Decomposing Degree Achievements: Evidence from Measure Phrases and Sub-lexical Modifiers

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1. Introduction

Degree achievements, which we take to be deadjectival verbs built of out adjectival roots that denote properties on open scales, have been the subject of much recent work in argument structure. Many recent analyses emphasize the importance of the scalar structure of the adjectival roots in predicting the properties of deadjectival verbs. These approaches seek to provide a unified scalar analysis of deadjectival verbs (including both open and closed scale) by analyzing these verbs as measure of change functions derived from underlying measure functions (e.g. Kennedy & Levin 2008, Pedersen 2015).

In contrast, there is a long tradition of decomposing deadjectival verbs into both an eventive and stative component, particularly for causative verbs (e.g. McCawley 1978, Dowty 1979, Hoekstra 1988, von Stechow 1996, Beck & Johnson 2004, Pylkkänen 2008, Harley 2012). In this paper, we argue for such an analysis for degree achievements following von Stechow (1996). The evidence comes from sub-lexical modification with *again*, particularly when the shape of *again*'s presupposition can be determined by measure phrases. The relevant observation is that measure phrases specifying the end measure of a property held by an object at the end of the event of change denoted by the degree achievement can impose what has been called a restitutive interpretation of *again*'s presupposition, while measure phrases specifying the measure of the property at the beginning of the event allow only a repetitive interpretation. This observation would make sense if there is a stative component specifying the measure of a property held by an object at the end of the change event, while eventiveness is introduced by a higher verbal layer. Measure phrases hence attach at different structural heights in the same way *again* can (von Stechow 1996), leading to the observed difference.

We proceed as follows. Section 2 reviews the interaction of sub-lexical modifiers like *again* with degree achievement verbs, specifically the way *again*'s presupposition is interpreted, which has led to authors calling for a scalar analysis to deadjectival verbs. Section 3 discusses how measure phrases interact with *again*'s presupposition, showing the need for a stative component in the syntax and semantics of degree achievements. Section 4 presents our proposal and the formal implementation of it. Section 5 reviews alternative scalar analyses of degree achievements with *again* and section 6 concludes.

2. Counterdirectional Presuppositions with Degree Achievements and *Again*

One well-known argument for decomposing deadjectival verbs like *open*, *close*, and *dry* comes from *again*-ambiguities. The basic observation is that *again* has two readings when modifying such verbs, namely a repetitive one where an identical event happened previously, or a restutitve one where a *state* held previously, as shown in (1) (e.g. McCawley 1978, Dowty 1979, von Stechow 1996). Work in the syntactic decompositional tradition, such as von Stechow (1996), Pylkkänen (2008), and Harley (2012) typically analyze such verbs as containing a stative core with an eventive (causative) layer introduced by functional heads like little *v* as in (2). Given this decomposition, the two readings of *again*'s presupposition are explained because of the different structural height at which it attches; attaching to the stative constituent produces the restitutive presupposition, while attaching to the eventive layer produces the repetitive presupposition (von Stechow 1996).

(1) Sally opened the door again.

    a. Sally opened the door, and that had happened before.   (repetitive)

    b. Sally opened the door, and the door had been open before.   (restitutive)

                                                        (Beck & Johnson 2004: 106)

(2) $[_{Event}$ *Sally* v_{CAUSE} $[_{State}$ OPEN *the door* $]$ $]$

Objections to this influential analysis abound (e.g. Fabricius-Hansen 2001, Jäger & Blutner 2003, Pedersen 2015). Focusing on degree achievement verbs built out of open scale adjectival roots like *widen*, Pedersen (2015) shows that when modified by *again*, these verbs permit a different range of readings from deadjectival verbs built out of scales that are either totally or partially closed, like *open*, *close*, and *dry*. In particular, degree achievement verbs permit successive increase contexts in (3a), and pure reversal contexts in (3b) where it is not entailed that the river was previously wide. In contrast, verbs like *dry* do not permit successive increase contexts (4a), and in reversal contexts there must be repetition of the state denoted by the adjectival root (4b).

(3) a. Last week, the river widened a lot and reached the flood barrier. This week, the river widened some more / again and overflowed onto the bank.

    b. The river narrowed, but it soon widened again. ⇏ The river was previously wide.

                                                        (Pedersen 2015: 376, 405)

(4) a. This morning, I left the soaking wet shirt out in the sun for a few hours. When I took it in, it had dried somewhat but was still quite damp. When I put the shirt outside in the afternoon, it dried some more / # again.

    b. The roof got wet, but it soon dried again. ⇒ The roof was previously dry.

                                                          (Pedersen 2015: 377, 405)

Following Kennedy (2007) and Kennedy & Levin (2008), Pedersen argues that it is the scalar structure of the underlying adjectival roots of deadjectival verbs that leads to the observed differences. Utilizing a polysemous account of *again*-ambiguities (e.g. Fabricius-Hansen 2001, Jäger & Blutner 2003), the differences in readings between *widen* and *dry* fall out because *widen* is built out of an adjectival root whose scale is open, while *dry* is built out of an adjectival root whose scale is closed at the top (maximal degree). We briefly outline the specifics of Pedersen's analysis in section 5, where we show that it makes wrong predictions for the facts observed with measure phrases.

3. Measure Phrases Can Constrain *Again*'s Presupposition

While Pedersen (2015) showed how *again* interacts with degree achievements and how this interaction is different from verbs built out of closed scaled adjectival roots, measure phrases and how they can determine *again*'s presupposition were not examined in detail. In English, degree achievement verbs permit measure phrases introduced by specific prepositions. Measure phrases can introduce the measure of a property held by an object a the start of the event using a PP introduced by *from*, or specify the end measure using a PP introduced by *to*.

(5) a. The river widened *from 30 feet* (to 50 feet).

    b. The river widened (from 20 feet) *to 30 feet*.

Interestingly, and most relevant for our purposes, we observe that measure phrases can shape the way *again*'s presupposition is interpreted. Recall that Pedersen argued that degree achievement verbs produce a pure reversal presupposition with *again*, where there is no repetition of a previous state. However, in the presence of a *to*-phrase specifying the end measure of a property held by an object, we observe that the presupposition produced *must* involve repetition of a state where the object previously held the measure of a property specified by the *to*-phrase i.e. a *restitutive* presupposition. A pure reversal presupposition is, in fact, ruled out in such contexts. We illustrate this using *widen*. Note that the context allows the river's width to be different or identical to the width specified by the *to*-phrase. When different, *again* is

not licensed by the intermediate narrowing event, indicating that this is not the reversal presupposition of Pedersen (2015); rather, a *restitutive* presupposition where a previous state of being the same width as specified by the measure phrase is required.

(6) CONTEXT: The river was previously ✓ 30 feet / # 20 feet wide. It narrowed to 10 feet. Then the heavy monsoons rains came and...
The river widened to 30 feet again.

This fact is surprising given Pedersen's claim that the *again* produces a pure reversal rather than a restitutive presupposition with degree achievement verbs. If so, we expect the reversal in the above context to license the use of *again*, which is disallowed. We hence take the presupposition of *again* to truly be restitutive in that it requires a repetition of a prior state both with or without measure phrases, which we formalize in the next section.

A second observation we make concerns the interpretation of *from*-phrases with *again*. In particular, *from*-phrases do not permit a restitutive presupposition of any sort; rather, in the presence of *from*-phrases, the presupposition produced must be *eventive and repetitive*. The two contrasting contexts below illustrate. In (7a), *again* is not licensed despite the fact that the river was at various points 30 feet wide. The intuitive explanation is that there was previously only a narrowing event, not a widening event. When there is a previous widening event from the width specified by the *from*-phrase, *again* is licensed as in (7b).

(7) a. CONTEXT: The river was 30 feet wide on Monday . **It narrowed to 20 feet on Tuesday**. On Wednesday, the rains increased its width back to 30 feet . Then, on Thursday ...
The river widened from 30 feet again.

b. CONTEXT: The river was 30 feet on Monday . **It widened to 50 feet on Tuesday because of the rain**. On Wednesday, the heat narrowed the river back to 30 feet . On Thursday, a farmer pumped water into it to increase it to 60 feet and so ...
✓ The river widened from 30 feet again.

In short, the basic empirical observation is that measure phrases can determine the shape of *again*'s presupposition. In particular, with *to*-phrases, *again*'s presupposition must be *restitutive* and not purely reversal, while with *from*-phrases, *again*'s presupposition must be eventive and repetitive. We argue that these observations are best captured if degree acheivements like *widen* have both an eventive and stative constituent to which measure phrases and *again* can attach, which we formalize in the next section.

4. Proposal

Following work in the decompositional tradition, we propose that the roots of degree achievements are simple predicates of states denoting how much of a property a particular object holds, rather than measure functions denoting degrees (c.f. Kennedy & Levin 2008). The stative constituent in degree achievements, however, is comparative in nature where two states are compared in terms of how much of a property each state measures (von Stechow 1996, Bobaljik 2012, Wellwood 2015, Spathas & Michelioudakis 2020). We provide the syntax and semantics of a degree achievement verb like *widen* below. The adjectival base on which the degree achievement verb is built out of is represented as a root, while eventive semantics are provided by an eventive little *v* head in the Distributed Morphology tradition (Halle & Marantz 1993, Pesetsky 1995, Marantz 1997, a.o.). For the purposes of the composition, we take Comp to introduce a measure function, a standard of comparison in the form of a second state variable *s'*, as well as an individual variable *x*; these two variables will be abstracted over and bound when *v* is introduced. The two variables can be given explicit syntactic representation as well through the use of empty elements like PRO if so desired, but nothing crucial hinges on the particular choice. The measure function μ is a function that takes an eventuality variable to a degree on a scale; following Wellwood (2015), we assume that the measure function selected (here width) must be monotonic such that for two different states of possessing a property of width *s* and *s'*, they must be strictly ordered on a scale in that either $\mu(s) > \mu(s')$ or $\mu(s)$

$< \mu(s')$ holds.[1] [2] Finally, v introduces an event variable and orders the two state variables temporally by introducing INIT and FIN, which are functions from events to the state held at the beginning and end of the event respectively.

(8) The river widened.
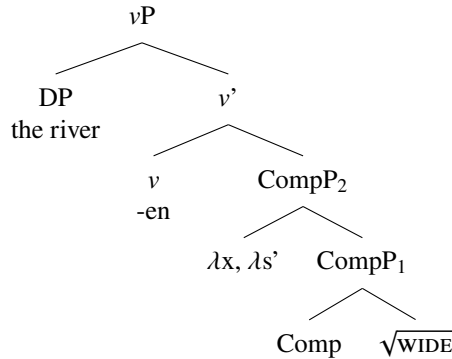
(9) a. ⟦$\sqrt{\text{WIDE}}$⟧: $\lambda x.\lambda s.\text{WIDE}(s) \wedge \text{HOLDER}(s) = x$

b. ⟦Comp⟧: $\lambda P.\lambda s.P(x)(s) \wedge P(x)(s') \wedge \mu(s) > \mu(s')$

c. ⟦CompP$_1$⟧: $\lambda s.\text{WIDE}(s) \wedge \text{HOLDER}(s) = x \wedge \text{WIDE}(s') \wedge \text{HOLDER}(s') = x \wedge \mu(s) > \mu(s')$

d. ⟦CompP$_2$⟧: $\lambda x.\lambda s'.\lambda s.\text{WIDE}(s) \wedge \text{HOLDER}(s) = x \wedge \text{WIDE}(s') \wedge \text{HOLDER}(s') = x \wedge \mu(s) > \mu(s')$

e. ⟦v⟧: $\lambda V.\lambda x.\lambda e.V(x)(\text{INIT}(e))(\text{FIN}(e))$

f. ⟦v'⟧: $\lambda x.\lambda e.\text{WIDE}(\text{FIN}(e)) \wedge \text{HOLDER}(\text{FIN}(e)) = x \wedge \text{WIDE}(\text{INIT}(e)) \wedge \text{HOLDER}(\text{INIT}(e)) = x \wedge \mu(\text{FIN}(e)) > \mu(\text{INIT}(e))$

g. ⟦vP⟧: $\lambda e.\text{WIDE}(\text{FIN}(e)) \wedge \text{HOLDER}(\text{FIN}(e)) = r \wedge \text{WIDE}(\text{INIT}(e)) \wedge \text{HOLDER}(\text{INIT}(e)) = r \wedge \mu(\text{FIN}(e)) > \mu(\text{INIT}(e))$

With the above analysis in hand, we might begin to explain some of the interpretations observed with *again*'s presupposition. We take the semantics of *again* to be as in (10), following Bale (2007). *Again* is an identity function over predicates of eventualities, introducing a presupposition that a similar eventuality held before utterance time, then did not hold in an intermediate temporal interval, before coming to hold again at utterance time.[3]

(10) ⟦again⟧: $\lambda P.\lambda e.P(e)$
Presupposition: $\exists e^1 \exists e^2 [e^1 < e^2 < E \wedge P(e^1) \wedge \neg P(e^2)]$

Again is hence a function of type $<<v,t>,<v,t>>$, requiring a predicate of eventualities as its first argument. This means that it can attach at the vP level or at CompP$_1$ in the structure in (8). Attaching at vP produces a repetitive presupposition, where there was simply a previous widening event. The negation in the presupposition requires that there be no intermediate widening event before utterance time, hence allowing for Pedersen's successive increase context. The reversal context Pedersen points out as problematic for decompositional analyses is in fact a non-issue; attaching *again* to CompP$_1$ will produce a presupposition where there was a previous state in which the object held a greater width than the start of the asserted change event i.e., INIT(e), then an intermediate interval where it was not wider than INIT(e). *Again*'s presupposition hence requires a narrowing from the width held at INIT(e), accounting for the reversal contexts of Pedersen. We calculate this *restitutive* presupposition below; the important thing to note is that at the point at which *again* attaches, the second state variable *s'* is yet to be bound, but will be

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[1] We take eventualities to encompass both events and states.

[2] As Wellwood (2015) shows, the measure function should be type-neutral in order to account for comparisons across different categories.

[3] E here refers to a contextually determined time, usually assumed to be utterance time. This is to allow for instances where the asserted utterance contains other operators like negation. In these contexts, the asserted event in fact does not occur but *again*'s presupposition nonetheless projects and can still be calculated; see Bale (2007) for discussion.

abstracted over, bound, and then replaced by INIT(e) through function application when *v* is introduced. We hence arrive at the analysis first proposed by von Stechow (1996) for degree achievement verbs.

(11) Restitutive presupposition: $\exists e^1 \exists e^2 [e^1 < e^2 < E \wedge [\text{WIDE}(e^1) \wedge \text{HOLDER}(e^1) = x \wedge \text{WIDE}(s') \wedge \text{HOLDER}(s') = x \wedge \mu(e^1) > \mu(s')] \wedge \neg[\text{WIDE}(e^2) \wedge \text{HOLDER}(e^2) = x \wedge \text{WIDE}(s') \wedge \text{HOLDER}(s') = x \wedge \mu(e^2) > \mu(s')]]$

With that basic analysis in place, we can now turn our attention to measure phrases. The basic intuition we pursue is that *to*-phrases attach to stative constituents, while *from*-phrases attach only to eventive *v*P. We provide the semantic denotations of the measure phrases below; effectively, they are functions that take predicates of eventualities to predicates of eventualities. *From*-phrases will be specified to be able to attach only to eventive predicates and not stative ones, indicated by the variable over events i.e., V_e, and introduce a measure function specifying the measure of a property at the beginning of an event. *To*-phrases in contrast simply provide the measure of a state and does not require an eventive predicate; they measure the property held at the end of the event only because of the eventive layer above it rather than due to their inherent semantics.

(12)   a. $[\![\text{to 30 feet}]\!]$: $\lambda V.\lambda s.V(s) \wedge \mu(s) = 30$ feet
    b. $[\![\text{from 30 feet}]\!]$: $\lambda V_e.\lambda e.V(e) \wedge \mu(\text{INIT}(\text{E})) = 30$ feet

We calculate the respective presuppositions below. *To*-phrases will attach to CompP$_1$ under the scope of *again*, while *from*-phrases attach to *v*P, also under the scope of *again*. The restitutive presupposition requires that the previous state held by the river is 30 feet, and then not 30 feet and not wider than INIT(e), before becoming 30 feet once more, hence requiring a pure restitutive context in (6). The repetitive presupposition requires that the river widened from 30 feet, then not widening from 30 feet, before widening from 30 feet once more. In such cases, the requirement of widening from 30 feet in the assertion requires that there be a narrowing back to 30 feet, as illustrated in (7b).

(13)   a. Restitutive presupposition with *to*-phrase:
    $\exists e^1 \exists e^2 [e^1 < e^2 < E \wedge [\text{WIDE}(e^1) \wedge \text{HOLDER}(e^1) = x \wedge \text{WIDE}(s') \wedge \text{HOLDER}(s') = x \wedge \mu(e^1) > \mu(s') \wedge \mu(e^1) = 30$ feet$] \wedge \neg[\text{WIDE}(e^2) \wedge \text{HOLDER}(e^2) = x \wedge \text{WIDE}(s') \wedge \text{HOLDER}(s') = x \wedge \mu(e^2) > \mu(s') \wedge \mu(e^2) = 30$ feet$]]$
    b. Repetitive presupposition with *from*-phrase:
    $\exists e^1 \exists e^2 [e^1 < e^2 < E \wedge [\text{WIDE}(\text{FIN}(e^1)) \wedge \text{HOLDER}(\text{FIN}(e^1)) = r \wedge \text{WIDE}(\text{INIT}(e^1)) \wedge \text{HOLDER}(\text{INIT}(e^1)) = r \wedge \mu(\text{FIN}(e^1)) > \mu(\text{INIT}(e^1)) \wedge \mu(\text{INIT}(e^1)) = 30$ feet$] \wedge \neg[\text{WIDE}(\text{FIN}(e^2)) \wedge \text{HOLDER}(\text{FIN}(e^2)) = r \wedge \text{WIDE}(\text{INIT}(e^2)) \wedge \text{HOLDER}(\text{INIT}(e^2)) = r \wedge \mu(\text{FIN}(e^2)) > \mu(\text{INIT}(e^2)) \wedge \mu(\text{INIT}(e^2)) = 30$ feet$]]$

We also make one additional prediction: since measure phrases are functions that take predicates of eventualities as arguments, they should be flexible with respect to their scopal interactions with *again*. That is, measure phrases can be outside the scope of *again*, attaching only after *again* has attached. This is borne out; for example, we may have the sentence where *again* precedes the *to*-phrase, which indicates that the *to*-phrase is not within its scope (Bale 2007), licensed by the infelicitous context in (6).

(14)   CONTEXT: The river was previously $\boxed{20 \text{ feet}}$ wide. It narrowed to 10 feet. Then the heavy monsoons rains came and...
    \# The river widened to 30 feet again. / ✓ The river widened again to 30 feet.

Likewise, when *again* precedes a *from*-phrase, its presupposition is satisfied even if the previous widening event began from a different width than the width specified by the *from*-phrase.

(15)   CONTEXT: The river was $\boxed{20 \text{ feet on Monday}}$. **It widened to 50 feet on Tuesday because of the rain**. On Wednesday, the heat $\boxed{\text{narrowed the river to 30 feet}}$. On Thursday, a farmer pumped water into it to increase it to 60 feet and so ...
    \# The river widened from 30 feet again. / ✓ The river widened again from 30 feet.

5. Alternative Analyses

We return here to Pedersen's (2015) analysis, which is, as far as we know, the most articulated account of *again*-ambiguities with degree achievement verbs outside of von Stechow (1996). Pedersen follows Kennedy & Levin (2008) is assuming that the adjectival roots of degree achievement verbs denote measure functions. Following Spathas (2019), who relativizes Pedersen's analysis to events, the semantics of the adjectival root underlying a degree achievement verb like *widen* is given in (16), a function of type *<e, <v,d>>*.

(16) $[\![\sqrt{\text{WIDE}}]\!]$: $\lambda x.\lambda e.\text{WIDTH}(x)(e)$

The adjectival root is converted into a measure of change function, which Pedersen assumes is accomplished by the -EN morpheme. Unlike Kennedy & Levin (2008), Pedersen assumes that measure of change functions are degree vectors, an ordered pair of degrees representing the degree of a property held at the beginning and end of an event.

(17) a. $[\![\text{-en}]\!]$: $\lambda g.\lambda x.\lambda e.<g(x)(\text{INIT}(e)), g(x)(\text{FIN}(e))$
      b. $[\![\sqrt{\text{WIDE}}\text{-en}]\!]$: $\lambda x.\lambda e.<\text{WIDTH}(x)(\text{INIT}(e)), \text{WIDTH}(x)(\text{FIN}(e))$

Because the measure of change function is not a function returning a truth value, Pedersen assumes a verbal version of the positive morpheme POS, which takes a measure of change function and and relates this to a standard of change, which are sets of degree vectors. The standard of change is determined based on the scalar structure of the underlying adjectival root, regulated by Kennedy's (2007) INTERPRETIVE ECONOMY. With open scale degree achievement verbs like *widen*, the standard of change set is the set of degree vectors whereby the second degree is larger than the first degree in terms of the property of width. Verbal POS asserts that the measure of change degree vector is a member of the standard of change set.

(18) a. Standard of change set ($S_{MOCwidth}$) for *widen*: {<d, d'> : d $<_{\text{WIDTH}}$ d' }
      b. $[\![\text{POS} \sqrt{\text{WIDE}}\text{-en}]\!]$: $\lambda x.\lambda e.<\text{WIDTH}(x)(\text{INIT}(e)), \text{WIDTH}(x)(\text{FIN}(e))> \in S_{MOCwidth}$

Finally, Pedersen assumes *again* is polysemous between an event modifier, which modifies the predicate of events produced after POS attaches to produce a repetitive presupposition, or a measure of change modifier, which takes a measure of change function as argument and presupposes that a scalar change in the reverse direction occurred i.e., the first degree of width is *larger* than the second degree of width and hence, a narrowing event.

We wish to point out one main empirical issue with this analysis. Note that there is no predicate of events within such analyses until verbal POS is introduced. If so, there are in principle two ways in which measure phrases can be analyzed. First, they can be analyzed as measure of change function modifiers. However such an analysis is implemented, measure phrases will attach to the measure of change function constituent and specify the measure of a property at the beginning or end of the event. In other words, they will specify the measure of the two degrees within a degree vector. Alternatively, they may be event modifiers, taking predicates of events as arguments and specifying the measure of a property at the beginning or end of the event, as we have done here. Crucially, because the attachment site of the measure phrases will be the same, such analyses do not predict an asymmetry between *from-* and *to*-phrases in terms of their ability to license a purely stative and restitutive presupposition, as observed in the contrast between (6) and (7). In particular, all presuppositions produced with *to*-phrases should be *eventive*, in that there is always an event of change denoted by the measure of change function whereby an object must have changed in terms of the degree to which it holds a property, as there is simply no constituent in the analysis in (18b) that denotes only that an object holds a property of a particular degree (Spathas 2019, Spathas & Michelioudakis 2020). Since there is no such constituent, contexts like (6) are not predicted to be possible with such analyses.

In addition, Spathas (2019) also provides cross-linguistic evidence that stative constituents are needed in the syntax and semantics of degree achievement verbs using modifiers that introduce additive presuppositions. The Greek additive modifier *ke* 'also', for example, can occur with verbs like *akriveno* 'become (more) expensive', which is an open scale property, and licenses a purely stative presupposition that another object is expensive according to some given standard i.e., it licenses positive inferences, contra the

English cases.[4] Spathas (2019) argues that this is explained only if there is a stative constituent containing the adjectival POS operator, which licenses positive inferences.

(19)   CONTEXT: Bread and milk are expensive if they cost more than 1 euro (per kilo). John opened a bakery in January and set the price of milk to 1.20 euros and that of bread to 0.80 euros. In February, he raised the price of bread to 1.10 euros so ...

Akrivine   ke to psomi.
expensive.V also the bread
'The bread got (more) expensive too.'

(Spathas 2019: examples (27) and (28))

6. Conclusion

We argued in this paper that degree achievement verbs built out of underlying adjectival roots with open scales in English should be given a decompositional analysis, whereby there is both an eventive and comparative stative constituent. This follows analyses like von Stechow (1996) and Wellwood (2015), whereby the underlying adjectival roots are simple predicates of states and comparison and reference to degrees are introduced compositionally. This contrasts with analyses like Kennedy (2007) and Pedersen (2015) whereby the adjectival roots themselves are measure functions making reference to degrees. The main empirical motivation for such an analysis comes from measure phrases like *from-* and *to*-phrases, which specify the measure of a property an object holds at the start and end of an event of change respectively. We observed that there is an asymmetry between *from-* and *to*-phrases in licensing purely stative presuppositions with *again*. In addition, *to*-phrases require restitutive contexts where there is a previous state of holding the exact measure of the property specified and do not allow for reversal contexts with *again*, contra other authors' proposals that the restitutive presupposition of *again* is really a reversal one. We argue that this state of affairs is best explained by decomposing degree achievement verbs into an eventive and comparative stative component such that *to*-phrases attach to the stative component, while *from*-phrases attach to the eventive component, and provided a compositional implementation of such an analysis. Finally, we showed how analyses incorporating measure functions and measure of change functions might deal with measure phrases and how they interact with *again*, showing that they do not predict the kind of asymmetry we observed with *again* and hence providing further support for our analysis.

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[4] For degree achievement verbs in English, the stative constituent is always comparative since positive inferences are never licensed.

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