambering, nor upward movement. Rather, since the prototypical climbers are animates (humans and mammals), the prototypical instantiation of the manner is clambering. Clambering is the way in which humans move when they are in physical contact with a reference object and trying to move along it against the pull of gravity.[9] This prototypical

[8] A more precise characterization of the manner may be in terms of resistance to an ambient force, because it is possible to come up with examples set in space, say, where gravity is not at issue, as in *After the space walk, the astronaut climbed back into the space capsule*. Sometimes notions of effort and slowness have also been said to be part of *climb*'s manner. We believe these notions are not part of the verb's entailed meaning, but are contextually understood, perhaps because exerting a force against gravity is effortful and may require moving slowly and with difficulty.

[9] Mateu and Acedo-Matellán (2011) argue that these uses are not manner uses based primarily on data from Catalan and Dutch. We are reluctant to draw a conclusion about English based on data from another language since there could be subtle but crucial differences in meaning between purported translation equivalents; see, for example, McClure's (1990) discussion of the Italian and Dutch translation equivalents of English *blush*.

instantiation has been taken to be the manner that *climb* lexicalizes. Mammals like cats and squirrels, which use their limbs to move upward along some object against gravity, also are said to climb. More important, even animals that lack limbs can also *climb* as long as they are able to move along a surface in a manner that exerts a force against gravity. Thus, despite Fillmore's (1982:32) claim to the contrary, snails can indeed climb, as in (23), and, in fact, there is even research into the climbing behavior of snails (McBride and Henry 1989).

(23) a. . . . it seems the snail **climbed** up the side of the tank . . .
(www.aqua-fish.net/show.php?h=siamesefightingfish)

b. Is it possible that the snail **climbed** the greenhouse and dropped down, bypassing your copper tape? (forums.moneysavingexpert.com/.../t-974821.html)

Because the motion is understood as upward in the examples in (23), it could be argued that in them *climb* lexicalizes upward motion only and not a manner; however, there are also examples where snails climb in directions other than upward, as in (24).

(24) a. At the completion of mating, the snails separated, the top snail **climbed** down and the snails crawled away from each other. (home.earthlink.net/∼aydinslibrary2/Orstan2010.pdf)

b. As this snail **climbed** down, his shell was pulling him.
(http://www.flickr.com/photos/phoo_tographer/page9/)

c. Watch this crazy **snail** climb across the tops of my plants, and bend them over to the glass . . .
(www.aquaticcommunity.com/aquariumforum/archive/.../t-20939.html)

These examples show without a doubt that *climb* in its manner use can be predicated of entities which lack arms and legs.

Furthermore, machines such as cars, planes, and elevators can all be said to climb in that they are designed to move against the force of gravity because of their engines and possibly other design features; however, since they do not have limbs, they do not instantiate such motion by clambering. Yet another example noted by Geuder and Weisberger is a balloon, which can climb because being lighter than air, its buoyancy exerts an upward force. Thus, although it is possible to identify a unified manner across the range of themes found with *climb*, as Geuder and Weisberger also point out, this manner is instantiated in various ways because each type of theme has its own way of exerting a force against the pull of gravity. The many apparent instantiations of climbing can be likened to the many instantiations of opening; as we noted in Sect. 3.1, the result state that constitutes being open depends on what is being opened.

3.5.2 *Where Does the Inference of Upwardness Come From?*

If *climb* indeed lexicalizes manner in uses previously said to lexicalize direction, why is it that an upward direction is understood in so many uses of *climb*—perhaps so strongly that it explains why *climb* has been said to lexicalize direction? The reason, we propose, is that there is a default association of this manner and upward direction.

Geuder (2009:132) elaborates on this, noting that there is a directional meaning component associated with *climb*'s manner, independent of the overall direction of displacement of the theme. As he writes, the manner involves "a force oriented vertically and opposed to gravity" (Geuder 2009:132; translated from French by BL). Further, as Geuder continues, "*climb* in an upward direction can designate a continuous movement (because the displacement always accords with the manner), while the process designated by *climb* in a downward direction must take place in stages (because a section of a descent must be inserted between each pair of points of contact with vertical support)" (2009:133; translated by BL). It is this difference that is behind the inference of upwardness in the absence of contextual cues to the contrary. The presence of an upward force in *climb*'s manner is consistent with movement in an upward direction, though context may provide evidence that the motion is in some other direction. Thus, in (25a) motion on a jungle gym (or monkey bars) is in just about any direction, while in (25b), the motion need not be upward, but simply over a rugged terrain requiring the relevant manner of motion.

(25) a. The children climbed on the jungle gym all afternoon.
b. The backpackers climbed all day.

3.5.3 *Transitive* **Climb** *Does Not Lexicalize Direction*

Having clarified the nature of *climb*'s manner component of meaning, we turn now to the transitive uses of *climb* such as in (15), repeated as (26), which must be understood as describing a scenario that involves both a clambering manner and upward motion. Indeed, as noted, the verb *climb* has been said to lexicalize both manner and direction in such examples.

(26) Kelly climbed the tree.

The question, then, is whether such examples are truly a problem for manner/result complementarity? We propose that the transitive uses of *climb* ONLY lexicalize manner, where the manner again is force exertion against gravity. We suggest that the understood direction of motion in transitive uses arises contextually from the interaction of the manner, the nature of the reference object (e.g., the tree in (26)), and the intention of the agent. As we show, the understanding of a particular direction of motion associated with uses of *climb* with a reference object is just

one instance of a more general phenomenon attested with manner of motion verbs taking reference object and agent arguments.

If the upward direction understood in (26) were attributable to the verb, then every instance of transitive *climb* should also be understood as involving upward motion, no matter what the reference object. However, although the direction of motion is understood as upward in (26), it is clearly not so in all transitive uses of *climb*. This means that the upward direction must not be lexicalized in (26), but rather must arise from the context. In the next two examples, the context makes clear that the direction in which the climbing takes place must be downward.

(27) According to his story, he had trailed the Mexicans and from a place of concealment had watched them **climb** a rope ladder into a chasm. He saw them haul up sacks of ore, and water for their horses, which were staked on the rim. (J.F. Dobie. 1978. *Coronado's children: tales of lost mines and buried treasures of the Southwest*. 234–235. Austin: University of Texas Press; books.google.com/books?isbn=0292710526)

(28) 'Bring the Governor's reply straight back,' shouted Master Mace as Mungo **climbed** the rope ladder into the ship's rowing boat. (J. Riordan, and B.K. McCalla. 2007. *Rebel cargo*. 149. London: Frances Lincoln; books.google.com/books?isbn=1845077741)

In (27), the narrator is located at the top of a chasm, watching the Mexicans move down into it and then carry things up from it. In (28), Master Mace is on a ship, and he is sending Mungo down to a smaller boat. The preposition *into* does not contribute information about direction in either (27) or (28). In fact, *into* is found with both downward motion into a ship as in (28) and upward motion into a ship as in (29).

(29) Marian **climbed** the rope ladder into the ship unaided, and was back on board within 15 min of jumping. (www.geocities.com/jckinghorn/ATL/content/56Minnekahda.htm)

Why does the understood direction vary in transitive sentences with *climb* as the direct object is varied? We propose that this variation follows from properties of the direct object—i.e. the reference object—and in particular, the way in which agents typically interact with this object. In general, a reference object defines a salient path via its inherent nature and the way an agent typically interacts with it, and this determines a default direction in any interaction with this reference object when it is part of the agent's path of motion. Thus, a significant factor in the absence of a downward interpretation for *climb the tree* is the nature of our interactions with trees. Trees have a prominent vertical dimension: they are perceived as projecting upward from the ground, so they are typically encountered as something to ascend, especially because they might contain fruits or provide a haven from danger. In contrast, cliffs may be encountered either projecting upward or downward from ground level. Evidence for these different perceptions comes from searches of the World Wide Web. Although these numbers are only approximate, with *the/a*

tree, there are over 12 times more *climb(ed) up* than *climb(ed) down* in October 2008. With *the/a cliff*, there are considerably less total examples, with slightly more *climb(ed) up*.

These distributional observations lead us to expect that if circumstances conspire, downward transitive uses of *climb* might be attested, and indeed they are, as the examples in (27) and (28) show. Interestingly, examples of downward motion with transitive *climb* can cooccur with *down* without seeming contradictory, suggesting that the sense of upward movement in *climb(ed) the/a ladder* is due to a very strong inference.[10]

(30) You **climb** the ladder down into the crew quarters, and encounter a Protagonist, lying on a cot and brooding.
(kol.coldfront.net/thekolwiki/index.php/Random_Lack_of_an_Encounter)

In contrast, there are only a handful of comparable *down* examples with *climb(ed) the/a tree*, suggesting that this reference object is interacted with differently.

(31) a. Once a mother came with three or four of her babies and one was stuck on the roof since it was too afraid to **climb** the tree down to join the others . . .
(artizek.deviantart.com/art/Racoon-39425624?offset=0)

b. We don't know if it was cut to take Glen's body down or if a police officer, homicide detective or investigator climbed the tree or had someone **climb** the tree down to remove the entire rope.
(http://crimeshots.com/forums/showthread.php?t=6334)

Finally, to further illustrate that the direction of motion does not arise from the verb alone, we cite examples of transitive *climb* where the understood direction is 'across'. Various web pages explain how to climb monkey bars (or jungle gyms). For example, the web page "How to Climb Monkey Bars" (http://www.ehow.com/how_6575386_climb-monkey-bars.html) provides instructions for moving along "a series of bars in a row that are meant to be swung on, going across, under the bars, from one to the other".

Our analysis has the advantage that it is not tailored specifically to the verb *climb*. Thus, it also explains the behavior of other manner of motion verbs: when they take a reference object as direct object, the direction of motion again depends on the nature of the reference object and how the theme interacts with it. This point is not usually appreciated because a limited set of reference objects is commonly cited, suggesting that there is a single, default direction understood with each verb (e.g., Jackendoff 1985: 277). Thus, *hike* and *ride* are said to be associated with motion along a predefined path, as in (32a), while *swim* is said to be associated with motion across, as in (32b).

[10] A reviewer questions the acceptability of these examples and wonders if there are dialectal differences or changes in the usage of the verb *climb*. Determining this is beyond the scope of this paper; what matters here is that such uses do exist for at least some speakers.

(32) a. hike/ride the Appalachian trail

b. swim the Channel

But other directions may be understood with these verbs with alternative choices of reference object. Even though (33) and (34) involve the same verb, *ride*, and the same reference object, *the slope*, the larger context indicates that the direction is DOWN in (33) and UP in (34)—neither of which is the default 'along' of (32a).

(33) He was descending a hill of a four-lane arterial, on a bicycle equipped with the all-reflector system of nighttime protection that is required by federal regulation, but not using a headlamp. ... I testified to two accurate ways to determine speed on a slope. The first is plain experimentation. **Ride the slope** and see what speed develops. (http://johnforester.com/Consult/GreenJM/derby.htm)

(34) ... the cart inched up the winding slant of the hill. ... Martin **rode the slope** glancing at the sky, watching the double file of muscle-legged beasts lean straining with the cart against the long incline. (T. Lea, *The Wonderful Country*, TCU Press, Fort Worth, TX, 2002, p. 178; books.google.com/books?isbn=0875652557)

The verb *ride* differs from *climb* in that its manner does not so strongly give rise to an understood default direction of motion; most likely, this explains the wider variety of understood directions in its transitive uses.

Finally, the verb *scale*, which Goldberg (2010:48) suggests lexicalizes both manner and upward direction, just as *climb* has been said to, shows a downward transitive use with *cliff*.

(35) A woman escaped with minor injuries after her car plunged over cliffs in East Sussex and landed on a ledge. ... The vehicle landed almost vertically on the ledge about 100 ft down from the top of the cliff with the woman inside. A coastguard team **scaled** the cliff to reach the woman who was then winched to safety and taken to hospital.

(http://news.bbc.co.uk/1/hi/england/southern_counties/3691952.stm)

Although the relevant manner is again intended for motion against the pull of gravity over typically vertical surfaces, (35) shows that the motion need not be upward. With this verb, too, direction is not lexicalized in the verb, but inferred in part from context.

3.5.4 The Direction-Only Use of Climb

Among the purported direction-only uses of *climb*, Jackendoff (1985:278, (14d)) includes *The temperature climbed (to 102°)*. We agree that in this use and comparable uses in (36), the verb indeed lexicalizes direction only.

(36) a. The prices/cost climbed.

b. Despite the new measures, the inflation/unemployment rate climbed.

c. During the recession, the number of foreclosures climbed.

As these examples involve abstract themes, no manner component is possible at all. What is striking is that the themes are all measurable attributes of entities whose values form a scale—in these instances, a set of points representing the possible values of the attribute arranged according to an ordering relation (Kennedy 2001; Kennedy and McNally 2005). Since these attributes are scalar-valued, a change in their value can be understood as motion along the scale. Thus, when they are arguments of a verb such as *climb*, the upward direction associated with *climb* is understood figuratively, translating into an increase in the value of the relevant attribute along its associated scale. In these uses, then, *climb* acquires a use that indicates motion in an upward direction (figuratively), but only with a concomitant loss of the manner component, consistent with manner/result complementarity.

In this direction-only use, *climb* patterns very much like the inherently directed motion verb *rise*, which may also be used to describe a change in an increasing direction along a scale; see Geuder and Weisgerber (2008:33–37) for further discussion of similarities and differences between the two verbs.

(37) The prices/temperature climbed/rose.

We suggest that the existence of the direction-only meaning of *climb* can be explained in the same general way as the manner-only meaning of *cut*.[11] Just as in its basic meaning *cut* encodes a result and has a conventionally determined, but nonlexicalized manner, so *climb* basically encodes a manner, which brings with it a default direction. Furthermore, just as there is a second meaning for the verb *cut* in which the conventionalized manner is lexicalized, but only if the result meaning is not, so too with *climb*, there is a second use in which the default direction is lexicalized, but then the manner meaning is not. Importantly, each meaning of both verbs shows manner/result complementarity, conforming to the lexicalization constraint.

[11]If climbing is so strongly associated with upward movement, then it might be expected to be associated with upward movement without clambering for animates, just as *cut* is associated with either a result only or a manner only for the same choice of argument. Although this might be attributable to a lack of conventionalization, there might be other reasons why this has not happened. There could be a blocking effect given the existence of inherently directed motion verbs like *rise* and *ascend*, which lexicalize upward motion. It may also be easier for a meaning to shift from result to manner than from manner to result: an entity that ends up in a result state plays a large part in determining the manner in which the state is achieved, but the theme of a motion event does not restrict its final destination to the same extent. Even with the verb *climb*, although it may be inferred that the theme moves, the actual goal of movement cannot be inferred, especially in the absence of a reference object.

3.6 Potential Counterexamples Are Systematic, Even if Sporadic

If some facets of the behavior of *cut* and *climb* are a consequence of manner/result complementarity, we expect to find at least some other verbs which pattern like them. That is, we should find some verbs which lexicalize results that are conventionally brought about in a specific manner and hence also have uses which lexicalize only the manner, and also some verbs which lexicalize manners that are conventionally associated with a specific result (or direction) and hence also have uses in which only the result is lexicalized.

We illustrate the existence of such verbs with another verb that patterns like *cut*: the English verb *slice*. It too is basically a result verb, and like such verbs, it has a zero-related result noun. The verb *slice* differs from *cut* in that the noun *cut* names a type of separation in an entity, while the noun *slice* names a piece of matter that becomes separated with a characteristic result shape. What matters here is that a slice, like a cut, is brought about through a well-defined use of a specialized instrument, though neither the specific instrument, nor the action used in wielding it is lexicalized by the verb. Yet, the verb *slice*, like *cut*, can appear in the conative construction. In such uses, the result need not be entailed, and, in fact, in the context in (38) it is impossible to conceive of a slice being created at all.

(38) She . . . was **slicing** at the tape that held his legs . . .
(books.google.com/books?isbn=0060541075)

The conative example must be understood as involving an agent using a knife-like instrument in the same way as when slices are cut. Thus, if the action was performed with scissors, then it would be understood as involving a single blade of the scissors used like a knife. Furthermore, the conative would not be used, say, if the agent were using a bread-slicing machine, which does not replicate the pattern of actions that a person makes in slicing. Thus, *slice* behaves like *cut*, which cannot be found in the conative construction use when the action is carried out by a machine. Thus, in the conative use of *slice* a manner is lexicalized, but the result drops out. Presumably, the manner use arises because an event of slicing, like an event of cutting, is conventionally associated with a particular manner.[12]

Summarizing, *slice*, like *cut*, is strongly associated with a conventional manner of bringing about the result it lexicalizes; consequently, it can lexicalize the manner, with the result meaning component dropping out, and appear in the conative construction. That the manner is entailed only when the result component of meaning drops out is strong evidence for the manner/result complementarity hypothesis.

[12]Despite the many behavioral similarities, *slice* does differ from *cut* in one respect: it seems very difficult to get an anticausative use of this verb. We suspect that the anticausative use is precluded because of properties of the action of slicing itself, but this will need to be verified through additional investigation of this verb.

Similarly, if there are manner of motion verbs, which are like *climb* in that the very nature of the manner they lexicalize gives them a strong conventional association with a particular direction of motion, then they might be expected to show result uses with the manner dropping out. In fact, there are verbs, which like *climb*, involve manners that facilitate motion either with or against gravity, such as *plunge* and *soar*. Again when such verbs are predicated of scalar-valued attributes, they show result meanings, as in *The prices plunged/soared*.

3.7 Concluding Words: The Lesson from the Problematic Verbs

An examination of apparent violations of manner/result complementarity reveals that when a result verb has a conventionally associated activity, the associated activity may get lexicalized in some uses of the verb, but only if the result drops out (as with *cut* and *slice*). Likewise, when a manner has a conventionally associated result, the result may be lexicalized in some uses of the verb, but only if the manner component drops out (as with *climb*, *plunge*, and *soar*). Given our definition of lexicalization, which requires lexicalized meaning to be constant across all uses of a verb, such verbs, then, must be polysemous, having both manner and result senses. However, these limited instances of polysemy are motivated, arising from conventional associations in the real world between certain manners and results. Perhaps equally important is recognizing that this deeper understanding of the behavior of these verbs is made possible by carefully distinguishing facets of meaning which are directly attributable to the verb from facets of meaning which are derived from context.

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Chapter 4
Oriented Adverbs and Object Experiencer Psych-Verbs

Fabienne Martin

4.1 Introduction

This paper investigates the possibility of combining Object Experiencer psych-verbs – and, in some extent, achievement verbs – with adverbs derived from dispositional adjectives (*cleverly*, *patiently*) or from psychological adjectives (*sadly, calmly*). I give in (1) some examples of adverbs of this kind, that I will call 'subjective adverbs'. 'Dispositional adverbs' like *cleverly* are also called 'subject-oriented' adverbs (Jackendoff 1972; Ernst 1984) or 'agent-oriented' adverbs (Geuder 2000; Schäfer 2005; Piñón 2008), cf. (1a). 'Psychological adverbs' roughly correspond to what have been called 'mental attitude adverbs' (Ernst *id.*, Schaefer *id.*), or 'transparent' adverbs (Geuder 2000), cf. (1b).

(1) a. cleverly, patiently, aggressively, attentively, cautiously, carefully, cruelly, foolishly, graciously, intelligently, laboriously, nicely, politely, relentlessly, rudely, skilfully, studiously, stupidly, tactfully, wisely, ostensibly, craftily, relentlessly, stubbornly, impolitely
b. sadly, gladly, angrily, calmly, bitterly, furiously, nervously, anxiously, cheerfully, worriedly, plaintively

So-called object Experiencer psychological verbs (OEPVs for short) assign the role Experiencer to their object. Some verbs of this type (taken from Class 31.1 of Levin 1993) are given in (2). A common view is that these verbs are causatives (cf. Chomsky 1970; McCawley 1976; Di Desidero 1993; Parsons 1990; Pesetsky 1995; Wechsler 1995; van Valin and LaPolla 1997). A competing thesis is that they are unaccusatives (cf. e.g. Belletti and Rizzi 1988). This paper argues in favour of the first view; all OEPVs have a causative reading, including the less agentive ones.

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(2) a. amuse, annoy, console, discourage, encourage, frighten, surprise, terrorize, provoke
b. agitate, alarm, amaze, appease, astonish, astound, convince, delight, enrage, exasperate, impress, inspire, irritate, persuade, preoccupy, stimulate, strike, terrify, trouble, worry, wound

It is common to distinguish between the agentive and non agentive readings of causative verbs, depending on whether the subject is associated to the role Agent or Causer, cf. (3).

(3) a. Peter (deliberately) broke a vase. (agentive reading)
b. The stone broke a vase. (non-agentive reading)

Among OEPVs, it is generally assumed that the ambiguity is displayed by a subset of them only; some cannot enter the typical agentive constructions and are therefore sometimes labelled 'non agentive' verbs, cf. (4b). Verbs in (2a) are 'agentive', while those in (2b) are 'non agentive'. Among the 'non agentive' OEPVs are verbs like *convince* or *persuade*, which have an independent reason to be incompatible with agentive constructions, namely their belonging to the achievement class (cf. Vendler 1967; Piñón 1997).[1]

(4) a. Peter encouraged her (patiently). (agentive OEPV)
b. Peter inspired her (# patiently). (non-agentive OEPV)

One conclusion of this paper is that the OEPVs in (2b) *are*, in fact, compatible with lexical items or constructions which force them to denote an action. Therefore, I won't label them non agentive verbs. However, given that they are not compatible with every agentive construction like typical agentive predicates (for instance, most of them are difficult to embed under *make/ faire*), I will call them *weakly agentive verbs*.

The traditional account for the non agentivity of so-called 'non agentive' OEPVs is that these verbs denote 'uncontrollable events', either because they are not events at all given that they have zero duration (cf. Piñón 1997 about achievement verbs) or because they do not involve a real Agent (Bouchard 1995; van Voorst 1995 about OEPVs).

As it stands, this account raises several problems. Firstly, the different agentive constructions often give heterogeneous results for a same verb. A unified explanation is thus not satisfactory. In French for instance, *étonner* is acceptable in imperatives; as Ruwet 1972 reminds us, Diaghilev asked Cocteau to provoke his

[1]The possibility for a verb to be simultaneously an achievement and a causative largely depends on the way these classes are defined in details. For those like van Voorst 1992 who define achievements as denoting punctual events, 'their status as achievements rules out their being causative' (p.84). For those like Kearns 2003 who admit that achievement verbs have a non-punctual reading, achievement verbs can be causatives. I will adopt the second view here, cf. Sect. 4.3.

astonishment by saying *Etonne-moi!*; however, the same verb cannot be embedded under *faire*.[2] In English, a verb like *interest is* compatible with *some* subjective adverbs, cf. (5a), but cannot be embedded under *persuade* (note that the adverb in (5a) can have its manner reading).

(5) a. Paul ***cleverly interested*** Mattel in the toy. (Internet)
b. # I ***persuaded*** Paul ***to interest*** Mattel in the toy.

Secondly, data traditionally used to illustrate the alleged incompatibility of weakly agentive verbs with subjective adverbs are not always confirmed by research on large corpora, see again (5a). In general, adverbs like *cleverly* raise fewer difficulties with weakly agentive verbs than adverbs that Jayez 1996 calls 'attentional adverbs', which denote an attentional state of the subject's referent, cf. e.g. *patiently* or *attentively* in (6). To my knowledge, traditional accounts miss this difference and cannot account for it.

(6) a. Pierre a ***trouvé*** la solution ***élégamment/*patiemment***.
Pierre found the solution elegantly/patiently.
b. Pierre a ***captivé*** son auditoire ***intelligemment/*attentivement***.
Pierre fascinated his audience cleverly/attentively.
c. Pierre l'***a inspiré généreusement/*patiemment***.
Pierre inspired him generously/patiently.
d. Pierre nous ***a émus stupidement/*prudemment***.
Pierre moved us stupidly/cautiously.
e. Il a ***intelligemment/*attentivement intéressé*** les investisseurs à son project.
Pierre cleverly/attentively interested the investors to his project.

Additionally, although 'attentional' adverbs are as a rule the most problematic ones with weakly agentive verbs, they are nevertheless sometimes acceptable with some of them. For instance, they occur quite regularly in corpora with *convince*, contrary to what is generally claimed (included by myself in Martin 2006 for French).[3] The English, French and German examples repeated below were all found on the Internet and judged acceptable by the native speakers to whom I submitted them.

(7) a. It wasn't all lost and the week was saved as Sandra, ***patiently, convinced*** me to use her power meter for some tests.

[2]The reader will easily find other examples of OEPVs which pass some tests of agentivity but not others in the language of her choice (see Martin 2006 for more systematic examples of these kinds of discrepancies for French). Actually, heterogeneity in the results of agentivity tests is not surprising, given that some of these tests do not seem to diagnose agentivity at all. For instance, imperatives are compatible with predicates who denote states whose occurrence cannot be controlled by the Addressee (*Be spontaneous!* is a grammatical sentence, even if spontaneity is an uncontrollable state, as Stendhal 1890/1996 or Elster 1983 have noted). Cf. Martin (2008a) on imperative sentences with weakly agentive predicates.

[3]Note that at least in some of the examples of (7), *patiently* (or its French and German equivalent) has its manner reading, despite the pre-verbal position.

b. Through lots of consistent ground work and trail lessons, Larry ***patiently convinced*** her of a better way to live [. . .]
c. I was reluctant to do it over the phone, but the gent spoke very well and ***convinced*** me ***patiently***, so I went ahead.

(8) a. Mon père a ***patiemment convaincu*** Charlie.
My father patiently convinced Charlie.
b. Après tout [. . .] le non-lecteur n'est jamais que celui qu'on a ***patiemment convaincu*** de l'inutilité de l'écrit.
After all [. . .] *the non-reader is only the person that one patiently convinced of the uselessness of written texts.*
c. Plus que tout autre, il aura ***patiemment convaincu*** Angela Merkel [. . .].
More than nobody else, he will have patiently convinced Angela Merkel [. . .].

(9) a. Mein Arzt hat meine Sorgen ernstgenommen und mich ***geduldig überzeugt*** dass die Bauchfelldialyse für mich richtig ist.
My doctor took my worries seriously and patiently convinced me that a dialysis of the peritoneum was the right thing to do for me.
b. Eberhard kam eilends und hat mich ***geduldig überzeugt***, dass es viel sinnvoller ist, im Garten zu bleiben.
Eberhard came quickly and patiently convinced me that it was much more meaningful to stay in the garden.

Observations of the same kind can easily be made for several combinations of other weakly agentive OEPVs and subjective adverbs. (10) gives a list of examples found on the Internet which should be ungrammatical according to traditional accounts, but which are all judged acceptable by my informants. Note that moving the verbs at hand into the category of agentive OEPVs would not suffice to solve the problem. Indeed, in some cases, subjective adverbs are acceptable in a context where the verb clearly has a non-agentive reading. For instance in (10d), *amuser* must have a non agentive reading, since its subject denotes an inanimate (Sect. 4.2.6 discusses examples of this kind in more detail).

(10) a. Un scénario subtil, qui met cul par dessus tête la psychanalyse, provoque de manière charmante, ***émeut intelligemment*** [. . .].
A subtle plot, which turns psychoanalysis upside down, provokes in a charming way, moves cleverly [. . .].
b. L'empereur français est ***habilement convaincu*** par Cavour que la situation italienne est arrivée à un point critique [. . .].
The French emperor is skilfully convinced by Cavour that the Italian situation is arrived at a critical point [. . .].
c. I would give up on Google and knols [sic] if it were not for my daughter, who ***patiently found*** out whom to talk at Google [. . .].
d. Un rien t'***amuse intelligemment***, cher cousin.
The simplest thing amuses you cleverly, dear cousin.

One could argue that in these examples, the verbs *to v* at hand are reinterpreted as *try to v* through the mechanism of coercion. However, tenants of this view should then explain why weakly agentive OEPVs are not all acceptable with subjective adverbs (although the explicit inchoative version *try to v* is). For instance, (11) lists VPs which are either never produced or rejected by our informants when found on corpora, although the inchoative version in *essayer de v* is acceptable in each case.

(11) a. # Pierre a ***attiré prudemment*** sa voisine. (cp. OK Pierre a ***prudemment essayé d'attirer*** sa voisine).
Pierre attracted cautiously her neighbour. (Pierre cautiously tried to attract her neighbour)

b. # Pierre l'a ***patiemment fascinée***. (cp. Pierre a ***patiemment essayé de la fasciner***).
Pierre fascinated her patiently. (cp. Pierre patiently tried to fascinate her)

c. # Pierre a ***patiemment trouvé*** sa clé. (cp. OK Pierre a ***patiemment essayé de trouver*** sa clé)
Pierre patiently found his key (cp. Pierre patiently tried to find his key)

d. # Pierre a ***patiemment intéressé*** ses étudiants à la logique (cp. OK Pierre a ***patiemment essayé d'intéresser*** ses étudiants à la logique.)
Pierre patiently interested his students in logic. (cp. Pierre patiently tried to interest his students in logic)

A third problem of the traditional account is that types and readings of subjective adverbs which have been shown to have different properties are sometimes inappropriately lumped together. For instance, van Voorst 1992 and Ruwet 1972, 1995 treat the adverb *intentionally* on a par with other subjective adverbs like *cleverly* or *patiently*, as well as the different readings of the latter (cf. *infra*). Besides, several recent in depth studies have been devoted to this class of adverbs (cf. e.g. Geuder 2000; Piñón 2008, 2009; Schäfer 2008; Maienborn and Schäfer 2010), and to my knowledge, the semantic analysis of OEPVs has not benefited from their insights yet.

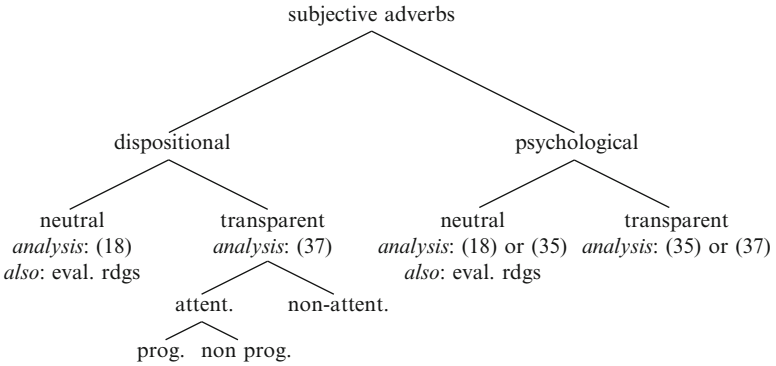
This paper is divided as follows. Section 4.2 recalls the different types of dispositional and psychological adverbs and provides a new typology of their different readings. Section 4.3 accounts for the compatibility of OEPVs and other weakly agentive verbs like achievements with subjective adverbs in general. Since the data under analysis are often subtle and require a native speaker ability, this work will be mostly based on French data.

4.2 Subjective Adverbs: Typology and Ambiguities

The tree-type diagram provided below provides a road-map to the typology of subjective adverbs which will be built in this section. Each adverb class is indexed with its λ-calculus representation(s) (symbolised by the numbers under which they are given). The initial branches distinguish dispositional adverbs (derived from

dispositional adjectives) from psychological adverbs (derived from psychological adjectives). Each class splits into two subclasses of 'neutral' vs 'transparent' subjective adverbs.[4] What I call transparent *adverbs* must be understood as expressing a state of the Agent *under any of their readings*. They are transparent wrt the adjectival base: transparent 'ADJ-ly' adverbs express in a transparent way that the subject's referent is in an ADJ state. For instance, as shown below, *patiemment* 'patiently' lexically encodes a mental state in all its uses. Neutral adverbs are non transparent adverbs: they do not automatically express a state of the Agent. However, neutral adverbs might very well have transparent *readings*. That is, an adverb which does not lexically encode the state of the Agent can be used to describe this state.

(12)



4.2.1 Dispositional Adverbs

4.2.1.1 Introduction

This section deals with subjective adverbs like *cleverly* or *clumsily*, which derive from dispositional adjectives. Jackendoff 1972 observes that adverbs of this type have two different readings. The intended reading is supposed to vary with the syntactical position of the adverb.

(13) a. Cleverly/Clumsily, John dropped his cup of coffee.
b. John dropped his cup of coffee cleverly/clumsily.
c. John cleverly/clumsily dropped his cup of coffee.

Sentences (13a) and (13b) are roughly paraphrasable by (14a)–(14a') and (14b) respectively.

[4]The term 'transparent' is introduced by Geuder 2000. The differences between his use and mine will be made clear in Sect. 4.2.2.2.

(14) a. It was clever/clumsy of John to drop his cup of coffee.
a'. John was clever/clumsy to drop his cup of coffee.
b. The manner in which John dropped his cup of coffee was clever/clumsy.

I will follow Geuder's terminology and call *agentive* the reading in (13a). The adverbs in (13b) have a manner reading. The sentence in (13c) can have either of the two readings in (14).

No consensus has been reached yet on the way the two readings should be analysed semantically. While there is agreement on the view that manner adverbs are predicates of events, agentive adverbs have been analysed in many different ways. Moore 1985 analyses them as predicates of situations and Wyner 2008 as predicates of facts. The obvious disadvantage of these accounts is that they live unexplained the polysemy between the agentive and manner readings. Recently, Piñón 2009 resurrected and recasted an alternative analysis of McConnell-Ginet 1982, according to which agentive adverbs modify an implicit abstract predicate ACT (under this view, (13a) means something like 'John acted cleverly/clumsily to drop his cup of coffee'). As Piñón puts it, this proposal suggests an exciting general scenario in which *(nearly) every adverb is a manner adverb*, and elegantly explains the polysemy of dispositional adverbs.[5]

The details of the analysis of the agentive reading is however not so relevant for my purpose, since this reading is almost always possible with weakly agentive verbs, as soon as the context allows to infer that the subject referent intentionally tries to trigger the denoted change of state. For instance, (15) is unproblematic as soon as the relevant intention is attributed to the subject referent. If this possibility is blocked, it is rather for a pragmatic than for a semantic reason.

(15) ***Prudemment, il a perdu*** quelques minutes plutôt que d'endommager la voiture.
Cautiously, he lost several minutes rather than damaging the car.

With weakly agentive verbs, the problematic reading is the manner one. In the next section are reviewed the different analyses of the manner reading of dispositional adverbs.

4.2.1.2 The Manner Reading: Two Previous Analyses

As already mentioned, dispositional adverbs under their manner reading are traditionally analysed as predicates of an event argument. For instance, to (16a) corresponds the logical representation (16b).

(16) a. Annette replied cleverly.
b. $\exists\, e$[Subject(e, a) & Reply(e) & Clever(e)] (manner reading)

[5]In the line of Schäfer 2002, Rawlins this volume makes a similar proposal for adverbs of space and time like *slowly*, that he takes to be predicates of events (and therefore pure manner adverbs) in all their uses, included in high-attached positions.

Ernst 2002 is one of the few authors to define the manner reading of dispositional adverbs in more detail. He defines the predication ADV(e) under the manner reading as follows (ADJ symbolises the evaluative adjective and ADV the adverb derived from it).

(17) ADV (e)= e [$_{REL}$ manifests] ADJ in Agent

The relation 'Manifest' in (17) "is intended primarily to capture the fact that the manner reading describes some sort of external manifestation" of the quality through the event; if x acts in a clever way, cleverness should be somehow observable within the event (p. 56). The agentive reading does not require this: if x is clever *to answer*, the answering event itself can very well manifest stupidity.[6]

A second observation of Ernst is that under the manner reading, the agent itself does not have to be in a ADJ state at the moment the event is performed. For instance, (16a) can be true if Annette is a stupid person (permanently stupid), and even if she is stupid at the moment she replies (temporarily stupid). What is required is that her answer 'manifests', or 'shows properties typical of' stupidity. Although admittedly, the typical situation is that x is stupid when x acts in a stupid way, it can nevertheless be that x is *not* stupid at the moment she performed her stupid action. In fact, her state of mind is not directly relevant to judge the sentence true or not. What counts is that stupidity *was manifested through* the act.

Although Ernst is right to claim that dispositional adverbs like *stupidly* are neutral with respect to the state of the Agent under their manner reading, he attributes them a semantic representation which tends to show the contrary. Indeed, (17) makes reference to the state of the Agent, although implicitly (as noted by Geuder 2004), through the predication ADJ in Agent. A representation like (18) would have been more justice to Ernst's observation (ADJ-NESS is the noun morphologically related to the adjective; it denotes the disposition which is manifested).

(18) ADV (e)= Manifest (e, ADJ-NESS)
(manner reading of subjective adverbs)

Geuder 2000:21 casts some doubts on the view that dispositional adverbs like *intelligently* are entirely neutral wrt the state of the Agent, on the basis of the fact that they apparently require that the subject denotes an entity capable of mental operations, see his examples (19).

(19) a. # The equation came out intelligently.
b. # The key opened the door intelligently.

It is not clear however that the unacceptability of (19), whose oddness might very well involve independent factors, forces us to conclude that these adverbs lexically encode a mental state.[7]

[6] According to Piñón 2009's analysis, under the agentive reading, the adverb predicates the event of *deciding* to answer. If we combine this idea to Ernst's hypothesis, we would therefore assume that under the agentive reading, cleverness has to manifest itself in the *decision* to answer.

[7] Geuder itself does not draw this conclusion. His only concludes that adverbs like *intelligently* have an 'opaque' relationship to predicates of individuals. He contrasts these 'opaque' adverbs to

Some contexts tend on the contrary to show that adverbs of this type can very well have a pure manner reading. Firstly, they are compatible with predicates like *sleep*, whose subject is not an Agent, or at least not a typical one, cf. (20), or with stative predicates like *be beautiful*, cf. (20d). Secondly, they can have inanimate subjects, cf. (21).[8] Examples (20) and (21) are all taken from the Internet.

(20) a. Prenez ces 8 semaines pour ***dormir intelligemment*** en écoutant votre train de sommeil le soir.
Take these 8 weeks to sleep intelligently in listening to your sleep train in the evening.
b. Pour ***dormir intelligemment***. La couette de soie de Smart Silk pourrait bien transformer votre sommeil et du même coup, votre vie. . .
To sleep smartly. The silk duvet of Smart Silk might very well change your sleep and your life by the same token.
c. I agree that some people do not ***co-sleep intelligently*** but in an ideal situation (plenty of space, no drugs/alcohol involved) [. . .].
d. And her account of the solo was ***intelligently beautiful***.

(21) a. Most of the computers that are being manufactured today include a capability to ***sleep intelligently*** on a network.
b. The tears she had been desperately trying to hide ***exploded generously*** from her eyes, and she writhed and kicked.
c. The night ***exploded generously***, giving itself to the lonely and the frightened.
d. His pride above all ***suffered cruelly*** all that month.

To be sure, some of these examples at least force a figurative reading of the adverbs at hand. However, that a meaning shift might be involved does not mean *per se* that these adverbs make reference to a mental state of the Agent. In fact, that they can have this figurative reading shows that they do not lexically encode such a state. And that no *personification* of the subject is required with the figurative reading further confirms this.

Now let us contrast these adverbs with other dispositional adverbs like *patiemment* in the same contexts. What one can see then is that the latter either *do* force the personification of the subject in examples like (21), cf. (22), or oblige to reinterpret predicates like *sleep* as fully agentive predicates, cf. (23).

(22) a. # Most of the computers that are being manufactured today include a capability to ***sleep patiently*** on a network.
b. # The tears ***went out patiently*** from her eyes.
c. # The night ***came patiently***, giving itself to the lonely and the frightened.

'transparent' adverbs, which will be presented in the next section. As already mentioned in the introduction, 'transparent' adverbs are transparent wrt their adjectival base in the sense that they must be understood as saying something about the state of the Agent.

[8]Note that the alternative agentive reading of the adverbs is excluded given the context and the post-verbal position. So the manner reading is selected in (20).

(23) a. # Prenez ces 8 semaines pour ***dormir patiemment***.
Take these 8 weeks to sleep patiently.
b. # I agree that some people do not ***co-sleep patiently***.
c. # And her account of the solo was ***patiently beautiful***.

Clearly, *patiently* requires a subject endowed with mental capacities *in all its uses*, which is not the case of *cleverly*, *generously* or *cruelly*. Contrasts in (24) illustrate the same point: *stupidement* and the like can apply to change of state predicates, while *patiemment* or *attentivement* can only do so if the predicate is reinterpreted as an action-denoting verb.

(24) a. L'accident est arrivé stupidement. (# impatiemment)
The accident happened stupidly. (impatiently)
b. La pluie est tombée généreusement. (# attentivement)
The rain fell generously. (attentively)

Another related property of adverbs like *patiently* is that they require that the subject referent performs the event denoted by the verb *intentionally*. On the contrary, under their manner reading, *stupidly* or *cruelly* can be ascribed to a referent which is not acting deliberately. For instance, it is possible to kill an animal accidentally, and to do it in a cruel way. The contrast in (25) reflects this difference.

(25) a. Cet animal, tu l'as tué bien cruellement, même si tu ne l'as pas fait exprès.
This animal, you killed it quite cruelly, even if you didn't do it on purpose.
b. Cet animal, tu l'as tué bien adroitement, # même si tu ne l'as pas fait exprès.
This animal, you killed it quite skilfully, even if you didn't do it on purpose.

As already mentioned in the introduction to this section, I will call adverbs like *cleverly* 'neutral' dispositional adverbs, and those like *patiently* 'transparent' dispositional adverbs. More examples of each class are given in (26).

(26) a. **neutral dispositional adverbs**: intelligemment (*cleverly/ intelligently*), généreusement (*generously*), stupidement (*stupidly*), cruellement (*cruelly*), élégamment (*elegantly*), violemment (*violently*)
b. **transparent dispositional adverbs**: attentivement (*attentively*), studieusement (*studiously*), prudemment (*cautiously*), poliment (*politely*), patiemment (*patiently*), adroitement/ habilement (*skilfully*, *craftily*)

This difference between the two classes is particularly interesting for us, since those in (26b) are much more problematic with weakly agentive verbs than the ones in (26a) (cf. the contrasts in (6) presented in the introduction). Note that this difference is directly inherited from the adjectives from which they are derived. Adjectives like *intelligent* can apply to inanimate entities as soon as they manifest the quality described by the adjective, cf. (27a), while those like *attentif* more strongly require an Experiencer as its argument, cf. (27b).

(27) a. Un plat intelligent, généreux, stupide, élégant
A clever, generous, stupid, elegant dish

b. # Un plat attentif, studieux, prudent, poli, patient[9]
An attentive, studious, cautious, polite, patient, skilful dish

I adopt the representation (18) for neutral dispositional adverbs. Of course, this representation does not apply to the transparent dispositional adverbs (cf. (26b)), which refer to a mental state. The semantics of these adverbs will be addressed in the next section, through the analysis of psychological adverbs.

4.2.2 Psychological Adverbs

4.2.2.1 Ernst 2002

State vs intentional reading.

Within the group of subjective adverbs, Ernst 2002 distinguishes the adverbs just presented from what he calls mental-attitude adverbs. As a rule, the latter are derived from psychological adjectives (*sad, calm, anxious*. . .).[10]

Ernst gives a formal criterion to distinguish the two classes of adverbs, namely that psychological adverbs only can be replaced by depictives formed on the same adjective, cf. (28).[11]

(28) a. (Calm), she left the room (calm). (psychological adjective)
b. *(Rude), she left the room *(rude). (dispositional adjective)

He distinguishes three readings for psychological adverbs, namely the state reading, the intentional one, and the manner reading. Any psychological adverb is supposed to have the first two, although 'intentional' psychological adverbs (*willingly, intentionally, reluctantly*) prefer the intentional one, while 'state' ones (*calmly, bitterly, anxiously, sadly*) prefer the state reading. The ambiguity between the state and the intentional readings is illustrated in (29).

(29) Chris calmly had left the room.

a. Chris was calm as she left the room. (state)
b. The decision of Chris to leave the room was calm. (intentional)

[9]Among 'transparent' dispositional adjectives, some like *adroit* or *habile* can however predicate a noun which does not refer to an Experiencer (cf. *un plat adroit* 'a skilful meal').

[10]Ernst seems to admit that some dispositional adverbs like *patiently* are mental-attitude adverbs, probably because they entail an agent state as we saw above. For us, *patiently* is simply a transparent dispositional adverb. In the presentation, I will call Ernst's mental-attitude adverbs psychological adverbs, and ignore the few dispositional adverbs that he considers to be mental attitude adverbs until Sect. 4.2.2.2.

[11]One immediately sees that on this respect, *patiently* does not conform with *sadly* and *calmly*, since *patient* cannot be used as a depictive.

Under the state reading, that Ernst translates as in (30), psychological adverbs describe a property of a mental state the subject experiences during the time that the event holds (p. 63), cf. the paraphrase in (29a). When the adverb 'transparently' describes some state of the subject during the performance of the action, I will say that it satisfies TRANSPARENCY. The semantic representation Geuder 2000 offers for this reading will be preferred to (30) for reasons explained below.

(30) e [$_{REL}$ is accompanied by] ADJ in the Experiencer (Subject)

Under the intentional reading, the state of calm precedes the event described and is in fact simultaneous with the act of deciding to leave.[12] I will ignore this reading here, since its distribution with weakly agentive predicates is again not very interesting (basically, it is acceptable as soon as the intention to perform the action denoted by the verb can be attributed to the subject).

Manner vs state reading.

More important for our purposes are the differences Ernst does between what he calls the manner and the state readings of psychological adverbs.

As already mentioned, under their state reading (preferred in (29)), psychological adverbs express the mental state the Experiencer is in during the time the event holds, and do not predicate the event itself. On the contrary, under their manner reading, psychological adverbs are pure predicates of events. Thus, TRANSPARENCY is satisfied under the state reading only.

For adverbs like *sadly* or *calmly*, the state and the manner readings can be differentiated relatively easily:[13]

(31) Peter ***sadly sung***.

a. The singing of Peter was sad (but Peter might not have been sad when he sung). (manner reading)
b. Peter was sad when he sung (but the singing itself might not have been sad). (state reading)

(32) Peter ***calmly called her***.

a. The call of Peter was calm (but Peter might not have been calm when he called). (manner reading)
b. Peter was calm when he called her (but the calling itself might not have been calm). (state reading)

[12]This makes the intentional reading of psychological adverbs very similar to the agentive reading of dispositional adverbs proposed by Piñón (2009).

[13]This is not the case for the transparent dispositional adverbs listed in (26b). Section 4.2.3 shows that transparent adverbs (26b) *do not* display the ambiguity illustrated in (31) and (32), contrary to what Ernst claims (since he classifies adverbs like *patiently* among the mental-attitude adverbs, which are supposed to display the manner/state ambiguity).

Geuder 2000, who studies the same kind of ambiguity, observes that the state reading is preferred in the pre-verbal position, although it is not confined to it. The preferences are reversed for the manner reading. See for instance Ernst's contrast in (33) (Ernst 2002:66).

(33) a. Though her emotions were in turmoil, she managed to ***leave the room calmly***. (manner reading)
b. ??Though her emotions were in turmoil, she ***calmly had left*** the room. (state reading)

Since the manner reading only requires the overt manifestation of the quality, no contradiction arises in (33a). On the contrary, the state reading requires that the Experiencer actually is in a mental state satisfying the predicate, which conflicts with the concessive clause in (33b).

4.2.2.2 Geuder 2000/2004

Geuder 2000: 21–24 defines an adverbial reading very similar, although not identical, to Ernst's state reading of psychological adverbs. Adverbs that Geuder takes to instantiate this use, which he calls the transparent reading, are derived from psychological (vs. dispositional) predicates, like *sadly, angrily, anxiously, calmly*. *Patiently*, *cautiously* and *attentively* are examples of Ernst's state mental attitude adverbs which are not classified as having a transparent reading by Geuder.

According to Geuder, adverbs under their transparent reading express the state of an Agent. On this point, Geuder's transparent reading is similar to Ernst's state one. Another property through which Geuder distinguishes transparent from manner uses is that the former can be combined with the assertion of a prolonged existence of the mental state in question. This is illustrated in (34), from Geuder 2000:22. I will call TEMPORAL INDEPENDENCE this property of Geuder's transparent reading.

(34) a. John ***sadly left***, and he was still sad when he was walking down the street.
b. John ***angrily wrote a letter*** to the editor, and he was still angry when he posted it.
c. ??John ***defended his thesis cleverly***, and was still clever at the party.

Another point I should recall here is that Geuder adds that under the transparent reading, subjective adverbs do more than just expressing a mental state, in that they assert a dependence relation (of an underspecified nature) between this state and the event expressed by the verb. For instance, in (34a), the state of sadness of John is 'connected' (in an underspecified way) to his leaving. This property of transparent adverbs is, according to Geuder, what distinguishes transparent adverbs from the morphologically related depictives, which, on the contrary, assert that the state

they describe is independent from the event expressed by the verb.[14] However, this relation is not part of the lexical semantics of the adverb itself. Rather, it is explained by a mechanism of semantic interpolation that enriches the lexical meanings, in accordance with contextual and world knowledge (Geuder 2000:201).

Geuder analyses the transparent reading as in (35), where R expresses the dependence relation whose exact nature is underspecified, *v* the verbal predicate, ADJ the adjective from which the adverb derives, and '∘' the temporal relation of overlap. Note that contrary to Ernst's definition of psychological adverbs (30), (35) makes an explicit reference to states. I will adopt (35) for what I will call the *absolute* transparent reading of subjective adverbs.

(35) $\lambda e[v(e, x, y) \wedge \exists s\ (\mathrm{ADJ}(s, x) \wedge s \circ e \wedge \mathrm{R}(s, e))]$
(absolute transparent reading)

For instance, the representation (35) applies for (33b), while the representation (18) is selected in (33a).

4.2.3 Relative and Absolute Transparent Adverbs

This section shows that the two properties that Geuder takes as definitional of the transparent reading are in fact independent. What I call transparent dispositional adverbs (e.g. *patiently*) satisfy TRANSPARENCY but not TEMPORAL INDEPENDENCE. This category corresponds to the adverbs that are classified as mental-attitude adverbs by Ernst, but not as transparent adverbs by Geuder.

As previously noted, adverbs like *patiently* must be understood as denoting a state of the agent, cf. ex. (22) and (23) of Sect. 4.2.1.2. As such, they always satisfy TRANSPARENCY. However, they do not satisfy TEMPORAL INTERDEPENDENCE (they are not compatible with the assertion of a prolonged occurrence of the mental state in question), cf. (36a).

(36) a. ??John ***patiently/cautiously wrote a letter*** to the editor, and he was still patient/cautious when he posted it.
b. ??John ***wrote a letter*** to the editor ***patient/cautious***.

Besides, the adjective from which they derive cannot easily be used as a depictive, cf. (36b). On this point, they do not fit Ernst's description of mental-attitude adverbs. I thus propose to split the category of transparent adverbs in two.

Relative transparent adverbs – those that are listed under (26b) – are derived from dispositional adjectives. They satisfy TRANSPARENCY but not TEMPORAL INDEPENDENCE. They describe a temporary state *s* which has to be understood

[14]Geuder thus contests Ernst's hypothesis that mental attitude adverbs are semantically similar to depictives, which is supported by the contrasts in the distribution of transparent adverbs and depictives provided in Geuder 2000: 178 & 192 and Geuder 2004:147–148.

as 'relative' to the action e expressed by the verb: when temporary patience is attributed to x, it is by default because x was patient through one or several action(s) (temporary patience ontologically depends on actions).[15] The relation that has to take place between s (the state of patience) and a (the writing of the letter) is *not* underspecified as for the transparent reading of psychological adverbs like $sadly$. For instance, patience cannot just accompany the event like sadness — it has to manifest itself through it.

Absolute transparent adverbs derive from psychological adjectives. They satisfy both TRANSPARENCY and TEMPORAL INDEPENDENCE. They describe a state which could in principle occur without the event expressed by the verb. If this is the case of adverbs derived from psychological adjectives, it is because the state they denote does not ontologically depend on any action (one can be sad without doing anything).

Geuder's transparent reading is always absolute; this is why the adverbs which have the Geuderian transparent reading always successfully pass the test illustrated in (36). His representation (35) thus corresponds to this subcategory. I will define the relative transparent reading — the transparent reading instantiated by dispositional adverbs (26b) — as in (37).

(37) $\lambda e[v(e, x, y) \wedge \exists s(\text{ADJ}(s, x) \wedge \sigma(e) = \sigma(s) \wedge \text{Manifest}(s, e))]$
(relative transparent reading)

4.2.4 The Manner Reading of Adverbs with a Transparent Use

Geuder claims that transparent adverbs have a manner reading (remember that Ernst claims too that state mental attitude adverbs have a manner reading).

Is it the case for dispositional adverbs, whose transparent reading is relative?[16] In fact, according to (37), the relative transparent reading is a kind of hybrid between the state and the manner readings: the Agent's state has to be referred to, but it must manifest itself through the event described by the verb. The relation Manifest is reminiscent of the manner reading (cf. (18)). Given this hybrid character of (37), we expect that the difference between the state and the manner reading to be blurred with relative transparent adverbs. This prediction is correct: with transparent dispositional adverbs, one cannot easily replicate the ambiguity illustrated in (31) and (32) with *calmly* and *sadly*, cf. (38).

[15]The state denoted by adverbs derived from these adjectives takes place during the event and is thus always transitory in a non-generic sentence.

I borrow the term *relative* from Barker 2002, who introduces it to distinguish two uses of evaluative adjectives like *clever* or *patient*. In its relative use, *patient* describes a state of x relative to an act of x (as in *He is patient to/in doing that*). In its absolute use, it describes a (permanent) disposition independent of any of its instantiations (as in *He's a patient person*).

[16]Remember that these adverbs are not considered as transparent by Geuder.

(38) Peter ***patiently answered***.

a. # The answer of Peter was patient (but he might not have been patient when he answered).
b. # Peter was patient when he answered (but his answer might not have been patient).

These adverbs thus always have the only reading they can have, namely the relative transparent one.

Let us now see whether psychological adverbs have a pure manner reading. Again, a distinction should be made within this class, parallel to the one between *cleverly* (neutral) and *patiently* (transparent) in the class of dispositional adverbs. Some of them, included *sadly*, are compatible with inanimate subjects, cf. (39a).

(39) a. The music ***progresses sadly***, hesitantly to a profound climax for the full orchestra. (Internet)
b. # The music ***progresses anxiously***, hesitantly to a profound climax for the full orchestra. (personification required)

The example (39a) shows that *sadly* does not lexically encode a reference to a mental state – it is not a transparent *adverb*, although it has a transparent *reading*. It is thus free to have a 'pure' manner reading. I take this pure manner reading of neutral psychological adverbs to be identical to the manner reading of *cleverly* adverbs, cf. (18).[17]

A second class of psychological adverbs, including *anxiously*, must be understood *in any use* as describing a mental state of the subject's referent – in other words, they are transparent psychological adverbs. Consequently, they cannot have a pure manner reading. For instance, (39b) is acceptable only if the music is somehow personalized and plays the role of a cognitive agent.

Again, this difference between *sadly* and *anxiously* reflects a difference among the adjectives from which these adverbs derive. *Sad* can modify either the state of an Experiencer (*a sad man*) or the object causing the experience (*a sad book*), cf. e.g. Pustejovsky 1995. *Anxious* only has the first reading (cf. *an anxious man* vs *# an anxious book*).

Although adverbs like *anxiously* must always display a transparent reading, they nevertheless display a kind of 'state/manner' ambiguity, as shown in (40), because the state that they refer to can be understood as manifesting itself through the event or not (remember that the nature of the relation between *s* and *e* is left underspecified with transparent psychological adverbs).

[17] Geuder 2000:202–204 has a different view. He considers that on its manner reading, *sadly* describes an event which makes 'externally visible' the state of sadness of the subject's referent. He thus assumes that these adverbs are 'transparent' also on their manner use in that they still denote a mental state. I do not think it is the case of *sadly*, given the possibility to use them with inanimate subjects (cf. (39a). But I think it is correct for other psychological adverbs like *anxiously*, cf. below.

(40) He (***anxiously***) ***called*** her (***anxiously***).

a. He was anxious when he called her (but the call itself might not have been anxious) (state reading)
b. He called her in an anxious manner (pseudo-manner reading)

Given that *anxiously* cannot get rid of its reference to a state, its pseudo-manner reading cannot be defined as in (18). I propose to capture the pseudo-manner/state ambiguity of *anxiously* adverbs through the difference between the absolute and relative transparent readings. On the absolute transparent reading, which is selected in (40a) and represented as in (35), the mental state *s* does not have to 'manifest itself', to 'become externally visible' in the event — it can very well simply accompany it (the nature of R is left underspecified in (35)). On the relative transparent reading, which is selected in (40b), *s* has on the contrary to manifest itself within the event, and this is why it has the flavour of the manner reading. In this case, the representation (37) applies.

More examples of each subclass of psychological adverbs are given below.

(41) a. **neutral psychological adverbs** (with a true manner reading): tristement (*sadly*), joyeusement (*happily, gladly*), calmement (*calmly*), nerveusement (*nervously*)
b. **transparent psychological adverbs** (without a true manner reading): anxieusement (*anxiously*), soucieusement (*worriedly*), plaintivement (*plaintively*)

4.2.5 Evaluative Reading

A proper subset of subjective adverbs that do not systematically refer to the Agent's mental state — the one I called 'neutral', like *stupidly* or *calmly* — have an additional reading, namely the evaluative one. On this use, the adverb does not qualify the action or the mental state of the subject, but rather conveys the evaluation of a cognitive agent, generally identified with the speaker. This reading is typically selected when the subject refers to an inanimate like in (42). The traditional paraphrase for the evaluative reading is given in (42a) under [i.].[18] Observe however that the paraphrase in *in a Adj way* also conveys the evaluative reading, cf. the paraphrase [ii.] of the same example. Thus, the possibility of such a paraphrase is a necessary but not sufficient condition to have the manner reading (as also observed

[18]Interestingly, *intelligemment* differs from *stupidement* in this respect in that it does not have the evaluative reading (cf. *Stupidement/ # Intelligement, il a plu* ('Stupidly/ Cleverly, it rained'). See e.g. Bellert 1977 and Bonami et al. 2004 on the syntax/semantics of this class. *Clearly* or *(un)fortunately* are typical examples of evaluative adverbs.

by Rawlins this volume, fn 2).[19] As (42c) shows, the evaluative reading is also available in post-verbal position (again, all examples in (42) are taken from the Internet).

(42) a. BTW the reason I was suppos[ed] to dress up was for pictures Nikki was gonna take but we couldn't cuz ***it stupidly rained***.

i. It is stupid that it rained.
ii. In a stupid way, it rained.

b. I think this algorithm will help to not ***stupidly bother*** users by asking unnecessary questions.
c. It ***rained stupidly*** on Saturday and as soon as the rain ceased, I have been on the road.

4.2.6 Result Reading

Geuder 2000 and Eckardt 2003 have already made clear that when used as predicates of events, subjective adverbs are able to scope not only on the action of the deep subject, but also on the change of state of the deep object, depending on the verbal predicate used. Ambiguity of this type is observed by Geuder and Eckardt for the adverb *elegantly*.

(43) Esther dressed elegantly.

a. The process of dressing is elegant (manner reading)
b. The result of the dressing process is elegant (result reading)

As Geuder observes, Esther can be elegant in dressing no matter how shabby the result will look afterwards (manner reading), and the result can be elegant even if dressing is performed in a roughly way (result reading).

In French, an ambiguity of the same kind is displayed by neutral adverbs like *intelligemment, gentiment* or *généreusement*. Under the manner reading, they qualify the way the subject's referent performs the event, while under the result reading, they qualify the way the object's referent endures the reported change of state. For instance, examples like (6c) and (6d) repeated below have two readings, depending on whether stupidity or generosity characterizes the event performed by Pierre (manner), or the change of state triggered by this event (result). On the result reading, (6c) entails that the object's referent *y* was very inspired by Pierre, and this is compatible with a situation where Pierre acts quite parsimoniously. Similarly, (6d) means either that Pierre only had to perform a stupid act to move us, no matter

[19]The paraphrase in *The way... was Adj.* is a safer diagnosis of the manner reading, since it is not possible for the evaluative reading (cf. # *The way it rained was stupid*), or when possible, it does not express the same meaning as the sentence which contains the adverb.

Table 4.1 Typology of subjective adverbs

	Dispositional adverbs		Psychological adverbs	
	Neutral	Transparent	Neutral	Transparent
	Intelligemment	*Patiemment*	*Tristement*	*Anxieusement*
Transparency	−/+	+	−/+	+
Pure manner/result reading	+	−	+	−
Temporal independence	−	−	+	+
Evaluative reading	−/+	−	−/+	−

how intelligent or stupid our emotion was (manner), or that our emotion was stupid, no matter how clever was Pierre's attempt to trigger this emotion (result).

(6) c. Pierre l'***a inspiré généreusement.***
Pierre inspired him generously/patiently.
d. Pierre nous ***a émus stupidement.***
Pierre moved us stupidly/cautiously.

The result reading is the most obvious choice when the subject is inanimate, as in the examples (44) below. In that case indeed, the eventuality which involves the subject's referent is not likely to manifest the quality. For instance, in (44b), the Scrabble does not manifest intelligence — rather, intelligence manifests itself through the amusement of the player.

(44) a. Un rien t'***amuse intelligemment***, cher cousin (=(10d))
The simplest thing amuses you cleverly, dear cousin.
b. Le Scrabble [. . .] ça ***amuse intelligemment***. (*id.*)
The Scrabble amuses cleverly.
c. Une expérience de ce genre ***émeut intelligemment***.
An experience of this type moves cleverly.

I will assume that under their result reading, subjective adverbs have the same semantics as under their manner reading (cf. (18)); what changes is that under the result reading, the quality has to manifest itself through a result or caused eventuality.

As for transparent dispositional adverbs, since they cannot get rid of their reference to the state of the subject, they cannot display a pure result reading for the same reason that they cannot have the pure manner one. The typology of adverbs built throughout the last sections is summarised in Table 4.1.

4.3 Subjective Adverbs and Weakly Agentive Predicates

In this section, I come back to the problem presented in the introduction, namely the distribution of subjective adverbs with weakly agentive predicates. The main conclusion will be that this distribution shows that achievement verbs can denote

a durative event, and that weakly agentive OEPVs can have a causative reading (cf. Sect. 4.3.1). Besides, it shows that this (causing) event can be an action (Sect. 4.3.2).

4.3.1 Convince Cleverly

We saw that neutral dispositional adverbs can modify achievement verbs and weakly agentive OEPVs under their manner reading, cf. ex. (5)–(6) and (10). Under the reasonable assumption that a quality can only manifest itself in a 'thick' eventuality (with a certain duration), it follows that verbs of these two classes can be coerced so that they can denote such eventualities.

As for weakly agentive OEPVs, this allows to conclude that these verbs denote a causation, or at least can be coerced into causative verbs, *contra* e.g. Belletti and Rizzi 1988. For instance, in (6b)–(6e), the OEPVs must have a causative reading such that the adverb can apply to the causing event.

As for achievement verbs, their distribution with neutral dispositional verbs suggests that they can be coerced in durative predicates, which was already argued for by Caudal 1999, Kearns 2003 and Martin 2011, contra e.g. Piñón 1997.

Note that this coercion process of achievement verbs is *not* necessarily accompanied by a meaning shift. This has been argued for by Piñón to account for the compatibility of achievement verbs with the progressive (which is *a priori* problematic on his view that achievement verbs denote boundaries, that is 'thin' events with zero duration). For instance, he claims, "*was winning the race* has 'was ahead the race' as a paraphrase" (p. 4). But such a meaning shift is not required to make the manner reading of dispositional adverbs acceptable with achievement verbs. In fact, (45a) and (45b) have different meanings.

(45) a. He **won** the race quite **cleverly**.
b. He **was ahead the race** quite **cleverly**.

4.3.2 Convince Patiently

We saw that with weakly agentive verbs, neutral dispositional adverbs are generally much less problematic than transparent ones, cf. again the contrasts in (6). This is expected, given that the semantics of transparent dispositional adverbs is 'heavier' than the one of neutral ones. Neutral dispositional adverbs have a pure manner reading which is satisfied as soon as the quality is manifested through the event involving the subject's referent x. On the other hand, the transparent reading requires an ascription of a mental state to x, and this state has to manifest itself in e.

This difference between the two classes of adverbs is also expected given that they do not require the same degree of agentivity on the part of the subject's referent x. With neutral adverbs, x can in principle be a Causer (vs Agent). Indeed,

these adverbs denote qualities which can manifest themselves in events which are not acts, cf. e.g. the examples in (20), (21) and (24). On the other hand, transparent dispositional adverbs not only tend to reject pure Causers in subject position (cf. (22) and (23)), but also impose a tighter relation between the subject's referent *x* and the event, since *x*'s mental state has to manifest itself in the event.

However, weakly agentive predicates *are* generally quite acceptable with a subclass of transparent dispositional adverbs, like *adroitement* or *habilement*, cf. the examples below. Given the semantics of transparent dispositional adverbs, I conclude from this observation that once coerced, these predicates can denote *actions*.

(46) a. Il avait ***adroitement intéressé*** le roi et l'état dans sa querelle. (Internet)
He skilfully interested the king and the State in his dispute.
b. Pierre l'***a habilement inspiré***.
Pierre skilfully inspired him.
c. Pierre ***a adroitement ému*** son auditoire.
Pierre skilfully moved his audience.
d. Il a ***asticieusement intéressé*** ses étudiants à la logique.
Pierre craftily interested his students in logic.

An intriguing fact though is that some transparent dispositional adverbs are much more problematic than the ones used in (46). For instance, *patiemment*, *attentivement* and *studieusement* would be all unacceptable in the same examples. Why would *patiemment* require more agentivity from the verbal predicate than *adroitement*?

The intuition I would like to pursue is that doing something patiently (attentively, studiously. . .) somehow requires the action to *unfold progressively*, step by step. It is this 'progressivity' requirement that explains, I claim, the clash of weakly agentive predicates with what I will call 'progressive' dispositional adverbs.

A concrete indication of this value is that these adverbs are problematic once conjoined with an adverb like *tout d'un coup* ('in one stroke'), which asks for non-progressivity, cf. (47a). This also explain why these adverbs are a bit odd with verbs like *fall* and *jump* which denote so short events — at least on their non iterative reading — that it is difficult to conceive them as taking place step by step, cf. (47b).

(47) a. # Il a fait cela patiemment/attentivement et tout d'un coup.
He did that patiently and in one stroke.
b. # Il est tombé patiemment /a fait un bond patiemment.
He fell patiently/jumped (once) patiently.

Adverbs like *adroitement* do not project this temporal schema on the event; an act skilfully performed can be done instantaneously, in one step; consequently, they do not raise difficulties with *in one step* and verbs denoting very quick events, cf. (48).

(48) a. Il a fait cela adroitement et tout d'un coup.
He did that skilfully and in one stroke.
b. Il est tombé adroitement/a fait un bond adroitement.
He fell skilfully/jumped (once) skilfully.

Besides, with causative verbs, progressive dispositional adverbs like *patiemment* not only require that the action unfolds progressively, but also that the change of state does so. For instance, the examples (49) are problematic too, although they leave open the possibility that the action satisfies the progressivity requirement of *patiemment*.

(49) a. Pierre l'***a séduite patiemment***. # Et elle a été séduite instantanément!
Pierre patiently seduced her. And she was seduced instantaneously!
b. Pierre ***a fondu*** le composé chimique ***attentivement***. # Et il a fondu tout soudainement!
Pierre melted the chemical mixture attentively. And it melted very suddenly!

In fact, it seems that an incremental mapping is required between the progressive unfolding of the action and the progressive unfolding of the change of state. *Patiently seduce*, for instance, refers to an action a fragmented in several subparts a', $a''\ldots$, and to each of these steps corresponds a subpart e', $e''\ldots$ of the change of state e, so that at each step, the degree of a and e as determined by the predicate steadily increases.

A prediction which follows from these observations is that verbs that are not compatible with progressive dispositional adverbs should also raise a problem with other adverbs implying progressivity. This seems correct: weakly agentive OEPVs are, for instance, odd with *in several steps*, cf. (51).[20,21]

(51) a. # Pierre a ému son auditoire en plusieurs étapes.
Pierre moved his audience in several steps.

[20]Note that facts are a bit more complicated with the adverb *graduellement* 'gradually'. As already observed by Piñón 2000, *gradually* has a reading under which he does not scope on the event introduced by the verb, but on tense. This is for instance the case below.

(50) Gradually there's not more work for her. (*I married a communist*, Philip Roth, cited by Piñón 2000)

In this case, *gradually* does not assert gradualness of the event described by the verb, but rather of "*what leads up* to this situation" (Piñón, *ibid.*). This reading is not available for *in several steps*, as attested by the difficulty to replace *gradually* with it in (50). So a verb which is compatible with *gradually* does not necessarily satisfy gradualness (whereas I claim this is the case with adverbs like *in several steps*). See also Sect. 7.4.1 of Rawlins this volume about low- and high-attached *gradually*.

Another important difference between *patiently* and *gradually* is that the former does not require a scale: it is compatible with atelic predicates (cf. *I'm waiting patiently/# gradually*). However, combined with telic predicates, *patiently* resembles *gradually* in that the progressive unfolding of the event is automatically conceived as scalar and gradual (cf. e.g. *eat an apple patiently*).

[21]As it stands, my account is unsatisfactory because it predicts that weakly agentive adverbs should be unacceptable with *progressivement* 'progressively', which certainly requires that the event unfolds progressively. This goes against the facts: *progressivement* does not raise the problem of *en plusieurs étapes* in (51).

b. # Il a captivé ses étudiants en plusieurs étapes.
He fascinated his students in several steps.

Let us recap. With weakly agentive OEPVs, the event performed by the subject's referent actually *can* be an act, as shown by their compatibility with transparent dispositional adverbs like *skilfully*. However, the Agent *cannot* control the *progressive unfolding* of the causation, as required by *patiemment*. If x moves y, x can agentively trigger y's emotion (emotional manipulation is after all quite frequent) and even maybe control this emotion in some ways; but what x can hardly control is that to each subpart of her action e corresponds a subpart of the emotion e, so that the degree of a and e as determined by Move steadily increases.

An argument in favour of this explanation is that when the aspectual requirement of progressive dispositional adverbs is satisfied by the context, then the problem vanishes. This is for instance the case in (10c) repeated below.

(52) a. I would give up on Google and knols [sic] if it were not for my daughter, who ***patiently found*** out whom to talk at Google... (=(10c))
b. # I patiently found my key.

In (52a), one could imagine that at each step of the search, the degree of the event as determined by Find steadily increases. Such a context is hard to build in (52b), hence the contrast.

Also in favour of this line of explanation is that a verb like *kill*, which is certainly not traditionally analysed as non agentive, is nevertheless problematic with progressive dispositional adverbs, because it cannot satisfy the progressivity requirement, cf. (53).

(53) a. # Il a tué son chat patiemment/attentivement.
He killed his cat patiently/attentively.
b. # Il l'a tué en plusieurs étapes.
He killed his cat in several steps.[22]

Indeed, although a killing can of course be intentional, it is hard for the killer to insure that the killing and the death unfold progressively and incrementally (see also Martin 2011).

On the other hand, a verb like *convaincre* 'convince' which is traditionally analysed as non agentive *is* compatible with these adverbs, cf. the attested examples (7) presented in the introduction, precisely because the inferential path which leads to agreement that is denoted by *convaincre* can be progressive and controlled by the speaker (contrary to the one denoted by *persuader*).[23]

[22]No (relevant) occurrences of *tué en plusieurs étapes* or *killed in several steps* found on the Internet.

[23]On the difference between conviction and persuasion, cf. Kant 1787/1998 and Perelman and Olbrechts-Tyteca 1970 (and Martin 2006:338–341 for the differences in the aspectual properties between the two).

4.3.3 Psychological Adverbs

As for psychological adverbs, they are generally unproblematic with weakly agentive verbs. This is unsurprising, because their transparent reading is (or can be) absolute, cf. (54). On this reading, the adverb simply refers to a mental state which does not have to manifest itself in the event involving the subject's referent – it can simply accompany it. As expected, the fact that this event is an action or not does not affect the acceptability of the psychological adverb.

(54) a. J'ai ***calmement trouvé*** une solution et je l'ai informée. (Internet)
I calmly found a solution and I informed her.
b. Tous les membres des comités [. . .] m'ont ***joyeusement inspiré***. (Internet)
All members of the committees [. . .] happily inspired me.

4.4 Conclusions

This paper argues for the following points:

- Dispositional and psychological adverbs come in two sorts: *transparent* adverbs (*patiemment, anxieusement*) lexically encode a mental state in any of their readings, while neutral ones (*intelligemment, tristement*) only optionally express it. As a consequence, only the latter have a pure manner reading.
- This difference has its origin within the adjectives from which transparent and neutral adverbs are derived.
- The relation between the mental state *s* and the event *e* described by the verb is left underspecified by transparent *psychological* adverbs (their transparent reading is *absolute*), whereas transparent *dispositional* adverbs require *s* to manifest itself in *e* (their transparent reading is *relative*).
- Some neutral subjective adverbs (e.g. *intelligemment, généreusement*) can display a result reading.
- The distribution of dispositional and psychological adverbs with weakly agentive verbs shows that (i) achievement predicates can be coerced into durative (and agentive) predicates and (ii) so-called 'non-agentive' OEPVs can have a causative (and agentive) reading.
- Neutral adverbs are less problematic than transparent ones with weakly agentive adverbs because they can display a pure manner or result reading.
- Transparent dispositional adverbs like *patiemment* or *attentivement* are especially problematic with weakly agentive verbs because of their 'progressivity' requirement.

Several questions are left unanswered. Firstly, one wonders why weakly agentive verbs can be coerced into action-denoting predicates by subjective adverbs, but

cannot be embedded under *make* or *persuade*.[24] Secondly, one would like to understand how the difference between fully agentive and weakly agentive OEPVs reflects in the nominal domain. Thirdly, it would be interesting to reanalyse the differences between these two classes of OEPVs in the context of the studies devoted to the manner/result complementarity (see e.g. Levin and Rappaport Hovav this volume). Intuitively indeed, weakly agentive OEPVs (2b) seem to lexicalize a result, even when coerced into an agentive predicate by an oriented adverb, whereas fully agentive OEPVs (2a) lexicalize a manner. A fourth interesting point concerns the nature of the manner reading. For adverbs of space and time like *slowly*, Rawlins this volume argues that the manner is a property that characterizes subintervals of the event described by the sentence; if x ate slowly, subparts of the eating event must (in average) be slow. As a rule, the manner reading of psychological adverbs seems distributive; if Peter sung sadly (nervously), the relevant subparts of the singing event must have been sad (nervous). On the contrary, the manner reading of dispositional adverbs is sometimes distributive, sometimes not. For instance, an event performed in a stupid way does not have to have stupid subparts. I can write a letter in a stupid way, although all parts of the writing are clever. On the other hand, an event performed aggressively has to be made of aggressive subparts. This difference between 'distributive' and 'non-distributive' manner adverbs is probably directly inherited from their adjectival stems. Indeed, the distribution of past tenses in French suggests that dispositional adjectives like *stupide* are not distributive under their stage-level reading, while those like *agressif* are, as well as psychological adjectives in general (see Martin 2008b).

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[24] Almost all French translations of the verbs in (2b) cannot be embedded under *faire*, except for *convaincre*.

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Chapter 5
Two Sources of Scalarity Within the Verb Phrase

M. Ryan Bochnak

5.1 Scalarity and the Verb Phrase

Over the past decade or so, several proposals have been put forth for scalar approaches to aspectual composition and telicity (Hay et al. 1999; Piñón 2000, 2005, 2008; Caudal and Nicolas 2005; Beavers 2008; Kennedy and Levin 2008; Stensrud 2009). Many of these approaches begin with the observation that event descriptions display certain characteristics that are akin to those found in the domain of scalar and degree semantics, which thus far has mainly been pursued in the study of gradable adjectives and comparatives. For instance, Hay et al. (1999) and Kennedy and Levin (2008) captialize on the fact that degree achievement verbs are derived from gradable adjectives and use insights from the properties of scale structure to derive the variable telicity effects that had previously been problematic under traditional accounts of aspectual structure and telicity. Meanwhile, Caudal and Nicolas (2005) and Piñón (2005, 2008) begin with the observation that proportional modifiers such as *half*, *partway* and *completely* that have played an important role in diagnosing scalar structure also occur as event modifiers, and use this fact as the starting point of their analyses.

One question that has not been adequately addressed is how event descriptions come to be associated with scales and degrees in the first place. Hay et al. (1999) and Kennedy and Levin (2008) argue that degree achievement verbs are endowed with a degree argument, which seems plausible since these verbs are derived from gradable adjectives. Kennedy and Levin (2008) argue that their account can be extended to at least incremental theme verbs, but do not provide a concrete proposal as to how this can be done. Piñón (2005, 2008) assumes without much argument that for other aspectual classes, in particular incremental theme verbs, a degree argument

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is associated with the verb itself, either originating from the lexicon or via a type-shifting rule. Rappaport Hovav (2008) meanwhile provides arguments that scales are lexicalized only in certain classes of verbs, and that crucially incremental theme verbs do not themselves lexicalize quantity scales, contra Piñón. Finally, Beavers (2008) claims that scales can be determined by lexical, contextual and pragmatic factors, but does not go into detail about the formal mechanisms of associating degrees with event descriptions.

In this paper, I argue for two distinct sources of scalarity within the verb phrase, focusing specifically on VPs headed by incremental theme verbs. First, I claim that there is a quantity scale that is associated with the presence, and more specifically the quantity, of an incremental theme argument. The structure of this quantity scale is crucially related to the part structure, in particular the boundedness, of the nominal argument. Second, there is a quality, or prototypicality, scale associated with the lexical entry of the verb itself, related to the different dimensions upon which events are classified by the verbs that name them. I argue that two distinct readings for the proportional modifier *half* provide evidence for these two sources of scalarity. Specifically, a sentence like (1) has two readings.

(1) John half ate the apple.

On one reading, which I will call the EVENTIVE reading, *half* measures out the event of eating the apple by tracking in the quantity of apple parts that are eaten. On the second reading, which I will call the EVALUATIVE reading, *half* names the degree to which the event represents a prototypical eating event. I integrate these two types of scales into a greater theory of aspectual composition with degrees, using properties of scale structure that have figured prominently in the analysis of gradable predicates.

In Sect. 5.2, I go into more detail about the characteristics of these two readings of *half* and especially their distinct behavior with respect to aspect and telicity. Section 5.3 contains an outline of the semantic properties of scales and degrees that are relevant for the degree-based account of aspectual composition developed in this paper. In Sect. 5.4 I detail the mechanics of integrating a quantity scale into the aspectual composition, where I argue that a functional head relates the quantity of the incremental theme argument with a scale that can be targeted by eventive *half*. Then in Sect. 5.5 I provide arguments that the verb itself can be associated with a quality scale that can be targeted by evaluative *half*. Crosslinguistic support for the separate treatment of the eventive and evaluative readings is given in Sect. 5.6, which also concludes.

In addition to the agenda outlined above, this study of scales and gradability within the domain of events will lead us into a discussion of verb meaning more generally. In particular, I will argue that incremental theme verbs do not lexicalize a quantity scale (following Rappaport Hovav 2008), but do lexicalize a quality, or prototypicality, scale. Furthermore, I will argue that incremental theme verbs are simple activity predicates that do not directly select for their internal theme

argument; rather the incremental theme is introduced syntactically by a functional head, analogous to analyses where the external agent is introduced by a little *v* head (e.g. Kratzer 1996, 2003).

5.2 Eventive and Evaluative Uses of *Half*

As we have seen from example (1) there are two relevant readings for *half* that are at issue. In this section I go into more detail about the differences between the two readings, and in particular their interaction with aspect and telicity.

5.2.1 Two Readings

While the account presented in this paper is meant to be general enough to extend to the entire class of proportional modifiers, for the most part I focus our attention on the modifier *half* in English. This is because English *half* most clearly demonstrates a two-way split in its distribution and behavior that is key to understanding the nature of the two sources of scalarity within the verb phrase that are at issue. The crucial contrast to be explored in this paper is that between the EVENTIVE and EVALUATIVE uses of *half*, as defined in (2).

(2) a. **Eventive use**: names the proportion of an event that is complete

b. **Evaluative use**: makes a comment about the degree to which the event described represents a prototypical event of that type

The fact that proportional modifiers have an eventive use that measures out the extent to which an event is complete has been discussed fairly widely in the literature (see for instance Moltmann 1997; Tenny 2000; Caudal and Nicolas 2005; Piñón 2005, 2008; Bochnak 2010a,b). The evaluative use of such modifiers has received much less attention, but has been discussed by Tenny (2000), where it is referred to as a 'messing around' reading.

This contrast between the eventive and evaluative uses of *half* can be seen in the context of a VP headed by an incremental theme verb.[1] For instance, a sentence like (3) displays both readings.

(3) The girls half washed the dishes.

[1]For the purposes of this paper I focus on incremental theme verbs, though many of the behaviors discussed here are also exhibited by change of state verbs. As noted by Tenny (2000), the distinction between incremental theme verbs and change of state verbs can sometimes be blurry, as in the case of verbs like *fill* or *melt*.

On the eventive reading, (3) is true in a situation where a contextually relevant set of girls completed an event of washing a contextually relevant set of dishes halfway. On its most natural interpretation, this reading describes an event where half of the amount of dishes were washed. By contrast, on the evaluative reading, the speaker of (3) makes a claim that the event that took place does not represent a prototypical dish-washing event, i.e., that the girls did not do a very good job of washing the dishes. I claim that the basis of this contrast is that the eventive use of *half* tracks the QUANTITY of the theme argument, while the evaluative reading does not.[2]

To illustrate further that sentences like (3) are indeed ambiguous between an eventive reading and an evaluative one, and to appreciate the differences between these two interpretations, I draw our attention to the following real-world example. It comes from a website[3] where readers post questions to solicit advice from the online community. The ambiguous sentence is in the title of the post, which involves the incremental theme verb *eat*.

(4) Title of post: "What can I do about a fly in my drink? What if I **half ate it**?"

a. EVALUATIVE interpretation: (description given by author of post)

- "Today I got my usual mochalatta chill drink from Cinnabon and as I was about to swallow, felt something solid. I chewed on it and realized it wasn't a piece of ice so I took it out of my mouth and it was a half chewed up fly!!! I was so grossed out and now I have an upset stomach. What are all the things I can do in this situation? Like can I sue them or something?"

b. EVENTIVE interpretation:

- Reply A: "you're [sic] upset stomach is probably more due to thinking about what you bit on and swallowed, than actually caused by the half fly in your stomach."
- Reply B: "You should go ahead and eat the other half. My mom always said 'Finish what you start"'

From the description given following the question, it is clear that the author of the post assigns the evaluative interpretation to *half* in the VP "half ate [the fly]." She describes how she chewed on the fly, but didn't actually swallow, and furthermore spit it out of her mouth. Indeed, this is not a prototypical eating event, and this reading of *half* does not track the quantity of the incremental theme argument, since none of the parts of the fly were actually consumed. Meanwhile, the authors of two replies clearly ascribe the eventive interpretation to *half*. Both authors make

[2] A reviewer correctly points out that (3) also displays a distributive reading, which is true if half of every dish is washed. This amounts to a sub-case of the eventive reading, since it is still the quantity of dishes (or rather the quantity of surface area of each dish) that is at issue.

[3] Yahoo Answers: http://answers.yahoo.com/question/index?qid=20080723194852AAdXOe8; retrieved March 1, 2010; emphasis added.

reference to parts of fly-matter eaten (despite the author's description of spitting it out before swallowing), showing that this reading of *half* does track the quantity of the incremental theme argument.

In the following subsection, I show that the availability of these two readings corresponds with aspectual properties of the VPs in which *half* appears.

5.2.2 Half and Aspect

The eventive use of *half* is restricted to VPs where the incremental theme argument is quantized, while the evaluative use has no such restriction. For instance, all the sentences in (5) allow both the eventive and evaluative interpretations, while those in (6) have only the evaluative reading.

(5) ✓eventive / ✓evaluative

a. Alana half ate a stack of pancakes.

b. Michael half swam around the lake.

c. Jim half pushed the cart to the store.

d. Ann half sang the opera.

(6) * eventive / ✓evaluative

a. Alana half ate pancakes.

b. Michael half swam.

c. Jim half pushed the cart.

d. Ann half sang.

Furthermore, note that the availability of the eventive reading corresponds with the availability of a telic interpretation of the sentences. Specifically, those sentences in (5) allow both the eventive and evaluative readings of *half* under their telic interpretations, but also have atelic readings where only evaluative *half* is possible. Conversely, those in (6) have only atelic interpretations and only license the evaluative reading of *half*. That these correspondences hold can be shown by using the *in an hour/for an hour* adverbial tests for telicity, as in (7).

(7) a. Alana half ate a stack of pancakes in an hour. (telic; eventive or evaluative)

b. Alana half ate a stack of pancakes for an hour. (atelic; evaluative only)

c. Alana half ate pancakes for an hour / ??in an hour. (atelic; evaluative only)

The unifying thread connecting the eventive reading of *half* and the availability of a telic reading is the notion of quantized nominal reference. The connection between telicity and quantization of the incremental theme argument is well-known (see Mittwoch 1982; Dowty 1991; Tenny 1994, among others), and has

been formalized in the work of Krifka (1989, 1992) via the OBJECT-EVENT HOMOMORPHISM. Under this theory, there is a homomorphic relation between the internal structure of an event e and the part structure of an event participant x so long as they stand in a particular thematic relation with each other. Specifically, this homomorphism subsumes a mapping to objects and a mapping to events as formalized in (8).

(8) a. MAPPING TO OBJECTS:
$\forall R[MAP\text{-}O(R) \leftrightarrow \forall e, e', x[R(e, x) \wedge e' \leq e \rightarrow \exists x'[x' \leq x \wedge R(e', x')]]]$

b. MAPPING TO EVENTS:
$\forall R[MAP\text{-}E(R) \leftrightarrow \forall e, x, x'[R(e, x) \wedge x' \leq x \rightarrow \exists e'[e' \leq e \wedge R(e', x')]]]$

Mapping to objects states that for each sub-event e' of event e with participant x, there is a sub-participant x' that stands in the relation R to e'. Mapping to events states that for every sub-part x' of participant x in an event e, there is a sub-event e' that stands in the relation R to x'. In particular, the incremental theme relation is such a relation R for which the object-event homomorphism holds.

The object-event homomorphism derives the fact that quantized incremental themes correspond to telic events, while non-quantized (cumulative) incremental themes yield atelic events. Take, for example, the VP *eat three pancakes*, where the incremental theme argument is quantized. A sub-event involves eating a sub-part of three apples, and can thus not count as an event of eating three apples. That is, the event described by the VP *eat three pancakes* does not describe its sub-events. This property corresponds with telicity in this system. Conversely, the VP *eat pancakes* contains a non-quantized incremental theme. A sub-event of eating (some unspecified amount of) pancake-stuff is still an event of eating (some unspecified amount of) pancake-stuff. That is, in this case, the event described by *eat pancakes* does hold of sub-events, and thereby the event described by this VP is atelic. This formalization also neatly captures a conceptual similarity between telic eventualities and quantized nominal reference on one hand, and atelic eventualities and cumulative nominal reference on the other. This is because cumulative nominal reference can be applied to an entity x and also its sub-parts, which is not the case for quantized nominal reference. More generally, boundedness of the incremental theme argument (or path) corresponds with boundedness of the event.

Returning to *half*, it appears then that the eventive use has the effect of measuring out the event by measuring out the quantity of incremental argument. That is, there is a sense in which the sentences in (5) on their eventive interpretation can roughly be paraphrased by those in (9).

(9) a. Alana ate half of a stack of pancakes.
b. Michael swam halfway around the lake.
c. Jim pushed the cart halfway to the store.
d. Ann sang half of the opera.

Note that in the paraphrases in (9a) and (9d), the incremental theme argument appears embedded in a partitive structure. Meanwhile in (9b) and (9c), it is more

natural to use *halfway* rather than *half*. While both *half* and *halfway* have the effect of measuring out the event relative to an internal argument, *halfway* is preferred in contexts where it is a path that is being measured. In cases where *half* and *halfway* are both acceptable, the use of *halfway* has the effect of imposing a path-like structure on the theme argument. Consider the contrast in (10).[4]

(10) a. Keelin half read the book.

b. Keelin read the book halfway.

Both sentences entail that half of the book was read, meaning that both *half* and *halfway* measure out the event by measuring the quantity of the theme involved in the event. However, the use of *halfway* in (10b) imposes a path-like structure on the theme, such that (10b) seems to make a stronger claim than (10a). Whereas (10a) can be true if Keelin read any half of the pages in the book in any order, (10b) seems to require that she started at the beginning and read consecutive pages up to the halfway point. While I concede that the contexts of use for *half* and *halfway* are slightly different, going forward I focus mainly on *half* and treat *halfway* as a synonymous variant.

Thus, the eventive use of *half* plays a role in measuring out the event, specifically by identifying the proportion or quantity of the incremental theme argument that is involved in the event. In this respect, eventive *half* correlates with quantization of the incremental theme, which explains why it co-occurs with a telic interpretation of the VP. The evaluative use, by contrast, has no such effect. This is clear from the fact that the evaluative use is felicitous in contexts where there is no incremental theme argument to measure (*cf.* (6b–6d)). In fact, as we have seen, the evaluative use is the only interpretation available in these cases. Evaluative *half* is, in a sense, unmarked for telicity, since it can occur in both telic and atelic contexts.

5.2.3 Looking Ahead

Proportional modifiers have also received attention in the literature as modifiers of gradable adjectives as in (11) (see for example Cruse 1986; Kennedy and McNally 2005).

(11) The glass is partially/half/mostly/completely full.

Because of their distribution as modifiers of both adjectives and VPs, certain authors have recently used evidence from proportional modification as a starting point to developing a degree-based analysis of aspectual composition, notably Caudal and Nicolas (2005) and Piñón (2005, 2008). I too follow this path in unifying degree semantics with aspect in the case of VPs headed by incremental theme verbs. In the

[4]Thanks to Anita Mittwoch for pointing out this minimal pair to me.

next section, I outline the formal analysis of the semantics of scales and degrees, and point out the crucial properties of scale structure upon which my theory of aspectual composition will be built.

More generally, a scalar account of aspect and events has been recently pursued in the literature. In such accounts, progress of an event corresponds with movement along a scale (Krifka 1998; Wechsler 2005; Beavers 2008). Thus, boundedness of a scale yields a bounded (telic) event, where the scale at issue corresponds with a (change in a) property of an event participant (See also Hay et al. 1999; Filip 2008; Kennedy and Levin 2008; Stensrud 2009).

5.3 The Semantics of Scales and Degrees

In this section I review the relevant properties of scales and degrees that will be essential in my analysis of *half* and the interactions between aspect and scale structure. Of particular interest will be the distinction between open and closed scales (see also Fleischhauer, this volume), as well as scales based on the quantity of a nominal argument.

5.3.1 Formal Properties of Scales and Degrees

In this section I outline the semantics of scales and degrees, and detail the formal properties of scales that will be relevant for developing a degree-based analysis of aspectual composition. The discussion here is largely based on the analysis of gradable adjectives and their modifiers by Kennedy and McNally (2005) (henceforth K&M). Following K&M and others (e.g. Rotstein and Winter, 2004), I take scales to consist of three components: a set of degrees, a dimension, and an ordering relation. For our purposes, the most important aspect of scale structure is the set of degrees, and specifically whether a scale includes upper and lower bounds. Through a detailed study of the behavior of modifiers of gradable adjectives, K&M conclude that it is linguistically relevant whether an adjective lexicalizes an upper bound, lower bound, both, or neither. Scales that include both upper and lower bounds are said to be fully CLOSED; those that include neither are said to be OPEN; while those that include only an upper or lower bound are upper and lower closed, respectively. K&M take as a diagnostic for scale boundedness whether antonym pairs with the same scale accept modifiers that make reference to maximal bounds.

(12) a. Fully closed:
The room is 100% full/empty.

b. Upper closed:
This product is 100% pure/??impure.

c. Lower closed:
That author is completely ??famous/unknown.

d. Fully open:
Her brother is completely ??tall/??short.

As previously mentioned, the proportional modifiers that we are interested in here, including *half*, not only appear as VP modifiers, but can also modify gradable adjectives. However, their distribution with gradable adjectives is restricted, and in particular these modifiers are sensitive to the scale structure of the predicate they modify. Note that *half* is perfectly grammatical in (13) as a modifier of *full* and *open*, while in (14), *half* is infelicitous modifying *tall* or *old*.

(13) a. The glass is half full.

b. The door is half open.

(14) ??Taylor is half tall/old.

K&M claim that the contrast in acceptability between (13) and (14) is due to the different scale structures of the adjectives involved. On one hand, *full* and *open* are associated with fully closed scales, while on the other hand, *tall* and *old* are associated with open scales. The reader can verify that *half* is likewise infelicitous with upper closed and lower closed scales.

From a purely intuitive point of view, the fact that *half* should only be felicitous with fully closed scales makes sense. The function of *half* is to select a midpoint, equidistant from a minimum and maximum value. Without either a minimum or maximum value, the operation of finding a midpoint fails.

Within this framework, gradable predicates are of semantic type $\langle d, et \rangle$.[5] That is, they are endowed with an open degree argument that must be saturated before they can be used as regular predicates of individuals. Degree modifiers are able to fulfill the role of providing the degree argument with a value. In the case of *half*, this value is the midpoint of a fully closed scale. The denotation of *half* can be given as in (15), where S_G is the scale associated with a gradable predicate G.

(15) $[\![\textit{half}]\!] = \lambda G \lambda x . G(x)(\mathbf{mid}(S_G))$

The notation $\mathbf{mid}(S_G)$ is shorthand for a function that calculates the midpoint between the maximum and minimum values of a scale. That is, since $\mathbf{mid}(S_G)$ requires both a maximum and minimum value of the relevant scale, *half* will only be compatible with gradable predicates that have fully closed scales. Given (15) and the meaning of *full* in (16), the meaning of *half full* can be derived as in (17).

(16) $[\![\textit{full}]\!] = \lambda d \lambda y . \mathbf{full}(y) = d$

[5]Throughout this paper, in addition to the standard types e for individuals and t for truth values, I also use d for the type of degrees and s for the type of events.

(17) $[\![\textit{half}]\!]([\![\textit{full}]\!])$
$= \lambda G \lambda x.G(x)(\mathbf{mid}(S_G))[\lambda d \lambda y.\mathbf{full}(y) = d]$
$= \lambda x.[\lambda d \lambda y.\mathbf{full}(y) = d](\mathbf{mid}(S_{full}))$
$= \lambda x.\mathbf{full}(x) = \mathbf{mid}(S_{full})$

The result of (17) is a predicate of individuals that is true if the degree to which x holds the property of being full is half, i.e., the midpoint on the scale of *full*. In the absence of a degree modifier, a null degree morpheme *pos* values the degree argument of the gradable predicate based on a contextual standard of comparison. For adjectives with upper-closed scales, including the adjectives that accept modification by *half*, *pos* returns the maximal value on the scale as the contextual standard. This follows from a principle of Interpretive Economy (Kennedy 2007). This null morpheme will come to play a role in the degree-based account of aspectual composition to follow.

5.3.2 Quantity-Based Scales and Nominal Part Structure

Under the account presented so far, the scale targeted by *half* and other degree modifiers is part of the adjective meaning. That is, gradable adjectives lexicalize scales and degree arguments. These lexicalized scales typically involve some kind of property, such as being full, tall, old, etc. However, in many cases, the type of scale targeted by *half* is related to the QUANTITY of the individual that the adjective is predicated of. Consider the sentences in (18), each of which is ambiguous.

(18) a. The meat is half cooked.
b. The glasses are half full.

The ambiguity stems from the availability of two distinct scales that can be targeted by *half*. On one reading of (18a), *half* is targeting the scale that is lexically encoded in the deverbal adjective *cooked* – the cooked-ness scale. On this reading, the sentence is true if the degree to which the meat is cooked is half. There is also a second reading, where *half* is targeting a quantity-based scale that is based on the part structure of the nominal argument. On this reading, the sentence is true if the proportion of meat that is cooked is half. Similarly, (18b) could be true if all the glasses in the contextually relevant set are full to the degree corresponding with the midpoint of the fullness scale, or if half of the glasses are full and the other half are not.

Noticing that this type of ambiguity is pervasive among gradable adjectives, Kennedy and McNally (2010) propose that many gradable adjectives can encode both a quality (property) scale and a quantity scale. The distinction between the two readings becomes especially clear when the adjective is modified by proportional scalar modifiers like *half*. Importantly though, the structure of the quantity-based scale made available for modification is crucially linked to the part structure of

the nominal argument. In particular, the quantity-based reading for *half* requires a bounded nominal argument to measure. Note that this reading of *half* is unavailable when the nominal argument is a bare mass noun or bare plural, as in (19).

(19) a. ??Meat is half cooked.
b. ??Glasses are half full.

This behavior of *half* in the adjectival case parallels that of the eventive use of *half* as discussed in the previous section. That is, this use of *half* requires a bounded nominal argument upon which a fully closed scale structure can be based. Bare mass nouns and bare plurals denote unbounded quantities, i.e., they are an instance of non-quantized nominal reference, meaning they correspond with open scales.

What is important here is that nominal part structure crucially correlates with scale structure. That is, a bounded, quantized nominal argument corresponds with a fully closed scale, which is required for the successful application of *half*. This use of *half* in the adjectival case also corresponds with a partitive-like meaning, whereby the modifier identifies the proportion of the parts of the nominal to which the adjective applies.

5.4 The Eventive Reading

In this section I go into detail about how to account for the eventive use of *half* within a framework that incorporates degree semantics into aspectual composition. Recall what needs to be accounted for: first, that eventive *half* targets a quantity-based scale that is related to the nominal part structure of the incremental theme argument; second, that the use of eventive *half* correlates with telic readings of the VP; and third, that *half* targets fully closed scales only (these last two points being closely related). While the main goal of this section is to account for the contribution of *half* within the proposed framework of aspectual composition, in order to arrive at the final analysis we will be faced with the question of the lexical semantics and argument structure of incremental theme verbs more generally. Previewing the final outcome, it will be shown that incremental theme verbs are simple activity predicates that neither lexicalize a degree argument nor directly select for their internal argument.

5.4.1 Degrees, Aspect and the Incremental Theme

As we have seen in the previous section, *half* can be analyzed as a degree term that is a function from gradable predicates of semantic type $\langle d, et \rangle$ to predicates of type $\langle e, t \rangle$. In the case of quantity-based scales, *half* has the function of measuring out the quantity of the individual to which the property named by the adjective is ascribed. As shown in Sect. 5.2, the eventive use of *half* has the function of

measuring out the event described. Thus, to extend the degree-based analysis to events and aspectual composition, it seems we need to allow at least some event descriptions to be construed as gradable predicates as well. That is, given that the function of proportional modifiers such as *half* is to supply a value to an open degree argument, it seems that we need to allow that VPs headed by incremental theme verbs be of semantic type $\langle d, st \rangle$ (where s is the type of events).

Some previous attempts to integrate degrees into aspectual composition have used the above reasoning as their guiding intuition and have tried to implement it in different ways. Piñón (2000, 2005) assumes that incremental theme verbs do not lexicalize a degree argument, but undergo a type shift to add a degree argument to their denotation. This move makes available an open degree argument that can be targeted by degree modifiers, including *half*. This type of implementation, however, runs the risk of overgeneration, which means that the type-shifting mechanism needs to be constrained to occur only with certain classes of verbs. Thus, such an analysis needs to stipulate which verb classes can be subject to this type shift. This problem is circumvented in a later analysis by Piñón (2008), where it is proposed that incremental theme verbs are themselves endowed with a degree argument from the lexicon.[6]

A problem with both these types of accounts is that there is evidence against having an open degree argument in the verb itself or at the VP level.[7] Rappaport Hovav (2008) gives an overview of the types of scales that are aspectually relevant and which of those can be lexicalized in the meanings of verbs. In the case of VPs headed by incremental theme verbs, the relevant type of scale is what she calls a volume/extent scale (what we have been calling a 'quantity-based' scale). She argues that extent scales are not actually lexicalized in incremental theme verbs, since they can appear with a wide variety of resultatives.

(20) a. Larissa steamed the clothes dry/clean/stiff.
b. Cinderella scrubbed her knees sore/the dirt off the table/the table clean.

Since resultatives have the function of introducing their own scale or specifying a scale lexicalized in the verb (Levin and Rappaport Hovav, 1995; Wechsler, 2005), and given the constraint against specifying multiple scales within a single VP (Levin and Rappaport Hovav, 1995), the fact that all the resultatives in (20) are felicitous leads to the conclusion that the verbs themselves do not lexicalize a scale. Note that this behavior contrasts with verbs that do lexicalize a scale, where a resultative can only be used to specify that scale, not introduce a new one.

(21) a. Jerome froze the ice cream solid/??clean.
b. ??We dimmed the room empty.

[6] Caudal and Nicolas (2005) also formalize a degree-based analysis of aspectual composition, but appear to be non-committal as to where the degree argument comes from, i.e., whether it is associated with the verb from the lexicon or whether it is the result of a type-shifting mechanism.

[7] The argumentation in this section is an expanded version of that found in Bochnak (2010b).

Another piece of evidence comes from argument realization properties of incremental theme verbs. Transitive verbs that lexically encode a scale require that their patient be the entity that undergoes the scalar change denoted by the scale, and furthermore require these objects to be realized syntactically. Incremental theme verbs do not show this behavior and can appear intransitively.

(22) Last night we cooled *(the room with the air conditioner).

(23) Last night we ate/read/scrubbed.

Given this evidence, Rappaport Hovav concludes that incremental theme verbs do not themselves lexicalize scalar meaning. Rather, the scale at issue in these cases is provided by the referent of the incremental theme argument itself. I take this one step further and claim that is evidence against the presence of a degree argument that tracks the quantity-based scale in the denotation of the verb itself. This means that eventive *half* does not combine directly with the verb, since the latter is not of the right semantic type.[8]

In addition, there is also evidence for a lack of an open degree argument at the VP level as well. Specifically, as shown by Gawron (2007), VPs headed by incremental theme verbs do not accept the full range of degree morphology that would otherwise be expected if there was in fact an open degree argument at this level.

(24) a. i. ??Tim wrote the paper more than Tommy did.

ii. ??Tim more wrote the paper than Tommy did.

b. ??Tim wrote the paper too much.

c. ??Tim wrote the paper so much that Tommy barely did anything at all.

Indeed, the set of proportional modifiers that measure out events (and also the intensifier *really*) are among the few degree terms that actually appear to be able to modify VPs headed by incremental theme verbs. In order to get the intended readings for the sentences in (24) (i.e., readings based on the quantity scale derived from the part structure of the theme argument), the degree morphology must appear embedded within the VP, closer to the incremental theme argument itself.

(25) a. Tim wrote more of the paper than Tommy did.

b. Tim wrote too much of the paper.

c. Tim wrote so much of the paper that Tommy barely did anything at all.

Therefore degree morphology is possible, just not at the VP level. Notice also that in all the sentences in (25), there is the obligatory insertion of *of* when degree morphology is present.

[8] I also take this as evidence against a type-shifting analysis *à la* Piñón (2000, 2005), since such an account misses the generalization that the scale at issue is crucially related to the incremental theme argument, and thus it is unclear how this scale could be 'passed up' to the verb.

Given this evidence, I conclude that there is no open degree argument on the verb itself or at the VP level. But then we are left with a puzzle as to why *half* appears to be a VP modifier if there is no degree argument at this level for it to target. In what follows, I propose an analysis whereby all the action of the degree semantics is internal to the VP. As such, we will be able to capture the fact that the quantity scale is directly related to the incremental theme argument, and also the fact that degree semantics more generally occurs embedded within the VP, with no open degree argument at the VP level.[9]

5.4.2 Deriving the Eventive Reading

Let us recap what we have learned so far: eventive *half* is a degree term that targets a quantity-based scale; incremental theme verbs do not themselves lexicalize a quantity scale; there is evidence against having an open degree argument at the VP level; and other degree morphology appears embedded within the VP, and is accompanied by *of*-insertion. In addition, we know that the quantity-based scale is related to the referent of the incremental theme argument. Thus, it appears what we need is a way for the part structure of the nominal to be mapped onto a quantity scale that can be targeted by *half* (or other degree terms as in (25)).

My proposal is that the mapping between nominal part structure and the quantity scale is due to the presence of a functional head which I will call μ (for *measure*). This function takes an incremental theme nominal and returns a gradable event description that is true of an event whose theme is the parts of the nominal argument, the quantity of which is equal to a degree d.

(26) $[\![\mu]\!] = \lambda x \lambda d \lambda e . \exists y [y \leq x \wedge \textbf{theme}(e)(y) \wedge \textbf{quantity}(y) = d]$

The inclusion of the QUANTITY predicate within μ underscores the fact that it is not simply the incremental theme argument in and of itself that is responsible for the scale at issue, but rather a *property of* the incremental theme, namely its quantity. That is, event measurement, and thereby (a)telicity, tracks a physical property of the affected argument (see also Hay et al. 1999 and Stensrud 2009 for similar discussion). Also embedded within the meaning of μ is a partitive semantics (Ladusaw, 1982).[10] In effect, it is the parts of the nominal that constitute the incremental theme argument. This has two desirable consequences. First, it captures the fact that eventive *half* measures out the event by measuring out the quantity of the theme argument involved in the event. Recall that sentences with eventive *half* can be roughly paraphrased using actual partitives as in (9); this intuitive connection to the partitive construction is thereby captured in (26). Second,

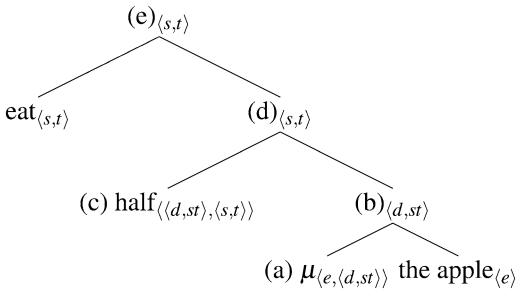
[9]Such an account is similar in spirit to the one presented in Stensrud (2009), whereby telicity is derived by measure-of-change function embedded within the VP.

[10]This is a slight modification of the analysis of μ in Bochnak (2010b).

the mandatory presence of *of* in other quantity-based degree constructions as in (25) can be explained if this *of* is actually an overt spell-out of μ in these cases.

A sample derivation of the VP *half eat the apple* is given as in (5.4.2). First, μ combines with the theme argument, resulting in a gradable property of events. Next, *half* merges to saturate the open degree argument, and the resulting event description combines with the verb by event identification/conjunction (*cf.* Kratzer, 1996; Stensrud, 2009).

(27)



a. $[\![\mu]\!] = \lambda x \lambda d \lambda e . \exists y [y \leq x \wedge \textbf{theme}(e)(y) \wedge \textbf{quantity}(y) = d]$

b. $[\![\mu \text{ the apple}]\!] = \lambda d \lambda e . \exists y [y \leq \textit{the.apple} \wedge \textbf{theme}(e)(y) \wedge \textbf{quantity}(y) = d]$

c. $[\![\textit{half}]\!] = \lambda G \lambda e . G(e)(\textbf{mid}(S_G))$

d. $[\![\textit{half } \mu \textit{ the apple}]\!] = \lambda e . \exists y [y \leq \textit{the.apple} \wedge \textbf{theme}(e)(y) \wedge \textbf{quantity}(y) = \textbf{mid}(S_{apple})]$

e. $[\![\textit{eat half } \mu \textit{ the apple}]\!] = \lambda e . \textbf{eat}(e) \wedge \exists y [y \leq \textit{the.apple} \wedge \textbf{theme}(e)(y) \wedge \textbf{quantity}(y) = \textbf{mid}(S_{apple})]$

The result is an event description that is true of an event e that is an eating, and whose theme is the parts of *the apple* whose quantity is equal to half. All that is needed to account for the data is a spell-out rule that says when *half* or other proportional modifiers combine with μ, those modifiers move to a position above the verb to arrive at the correct word order (i.e., *half eat the apple*), and μ is unpronounced, whereas for other degree constructions, the degree word stays in situ, and μ is spelled out as *of*, which nicely captures the data from Gawron in (25).[11]

Under the analysis presented here, the function μ mediates between the part structure of the incremental theme argument and the quantity scale targeted by degree morphology. In addition, μ also syntactically introduces the incremental theme argument, since it is not directly selected for by the verb. This essentially puts

[11] As for the distributive reading mentioned above, I tentatively propose that some form of a generalized distributivity operator may apply to μ (see Lasersohn, 1998). The application of such an operator would be vacuous in the case where the theme is a singular individual, but would result in a distributive reading over a plural theme argument as in (3).

μ on par with the agentive *v* head that introduces the agent of an event (Kratzer, 1996, 2003). That is, both are functional heads that syntactically introduce and assign thematic roles to a verb's arguments. Specifically, μ introduces the verb's internal argument and assigns the theme role, while *v* introduces the verb's external argument and assigns the role of agent to that argument. What this means is that under the analysis advocated here, the syntax and semantics of event predicates headed by incremental theme verbs is fully Neo-Davidsonian, in that the verb does not even select for its internal argument. On one hand, Kratzer (1996, 2003) has argued against such an approach, and specifically that themes must be selected by their verbs, so my claim that the internal argument is also introduced by a functional head is not uncontroversial. On the other hand, there are also arguments that have been raised that incremental theme verbs do not directly select for their themes.[12]

Rappaport Hovav (2008) provides at least three pieces of evidence pointing to the conclusion that incremental theme verbs do not show a strong attachment to their direct object. First, these verbs can be used intransitively as in (28).

(28) All last night Cinderella scrubbed/ate/read/drank/wiped and wiped.

Second, as already shown, incremental theme verbs can appear with resultatives (*cf.* (20)). In certain cases, these resultatives may include nominals that appear to be objects, but are clearly not selected by the verb itself.

(29) Cinderella scrubbed her knees sore/the dirt off the table.

Third, these verbs can appear with *out-* prefixation, in which case the object is not an incremental theme.

(30) Cinderella out-scrubbed/out-ate/out-read/out-drank/out-wiped her step-sisters.

Rappaport Hovav takes these facts as evidence that incremental theme verbs denote simple activity predicates that do not directly select for their theme argument.

Furthermore, a recent challenge to Kratzer's claim that internal and external arguments be treated differently in the syntax and semantics comes from Williams (2009). According to Williams, evidence from resultatives in Mandarin reveals that agent and theme roles show certain interpretational parallels that would not be expected under an analysis that treats them in two different ways, i.e., with the theme selected by the verb and the agent introduced by a functional head. This idea is captured in the present analysis whereby both internal and external arguments are introduced via functional material. I take the set of evidence briefly outlined here to indicate that the analysis advocated in this paper involving μ is at the very least a plausible one.

The analysis presented here not only accounts for the acceptability of eventive *half* with quantized incremental themes, but can also explain its unacceptability

[12]Once again, much of this argumentation is borrowed from Bochnak (2010b).

with non-quantized, cumulative incremental themes, and why we get default telic readings with quantized themes, and atelic readings with cumulative ones, in the absence of a degree modifier. First, as was shown in Sect. 5.2, eventive *half* is only felicitous with a bounded incremental theme argument, but cannot occur with (unbounded) bare plurals or mass nouns, or when there is no theme argument present at all (*cf.* (6)). These facts receive a principled explanation under the analysis proposed here. When a bare plural or mass noun combines with μ, the resulting set of degrees corresponds to an open scale. This explains why eventive *half* cannot occur in these cases – it requires a fully closed scale over which to operate. In the case where no incremental theme argument is present at all (i.e., in intransitive uses of incremental theme verbs), no quantity scale is available for modification in the first place, explaining why eventive *half* cannot occur in such contexts either.

Second, the degree-based account also explains why telic readings of incremental theme VPs with quantized themes are most natural, while only atelic readings are possible with cumulative theme arguments. For concreteness, let us consider the sentences in (31).

(31) a. Cathy ate the apple. (telic reading preferred)

b. Cathy ate apples/applesauce. (atelic reading only)

Under the analysis presented here, the incremental theme arguments in both these sentences are introduced by μ, with the result being a gradable property of events.[13] I propose that in cases such as those in (31) where there is no overt degree morpheme present, that a silent degree morpheme *pos* applies and supplies the degree argument with a contextual standard, parallel with the adjectival case (*cf.* the discussion in Sect. 5.3).[14] In the case of (31a), the quantized theme argument introduces a fully closed scale when it combines with μ. Recall that in the case of adjectives with fully closed scales, the effect of *pos* is to supply the degree argument with the maximal value of the scale, resulting in a default maximal interpretation. The situation is parallel when *pos* applies to the fully closed scale in (31a), resulting in the default maximal, telic interpretation. By contrast, the scale at issue in (31b) is an open scale, and *pos* simply returns a contextual value for the degree argument. This value cannot be a maximal one since the scale is an open scale. In this case, the application of *pos* yields a vague interpretation of the sentence based on a contextual standard, meaning that the quantity of apple-matter or applesauce is unspecified, and therefore only an atelic reading is possible. This behavior follows directly from the degree-based analysis advocated here, and from the more general principles of the semantics of scales and degrees as presented in Sect. 5.3, and is indeed a welcome consequence.

[13]Since μ takes as its first argument an individual of type e, this analysis assumes that bare nominals as in (31b) must be kind-denoting individuals (see Chierchia, 1998).

[14]Also see similar proposals for a *pos* morpheme for events in Piñón (2005, 2008), Kennedy and Levin (2008) and Stensrud (2009).

5.5 The Evaluative Reading

Our attention now turns to what I have been calling the evaluative use of *half*. Recall that this use of *half* has very different aspectual properties from the eventive use. Specifically, this reading is available in both telic and atelic contexts, as shown in (32). Importantly, this reading of *half* does not track the quantity of the incremental theme argument, in contrast with the eventive reading discussed in the previous section. Therefore, evaluative *half* can appear with a quantized incremental theme argument as in (32a), with a cumulative incremental theme as in (32b), and even with intransitive uses of incremental theme verbs, where there is no nominal to measure at all, as in (32c).

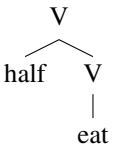
(32) a. Cathy half ate the apple. (telic or atelic interpretations)
b. Cathy half ate applesauce. (atelic interpretation only)
c. Cathy half ate. (atelic interpretation only)

Further evidence that evaluative *half* does not measure out events comes from the fact that it can appear with predicates that are argued to lack internal event structure. The following examples come from Tenny (2000), where the verbs *know*, *hear* and *like* are argued to lack what she calls a *core event*.

(33) a. Billy half knew the truth, but didn't want to admit it to himself.
b. Jimmy half heard the Beethoven Quartet, while he was thinking of what he would tell his boss.
c. Sue half liked the answer she received.

Rather, this use of *half* makes an evaluative statement that the event performed was not a prototypical event of the type named by the predicate. As seen from the examples in (33), this reading is not restricted to incremental theme verbs, but more generally across verb classes.[15] I argue that evaluative *half* combines directly with the verb to create a compound verb with a meaning of *half* V. The syntax of *half eat* on the evaluative reading is given in (34).

(34)



[15] A reviewer wonders whether an agent must have control over the event in order to license the evaluative reading. While it is true that the evaluative reading for *half* seems marginal with unaccusative verbs like *fall* or *die*, which do not select an agent argument, the examples in (33) don't seem to involve agent control and yet still allow the evaluative reading of *half*.

Given what we have said so far about *half* as a degree modifier, this suggests that the verb to which evaluative *half* attaches should be gradable, i.e., of semantic type $\langle d, st \rangle$. Meanwhile, in the previous section I argued that incremental theme verbs are crucially not gradable predicates. However, the arguments in that case were against incremental theme verbs lexicalizing a quantity scale, and as we have just seen, evaluative *half* plays no role in measuring quantities. In what follows, I argue that these verbs may indeed be gradable on the relevant quality-based interpretation, and that it is precisely this type of scale that is targeted by evaluative *half*.

As pointed out by Rappaport Hovav (2008), incremental theme verbs describe complex changes, in that there are many dimensions along which we evaluate what "counts" as an event of the type named by the verb. For example, a verb like *wash* is associated with a wide range of criteria for classifying such events, such as the amount of soap used, the force and thoroughness of scrubbing, etc. Each of these criteria are themselves gradable properties associated with their own scales. I suggest, then, that evaluative *half* may target one or more of these properties in order to indicate that the event performed was not performed well. Which specific property that is at issue is a matter of context. For instance, in the example in (4) above involving *half eat*, there are at least two dimensions of eating that are at issue: chewing and swallowing. In this case, the speaker uses *half eat* to describe a non-prototypical eating event where a fly is chewed on, but not swallowed.

While evaluative *half* appears to be acceptable with a wider range of verbs compared with eventive *half* (*cf.* uses in (33) with non incremental theme verbs), its distribution is not completely free. For instance, many speakers find the sentences in (35) to be marginal on the evaluative reading (note that the eventive readings here are fine).[16]

(35) a. ??Larry half opened the door.

b. ??Elaine half melted the candle.

I suggest that these verbs do not have the sufficient richness of dimensions that are necessary for a verb to have the type of scale that can be targeted by evaluative *half*. Unlike verbs such as *wash* that are associated with multiple dimensions that can be used to classify events of a certain type, verbs like *open* and *melt* describe events that involve a change in a single attribute. Either Larry opened the door, or he didn't; either Elaine did something that caused the candle to melt, or she didn't – there is no in-between. That is, there is no complex scale whose midpoint can be picked out by evaluative *half*.[17]

[16] Tenny (2000) finds these uses of evaluative *half* to be acceptable, though many speakers I have consulted with find them odd. An evaluative-like reading with these verbs seems more natural with the modifier *sort of*.

[17] A reviewer points out that (35a) accepts adverbial modification by *powerfully*, which suggests that the verb may be associated with an intensity scale, thereby undermining the idea that such verbs lack a richness of dimensions to license the evaluative reading of *half*. However, the use of adverbs like *powerfully* do not indicate that the verb *lexicalizes* an intensity scale no more

As we have already seen, incremental theme verbs freely accept *out-* prefixation, as shown again in (36). Of relevance here is that the effect of *out-* prefixation in these cases describes a scenario where the speaker is evaluating who performed better at an event of the type named by the verb.

(36) Cinderella out-scrubbed/out-ate/out-read/out-drank/out-wiped her step-sisters.

Thus, (36) states that Cinderella did a better job at scrubbing, eating, etc., than her step-sisters. That is, the speaker is evaluating who performed an action better, indicating that these verbs do indeed lexicalize an evaluative scale for this use. Granted, for some of these verbs, especially *eat* and *drink*, the most natural reading seems to be one where Cinderella ate or drank more of something, which appears to undermine the claim that this use is not quantity-based. In such cases, though, it just happens to be that we usually evaluate the quality of eating and drinking events based on the quantity consumed. Thus, it is still an evaluative scale at issue in these cases, where the quality of the event is evaluated based on how much was eaten. Note that the verbs in (35) where evaluative *half* is marginal also do not readily accept *out-* prefixation to yield a verb with this evaluative competition reading.

(37) a. ??Larry out-opened Elaine.

b. ??Elaine out-melted Larry.

More convincing evidence for the scalarity of these verbs comes from the fact that there is at least one other construction in English that seems to target the same scale. The relevant construction is contrastive focus reduplication (CR), as discussed by Ghomeshi et al. (2004), also called 'doubles' or 'clones' by Horn (1993). CR consists of copying a word in order to put into focus a more prototypical instance of the reduplicated element. As shown by Ghomeshi et al., CR is used to specify a prototypical instance of the item being reduplicated, in contrast to other potentially looser meanings. A looser instance of the verb is exactly the type of meaning we get when *half* combines directly with the verb in its evaluative use, and this looser meaning can be contrasted quite naturally with a more prototypical instance of an event, as in (38).

(38) Larissa only half-washed the dishes, she didn't wash-wash them.

Ghomeshi et al. argue that the effect of CR is one of set-shrinking, in that the possible range of appropriate instantiations of a property is reduced to only the most prototypical ones. This sets up the contrast between prototypical and non-prototypical extensions of the properties involved. However, an alternative way of

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than other modifiers that describe manner such as *with both hands* or *by blowing really hard* indicate that the verb lexicalizes a number-of-hands-used scale or an amount-of-blowing scale. Correspondingly, these verbs are not classified as manner verbs, meaning that they do not involve complex changes as argued by Rappaport Hovav and Levin (2010).

thinking about the semantic effect of CR would be to say that verbs are associated with a scale that measures the degree to which an action performed is a prototypical instance of the action named by the verb. Then we can say that CR makes reference to the maximal endpoint of that scale, i.e., the most prototypical instance of that property. That is, the availability of CR not only shows that these verbs can be associated with evaluative, quality-based scales, but also that such scales are indeed closed scales, which is exactly the type of scale structure required by *half* on its other uses as well. Evaluative *half* picks out the midpoint of this quality-based scale when it combines with verbs that are associated with such scales. Thus, we can maintain a uniform semantics for *half* across its uses, in that it always picks out the midpoint of a fully closed scale.

Further evidence that evaluative *half*, *out-* prefixation and CR all operate over the same scale is the fact that they cannot co-occur, as shown in (39) (note that (39b) improves on the eventive reading of *half*).

(39) a. ??Larissa half out-washed Cathy.

b. ??Larissa half wash-washed the dishes.

c. ??Larissa out-wash-washed Cathy.

All these operations target the same scale associated with the verb, and therefore cannot co-occur. A remaining puzzle, however, is why this type of evaluative scale does not accept a wider range of degree morphology that we see in adjectival contexts, or quantity scale contexts as we saw in Sect. 5.4.

Recapping, the evaluative use of *half* targets a quality scale (or prototypicality scale) that is associated with the verb itself. This explains why this use of *half* can appear in both telic and atelic contexts: telicity is a property of the VP, and is crucially related to the quantization of the incremental theme argument, if present. This means that incremental theme verbs themselves are not inherently telic or atelic; rather, telicity is compositional. The application of evaluative *half* occurs at the verb level, creating a new verb with the same aspectual properties as the base verb, i.e., unmarked with respect to telicity.

In the absence of an overt degree modifier, I propose that a null verbal *pos* morpheme supplies the degree argument with a contextual standard. Since, as I have argued, the scale at issue is fully closed, the resulting interpretation is a maximal one, as expected. That is, the interpretation of the verb *eat* without any degree modifiers is one of a prototypical event of eating.

5.6 Crosslinguistic Support and Conclusions

In this paper, I described and accounted for two distinct sources of scalarity that are present within verb phrases headed by incremental theme verbs. Two distinct uses of the modifier *half* diagnose the differences in behavior of these scales. First, the eventive use of *half* is used to measure out an event by measuring out the

quantity of the incremental theme that participates in the event. The quantity-based scale that is at issue for this reading is derived by combining an incremental theme argument with a functional head μ, which maps the part structure of the nominal onto a scale and makes available a degree argument for modification. Bounded incremental theme arguments correspond with fully closed scales, which explains both why eventive *half* can only occur when there is a bounded theme argument present and why this reading correlates with a telic interpretation of the VP. I also proposed that partitive *of* is an overt instantiation of μ where other types of degree morphology targeting a quantity scale appear within the verb phrase. Second, the evaluative use of *half* targets a quality-based scale that is associated with the verb itself. This scale is present in verbs that are associated with multiple dimensions that classify prototypical instances of the set of events named by the verbs. The quality-based scales are fully closed scales, which is why they can be targeted by *half*. Both the quantity and quality scales were shown to display behaviors parallel with scales found in the domain of gradable adjectives, particularly with respect to the interpretation of *pos* in the absence of overt degree morphology.

Thus, with respect to the main research question of this paper – where do scales come from within the verb phrase – we see that quantity-based scales are not lexicalized in verb meaning, but rather are derived via the presence of an incremental theme argument, while quality-based scales are lexicalized in verb meaning. This conclusion also relates to the secondary issue addressed here, namely the question of what is lexically encoded in verb meaning. With respect to this question, I argued not only that incremental theme verbs lexically encode a degree argument associated with a quality-based scale (and crucially not a quantity-based scale), but also that these verbs do not directly select for their incremental theme argument. Rather, this argument is introduced by a functional head μ, parallel with the external agent argument that is syntactically introduced by the *v* head. This means that incremental theme verbs at their core are intransitive activity predicates.

I argued that the two readings associated with *half* reflect distinct derivational histories, despite identical surface forms in English. The result was that I was required to make recourse to a spell-out rule that moved eventive *half* from the position within the VP close to the theme argument where I claimed it occurred at LF to the position left of the verb where it is pronounced in English, which seemingly makes the analysis a bit costly. Cross-linguistic evidence, however, indicates that such an account is indeed on the right track. For instance in European Portuguese, the eventive reading *half* indeed occurs when *meia* 'half' is embedded within the VP, next to the nominal whose quantity it measures (Patricia Amaral, p.c.).

(40) Ele comeu **meia** maçã.
he eat.PAST.3SG half apple
'He half ate the apple.' (eventive reading only)

The evaluative reading of *half* is not available in (42). Furthermore, in Greek, we see that *miso* 'half' can appear both embedded within the verb phrase or to the left of the verb (Anastasia Giannakidou, p.c.), and that this surface variation corresponds with the eventive/evaluative distinction, as predicted by the present analysis.

(41) a. Efage **miso** milo.
eat.PAST.3SG half apple
'He half ate an apple.' (eventive reading only)

b. **Miso**-efage ena milo.
half-eat.PAST.3SG DET apple
'He half ate an apple.' (evaluative reading only)

Thus in Greek, eventive *half* in (41a) is pronounced in the position where it is generated at LF, embedded within the VP closer to the incremental theme argument. Meanwhile, evaluative *half* in (41b) appears in a compound verb form. Thus, in these languages, there is evidence that eventive *half* is indeed generated within the VP, close to the nominal argument whose quantity it measures, making a similar analysis for English plausible as well. Finally, evidence from German shows that the eventive/evaluative distinction may be encoded in two distinct lexical items. This is shown in (42), where *zur Hälfte* corresponds with the eventive reading, while *halbwegs* corresponds with the evaluative reading.[18]

(42) a. Ich habe das Zimmer **zur Hälfte** aufgeräumt.
I have the room half cleaned.up
'I half cleaned up the room.' (eventive reading only)

b. Ich habe das Zimmer **halbwegs** aufgeräumt.
I have the room half cleaned.up
'I half cleaned up the room.' (evaluative reading only)

Thus, whereas English uses a single lexical item to express both the eventive and evaluative readings, German distinguishes these readings using two lexical items, an interesting point of crosslinguistic variation that further supports the analysis presented in this paper.

Finally, this paper has underscored the link between nominal part structure and scale structure in the case of eventive *half*. This connection is found not only in the quantity-based scales associated with incremental theme VPs, but also more generally with gradable adjectives as shown in Sect. 5.3, and in prior work I have suggested that the very same mapping between nominal part structure and quantity scales is at work in partitives as well (Bochnak, 2010b). In a sense then, there is an analog of partitivity found within the structure of incremental theme VPs, which is sometimes found overtly in the cases where μ is instantiated as *of* in English. This suggests that the mapping from part structure to scale structure is a fairly general semantic mechanism that is at work in these diverse syntactic environments. Future research should work towards further describing and explaining the nature of this mechanism, which I have begun to explore in this paper.

[18]Thanks to a reviewer for pointing out this contrast, and to Eva Csipak for providing judgements on the sentences in (42).

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Chapter 6
Interaction of Telicity and Degree Gradation in Change of State Verbs

Jens Fleischhauer

6.1 Introduction

In recent years the role of scalarity in verbal semantics has been emphasized. Among other things change of state verbs, incremental theme verbs, and verbs of directed motion have been analyzed as expressing scalar predications (e.g. Rappaport Hovav 2008; Rappaport Hovav and Levin 2010; Caudal and Nicolas 2005; Piñón 2008; Bochnak this volume). It is not only predicates expressing scalar predications that can be analyzed in scalar terms, but also phenomena like grammatical aspect (Filip 2007) and telicity (Caudal and Nicolas 2005; Kennedy and Levin 2008). The topic of this paper is the gradation of verbs, a special emphasise is put on the gradation of change of state verbs with the German degree adverb *sehr*. Some aspects of the degree gradation of verbs are discussed in, for example, Tsujimura 2001; Ropertz 2001 and Löbner forthcoming, but a detailed semantic analysis of verbal degree gradation is still missing. The aim of this paper is twofold: first, it contributes to the semantic analysis of degree gradation of verbs and second, it explores the interaction of degree gradation and subatomic event semantics of verbs, concentrating on telicity. For this reason, the analysis focuses on the gradation of change of state verbs, since (i) these verbs are lexically scalar (cf. Rappaport Hovav 2008) and (ii) the relevant gradation scale also figures in measuring out the event, i.e., is relevant to determine the telicity of the predication (e.g., Tenny 1994). But this gives rise to the central empirical problem explored in this paper. A telic predication is true if the telos is reached. The telos of telic change of state verbs such as *stabilisieren* (*to stabilize*) is analyzed as a maximal scale value. *Sehr* (*very)* indicates that a scalar predication holds at least to a 'high' degree. If a telos is a maximal scale value, a

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higher degree should not be possible. But telic predicates can be graded by *sehr*, expressing that a 'high' degree of the result state is attained. The problem is to give an analysis of telicity which is compatible with verb gradation.

The data discussed in this paper will offer support for the claim made by Kearns 2007 that two types of telos have to be distinguished. It will be argued that the distinction between a maximum telos, equated with the maximal scale value, and a standard telos, expressing a nonmaximal degree, has to be drawn. This distinction makes it possible to explain why some telic change of state verbs are gradable, and others are not.

A short background on verb gradation and the notion of scales is provided in Sect. 6.2. In Sect. 6.3 the German degree adverb *sehr* is discussed with regard to its semantic background. The concept of telicity is introduced in Sect. 6.4. Two different accounts on telicity, the endpoint and the homogeneity approach, are discussed and evaluated against the data on gradation of change of state verbs in German presented in Sect. 6.5. Section 6.6 contains an analysis of the interaction of verb gradation and telicity, resulting in a reformulation of the endpoint approach to telicity. The results attained from the discussion of German data are tested against a cross-linguistic background (Russian and French) in Sect. 6.7. The paper ends with a conclusion (Sect. 6.8).

6.2 Verb Gradation

Following Bolinger 1972, two types of verb gradation have to be distinguished: extent and degree gradation. Extent gradation is an instance of verbal quantification, in which the duration or frequency of an event is modified. Degree gradation is more restricted and related to the modification of a gradable property lexicalized by the verb. Gradable properties can be characterized as measure functions, i.e., functions from individuals to degrees which assign the bearer of the property a value on a scale (e.g., Bierwisch 1989; Kennedy 1999). A scale is a linearly ordered set of degrees which represent measurement values of a certain dimension. The dimension indicates the kind of property measured, for example 'size,' 'price' or 'intensity of a feeling' (e.g., Kennedy and McNally 2005, 351). Scales can be distinguished as to whether they include minimal or maximal values. A maximal value is the endpoint of the scale indicating that no superior degree exists. The reverse is true for a minimal value, which excludes inferior degrees. Regarding the presence or absence of minimal and maximal values, four combinations are possible: a scale can possess a minimal and a maximal value, only one or neither of them (e.g., Kennedy 1999). Accordingly, a scale is called '(fully) closed' if it exhibits a minimal and a maximal value and 'open' if it possesses neither of these values. Moreover, a scale is called 'partially closed' if it has only one of these values. To test whether a scale is open or closed, different adverbial modifiers can be used. The adverb *completely* (in German *vollständig*/*vollkommen*) presupposes a closed scale, since it expresses the reaching of a minimal or maximal value. On the other hand, proportional modifiers

like *halfway* (in German *zur Hälfte*) presuppose a fully closed scale, as a beginning and an endpoint are necessary for measuring a proportion (Kennedy and McNally 2005, 352).

The type of gradation discussed in this paper is realized by degree adverbs[1] which have the effect of specifying the degree of the gradable property. Modifiers like *completely* and *halfway* restrict the degree to a concrete value of the scale, i.e., the maximal or middle value respectively. *Very* and *sehr*, on the other hand, do not specify a concrete value to which the gradable property holds, furthermore they introduce a standard value that specifies a lower bound to which the degree of the gradable property holds at least.[2] *Sehr* introduces a standard that separates 'non-high' and 'high' degrees of the respective property (cf. Bierwisch 1989; Ropertz 2001).

Two types of degree modifiers can be distinguished: those which entail the truth of the unmodified predication and those which do not. The first type is called 'contrastive modifiers' by Bierwisch 1989. *Halfway* and *partly*, as well as their German counterparts, are not contrastive (Piñón 2005), while *sehr* is. This can be illustrated by the examples in (1). That a problem is partly solved does not entail that it is solved. On the other hand, if something has grown a lot, this entails that it has definitely grown. The examples in (2) illustrate the entailment relationships. It is no contradiction to state that something has been partly solved, but has not been solved (2-a). On the other hand, it is a contradiction to express that something has grown a lot, but has not grown (2-b).

(1) a. Rebecca partly solved the problem $\nrightarrow$ Rebecca solved the problem
b. Rebecca ist sehr gewachsen $\rightarrow$ Rebecca ist gewachsen
Rebecca is very grown Rebecca is grown
'Rebecca has grown a lot' $\rightarrow$ 'Rebecca has grown'

(2) a. Rebecca has partly solved the problem, but she has not solved the problem
b. *Rebecca ist sehr gewachsen, aber sie ist nicht gewachsen
Rebecca is very grown, but she is not grown
'Rebecca has grown a lot, but she has not grown'

This property of *sehr* sets the ground for the empirical problem mentioned in the introduction. *Sehr* presupposes the truth of the unmodified predication and a telic predication is true if the telos is reached. To express that a 'high' degree has been reached is only possible in this case if the process continues after reaching the telos.

[1]For different linguistic realizations of verb gradation e.g., by intonation, cf. Bolinger 1972.

[2]In contrast to English *very*, *sehr* can be used for degree gradation of adjectives as well as verbs. For differences between *sehr* as adjectival and *sehr* as verbal degree modificator cf. Ropertz 2001. In English a general degree adverb like *sehr* is missing, therefore it is not possible to provide a uniform translation of *sehr* in the examples throughout this paper.

However, this means that then the telos cannot be a maximal scale value. I will discuss this problem in more detail in Sect. 6.4, in which a definition of telicity is presented.

A further relevant aspect is the problem of a straightforward compositional analysis of verb gradation. In a classical formulation of the principle of compositionality, Partee et al. 1990 state that the meaning of a complex expression is a function of the meaning of its components and the syntactic structure of the whole. For a compositional analysis of verb gradation, the deep lexical semantics of the verbs must be taken into account (Löbner forthcoming). Syntactically there is no difference between the examples in (3). But the interpretation of the examples differs: in (3-a) *sehr* modifies the amount of substance emitted, in (3-b) it modifies the volume of the emitted sound, and in (3-c) it is the divergence from the execution of a normal action that is graded by *sehr*. Each verb is associated with a different type of scale and furthermore these scales are in a different relation to the expressed event.[3] This is illustrated by the contrast between the examples in (4) and (5), in the (a) examples the verbs are used in the progressive[4] and in (b) examples in the perfective. Depending on grammatical aspect, the interpretation of the gradation by *sehr* changes for verbs of substance emission, but not for verbs of sound emission. In (4-a) *sehr* specifies the rate of emission as 'high,' while in (4-b) the total quantity of substance emitted is specified as 'large.' Such a contrast does not occur in (5), in both cases the interpretation is that the volume of the sound emitted is 'high.'

(3) a. Peter hat sehr geblutet
Peter has very bled
'Peter has bled a lot'

b. Der Motor hat sehr gedröhnt
the engine has very droned
'The engine has droned very much'

c. Der Mann hat sehr gehumpelt
the man has very hobbled
'The man has hobbled very much'

(4) a. Die Wunde blutet sehr/ist sehr am Bluten
the wound bleed very/is very at.the to bleed$_{Nom}$
'The wound is bleeding a lot'

b. Die Wunde hat sehr geblutet
the wound has very bled
'The wound has bled a lot'

[3] In Sect. 6.8 a distinction between two different types of degree gradation is introduced, depending on the kind of relationship between the gradation scale and the event.

[4] One way to express progressive in German is to use a periphrastic construction consisting of *sein* (to be), *am* (*at, by*), which is a contraction of the preposition *an* and the definite article, and a nominalized infinitive. In the glosses, I mark the single components of the construction and indicate the nominalization of the infinitive by the subscript Nom.

(5) a. Der Motor dröhnt sehr/ist sehr am Dröhnen
the engine drones very/is very at.the to drone$_{Nom}$
'The engine is droning very much'
b. Der Motor hat sehr gedröhnt
the engine has very droned
'The engine has droned very much'

A regular compositional pattern exists for the gradation of semantic verb classes in the sense of Levin 1993 but not for the construction *sehr* + `Verb` in general. A syntactic construction like this, for which no uniform rule of semantic composition exists, is called *subcompositional* by Löbner forthcoming. On the one hand, the effect of *sehr* is the same in all cases of verb gradation, namely to specify a 'high' degree on a scale. On the other hand, a uniform rule of semantic composition cannot be given, since in this case semantic composition relies heavily on differences between the semantic verb classes.

6.3 Semantic Assumptions About *Sehr*

Sehr is a degree adverb which has the sole function of expressing a 'high' degree. In contrast to other degree adverbs like *stark* (*strongly*) it cannot be used as a manner adverb. Commonly it is assumed that *sehr*, as well as *very*, presuppose an open scale (e.g., Kennedy and McNally 2005 for *very* and Breindl 2009; Löbner forthcoming for *sehr*). One argument in favor of this view is that *sehr* and *vollständig* seem to be in complementary distribution, as indicated in (6).

(6) a. Peter ist sehr/*vollkommen groß
Peter is very/completely tall
'Peter is very/*completely tall'
b. Das Fenster ist *sehr/vollkommen geschlossen
the window is very/completely closed
'The window is *very/completely closed'

Kennedy and McNally 2005, 370 present a discussion of the adjective *dry*, which can be used with a relative and an absolute standard. A relative standard is a context-dependent standard value, in contrast to an absolute standard that coincides with a minimal or maximal scale value (cf. Kennedy and McNally 2005). In its use with a relative standard *dry* can be modified by *very*; while as an absolute adjective, *dry* only licenses a modification by *completely*, but not by *very*. In German, too, some adjectives can be modified by *sehr* as well as *vollkommen* (*completely*). Examples are *leer* (*empty*) and *voll* (*full*) as indicated in (7). In (7-a) it is expressed that for a certain context very few or many people are in the theater. In (7-b) it is expressed that nobody is inside the theater, focusing on the absolute interpretation of *leer*.

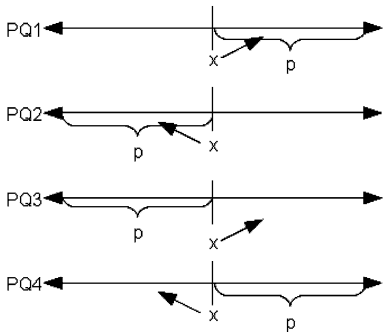

Fig. 6.1 Graphical representations of the four different types of phase quantifiers (According to Löbner 1990). The part of the scale marked by *p* is the positive phase, the *arrow* indicates to which phase the argument (*x*) of the predicate is assigned

(7) a. Das Theater ist sehr leer/voll
the theater is very empty/full
'The theater is very empty/full'
b. Das Theater ist vollkommen leer/voll
the theater is completely empty/full
'The theater is completely empty/full'

With regard to verbs, I argue in Sect. 6.6 that a predicate can be related to an absolute and a relative standard at the same time, so that a lower and an upper bound of the result state are specified. In this case, one does not have to assume coercion of a closed scale to an open scale predicate. Based on this assumption, it is not necessary to restrict *sehr* to open scale predicates, but only that the predicate modified by *sehr* truthfully denotes a range of value on a scale and not a single value (cf. Kirschbaum 2002, 46). A predicate which is only related to an absolute standard truthfully denotes a single value; this is the maximal or minimal scale value. In such a case, *sehr* cannot distinguish between 'non-high' and 'high' values and accordingly it cannot apply to the predicate.

For a formal analysis of *sehr*, I use the account of phase quantification described in Löbner 1986, 1990. Phase quantification is a general format for scalar and quantificational predications. Operators that express a quantificational or scalar predication, e.g., aspectual particles like *still* and *already*, scalar adjectives as well as degree adverbs are called phase quantifiers (PQ). "[A] phase quantifier predicates about a given first-order predication that there is, or is not, a transition on some scale between the predication being false and being true" (Löbner in press, 2). A scale is divided into two succeeding and contiguous phases and the truth of the predication is relative to the assignment of the argument of the predication to one of the phases. Phase quantifiers are markedness predications, since the values of one of the phases are marked regarding the relevant dimension. Depending on the order of the phases and the assignment of the argument of the predication to one of these phases, four different types of phase quantifiers can be distinguished. The four types are depicted in Fig. 6.1 and the relevant differences between the types relate to whether the marked values are higher or lower on the scale than the contrasting values (PQ1/PQ3 vs. PQ2/PQ4) and whether the argument is true or false with respect to the marked

phase (PQ1/PQ2 vs. PQ3/PQ4). An example of a PQ1 would be the positive polar adjective *large*, in which case marked size values are contrasted with lower degrees. A PQ2 would be the negative polar adjective *small* that leads to a contrast with higher degrees. PQ3 can be exemplified by *not large*, for which the same contrasting values as for *large* are relevant, but the argument of the predication is assigned to the unmarked phase, i.e., the referent of the argument is unmarked with regard to size and therefore not large or not small. Accordingly, an example of a PQ4 would be *not small*.

Sehr is a PQ1 since it assigns its argument in a positive phase that contrasts with inferior values. Like every phase quantifier, it is characterized by three parameters: a scale, the argument of the predication, and a predication. *Sehr* does not lexically specify a scale, so it has an open scale argument indicated by α. This open argument has to be saturated by the verb, which is reasonable since degree gradation is only possible if the verb lexicalizes a scalar property and hence can provide a scale. The argument of the predication is a function *f(e)* that maps events onto α (f: e $\rightarrow \alpha$). The predication of *sehr* expresses that the respective event has a marked value on the scale, whereby **marked** means that the degree on the scale is equal to or larger than the standard introduced by *sehr*. (8) shows the lexical entry for *sehr*.

(8) *sehr*: λe PQ1 (α, f(e), λe'(**marked**(f(e)')))

To exemplify the formula, we can take *bluten* (*to bleed*) as an example. In the case of *bluten*, α is the quantity scale lexicalized by the verb. *f(e)* maps the event onto that scale, so that one yields `Quantity(Substance(Emitter(e)))`, which is the quantity of the substance emitted by the emitter of the event (for the sake of simplicity, I ignore the influence of grammatical aspect on gradation). *Sehr* predicates that the event is marked regarding the quantity of substance emitted, i.e., it is an event in which the quantity of emitted substance exceeds the standard introduced by *sehr*. Since *sehr* presupposes the truth of the predication it modifies, it applies to the marked phase of the scale. Hence, *sehr* leads to a predication between the values for which the ungraded predicate is true, so that the right comparison class is given. This already follows from the definition of the phase quantifiers, as presented in Löbner 1990.

To summarize, *sehr* is a second-order predicate that applies to a first-order scalar predication and separates the part of the scale denoted by the predicate in a marked and a contrastive lower unmarked phase. One future task is to determine which verbs lexicalize scales and which kinds of scales are lexicalized.

6.4 Telicity

Telicity is one *aktionsart* property of verbs; a telic predicate describes an eventuality which is bounded. In this paper, boundedness is understood as the presence of a culmination point which has to be reached to yield a true predication.

Borik 2006 distinguishes between two different major approaches to telicity: an 'endpoint approach' and a 'homogeneity approach.' In the 'homogeneity approach', exemplified, for example, by Borer 2005 and 2006 (both are based on Krifkas (1989; 1998) approach to telicity), it is assumed that the difference between atelic and telic predications is based on referential properties of predicates. Atelic predicates are homogeneous, while telic ones are not. Homogeneity is based on the subinterval property. Atelic predications show the subinterval property since they license an entailment from the progressive to the perfect of a predicate. Every subevent of *laufen* (*to run*) can itself be denoted by *laufen* (9-a); while not every subevent of *einen Wagen reparieren* (*to repair a car*) is a proper instance of the predicate (9-b).

(9) a. Peter war am Laufen, als er unterbrochen wurde → Peter ist
Peter was at.the to run$_{Nom}$ when he interrupted was Peter is
gelaufen
run
'Peter was running, when he was interrupted' → 'Peter has run'

b. Peter war den Wagen am Reparieren, als er unterbrochen wurde
Peter was the car at.the to repair$_{Nom}$ when he interrupted was
↛ Peter hat den Wagen repariert
Peter has the car repaired
'Peter was repairing the car, when he was interrupted' ↛ 'Peter has repaired the car'

Predicates that show the subinterval property are homogeneous, which means that they truthfully apply to an event and every proper subevent. Formally this can be captured as presented in (10). The 'homogeneous approach' is directly related to Krifkas notion of telicity, since a homogeneous predicate is cumulative and divisive (cf. Filip 2000, 61).

(10) A predicate P is homogeneous iff: $\forall e, \forall e'$ [P(e) $\wedge$ (e' $\subset$ e) → P(e')]

According to the 'endpoint approach' telicity is mainly defined with respect to a culmination point. A standard test for the presence of a culmination point is the interpretation of time-span adverbials like *in ten minutes* (11). In (11-a) it is expressed that the repairing of the car is finished after 10 min. For (11-b), the only possible interpretation is that Peter starts to run after the specified time interval (this interpretation is also available for the telic predicate), but not that the event is finished.

(11) a. Peter repariert den Wagen in zehn Minuten
Peter repairs the car in ten minutes
'Peter repairs the car in ten minutes'

b. ??Peter läuft in zehn Minuten
Peter runs in ten minutes
'Peter runs in ten minutes'

Different versions of the 'endpoint approach' approach exist, but in the remainder of this paper I focus on the version of Caudal and Nicolas 2005, since it is an explicit scalar analysis of telicity. The Caudal and Nicolas 2005, 294 definition of telicity is presented in (12). In this account of telicity a prediction is telic if the denoted event is mapped onto a scale with a maximal value. A relevant part of the definition is that a homomorphic mapping between the scale measuring the change and the events exists, which is executed by the `Become` predicate.[5] `Become` maps an event onto the scale so that the order on degrees matches the temporal order of the event. This mapping guarantees that the initial subevent is mapped on a lesser degree than any other subevent. Further, if a maximal degree exists, the final subevent is mapped onto that degree.

(12) **Telicity**: A predication is telic if and only if,
   a. it has an associated set of degrees with,
   b. a specified maximal degree, and
   c. its verbal predication satisfies axiom `Become` [. . .].

A telic interpretation obtains if a maximal scale value exists, which means that the scale has to be closed. If the maximal degree is reached, the event cannot progress further. A development of the event beyond the subevent that is associated with the maximal value is strictly excluded. This indicates that the telos is analyzed as a single and maximal scale value. Atelic predications are related to open scales (Caudal 2005, 113), since no 'set terminal point' exists that has to be reached. In this account telicity is related to the scale structure.

Caudal and Nicolas' definition of telicity accounts only for verbs with a `Become` predicate in their event structure, which is the case for change of state verbs. These verbs express a change in a property which can be analyzed as an attribute of the referent of the theme argument (following for example Rappaport Hovav 2008). *To grow* expresses a change with regard to the size of the referent of the theme argument and *to stabilize* a change regarding its stability. These attributes are the gradable property modified by *sehr* and can be analyzed as measure functions. Following Kennedy and Levin 2008, I assume that in the case of change of state verbs the measure function is a difference function which takes an object and an event and returns a degree that represents the amount of change (for a formal analysis cf. Kennedy and Levin 2008, 172f.).

In this paper, I concentrate on durative change of state verbs which can be subdivided into telic and atelic predicates. Telic change of state verbs express definite changes and atelic change of state verbs comparative changes. A definite change expresses the attainment of a certain lexically specified result state, while in the case of a comparative change it is only expressed that the degree on the scale has increased, but no fixed result state is entailed. Durative change of state verbs that entail a definite change are telic and in this paper they are called *accomplishments*.

[5]For a formal definition of the homomorphic mapping cf. Caudal and Nicolas 2005, 293).

Degree achievements are those change of state verbs that show variable telicity and allow a telic or an atelic interpretation (cf. Kennedy and Levin 2008).[6] In the remainder of this paper I will use the term 'degree achievement' to denote atelic uses of change of state verbs and subsume all telic uses under the term 'accomplishment'. Accomplishments and degree achievements differ with respect to their truth conditions. Degree achievements express that the degree obtained by the change is higher than the initial degree; they are related to a minimal absolute standard, since any change on the scale leads to a true predication. This entails that their predication is not restricted to a certain part of the scale. On the other hand, accomplishments have truth conditions similar to adjectival positive constructions (cf. Kennedy and Levin 2008). Accomplishments only yield a true predication if the telos is reached, thus a truthful predication is restricted to the part of the scale denoted by the telos, i.e. the maximal scale value.[7] If the result state is denotable by an adjective, an accomplishment entails the adjective in its positive form, while a degree achievement entails it in its comparative form, as shown in (13).

(13) a. Der Zustand des Patienten hat sich stabilisiert → Der Zustand
the condition of.the patient has itself stabilized the condition
des Patienten ist stabil/*stabiler
of.the patient is stable/*more stable
'The physical condition of the patient has been stabilized' → 'The physical condition is stable/*more stable (than before)'

b. Der Riss hat sich verbreitert → Der Riss ist breiter/*breit
the crack has himself widened the crack is wider/wide
'The crack has widened' → 'The crack is wider/*wide'

Caudal and Nicolas' account of telicity predicts that telic change of state verbs are gradable by *sehr*, while telic change of state verbs should reject such a kind of gradation. Two different explanations for these assumed facts are possible. First, based on the view that *sehr* presupposes an open scale, accomplishments should not be gradable, since they are related to closed scales. A second explanation why accomplishments should not be gradable is that *sehr* presupposes that the predicate it modifies denotes a range of values, but the telos is a single maximal value. Degree achievements should provide no problem for degree gradation by *sehr* since they are related to open scales and truthfully denote a range of values. In the next section it will be shown that the prediction with respect to accomplishments is false since these verbs can be graded by *sehr*.

[6]The term *degree achievement* goes back to Dowty 1979 and differs from Vendler's (1967) notion of achievement. The term is misleading, since achievements in Dowty's sense are not punctual verbs but intransitive (that is noncausative) verbs expressing a change.

[7]I am analyzing only perfective uses of change of state verbs, since in case of imperfective aspect the culmination condition is canceled, which alters the truth conditions of the predicate.

6.5 Gradation of Change of State Verbs

In this section, I will present an analysis of graded change of state verbs in German.[8] An analysis similar to the one presented in this paper can be found in Ropertz 2001, but without reference to telicity. I begin with a discussion of the gradation of degree achievements (atelic change of state verbs) and will then provide a discussion of the gradation of accomplishments (telic change of state verbs).

6.5.1 Gradation of Degree Achievements

At the end of Sect. 6.4 I formulated the presumption that if change of state verbs can be graded by *sehr*, it should be degree achievements that allow this kind of gradation. Some examples of graded degree achievements are presented in (14), indicating that this part of the prediction is right.

(14) a. Das Angebot der Pflege hat sich in den letzten Jahrzehnten in
the offer of care has itself in the last centuries in
Folge der immer weiter zerfallenden Kleinfamilien **sehr**
course of the ever more decaying nuclear family very
verbreitert.
widened
'The range of care has expanded greatly over the last few decades as a consequence of the decay of the nuclear family'

b. Erst als ich die Vorlagen **sehr** *vergrößert* hatte, konnte er den
first when I the template very enlarged had could he the
Text lesen.
text read
'Only after I enlarged the template a lot, was he able to read the text'

c. Zu den Chancen einer kirchlichen Wiedervereinigung sagte
to the chances a churchly reunification said
Lehmann: "Sie sind natürlich **sehr** *gewachsen*, wie noch nie in
Lehmann they are naturally very grown like still never in
der Geschichte vorher"
the history before
'Speaking of the likelihood of a reunification of the churches, Lehmann said: "Of course, they have increased a lot, like never before" '

[8]The examples discussed in this section are taken from dataset collected in the project LO 4545/1 "Verbgraduierung" supported by the German Research Community and conducted by Sebastian Löbner.

In addition to the verbs mentioned in (14), some further degree achievements that can be graded by *sehr* are: *abkühlen* (*to cool*), *abnehmen* (*to decrease*; *to diminish*), *anheben* (*to raise*), *anschwellen* (*to swell*), *beschleunigen* (*to accelerate*), *dehnen* (*to stretch*), *stärken* (*to strengthen*), *verändern* (*to change*), *verbessern* (*to improve*), *verringern* (*to decrease*), *verschlechtern* (*to worsen*), and *zunehmen* (*to increase*). The gradation of degree achievements is very productive and it seems that almost all degree achievements can be modified by *sehr*.

To explicate the semantic effect of the gradation, I compare the use of *vergrößern* without *sehr* in (15) with its graded use in (14-b).

(15) Erst als ich die Vorlage vergrößert hatte, konnte er den Text lesen.
first when I the template enlarged had could he the text read
'Only after I enlarged the template, was he able to read the text'

In (15) *vergrößern* expresses that the text has been increased in size to get readable. The increase in size is not further specified with respect to its extent, it is just stated that a difference in size came about. In sentence (14-b) *sehr* specifies the amount of change as a contextually 'large' increase in size. In terms of phase quantification, *sehr* specifies that the degree of the difference in size is marked. In the example α would be the size scale and *f(e)* maps the event that expresses a change in a property onto the corresponding property scale. The function returns the degree of the difference (`Diff`) in size of the theme argument between the initial and the final subevent. *Sehr* predicates that this difference is marked, i.e. the difference is equal or larger than the standard introduced by *sehr* that differentiates 'normal' from 'large' changes. The formula in (16) illustrates this analysis, as an abbreviation the second parameter is written as the function *f(e)* and not as its value.

(16) *sehr wachsen*: λe PQ1 (`Size`, f(e), λe'(`Diff(Size(Theme(e), Ini(e')), Size(Theme(e), Final(e')))` ⩾ standard))

As already mentioned, grammatical aspects have an influence on the interpretation of the gradation of change of state verbs. The examples in (17) give an illustration of this difference. In (17-a) *vergrößern* is used in a perfective construction and as indicated *sehr* specifies the amount of change. (17-b) provides an example of *vergrößern* in a progressive construction, in which case *sehr* does not specify the amount of change, but the rapidity of change, meaning that the size of the crack increases rapidly (cf. Ropertz 2001). Grammatical aspect shows the same effect on gradation with respect to accomplishments.

(17) a. Der Riss hat sich sehr vergrößert
the crack has itmself very widened
'The crack has widened a lot'

b. Der Riss ist dabei sich sehr zu vergrößern/ist sich sehr
the crack is in the process itself very to widen/is himself very
am Vergrößern
at.the to widen_{Nom}
'The crack is widening a lot'

6.5.2 Gradation of Accomplishments

The gradation of degree achievements is unproblematic since it is not in conflict with the definition of telicity presented in Sect. 6.4. Based on the prediction formulated at the end of that section, accomplishments should not be gradable. However, the examples in (18) indicate that telic change of state verbs can be graded by *sehr*. The verbs *normalisieren* (*to normalize*) and *vereinheitlichen* (*to standardize, to unify*) are lexically telic, while *austrocken* (*to dry out*) is a prefix verb build from the verb stem *trocken* (*to dry*) and the prefix *aus-* (*out*); it is the prefix that accounts for the telicity of the predicate.[9] A demonstration of the telicity of the verbs is exemplified by applying the *fast* (*almost*) test to the verb *normalisieren* in (19). Applied to a telic predicate *fast* can express that (i) the event was almost starting, but did not start or that (ii) it is almost finished, while for an atelic predication only the first interpretation is possible (cf. Dowty 1979).

(18) a. In der Sonne **trocknen** Nacktschnecken **sehr** *aus*
in the sun dry slugs very out
'Slugs dry out a lot in the sun'
b. Die Verhältnisse haben sich wieder **sehr** *normalisiert*
the circumstances have themselves again very normalized
'The circumstances have very much normalized again'
c. Man könnte die beiden Gruppen noch **sehr** *vereinheitlichen*
one could the both groups still very standardize
'One could still standardize both groups very much'

(19) Die Verhältnisse haben sich fast normalisiert
the conditions have themselves almost normalized
'The circumstances have almost normalized'
→ *The circumstances have almost started to normalize*
→ *The circumstances have almost become normal*

Some further accomplishments gradable by *sehr* are: *immunisieren* (*to immunize*), *spezialisieren* (*to specialize*), *stabilisieren* (*to stabilize*), *standardisieren* (*to standardize*), and *zusammenwachsen* (*to grow together*). Unlike degree achievements, not all accomplishments can be graded by *sehr*. Examples of accomplishments that reject gradation by *sehr* are: *reparieren* (*to repair*) and *schließen* (*to close*). In Sect. 6.6 I will provide an explanation why some telic change of state verbs cannot be graded by *sehr*.

To illustrate the semantic effect of the gradation of accomplishments, I compare sentence (18-a) with a corresponding sentence without degree adverb (20). In (20) it is expressed that slugs get dry in the sun. The process of 'drying out' progresses

[9] For an analysis of prefix verbs in German and the effect of prefixes and particles and the semantics of the verbs cf. Stiebels 1996.

until the slugs attain the result state of being dry, so that at the end the slugs are dry. In the graded use *sehr* specifies the degree of the result state; the slugs are not only dry, but dry to a high degree. 'Dry to a high degree' is a weaker statement than 'completely dry' and presupposes that the adjective that denotes the result state *dry* allows for an absolute and a relative interpretation, as discussed in Sect. 6.3. It cannot be an absolute standard to which the verb is related in (18-a); otherwise it would not be possible for the slugs to get even drier. As in the case of the gradation of degree achievements, *sehr* modifies the amount of change expressed by the accomplishments, i.e., the difference between the degrees at the initial and final subevent. Since accomplishments are telic, they express that a specified culmination point is reached. This point – the telos – is the first value specified on the scale, which has to be attained. *Sehr* introduces a second value, its standard value, which has to be reached to make the graded predication true. Thus, by introducing the standard, the gradation leads to a refinement of the result state lexicalized by the verb. That the standard value introduced by *sehr* has to fall beyond the telos follows from the logical characteristics of *sehr*. It is a contrastive modifier that presupposes the truth of the predicate it modifies, in the case of an accomplishment this means that the telos has to be reached. This requirement is incompatible with the analysis of the telos as a single and maximal scale value, indicating that the definition of telicity given by Caudal and Nicolas needs a revision. Before presenting the refined definition of telicity, I will demonstrate in Sect. 6.5.3 that the accomplishments remain telic if they are graded by *sehr*.

(20) In der Sonne trocknen Nacktschnecken aus
in the sun dry slugs out
'Slugs dry out in the sun'

6.5.3 The Effect of Sehr on Telicity

In this section I want to discuss two different options in which *sehr* could influence the telicity of the predicate it modifies. First, in Sect. 6.5.2 it was demonstrated that the unmodified accomplishments are telic, but it could still be possible that *sehr* has an effect on the telicity of the predicates and shifts the telic to an atelic predication. This would be reasonable since some authors assume that *sehr* presupposes an open scale, so it could have the effect of canceling the maximal scale value. A second option would be that *sehr* affects the telicity of atelic change of state predicates and renders them telic. That would be reasonable because *sehr* introduces a standard value that has to be reached, so no longer any change on the scale leads to a true predication, but just a change that reaches at least the standard value of *sehr*.

One example that contradicts the view that *sehr* changes a telic to an atelic predication is presented in (21). The *fast* (*almost*) test (21-a) indicates that *stabilisieren* (*to stabilize*) is a telic predicate. It allows an interpretation in which the event is

almost finished. In (21-b) the same verb graded by *sehr* is combined with the time-span adverbial *in kurzer Zeit* (*in a short time*) and the adverbial specifies the time it took until the physical condition was stabilized to a high degree. That is the relevant telic interpretation of the time-span adverbial, indicating the telicity of the graded predication. Based on the example in (21-b), I assume that *sehr* does not shift a telic to an atelic predication.

(21) a. Der Zustand des Patienten hat sich fast stabilisiert
the condition of.the patient has itself almost stabilized
'The physical condition of the patient has almost stabilized'

b. Ich kam sehr instabil auf die Station [...] Dennoch wurde ich in kurzer Zeit sehr stabilisiert
I came very instable on the ward however became I in short time very stabilized
'I was in a very unstable condition when I arrived on the ward [...] but my condition stabilized a lot within a short time'

After refuting the first option, I turn now to the second one. As the examples in (22) illustrate, it is the case that *sehr* shifts an atelic change of state predication to a telic one. In (22-a) it is shown that the degree achievement *wachsen* (*to grow*) is odd with a time-span adverbial, but, as can be seen in (22-b), the time adverbial is perfectly acceptable if the verb is graded by *sehr*. In this case, the adverbial specifies the time interval after which a contextually large difference in size is attained.

(22) a. ??Er ist in einem Jahr gewachsen
he is in one year grown
'He has grown in one year'

b. Er ist in einem Jahr sehr gewachsen
he is in one year very grown
'He has grown a lot in one year'

Examples similar to (22) are discussed by Caudal and Nicolas. The authors assume that "a lot apparently requires an open scale as its input, and yields a closed one as its output" (Caudal and Nicolas 2005, 284). It is not easy to test whether *a lot* or German *sehr* shifts an open to a closed scale predication, since the criterion to test whether a scale is open or closed is its modifiability by endpoint modifiers. But a simultaneous modification by *sehr* and *vollständig* is not possible, so that this assumption cannot be tested. It seems that the only reason why Caudal and Nicolas assume that *a lot* closes the scale is the assumption that telic predications are related to closed scales. In the next section I will present a reformulation of Caudal and Nicolas' telicity definition without the assumption that a telos is related to a maximal scale value. Hence, instead of assuming that *sehr* closes the scale of a graded degree achievement, I will assume that telic predications are compatible with open scales.

6.6 Gradation and Telicity

In the last section it was argued that the gradation of telic change of state verbs is problematic for the assumption that a telos can uniformly described as a maximal scale value. This raises problems for the 'endpoint approach' of Caudal and Nicolas. Before I present a reformulation of this approach, I want to show why the 'homogeneity approach' cannot fully explain the relevant data.

In the 'homogeneity approach' the change in telicity of graded degree achievements can be straightforwardly explained. Degree achievements are homogeneous since every proper subevent of the process denoted by a verb like *vergrößern* (*to enlarge*) can also be denoted by the verb, while not every subevent of *einen Wagen reparieren* (*to repair a car*) is an instance of the predicate. A degree achievement graded by *sehr* is no longer a homogeneous predication because of the introduction of the standard value. *Sehr wachsen* (*to grow a lot*) does not apply to every one of its subevents because not every increase in size is itself an instance of a large increase. Consequently, *sehr* does not only change the truth conditions of a predication, but also the referential properties.

While an explanation of the telicity of graded accomplishments is possible, an explanation of the differences between gradable and ungradable accomplishments is not as straightforward. Gradable and ungradable change of state verbs are both telic and hence both types of predications are not homogeneous. To account for the differences between the types of accomplishments, one has to distinguish subtypes of non-homogeneous predications. Borer presents a modified version of the 'homogeneous approach' in which she assumes that a telic reading is possible if "some intermediate point within the event should turn out to be sufficiently well differentiated from the rest of the event, in involving, specifically the (sub-) culmination of some subevent" (Borer 2005, 58). It remains an open question what such a 'sub-culmination point' is, nevertheless it seems that by introducing this term, the 'homogeneous approach' merges with the 'endpoint approach'.

The 'endpoint approach' as formulated by Caudal and Nicolas is too strong to account for the data presented in Sect. 6.5.2, since if one restricts the notion of a telos to a single and maximal scale value, the gradability of accomplishments should be impossible. Obviously, this is in conflict with the data presented in the last section. For a solution to this problem, a distinction between two types of telos – a standard and a maximum telos – can be assumed, following Kearns 2007. Caudal and Nicolas' definition only accounts for the maximum telos that can be equated with a maximal scale value. In their definition, the notion of a standard telos is not included, as it does not mark an endpoint on a scale, but a nonmaximal degree, which is the onset or lower bound of a result state. If the result state is not extended, i.e., a single scale value, standard and maximum telos fall together and define an absolute standard. The standard telos can be analyzed as a relative standard, if standard and

maximum telos are distinct.[10] Accordingly, the assumption that the telos is a single value on a scale only holds for an absolute standard telos.

Kearns 2007 mentions two test criteria to decide whether a predicate is related to a standard or a maximum telos. The first criterion is to test whether the transition to the maximal value can be negated without contradiction. If this is possible, the transition to this value is an implicature and not an entailment. (23-a) indicates that *stabilisieren* (*to stabilize*) is telic, since the attainment of a result state cannot be denied without contradiction. But as shown in (23-b) it is possible without contradiction to negate that the condition has completely stabilized. This indicates that *stabilisieren* describes a transition to a telos that has not to be the endpoint of the scale.

(23) a. *Der Zustand hat sich stabilisiert, er ist aber nicht stabil
the condition has itself stabilized he is but not stable
'The condition has stabilized, but it is not stable'

b. Der Zustand hat sich stabilisiert, er ist aber nicht vollkommen
the condition has itself stabilized he is but not completely
stabil
stable
'The condition has stabilized, but it is not completely stable'

The second criterion tests whether it is possible that the result state is achieved but higher degrees could still be attained. If a verb can be used in a comparative construction like *X had v-ed, but it could still be more adj*, whereby *adj* is an adjective that denotes the result state of the verb, the telos cannot be a maximal value. A maximum telos would by definition exclude higher degrees, therefore a contradiction arises. *Stabilisieren* in (24-a) allows the test construction without contradiction, but *schließen* (*to close*) in (24-b), which is not gradable by *sehr*, leads to a contradiction.

(24) a. Der Zustand des Patienten hat sich stabilisiert, er könnte aber
the condition of.the patient has itself stabilized he could but
noch stabiler sein
still more stable be
'The physical condition of the patient has stabilized, but it could still be more stable'

b. *Peter hat die Tür geschlossen, sie könnte aber noch geschlossener
Peter has the door closed she could but still more closed
sein
be
'Peter has closed the door, but it could be still more closed'

[10]Throughout the paper I will use the notions *relative standard telos* and *absolute standard telos* to differentiate the cases in which standard and maximum telos are distinct (first case) or fall together (second case).

Table 6.1 Relationship between types of predications and types of telos

Type of predication	Type of telos
Degree achievement	No telos (= atelic)
Graded degree achievement	Derived standard telos (= standard value of *sehr*)
Accomplishment ungradable by *sehr*	Maximum telos (= absolute standard value)
Accomplishment gradable by *sehr*	Standard telos (entailment) and maximum telos (implicature)
Accomplishment graded by *sehr*	Like accomplishment gradable by *sehr*[a]

[a]The standard value of *sehr* has no effect on the telicity of predicates that are already telic; nevertheless the gradation by *sehr* has an effect on the truth conditions of the predications, as shown above

The test criteria indicate that a standard telos is compatible with a comparative result state. This comparative result state should not be confounded with the comparative truth conditions of degree achievements. A comparative result state is a lexicalized result state, which is compatible with different degrees of the obtained result. I assume that this kind of result state is normally denoted by gradable adjectives, while the result state of verbs that only obey a maximum telos, is denoted by ungradable adjectives.

A revision of Caudal and Nicolas' definition of telicity can be done based on the distinction between standard and maximum telos.[11] The revised definition is stated in (25); the requirement of the presence of a maximal scale value is changed to the presence of a specified standard value. According to (25) a predication is telic iff the event is mapped onto a scale on which a standard value that has to be reached is specified. It is left open whether it is a relative or an absolute standard value, so that the definition captures a standard as well as a maximum telos. The revised definition also gives an explanation of the fact that graded degree achievements are telic, since *sehr* introduces a standard value that has to be achieved.

(25) **Telicity:** A predication is telic if and only if,
   a. it has an associated set of degrees with,
   b. a specified standard value, and
   c. its verbal predication satisfies axiom `Become` [. . .].

Table 6.1 gives an overview of different types of predications and the type of telos they are related to. With respect to degree achievements graded by *sehr* it has to be mentioned that the telos is derived since it is identical to the standard value of *sehr*.

The view of telicity expressed above does not entail that a telos is an endpoint of an event. Rather a standard telos is compatible with situations that may progress further after the telos is reached. But this does not mean that in the case of

[11]The notion of a standard telos could also be used to explicate Borer's notion of the term sub-culmination point. But such an analysis approximates to the endpoint approach, since the different telos cannot be defined with regard to the notion of homogeneity.

accomplishments gradable by *sehr* no upper bound exists. Based on the previously mentioned distinction between standard and maximum telos, the following three subtypes of telic predications can be distinguished: (i) an accomplishment could only be related to a standard telos, (ii) it could only be related to a maximum telos, or (iii) it could be related to a standard as well as a maximum telos. In the first case, the scale is open, while in the second and third case, the scale is closed.[12] As indicated in Table 6.1, accomplishments gradable by *sehr* are assumed to belong to the third type. One reason for this assumption is that such accomplishments can be modified by *sehr* as well as by *vollständig*, as shown in (26). *Vollständig* requires an endpoint on the scale and this is realized by a maximum telos, but not by a standard telos. To do something completely entails that it was done until its maximum was reached and not just until the least value that counts as a result is achieved. Thus, the modifiability by *vollständig* indicates the presence of a maximum telos. The standard and the maximum telos of these verbs are of different status, since the maximum telos but not the standard telos can be negated without contradiction (as indicated by the test illustrated in (23)).

(26) a. Der Zustand hat sich vollständig stabilisiert
the condition has itself completely stabilized
'The condition has completely stabilized'
b. Die Situation hat sich vollständig normalisiert
the condition has itself completely normalized
'The situation has completely normalized'
c. In der Sonne trocknen Nacktschnecken vollständig aus
in the sun dry slugs completely out
'Slugs dry out completely in the sun'

At the end of Sect. 6.4 I presented two possible options which could account for the fact that some accomplishments cannot be graded by *sehr*. The first one was that *sehr* presupposes an open scale, while telic predications are related to closed scales. The second option was that *sehr* presupposes that the predicate it grades denotes a range of value on a scale, not just a single value. Given the data in (26) the hypothesis that *sehr* requires an open scale cannot be adhered to. Therefore it seems more plausible that the second option is relevant for an explanation of the fact that some telic change of state verbs can be graded by *sehr*. A (relative) standard telos is compatible with a telic predicate that truthfully denotes a range of scale values, so that this requirement of *sehr* is fulfilled. Accomplishments that are only related to a maximum telos truthfully denote a single value of the scale, which is incompatible with a gradation by *sehr*. One can predict that a relation between gradability and the type of telos of a (change of state) predicate exists, so that only accomplishments related to a relative standard telos are gradable by *sehr*, while accomplishments that

[12]It is an open question whether open scale accomplishments that are only related to a standard telos really exist.

are not related to such a standard telos should be incompatible with a gradation. In the next section I will test these predictions with data from Russian and French.

6.7 Predictions and Cross-Linguistic Comparison

A key result regarding the interaction of telicity and degree gradation was that gradability of change of state verbs is linked to the different types of telicity. It is predicted that verbs which are only related to a maximum telos cannot be graded by *sehr*. Verbs which are related to a standard telos should allow such a kind of gradation. In this section I will test these predictions with data from Russian and French, whereby I assume that the analysis of *sehr* presented in Sect. 6.3 can be transferred to the Russian degree adverb *očen'* as well as to the degree modifier use of French *beaucoup*.

6.7.1 Gradation of Change of State Verbs in Russian

Like German, Russian has a general intensifier *očen'* that expresses a general high degree and can only be used for degree gradation. A short but not extensive discussion of the gradability of verbs in Russian can be found in Gerber 1984, while Bitextina 1975 provides a short discussion of *očen'* and other degree adverbs in Russian. In the following I restrict the discussion to perfective change of state verbs, excluding aspectual prefixes from the analysis.

In (27) examples of degree achievements graded by *očen* are presented.[13] The effect of *očen'* is the specification of the extent of the change expressed by the verb. The unmodified verb *uveličivat'* only expresses that an (unspecified) increase in fortune obtains, while the verb graded by *očen'* (27-a) specifies it as a 'large' increase.[14]

(27) a. Ona znala, čto ix sostojanie vnezapno **očen'**
she.Nom knew that their.Gen fortune.Acc suddenly very
uveličiloc'.
increased
'She knew that their fortune has suddenly increased a lot'

[13]The examples in (27) are taken from the Russian National Corpus (http://www.ruscorpora.ru/en/index.html).

[14]In the Russian examples I have marked the case of the nouns in the glossed to indicate grammatical relations. Following abbreviations are used: Nom = Nominative, Acc = Accusative, Gen = Genitive, Inst = *Instrumental* and Prep = Prepositional.

b. **Očen'** *passširila* moi predstavlenija o russkoj
very extended my.Nom conception.Acc about russian.Prep
poezin XX veka Nadežda Januarievna Rykova
poetry.Prep 20th century.Gen Nadežda Januarievna Rykova.Nom
[...].
'My understanding of Russian 20th century poetry was extended very much by Ms Rykova'

c. Popytka uderžat aeroplan rulem vysoty **očen'**
attempt.Nom hold.on aeroplane.Acc wheel.Inst height.Gen very
uxudšila delo [...].
worsened case.Acc
'An attempt to hold the aeroplane with only the steering wheel worsened the thing a lot'

That degree achievements are gradable by *očen'* in Russian is not surprising, more interesting is that telic change of state verbs also allow such a modification. Examples of modified accomplishments are listed in (28).[15] The verbs *standartizirovat'* (*to standardize*), *stabilizirovat'* (*to stabilze*) and *unificirovat'* (*to unify*) are biaspectual (for this term cf. Forsyth 1970) and can receive a perfective interpretation without special marking of aspect. *Očen'* modifies the amount of change, like in the German examples. As was indicated with respect to the degree achievements graded by *očen'* in (27), the interpretation of gradation does not differ between both languages.

(28) a. Esli **očen'** *standartizirovat'* i poctavit' na potok vozmočno,
If very standardized and put on stream.Acc possible
eta cifra snizitcja do 150–200 tycjač
this.Nom number.Nom reduces up to 150–200 thousand.Gen
'If you standardize it very much and put it on the assembly line, the number could possibly decrease to 150–200 thousand'

b. Sejčas my provodim konsul'tacii s tem, čtob
now we.Nom conduct consultations.Acc with that.Inst to
vce-taki **očen'** *unificirovat'* tarify konsul'skix sborov [...].
ultimately very unify rate.Acc consular.Gen taxes .Gen
'At the moment we are negotiating with the aim of standardizing the consultate fares very much'

c. 1-oe, čto nužno sdelat' **očen'** *stabilizirovat'* sostojanie
first what need make very stabilize condition.Acc
bol'nogo [...].
ill.Gen
'The first thing that needs to be done, is to stabilize the condition of the injured a lot [...]'

[15]The examples are taken from the following sources: (28-a) http://cagey.livejournal.com/454951.html (04.08.2010), (28-b) http://turism.pp.ua/tags/%F1%E1%EE%F0/page/2/ (04.08.2010) and (28-c) http://medicinecedole.ru/188.php (04.08.2010).

After indicating that atelic and telic change of state verbs can be graded in Russian, I now turn to the relationship between gradability and the type of telos of the predicate. First, it has to be mentioned that the equivalents of some of the verbs that are gradable by *sehr* in German cannot be graded by *očen'* in Russian, for example the verbs *vysoxnut'* (*to dry out*) and *normalizovat'* (*to normalize*). Based on the above formulated prediction, these verbs should be related only to a maximum telos in Russian, while they are related to a standard telos in German. This is tested for the Russian verbs in (29) by using the comparative construction test introduced in the last section. Please note that some of the examples in (29) differ from the original formulation of the comparative test, since the comparative result state is not indicated by an adjective in the comparative form, but by the expression *but it could still further v*. In this case, it is stated that the telos is achieved with regard to the theme argument, but the process denoted by the verb can still continue. I assume that no relevant differences between both versions of the test exist. The examples in (29-a) and (29-b) do not receive a contradictory interpretation, while the sentences in (29-c) and (29-d) do. This indicates that *vysoxnut'* and *normalizovat'* are related to a maximum telos, while *stabilizirovat'* and *unificirovat'* are related to a standard telos. The results of the test sentences indicate that a relationship between gradability and the type of telos of an accomplishment can be found in Russian. It is relevant to note that *vysoxnut'* is built from the verb *soxnut'* (*to dry*) and the prefix *vy-*. Whether and how prefixation interacts with verb gradation is a topic for future analysis.

(29) a. Sostojanie pacienta stabilizirovalos', no moglo by byt'
condition.Nom patient.Gen stabilized but could still be
eščë stabil'nee
more stable
'The physical condition of the patient has stabilized, but it could be still more stable'

b. Provedenie èkzamenov unificirovali, no možno dal'še
conduct.Acc exams.Gen unified but can further
unificirovat'
unify
'The exams have been standardized, but they still could be further standardized'

c. ??Prud vysox, no možet i eščë vysoxnut'
pond.Nom dried out but might still further dry out
'The pond has dried out, but it could dry out still further'

d. ??Situacija normalizovalas', no možet eščë dal'še
situation.Nom normalized but could still further
normalicirovat'sja
normalize
'The situation has normalized, but it could normalize still further'

6.7.2 Gradation of Change of State Verbs in French

French is interesting in the context of degree gradation of verbs because the modifier *beaucoup* can be used for degree gradation as well as for extent gradation. The differences between *sehr* and *beaucoup* are illustrated by the examples in (30) and (31). In the (a) sentences the frequency of the event is modified and in the sentences in (b) the degree of the intensity of appreciating the film is graded. In German, two different modifiers for extent and degree gradation have to be used, while in French *beaucoup* is used in both cases. For a discussion of the distributional differences of *beaucoup* and adverbs like *sehr*/*viel* cf. Doetjes 1997, 2008 and Obenauer 1984.

(30) a. Er geht viel ins Kino
he goes much to.the cinema
'He goes to the cinema a lot'
b. Jean mochte den Film sehr
Jean liked the movie very
'Jean liked the movie very much'

(31) a. Il va beaucoup au cinéma Doetjes 1997, 136
he goes a lot to.the cinema
'He goes to the movies a lot'
b. Jean a beaucoup apprécié ce film Doetjes 1997, 128
Jean has a lot appreciated this movie
'Jean appreciated this movie a lot'

In this paper only the use of *beaucoup* as degree modifier is discussed, since with regard to change of state verbs *beaucoup* has an intensifying function. The interpretation of the degree gradation of the change of state verbs does not differ from the German and Russian examples, so that a uniform pattern regarding the interpretation in all three languages can be observed.

In (32) a few examples of degree achievements graded by *beaucoup* are listed.[16] The verbs discussed in the following are all used in the perfective, as was the case for the German and Russian examples too.

(32) a. Si mon état s'est **beaucoup** *amélioré* depuis quelques
if my condition itself-is a lot improved since several
mois [...]
months
'If my condition has greatly improved since several months [...]'
b. [...] cette perfide instabilité **diminua** *beaucoup* la confiance
this perfidious instability diminished a lot the confidence
et l'amitié que m'inspirait la nature.
and friendship that me-inspired the nature

[16]The examples in (32) are taken from a French online corpus (http://www.frantext.fr/).

'[. . .] this perfidious instability has greatly diminished the confidence and friendship that nature inspired in me.'

c. [. . .] les êtres dont l'organisation est très simple n'ont
the creatures whose the-organisation is very simple not-has
pu se **modifier** *beaucoup* [. . .].
could himself modified a lot
'[. . .] the creatures whose organization is very simple could not change a lot'

Examples of accomplishments graded by *beaucoup* are listed in (33).[17] It is again the case that not all of the accomplishments which can be graded by *sehr* in German allow a gradation by *beaucoup*. For example, the verbs *stabiliser* (*to stabilize*) and *normaliser* (*to normalize*) reject such a gradation.

(33) a. [. . .] et le lexique c'est **beaucoup** *standardisé* en s'alignant
and the lexicon that-is a lot standardized by itself.adapting
sur le haut-allemand de l'école et des médias.
to the high-German in the-school and in-the media
'[. . .] and the lexicon has been very much standardized by being adapted to High German in school and in media.'

b. Le Parti socialiste a **beaucoup** *homogénéisé* et ceux-ci ont
the party socialist has a lot homogenized and these have
perdus une grosse partie de leurs charmes.
lost a big part of their charm
'The socialist party has greatly unified its doctrine and they have lost a big part of their charm.'

As was done for the Russian examples, I will apply the comparative construction test to the French verbs to show the influence of the subtypes of telicity on verbal degree gradation. In (34) it is shown that the selected verbs, which reject gradation by *beaucoup*, are related to a maximum telos, while *standardiser*, which is gradable by *beaucoup*, is acceptable in the test construction and hence it is related to a standard telos.

(34) a. ??L'état du patient s'est stabilisé, mais il pourrait être
the-condition of.the patient itself-is stabilized but he could be
encore plus stable.
still more stable
'The condition of the patient has stabilized, but it could be more stable'

[17]Example (33-a) is taken from http://projetbabel.org/forum/viewtopic.php?t=7922 (04.08.2010) and (33-b) is from http://www.france24.com/fr/20081125-je-pense-pas-quune-scission-ps-soit-possible-parti-socialiste?quicktabs_1=0 (04.08.2010).

b. ??La situation s'est normalisée, mais elle pourrait se
the situation herself-is normalized but she could himself
normaliser encore plus.
normalize still more
'The situation has normalized, but it could normalize further'

c. La méthode de test a été standardisée, mais elle pourrait être
the method of test has been standardized but she could be
encore plus standardisée.
still more standardized
'The examination procedure has been standardized, but it could be further standardized'

The French as well the Russian examples demonstrate that the gradation of telic change of state verbs is not limited to German. Furthermore it is shown that a direct relationship between the gradability of change of state verbs and the presence of a standard telos exists. But the cross-linguistic comparison also shows that it is language specific which type of telos a verb in a certain language is related to. This leads to cross-linguistic variation in respect to the gradability of these verbs, but this variation is regular and based on the type of telos.

6.8 Conclusion

In this paper I have argued for a distinction between standard and maximum telos based on data of verb gradation. The central claim is that a telos can generally be interpreted as a standard value, be it a nonmaximal value that indicates the onset of the result state or a maximal scale value. This view of telicity makes it possible to explain why (i) telic change of state verbs can be graded by *sehr* (as well as *očen'* and *beaucoup*), (ii) degree achievements graded by one of these adverbs are telic and (iii) why some accomplishments reject such a gradation. It further accounts for the cross-linguistic variation regarding verb gradation observed in the last section.

The analysis presented here states that a telos is a specified standard value. Since *sehr* always introduces a standard value, one could assume that every graded predicate is telic. But it is only a subset of verbs gradable by *sehr* which shift from an atelic to a telic predication. Only in those cases, in which the scale is directly related to the event, does the gradation by *sehr* interact with telicity. This is shown in the examples in (35) and (36). Verbs of sound emission are atelic and remain atelic even if graded by *sehr*. On the other hand, the gradation by *sehr* shifts atelic verbs of substance emission to a telic reading.

(35) a. *Der Motor dröhnte in zehn Minuten
the engine droned in ten minutes
'The engine droned in ten minutes'

b. *Der Motor dröhnte sehr in zehn Minuten
the engine droned very in ten minutes
'The engine droned very much in ten minutes'

(36) a. ??Peter hat in kurzer Zeit geblutet
Peter has in short time bled
'Peter has bled in a short time'

b. Peter hat in kurzer Zeit sehr geblutet
Peter has in short time very bled
'Peter has bled very much in a short time'

In Sect. 6.4 I discussed the homomorphic mapping of scale and event in the case of change of state verbs. It is assumed that this homomorphism is introduced by the `Become` predicate in the decompositional structure of these verbs. For verbs of substance emission a tight coupling of the quantity scale and the denoted event is also reasonable since the amount of substance emitted accumulates while the event progresses. The more the event progresses, the more substance is emitted, which means that the value on the scale increases while the event progresses. This is different for verbs of sound emission. The intensity (loudness) of the sound does not increase while the event progresses. No relationship between the degree on the loudness scale and the progression of the event exists, therefore the scale cannot account for measuring out the event. Therefore it is reasonable to assume that a homomorphic mapping between event and scale is also the case for verbs of substance emission. But then the homomorphism is independent of event structure, since verbs of substance emission do not integrate a `Become` predicate in their decompositional structure.

I assume that gradation interacts with lexical and grammatical aspects if the progression of the event leads to a monotonic increase of the degree on the scale. If, as in the case of change of state verbs and verbs of substance emission, gradation is linked to the progression of the event and interacts with lexical and grammatical aspect, I call it *event-dependent degree gradation*. Gradation as exemplified by the verbs of sound emission will be called *event-independent degree gradation*, in this case the gradation scale is not linked to the event. The exact relationship between the scale and the event in the case of verbs of substance emission will be part of future work. Moreover it is an open question as to which semantic verb classes allow event-dependent degree gradation and therefore have to be analyzed with regard to a homomorphic mapping of the denoted event and same scale. Despite the questions addressed in this paper, verb gradation is a topic that can lead to a better understanding of the relationship between scalarity and lexical as well as grammatical aspect, but also reveals insights of the subatomic semantics of verbs.

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Chapter 7
On Adverbs of (Space and) Time

Kyle Rawlins

7.1 Overview

This paper presents a solution to a series of linked puzzles centering around what Cresswell 1977 called *adverbs of space and time*. Adverbs in this class include "quickly", "slowly", "suddenly", "immediately", "glacially", "fast", "rapidly", and others. The proposal I develop is that these adverbs in fact just measure time. In particular, I propose that the core meaning of these adverbs is a distributive degree predicate over events; a range of interpretive properties follow from the interaction of distributivity and event structure. I also propose that this distributivity has an effect on how the degree predication works, and in particular what type of measure function is used and what measure phrases are licensed. Cresswell's classification of these adverbs as spatial turns out to follow from the type of verbal predicate involved; they combine with VPs that involve directed change along some dimension of measurement, and VPs involving change in the spatial domain are a special case. For that reason they might be better called *adverbs of time and change*, though I will stick with Cresswell's label for this paper.[1] In the big picture, I propose that this notion of distribution of the adverbial property over the event structure leads to a unified notion of manner for some, but not all manner adverbs, and so the proposal is aimed in large part at an understanding of what a "manner" is.

The key new data centers around the distribution of what I will call *ratio* readings vs. *extent* readings of space/time adverbs. A concrete manifestation of this distinction comes in the form of the (surprising) fact that this class of adverbs in the

[1] Another term sometimes used in the cartographic literature is "celerative" adverbs (Cinque 1999).

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comparative takes two different types of measure phrases, characterizing rate and temporal extent, as in (1). (For the moment I will focus on adverbs adjoined low, in a "manner" position.)

(1) a. ✓ Alfonso ran to the park 2 miles per hour more quickly than Joanna.
b. ✓ Alfonso ran to the park 2 minutes more quickly than Joanna.

More familiar measure phrase constructions in the adjectival domain typically are compatible with only one type of measure phrase, determined by the dimension of the predicate, so clearly this in itself is a puzzle to be explained. Further, I will show shortly that the distribution of these types of measure phrases varies by lexical aspect, as well as position of attachment of the AdvP. (There will also be effects of grammatical aspect that I will largely set aside in this paper.) By giving an account of the distribution of ratio/extent measure phrases we can learn much about the properties of these adverbs, and adverbial modification in general.

A number of other authors have proposed that adverbs like "quickly" in the non-comparative form also give rise to ambiguities (Cresswell 1977; Travis 1988; Pustejovsky 1991; Tenny 2000; Thompson 2006; Eszes 2009). The terminology and particular characterization of the apparent ambiguity differs (I will expand on this later), but two paraphrases corresponding to ratio and extent measure phrases can be roughly mapped onto the previous proposals, as in (2).

(2) Alfonso ran to the park quickly.
a. ≈ Alfonso ran to the park in a quick manner.
b. ≈ Alfonso ran to the park in a short time.

On the ratio reading, "quickly" intuitively tells something about Alfonso's "manner" of running – he was running quickly. This reading can be paraphrased using "in a quick manner". But on the extent reading, the adverb tells us that the overall time it took to get to the park was short (this needn't be true on the ratio reading), and use of "in a quick manner" does not lead to this reading.[2]

One issue raised by much of this previous work is how we can differentiate the readings of space/time adverbs truth-conditionally, and how the readings are related. Many of these authors also discuss a third reading available only when the adverb is attached higher in the structure; see (11) below. Some authors also distinguish the ratio from the manner reading (where I have collapsed them into (a)), and/or set aside anything analogous to what I am calling the extent reading. My proposal is that the distribution of measure phrases, and the analysis necessary to account for it, must inform the analysis of any ambiguities in non-comparative space/time adverbs. In §7.3 I demonstrate using measure phrase data as well as a

[2]In general, I do not take "in an X manner" paraphrases to be a reliable diagnostic of actual manner readings; the distribution of this kind of adverbial does not closely match the distribution of the corresponding adverbs.

number of other arguments that certain proposed ambiguities in the literature must be collapsed, and that the availability of readings in the 'manner' position is greater than has been supposed. The result is a much simplified picture of what readings are available when, on a firmer empirical basis.

The above predicate ("run to the park") is an accomplishment predicate in lexical aspect terms (Vendler 1957; Dowty 1979 etc). This particular predicate shows both 'readings', but not all accomplishments pattern in the same way. An accomplishment predicate like "win the race"[3] allows only the extent reading and measure phrase.

(3) Alfonso won the race quickly.

(4) a. ✓ Alfonso won the race 10 minutes more quickly than last time.
b. * Alfonso won the race 2 miles per hour more quickly than last time.

I will propose that this distinction between accomplishments follows from a difference in the part-whole structure of the two types of events involved – "run to the park" involves an activity with a compositionally supplied culmination.

On that note, activity predicates pattern differently, allowing only ratio(/manner) readings and the corresponding measure phrases:

(5) Alfonso ran quickly.

(6) a. * Alfonso ran 10 minutes more quickly than Joanna.
b. ✓ Alfonso ran 10 miles per hour more quickly than Joanna.

Achievement predicates and semelfactives tend to be good with these adverbs only if they can be coerced to an accomplishment reading, with the adverb describing the time it took to get to the culmination:

(7) Alfonso reached the peak quickly.

(8) a. ✓ Alfonso reached the peak 10 minutes more quickly than Henry.
b. * Alfonso reached the peak 2 miles per hour more quickly than Henry.

In some cases, Rothstein's 2004 'slow motion' readings are available with adverbs of space and time (at least to the extent that they are available with parallel "for" adverbials; intuitions vary):

(9) (Regular slow motion readings)
a. Alfonso reached the peak for two minutes. (≈ the last step took 2 minutes.)
b. Alfonso sneezed for 15 seconds. (≈ a single sneeze extended for 15s.)

(10) a. Alfonso reached the peak very slowly. (≈ the last step was very slow.)
b. Alfonso sneezed slowly. (≈ a single sneeze was slow.)

[3]Note that "win" may also lead to achievement readings; these are blocked for reasons that will become clear, and aren't relevant to the present point.

My proposal is that in the case of 'processes' (in Bach's 1986 terminology, the type of event corresponding to an activity predicate), the measuring of time is distributed over the homogeneous part-whole structure of the process. In other cases, measuring does not distribute. Whether there is distributivity aligns with Krifka's 1989 distinction between quantized and non-quantized events. The basic idea that these adverbs are distributive is due to Cresswell 1977, but the account Cresswell develops is highly specialized, focusing just on manner modification of activity predicates and accomplishment predicates of the "run to the park" type, for verbs involving spatial movement. Cresswell also did not discuss the measure phrase data above (in fact, measure phrases are seldom discussed at all in the context of adverbial comparatives). I show how to generalize the core idea of Cresswell's account, distributivity, to handle the full range of data, and solve the puzzle of measure phrases as well. I give an account whereby regular measure function can be coerced into a ratio measure function in a composite dimension of comparison; this function measures change over time, where the dimension of change is supplied by the verbal predicate.

There is one more crucial type of example, much discussed in the literature. All of the above data involves the adverb being adjoined low, to VP. These adverbs can productively attach to a clause in a higher structural position. The difference in readings here goes beyond just the ratio vs. extent distinction, but along that dimension, adverbs of space and time allow only extent measure phrases regardless of lexical aspect. (There is, on the other hand, some interaction with grammatical aspect that I will mostly ignore.)

(11) Slowly, the students left the classroom.

a. ✓ 5 minutes more slowly than last class, a student left.

b. * 2 feet per minutes more slowly than last class, a student left.

The other main difference between (11) and a corresponding example with manner "slowly" is that, intuitively, (11) seems to measure the time that has passed since some previous event. The low-attached adverbs are more 'internal' in the sense that they characterize only properties of the event(s) described by the sentence itself. I develop an account of the distribution of these high-attached adverbs that reduces them to the same core meaning as the other cases, and derives this apparently anaphoric interpretation from the properties of the narrative discourses that it appears embedded in.

This last batch of data connects to an important puzzle for the account of adverbs across many classes, what I term the *scope puzzle*. This is that many classes of adverbs show apparent meaning alternations between their use in a high structural position, and in a lower/manner modifying position (Austin 1956; Jackendoff 1972; McConnell-Ginet 1982; Ernst 1984, 2002; Wyner 1994; Geuder 2000; Shaer 2004; Rawlins 2008; Martin this volume, a.o.). The alternation for "slowly" is visible in the above examples, where the primary distinction is anaphoricity and type of measure phrase. Here is a range of further examples drawn from various classes of

adverbs, where there are less subtle distinctions (see also Martin (this volume) for a more detailed overview of available readings):

(12) a. Clumsily, he trod on the snail. (Austin 1956)
b. He trod on the snail clumsily.

(13) a. Cleverly, John dropped his cup of coffee. (Jackendoff 1972)
b. John dropped his cup of coffee cleverly.

(14) a. Louisa rudely departed (McConnell-Ginet 1982)
b. Louisa departed rudely.

(15) a. Appropriately, Kim kissed Sandy. (Wyner 1994)
b. Kim kissed Sandy appropriately.

(16) a. Illegally, white moved a pawn. (Rawlins 2008)
b. White moved a pawn illegally.

For example, the sentence in (16a) is true if it was illegal for white to move a pawn at all, for instance if it wasn't their turn. But (16b) is compatible with scenarios where white was allowed to move a pawn somehow, but violated a rule in the particular move they made (e.g. moving a pawn diagonally without capturing).

The general problem can be framed in terms of *regular polysemy* (Rappaport-Hovav and Levin, 1998) in the adverbial domain: what is the shape of a systematic account of these alternations? Various approaches have been taken involving lexical (McConnell-Ginet 1982; Geuder 2000; Ernst 2002) or compositional (Thomason and Stalnaker 1973; Rawlins 2008) processes to derive the differences, but the jury is still out. Previous accounts of adverbs of space and time (Cresswell 1977; Schäfer 2002; Eszes 2009) imply a lexical solution – either there is simply accidentally polysemy, or the high-attaching adverbs are a metaphorical extension of the manner modifiers out of the spatial domain. Here I will pursue the hypothesis that adverbs of space and time, at least, share the same core meaning across positions, with the goal of deriving the differences from differences in compositional environment.[4] In particular, the behavior and distribution of high-attached adverbs of space and time will follow from independently motivated properties of narrative discourse.

In the remainder of this section I will set out some technical background about neo-Davidsonian approaches to events. In §7.2.1 I discuss the major previous analysis of adverbs of space and time, due to Cresswell. The goal there is not to argue against Cresswell per se, but rather to highlight the crucial ideas in Cresswell's analysis that mine will attempt to generalize. In §7.4 I present my own proposal, focusing first on manner modification, and then on sentence modification. Finally, in §7.5 I turn to the analysis of measure phrases and their distribution.

[4] See Piñón 2000 for a similar claim about "gradually".

7.1.1 The Neo-Davidsonian Backdrop

Part of the goal of this paper is to develop an analysis of space-time adverbs that is framed in an event semantics (following Eszes 2009). As such I will be adopting a neo-Davidsonian approach to adverbial modification (Davidson 1967; Parsons 1990, etc.) The basic idea is that sentences describe eventualities, and both verbs and adverbs denote properties of eventualities. Compositionally, sentences come to describe eventualities via an "Existential Closure" operation over an unsaturated event variable. I will assume here that existential closure is a type-shifting operator applied in order to produce a sentence of type t (Landman 2000), though nothing hinges on this particular formulation. Before getting into the details I will give the type conventions I am assuming:

(17) Types: e = individuals
v = events
s = possible worlds
τ = intervals
d = degrees

I will follow Kratzer 1996 (a.o.) and assume that a subject argument is assigned a thematic role by an agentive little-v, rather than directly by the verb:

(18) $[\![\mathbf{v_{agent}}]\!] = \lambda P_{\langle vt \rangle} . \lambda x_e . \lambda e_v . \textsc{Agent}(e) = x \ \& \ P(e)$

Though this assumption is not crucial, it makes the types of adverbs much simpler to work with. In this paper I will attempt to ignore tense and grammatical aspect as much as possible, though it will not be entirely escapable.

Putting these pieces together leads to a standard neo-Davidsonian account of an adverb like "slowly" (Davidson 1967; Harman 1972; Parsons 1990):

(19) a. $[\![\textbf{danced}]\!] = \lambda e_v . e$ was a dancing

b. $[\![\textbf{slowly}]\!] = \lambda e_v . e$ is slow

c. $[\![\textbf{danced slowly}]\!] = \lambda e_v . e$ was a dancing & e is slow
(Predicate Modification)

d. $[\![\textbf{Alfonso danced slowly}]\!] =$
$\exists e_v . \textsc{Agent}(e) =$ Alfonso & e was a dancing & e was slow
(Function Application (x2) + existential closure)

The question now raised in this neo-Davidsonian context is what exactly is involved in predicating slowness of an event. A version of this question was raised as a potentially insurmountable challenge to Harman's neo-Davidsonian analysis by Lakoff 1977, but here I take this question to be instead an opportunity to deepen our understanding of adverbs, event structure, degrees, and many other issues (see also Reeves 1977).

7.2 Background

7.2.1 The Ratio Analysis and Its Challenges

A core question, therefore, is what it means for an event to be slow. Cresswell provides an answer to that question, though not framed in terms of events: "The semantics of *quickly* [etc.] is concerned with the ratio of spatial distance covered to time taken to cover it" (Cresswell 1977). The idea works best with movement verbs:

(20) John walked quickly.
($\approx$ most subintervals that are walkings are above average speed for walkings of that length.)

More formally:

(21) Let center(a, t, w) be a function from moments in the interval t such that for any $m \in t$, (center(a, t, w))(m) is the center point of the space occupied by t at m.

(22) Let d be a function (a "metric") such that:
   (i) For any interval t, $d(t) =_{\text{def}}$ a real number giving the temporal extent of t.
   (ii) for any function from moments to points f, $d(f) =_{\text{def}}$ a real number giving the distance traveled during the domain of f.
   (i.e. $d \approx$ a multi-sorted measure function)

(23) $[\![\textbf{John walks quickly}]\!]^{w,t} = 1$ iff
For most minimal subintervals $t*$ of t which are intervals of John's walking in w,

$$\frac{d(\text{center}(John, t*, w))}{d(t*)} > \text{avg}\left(\left\{ \frac{d(\text{center}(b, t', w))}{d(t')} : t' \text{ is an interval where } b \text{ is walking} \right\}\right)$$

Cresswell develops a compositional analysis that derives this interpretation, and I don't propose to go over the compositional details, except insofar as the analysis I later develop resembles Cresswell's. The key component is that "quickly" functions to compare the ratio of distance to time (speed) for subintervals of the described interval where John was walking, to some average or standard speed for similar intervals. While Cresswell did not use an event semantics, the idea could be implemented in one: events that involve some distance traveled have a spatio-temporal trace (Krifka 1989; Piñón 1993 a.o.), and the ratio in question can be calculated from this trace. This proposal seems entirely adequate to account for the

truth conditions of data like (20). The ratio analysis additionally captures something like the ratio/extent ambiguity I introduced in §7.1; a version of this difference follows from what constituent the adverb modifies (note that the following parses are Cresswell's):

(24) John [[quickly walks] to the station]
(≈ most subintervals that are walkings are above average speed for walkings of that length.)

(25) John [quickly [walks to the station]]
(≈ most subintervals that are walkings-to-the-station are above average speed for walkings-to-the-station of that length.)

The intuition here is that one reading involves a quick manner of walking, and the other a quick overall coverage of the path to the station. The analysis captures the difference in terms of quantification over subintervals of different granularity, and this follows compositionally.

This analysis has two main benefits, each providing important insights. The first is that it handles 'manner' readings well, and the insight is that manner readings involve quantification over (typically short) subintervals of the event the sentence describes, where the sortal predicate is still true (e.g. minimal subintervals that are still walkings). A way of rephrasing the insight that I will take away from this is that a manner is a property that characterizes these minimal subintervals in some way. The second benefit is that it makes at least some correct predictions about the distribution of measure phrases (this is not an issue Cresswell explored). That is, by virtue of involving comparison of ratios to a standard, it predicts "miles per hour"-type measure phrases (ratio MPs) in examples like (20), and this is the right prediction:

(26) Alfonso walked one mile per hour more quickly than Joanna.

Unfortunately, the proposal has a number of disadvantages. First, it (by design) does not handle the high-scope readings, such as one reading of Cresswell's (27) (this is the reading where the time from some previous event until someone entered was short):

(27) Someone quickly entered.

Cresswell has this to say: "this use… does not seem to bear the literal and physical meaning which we have so far been studying." That is, it doesn't seem to be about distance traveled per se, and in fact Cresswell suggests that high-attached readings could be about something more abstract, such as the rate of a proposition becoming true. Schäfer 2002 makes a similar suggestion, that high-scoping adverbs of this type involve a metaphorical extension of a more physical reading. (See also Piñón's 2000 discussion of high-attachment readings of "gradually".)

Two disadvantages are really opportunities for development – the account does not as-is explain the selectional/distributional puzzles involving lexical aspect, and

does not connect the interpretation of the adverbs with more current theories of comparatives. But there are obvious lines of development for Cresswell's proposal to solve both of these issues, and one contribution of the present paper is to explore these. In particular, I will reformulate the ideas in the context of an event semantics, and more recent approaches to comparatives.

Finally, there are two more serious empirical problems. First, as we have already seen, the full distribution of measure phrases is complex, and the ratio analysis would not ever lead us to expect temporal extent measure phrases. Nonetheless, we find temporal extent MPs in certain contexts (see data in §7.1), and this has to be explained. To account for this I will end up proposing that the ratio readings are derived, not basic. A closely related problem is that the analysis really only works with motion verbs, but adverbs of space and time can apply freely to nearly any verb that involves some kind of change. Here are a range of examples:

(28) The water heated slowly.

(29) Alfonso sneezed slowly.

(30) Alfonso solved the problem quickly.

(31) Alfonso changed slowly into a werewolf.

(32) Alfonso ran in place quickly. (after Lakoff 1977)

In most of the above examples there is no change in terms of distance, but the sentence still seems intuitively to express some rate or ratio. For example, in (28) a natural paraphrase along the lines of Cresswell's analysis would be that the ratio of temperature increase to time for most short subintervals of heating is smaller than in typical comparable subintervals of heating. (As we might expect, the properties of measure phrases are affected by the verb as well; see data in §7.5.) The example in (32) illustrates that even with motion verbs, on the manner reading there isn't necessarily a change at all in location, i.e. distance needn't be covered. How can Cresswell's analysis be generalized to cover the full range of verbs that adverbs of space and time can combine with?

7.3 More Ambiguities?

The proposals above involve a lexical ambiguity triggered by syntactic position of the adverb. A number of authors (Travis 1988; Tenny 2000; Ernst 2002; Thompson 2006; Eszes 2009) have explored similar ideas, and in fact suggested extra readings beyond the two originating from Cresswell. Here I will focus on Eszes's 2009 proposal, as it is the most detailed. Eszes, following Tenny, assumes that there are three possible readings for space/time adverbs. One (which this literature calls 'aspectual modification' or as in Schäfer, 'temporal reading') is the reading appearing in high-attached positions (e.g. (11) above), and its existence is uncontroversial. In certain positions, these authors further distinguish between

'true rate' modification, and manner modification, as in (33) (Tenny's paraphrases). Furthermore, Eszes claims that the low-attached adverb in (34) (after ex. 7 in that paper) has only the manner reading, not the rate reading.

(33) Kazuko moved quickly to the window. (Tenny 2000 ex. 66)

a. Paraphrase: Kazuko moved her body in quick motions while progressing to the window, although her traversal of the path to the window might not have been a fast one. ("pure manner modification")

b. Paraphrase: Kazuko's traversal of the path to the window was fast. ("modification internal to the core event (true rate modification)")

(34) Kazuko moved to the window quickly.

How can these two readings be disentangled, given the similarity of truth-conditions that result? In fact, I do not believe there is evidence to distinguish precisely these readings. First, though (a) above is phrased by Tenny to try to make sure that it doesn't entail (b), native speakers do not easily accept the content of the "although"-clause in the paraphrase, and so this lack of entailment is far from clear. Second, though the (b) paraphrase does not necessarily entail the (a) paraphrase in a logical sense, when enriched with background knowledge, it is almost impossible for it to be true while the (a) paraphrase is false. Finally, the claim that (34) selects only for one of these paraphrases is in clear contradiction with native speaker judgments, for English at least. (It should be noted that much of Eszes's 2009 data is in Hungarian, and I will not deal with that data here.) Consequently, native speaker intuitions do not support distinguishing Tenny's paraphrases as readings.[5] To find different readings we must look for further evidence.

That is not to say that these paraphrases are wrong per se, though. First, the 'pure manner' paraphrase above is much more salient when there is no path expression in the same clause:

(35) Kazuko moved quickly while going to the window.

So we must be able to account for the interaction of these adverbs in cases where the event characterized does not involve a path directly. This example, in contrast to (33), does seem to be able to support the pure manner reading described by the paraphrase in (a) without committing to the rate reading in (b).

[5] Eszes (2009) phrases the claim quite strongly: "At first we might suppose that an analysis would be adequate which uses a scale structure with degrees ordered along the dimension of speed for the minimal parts (which may be considered separate bodily motions). However, this would result in an incorrect prediction, considering that the minimal parts make up the whole event, so that their speed values add up and determine the rate of the event, which means that on this supposition the rate reading would depend asymmetrically on the manner reading. Obviously, we have to make sure this does not happen." This is far from obvious, for English at least, and the quoted claim seems to be based entirely on Tenny's paraphrases. It actually seems to be correct that any rate-like paraphrase does depend on a manner paraphrase, and vice versa, as shown by the data below. In fact my proposal amounts to reducing the manner reading to a distributive rate reading.

I propose that the measure phrase data provides a useful independent window on the issue. There is clearly something like a rate reading, corresponding to the presence of a rate measure phrase. As we have seen, rate measure phrases appear with adverbs in the low-attaching position as in (34). This is clear evidence against the idea that this position doesn't allow for rate readings. With accomplishments, temporal extent measure phrases also work, as we have seen. Though I will have to largely set the intermediate positions aside for reasons of space, a rate MP also works there, but an extent MP is odd:

(36) Kazuko moved 1 m/s more quickly to the window than Henry.

(37) # Kazuko moved 1 s more quickly to the window than Henry.

Finally, in examples like (35) where apparently only the manner paraphrase works, we can still find rate MPs (an extent MP would be bad here, just as in (5) earlier):

(38) Kazuko moved 2 m/s more quickly than Henry while going to the window.

The evidence from measure phrases is completely inconsistent with the characterization of the ambiguities from previous literature. The low-attaching position supports both kinds of measure phrase. The intermediate positions supports only rate MPs. And examples which should have only a manner reading also support rate MPs. (As a reminder, the high-attaching 'aspectual' readings support only extent MPs.) In fact, the generalization that emerges is that rate MPs correlate with 'manner'. My proposal will be that the rate readings for space/time adverbs *are* the manner readings. Additionally, the previous literature would lead us to expect extent MPs only in the high-attached position, as this is the only position where the 'whole event' is modified (Travis 1988; Cinque 1999; Tenny 2000; see discussion in Tenny 2000 p. 322 and Eszes 2009 §4.2). In contrast, we find extent MPs in what previously have been described as manner-only slots. (While dealing with licensing of adverbs is not my main focus here, it is worth noting that this data is highly problematic for the Cinquean perspective that many of these authors have taken.)

Though the appearance of multiple MPs in low-attached positions is suggestive of an ambiguity, it is not in fact solid evidence that in examples without an MP we do have an ambiguity. For one thing, just as with Tenny's characterization, rate and extent paraphrases are not easy to disentangle truth-conditionally, so independent evidence is lacking. The alternative is that such examples are simply underspecified or vague. I will structure my analysis so that it is adaptable either way, though the precise proposal I develop here is on the ambiguity side.

Finally, I will briefly discuss Eszes's 2009 analysis, as I will be adopting several elements from it. In particular, Eszes gives an analysis in a neo-Davidsonian event semantics that treats adverbs of space and time as gradable predicates of properties of events or intervals. Depending on position, an adverb like "slowly" has access to the 'intensity' of the agent's atomic actions in the compositionally available event, or the rate of the event. "Slowly" would then tell us that whichever property it takes is low relative to the standard for similar atomic actions or events. Similarly to

Cresswell's ratio analysis, the manner/intensity readings involve distribution over event structure. The 'aspectual' readings (following Schäfer) involve comparison of contextually given intervals to a standard for similar intervals. The ambiguities that arise, arise from the range of things that the adverb can compare to a standard in a particular position. This account therefore allows for two additional possible answers beyond having a low rate to what it means for an event to be slow: the intensity of action is low, or its duration (as part of some salient interval) is long.

Since, as discussed above, neither the judgments nor the measure phrase evidence supports the ambiguities that the analysis is based on, I will not be adopting the proposal for generating these readings via lexical ambiguity. However, I will be adopting several components of the analysis. First, the treatment of adverbs of space & time as event predicates (from Tenny 2000; Ernst 2002; Torner 2003; Eszes 2009). Second, the idea of manner-like readings involving distribution over event structure (also present in Cresswell 1977). And most importantly, novel to Eszes's 2009 proposal, I will develop an account where adverbs of space and time are gradable predicates.

7.4 The Analysis

In this section I develop the analysis of adverbs of space and time in two parts: first I show how they work as manner (VP) modifiers, and then I turn to their properties when adjoined to a clause.

7.4.1 Manner Modification

My proposal for manner modification with adverbs of space and time involves two main ideas: (i) the core of the denotation of a space-time adverb is a degree function (following most directly Kennedy 1999, 2007; Kennedy and McNally 2005 on adjectives, as well as Eszes 2009), and (ii) the degree predication distributes over event structure (building on Cresswell's insight and Eszes's 2009 treatment of manner readings). I develop the proposal in two steps, corresponding to these ideas.

7.4.1.1 Manner Adverbs and Degrees

I develop the idea here that manner adverbs involve the same kind of degree predication as gradable adjectives. The idea is hardly unprecedented; there is a long tradition in the adjective literature of making just this assumption, most typically as a secondary issue (see Bowers 1970, 1975; Bresnan 1973; Cresswell 1977; von Stechow 1984; Rullmann 1995; Alexiadou 1997; Haumann 2004 a.o.). The idea has also been explored in the morphosyntax of adverbs and adjectives by Zwicky 1989, 1995. Why is a degree analysis important for understanding space-time

adverbs? It provides the key to understanding the derivation of Cresswell's ratio interpretation, as well as the conditions under which it is derived. It also provides the key to understanding the distribution of measure phrases, as well as the behavior of these adverbs with verbs of directed change that do not involve motion per se. It also provides the key to understanding how 'intensity' readings as in Eszes 2009 can be derived from a single entry for the adverb.

The main standard argument for connecting degree predication in adverbs to that in adjectives is that adverbs typically take the same sorts of degree morphology; intensifiers ("very"), comparative structure ("more ... than ..."), and comparison class marking ("for" phrases). And we have of course already seen that the comparative forms take measure phrases.

(39) Alfonso drove very slowly.

(40) Alfonso drove more slowly than Henry.

(41) Alfonso drove as slowly as Henry.

(42) Alfonso drove slowly for an American.

Degrees and Adjectives

On the Kennedy(/McNally) analysis of gradable adjectives Kennedy 1999, 2007; Kennedy and McNally 2005, the core lexical entry involves at least three parts: a measure function, a domain in which the measurement is occurring, and an ordering relation on that domain. For instance:

(43) $[\![\textbf{tall}]\!] = \lambda x_e \,.\, \textsc{Height}(x)$ type: $\langle ed \rangle$
DIMENSION: height, ORDERING RELATION: >

In cases where the adjective is used as a positive predicate without extra degree morphology, this core meaning composes with a covert "positive" degree operator, leading to a predicate that measures its argument along the relevant dimension, and compares that measurement to some standard (von Stechow 1984). The positive degree morpheme is defined in (44), and a composed example involving "tall" in (45).

(44) $[\![\textbf{pos}_{\textbf{adj}}]\!] = \lambda P_{\langle ed \rangle} \,.\, \lambda x_e \,.\, P(x) \succeq s(P)(C)(x)$ type: $\langle \langle ed \rangle \langle et \rangle \rangle$
where s is a contextually provided standard function, and C a contextually provided comparison class.

(45) $[\![\textbf{[pos [tall]]}]\!] = \lambda x_e \,.\, \textsc{Height}(x) \succeq s(\textsc{Height})(C)(x)$

I will be non-specific about how the standard and the comparison class get filled in, as this issue goes well beyond the scope of the present paper, but in all of the cases we are interested in, the comparison class has some dependence on the modified predicate.[6]

[6]The challenge, pointed out to me by an anonymous reviewer, is to ensure that the right comparison class is chosen when an event's atoms could have multiple true descriptions, e.g. the parts of a slow

I am assuming, informally at this point, that the $\succeq$ operator in the denotation of "pos" gets filled in with the lexically specified order (in this case $>$), and that the comparison is performed only along the specified dimension. For the moment, D_d can be treated as isomorphic to the reals, and so operators like $>$ have the usual definition as total linear orders. To implement this fully we would need a formalization of dimensions, but at this point that is not necessary. Dimensions will be necessary to handle the distribution of measure phrases, and so in §7.5 I will give a formalization of dimensions based on Alrenga 2007, 2009.

Degrees and Adverbs

This analysis can be applied directly to adverbs. I take the core of a space-time adverb to involve measuring the length of an event. A sample denotation for "quickly" is given in (48). Note that this entry is not fundamentally different than what might be used for the adjective "quick". Its antonym "slowly", I assume here, would involve simply reversing the order, analogous to pairs like "hot"/"cold".[7] This is shown in (49).

(46) For any event e, $\tau(e) \underset{\text{def}}{=}$ the temporal trace of e (a possibly discontinuous interval).

(47) For any (possibly discontinuous) temporal interval i,
$|i| \underset{\text{def}}{=}$ the maximal temporal extent of i.

(48) $[\![\textbf{quickly}]\!] = \lambda e_v\,.\ |\tau(e)|$ type: $\langle vd \rangle$
DIMENSION: temporal extent, ORDERING RELATION: $<$

(49) $[\![\textbf{slowly}]\!] = \lambda e_v\,.\ |\tau(e)|$ type: $\langle vd \rangle$
DIMENSION: temporal extent, ORDERING RELATION: $>$

As in the adjectival domain, in cases where we see a gradable adverb without overt degree morphology, I assume that there is a covert positive comparison operator. A first pass at this item is given in (50), and its syntax is shown in (51).

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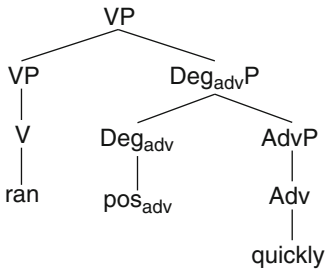
run might be non-differentiable from the parts of a fast jog. It is clear that we cannot simply extract this information from the event argument to s, as a previous version of this proposal suggested. This problem is very similar to the case where a short basketball player might be tall for a linguist; again we need a comparison class independent of the individual being measured. The analysis of "slowly" and "quickly" developed in the following sections adds in the additional problem of distribution to atoms, which makes it even more difficult to extract meaningful information about what the comparison class should be from the event itself.

[7] Intuitively, it seems plausible that "slowly" and "quickly" are further apart on the scale than mere reversal of order would suggest. We also would need to differentiate other adverbs such as "glacially", etc. This is analogous to understanding the lexical differentiation of e.g. "hot" and "warm". While formal semantic theories of degree modification have not focused on this kind of lexical difference, a natural solution has been developed in the computational semantics literature (Raskin and Nirenburg, 1996). This solution simply introduces an additional parameter into the lexical meaning, that allows adjusting the standard of comparison.

(50) **Positive adverbial degree morpheme, version 1**
$[\![\textbf{pos}_{\textbf{adv}}]\!] = \lambda P_{\langle vd\rangle} . \lambda e_v . P(e) \succeq s(P)(C)(e)$ type: $\langle\langle \text{vd}\rangle\langle \text{vt}\rangle\rangle$
where s is a contextually provided standard function, and C a contextually provided comparison class.

(51)



Again, I am assuming that $\succeq$ fills in for the ordering relation provided by the adverb; see §7.5 for details. As in the adjectival domain, Deg heads can be transitive, and a standard analysis of "more…than…" can be imported. Assuming that a "than"-phrase denotes a degree:

(52) $[\![\textbf{more}_{\textbf{adv}}]\!] = \lambda P_{\langle vd\rangle} . \lambda d_d . \lambda e_v . P(e) \succ d$ type: $\langle\langle \text{vd}\rangle\langle \text{d}\langle \text{vt}\rangle\rangle\rangle$

Other degree heads can be transferred to the adverbial domain similarly. In fact, the differences are so minimal that we might well give a single cross-categorial denotation to them, and apply type-shifts to coerce them into event or individual measurement as necessary (though I will not pursue this idea further here).

7.4.1.2 Distributivity

This sketch illustrates how to import the Deg analysis of gradable adjectives into the adverbial domain, but unfortunately it won't yet capture most of the interpretive patterns we are interested in. For example, in combination with an activity predicate (as in "Alfonso ran quickly"), it would predict that we compare running events of indeterminate length against each other. It seems that we should allow for Alfonso running quickly for an hour, even if Joanna ran slowly for an hour. To solve this we need some alternative way of measuring durations of events that doesn't rely on the entire run-time, and that works for both telic and atelic predicates. The analysis as it stands also leads to the expectation that we should use only temporal extent measure phrases in comparatives, the inverse of the ratio analysis' incorrect prediction.

The first step at remedying these problems is this: I propose that manner modifiers distribute over event structure, if they can. To condition how and when distribution happens, I will appeal to Krifka's 1989 distinction between quantized and non-quantized events (corresponding basically to activities on the one hand, and achievements/accomplishments on the other). An event's part-whole structure,

on Krifka's 1989 terminology, is non-quantized if it has a part-whole structure that is homogeneous with respect to the verbal predicate. It is quantized if this is not the case. For instance, a running event is non-quantized because because it has many parts that are themselves runnings, and those parts have such parts, etc. A running-to-the-park event is quantized because, while it has many parts that are running events, it has no proper parts that are also running-to-the-park events. This distinction in quantization turns out to predict much of the behavior of space-time adverbs. This idea for handling adverbs is really due to Cresswell 1977: there it effectively corresponds to whether the verbal predicate is homogeneous over the interval, or not.

One piece of evidence that ratio readings are distributive is that overt ratio measure phrases are compatible with "on average":

(53) Alfonso ran two miles per more quickly on average than Joanna.

(54) # Alfonso ran to the park two minutes more quickly on average than Joanna. (Ok on non-episodic reading.)

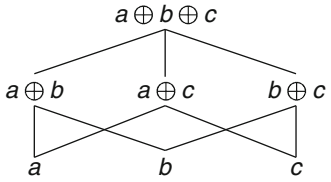
This use of "on average" requires a set of multiple measured events to average over, and distributivity over activities supplies this.[8] Its infelicity with extent measure phrases in episodic readings follows from the fact that there is only one event to average over.

Distributivity operators are more typically applied to individuals, except in the case of pluractional operators (Lasersohn 1995), and van Geenhoven's notion of cross-domain distributivity (van Geenhoven 2004, 2005). A central part of this proposal therefore is that adverbs of space and time are a species of pluractional operator. The idea is that what "quickly" etc. measure the length of, on ratio readings, is not the whole event, but minimal parts of the event. (In extent readings, the whole event will trivially be the only minimal part of the event.)

The implementation of distributivity I adopt here is standard. I assume that eventualities have a plural structure analogous to individuals (Bach 1986; Link 1987, 1998; Krifka 1989; Zucchi and White 2001 etc.), which in some cases can be modeled as join semi-lattices. A join semi-lattice is a set with a partial order and a binary join operator ($\oplus$) – the ordering relation here models part-whole structure, and the join operation the combination of parts into wholes. The set must be closed under join. For the moment I will focus on atomic semi-lattices, where there are minimal elements in the ordering relation, and all other members of the set can be constructed from these atoms using joins. A simple three-element atomic join semi-lattice is illustrated in (55). The top element ($a \oplus b \oplus c$) represents a plural event, and the bottom nodes are atoms.

[8] See Kennedy and Stanley 2009 for an analysis of a fairly different set of cases of "average" that involves averaging a series of measurements.

(55) **Example three-element atomic join semi-lattice**



I will make use of this kind of part-whole structure in a somewhat complicated way. A more standard approach is to assume that events have non-trivial part structure only when that structure forms a join semilattice. I do not assume that here, as I don't think it allows us to adequately explains the data. Rather I will allow more complex part structures (being mostly agnostic about how they work), but provide machinery for getting at homogeneous semilattices as a privileged special case. First, some basic tools for identifying the right kind of part-whole structures:

(56) A set of events X is homogeneous with respect to a property P iff $\forall e \in X : P(e) = 1$.

(57) $\text{lat}(e, P) =$ the maximal set of parts of e that form an join semilattice that is homogeneous with respect to P

Now, to put these to use. In order to handle the ambiguities with complex accomplishments (see §7.4.1.4 below) I will define a notion of immediate accessibility: this makes the event itself (e in this definition) accessible, and also any immediate parts. The goal here is to capture the behavior of accomplishments that consist of activities plus a culmination (e.g. "run to the park"). I then define the set of atoms from some homogeneous part-whole structure.

(58) An event e' is immediately accessible from another event e iff
$$e' \leq e \wedge [\forall e'' : e' \leq e'' \leq e](e'' = e \vee e'' = e')$$

(59) $\text{HATOMS}(e, P) \underset{\text{def}}{=}$ the set of atomic parts in $\text{lat}(e', P)$, where e' is an event immediately accessible from e.
Defined only if $\text{lat}(e', P)$ is atomic.

Note that despite using "the" in the definition of 'HATOMS' in (59), I intend this definition to be underspecified. The point of underspecification is the choice of e', for which there can be multiple options in certain special cases. A fully quantized event will return the trivial lattice structure containing only itself. (I.e. $\text{HATOMS}(e, P) = \{e\}$). But in the case of e.g. "run to the park", this operator can return either the trivial accomplishment lattice, or the lattice corresponding to the running activity leading up to the arrival at the park, depending on the choice of e'. (I return to this in §7.4.1.4.) In most cases, the behavior of "HATOMS" is simple, however; for a quantized event it returns the singleton set containing that

event itself, and for a non-quantized event, the part-whole structure that forms a join semi-lattice.

In the context of an atomic join semi-lattice, some generalized distributivity operators can be defined as follows: (These are most directly from Landman 2000, but similar operators can be found in Link 1983, 1987, 1998; Schein 1993; Lasersohn 1995; Schwarzschild 1996 a.o.)

(60) Where C_H is some highly salient property of events (supplying a homogeneity criterion):
For any f of type $\langle\alpha\langle \text{vt}\rangle\rangle$, ${}^{D}f \underset{\text{def}}{=} \lambda P_{\alpha}.\lambda e_{v}.\forall e' \in \text{HATOMS}(e, C_H),\ f(P)(e')$
For any f of type $\langle\alpha\langle\beta\langle \text{vt}\rangle\rangle\rangle$,
${}^{D}f \underset{\text{def}}{=} \lambda P_{\alpha}\ .\ Q_{\beta}\ .\ \lambda e_{v}\ .\ \forall e' \in \text{HATOMS}(e, C_H),\ f(P)(Q)(e')$

The only mysterious part of these operators is the source of C_H, the homogeneity criterion. There are various ways to go, but here I have chosen for it to be contextually supplied. (Compare Cresswell, who effectively supplies a homogeneity criterion compositionally, from the predicate the adverb modifies.) This is perhaps too weak, as in the vast majority of cases I intend it to provided be the modified VP. (Once again, the complication is to handle accomplishments with an initial activity part.)

A distributive version of the "pos" operator is shown in (61):[9]

(61) **Positive adverbial degree morpheme, version 2**
$[\![{}^{D}\textbf{pos}_{\textbf{adv}}]\!] = \lambda P_{\langle vd\rangle}\ .\ \lambda e_{v}\ .\ \forall e' \in \text{HATOMS}(e, C_H) : P(e') \succeq s(P)(C_C)(e')$
Defined for e only if $\text{HATOMS}(e, C_H)$ is defined, and where s is a contextually provided standard function, and C_H is some highly salient property of events providing a homogeneity criterion, and C_C is a salient comparison class.

This operator composes with the core of an adverb as before, but now leading to comparison of the atoms of the event to a standard. Since the standard is relativized to the events in question, I assume that the comparison relates atoms of the event in question to other similarly atomic events.[10]

(62) $[\![[\textbf{DegP}\ {}^{D}\textbf{pos}_{\textbf{adv}}\ [\textbf{AdvP}\ \textbf{quickly}]]]\!] =$
$\lambda e.\forall e' \in \text{HATOMS}(e, C_H) : |\tau(e')| \succeq s\left(\lambda e''_{v}\ .\ |\tau(e'')|\right)(C_C)(e')$
Defined for e only if $\text{HATOMS}(e, C_H)$ is defined.

The intuition for e.g. "runs quickly" is that we look at the minimal parts of a running event that are still runnings (the verbal predicate provides the homogeneity criterion,

[9]The distributivity operator applies straightforwardly to "more", but forces us into some tricky assumptions. In particular, I will assume that a "than"-phrase with a distributive gradable predicate applying to the degree gap denotes the average degree for that distribution.

[10]Can the homogeneity criterion and the comparison class be identified? It seems plausible that they could be, but I will not try to settle the issue now.

and thus defines the semi-lattice structure), and check whether they are all[11] shorter than typical comparable minimal runnings (determined by C_C. For a running event, these atoms naturally correspond to something like individual steps or motions, similar to the distribution over actions in Eszes 2009. While it is important to understand how C_C is supplied, the issue goes beyond the scope of the present paper. I do not believe that it is a fundamentally different problem than supplying the comparison class for attributive adjectives, and thus will assume that any correct solution for that case can be applied here.

In consequence, when a degree predicate distributives over a quantized event, it involves trivial universal quantification over a single element – that event itself. This derives the fact that with accomplishments, space-time adverbs seem intuitively to describe the length of the entire event, and the type of measure phrases allowed match.

7.4.1.3 Atomicity

I have so far assumed that distribution happens to atoms. This is intuitively plausible for running events, but it makes the prediction that combination of "slowly" etc. with a verb that describes an event without atoms will be infelicitous. (The presupposition introduced by the distributivity operator will fail.) This may be right in some cases[12], but there are many felicitous combinations, for example driving quickly, falling quickly, etc., that seem to challenge this idea. It is entirely unclear that driving events, though homogeneous, should have atoms of the right type, or at all; driving is much more continuous, and the agent's actions are not what an adverb describes. For that matter, native speakers tend to lack access to intuitions as to precisely what the atoms of running events are. As a matter of natural language metaphysics, it has proven surprisingly difficult to adjudicate questions of whether processes have atoms in general (see Link 1998 ch. 12, Rothstein 2004 for discussion), but for the account to go forward, I will need to make an assumption one way or the other.

An analogous problem has appeared in the literature on mass terms, the canonical non-quantized expression in the individual domain. Chierchia 1998 made a similar assumption, that even mass terms like "water" involve atomic part-whole (join semi-lattice) structures. Chierchia 2010 develops this idea in an interesting way that I will follow here. In particular, he proposes that what mass terms like "water" lack is not atoms, but rather, a stable way of individuating the atoms. The proposal is that the part-whole structures for these terms are vague, and don't identify a single individuation scheme, but that for any way of making the part-whole structure precise, there are identifiable atoms. (One way of thinking of an individuation

[11] Substituting a "most"-type quantifier, to more closely parallel Cresswell's analysis, would be straightforward.

[12] A potential example is "*Alfonso slept quickly" (Katz, 2003); but here I think the problem may be lack of directed change rather than lack of atoms.

scheme is as a minimal cover of the part-whole structure; cf. Schwarzschild 1996.) Plural terms that involve stable atoms (e.g. count plurals, and some mass terms such as "rice" or "furniture") don't characterize a part-whole structure that is vague in this way. See also Rothstein 2010 for a related, independent proposal – that some mass terms are atomic relative only to a particular context, and some are atomic in a context-independent way.

I will adopt the same assumption for the part-whole structure characterized by non-quantized event predicates. That is, such part-whole structures are vague but for any way of making the structure precise, there are identifiable atoms. Distributivity is still well-defined for any precisification (way of making the atoms precise), but vague. I won't import Chierchia's formal implementation of this idea (using supervaluations) to the event domain, but the importation is straightforward. In fact, I will suggest in §7.5 that it is the instability that drives coercion to ratio measures.[13]

7.4.1.4 Explaining the Aspectual Patterns

Before turning to adverbs of space and time in the high structural position, I will briefly go through the details of the interaction of the above proposal with lexical aspect. As noted above, the interactions follow from the part-whole structure of the events.

First, the two clearest cases are accomplishments with no internal activity component, and activities. I showed in the introduction that accomplishments like "win the race quickly" involve only extent readings and measure phrases. For example:

(63) We chatted a bit and it dawned on me that he'd won the entire race 20 minutes faster than it took me to complete the first 62 miles. (via Google)

(64) The 4G iPod touch booted 2 seconds more quickly (26 seconds versus 28 seconds), but apps launched equally as fast on the two iPods and the two performed nearly identically in a variety of applications. (via Google)

In both examples the adverb requires a temporal extent measure phrase, and even without it, would describe the length of the whole winning/booting event. There is no intuition that the adverb describes the manner of motion or change, and "in a quick manner" can't be substituted (for the same reading; other manner-ish readings may be available). This follows straightforwardly on the account developed above. Assume that "win the race" is the only highly salient predicate that could be used to individuate events in a part-whole structure. There is only one winning-the-race event, and its parts are not winning-the-race events, so the only homogeneous join semi-lattice is the trivial one consisting of that event itself. (That is, the event is

[13] An alternative idea, along the lines of Schwarzschild 1996, would be to assume that the part-whole structure is not necessarily atomic, but that when it is not, we construct an atomic approximation using minimal covers.

quantized.) Consequently, distribution over event structure is trivial, and the event that is measured is the entire winning-the-race event itself.

Activities are the inverted case. They take only ratio measure phrases, and have only ratio/manner readings. For example:

(65) Alfonso ran 2 miles per hour more quickly than Joanna.

(66) and the car stops from high speeds with little drama (as we found out on the autobahn when an old plastic Communist-era car pulled into our lane going about 75 mph more slowly), aided by standard Brake Assist. (via Google.)

(67) It's tremendous; indescribable. With most of the traffic travelling 20 to 25 mph faster than anyone else. (via Davies 2004)

I will not deal with the measure phrases until §7.5. But the reason for the ratio reading becomes clear: distributivity is not trivial, and what is being measured is the length of the (unstable) atoms of the running/driving/etc. event, rather than the whole thing. In cases where these atoms involve some particular type of motion by an agent (e.g. running, jogging, walking), from the length of the atoms we learn something about other, more manner-esque, characteristics.

Many accomplishments are derived compositionally, and these are often composed of processes and culminations. The empirical generalization is that such accomplishments freely permit both temporal extent measure phrases, and ratio measure phrases. (Most speakers accept the ratio examples, but I haven't found any attested examples.)

(68) His wife, Annabel, had run the London marathon three minutes faster than he managed at Reykjavik. (via Google)

(69) Alfonso ran the marathon 3 miles per hour faster than last time.

On the present analysis this is captured by making the activity subevent of the running-the-marathon event 'immediately accessible' from the running-the-marathon event itself. The 'HATOMS' function therefore will either return the singleton set containing the entire event, or the atoms of the activity subevent, depending on the choice of e'.[14] This differs from Cresswell's proposal, which tries to derive differences of this type purely from attachment ambiguities. The reason I have differed in this way is that I do not take sentence-final adverbs to be plausibly ambiguous as to their attachment site[15], but both readings and measure phrases are clearly available.

[14]See Torner 2003 for a similar proposal to explain the behavior of Spanish space/time adverbs in this type of context.

[15]Though on a Cinque 1999/cartographic approach one might expect that apparent right-adjunction is accomplished via (possibly remnant) movement of VP past a higher attachment point for the adverb than is apparent from surface structure.

Achievements and semelfactives (as in "sneeze") are quantized, but not normally considered to be durative. Since the adverbs in question measure time, we would not expect them to be compatible with a non-durative event, and this is the correct prediction. They are licensed only if a "slow motion" reading (Rothstein 2004) is available, and in this case, we get an extent reading.

(70) Alfonso sneezed for 0.23 seconds.

(71) Alfonso sneezed 0.23 seconds more slowly than Joanna.

Finally, adverbs of space and time aren't compatible with stative VPs at all in this low-attached position. This isn't entirely surprising, as by and large, manner modifiers aren't compatible with stative predicates at all (Katz 2003). Katz' account is that (following Kratzer 1995) state verbs don't have an eventuality argument at all, so there is no state variable to be modified. This is a potential explanation for this special case; but here I will be (mostly) agnostic about the presence of state variables. Part of the proposal for the distribution of sentence modifying adverbs of space and time is that they have a strict sortal restriction to events proper, and this would also explain the inability to modify stative VPs.

This completes the core analysis of manner modification with space/time adverbs, though I will revisit many of these issues in the context of measure phrases. Now I turn to sentence modifiers.

7.4.2 Sentence Modification

When an adverb of space and time modifies a whole clause, it apparently measures the time from some previous event until the event described in the modified sentence.[16] For example, in (72), the contribution of "slowly" is to tell us that it took a while after the instructor's arrival before they got set up. In fact, if the discourse does not set up a prior event, as in (73), a high-attached adverb is not acceptable (though a manner adverb would be fine).

[16]One extremely interesting case I will not deal with is noted by Shaer 1998; when these adverbs attach to questions or commands they have a different effect:

(i) Quickly, talk to Alfonso.

(ii) Quickly, what is the capital of Spain?

What is measured here, apparently, is the time between the present speech event and the event that would occur if the command is obeyed, or the speech event that would be involved in answering the question. Similar effects happen with other types of high-attached adverbs in non-assertions, e.g. "frankly" (Isaacs and Potts, 2003).

(72) The instructor walked in. ✓ Slowly, he set up.

(73) (beginning of narration) The class was taking forever to get going.

a. # Slowly, the instructor set up his computer.

b. ✓ The instructor set up his computer slowly.

The puzzle that this data presents is how to give a unified account of adverbs of space and time for both structural attachment positions. As noted earlier, this challenge resembles problems of adverb interpretation and scope that span a wide range of adverb classes (Austin 1956; Jackendoff 1972; McConnell-Ginet 1982; Ernst 1984, 2002; Wyner 1994; Geuder 2000; Shaer 2004; Rawlins 2008 a.o.)

A second generalization, not discussed in previous literature, is that high-attached adverbs of space/time are not generally acceptable unless the clause they attach to is embedded in a narrative discourse. (By narrative discourse I mean the kind found in e.g. narration of stories, where events are described one after the other; see Kamp and Rohrer (1983) and other references below.) How can this generalization be captured?

One obvious move is to posit two lexical entries for each of these adverbs. This has been the dominant approach in the literature so far, with Cresswell 1977 and Schäfer 2002 assuming that the different uses are only indirectly related (Schäfer specifically proposing a metaphorical extension analysis for the high-attached adverbs), and a similar though more motivated proposal by Eszes 2009. I think this is the wrong move for a number of reasons. Cresswell's motivation for separating out these cases were that they didn't involve a ratio reading, and they didn't involve physical movement. But we have seen that non-ratio readings are also available with low-attached adverbs, and these adverbs in general don't require physical movement (see data in §7.5). Furthermore, a lexical ambiguity approach doesn't explain why interpretive differences correlate with position, or why so many classes of adverbs show scopal alternations resembling this one (see §7.1). McConnell-Ginet 1982; Geuder 2000; Ernst 2002 make use lexical processes for deriving one reading from another, leading to (in some sense) a more explanatory account of adverb scopal alternations, but this kind of analysis still leaves the direct connection to scope unexplained. The Cresswell/Schäfer approach fits into this class: proposing that high-attached adverbs of space and time involve metaphorical extension fails to explain two issues: (i) how freely these adverbs do appear, at least in narrative discourse, and (ii) the similarities between non-ratio readings across positions. Furthermore, no precise version of the metaphorical extension account has yet been given, so it is more of a straw-man than a worked out competitor. Ideally we would want the interpretive differences to follow from the compositional semantics, as in the accounts of Thomason and Stalnaker 1973; Rawlins 2008. Rawlins in particular proposes that adverbs attach and compose freely, but their interpretation at different points of attachment is mediated by a family of adverbial type shifts. For adverbs of space and time, I will give an account that does not require type-shifting, but

involves free attachment with interpretation following compositionally from the structure at the point of attachment.[17]

The proposal I develop here is that adverbs of space and time are predicates of events, and only events (not other abstract entities such as propositions, intervals, facts, states, etc.). This follows part of Schäfer's 2002 proposal – that adverbs of this type are "pure manner adverbs" along the lines of "loudly", which in general have only event-predicate interpretations in ad-clausal positions. Furthermore, I propose that at the structural point where these adverbs attach high, events are only compositionally available in sentences embedded in a narrative discourse. This idea is an extension of existing treatments of narrative discourse, though as we will see, the present analysis needs a slightly more complicated event structure than the standard. The kind of event compositionally available, which I refer to as a "narrative event", is always quantized, and so ratio readings are never available.

7.4.2.1 Narrative Discourse

There are three core properties of narrative discourse, two of which will be key to the distribution of adverbs of space and time. The most commonly addressed one is *ordering*: the temporal order of events described in a narrative discourse matches the utterance order (Kamp and Rohrer 1983; Partee 1984; Dowty 1986; Hinrichs 1986; Lascarides and Asher 1993; Kehler 1994; Asher and Lascarides 2003 a.o.; cf. Grice's 1975 maxim of manner).

A second constraint is what I will call *immediateness*. This states that if e_1 precedes e_2 in a narrative event sequence, by default e_2 closely or immediately follows e_1. Dowty 1986 characterizes immediateness by saying that "no event of crucial importance to the narrative overlaps with the two successive events or intervenes temporally between them." The reason this constraint is a default constraint is that overt time adverbials can directly affect the alignment of events. An alternative formulation of immediateness due to Asher et al. 1996; Asher and Lascarides 2003 is that e_1's post-state must overlap with e_2's pre-state. (On this view, what I will characterize as the narrative event is the minimal event temporally containing e_1's pre-state $\oplus e_1$.)

A third constraint that is less important for present purposes is *topichood* (Lascarides and Asher, 1993): narrative sequences share a common topic (in some sense). For simplicity I will take all of these properties for granted as atomic constraints, though obviously an account of narrative discourse itself should explain them (see discussion in the papers cited above).

[17] I won't take a stand here on how widely this approach can be applied, and it does seem like lexical derivation may be necessary for some adverb classes. For example, it is hard to give an account along these lines that directly relates the (ad-sentential) speaker-oriented and (ad-VP) non-speaker-oriented readings of adverbs like "frankly" (Potts, 2003; Ernst, 2009).

I will assume here a somewhat novel implementation of narrative discourse structure, that simplifies the account of adverbs of space and time. I assume that narrative discourse is chunked into "narrative events". These must be closely aligned. A narrative event contains but is not identical to the event described in the sentence itself. The relation between a narrative event and the described event is exactly analagous to the relation between reference time(/interval) and event time(/interval) in Reichenbach 1947; Klein 1994; Kratzer 1998: in the English simple past (e.g. past perfective) the narrative event/reference time contains the described event/event time. The correlate of the immediateness constraint on this proposal is actually a constraint that tries to maximize the time-span described event relative to the narrative event.[18] One way of putting this assumption is that narrative discourse involves a specialized *narrative aspect*, resembling the perfective, but leading to a slightly different compositional structure (narrative events, instead of intervals). I'll leave the details for another time, but this idea gains some plausibility given two points: (i) the narrative present in English clearly does not have the semantics of a normal present tense (see e.g. Comrie 1976), and (ii) a range of languages (e.g. Bantu languages) do overtly have a specialized narrative aspect (Dahl, 1985). A defining characteristic of this marker according to Dahl is that it shows up in any verb in a narrative discourse except the first. The constraint against discourse-initial adverbs of space and time therefore follows from the distribution of narrative aspect.

7.4.2.2 Back to Adverbs

A major stumbling block that I believe led previous accounts to propose lexical ambiguity is the seeming anaphoricity of high-attached adverbs of space and time. Here I propose that this apparent anaphoricity follows from their appearance in narrative discourse – the alignment constraint for narrative events means that the beginning of a narrative event will be aligned with the end of a previous one. The adverbs aren't truly anaphoric, and the relationship to a contextually salient previous time is mediated by narrative discourse. To constrain them to narrative discourse, I propose that these adverbs have a strict sortal restriction to events. On the account of narrative discourse sketched above, events will only be compositionally available in this position in narrative discourse. See Rawlins 2008 for a recent defense of the claim that a large range of other adverbs appearing in this position act like propositional operators, an idea that goes back to Thomason and Stalnaker 1973 – i.e. the case of high-attached adverbs of space and time is not typical. This idea is

[18] An alternative way of going about this would be to have adverbs of space and time simply measure an interval, and apply a type-shift in the case of manner modification. I don't take this route here because it complicates the task of explaining the restriction to narrative discourse, but further research is clearly needed.

partly inspired by Schäfer's 2002 proposal that adverbs of space and time are a kind of "pure manner adverb"; a more canonical example of this class being "loudly".

I'll sketch the account in detail by going through an example. I assume that the denotation of a simple sentence appearing in a narrative discourse prior to any existential closure would have the following structure (τ-contains means temporally-contains):

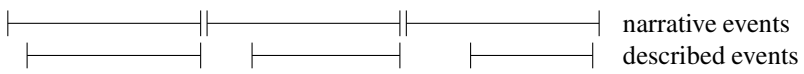
(74) (In a narration, before $\exists$-closure) $[\![$**Alfonso sneezed**$]\!] =$
$\lambda e_v \,.\, \tau(e) < now \wedge (\exists e' : \tau\text{-contains}(e, e') \wedge Ag(e') = \text{Alfonso} \wedge \text{sneezing}(e'))$

In the above formula, e is the narrative event, introduced by narrative aspect. I assume this event is always quantized/atomic (i.e. $\text{HATOMS}(e, C) = \{e\}$), and that the homogeneity criterion is supplied by the sister of the adverb (i.e. the property above). This formula will combine with adverbs like "quickly" just as before, except now the predicated-of event is distinct from the described event. Where C is the above function,

(75) $[\![$**Quickly, Alfonso sneezed**$]\!] =$
$\lambda e_v \,.\, \tau(e) < now \wedge (\exists e' : \tau\text{-contains}(e, e') \wedge Ag(e') = \text{Alfonso} \wedge \text{sneezing}(e'))$
$\wedge\, (\forall e'' \in \text{HATOMS}(e, C_H) \;:\; |\tau(e'')| \preceq s(\lambda e_v \,.\, |\tau(e)|)(C_C)(e''))$

What is 'quick' is the narrative event itself. Because this event contains the described event, an upper bound is placed on the duration of the embedded event. Furthermore, because the narrative event is aligned with the previous narrative event in discourse (not formally represented here), the adverb functions to additionally express a relationship between the previous event and the present one. The described event is contained in the narrative event, and is aligned to it, but not necessarily in a maximal way, at least for the initial part of the narrative event. Dowty's version of the immediateness constraint can be restated in the present view: there is no event of importance to the discourse that is part of the narrative event that precedes any part of the described event. (This would be most easily stated, on the account I am developing here, as a presupposition on narrative aspect.) This allows for a time gap, but not any events in that time gap. This can be visualized as in (76):

(76) Example: narrative sequence with described events temporally contained in narrative events



This diagram shows a sample discourse configuration of narrative events in time; the narrative events follow immediately after each other, and the described events are closely contained. I have assumed that there does not tend to be a gap at the end (it seems sensible to take this as a hard constraint), but there may be a time gap at the beginning of a narrative event, that is not included in the runtime of the described event.

This conception of narrative discourse serves so far to explain the apparent anaphoricity of adverbs of space and time, by reducing it to the anaphoricity of narrative 'aspect' itself. It also explains both the distribution of measure phrases, and the lack of interaction with lexical aspect. While the described event is part of the narrative event, the narrative event itself is guaranteed to lack any homogeneous part structure. If we were to try to categorize it into some aspectual class, in fact, it would most closely resemble an accomplishment. The account of the interaction with aspect for manner modification, therefore, predicts we should get only extent readings and measure phrases, and this is exactly the right prediction.

Furthermore, the account predicts that we should expect licit combinations of clausal space/time adverbs in cases where they can't attach as manner modifiers, e.g. achievements, semelfactives (on a non-slow-motion reading), and perhaps even statives. This is again the correct prediction. Across these classes, we find what Dowty 1986 called *inceptive* readings (sometimes called *inchoative* readings, e.g. Homer 2010).

It is well known in the literature on narrative discourse that stative sentences tend to be infelicitous, modulo appearance of grammatical aspects that allow the clause to act non-statively.[19] This is fairly unsurprising on an intuitive level, as narrative discourse involves events happening one after the other, but states tend to hold for more unbounded periods of time. What Dowty 1986 noticed is that in certain special cases, in particular where adverbs like "suddenly" and "quickly" appear, statives are licensed. An example after Dowty is given in (77):

(77) Alfonso walked into the room. Suddenly/quickly, the students were asleep.

The reading is one where, a short time after Alfonso walked into the room, it became true that the students were asleep. The class of licensing adverbs includes the adverbs under study here. There are two questions to address: (i) why are adverbs of space and time licensed attached high to stative sentences only under inceptive readings? (ii) why do these adverbs license inceptive readings at all? I.e. the corresponding discourse to (77) without the adverb does not have an inceptive reading available:

(78) Alfonso walked into the room. The students were asleep.

The natural reading for (78) is one where Alfonso discovers the students being asleep, and the discourse structure here would not involve narration, but rather something like background (or possibly elaboration).

[19] Except, of course, in complex discourse structures where they e.g. provide explanations or elaborations for part of a narrative sequence, as in:

(i) Joanna walked into the room. Alfonso was asleep. She walked over to the bed.

I suggest that the strict sortal restriction of adverbs of space and time to events explains both of these puzzles. Inceptive readings are only available under a kind of aspectual coercion, which I take to be a last resort. A concrete coercion operator that leads to the desired reading (following Homer 2010, who motivates this operator for entirely independent reasons) appears in (79):

(79) $\textsc{Inceptive} = \lambda P_{\langle v_s t \rangle} \, . \, \lambda e_{v_e} \, . \, \exists s \in D_{v_s} \, . \, P(s) \wedge \textsc{result}(e) = s$

A space-time adverb can't combine with a stative sentence directly (even assuming there is a state argument analogous to the event argument) because of the sortal restriction, so some coercion must apply to make it possible. Similarly, a stative sentence isn't licensed in discourse (i.e. because the verb is not compatible with narrative aspect). In a discourse structure like (78) there is no reason to coerce an eventive reading, because there is a perfectly acceptable non-narrative (elaboration) reading already. But with an adverb of space and time, an eventive reading is required, i.e. elaboration is not possible, and this forces a narrative reading.

It is clearly a complicated matter to fully describe what constrains operators like (79), and beyond the scope of this paper. An adverb of space and time is not absolutely obligatory, but it is often helpful. We would also want the operator to appear with achievements, and even some activities (e.g. "Slowly, Alfonso slept.").

In summary, I have proposed that high-attached adverbs of space and time measure the length of a "narrative event" – an event sequenced in a narrative discourse. This event has a consistent part-whole structure that is determined independently of lexical aspect[20], and consequently we see only extent readings/measure phrases. Verbs of any aspectual category are acceptable as long as they can be coerced into "inceptive" readings. Crucially, the core denotation of the adverb, its sortal restriction to events proper, and its interaction with degree morphology, are the same across different positions – what is different is the compositional environment it appears in, and the part-whole structure of the events it interacts with (cf. Ernst 2002).

The account makes an important prediction. We might have expected these adverbs to measure the gap between two sequenced events, and in fact many previous discussions would also lead us to expect this, but this is not the prediction of the present account: they should measure the duration of the narrative event, which at least includes the described event. This is correct; the example in (80) cannot have a reading where just the time until Alfonso started the novel was short – he has to complete it.

(80) Alfonso's bank account started getting low. Quickly, he wrote another novel.

[20]Though we might expect some interaction with grammatical aspect, which is not consistently compatible with narrative discourse. But this is complicated by the interaction between what I have called narrative aspect, and other grammatical aspectual operators, which I will leave for the future.

7.5 The Measure Phrase Puzzle

The major remaining task is to explain the complicated distribution of measure phrases with adverbs of space and time. There are two types of measure phrases that co-occur with these adverbs in the comparative form: temporal extent measure phrases such as "20 min", and ratio measure phrases such as "20 miles/h", "20° per min", etc.[21] The basic generalization is that a ratio measure phrase can occur if distribution over the event structure can happen non-trivially. In particular, it appears in cases where the event involves some homogeneous part-whole structure that the predication can distribute over. As long as this distributivity must happen, extent measure phrases are not possible.[22] A case of particular interest is high-attached space-time adverbs, which only ever receive extent measure phrases (see (11)) on the 'anaphoric' reading discussed in §7.4.2. (In some cases regular ratio/extent readings are marginally available; I will set these aside assuming they involve topicalized adverbs.)

The proposal is that extent phrases are unavailable in distributive cases exactly because of the property adopted from Chierchia 2010 in §7.4.1.3. Distributivity requires measuring the atoms, but pure extents are not useful because the atoms themselves aren't stable – there is not a unique way of making the atomization precise, making it difficult to compare the extents of atoms across different events. As proposed in §7.4.1.3, a stable measure (that achieves independence from the particular way of making the atomization precise) is available as a ratio of some measure of change, to time, e.g. speed (as in (81) below) or the ratio of temperature to time (as in (82)). The type of change is derived from the verb/event itself. For evidence for the last claim, it is helpful to consider cases where the direction of measurement, or the measure itself, can be determined by the verb, or even by the direct object:

(81) The left gap widened 1.2 meters per second more quickly than the right one.

(82) The temperature rose 2 degrees per hour more quickly than on the same day last year.

(83) The tank filled 2 gallons per seconds more quickly than I expected.

(84) Alfonso picked apples 2 apples per minute more quickly than Joanna.

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[21] One important type of measure phrase I will not deal with here is exemplified by "three times more slowly".

[22] We do get extent measure phrases with activities to the extent they can be treated as semelfactives (i.e. atomic). This can be seen in Krifka's 1989 wine-drinking competition example, and extends to measure phrases modifying adverbs of space and time.

(i) Ann drank wine in 0.43 s. (Krifka 1989 ex. 19)

(ii) Ann drank wine 0.21 s more quickly than Joanna.

Not all speakers accept wine-contest readings, but the judgment is always the same for (i) and (ii).

(This data supports the overall theme of the paper: what is constant across uses of adverbs of space and time is in fact only time.)

To make this idea precise, I will sketch a mechanism for deriving a measure function with the right properties to license ratio measure phrases. The denominator dimension, I claim, comes from the measure function provided by the adverb. Determining the numerator dimension is somewhat more complicated. In general, it is determined by whatever units of change are salient from the verb or the VP. In many examples this is distance, but not always; in (82) it is degrees. In some cases, as in (84), it is determined by the direct object (especially in V+bare plural combinations). While I will not give a compositional mechanism for extracting the dimension of change from a VP denotation, one is clearly important.

Up until now I have left the notion of a dimension informal, but to give the details of this derived measure phrase, we need to make it more explicit. Here I adopt a variant of Alrenga's 2007, 2009 analysis of dimensions for scalar adjectives (see also Kennedy 1999 ch. 4., Schwarzschild 2002; Heim 2006, 2008 a.o.). A dimension, on this view, is a sort of the domain of degrees (i.e. a subset of D_d); this domain can be constructed from the set of dimensions (which are disjoint).

(85) $D_d = \textsc{SpatExt} \cup \textsc{TempExt} \cup \textsc{Temperature} \cup \ldots$

Measure functions will now return intervals in their specified sort (functions of type $\langle \text{dt} \rangle$), and also supply an ordering relation as part of the actual denotation (recall that above, this was left informal as well). Two revised denotations for "quickly" and "slowly" are given below:

(86) $[\![\textbf{quickly}]\!] = \lambda e_v \,.\, \lambda d_d \,.\, d \in \textsc{TempExt} \wedge |\tau(e)| \leq d$ type: $\langle \text{v}\langle \text{dt} \rangle \rangle$

(87) $[\![\textbf{slowly}]\!] = \lambda e_v \,.\, \lambda d_d \,.\, d \in \textsc{TempExt} \wedge |\tau(e)| \geq d$ type: $\langle \text{v}\langle \text{dt} \rangle \rangle$

For example, an event measured by the above core entry for (the positive) $[\![\textbf{slowly}]\!]$ will return an interval that extends from the minimal temporal extent (0, on any unit) up to the degree corresponding to the actual length of the event. It might seem counterintuitive to include more degrees than the one actually corresponding directly to the measured object, but in this framework, the ordering differences between antonyms are encoded by this idea (Heim 2008), as well as several other important notions. So the interval measured will have to properly contain the interval corresponding to the standard of comparison (see below). $[\![\textbf{Quickly}]\!]$ reverses the relation, and includes all larger intervals in the domain.

The denotation for the covert positive comparative operator also needs revision; it will now make reference to a standard interval over degrees, and compare the measured degree against that interval. These standard intervals typically range from the 0 measure up to some maximal degree. The restriction on dimensions is captured with the notion of *commensurability*, defined in (89) (switching implicitly to "set talk" when discussing intervals).

(88) $[\![\textbf{pos}_{\textbf{adv}}]\!] = \lambda A_{\langle v\langle dt\rangle\rangle} . \lambda e_v . A(e) \supset s(A)(C_C)(e)$ type:$\langle\langle \mathrm{v}\langle \mathrm{dt}\rangle\rangle\langle \mathrm{vt}\rangle\rangle$
Where $s(A)(C_C)(e)$ is a contextually provided standard interval commensurable with $A(e)$

(89) Two intervals P, Q are commensurable only if $Q \subset P \vee P \subset Q \vee P = Q$.

Note that two intervals are commensurable only if they are drawn from the same sort. (But also, for instance, antonymic intervals will not be commensurable.) An entry for "more" can be given similarly to "pos" as follows:

(90) $[\![\textbf{more}_{\textbf{adv}}]\!] = \lambda A_{\langle v\langle dt\rangle\rangle} . \lambda Q_{\langle dt\rangle} . \lambda e_v . A(e) \supset Q$ type: $\langle\langle \mathrm{v}\langle \mathrm{dt}\rangle\rangle\langle\langle \mathrm{dt}\rangle\langle \mathrm{vt}\rangle\rangle\rangle$
defined only if $A(e)$ and Q are commensurable.

In (90) I am assuming that the denotation of a "than"-phrase is an interval. This denotation is more satisfactory than the earlier version in (52) in that it captures the fact that the dimension of the "than"-clause has to match the dimension supplied by the gradable predicate. (This is also how this type of framework captures cross-polar anomalies; see Kennedy 1999 for discussion.) The distributivity operators apply straightforwardly to these revised Deg heads. (Recall the earlier assumption that a "than"-phrase denotes an average degree if it involves distributive degree predication of its gap.)

If Δ is the symmetric difference operator (i.e. $(A - B) \cup (B - A)$), then commensurability guarantees that Δ will measure the gap between the two intervals (regardless of which one is the larger one if any; this is the reason for symmetry). To measure such a gap using some defined unit, we would need to scale the degrees according to that unit. I will simply assume that this can be done – e.g. that there is a function "minutes" as follows:

(91) minutes(d) = the size of the interval d scaled to minutes.
defined only if d is commensurable with TEMPEXT

I will not here assume any general theory of measure phrases, though one is clearly desirable (see Schwarzschild 2006); here is a specific entry for a measure phrase tailored to combine with a "more…than…" adverbial comparative:

(92) $[\![\textbf{2 min}_{\textbf{Adv}}]\!] = \lambda D_{\langle\langle v\langle dt\rangle\rangle\langle\langle dt\rangle\langle vt\rangle\rangle\rangle} . \lambda A_{\langle v\langle dt\rangle\rangle} . \lambda Q_{\langle dt\rangle} . \lambda e_v . D(A)(Q)(e) \wedge$ minutes$(A(e) \Delta Q) = 2$
defined only if $A(e)$ and Q are both commensurable with TEMPEXT and with each other.

This approach takes measure phrases to be Deg modifiers. In (92), the D argument is a transitive Deg head, and a function with the same type as D is returned – it then combines with the adverb (A), and the "than"-phrase (Q), as before. This entry implements the idea discussed by Schwarzschild 2006 (see also McConnell-Ginet 1973), that measure phrases in comparatives are predicates of gaps, and it does it in a fairly uninteresting way, by compositionally ensuring that the measure phrase

has access to the two intervals that there is a gap between.[23] I leave the challenge of generalizing this to the future. Note that on this version, we must assume that the measure phrase combines with the Deg head before the distributivity predicate is applied – not an issue for cases where distribution is trivial, which involve extent phrases, but it will be an issue shortly.

Given the notion of a dimension, composite ratio dimensions can be constructed straightforwardly (setting aside some issues in properly defining division):

(93) **Ratio dimensions** For any dimensions DIMA and DIMB:
$\text{ratio}(\text{DIMA}, \text{DIMB}) \underset{\text{def}}{=} \left\{ x \;\middle|\; \exists d_1 \in \text{DIMA} : \exists d_2 \in \text{DIMB} : d_2 > 0 \wedge x = \frac{d_1}{d_2} \right\}$

Now we come to the key definitions for understanding adverbs of space and time. First I will define a "lattice induced measure function" (the name is based on Krifka's 1990 "object-induced measure phrases"), that takes a dimension, an adverbial core, and some (verbal) measure function, and constructs a composite measure function that measures the ratio of the verbal to the adverbial measure.

(94) **Lattice induced measure function**
If DIM is a dimension, A is a space/time adverb core, and M is a positive event measure function:
$\text{LIMF}(\text{DIM}, A, M) \underset{\text{def}}{=} \lambda e'_v \,.\, \lambda d_d \,.\, d \in \text{ratio}(\text{DIM}, \text{TEMPEXT}) \wedge \exists d_2 \in A(e') : d = \frac{max(M(e'))}{d_2}$

(95) **Unstable atom coercion**
If e is an unstable atomic event involving change in dimension DIM, Adv the core of an adverb of space/time, and M a measure function available for e whose domain is commensurable with DIM. then $[\![\textbf{Adv}]\!](e)$ can be coerced to be interpreted as $\text{LIMF}(\text{DIM}, [\![\textbf{Adv}]\!], M)(e)$

The coerced MP combines with the Deg head as normal. So, if the adverb meaning distributes over a homogeneous part/whole structure (e.g. with an activity predicate), and the minimal atoms involve directed change and are unstable (=not present on all ways of making the atoms precise), then we can instead coerce the measurement to be about some ratio based on the type of change involved. In the canonical cases, this will be a ratio of space to time. I remain agnostic about whether this shift is always required in the face of unstable atoms, but I do assume it is obligatory if there is an overt measure phrase – i.e. that the level of precision required by a measure phrase is not compatible with the vagueness of these part-whole structures. I also assume that this coercion will not take place unless it must, leaving extents the default.

[23] The observation that measure phrases with adverbs require comparatives has been lurking in the background of this paper for some time. But actually this isn't an interesting property; it turns out that it is those adjectives that take measure phrases without the comparative that are unusual; see Schwarzschild 2006.

How exactly is the measure function M supplied by the verb? The details will have to remain unclear, but Piñón 2000 provides a mechanism that covers two relevant sources: it could be provided directly by the verb (for degree achievements like "widen"), and it could be provided by constructing a measure function from the measuring out of a direct object. It seems that in many dimensions (spatial change) there is a 'standard' measure function (e.g. distance of the spatial trace of an event) for that dimension, and this is the one used. It also may be that what is measured is not always the event, but the event participant (cf. Cresswell's analysis, where the modifier has compositional access to participants).

Notice that by dividing the maximal element in $M(e')$ by all the degrees in the temporal interval, we reverse the polarity of the resulting interval from the simple temporal extent reading – "quickly" becomes positive (i.e. its interval extends from 0 to a maximal degree) and "slowly" becomes negative; this is the right result. That is, if an interval is quick, its time is lower than the standard, but if a speed is quick, it exceeds the standard. The following example illustrates a partly composed denotation. If this combined with the verb "runs", we would further substitute SPATEXT in for the dimension, and a distance measure on a eventuality trace function, for M.

(96) $[\![[\mathbf{_{DegP}}\ ^{D}\mathbf{pos_{adv}}\ [\mathbf{_{AdvP}}\ \mathbf{quickly}]]]\!]$ (with coercion) =

$$\lambda e\ .\ \forall e' \in \text{HATOMS}(e, C_H) : \begin{pmatrix} \left[\text{LIMF}(\text{DIM}, \lambda e''\ .\ |\tau(e'')|, M)\right](e') \\ \supset s\left(\text{LIMF}(\text{DIM}, \lambda e''\ .|\tau(e'')|, M)\right)(C_C)(e') \end{pmatrix}$$

There is much future work to do here; for instance, it is unclear whether an event itself should encode a dimension of change, or whether this coercion would require compositional access to the verb/VP. This coercion mechanism (for other denominator dimensions) might have far reaching application across many manner adverbs as long as they are distributive, but unfortunately, in terms of overt measure phrases, many adverbs measure along some dimension that lacks units in the vocabulary. (Or possibly, many adverbs involve qualitative dimensions which behave somewhat differently; see Alrenga 2007, 2009), and it is far from clear which adverbs are distributive. I will set these issues aside for now.

It is useful at this point to summarize the range of contextual variables that are filled by information originating mainly in the VP. First, there is the standard of comparison, and the comparison class, each of which has parallels in attributive adjectival modifiers. But I have also needed to introduce variables providing a homogeneity criteria, for deciding how distribution happens; for providing a dimension of change determined by the VP, and for some measure function in that dimension, also typically determined by the VP. Future work may lead to a more elegant way of transmitting this information to the modifier. But this also fits into the general pattern that Kamp and Partee 1995 described with the *head primacy principle*: in modification structures, the head determines the context for the modifier. In the case of adverbial modification, there are simply more parameters than have been discovered in attributive adjectival modification.

In summary, the main claim is that the presence of ratio readings and ratio measure phrases is due to the conceptual difficulty of measuring atoms of processes in any stable way. I have given a coercion mechanism that provides a (more) stable measure in the face of vagueness, and proposed that the numerator dimension is determined by the verb(/event), not by the adverb itself. Though it isn't formally implemented above (since I am considering adverbs that use the same dimension), we would also expect in general the denominator dimension to be supplied by the adverb. This result, that a single component of gradability in the adverbial domain, the choice of dimension, derives from both the verb and the adverb in question, is quite strikingly different than what is standardly assumed for adjectives.

7.5.1 Gradually

Before concluding, I will make a brief comparison between the behavior of "slowly" and "gradually", which has some similar properties (Piñón 2000). The similarities are mainly in high-attachment configurations, and with so-called "degree achievements" such as "expand" (Hay et al., 1999; Kennedy and Levin, 2008).

(97) a. Gradually, the Nigerians pushed the rebels out of Freetown. (Piñón 2000 ex. 6a)

b. Slowly, the Nigerians pushed the rebels out of Freetown.

(98) a. The economy expanded gradually (based on Piñón 2000 ex. 16a)

b. The economy expanded slowly.

It isn't clear that these pairs have precisely the same truth conditions, but what differences there may be are fairly subtle.[24] A further descriptive parallel is that the predicates that combine with "gradually" are restricted to those that involve directed change. However, the parallels end here. "Gradually" cannot productively take measure phrases at all (despite appearing in the comparative), and to the extent that there are good examples, only ratio measure phrases are allowed.[25] Furthermore, it

[24]Fabienne Martin (p.c.) pointed out attested examples that suggest "gradually" does not entail "slowly", such as (i):

(i) About a week ago my car gradually, but quickly, lost a lot of its power.

Speakers I have consulted did not find such examples entirely coherent, but it is unclear then why they should be as easy to find as they are.

[25]Kristen Johannes (p.c.) constructed the following example, which speakers do tend to accept. Interestingly, speakers that find (i) grammatical still have trouble providing a coherent paraphrase. Erin Zaroukian (p.c.) also pointed out that "gradually" takes "two times"-style MPs, which I have been ignoring.

(i) The temperature on Earth dropped two degrees per year more gradually than on Venus.

doesn't ever seem to serve as a manner modifier in the sense that "slowly" does, and can't combine in a low-attached position with most verbs (directed change is not a sufficient condition for licensing):

(99) * Alfonso ran (to the park) gradually.

Because of these differences, Piñón's 2000 account does not extend to adverbs of space and time in general. His proposal is that "gradually" characterizes a morphism from degree structure to event structure, that preserves temporal ordering in the event's part-whole structure (for initial parts) as ordering of degrees on the scale. The scale can be provided in three ways: (i) by the verb directly, in the case of degree achievements, (ii) by a derived scale that corresponds to how the verb measures out a direct object, and (iii) by a scale supplied by some other adverbial such as "more and more". The general impossibility of low-attachment readings is because most verbs don't supply a scale (or the right kind of scale) lexically. For high-attached "gradually", Piñón proposes (but doesn't implement the idea) that the scale is based on what leads up to the described event. In this case especially there is an obvious similarity to my proposal, but nonetheless, "gradually" itself on this account does not measure anything about the event, but rather acts as a higher-order operator on measure functions and event predicates. (This is a place for development of Piñón's analysis, as "gradually" takes all the normal degree morphology.) If the proposal is right, "gradually" is not an adverb of space and time at all. Nonetheless, the similarities are suggestive, and suggest the logical next step of broadening the scope of inquiry of the present analysis to include adverbs like "continuously", "smoothly", "gradually", "incrementally" etc., that all take degree morphology, and seem to measure something about the nature of change in an event. Adverbs of space and time simply measure temporal extent or its first derivative in some dimension, but these other adverbs may measure more complex properties of change in event structure.

7.6 Conclusions and Further Puzzles

In this paper I have defended an account of adverbs of space and time that explains the full range of data, with Cresswell's ratio data falling out as a special case. The core ingredients of my proposal are that (i) adverbs of space and time are distributive degree predicates of events, measuring temporal extent only, (ii) different readings follow from interaction of distributivity and event structure, in particular lexical aspect and narrative discourse, and (iii) the distribution of types of measure phrases follows from the same thing. On the proposal, no metaphorical extension to handle e.g. the high-adjoined case is needed.

The investigation of adverbs of space and time is far from done. One major question concerns the range of cross-linguistic variation; the literature is mostly silent about this. (Two exceptions are Torner's 2003 study of space/time-like adverbs in Spanish, and Eszes's 2009 examination of the Hungarian facts.) The

proposal I have developed here makes strong cross-linguistic predictions about such adverbs if they exist in a language: their interaction with lexical aspect, measure phrases, and narrative discourse should be the same (to the extent these phenomena are independently stable cross-linguistically). A particularly interesting test would be to investigate parallel adverbs in a language with an overt narrative verb form.

On the analysis I have developed, adverbs of space and time are really just time predicates, and the spatial component (if present) follows from the meaning of the verbs. This raises the question of how other time adverbials work, and how similar they actually are to these adverbs – how do adverbs of space, time, and change fit into the general theory of time adverbials? One starting place is Shaer's 2004 discussion of the effect of discourse structure on high (but not low) attached temporal adverbs, which appears parallel. A second point of departure for future work is the investigation of other manner adverbs. Intuitively, adverbs of space and time most characterize the "manner" of some event when combined with an activity predicate such as "run". I have effectively claimed here that what a manner is, for this kind of adverb, is a property of a minimal atom of such an event, distributed across the event structure. The reason why "run slowly" seems to describe something about the manner of motion is because what is characterized is the speed of the minimal steps that make up running. Is this notion of manner more general? It is far from clear at this point (see e.g. Landman and Morzycki 2003), but the idea must clearly fit into a larger theory of manners in some way. There are other types of adverbs where the idea seems to apply (e.g. "noisily"), but many adverbs with manner-like readings, e.g. many of those discussed in Martin (this volume), do not involve distributivity. The following example (from Fabienne Martin p.c.) involves what is intuitively a manner reading, but it is the entire drinking events that have a 'stupid' manner:

(100) Twice this weekend I drank stupidly.

In general, it seems that oriented adverbs have a dispreference for distributive readings, though much more empirical work is needed. How does the type of manner explored in the present paper meet up with the typology of adverbs developed in Martin (this volume)? Martin suggests that in the classes examined there, psychological adverbs involve distributive manner readings, and dispositional adverbs involve manner readings which do not need to be distributive, and points to a potential explanation in terms of the adjectival source. The distributivity hypothesis may therefore shed new light on adverbs beyond the space-time category.

I end with the issue of adjectives. Can the account be extended to handle "quick" and "slow"? It can, effectively unchanged, on Larson's 1998 account of subsective modifiers (though I leave the details for a future time).[26] Consider the following examples:

[26]This is especially interesting given that it is far from clear that adjectives and corresponding adverbs in general have a synchronic relationship of this type (Geuder, 2000).

(101) a. The concert was (very) slow. (event predicate)

b. Alfonso is a (very) slow dancer. (subsective modifier, -er nominal)

c. That is a (very) slow car. (subsective modifier, individual)

Larson proposes that many subsective modifiers are actually event predicates, of an event that is bound by some generic operator. The example in (101a) involves direct predication of an eventive nominal, and works straightforwardly.[27] On Larson's account, (101b) has a natural analysis where both "slow" and "dancer" are event predicates (with the same gradable machinery for "slow"), and there is a covert generic operator. The paraphrase might be, "for a typical dancing event with Alfonso as the agent, that event is slow". A similar approach extends slightly less naturally with (101c), where we can assume that the generic operator quantifies over typical events involving the car in a standard use (e.g. "driving"). The success of this sketch provides a final piece of evidence that my analysis of adverbs of space and time is on the right track.

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[27] Example like "John is slow" on a non-metaphoric reading can perhaps be handled like "slow car".

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Chapter 8
The Processing Domain of Aspectual Interpretation

Oliver Bott

8.1 Introduction

In theories of language processing it is commonly assumed that interpretation proceeds incrementally, that is on a word by word basis. An open question is whether this holds for aspectual semantic processing and for semantic processing in general as well. Crocker (1996, p. 251) formulated the principle of incrementality (the psycholinguistic perspective on syntactic processing) in the following way:

> "The sentence processor operates in such a way as to maximize the interpretation and comprehension of the sentence at each stage of processing (i.e., as each lexical item is encountered)."

By contrast, in semantic theory lexical aspect is often treated as a property of whole VPs or even whole sentences. This is what I call the semantic perspective (Dowty 1979, p. 62):

> "Not just verbs, but in fact whole verb phrases must be taken into account to distinguish activities from accomplishments. (In a certain sense, even whole sentences are involved. . .)"

According to the semantic perspective we should expect that a transitive verb on its own has no lexical aspect until it is composed with (at least) its internal argument. As a consequence, effects due to aspectual violations can only arise when the verb has received all or at least some of its arguments. Using an analogy from chemistry, the event type can thus be viewed as an atomic property which supervenes on the properties of its constituents. Building on this analogy, a lexical aspectual class is a higher order concept similar to the concept of a noble gas in chemistry. It should be clear right from the start that investigating the domain size of lexical aspect

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is independent of investigating the interplay of the verb and its arguments as for example on the thematic level (see eg. Ferretti et al. (2007), Malaia et al. (this volume) for very early aspectual effects in this respect).

Consider the examples in (1-b) to (1-d) which are all legal word order variants of (1-a). Note that *erreichen* (*reach*) is an unambiguous transitive German achievement verb. Like accomplishments, achievements are telic, but they express an instantaneous change of state and therefore lack a preparatory process (cf. Moens and Steedman (1988)). This explains why they don't allow modification by a *for*-adverbial rendering all three word order variants ungrammatical[1] whereas accomplishments can be coerced into an activity reading (see eg. Bott (2010)).

(1) a. *Der Bergsteiger erreichte den Gipfel zwei Stunden lang.
The mountaineer$_{nom}$ reached the summit$_{acc}$ two hours long.
*The mountaineer reached the summit for two hours.
b. *Den Gipfel erreichte zwei Stunden lang ein Bergsteiger.
The summit$_{acc}$ reached two hours long a mountaineer$_{nom}$.
*The mountaineer reached the summit for two hours.
c. *Der Bergsteiger erreichte zwei Stunden lang den Gipfel.
The mountaineer$_{nom}$ reached two hours long the summit$_{acc}$.
*The mountaineer reached the summit *for two hours.
d. *Zwei Stunden lang erreichte der Bergsteiger den Gipfel.
Two hours long reached the mountaineer$_{nom}$ the summit$_{acc}$.
*The mountaineer reached the summit for two hours.

What makes the three examples interesting is the point at which the aspectually mismatching information comes into play: In (1-a) the verb-argument structure is complete when the adverbial enters the sentence. In (1-b) the verb has already received the direct object, but the subject is still missing. This means we are dealing with a complete VP. Finally, in (1-c) the VP is actually not complete yet. At this point, the adverbial has to modify the bare verb. The same point is exemplified even more clearly in (1-d) where both the subject and the object enter the sentence only after the *for*-adverbial and the achievement verb.

Whereas the aspectually mismatching adverbial in (1-a)–(1-d) leads to a nonsensical sentence, cases of so called coercion provide examples where an aspectual mismatch emerges only locally and can somehow be repaired (see Moens and Steedman (1988) for a systematic overview over different kinds of coercion). Consider the following example.

(2) Der Bergsteiger erreichte den Gipfel in drei Tagen.
The mountaineer reached the summit in three days.

[1]It may be objected that the examples become sensical when coerced into an iteration of reaching events. Acceptability ratings for examples like these, however, indicate that naive informants are not aware of this possibility (Bott, 2010). On the basis of these findings I make a categorical distinction between cases of aspectual mismatch and coercion.

(2) is an instance of what Hamm and van Lambalgen (2005) called additive coercion. *Erreichen* (*reach*) is an unambiguous achievement verb which introduces a culmination (*the mountaineer reaches the summit*) and a consequent state (*the climber now being on top*). When the achievement is, however, combined with an *in*-adverbial, it has to be coerced into an accomplishment. For this, new semantic structure (a preparatory phase) has to be added to the aspectual representation. In our example world knowledge probably suggests that this was a *climbing* activity. But, the mountaineer also could have reached the top using a helicopter. This demonstrates that additive coercion requires an abductive inference to what preparatory process may have lead to the culmination event.

The present paper investigates whether an aspectual violation can be detected immediately at the mismatching adverbial irrespective of its structural position in the sentence. Since aspectual coercion may require more contextual information than mere mismatch detection, even more deferred processing may be expected in coercion than in mismatch cases. The time course of aspectual violation and reanalysis were investigated with word order variants of German transitive achievement verbs. These were modified by mismatching or coercing adverbial phrases and their processing was compared to an aspectual control condition using aspectually matching adverbials.

8.1.1 Previous Studies on Aspectual Coercion

It may be worth looking at the existing studies on the processing of lexical aspect. Without exception, all of them focus on aspectual coercion and none compares coercion effects to effects of aspectual mismatch. Moreover, as things stand, it is still an open question whether aspectual coercion leads to processing difficulty at all.[2] A reason for this somewhat unsatisfactory situation may be that the research has almost exclusively limited itself to one type of aspectual coercion, ie. the iteration of point action verbs. Furthermore, all existing studies on aspectual coercion used English materials. Because English has fixed word order it cannot be used to systematically investigate the processing of lexical aspect at various hierarchical levels. For instance, to test the VP as processing domain, the most natural choice is to use a transitive verb in a sentence with object before subject word order where the mismatching or coercing stimulus intervenes between the VP (= verb + direct object) and the subject. Unfortunately, this word order is ungrammatical in English. Thus, a language with relatively free word order like German is needed where all four construction types in (1-a)–(1-d) are grammatical.

[2]For complement coercion, things look different. Numerous studies have demonstrated that this type of coercion clearly enhances processing load (for an overview see eg. Pylkkänen and McElree (2006)).

Not surprisingly, the processing domain of lexical aspect has not been explicitly mentioned in the psycholinguistic literature. Let's have a look at the materials used in these studies to see if there is any implicit evidence concerning the issue. The following examples present sample materials from the first studies reporting a coercion effect:

(3) a. The insect glided effortlessly until ...
b. The insect hopped effortlessly until ...

(4) a. Howard sent a large check to his daughter for many years ...
b. Howard sent a large check to his daughter last year ...

Sentences like (3-a) vs. (3-b) were used in the cross modal lexical decision studies by Piñango et al. (1999) and Piñango et al. (2006). The coercing adverbial (*until* ...) only appeared after a minimal sentence was complete. Similarly, the materials in (4-a) vs. (4-b) used in a stops-makes-sense-judgment experiment by Todorova et al. (2000) only reveal a coercion effect after a complete verb-argument structure had been presented.

To complicate matters, Pickering et al. (2006) used the same materials as in the experiments mentioned above, but tested a coerced meaning during ordinary reading without an additional task. In two self-paced reading and two eyetracking experiments, they found aspectual coercion to be no more difficult than their aspectual control conditions. This lack of effect led them to propose the aspectual underspecification hypothesis. This hypothesis states that the aspectual representation stays underspecified during normal reading. Brennan and Pylkkänen (2008) challenged this view and reported a coercion effect of coercion sentences like (5-a) as compared to aspectual controls (5-b) both in self-paced reading (but see Bott (2010) for different findings in German) and in MEG. On the basis of a rating study they had carefully selected clear instances of point action verbs. However, the specific processing of aspectual coercion could be performed earliest at the verb, that is after readers were already dealing with a complete sentence.

(5) a. Throughout the day, the student sneezed in the back of the classroom.
b. After twenty minutes, the student sneezed in the back of the classroom.

To sum up, all online effects that have been reported were measured rather late downstream of the sentence. The existing studies, therefore, do not let us decide between the incremental aspectual interpretation hypothesis in (6) and the late aspectual interpretation hypothesis in (7).

(6) Incremental Aspectual Interpretation Hypothesis (IAIH)
Lexical aspect is computed incrementally, on a word-by-word basis.

(7) Late Aspectual Interpretation Hypothesis (LAIH)
Lexical aspect is not computed before the verb has all its arguments.

The IAIH and its counterpart, the LAIH, are the two extremes with respect to incrementality. To be maximally clear, the LAIH is not intended to imply that aspectual processing is delayed until the comprehender crosses a sentence boundary, but only to depend on the verb plus all its arguments. That is, even under the LAIH we may expect to find effects of aspectual processing well before the end of the sentence. Arguments in favor of this hypothesis have, for instance, been provided by Verkuyl (1993) showing that both the internal (= undergoer) and the external argument (= agent) can lead to a change in aspectual class. Certainly, there is also an intermediate alternative to the IAIH and the LAIH. Not the complete verb-argument complex, but only the verb and its internal argument (the VP) may constitute the processing domain of lexical aspect. We will come back to the intermediate hypothesis later in this paper. We conducted a series of reading time experiments to determine the processing domain of aspectual interpretation.

8.1.2 The Constructions Used in the Experiments

The following experiments tested German transitive achievement verbs which were modified by three types of temporal adverbials. Here is a sample item in *subject-verb-object-adverbial* (SVOA) word order.

(8) a. *Der Rentner fand den Schlüssel zwei Stunden lang in der Schublade.
The pensioner found the key two hours long in the drawer.
*For two hours, the pensioner found the key in the drawer.
b. Der Rentner fand den Schlüssel in zwei Stunden in der Schublade.
The pensioner found the key in two hours in the drawer.
In two hours, the pensioner found the key in the drawer.
c. Der Rentner fand den Schlüssel vor zwei Stunden in der Schublade.
The pensioner found the key ago two hours in the drawer.
Two hours ago, the pensioner found the key in the drawer.

Sentence (8-a) illustrates aspectual mismatch. The durative adverbial *for two hours* cannot modify the achievement denoting a punctual event. (8-b) exemplifies additive coercion (Hamm and van Lambalgen, 2005; Bott, 2010). Although the *in*-adverbial requires an accomplishment – one of the classic tests by Vendler (1957) – the sentence doesn't feel ill-formed. Obviously, comprehenders are able to infer the right kind of preparation (eg. *searching*) and implicitly shift the achievement into an accomplishment. (8-c) serves as control since the input requirements of the *ago*-adverbial perfectly match the achievement: composition yields a punctual event that is located 2 h before utterance time. We constructed 30 items in three conditions like (8-a)–(8-c). This set of experimental items was used in all of the following experiments except for the eyetracking study (Experiment. 4). The complete list of experimental sentences can be found in Bott (2010, Experiment. 4a/b and 8).

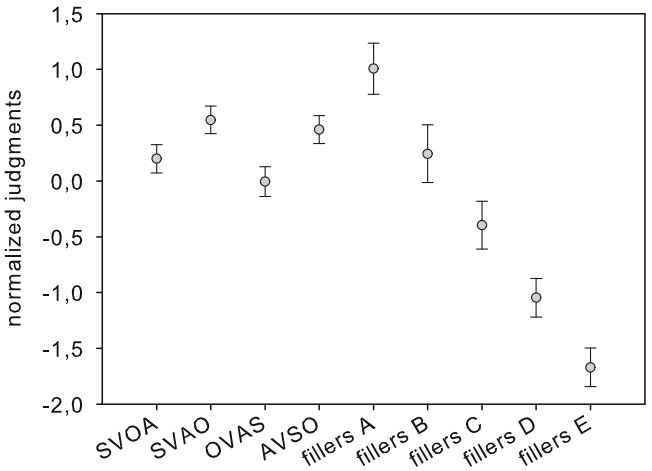


Fig. 8.1 Mean grammaticality judgments (+ 95% CI intervals) for the control condition in the four word orders. Also shown are mean judgments of five categories of normed filler sentences ranging from *perceived natural* (cat. A) to *strongly marked* (cat. E)

To test the incrementality of aspectual interpretation we manipulated the word order in these sentences. Besides SVOA sentences, we changed the position of the direct objects to SVAO word order. Furthermore, we manipulated the position of the subject yielding OVAS sentences. Finally, we constructed AVSO sentences in which the adverbial directly precedes the verb and the arguments come in only later.

German word order is relatively free, although not entirely free. Some word order variants may clearly be more marked than others. To compare aspectual processing among different syntactic configurations it is thus crucial that the constructions under study do not differ in grammaticality. For this purpose, we gathered judgments for all four word order variants using the thermometer judgement method (Featherston, 2008). The following orders were tested: SVOA, SVAO, OVAS and AVSO. All sentences were semantically well formed and used a transitive achievement modified by a *ago*-adverbial, ie. the control condition in the online studies. To find out if all four constructions are perceived as fully grammatical 20 normed distractors of five different levels of grammaticality were included. These were chosen from a pool of German example sentences which have been repeatedly tested in grammaticality surveys (see Featherston (2008)). Figure 8.1 depicts the mean judgments from 20 German native speakers. Two of the word orders, SVAO and AVSO, in which the adverbial preceded some of the arguments were rated even better than the canonical SVOA condition. Object topicalized sentences in the OVAS condition were rated slightly worse than the canonical SVOA sentences, but were still in the range of fully grammatical sentences. To compensate for this difference, the OVAS construction will be tested in an experiment (Experiment 3) that exclusively uses object initial sentences in the items and in the fillers.

8.2 Experiment 1: Providing a Continuation

Investigating adverbial modification in yet incomplete verb-argument structures raises an important question. Do readers automatically predict an argument that yields the *aktionsart* which is required by the adverbial? Consider (9-a) with the two continuations in (9-b) and (9-c).

(9) a. Der Bergsteiger erreichte zwei Stunden lang ...
The mountaineer reached two hours long ...
For two hours, the mountaineer reached ...
b. *den Gipfel. (*the top)
c. niemanden am Telefon. (nobody on the phone)

As (9-c) shows, (9-a) can be continued in a meaningful way, although the most typical continuation of a yet incomplete achievement in (9-b) yields a semantically ill-formed sentence. When the processor encounters the sentence fragment in (9-a), it will predict material that is yet to come (see eg. Altmann and Kamide (1999)). Let's assume that the IAIH is correct. Then the predictive capabilities of the parser are absolutely crucial and lead to different expectations about when processing difficulty emerges in sentences like (9-a) with the semantically anomalous continuation (9-b).

Let's assume that aspectual processing is incremental and the complete range of possible arguments is considered by the sentence processor. It will then interpret the incomplete sentence in (9-a) with the expectation of a continuation like (9-c). As a result, including the adverbial, the sentence fragment is predicted to be well formed. Only when a continuation like (9-b) is encountered, is the expectation disconfirmed and processing difficulty emerges. Thus, we would expect delayed processing precisely because of incremental interpretation with an extremely high predictive power, that is able to predict a specific continuation (including negation, bare plurals etc.) making the sentence well-formed.

A theoretical alternative is that the processor expects a continuation that is highly associated with the lexical material encountered so far, but there is no "deep" analysis of it. Interestingly, although this second alternative requires less predictive power than the first option, it predicts earlier difficulty in aspectual processing. In the context of *the mountaineer reached* something like *the top* is expected. The predicted object is semantically incongruous with the *for*-adverbial. Thus, difficulty is expected immediately at the adverbial even before the object is encountered.

Before coming to the online experiments, we have to decide between these two alternatives. For this purpose, we measured the interpretation of incomplete sentences like (9-a) by asking comprehenders for a continuation.

8.2.1 Method

The present experiment was a production experiment with no time pressure. This ensured that participants had the opportunity to find the most sensible continuation. If in an offline task like this they are not able to come up with arguments that change lexical aspect to fit the requirements of an otherwise mismatching adverbial, it is even less likely that they are able to do so during real-time comprehension.

8.2.1.1 Materials

The same thirty items that were used in the online experiments were tested in the aspectual mismatch condition: an achievement combined with a *for*-adverbial. The ends of the experimental sentences were eliminated. This yielded the conditions in (10-a)–(10-c).

(10) a. Der/Die Bergsteiger$_{nom.}$ erreichte/n$_{sing./pl.}$ zwei Stunden lang...
The mountaineer(s) reached two hours long...

b. Den Gipfel$_{acc.}$ erreichte/n$_{sing./pl.}$ zwei Stunden lang...
The top reached for two hours...

c. Zwei Stunden lang erreichte/n$_{sing./pl.}$...
For two hours reached...

Example (10-a) contains the (in the singular case disambiguated) subject *der/die Bergsteiger*, an unambiguously transitive achievement verb and a *for*-adverbial, but the object is still missing. In (10-b) the case-disambiguated object *den Gipfel* is realized preverbally in topicalized position, but the sentence lacks a subject. In (10-c) the bare verb is tested with the adverbial. In this condition readers have maximal freedom in choosing the appropriate arguments to satisfy the input requirements of the adverbial.

If aspectual processing is highly predictive as outlined above, the number information of the verb might provide an important cue to what is yet to come. The typical examples proving an aspectual sematic influence of the arguments involve cases with bare plurals (eg. *visitors/*a visitor arrived all night*). When encountering a plural verb it might be that aspectual processing automatically predicts a bare plural subject. To test this, the number of the verb (*singular* vs. *plural*) was manipulated yielding a total of six conditions employing a 3 × 2 (*word order* × *number*) factorial design.

Additionally, 40 distractors were included in the experiment. Thirty of them allowed for a sensible continuation while ten clearly did not. The latter contained tense violations like *morgen kam* ... (*tomorrow came...*) and aspectual violations of a different sort such as *Hans war gerade dabei intelligent zu sein, als* ... (*Hans was being intelligent, when* ...). The experimental items and the filler sentences were arranged in six lists in a latin square design.

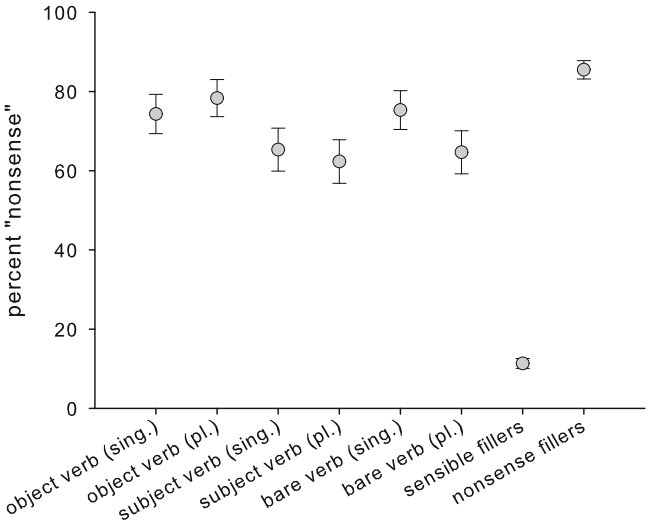


Fig. 8.2 Percent "nonsense" answers in Experiment 1 (+95% CIs)

8.2.1.2 Procedure and Participants

The experiment employed a combined acceptability rating/sentence completion task. Participants were asked to come up with a meaningful completion of the sentence. If they were not able to do so they were prompted to reject the sentence as nonsensical.

Sixty German native speakers (23 female; mean age 29.4 years) took part in the experiment. Among them, six prizes of 50€ were distributed by lot. Participants were randomly assigned to lists (ten participants per list). An experimental session took approximately 30 min.

For purposes of quantitative analysis, the percent of "nonsense" ratings were computed. In addition to "nonsense" button presses, all continuations that yielded sentences which were clearly not sensible or incomplete were also counted as "nonsense". This affected 13.5% of the trials with experimental items. A qualitative analysis of the provided continuations can be found in Bott (2010).

8.2.2 Results

Figure 8.2 depicts the percent of "nonsense" answers for the experimental items and the distractors. The performance on the fillers shows that participants had understood the task and provided a completion if this was possible.

The experimental items were overwhelmingly rejected as nonsensical with a mean of 70.1% nonsense answers. There were, however, differences among the conditions.

First of all, participants provided more sensible completions when they had to choose an object (63.8% "nonsense") than when the subject was missing (76.3% "nonsense"). In repeated measures ANOVAs this difference revealed a significant main effect of *verb argument structure* ($F_1(2, 118) = 10.70$; $p < .01$; $F_2(2, 58) = 4.74$; $p < .05$). ANOVAs which just compared the *missing object* and the *missing subject* conditions yielded a significant main effect of *word order* ($F_1(1, 59) = 22.74$; $p < .01$; $F_2(1, 29) = 7.12$; $p < .05$), but neither a reliable effect of *number* nor an interaction between *word order* and *number* (all $Fs < 2$).

Secondly, the interaction between *word order* and *number* was significant ($F_1(2, 118) = 5.46$; $p < .05$; $F_2(2, 58) = 4.57$; $p < .05$). The interaction was due to the *bare verb* conditions receiving more completions when the verb was plural than when it was singular ($t_1(59) = 4.28$; $p < .01$; $t_2(29) = 2.95$; $p < .01$), but the *missing object* and *missing subject* condition not showing a number effect. The main effect of *number* was not reliable ($F_1(1, 59) = 3.64$; $p = .06$; $F_2(1, 29) = 2.02$; $p = .17$).

8.2.3 Discussion

This experiment investigated whether readers can predict forthcoming arguments that shift the lexical aspect of a yet incomplete verb-argument structure in accordance with the input requirements of an aspectually mismatching adverbial. The findings clearly indicate that this is not the case. The initial part of sentences containing an achievement which is modified by a *for*-adverbial were overwhelmingly judged as nonsensical. This shows that readers just predict lexical material on an associative basis without deep aspectual analysis. As it seems, comprehenders aren't able to make use of the full set of combinatorial possibilities but rely on superficial lexical associations.

Nevertheless, the predictive capabilities depend on the parts of the verb-argument structure that have been encountered. Participants were able to come up with a sensible continuation more easily when the object than when the subject was missing. Although both, the internal and the external argument, matter with respect to lexical aspect, the internal argument seems to be more accessible than the external argument.

Interestingly, the number information of the verb did not have a big influence on the ability to predict material that is yet to come. In the *missing subject* conditions, participants were as likely to provide a sensible continuation when the verb had plural morphology as when it was singular. Thus, even with supportive morphological information there was no evidence of predicting the right kind of argument. Beyond the purposes of the present experiment this is an interesting finding since it demonstrates clear limitations of predictive processing.

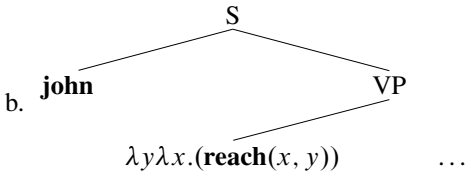
There was no time pressure to provide a completion. During ordinary reading, however, the processor is forced to decide much faster on the interpretation of the incoming material. Thus, if readers were not able to predict the right kinds of arguments in an offline task like the one employed here it is even less likely that the processor will engage in highly predictive parsing during ordinary comprehension. Assuming incremental aspectual parsing along the lines of the IAIH, readers can therefore be expected to stumble across mismatching aspectual information as soon as they encounter it.

8.3 Experiment 2: Complete Sentences Versus Extraposed Objects

Can an aspectually mismatching or coercing adverbial be immediately combined with a verb before the complete VP has been processed? The present experiment investigated this hypothesis by measuring reading times at adverbials that either matched the lexical aspect of achievement verbs, called for additive coercion or were aspectually mismatching. Processing was studied in SVOA and in SVAO sentences. In the latter the adverbial appeared at a point where the direct object of the unambiguously transitive verbs was still missing.

Under standard assumptions about the way compositional interpretation of the sentence works the subject cannot be combined with a transitive verb before the direct object is present (Heim and Kratzer, 1998).[3] Consider the first words of a simple sentence in (11-a) with the simplistic semantic representation in (11-b).

(11) a. John reaches ...

b.


Functional application of the subject node and the verb node is not possible before the VP node is semantically determined. But this depends on the object. As a result, composition has to wait until the object is present. This illustrates that common semantic practice cannot be easily brought together with incremental interpretation. Finding an immediate effect in the SVAO sentences would thus be particularly interesting when it comes to developing a cognitively realistic semantics.

[3] However, Heim and Kratzer (1998) actually argue for *top-down* interpretation which is somewhat different from the *bottom-up* approach chosen here. What is crucial here is that *top-down* interpretation also requires a complete sentence to compute a meaning for it.

8.3.1 Method

8.3.1.1 Materials

The experiment used a 3 × 2 factorial design with the factors *adverbial* (three levels: *control* vs. *additive coercion* vs. *mismatch*) and *word order* (two levels: *SVOA* vs. *SVAO*). The conditions are illustrated in the sample item in (12). Vertical lines indicate segmentation. (12-a) has SVOA word order, whereas (12-b) is SVAO. Instead of an *ago*-adverbial, the aspectual mismatch conditions had a *for*-adverbial (always of the type *x Zeit lang*, eg. *zehn Minuten lang*) and the additive coercion conditions had an *in*-adverbial (always of the type *in x Zeit*, eg. *in zehn Minuten*).

(12) a. Der Förster$_{subj.}$ | entdeckte | die Falle$_{obj.}$ | vor (in/ganze) zehn
The ranger | spotted | the trap | ago (in/for) ten
Minuten | im | Wald.
minutes | in-the | forest.

b. Der Förster$_{subj.}$ | entdeckte | vor (in/ganze) zehn Minuten | im |
The ranger | spotted | ago (in/for) ten minutes | in-the |
Wald | die Falle$_{obj.}$ | für | Bären.
forest | the trap | for | bears.

In the SVOA order, the adverbial was presented in one segment. It was always followed by a PP which was split up into two regions. These served as spillover regions and were included to see whether mismatch and coercion effects showed up before the end of the sentence. For statistical analysis, reading times were aggregated over the last two segments.

In the SVAO word order, the 30 items were constructed with two spillover regions. The adverbial was followed by a prepositional phrase which was divided into two regions, the preposition and the rest of the PP which was followed by the direct object. An effect of *aspect* at the direct object region is thus very unlikely to be a spillover effect from the adverbial region. Following the object, another PP was included as second spillover region. Like the first PP, it was divided into two segments. It was always attached to the object to make the noun phrase heavier and thus more natural in extraposed position. Statistical analyses used reading times that were aggregated over the two PP segments.

Additionally, 75 filler sentences were included in the experiment. They encompassed all kinds of aspectual classes and 25 of them were semantically ill-formed resulting in a overall ratio of 2:1 of well-formed to ill-formed sentences. The experimental items and the distractors were distributed over six lists in a latin square design. For each participant this yielded five data points per condition.

8.3.1.2 Procedure

The experiment was a self-paced reading study using moving window presentation. Each sentence was followed by a question. In the experimental items and half of the

fillers, questions queried whether the sentence made sense. To prevent participants from anticipating this kind of question, the other half of the filler sentences were followed by ordinary comprehension questions. Questions had to be answered with a time limit of 3 s.

The experiment started with written instructions. Then followed a practice session with ten trials. The practice items contained no aspectual violations. After the practice session the experiment followed in one block with an individually randomized order of sentences. An experimental session took about 20 min.

8.3.1.3 Participants

Thirty students from Tübingen University (all native German speakers, 24 female, mean age = 22.9 years) participated in the experiment. Each subject was paid 5€ for participation. The participants were randomly assigned to lists (five subjects per list).

8.3.1.4 Data Analysis

Reading times longer than 2,500 ms were trimmed to correct for outliers. This affected less than 0.5% of the data. Performance on the comprehension questions revealed that participants read attentively. Each of them answered more than 75% of the questions correctly.

8.3.2 Results

8.3.2.1 "Makes Sense" Judgements

The mean judgments are depicted in Fig. 8.3. In the SVOA conditions, participants judged the control condition as sensible in 93.2%, additive coercion in 48.5% and mismatch in 16.0%. The pattern was similar in the SVAO conditions. Aspectual control was judged sensible in 90.7%, additive coercion in 63.3% and aspectual mismatch in 29.9%. In ANOVAs, this difference lead to a significant main effect of *adverbial* ($F_1(2, 58) = 169, 70$; $p < .01$; $F_2(2, 58) = 98.64$; $p < .01$), a significant main effect of *word order* ($F_1(1, 29) = 8.91$; $p < .01$; $F_2(1, 29) = 12.58$; $p < .01$) and a significant interaction between the *adverbial* and *word order* ($F_1(2, 58) = 4.91$; $p < .05$; $F_2(2, 58) = 3.48$; $p < .01$).

Although the patterns are similar, mismatch detection was better in the SVOA mismatch condition than in the SVAO mismatch condition. Also, additive coercion was judged acceptable less often in SVOA sentences than in SVAO sentences. However, a direct comparison between the judgment results of the two word order variants is difficult, because the experimental items in the two conditions differed in

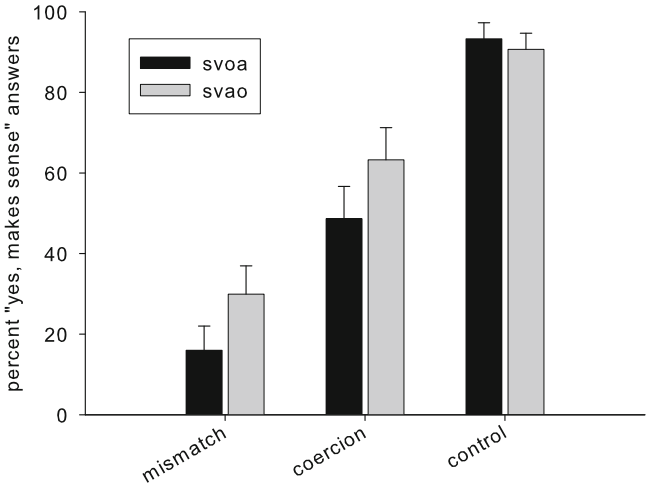


Fig. 8.3 Makes sense judgments of SVOA sentences in *black* and of SVAO sentences in *grey* (+95% CIs) in Experiment 2

length and furthermore the items in the SVAO conditions involved an additional PP which the items in the SVOA conditions did not.

Mean judgment times ranged between 1,400 and 1,580 ms, but there were no systematic differences between the conditions. Accordingly, ANOVAs analyzing judgment times did reveal neither significant main effects of *adverbial* or *order* (all $F_{1/2} < 1$) nor a significant interaction between them ($F_1(2, 58) = 2.11$; $p = .11$; $F_2(2, 58) = 1.76$; $p = .18$).

8.3.2.2 Reading Times: SVOA Word Order

Figure 8.4 shows mean reading times of sentences involving coercion and mismatch compared to control for the whole sentence.

Up to the adverbial phrase the three aspectual conditions were identical and did not differ in reading time (all $F_{1/2} < 1$).

When readers encountered the adverbial phrase they slowed down in case of a *for*-adverbial (mean RT 60.0 ms/char) and in case of an *in*-adverbial (mean RT 60.9 ms/char) compared to aspectual control (mean RT 54.1 ms/char). In ANOVAs, this difference was reflected in a significant main effect of *adverbial* ($F_1(2, 58) = 4.05$; $p < .05$; $F_2(2, 58) = 3.49$; $p < .05$). Paired t-tests using a Bonferroni adjusted alpha revealed that mismatch was read more slowly than control ($t_1(29) = 2.26$; $p < .025$; $t_2(29) = 2.32$; $p < .025$) and that coercion was read more slowly than control ($t_1(29) = 2.34$; $p < .025$; $t_2(29) = 2.44$; $p < .025$).

In the additive coercion condition the slow-down extended to the subsequent PP region (mean RT 105.5 ms/char), while mismatch (mean RT 93.4 ms/char) and

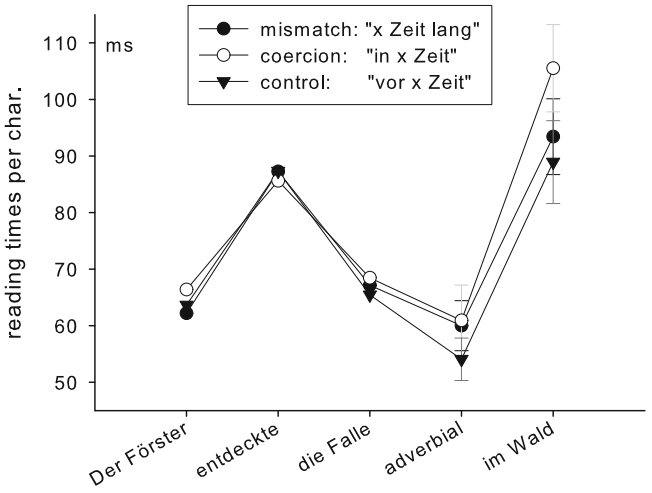


Fig. 8.4 Reading times per character in conditions with SVOA word order (+95% CIs) in Experiment 2

control (mean RT 88.9 ms/char) were roughly the same. In ANOVAs, this difference resulted in a significant main effect of *adverbial* ($F_1(2, 58) = 7.56$; $F_2(2, 58) = 4, 83$; $p < .05$). Paired t-tests revealed that reading times in the coercion condition were slower than in the mismatch condition ($t_1(29) = 3.04$; $p < .025$; $t_2(29) = 2.42$; $p < .025$). There was, however, no significant difference between mismatch and control ($t_1(29) = 1.21$; $p = .24$; $t_2(29) = .78$; $p = .44$).

Furthermore, reading times of coerced sentences were analyzed contingent on judgments. Thus, those trials in which participants judged a sentence with an *in*-adverbial semantically acceptable were analyzed separately from those in which they were considered semantically ill-formed. The former were trials in which subjects actually computed a coerced meaning (henceforth *coercion trials*) while the latter are trials where they failed to accomplish coercion (henceforth *failed reanalysis trials*). Table 8.1 presents the results.

On the regions preceding and including the adverbial, coercion trials and failed reanalysis trials had reading times of comparable length. At the sentence final PP, however, failed reanalysis trials were slower than coercion trials which didn't differ from control. The former difference was significant as revealed by a independent samples t-test ($t(146) = 2.59$; $p < .025$). In contrast, the numerical difference between coercion trials and control was not reliable ($t(209) = 1.26$; $p = .21$).

8.3.2.3 Reading Times: SVAO Word Order

Figure 8.5 shows mean reading times of SVAO word order across the three conditions. At the adverbial region control had a mean RT of 50.70 ms/char, mismatch had 51.16 ms/char and coercion had 50.54 ms/char. At the following

Table 8.1 Mean reading times in SVOA word order conditionalized on judgments in Experiment 2

	"Yes" coercion	"No" coercion	"Yes" control
Identical regions			
Subject	62.60 (4.53)	61.63 (3.10)	59.69 (2.47)
Verb	83.51 (3.88)	80.48 (3.37)	81.16 (2.74)
Object	66.06 (3.76)	63.08 (3.12)	60.87 (2.45)
Adverbial and PP			
In-adverbial	59.20 (4.37)	61.88 (4.68)	52.14 (1.89)
PP	94.76 (5.05)	114.57 (5.71)	86.85 (3.70)

Note: reading times per character in milliseconds (plus mean standard errors)

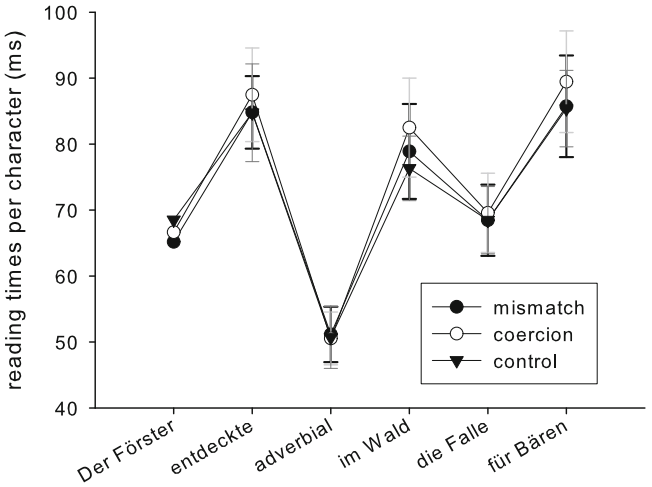


Fig. 8.5 Reading times per character in conditions with SVAO word order (+95% CIs) in Experiment 2

spillover region separating the adverbial from the object, control was numerically read fastest with a mean RT of 76.31 ms/char, mismatch had 78.90 ms/char and coercion had 82.49 ms/char. At the object region, control had a mean RT of 68.47 ms/char, mismatch had 68.46 ms/char and coercion had 69.58 ms/char. The sentence final segment had mean RTs of 85.38 ms/char in control and 85.73 and 89.46 ms/char in mismatch and coercion, respectively. Statistical analyses of the reading times revealed neither a significant difference at the adverbial region ($F_{1,2} < 0.5$) nor at any of the following segments (all $F_1 s < 1.5$; all $F_2 s < 1$). Since there was an overall numerical trend going slightly in the expected direction, we further analysed RTs of the end of the sentence by adding up the reading times of the last four segments. ANOVAs analyzing these cumulated RTs did not reveal any reliable differences between the three adverbials either ($F_{1,2} < .05$).

8.3.3 Discussion

This experiment investigated the processing of sentences involving aspectual mismatch and additive coercion. This type of coercion has so far not been investigated in the psycholinguistic literature. The findings provide evidence for additive coercion leading to considerable processing difficulty. First, judgments suggested that coercion was carried out only in approximately 50% of all trials. Second, coercion lead to longer reading times than control. This effect cannot be attributed to semantic markedness of the coerced sentences because reading pace also slowed down in coercion trials which were judged "yes, sensible". Finding processing difficulty across different types of coercion lends further support to the claim that aspectual coercion is a cognitively difficult operation generalizing over the few aspectual coercion types that have been investigated so far.

Besides the coercion effect we obtained a mismatch effect at the adverbial region in the SVOA word order. It is important to note that both coercion and mismatch were present at the region before the final segment. This indicates that the most extreme version of the LAIH – aspectual processing delayed until the very end of the sentence – cannot be true. Instead, we have to allude to the notions of a complete verb-argument structure and/or predication to properly lay out the range of possible hypotheses.

Crucial for the questions addressed in this paper, however, is that coercion and mismatch effects were only elicited by adverbials modifying a complete verb-argument structure. What is particularly striking about the results is the lack of a mismatch effect, even though the judgment data reveal that subjects were well aware of the aspectual mismatch. This shows that the information of the subject plus the verb is not enough to determine lexical aspect.

This finding is interesting because at first sight it conflicts with the incrementality assumption usually made in the processing literature at least for syntax (e.g. Frazier (1987), Crocker (1996), Hagoort (2003)). Although readers could in principle immediately interpret the initial part of the achievements, lexical aspect was not immediately determined and interpretation seemed to be delayed. However, at the end of the sentence, when providing a sensicality judgment, participants clearly had accomplished an aspectual interpretation. Judgments were relatively fast and were equally easy in the coercion condition, the mismatch condition and aspectual control. The findings thus provide evidence against the incremental aspectual interpretation hypothesis (IAIH).

How can this be, given the abundant evidence for incrementality from a wide range of psycholinguistic phenomena? In this experiment parsing would have been more efficient if the processor had immediately decided on an aspectual class, because the aspectual information of the lexical items could then directly be integrated into a situation model. The subject and the verb were maximally informative with respect to which lexical aspect had to be chosen. But note that this was due to the fact that the verbs used in this study were carefully selected. They provided clear instances of transitive achievement verbs with bounded subjects.

In the "real world", however, matters are often not that clear. In the majority of cases, looking at the verbal information alone may not tell the comprehender anything about the relevant situation type. Often, aspectual distinctions are far from clear cut and we are dealing more with a continuum than with a discrete system. Immediately deciding on the aspectual class would thus lead to a vast amount of rather costly aspectual reinterpretation. As a result, the processor might work most efficiently by waiting until the verb has received the minimally required arguments. This may be even more so, since incremental syntactic interpretation already provides a structured representation that can be kept in working memory keeping memory load comparably low.

If aspectual processing was delayed, why did no effects show up further downstream the sentence when readers eventually encountered the extraposed object? A possible explanation for this lack of effect may be that the materials contained adjuncts – the first spillover region – that intervened between the adverbial and the direct object. Although they were kept constant across conditions, the intervening material may have slowed down processing of the following material in general.[4] In turn, potential aspectual effects may have been obscured. In fact, there is psycholinguistic evidence for difficulty caused by intervening adjuncts (see eg. Staub et al. (2006)). In any case, we have to be very careful of drawing hasty conclusions because the suggested interpretation of results crucially relies on analysing null effects in the SVAO order.

To deal with this problem we decided to leave out the intervening adjuncts in the self-paced reading experiment testing OVAS constructions which will be reported in the next section. We will see clear indication of delayed effects there. Furthermore, the eyetracking experiment (Experiment 4) will provide additional evidence to substantiate the tentative claims made here.

8.4 Experiment 3: Modification of Complete VPs

Does the verb with its internal argument form a natural unit with respect to lexical aspect? Intuitive judgments reveal that the VP already encodes a minimal situation. For instance, we can talk about situations like *to build a house* while we leave it open who is actually building it. The examples in (13) illustrate that actually no local subject is needed to determine the aspectual class.

[4] An anonymous reviewer pointed to an alternative explanation which is exactly the opposite, ie. a speed-up due to irrevelant intervening material. Again, this may have obscured a potential effect at the object region. We fully agree that this is possible, too. No matter which explanation is correct, we think it is crucial to show that aspectual processing is delayed until the verb has received its minimally required arguments. Anticipating what is yet to come, this is exactly the kind of effect we observed in both of the following experiments.

(13) a. Es wurde begonnen den Schlüssel zu suchen.
It was begun the key to search.
Somebody began to search the key.
b. *Es wurde begonnen den Schlüssel zu finden.
It was begun the key to find.
*Somebody began to find the key.

Begin states that there was a start event of some durative process. In (13-a) *search the key* is of the required type, but the achievement *find the key* in (13-b) is not. Crucially, in the constructions in (13) the expletive *it* only serves as a dummy subject which lacks any semantic content.

Given these linguistic facts, it is quite plausible to assume that the processor determines lexical aspect at the level of the verb and its internal argument(s). This is stated in the *Complete Verb Phrase Hypothesis* in (14).

(14) Complete Verb Phrase Hypothesis (CVPH)
A complete VP is specified for lexical aspect.

The CVPH stands in sharp opposition to other linguistic facts. Above, we used the sentence *visitors arrived all night* to demonstrate that the right choice of subject bears an important influence on the aspectual class of the whole sentence. At first sight, these linguistic facts are providing conflicting evidence. On the one hand, the VP seems to be sufficient to determine lexical aspect, but on the other hand, complete verb-argument structures have to be considered. It is thus interesting to investigate whether adverbial modification of a complete VP will reveal mismatch or coercion effects well before the subject is present. The present experiment tested the CVPH by looking at the processing of OVAS sentences, ie. adverbial modification in constructions with extraposed subjects.

8.4.1 Method

The present self-paced reading experiment tested the CVPH using slightly modified materials of the previous experiments with OVAS word order. (15) is a sample item, vertical lines indicate segmentation.

(15) a. Den Haarriss$_{obj.}$ | am Wasserrohr | bemerkte | vor dreißig
The hairline-crack | at-the water-pipe | noticed | ago thirty
Minuten | . . .
minutes | . . .
Thirty minutes ago, [. . .] noticed the hairline crack at the water-pipe.
b. Den Haarriss$_{obj.}$ | am Wasserrohr | bemerkte | in dreißig
The hairline-crack | at-the water-pipe | noticed | in thirty
Minuten | . . .
minutes | . . .
In thirty minutes, [. . .] noticed the hairline crack at the water-pipe.

c. Den Haarriss$_{obj.}$ | am Wasserrohr | bemerkte | dreißig Minuten lang
The hairline-crack | at-the water-pipe | noticed | thirty minutes long
| . . .
| . . .
For thirty minutes, [. . .] noticed the hairline crack at the water-pipe.

d. . . . ein aufmerksamer Klempner
. . . an attentive plumber

Example (15-a) is aspectual control, (15-b) involves additive coercion and (15-c) contains an aspectual mismatch. The case disambiguated object always appeared in the sentence initial position. The object was always definite and maximally specific to license it in that position. Furthermore, to make the object-initial word order expected, all sentences, items as well as fillers, had an object before subject word order.

The number of the verb may provide some information about the forthcoming subject. A bare plural subject, for instance, is ungrammatical following a singular verb. For this reason, besides *adverbial*, *number* was manipulated in a 3×2 factorial design resulting in a total of six conditions. Each item in each aspectual condition was constructed in two versions, with a singular subject (eg. *an attentive plumber*) and with a plural subject (eg. *a few attentive plumbers*).

The 75 fillers from the previous experiment were transformed into object-initial sentences. Items and fillers were assigned to six lists in a latin square design. The experimental procedure was identical to the previous experiment: after reading a sentence participants had to provide a sensicality judgment.

42 native German speakers (31 female; mean age 23.0 years) from Tübingen University took part in the study for a payment of 5€. Participants were randomly assigned to lists (five subjects per list).

8.4.2 Results

8.4.2.1 Makes Sense Judgments and Judgment Times

While *control* was accepted in 89.7% (*sing.*: 92.9% vs. *pl.*: 86.6%), *mismatch* was only accepted in 31.3% (*sing.*: 26.8% vs. *pl.*: 35.7%). *Coercion* was intermediate with 63.0% "yes" responses (*sing.*: 58.7% vs. *pl.*: 67.6%). The sentences involving aspectual coercion were judged as sensible in the majority of cases, as was confirmed by a t-test testing whether *coercion* significantly differed from 50% ($t_1(41) = 3.64$; $p < .01$; $t_2(29) = 3.51$; $p < .01$).

In ANOVAs, the difference between the aspectual conditions was reflected by a significant main effect of *adverbial* ($F_1(2, 82) = 124.50$; $p < .01$; $F_2(2, 58) = 91.48$; $p < .01$). *Number* had a comparably weaker influence on the judgments.

Table 8.2 Mean judgment times in Experiment 3

	Judgment time	N (out of 210)
Singular		
"No" to mismatch	1,254 (664)	154
"Yes" to coercion	1,549 (759)	121
"Yes" to control	1,341 (633)	195
Plural		
"No" to mismatch	1,294 (655)	134
"Yes" to coercion	1,495 (666)	142
"Yes" to control	1,331 (672)	181

Note: Judgment times (+std.) of expected answers in ms

While the main effect of *number* was not reliable ($F_1(1, 41) = 3.25$; $p = .08$; $F_2(1, 29) = 2.07$; $p = .17$), the interaction between *number* and *adverbial* was significant ($F_1(2, 82) = 5.32$; $p < .05$; $F_2(2, 58) = 4.18$; $p < .05$). The interaction is due to the fact that the differences between the aspectual conditions are somewhat bigger in the *singular* than in the *plural* conditions.

Table 8.2 shows the judgment times for "no" responses in the *mismatch* conditions and "yes" responses in the *coercion* and *control* conditions.

In both *number* conditions, judgments took longer for sentences involving aspectual coercion than for controls or sentences involving an aspectual mismatch. In ANOVAs which analyzed judgment times of expected answers (= "no" with respect to *mismatch* and "yes" with respect to *coercion* and *control*), this difference was reflected by a main effect of *adverbial* that was significant by participants ($F_1(2, 82) = 5.14$; $p < .05$; $F_2(2, 58) = 2.84$; $p = .08$). Neither the main effect of *number* ($F_{1,2} < 1$) nor the interaction between *adverbial* and *number* was reliable ($F_{1,2} < 1$). A paired t-test comparing judgment times for coercion versus control (pooled over *number* conditions) revealed a reliable difference between these two conditions ($t_1(41) = 2.40$; $p < .05$; $t_2(29) = 3.10$; $p < .01$).

8.4.2.2 Reading Times

The reading times for the three aspectual conditions are depicted in Fig. 8.6. They were longer in the aspectual mismatch and the coercion condition compared to control. Since ANOVAs revealed that the pattern was the same in the singular and the plural conditions, the data were aggregated over the corresponding *singular* and *plural* conditions.

A difference in reading times only showed up at the head noun of the subject phrase (*mismatch*: 88.3 ms/char vs. *coercion*: 88.1 ms/char vs. *control*: 77.3 ms/char).

At the adverbial region, the aspectual conditions did not differ. *Mismatch* had a mean RT of 50.42 ms/char, *coercion* had 52.92 ms/char and *control* had 50.26 ms/char. ANOVAs didn't reveal a significant main effect of *aspect*

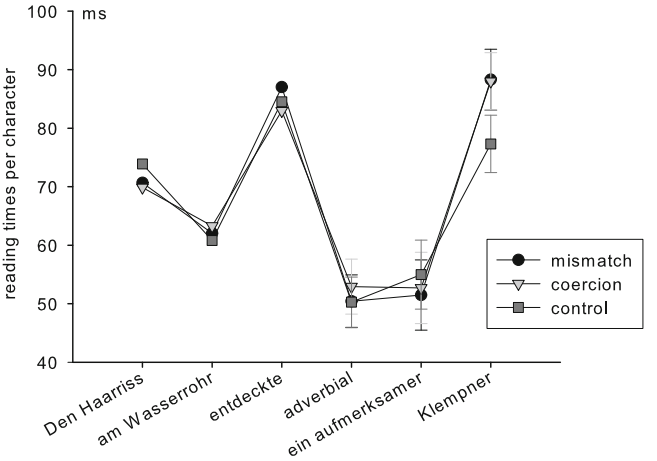


Fig. 8.6 Mean reading times (+ 95% CIs) in Experiment 3

($F_1(2, 82) = 2.64$; $p = .09$; $F_2(2, 58) = 1.01$; $p = .36$). At the following first part of the subject phrase, there were also no differences in reading time. Numerically, control was even slowest.

When readers encountered the head noun of the subject phrase, reading times were slower in the mismatch and the coercion conditions than in the *singular* and *plural* controls. In ANOVAs, this difference was reflected by a significant main effect of *aspect* ($F_1(2, 82) = 7.32$; $p < .01$; $F_2(2, 58) = 7.88$; $p < .01$).

8.4.3 Discussion

The present experiment provides additional evidence that processing sentences with aspectual mismatch and coercion are more difficult than aspectual controls. Interestingly, the difficulty only emerged after readers had encountered the extraposed subject phrase, that is only at the point when the verb had received its minimally required arguments. In contrast, at the critical adverbial and the subsequent region all three conditions were read equally fast. The results thus provide clear evidence against the Complete Verb Phrase Hypothesis (CVPH). The VP did not contain enough information to allow for aspectual mismatch and coercion effects when it was combined with a mismatching or coercing adverbial. Furthermore, since only delayed effects were found, it is not surprising that the *number* information wasn't used to predict what kind of subject is yet to come.

In contrast to the findings of the previous experiment, the results of the present study show delayed aspectual effects. This delayed effect can best be explained by a hierarchical organization of aspectual processing, where first the eventuality

of the verb-argument structure has to be computed and only in a second step is adverbial modification possible. The findings perfectly match the predictions of the Late Aspectual Interpretation Hypothesis (LAIH).

Can these late effects be due to lexical aspect being underspecified until readers cross a sentence boundary? On the basis of the findings reported in this paper this actually seems to be a viable option. Additional evidence from an experiment investigating the processing of sentences like (16-a) vs. (16-b) in Bott (2010, Experiment 2) makes this explanation, however, very unlikely.

(16) a. Peter joggte in fünfzehn Minuten...
Peter jogged in fifteen minutes...
b. Peter joggte fünfzehn Minuten lang...
Peter jogged for fifteen minutes...

In that experiment, reading times of the adverbial phrases in examples (16-a) vs. (16-b) indicated enhanced difficulty in (16-a) as compared to (16-b). This is interesting, since (16-a) can be continued in a sensible way, for instance by providing the right kind of path argument *drei Kilometer* (*three kilometers*). It thus seems that aspectual processing is in fact delayed until a minimal verb-argument structure is complete.

Taken together, Experiments 2 and 3 thus demonstrate a fascinating interplay between the parsing of argument structure and of lexical aspect. The former seems to be prior to aspectual processing. This adds an interesting new parameter to the incrementality debate, namely the domain size with respect to a particular phenomenon. In the next section we will further elaborate on another facet of incremental interpretation, that is which stages of processing are affected by processing lexical aspect.

8.5 Experiment 4: SVOA Versus AVSO Sentences

Is it possible that self-paced reading data are too coarse to detect aspectual effects in yet incomplete verb-argument structures? To check whether this was the case, we conducted an experiment in which we measured eye movements while participants were reading SVOA versus AVSO sentences. The latter construction allows us to keep track of aspectual processing while the verb and its arguments come in one piece after the other.

Eye-movement data may yield additional information with regard to the SVOA construction, too. They provide a more fine-grained measure of the stages of processing that are targeted by aspectual mismatch and aspectual coercion, respectively (cf. Rayner (1998) for an overview). Do mismatch and coercion already affect the initial analysis or will mismatch and coercion effects only show up in regressive eye-movements?

8.5.1 Method

8.5.1.1 Materials

We constructed 36 unambiguously transitive achievement sentences in six conditions according to a 3 (*adverbial*: *mismatch* vs. *additive coercion* vs. *control*) × 2 (*word order*: *SVOA* vs. *AVSO*) factorial design. A sample item is provided in (17-a) and (17-b), vertical lines indicate interest area boundaries. All items subordinated an *although*-clause which was segmented into four spillover regions. Line breaks always occurred after the first spillover region *obwohl* (*although*). The full set of materials is contained in the appendix.

(17) a. Der Ringer | gewann | das Turnier | ganze drei Stunden (in 3 h
The wrestler | won | the tournament | whole three hours (in 3 h
/ vor 3 h), | obwohl | es | viele | Konkurrenten gab.
/ ago 3 h), | although | it | many | competitors were.
The wrestler won the tournament for three hours (in three hours/three hours ago), although there were many competitors.

b. Ganze drei Stunden (In 3 h / Vor 3 h) | gewann | der Ringer | das
Whole three hours (In 3 h / Ago 3 h) | won | the wrestler | the
Turnier, | obwohl | es | viele | Konkurrenten | gab.
tournament, | although | it | many | competitors | were.
For three hours (In three hours/Three hours ago), the wrestler won the tournament, although there were many competitors.

A latin square was used to distribute the experimental sentences over six lists. One hundred and twenty-two fillers (40 non-sensical) were added to each list. Each experimental item and 62 of the distractors were followed by a question querying whether the sentence was sensible. Sixty fillers were followed by ordinary comprehension questions to prevent participants from anticipating the judgment while reading the sentence.

8.5.1.2 Participants

Participants were 24 students from Tübingen University (mean age 26.1, range from 19 to 33 years; 18 female) who received 8€ for their participation. None of them had participated in any of the previous experiments. Four participants were randomly assigned to each list. Five additional participants had to be excluded from the analysis due to calibration problems (N = 3) or error rates above 40% in the practice (N = 2).

8.5.1.3 Procedure

A desktop-mounted Eyelink 1,000 eyetracker monitored the gaze location of the participant's dominant eye. The eyetracker has a spatial resolution of 0.01° of visual angle and samples gaze location every millisecond. Participants viewed the stimuli binocularly on a 19 in. monitor 70 cm from their eyes. A head rest minimized head movements. The experiment was implemented using the Experiment Builder software and eyetracking data were exported with the Data Viewer software package.

Subjects were tested individually. The tracker was calibrated using a 3 × 3 grid guaranteeing that all fixations were less than 0.5° apart from the calibration stimuli. After calibration was completed, participants read the experimental instructions on the screen. This was followed by a practice session of ten items. In the experiment, each trial started with a calibration check. The tracker was recalibrated as necessary. Eye-movements were recorded during reading.

The trial began with the presentation of a screen which served as calibration control with a little black dot in the position where the center of the first word would appear. If no fixation was registered within 5 s, recalibration was enforced. Otherwise a sentence in yellow 15 point font size letters appeared in the center of a navy blue screen. Three characters corresponded approximately to 1° of visual angle. After reading the sentence participants had to move their eyes to an asterisk at the bottom of the screen. Fixating the area around the asterisk triggered the presentation of the question screen querying whether the sentence was sensible. There was no time limit for providing an answer.

8.5.1.4 Data Analysis

Prior to all analyses we preprocessed the data. Fixations that were shorter than 80 ms and within one character space of the previous or next fixation were assimilated to this fixation. The remaining fixations shorter than 80 ms or longer than 1,200 ms were excluded. This affected 5.6% of the data.

We analyzed fixation times with respect to five eyetracking measures.[5] *First-pass time* is the total time spent in an interest area before the reader moves on or looks back in the text. *Regression path durations* are the sum of fixation durations from the time the reader enters a region, to the time when the reader enters the following region, that is it includes first-pass time plus the time spent on regressions. Finally, *total reading time* is the sum of all fixations on a particular region. If a region was skipped during first-pass or never fixated at all, we replaced the missing value in the

[5] In addition to the measures reported here we analyzed first fixation durations. Since there were no differences we refrain from reporting these.

first-pass times, the regression path duration or the total times by a value of zero.[6] As for first-pass and total times, we analyzed reading times per character to compensate for systematic length differences between the three adverbial types (mean number of characters were 17.1 (coercion), 18.1 (control) and 19.6 (mismatch)). We also measured two types of proportions of regressions: *first pass regression ratios*,[7] ie. the proportions of how often readers launched a regression from a region during first pass (forward) reading. The proportion of *regressions in* a region is a measure of how often it was entered from the right.

8.5.1.5 Predictions

If aspectual processing is delayed until the verb-argument structure is complete, we will get the following predictions. During first-pass reading aspectual mismatch and coercion should not cause any delay or regressions out of regions that are encountered before the transitive verb has received both arguments. Only then should readers slow down and/or launch regressions to earlier parts of the sentence. Thus, in the SVOA conditions we expected mismatch and coercion effects to immediately show up at the adverbial, whereas in the AVSO conditions we expected delayed effects of 'early' reading time measures (ie. first-pass times, first-pass regression ratios and regression path durations) showing up at the object region. Indeed, this is what we found.

8.5.2 Results

The conditions were judged as follows: in the SVOA word order, *mismatch* was falsely accepted 14.6%, *coercion* was accepted 84.7% and *control* was accepted 81.3% of the time. Acceptance rates were similar in the AVSO word order: mismatch was falsely accepted 18.1%, *coercion* was accepted 88.9% and *control* was accepted 91.7% of the time. ANOVAs analyzing 'correct' judgments revealed no reliable main effects of *word order* or *adverbial* (all $F_{1/2} < 2.6$), but an interaction that was marginal by participants ($F_1(1, 23) = 2.76$; $p = .08$; $F_2(1, 35) = 3.34$; $p < .05$). The lack of a main effect of *adverbial* indicates that unlike in the previous experiments there were no consistent differences between the adverbial types. Additive coercion can be as felicitous as control when the context provides the relevant information (eg. some obstacle to the culminating event mentioned in the *although* clause that indicates what the preparatory process may have been).

[6] If a region receives no fixations, its information was most probably already available due to parafoveal preview of the preceding segment or predictive parsing.

[7] We will refer to them loosely as *regressions out*.

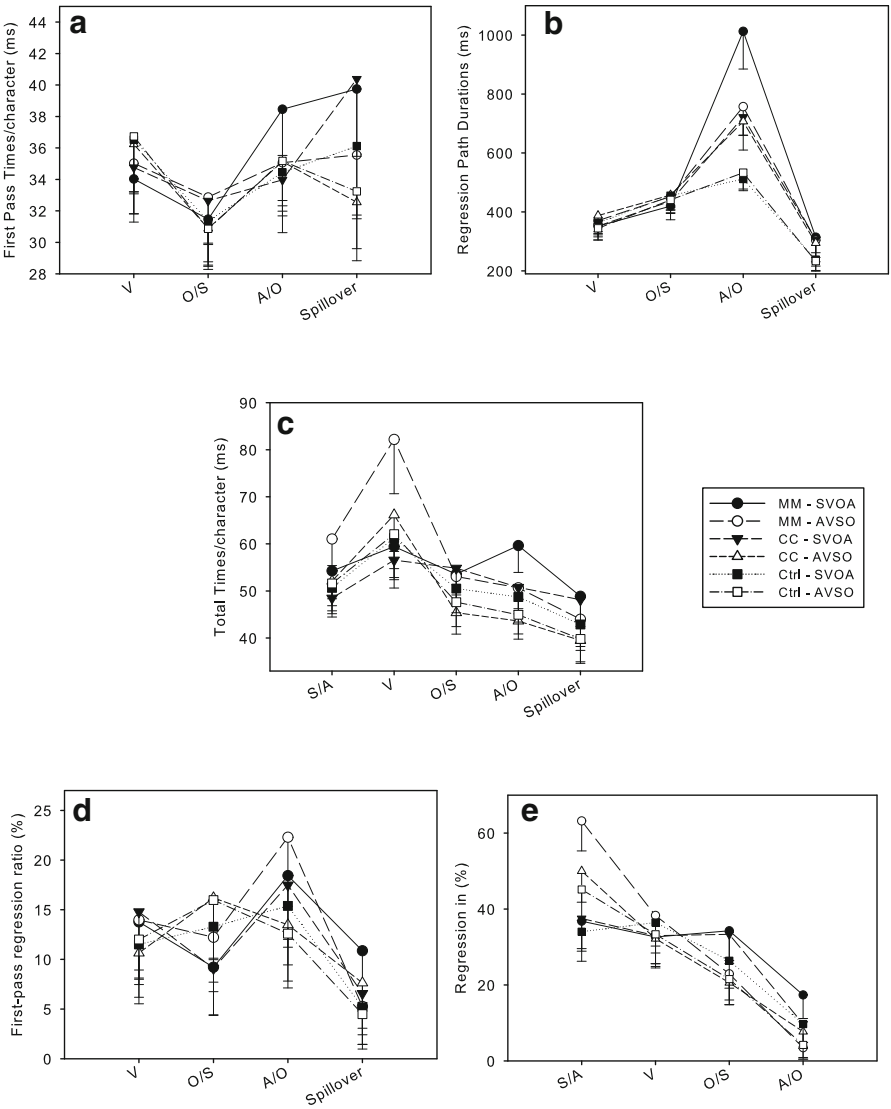


Fig. 8.7 Mean reading times and proportions of regressions (+ lower limit of 95% CIs) in Experiment 4. Abbreviations: Panel **a**) first-pass times. Panel **b**) regression path durations. Panel **c**) total times. Panel **d**) first-pass regression ratios. Panel e) proportions of regression in. *A* adverbial, *V* verb, *S* subject, *O* object

Figure 8.7 displays the mean first-pass time, regression path duration, total time and proportions of regressions in all six conditions up to the first spillover region. The first region was left out of the graphs because of length differences between the different adverbials. In the following paragraphs, we will walk trough the eyetracking record region by region.

At the first region of interest (ROI) there were big lexical differences between conditions. To investigate whether a potential mismatch effect already affected the preview of the verb, we compared the first-pass times in the AVSO mismatch and the AVSO control condition in a pairwise comparison. The difference between mismatch (38.6 ms/char) and control (37.3 ms/char) was not significant ($t_{1/2} < .8$; $p_{1/2} > .4$). It is thus unlikely that aspectual mismatch was detected during preview of the verb from the adverbial ROI. Proportions of regressions into this region revealed a clear difference between adverbial types in the AVSO word order. Mismatch had 63.2% regressions into the adverbial region, whereas coercion and control had 50 and 45.1%, respectively. By contrast, in the SVOA word order proportions of regressions in were roughly the same (mismatch: 36.8%; coercion: 37.5%; control: 34.0%). In ANOVAs, these differences led to significant main effects of *order* ($F_1(1, 23) = 12.00$; $p < .01$; $F_2(1, 35) = 19.09$; $p < .01$) and *adverbial* ($F_1(2, 46) = 4.33$; $p < .05$; $F_2(2, 70) = 3.52$; $p < .05$), but no significant interaction ($F_1(1, 23) = 2.03$; $p = .14$; $F_2(2, 70) = 1.80$; $p = .17$). Pairwise comparisons revealed a significant mismatch effect in the AVSO order (mismatch vs. control: $t_1(23) = 2.92$; $p < .01$; $t_2(35) = 2.96$; $p < .01$), but not in the SVOA order ($t_{1/2} < 1$).

At the verb region, the AVSO conditions did not differ either in first-pass times or regression path duration. ANOVAs revealed no reliable main effect of *adverbial* nor a significant interaction between *adverbial* and *order* (all $F_{1/2} < 1.2$). Also, first-pass regression ratios did not differ between conditions (all $F_{1/2} < 1$). When integrating the verb, aspectual mismatch or coercion thus went unnoticed in the AVSO conditions. The proportions of regressions in didn't differ in the verb region (all $F_{1/2} < 1.2$), either. In total times, however, the kind of adverbial made a clear difference in the AVSO sentences. In the mismatch condition total times were longer (82.2 ms/char) than in the coercion (66.2 ms/char) or the control condition (62.1 ms/char). This difference was absent in the SVOA conditions. ANOVAs analyzing the total times in all six conditions revealed a significant main effect of *order* ($F_1(1, 23) = 7.97$; $p < .01$; $F_2(1, 35) = 10.07$; $p < .01$), a significant main effect of *adverbial* ($F_1(2, 46) = 4.19$; $p < .05$; $F_2(2, 70) = 4.58$; $p < .05$) and an interaction that was significant by participants and marginal by items ($F_1(2, 46) = 3.34$; $p < .05$; $F_2(2, 70) = 2.83$; $p = .08$). This effect in total times in combination with the lack of effects in the earlier reading time measures indicates that the mismatch effect in the AVSO mismatch condition came from readers noticing a problem with the verb while rereading the sentence.

The third ROI contained the direct object in the SVOA conditions and the subject in the AVSO conditions. ANOVAs analyzing first-pass times and regression path durations revealed no significant main effects or a reliable interaction between the two (all $F_{1/2} < 1.3$). Again, there was no mismatch or coercion effect in the AVSO order. This is further corroborated by first-pass regression ratios. Numerically, in both word orders control led to slightly even more regressions than mismatch or

coercion. In total time, conditions were more or less the same. ANOVAs revealed a by participants significant main effect of *order* ($F_1(1,23) = 6.39$; $p < .05$; $F_2(1,35) = 2.15$; $p = .15$) due to SVOA conditions having slightly higher total times than the AVSO conditions. Neither the main effect of *adverbial* nor the interaction was reliable (both $F_{1/2} < 2.4$). This suggests that the arguments were not as important as the verb when it came to regressive eye movements due to aspectual mismatch. Proportions of regressions into this region differed between the two word orders (main effect of *order*: $F_1(1,23) = 15.06$; $p < .01$; $F_2(1,35) = 12.01$; $p < .01$). SVOA sentences received on average 9.2% more regressions than did AVSO sentences. Neither the main effect of adverbial nor the interaction were significant.

The next ROI was the critical segment. In the SVOA word order, it was the region where readers encountered a mismatching or coercing adverbial. In the AVSO word order, the readers got the direct object saturating the second argument slot. First-pass times didn't differ significantly between conditions (all $F_{1/2} < 1.6$). Yet, pairwise comparisons between mismatch and control revealed that in the SVOA order mismatching adverbials were read slower than *ago*-adverbials in the control condition (38.5 ms/char vs. 34.4 ms/char). This difference was significant by participants and marginal by items ($t_1(23) = 2.10$; $p < .05$; $t_2(35) = 1.85$; $p = .07$). There was, however, no difference between mismatch and control in the AVSO order (35.1 ms/char vs. 35.2 ms/char: $t_{1/2} < .1$). First-pass regression ratios, however, indicated an early mismatch effect in the AVSO word order, too. In AVSO sentences, mismatch led to 22.9% regressions out of the object region as compared to 13.9% in coercion and 12.6% in control sentences. In the SVOA conditions, the proportions ranged between 16.0 and 18.6%. ANOVAs revealed a marginally significant main effect of *adverbial* ($F_1(2,46) = 2.93$; $p = .07$; $F_2(2,70) = 3.78$; $p < .05$) but no significant main effect of *order* or their interaction. In pairwise comparisons, the mismatch effect turned out significant in the AVSO order ($t_1(23) = 2.87$; $p < .01$; $t_2(35) = 2.67$; $p < .05$), but not in the SVOA order ($t_{1/2} < 1$). In regression path duration we found a clear mismatch effect in both word orders. The SVOA mismatch condition had a mean regression path duration of 1,012 ms, whereas coercion and control had 757 and 722 ms. In the AVSO order we observed the same pattern: mismatch was read slowest with a mean regression path duration of 707 ms, whereas coercion and control were much faster with 512 and 533 ms. In ANOVAs this was reflected by significant main effects of *order* ($F_1(1,23) = 30.23$; $p < .01$; $F_2(1,35) = 35.49$; $p < .01$) and *adverbial* ($F_1(2,46) = 11.03$; $p < .01$; $F_2(2,70) = 17.77$; $p < .01$), but no reliable interaction ($F_{1/2} < 1$). Thus, when readers encountered an aspectually mismatching adverbial in SVOA word order, they launched a regression. In the AVSO order they regressed, too, but only launched a mismatch-induced regression after predication was complete. The total times followed the same pattern. Mismatch lead to longer RT than coercion and control. Statistically, the main effects of

order ($F_1(1,23) = 12.87$; $p < .01$; $F_2(1,35) = 7.78$; $p < .01$) and *adverbial* ($F_1(2,46) = 10.88$; $p < .01$; $F_2(2,70) = 7.74$; $p < .01$) were reliable, but there was no reliable interaction between *order* and *adverbial* ($F_{1/2} < 1$). Regressions in also differed between conditions. In the SVOA order there was a mismatch effect of 7.5% more regressions into mismatching adverbials than into control conditions, but the AVSO order was roughly the same. In ANOVAs this led to a significant main effect of order ($F_1(1,23) = 8.61$; $p < .01$; $F_2(1,35) = 15.00$; $p < .01$), a non significant main effect of *adverbial* ($F_{1/2} < 2$) and a by participants significant interaction between *order* and *adverbial* ($F_1(2,46) = 4.61$; $p < .05$; $F_2(2,70) = 2.80$; $p = .07$).

At the following spillover region, there were no reliable differences in any of the eyetracking measures.

8.5.3 Discussion

The present experiment provides clear support for the LAIH. The makes sense judgments show that readers noticed the aspectual mismatch in the aspectual mismatch condition. The eye movements indicate that mismatch detection in the SVOA mismatch condition was very fast. Immediately when readers encountered the mismatching adverbial reading was slower than in the control condition. The time course was different in the AVSO mismatch condition. Before having read the arguments, the lexical aspect of the verb was not composed with the mismatching adverbial. Only after the complete predication a delayed mismatch effect emerged. Like in the SVOA order, mismatch detection affected early eyetracking measures, namely first-pass regression ratio.

May a potential early mismatch effect in the AVSO conditions have gone unnoticed because of too small sample size in the present study? This is a legitimate concern because we are basically interpreting null effects. Nevertheless, we think that this is unlikely to be true. After completing the study we tested additional 12 participants to gain more statistical power. Still, the pattern of results was exactly the same as reported here (cf. Bott (2011)).

What is puzzling about the results of the present experiment is that both coercion conditions perfectly lined up with the control conditions.[8] This doesn't fit the results of the two self-paced reading studies reported earlier. An explanation for the divergent findings might be that the sentences in the present experiment were always continued with an *although* clause mentioning an obstacle that made the culmination hard to achieve. For instance, in the sample item (17-a)–(17-b) the culminating event *win the tournament* when combined with the coercing *in*-adverbial called

[8]We cannot go into the details here, but statistical analyses of the complete sentence also taking into account the subsequent spillover regions didn't yield a coercion effect whatsoever.

for a preparatory process not expressed in the main clause. The *although* clause implicitly stated what the preparation probably was, namely fighting a lot of fights. In this sense, the *although* clause may have resolved additive coercion in the present experiment. The self-paced reading experiments didn't have this kind of continuation, so it may have been left to the reader to come up with an appropriate preparatory process. This explanation receives independent support from an event related potentials (ERP) study on additive coercion (Bott, 2010) using the same kind of materials that were tested in the present experiment. The study showed that additive coercion differed qualitatively from aspectual mismatch. While the latter led to a P600 effect, the former only elicited a working memory LAN. Based on these findings we have argued that additive coercion involves a smooth update of the aspectual representation without revising it first. This kind of smooth update may have gone unnoticed in the present experiment. It has to be left to further research to investigate whether a coercion effect would show up in an eyetracking experiment, too, when the sentence doesn't contain any information about what the missing eventuality might have been.

8.6 General Discussion

The present paper investigated the processing domain of lexical aspect. We formulated three alternative hypotheses, *incremental aspectual interpretation* (IAIH), the *complete verb phrase hypothesis* (CVPH) versus the *late aspectual interpretation hypothesis* (LAIH). The first hypothesis is inspired by much psycholinguistic work on sentence processing which shows that the sentence representation is constructed on an (at least) word-by-word basis. By contrast, the LAIH takes into account semantic work on lexical aspect like Dowty (1979), Verkuyl (1993) and Krifka (1998) which demonstrates that the arguments have a great impact and that aspect can only be determined at the sentential level.

In three reading time studies we used adverbial modification of yet incomplete verb-argument structures to investigate whether aspectual mismatch and additive coercion slow down reading of the adverbial when arguments are still missing. The results of the experiments provide evidence for the LAIH: the adverbial only showed semantic effects after the verb had received all its arguments. These findings are particularly striking since the completion study showed that the same sentence fragments were judged to be semantically ill-formed with comprehenders not being able to continue them in a sensible way. The findings are thus clearly inconsistent with the IAIH and the CVPH. Lexical aspect seems to be determined at the sentence level at the earliest.

Does this mean that lexical aspect isn't processed incrementally? Reflecting upon the notion of *incrementality*, two senses have to be distinguished. First, *incrementality* sometimes means *immediacy* which reflects whether some kind of

information is taken into account immediately, that is during first interpretation. Second, *incremental interpretation* sometimes is used to refer to processing that proceeds *word-by-word*. In principle, these two aspects are independent from each other and have to be kept apart. Whereas lexical aspect depends on a bigger processing domain than the word or even the phrase, the time-course of mismatch and coercion effects speak in favor of immediate aspectual processing. In the eyetracking experiment, mismatch detection in the SVOA condition occurred immediately at the adverbial as indicated by enhanced first-pass times. This lends support to assumption that aspectual processing is incremental, in principle, but that the processor operates on increment units that are bigger than the word or even the phrase.

It is an open question, however, whether the present findings can be generalized to other aspectual classes or languages. To date, we can only speculate about these issues. We find it plausible to assume that the aspectual system of a language has a big influence on how the language is processed. For instance, in a language with grammatical means to distinguish telic from atelic processes we would expect to find immediate mismatch effects irrespective of potentially missing arguments. We are planning experiments testing these predictions by looking at crosslinguistic differences in domain size comparing German and Russian. Turning to other aspectual classes, we expect the findings to be fully generalizable. In any of these, the arguments and the construction play a crucial role, as (18-a) and (18-b) demonstrate for activities and semelfactives, respectively.

(18) a. In zwei Stunden joggte... (Peter bis ins nächste Dorf.)
In two hours jogged... (Peter to the next village)
b. In fünf Minuten hustete... (Peter das Tuch über den ganzen Tisch.)
In five minutes coughed... (Peter the cloth over the whole table.)

In conclusion, this paper addresses the question at what hierarchical level of verb-argument structure the processor constructs an atomic event unit. Let us continue the analogy from chemistry. In the same way that the properties of an atom do not depend only upon the nucleus but also upon the number of electrons, the atomic orbitals and their occupancy, lexical aspect seems to be determined only at a supralexical level. Just as in chemistry and physics this doesn't mean that an atomic unit has no internal structure, but rather that our means of investigation – the kinds of adverbials used here – are only sensitive to the holistic properties of the atomic event as a whole.

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Appendix: Sentence Materials Used in Experiment 4

1 Der Ringer|gewann|das Turnier|vor drei Stunden,|obwohl|es|viele|Konkurrenten gab.
2 Die Yacht|erreichte|den Hafen|vor einer halben Stunde,|obwohl|kein|starker|Wind blies.
3 Die Truppe|eroberte|die Festung|vor sieben Tagen,|obwohl|die Gegner|in der|Überzahl waren.
4 Die Jury|ernannte|die Sprecherin|vor drei Stunden,|obwohl|die Mitglieder|verschiedener| Meinung waren.
5 Der Stürmer|erkannte|die Chance|vor einer Minute,|obwohl|die Abwehr|sehr|dicht stand.
6 Der Kommissar|überführte|die Bankräuber|vor zwei Tagen,|obwohl sie|kaum|Spuren| hinterlassen hatten.
7 Der Archäologe|entdeckte|die Skulptur|vor zwei Wochen,|obwohl|das|Grabmal|teilweise verschüttet war.
8 Der Mechaniker|identifizierte|den Schaden|vor zwanzig Minuten,|obwohl|der Motor| nahezu|unzugänglich war.
9 Der Wilderer|erlegte|den Hirsch|vor zwanzig Minuten,|obwohl|drei|Kugeln|daneben gingen.
10 Der Junge|tötete|die Stechmücke|vor fünf Minuten,|obwohl|sie|sehr|schnell war.
11 Der Abiturient|erhielt|das Zeugnis|vor vierzig Minuten,|obwohl|er|der Letzte|im Alphabet war.
12 Die Ehefrau|fand|die Liebesbriefe|vor zwei Stunden,|obwohl|ihr Mann|sie|gut versteckt hatte.
13 Der Übersetzer|verstand|den Artikel|vor zwei Tagen,|obwohl|er|sehr|schwierig war.
14 Der Tüftler|erfand|die Maschine|vor fünf Tagen,|obwohl|die|Konstruktion|sehr kompliziert war.
15 Das Kind|bekam|das Paket|vor zwei Tagen,|obwohl|die|Adresse|nicht stimmte.
16 Der Klempner|bemerkte|den Rohrbruch|vor zehn Minuten,|obwohl|das Rohr|unter Putz| verlegt war.
17 Der Forscher|verließ|die Höhle|vor fünfzehn Minuten,|obwohl|seine|Taschenlampe|nicht funktionierte.
18 Der Schüler|bewältigte|die Aufgabe|vor einer Viertel Stunde,|obwohl er|nicht|schnell| schreiben konnte.
19 Der Mathematiker|durchschaute|die Idee|vor zwei Tagen,|obwohl|sie|unklar|formuliert war.
20 Das Militär|startete|die Operation|vor einer Stunde,|trotz|kleinerer|Unstimmigkeiten|im Führungsstab.
21 Das Virus|befiel|den Patienten|vor vierundzwanzig Stunden,|trotz|sorgfältigster| Maßnahmen|zur Quarantäne.
22 Der Rennfahrer|besiegte|den Konkurrenten|vor dreißig Minuten,|trotz|Motorschadens| in|der ersten Runde.
23 Der Matrose|erspähte|den Leuchtturm|vor fünf Minuten,|obwohl|es|überaus|neblig war.
24 Der Arzt|erblickte|den Kollegen|vor zehn Minuten,|obwohl|viele Leute|an|der Konferenz teilnahmen.
25 Die Schülerin|erfasste|das Problem|vor drei Minuten,|obwohl|die Aufgabe|verwirrend| formuliert war.
26 Der Hausmeister|erwischte|den Jungen|vor drei Minuten,|obwohl|dieser|ihn|auszutricksen versuchte.

27 Die Großmutter|löffnete|den Brief|vor zwei Minuten,|obwohl|dieser|extra|versiegelt war.
28 Die Studenten|gründeten|die Initiative|vor zwei Wochen,|obwohl|die Unileitung|gegen|sie agiert hatte.
29 Die Putzfrau|schloss|das Fenster|vor einer Minute,|obwohl|es|heftig|geklemmt hatte.
30 Der Mann|vergaß|die Telefonnummer|vor fünf Minuten,|obwohl|er sie|zu|memorieren versuchte.
31 Der Professor|akzeptierte|den Beweis|vor zwei Stunden,|obwohl er|anfangs|eine Prämisse| nicht verstanden hatte.
32 Die Nachbarin|erfuhr|das Gerücht|vor vierzig Minuten,|trotz|der|Verschwiegenheit|ihrer Nachbarn.
33 Das Mädchen|ergatterte|eine Karte|vor zwei Tagen,|obwohl|der|Schwarzmarkt|quasi leergefegt war.
34 Die Polizei|ertappte|den Einbrecher|vor dreißig Minuten,|obwohl|dieser|alle|Eventualitäten einberechnet hatte.
35 Der Minister|eröffnete|das Museum|vor fünfzig Minuten,|obwohl|mehrere|Ansprachen| gehalten wurden.
36 Der Einbrecher|zerbrach|die Scheibe|vor dreißig Minuten,|obwohl|diese|aus|Panzerglas bestand.

Note: all sentences in the SVOA control condition. Vertical lines indicate regions of interest.

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Chapter 9
Event End-Point Primes the Undergoer Argument: Neurobiological Bases of Event Structure Processing

Evie Malaia, Ronnie B. Wilbur, and Christine Weber-Fox

9.1 Introduction

The progress within neuroscience now allows probing the neural processing of language-related computations as they occur in the living brain. These in vivo investigations can assess how close linguistic theory has come to describing linguistic computations in the brain, uncover neural correlates of theoretically posited abstract linguistic features, and test language processing models. On the other hand, linguistic universals – the features that are consistently reported cross-linguistically – are likely to expose regularities inherent to human neural processing.

Verbal telicity belongs to a small set of semantic features which can affect the syntactic structure of the predicate, as well as the argument role assignment (Vendler 1967; Van Valin 2007; Dowty 1979). Telicity as an element of subatomic semantics is typically formulated as a reference to an end-point of an event within verbal semantics (e.g., *catch*, *fall*). Atelic verbs refer to activities or states, which are conceptualized as homogenous (*tease*, *sleep*).[1] From the point of view of semantics,

[1]Homogeneity and atelicity are not correlated in all theoretical frameworks. The early definitions of atelicity were based on homogeneity (Vendler 1967); however, such definitions did not define grain size of a single event, making difficult the treatment of semelfactives. (Krifka 1989) defined atelicity using the notion of cumulativity; some recent works also suggest treating atelicity as simply non-telicity. Homogeneity, however, remains the most intuitively simple explanation of what it means for a predicate to be atelic.

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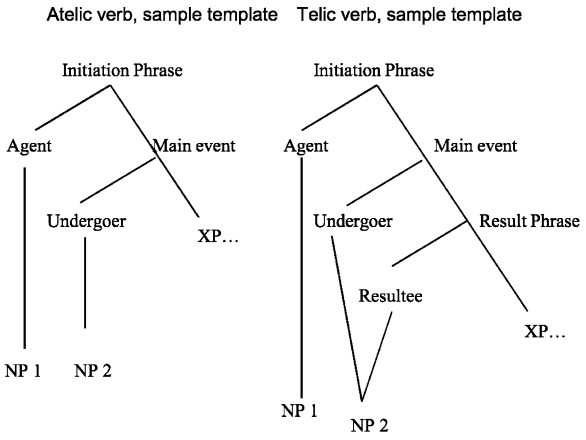

Fig. 9.1 Sample two-argument templates of atelic and telic verbs (cf. Ramchand 2008)

telic verbs provide a temporal reference point for further aspectual computations (Jackendoff 1991). Telic verbs also imply existence of an affected event participant.[2] They have been hypothesized to create a syntactic position for, and assign the thematic role of, the Patient argument, regardless of their transitivity status: intransitive/unaccusative, transitive, or ambitransitive (Tenny 1987; van Hout 2001).[3]

The linguistic behavior of telic verbs has long been of interest to syntacticians, who observed multiple correspondences between telicity (lexical aspect) of the verb, and syntactic structures it can be used in, exemplified by grammaticality of adverbial modification (Tenny 2000), aspectual coercion (Smith 1991), and argument structure alternations (Levin 1993; Ramchand 2008, etc.). Multiple theoretical proposals have been put forth to explain differences in syntactic behavior of verbs from distinct semantic classes; Fig. 9.1 illustrates one such proposal (after Ramchand 2008), linking verbal semantics with the presence of a Result Phrase in the syntactic template.

Early behavioral studies of subatomic event semantics, which indirectly measured the cognitive load induced by linguistic computation using reading and response times, had been driven by the question of whether the notion of

[2]Some languages, such as English or Dutch, require that the affected Patient is quantized in order for the VP to convey telic meaning. The use of bare mass nouns results in loss of telicity for the VP (cf. *I ate fish. – I ate the fish*.) The studies reviewed in this chapter all use quantized arguments.

[3]Multiple arguments exist as to whether to consider (a)telicity to be a feature of the verb, the full predicate (verb and its arguments – cf. Bott, Chap. 8 in this volume), or the entire sentence, (cf. Partee 2004); it is possible that the answer to this question is language-specific (cf. Malaia 2004). The present experiments avoided coercion and mismatch in telicity, as could be introduced by certain arguments or adjuncts: in the telic conditions, both the verb and the entire VP were telic. Additionally, the analysis of ERP waveforms was performed on the verb as well as all words within the VP, so as not to bias the results toward either theoretical framework.

telicity was purely semantic, or whether semantically telic verbs invoked specific syntactic structures during language processing. For example, Sanz (2000) used a cross-modal priming technique, and measured response times to semantic probes in sentences with telic and atelic verbs, showing re-activation of the Patient argument following telic verbs in Spanish (although not for English, possibly due to differential strategies used by the participants in the experiment). A 'word maze' experiment (O'Bryan 2003) used a type of extended grammaticality judgment to assess the effect of telicity on sentence comprehension: the participants were asked to build a grammatical sentence by sequentially choosing one of the two words on the screen (only one of the two words enabled the sentence to continue as grammatical). This experiment used four types of verbs: transitive telic (e.g. *accuse*), optionally transitive telic (e.g. *trip*), transitive atelic (e.g. *carry*), and optionally transitive atelic (e.g. *lecture*), in sentences containing Object reduced relative clauses (e.g. *The actress described by the writer left in a hurry*.). There was a significant reaction time advantage on the *by* for telic verbs, and an independent advantage for the second argument for transitive verbs (both telic and atelic), demonstrating independent effects of telicity and transitivity in this task. These results demonstrated that argument requirements of the verb, and the syntactic structure (or event template) that the verb invokes, are used independently for online sentence processing. Finally, a cross-modal priming study by (Friedmann et al. 2008) compared sentences with intransitive atelic (frequently also termed unergatives[4] in the linguistic literature) and intransitive telic (unaccusative[5]) English verbs, and found a priming effect for Subjects of intransitive telic verbs (unaccusatives), but not for intransitive atelic ones (unergatives).

Overall, behavioral investigations demonstrated that telic verbs (as compared to atelic ones) prime (or re-activate) the Patient argument. However, it remains unclear at which point online comprehension is affected by verbal event structure, and whether the effect is driven by semantic or syntactic properties of the verb. ERP investigations of the timecourse of verbal telicity effects on online processing help answer a crucial question in language comprehension: how do humans associate arguments with thematic roles provided by the verb? Do syntactic and semantic cues interact continuously during comprehension to provide one with the understanding of "who did what to whom", or does the processing occur/progress sequentially? The answers to these questions are important both for the development of linguistic theories, and for the understanding of the brain network interactions, which are ultimately responsible for linguistic computations.

[4] *Unergatives* are a subset of atelic verbs: those with only one argument. Telic verbs with one argument are also termed *unaccusatives*. The neuro-psychological reality of this linguistic distinction is supported by neuroimaging evidence (Shetreet et al. 2010).

[5] While all one-argument telic verbs are unaccusatives, not all unaccusatives are necessarily telic: verbs such as *melt, cool, warm* can denote scalar events – e.g. "melt to some degree, but not completely".

The two studies reviewed here (Malaia et al. 2009, 2012) address these questions using evoked response potentials to sentences with reduced relative clauses using telic and atelic verbs. As prior behavioral work has shown that telic verbs activate specific syntactic (event structure) templates, we hypothesized that these templates would be used for integrating incoming information. The exact timing of integration, and ERP components elicited by such integration, would help answer the question of how prior syntactic information is used during online language processing. Sequential processing models (Bornkessel and Schlesewsky 2006; Friederici and Frisch 2000; Friederici et al. 1996) predict that computation of thematic role re-assignment would elicit left anterior negativity (LAN), while selection of the correct syntactic template from several possible ones (e.g. for ambitransitive verbs) would elicit early left anterior negativity (ELAN) on the NP following the verb. Parallel processing theories (Jackendoff 2007), on the other hand, suggest non-directional competition of multiple linguistic constraints (in this case, syntactic and semantic) in verbal working memory, allowing for earlier effects which can occur on any disambiguating word in the sentence. In the following section, we review existing ERP evidence for these theoretically predicted components, and review the rationale for selection of specific components and time windows for statistical analysis.

9.2 Predictions for ERP Waveforms

As both predictions and interpretations of observed components in ERP experiments necessarily rely on extant ERP literature, the hypothesized results centered on the following components of ERP waveform:

N100 is an exogenous component elicited by visual and auditory stimuli, and modulated by selective attention. Phrase structure violations have been shown to elicit increased amplitude in this early negative component (Neville et al. 1991). Spatial distribution of enhanced N100 over the cortical surface in language studies appears to depend on the nature of the stimulus and the task: visual word-category recognition tasks (Lai and Mangels 2007) elicit parieto-occipital distribution of this component, while auditory (Astheimer and Sanders 2009) and syntactic processing tasks (Yamada and Neville 2007; Neville et al. 1991) elicit more fronto-central localization. Additionally, both visual and auditory linguistic studies showed that the amplitude of N100 is modulated by attentional effort (Astheimer and Sanders 2009; Lai and Mangels 2007).[6]

P200 is an exogenous component elicited by the visual stimuli, modulated by attention, which likely indexes higher-order perceptual processing, such as

[6]N100 is distinct from early left anterior negativity (ELAN) in that ELAN occurs in response to violations of word-category/phrase structure, and its cortical distribution is more left-lateralised or bilateral. The stimuli for the studies under discussion did not contain the violations evoking ELAN.

top-down attentional preparation for an expected word. Increased negativity over this component has been interpreted as indexing an increase in the processing load, as it typically follows the onset of the critical word in ungrammatical sentences (Yamada and Neville 2007; Osterhout et al. 1994). Yamada and Neville (2007) related anterior distribution of this component to syntax-semantic interface processing triggered by the presence of semantic information. Their study demonstrated anterior increase in the negativity of P200 in response to ungrammaticality in English sentences, as compared to an even distribution of the same modulation in response to Jabberwocky sentences.

Late-onset negative components.[7] The family of ERP components occurring within this time interval includes a left-lateralized anterior negativity (LAN), Anterior Negativity, and the N400. Increased load on verbal working memory in grammatical sentences has been shown to elicit fronto-central and right-hemispheric distribution of negativity between 300 and 600 ms (Anterior Negativity) in the studies of gapping sentences in English (Kaan et al. 2004) and anaphor resolution in German (Streb et al. 2004). Discrepancies in morpho-syntactic information, and increased working memory load elicited left-hemispheric distribution of negativity over this interval (LAN) (Hagoort and Brown 2000; King and Kutas 1995; Osterhout and Mobley 1995). Finally, conflicts in thematic interpretation of the arguments (e.g. presence of two animate arguments before the verb, competing for the Agent role; cf. Frisch and Schlesewsky 2001), and semantic and pragmatic violations (Kutas and Hillyard 1984; Hagoort et al. 2004; Kutas and Hillyard 1980) are indexed by a posteriorly distributed N400 component.

As behavioral studies demonstrated priming of the Patient by telic verbs, which could lead to an increase in the cognitive load in the atelic condition due to comparative difficulty in phrase structure re-analysis, all of the temporal windows for these ERP components were examined in the two studies described below. Additionally, as previous research in electrophysiology has demonstrated that temporal and amplitude measures of ERPs differentiate neural functions of adults with normal and high language proficiencies (Weber-Fox et al. 2003), all participants were administered the Listening Grammar (LG) subtest of the Test of Adolescent and Adult Language, Third Ed. (TOAL-3, Hammill et al. 1994), and subsequently divided into two proficiency groups (Normal Proficiency, or NP, and High Proficiency, or HP). The task in this subtest consists of selecting two sentences closest in meaning from the three sentences read aloud to the participant, e.g.:

1. Jane did not make the grade because she didn't do her best.
2. Although Jane did her best, she did not make the grade.
3. If Jane didn't make the grade, it wasn't because she didn't try.

[7]We did not predict a P600 in our experiment, since this component is task-dependent. Also, P600 can indicate syntactic or semantic repair; with our stimuli, neither was necessary: all stimulus sentences were completely grammatical, and made sense.

The correct answers are B and C; as the sentences are presented one after another, the participants have to rely on verbal working memory for retrieval of exact sentence meaning. The results of the subtest are thus possibly indicative both of one's linguistic proficiency and verbal working memory capacity. The latter can serve as the predictor of the processing strategy the participant is likely to use for language processing (Budd et al. 1995; King and Kutas 1995).

9.3 Thematic Role Re-assignment Facilitated by Telic Verbs

The reduced Object relative clauses (RRCs, such as *The actress chaperoned by the writer left the ball early*) are often used to investigate effects of semantic variables (argument animacy, quantification, verbal telicity, etc.) on garden-path recovery and thematic role assignment (Just et al. 1996; King and Kutas 1995). During the processing of a typical sentence, the first argument encountered in the sentences is assumed to be the prototypical Agent and the Subject of the sentence (Wekerly and Kutas 1999; Kuperberg et al. 2007; Townsend and Bever 2001). When this assumption turns out to be incorrect, such as in garden-path sentences with RRCs, the comprehender has to quickly re-analyze thematic role assignment in order to proceed with sentence parsing (Townsend and Bever 2001).

Here we consolidate the results of two ERP experiments on neurocognitive processes underlying thematic role assignment by telic and atelic verbs (Malaia et al. 2009, 2012). The studies examined neurophysiological bases of telicity effects on thematic role re-assignment in reduced relative clauses. In order to control for the independent effect of argument structure, which prior behavioral studies have revealed, we restricted the stimuli to strictly transitive verbs in study 1, and ambitransitive verbs in study 2. The stimuli used for the two studies are presented in Table 9.1. Both verbs in RRCs in example 1 are obligatorily transitive, i.e. require two arguments to produce a grammatical sentence. Both verbs in RRCs in example 2 are optionally transitive, i.e. can form grammatical sentences with only one argument (cf. *The actress awakened at 5 am, or The actress worshipped alone*), as well as with two arguments.

In the first study, ERPs were recorded from 20 English speakers as they silently read sentences with reduced and unreduced Object relative clauses, in which the main verb (either telic or atelic) was obligatorily transitive, e.g., "The actress

Table 9.1 Examples of sentences with reduced relative clauses

Transitivity	Telicity	Sample sentence with a reduced relative clause
1. Obligatory	(a) Telic	The actress **spotted** by the writer left in a hurry.
	(b) Atelic	The actress **chaperoned** by the writer left in a hurry.
2. Optional	(a) Telic	The actress **awakened** by the writer left in a hurry.
	(b) Atelic	The actress **worshipped** by the writer left in a hurry.

(who was) *spotted/chaperoned* by the writer left in a hurry". Based on the linguistic theory of event structure (Ramchand 2008) and the parallel architecture processing theory (Jackendoff 2007), we hypothesized that the event template of telic verbs would activate the syntactic position for the Determiner Phrase (DP) containing the Patient argument (i.e. at the definite article *the*, the first word in the DP, since the Agent thematic role is borne by the entire DP), and facilitate re-assignment of thematic roles during syntactic processing, as compared to sentences with atelic verbs.

Sixty stimulus sentences were constructed using obligatorily transitive verbs. Obligatory transitive verbs for the stimuli (30 telic and 30 atelic) were chosen based on (Levin 1993), and cross-referenced with examples of allowable usage from multiple dictionary sources. The sentences allowed the use of either telic or atelic verbs in the reduced relative clause, while remaining semantically plausible. The stimulus materials thus consisted of (a) 60 stimulus sentences with reduced relative clauses (RRCs), and (b) the same sentences but with the unreduced relative clauses (URCs). Noun-verb co-occurrences were assessed using the Pointwise Mutual Information measure (Recchia and Jones 2009), and were matched across verb type ($t(118) = 1.299$, $p > .05$), and argument order (first, second) in telic and atelic conditions ($t < 1$ in both cases). The stimulus verbs were compared for frequency in present and past forms using Kučera and Francis (1967) frequency tables; there was no effect of frequency for either present tense or past tense forms ($t < 1$). In addition, subjects were presented with 60 filler sentences with varying syntactic structures. Probe questions were constructed for all sentences in order to test for correct thematic role assignment, e.g. a sentence such as *The runner nominated by the coach won the race* was followed by a question *Did the runner nominate the coach?*. Stimulus sentences were presented word-by-word on a computer screen for 200 ms, with an interval of 315 ms between words. Sentence-final words appeared with a period. Each sentence was followed by a yes-no question. After the subject responded to the question, the prompt *Ready?* appeared on the screen, allowing the subject to pause before initiating the next trial.

EEG activity was recorded over the scalp using 32 Ag-Cl electrodes secured in an elastic cap (Quik-cap, Compumedics Neuroscan). Electrodes were positioned according to the criteria of the International 10–10 system (medial sites FZ, FCZ, CZ, CPZ, PZ, OZ; fronto-temporal lateral and mid-lateral sites F3/F4, F7/F8, FC3/FC4, FT7/FT8, C3/C4; parieto-occipital lateral and mid-lateral sites CP3/CP4, TP7/TP8, P7/P8, P3/P4, O1/O2). All electrode impedances were adjusted to 5 kOhms or less, and the electrical signals were amplified with a bandpass of .05 and 100 Hz, and digitized online (Neuroscan 4.0) at the rate of 500 Hz. Reference electrodes were placed over the left and right mastoids, and all scalp electrodes were re-referenced to the average of the left and right mastoid following the recording (Luck 2005). The eye movements and blinks were recorded using electrodes placed above and below the eye, and removed from the recorded data (7.7%). The 100 ms interval prior to onset served as the baseline for amplitude measurements of the ERPs.

Each ERP component was measured using a temporal window approximately centered around its peak in the grand averaged waveforms. The ERPs elicited by the verb in the relative clause, on the *by* following the verb, the article *the*, and

the Agent Noun were compared over three temporal windows. Thus, for the verb, the comparisons were made for negative peak amplitudes between 100 and 200 ms (N100), and positive peak amplitudes between 200 and 320 ms (P200) post word onset. For the preposition *by*, the respective windows were 85–185, and 185–315 ms post word onset. Mean amplitudes for the Anterior Negativity (AN) were measured between 360 and 600 ms for the verb, and between 385 and 585 ms for the preposition *by*. For the article *the*, the comparisons were made for negative peak amplitudes between 70 and 210 ms (N100), positive peak amplitudes between 210 and 330 ms (P200), and mean amplitudes between 370 and 630 ms (AN) following the onset of the definite article. For the Agent Noun, the comparisons were made for negative peak amplitudes between 115 and 215 ms (N100), positive peak amplitudes between 215 and 315 ms (P200), and mean amplitudes between 315 and 655 ms (AN) following the onset of the word. Statistical analyses included ERPs recorded at 26 scalp electrodes (medial sites FZ, FCZ, CZ, CPZ, PZ, OZ; fronto-temporal lateral and mid-lateral sites F3/F4, F7/F8, FC3/FC4, FT7/FT8, C3/C4; parieto-occipital lateral and mid-lateral sites CP3/CP4, TP7/TP8, P7/P8, P3/P4, O1/O2).

For lateral and mid-lateral sites, repeated-measures analysis of variance (ANOVA) was conducted to determine the effects of telicity (telic vs. atelic condition) separately with three factors (Telicity [telic, atelic], Hemisphere [left, right], and Anterior/Posterior [fronto-temporal, parieto-occipital]). For the analysis of the medial sites, analysis of variance included two factors (Telicity [telic, atelic], and Anterior/Posterior [fronto-central, parietal]). In cases where significant effects were found for interactions, a step-down ANOVA was performed to investigate whether the main effect was significant over a subset of electrode sites.

Telicity as an element of subatomic semantics is often formulated as a property of the verb referring to a change-of-state event (*catch*, *vanish*). Atelic verbs, on the other hand, refer to homogenous activities or states (*tease*, *sleep*). Telic, or change-of-state verbs infer existence of an affected event participant; thus telic verbs have been hypothesized to always assign the thematic role of the Patient, regardless of their transitivity status (intransitive/unaccusative, transitive, and ambitransitive) (Table 9.2).

In accordance with our predictions, ERPs in reduced relative clauses (RRCs) diverged on the definite article preceding the agent: the atelic condition was characterized by larger amplitude negativity at the N100 (Fig. 9.1). None of the reported interactions in unreduced relative clauses (URCs, e.g. *The actress who was chaperoned by the writer left the gala early*), which appeared significant at the full set of electrodes, had a significant effect over a subset of electrode sites; further data analysis demonstrated that significance of the interactions at the higher level was only due to the opposing direction of the effect over subsets of electrodes. The ERP waveforms elicited over the *by the* region in URCs are presented in Figs. 9.2 and 9.3.

As the ERP data analysis shows, the re-analysis of argument structure in garden-path-inducing RRCs with atelic verbs appears to produce a greater challenge in thematic role assignment as compared to the same process in RRCs with telic verbs. The processing data obtained for RRCs and URCs demonstrates that the syntactic

Table 9.2 Significant ANOVA results for various ERP measures taken on individual words

Word position	Effect	F (1, 19) =	p <	η_p^2 =
Sentences with Reduced Relative Clauses (RRCs)				
Verb in relative clause, e.g. *The actress spotted by* ...	T	5.169	.035	.214
N1 latency over lateral and mid-lateral sites				
the, e.g. *The actress spotted by the writer*...	T	6.633	.019	.259
N1 amplitude over midline sites	T × A	7.723	.012	.289
over anterior midline sites only	T	11.412	.003	.375
N1 amplitude over lateral and mid-lateral sites	T	4.370	.05	.187
P2 amplitude over midline sites	T × A	5.529	.030	.225
Anterior negativity over midline sites	T × A	9.46	.006	.333
over anterior midline sites only	T	4.740	.042	.200
Anterior negativity over lateral and mid-lateral sites	T × A	4.932	.039	.206
Sentences with Unreduced Relative Clauses (URCs)				
Verb in URC, e.g. *The actress who was spotted by* ...	T × A	5.388	.032	.230
Anterior negativity over lateral and mid-lateral sites				
Agent, e.g. *The actress who was spotted by the writer*...	T × A × H	12.160	.002	.390
N1 amplitude over lateral and mid-lateral sites				
P2 latency over lateral and mid-lateral sites	T × A × H	7.377	.014	.280

Note: Electrode subsets: midline [FZ, FCZ, CZ, CPZ, PZ, OZ]; midline anterior [FZ, FCZ, CZ]; midline posterior [CPZ, PZ, OZ]; anterior lateral and mid-lateral [F3/F4, F7/F8, FC3/FC4, FT7/FT8, C3/C4]; posterior lateral and mid-lateral [CP3/CP4, TP7/TP8, P7/P8, P3/P4, O1/O2]
T Telicity, *A* Anterior, *H* Hemisphere

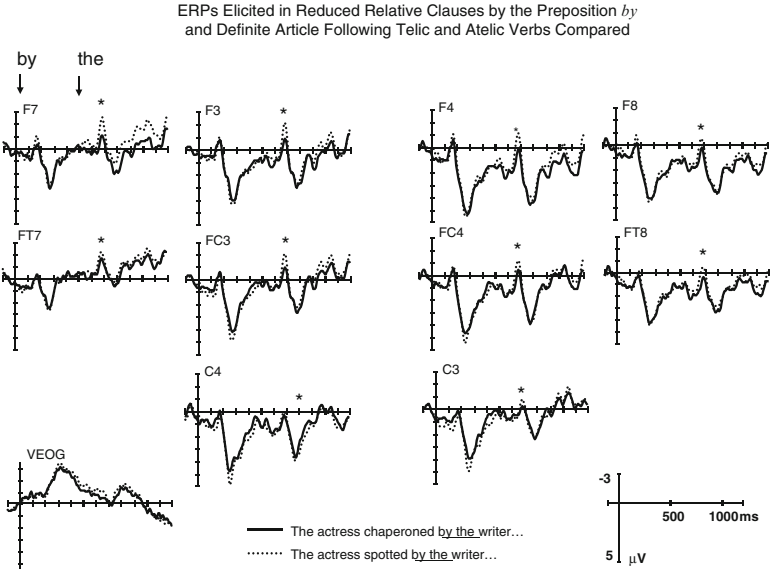

Fig. 9.2 ERPs elicited by the definite article in RRCs with telic and atelic verbs

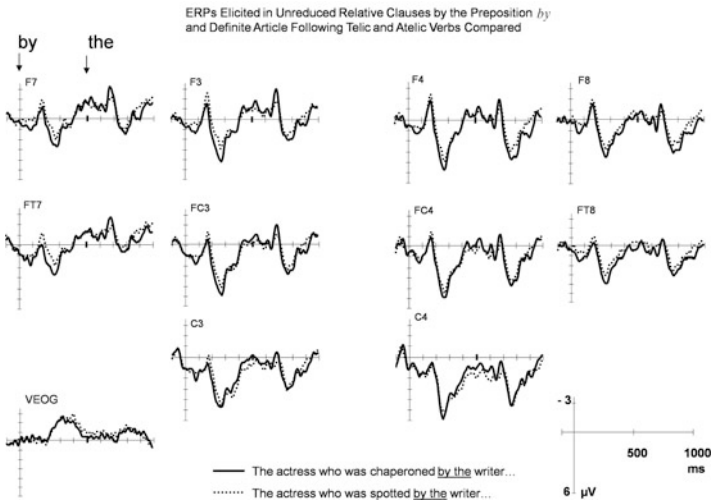

Fig. 9.3 ERPs elicited by the definite article in URCs with telic and atelic verbs

template activated by telic verbs is used for thematic role (re-)assignment in transitive clauses as soon as the head of DP (definite article *the*) is encountered. This effect is similar to the phenomenon of internal argument priming in unaccusative (i.e., intransitive telic) verbs (Friedmann et al. 2008). Since thematic role re-assignment begins on the head of DP, the article, rather than the Agent noun, it has to be attributed to prior activation of the Patient syntactic position (DP) by the telic event template, rather than to semantic or frequency effects. The current findings are consistent with previous results in language processing (Astheimer and Sanders 2009; Lai and Mangels 2007; Boddy and Weinberg 1981; Mehta et al. 2009) and indicate that modulations in attention with increased processing loads are quite rapid (∼150 ms). Taken together with previous findings, it appears that on-line adjustments to variations in language processing load may be mediated by changes in neuronal synchronization associated with attentional mechanisms.

9.4 Verbal Event Structure Used for Garden-Path Recovery

One peculiar aspect of the overt realization of thematic roles is that the Patient argument can appear in the surface syntactic structure of the sentence as either Subject or Object. If the verb is transitive, i.e. assigns two syntactically privileged argument roles (as in *Mary caught the ball*), the affected argument surfaces as an Object. If the verb is intransitive, i.e. only assigns one argument role (as in *Mary arrived*), the Patient surfaces as a Subject. Optionally transitive verbs, which can be used in sentences with one or two arguments (cf. *The baby awakened/The mother*

awakened the baby) alternate in assigning the affected argument to the Subject or Object position. Despite such variability in overt syntactic realization of thematic roles, comprehenders have no difficulty in correctly identifying the Agent and the Patient in each linguistic event.

It is, therefore, possible that argument structure (one vs. two arguments) is a more salient cue for thematic role assignment, as opposed to the syntactic structure activated by telic verbs. This hypothesis was tested in the second experiment, the methodology of which was identical to the first study. Twenty-two English speakers read sentences with an ambitransitive main verb, which was either telic or atelic, e.g., *The actress awakened/worshipped by the writer left in a hurry*. The participants were separated into groups according to whether their number of correct responses on the baseline (TOAL-3 LG subtest) was above or below the mean (29.7) for the entire group. The subjects were thus divided into Normal Proficiency (NP group, N = 12) and High proficiency (HP group, N = 10) responders. ERPs elicited by telic and atelic verbs, the preposition *by* introducing the second argument (Agent), and the second argument itself, e.g., *writer*, were compared. ERPs elicited in the atelic condition in high (HP) and normal (NP) proficiency groups were characterized by increased negativity, as compared to the telic condition. However, the two groups differed with regard to where in the sentence telicity information was utilized. In the HP group, the preposition *by* (the first word introducing the Agent argument) elicited differential processing in telic vs. atelic condition within 200 ms of word onset, which was sustained throughout the Anterior Negativity component (320–500 ms following the word onset) (Fig. 9.4). These results are consistent with a suggestion by Weber-Fox and Neville (2001) that participants with high linguistic proficiency have more reliance on closed-class words. In the NP group, however, the ERPs did not diverge until the Agent Noun itself; on the Agent Noun (Fig. 9.5), ERPs to atelic condition in this group were significantly more negative over N100 and P200 components (or N1-P2 complex).

This study demonstrated that ambitransitive telic verbs, as well as transitive ones, assign the Patient thematic role, thus facilitating parsing decisions in garden-path conditions. However, the exact timeline of thematic role re-assignment (on the *by* or on the Agent Noun) appears to be determined by the parsing strategy employed by the comprehender. A similar phenomenon, also attributed to strategic processing, has been observed in the behavioral investigation of telicity processing in Spanish (Sanz 2000), which employed a cross-modal priming paradigm. Based on the correlations between TOAL-3 (LG) scores of the participants and the strategy selected by each participant, we can assume that individual choice of strategy might be determined by one's syntactic proficiency (Pakulak and Neville 2010; Weber-Fox et al. 2003) or verbal working memory capacity, which is highly taxed in TOAL-3 LG tasks (Nakano et al. 2009; King and Kutas 1995).

An alternative analysis of these waveforms could be made using the long wave approach (Fig. 9.6): the overall slow frontal positive shift of the waveform in the telic condition can be interpreted as indexing higher ease of integration processes in the verbal working memory (cf. King and Kutas 1995).

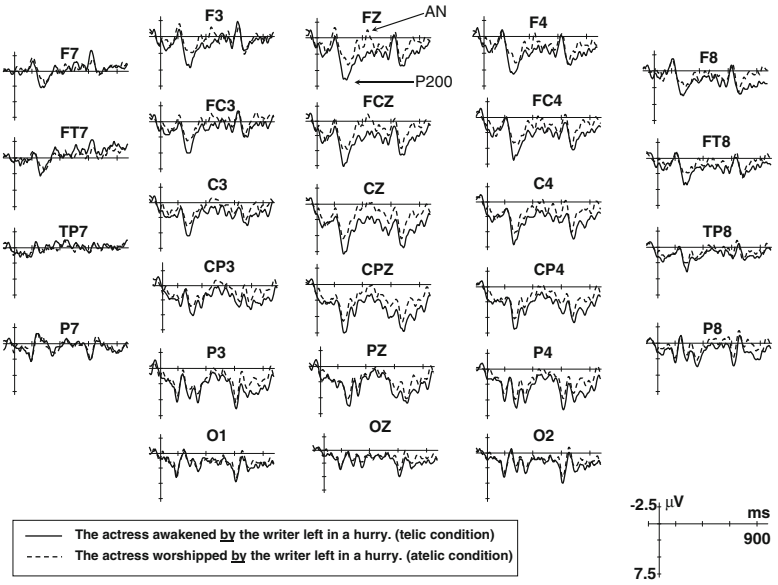

Fig. 9.4 ERPs elicited in the high proficiency group by the preposition *by*: relative clauses with telic and atelic verbs compared

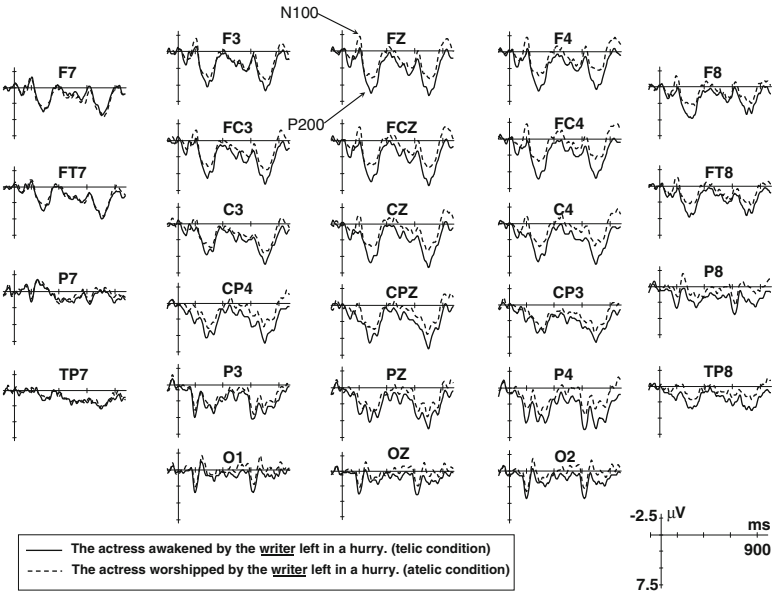

Fig. 9.5 Agent noun: ERPs elicited in the normal proficiency group by the relative clauses with telic and atelic verbs compared

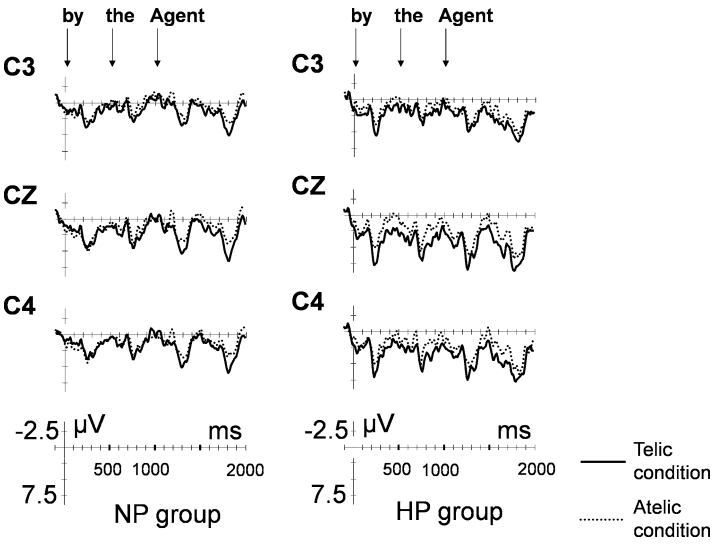

Fig. 9.6 Long epoch comparison of the High Proficiency (HP) and the Normal Proficiency (NP) groups

9.5 Linguistic Analysis

The comparative changes in event and argument structure in telic and atelic verbs undergoing intransitive-transitive frame alternations (Study 1) are illustrated in the following figures. Figure 9.7a, b provide a schematic representation of changes in argument role structure during thematic role re-assignment. As can be seen in Fig. 9.7a, the event template of telic verbs, which semantically signals that there will be an Undergoer/Resultee (possible forms of the Patient thematic role), activates the syntactic position for the Undergoer/Resultee, facilitating re-assignment of that thematic role to the first NP in the sentence when the second argument is encountered. The atelic verb template, lacking a semantic Resultee, does not activate the syntactic position for Undergoer(/Resultee). Thus, although in both conditions the Agent role is initially assigned to the first argument, the re-assignment of the Agent and Undergoer roles between the subject and the object of the reduced relative clauses with atelic verbs does not show the benefit of structural activation through the event structure template.

In the case of ambitransitive verbs (Study 2), when the second argument is introduced by the *by* construction, it is added to the existing verbal phrase frame as an external Agent, and does not necessitate re-assignment of thematic roles in telic condition (Fig. 9.8a). Atelic verbs, on the other hand, initially assign both Agent and Undergoer roles to the first argument, which results in necessary thematic role re-assignment when the second argument is added (Fig. 9.8b). Re-assignment of

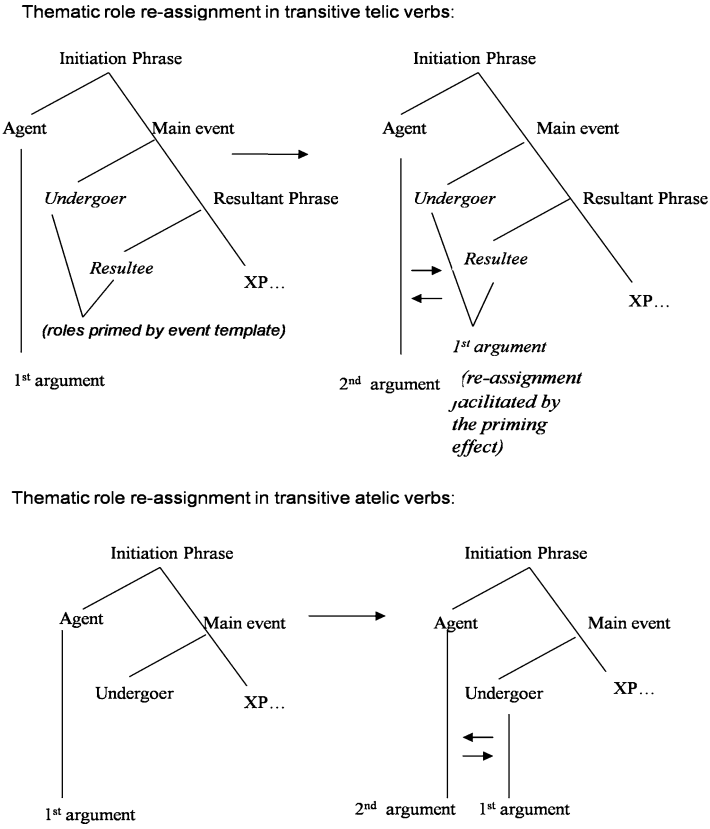

Fig. 9.7 Reanalysis of transitive verbs during garden-path recovery

Agent and Undergoer roles between the subject and the object of the reduced relative clause thus appears to be a process which elicits more negative ERPs as compared to simple addition of an extra argument in a vacant thematic role.

9.6 Conclusion

Early psycholinguistic research on event structure processing provided behavioral data indicating that the type of event denoted by the verb affected processing load (as evidenced by multimodal paradigms), and processing speed (response times). The ERP studies now indicate that integration of word-class information with information about the preceding verb's telicity occurs as early as 150 ms post-onset of visual word stimulus. Similar recognition timecourses have also been observed for grammatically relevant semantics features, such as animacy (cf. Boddy 1981).

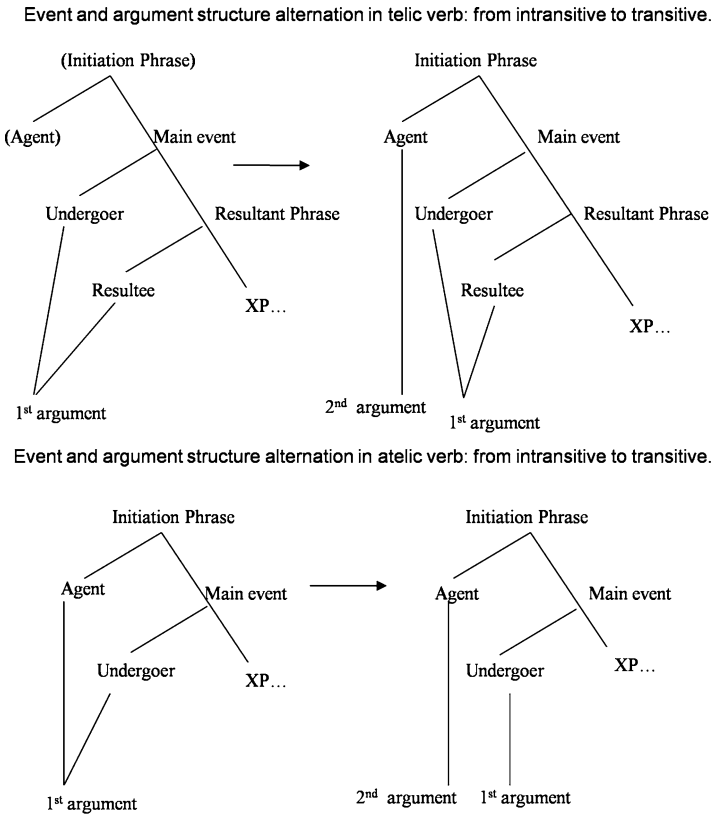

Fig. 9.8 Reanalysis of ambitransitive verbs during garden-path recovery

Our data is also consistent with behavioral and neuroimaging studies of intransitive telic (unaccusative) and intransitive atelic (unergative) verbs (Friedmann et al. 2008; Shetreet et al. 2010), which suggest that the Subject of telic verbs is base-generated in the internal argument position (the Patient, or the Undergoer).

The neurophysiological data from the two reviewed studies demonstrates that telic verbs activate an event structure template with an obligatory internal argument, which serves as a salient cue for thematic role assignment during online linguistic computations. The data from the two experiments shows that priming of the Patient by telic verbs is indexed by neurocognitive processes related to attention and cognitive load, while the syntactic structure evoked by telic verbs is utilized simultaneously with word-category assessment. In sentences with strong garden-path effect (study 2, optionally transitive verbs), individual choice of processing strategy also appears to depend on verbal working memory capacity. In all conditions, however, the effect of verbal event structure appears downstream, at the point of processing which necessitates (or questions) correct thematic role assignment. The results are consistent with the theoretical accounts of event structure, which integrate thematic

roles as structural positions within an event-argument structure complex (Ramchand 2008) and parallel processing theories (Jackendoff 2007). The reported results are somewhat less consistent with sequential processing theories, as they would seem to predict somewhat later differential ERP components indicative of re-linking of thematic roles. However, further investigation into the interaction of grammatically relevant semantic features of arguments (e.g. definiteness, animacy, Case, etc.) and verbal templates, as well as refinement of theoretical models of language processing based on neural data, might help reconcile the differences between theoretical and empirical findings.

While the opportunity to probe online linguistic processing creates a challenge for current theories to produce testable hypotheses about the language mechanisms with plausible neural realizations, it also enables more rapid progress in the field by revealing computational properties of the brain with regard to language, and other domains of higher-order cognition.

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