

# Telicity Corresponds to Degree of Change

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Topics in the Grammar of Scalar Expressions

UCLA, January 2002

## 1 Introduction

Analyses of aspect often focus on the variable telicity of creation/destruction verbs (1), but such variability is also shown by directed motion verbs (2) (Levin and Rappaport Hovav 1995) and (so-called) “degree achievement” (3) (Dowty 1979).

- (1) a. Kim ate rice for an hour. (ATELIC)  
b. Kim ate a bowl of rice in an hour. (TELIC)
- (2) a. The balloon ascended for an hour. (ATELIC)  
b. The submarine ascended in an hour. (TELIC)
- (3) a. The water dripping off the roof lengthened the icicle for an hour. (ATELIC)  
b. The tailor lengthened my pants in an hour. (TELIC)

Krifka (1989, 1992): telicity is determined by a mapping between the structure of the “incremental theme” argument of the verb and the structure of the described event (cf. Dowty 1991; Filip 1999; Jackendoff 1996; Tenny 1987, 1994; Verkuyl 1993; Ramchand 1997).

Focusing on verbs of creation/destruction, Krifka argues that a telic interpretation arises when the verb’s incremental theme argument is *quantized*.

- (4) A predicate  $P$  is *quantized* if and only if no entity that is  $P$  can be a subpart of another entity that is  $P$  (see Krifka 1998, p. 200).
- (5) An event description  $R$  is *telic* if and only if it applies to events  $e$  such that all parts of  $e$  that fall under  $R$  are initial and final parts of  $e$  (see Krifka 1998, p. 207).

Verbal predicates with quantized incremental theme arguments are telic because there is a homomorphic relation between the structure of the incremental theme argument and the time course of the event:

- Since a bowl of rice is quantized, the predicate *eat a bowl of rice* is true only of events whose endpoints correspond to that point in time at which a bowl’s worth of the rice has been consumed.
- Since ice is not quantized, the predicate *eat rice* is true of any event of rice-eating, regardless of endpoints.

**NB:** “The distinction between telicity and atelicity should not be in the nature of the object described, but in the description applied to the object.” (Krifka 1998, p. 207)

This sort of approach results in somewhat different analyses of the three verb classes (cf. Ramchand 1997; Tenny 1994):

- In verbs of creation/destruction, telicity involves a mapping from the structure of the incremental theme to the event. (*change in (volume/extent of) object*)
- In verbs of directed motion, telicity involves a mapping from the location of the moving object on a path to the event. (*change in location*)
- In degree achievements, telicity involves a mapping from a degree to which some property holds of the incremental theme argument to the event. (*change in property*)

But these verbs all describe events in which one participant (underlined in (1)-(3)) undergoes a change in the degree to which it possesses some gradable property: volume or spatial extent, a measure of location along a path, a property provided by a gradable adjective.

The goal of this talk is to show that the aspectual behavior of these verbs is most generally and insightfully explained in terms of underlying scalar properties of the source verbs, in particular, the structure of this “degree of change”,  $d$ .

- (6) [ $v$  lengthen the icicle]  $\rightarrow$  the length of the icicle at the beginning of the event +  $d$   
= the length of the icicle at the end of the event
- When  $d$  is quantized, *lengthen the icicle* is true only of events whose endpoints correspond to that point in time at which the length of the icicle has increased by  $d$ .
- When  $d$  is not quantized, *lengthen the icicle* is true of any event of icicle-lengthening.

We will show that this analysis extends to the entire class of gradual change.

- What determines the value of  $d$ ? What determines whether it is quantized or non-quantized?

$d$  may be:

1. explicitly provided by linguistic material
2. inferred based on the lexical semantics of the verb or its arguments
3. inferred based on real-world knowledge
4. bound by an existential quantifier (the elsewhere condition)

An important property of the analysis is that quantization may be determined by contextual factors, not just by the semantic properties of the lexical items in the sentence (cf. McCawley 1978; Krifka 1989; Filip, Levin and Rappaport Hovav 1999).

Our analysis differs from other analysis in that it dispenses with traditional ideas about the mapping from argument structure to events — in particular, the idea that telicity involves a homomorphic relation between the structure of the “incremental theme” argument and the progression of the event (Krifka 1989, 1992; Dowty 1991, etc.).

In our analysis, quantization/telicity follows completely from the structure of the degree of change argument.

## 2 A Quick Overview of Scalar Semantics

The scalar semantics we propose for verbs of gradual change is based on semantic analyses of gradable adjectives — perhaps the quintessential gradable predicates and the bases for degree achievement verbs.

Gradable adjectives denote functions from objects to abstract representations of measurement, or *degrees* (Kennedy 1999; Bartsch and Vennemann 1973; see also Cresswell 1977; Seuren 1978; Hellan 1981; von Stechow 1984a; Klein 1991 and many others).

Since a particular object may manifest different degrees of the same gradable property at different times — and we are interested in changes in properties over time — we incorporate a temporal variable into the function.

$$(7) \quad \begin{array}{l} \text{a. } [A \text{ long}] = \text{LONG}_{(e,(t,d))} \\ \text{b. } \llbracket \text{LONG}(a)(t) \rrbracket = \text{the degree to which } a \text{ is long at time } t \end{array}$$

The crucial components of a scalar semantics:

1. A SCALE: a set of points totally ordered along some dimension (e.g., *length*, *volume*, *duration*, etc.).
  - Assume for simplicity that a scale  $S$  is modeled on the set of real numbers between 0 and 1.
  - Scales can be open or closed.
2. DEGREES: positive or negative intervals on a scale (Seuren 1978; von Stechow 1984b; Kennedy 1999, 2001; Schwarzschild and Wilkinson 1999).

Some formal definitions:

$$(8) \quad \begin{array}{l} \text{Open and closed scales} \\ \text{a. } S_{\text{open}} = [p \in \mathfrak{R} \mid 0 < p < 1] \\ \text{b. } S_{\text{closed}} = [p \in \mathfrak{R} \mid 0 \leq p \leq 1] \end{array}$$

$$(9) \quad \begin{array}{l} \text{Positive and negative degrees} \\ \text{a. } d_{\text{pos}}^{(0,p)} = \{p' \in S \mid p' \leq p\} \\ \text{b. } d_{\text{neg}}^{(p,1)} = \{p' \in S \mid p \leq p'\} \end{array}$$

(10) illustrates the positive and negative projections of an object  $a$  on the LENGTH scale, derived by applying the functions denoted by ‘long’ and ‘short’ to  $a$ .

$$(10) \quad \text{LENGTH: } 0 \bullet \text{-----} \text{LONG}(a)(t) \text{-----} \bullet \text{-----} \text{SHORT}(a)(t) \text{-----} \circ 1$$

A simple adjectival predication like (11a) has the logical form in (11b), which is true in the context illustrated by (12).

$$(11) \quad \begin{array}{l} \text{a. } \text{This train is long.} \\ \text{b. } \text{LONG}(\text{this train}) \geq d_{s(\text{long})} \quad (d_{s(\text{long})} \text{ a contextually-determined standard}) \end{array}$$

$$(12) \quad \begin{array}{l} \text{LENGTH: } 0 \text{-----} \text{LONG}(\text{train})(t) \text{-----} \bullet \\ \text{LENGTH: } 0 \text{-----} d_{s(\text{long})} \text{-----} \bullet \end{array}$$

Comparatives are analyzed in roughly the same way:

$$(13) \quad \begin{array}{l} \text{a. } \text{Rod A is longer than rod B.} \\ \text{b. } \text{LONG}(A)(t) > \text{LONG}(B)(t) \end{array}$$

$$(14) \quad \begin{array}{l} \text{a. } \text{Rod B is shorter than rod A.} \\ \text{b. } \text{SHORT}(B)(t) > \text{SHORT}(A)(t) \end{array}$$

$$(15) \quad \begin{array}{l} \text{LENGTH: } 0 \bullet \text{-----} \text{LONG}(A)(t) \text{-----} \bullet \text{-----} \text{SHORT}(A)(t) \text{-----} \circ 1 \\ \text{LENGTH: } 0 \bullet \text{-----} \text{LONG}(B)(t) \text{-----} \bullet \text{-----} \text{SHORT}(B)(t) \text{-----} \circ 1 \end{array}$$

Since we are interested in degree of change, we also need to be able to talk about *differences* in the degree to which different things (or the same things at different times) have some property. Differences are also important for “differential comparatives” like (16a)-(16b).

$$(16) \quad \begin{array}{l} \text{a. } \text{Rod A is 16 inches longer than rod B.} \\ \text{b. } \text{Rod B is 16 inches shorter than rod A.} \end{array}$$

Following (Hellan 1981; von Stechow 1984a; Bierwisch 1989; Fallner 1998; Kennedy 2001), we therefore assume a third sort of degree, a *differential* degree, and we define degree addition as in (18) (von Stechow 1984b).

$$(17) \quad d_{df}^{(0,p)} = \{p' \in S \mid 0 \leq p' \leq p\}$$

$$(18) \quad \begin{array}{l} \text{a. } d_{\text{pos}}^{(0,p)} + d_{df}^{(0,q)} = d_{\text{pos}}^{(0,p+q)} \\ \text{b. } d_{\text{neg}}^{(p,1)} + d_{df}^{(0,q)} = d_{\text{neg}}^{(p-q,1)} \end{array}$$

This provides a semantics for differential comparatives (see Kennedy 2001; Schwarzschild and Wilkinson 1999).

$$(19) \quad \begin{array}{l} \text{a. } \text{LONG}(A) > \text{LONG}(B) \wedge [\text{LONG}(A) = \text{LONG}(B) + d_{df}^{(0,16)}] \\ \text{b. } \text{SHORT}(B) > \text{SHORT}(A) \wedge [\text{SHORT}(B) = \text{SHORT}(A) + d_{df}^{(0,16)}] \end{array}$$

### 3 A Scalar Semantics for Verbs of Gradual Change

In addition to supporting a comprehensive semantic analysis of gradable adjectives (including vagueness, comparison, polarity and degree modification; see the refs above), the framework outlined in section 2 also provides the basis for a general scalar approach to the semantics of verbs of gradual change.

### 3.1 Lexical Semantic Analysis

We claim that all three classes of verbs should be analyzed in a way that is most transparently represented by degree achievements — in terms of changes in the degree to which an object possesses a gradable property (i.e., a measure function). The central claims are as follows:

1. All verbs of gradual change contain gradable properties as parts of their meaning — even verbs of creation/destruction (cf. Kratzer 2000).  
 DEGREE ACHIEVEMENTS: a property determined by the adjectival base.  
 DIRECTED MOTION VERBS: a property that measures movement along a path.  
 CREATION/DESTRUCTION VERBS: a property that measures spatial extent.
2. The events described by these verbs involve changes (increases) in the degree to which one of their arguments possesses this gradable property.
3. The measure of change corresponds to a (differential) degree argument, which we refer to as the “degree of change” (cf. Hay, Kennedy, and Levin 1999).

The basic idea can be informally illustrated as follows:

- (20) For any verb of gradual change  $V_\Delta$  with associated gradable property  $Gr_V$ :  
 $[_{VP} V_\Delta x d\text{-much}]$  is true of an event  $e$  iff  $x$  increases in  $Gr_V$ -ness by  $d$ -much.
- (21) a. The tilting of the earth lengthened the day by 5 minutes.  
 b. (The tilting of the earth caused) the day to increase in (temporal) length by five minutes.
- (22) a. The balloon ascended 100 meters.  
 b. The balloon increased in vertical position by 100 meters.
- (23) a. Kim ate two bowls of rice.  
 b. Kim caused some quantity of rice to increase in eatmess by two bowls.

Note that we mostly ignore external arguments and causation, since causation is not a relevant factor — both causative and inchoative verbs show the same behavior with respect to (a) telicity. This is actually an important fact, since it indicates that causation and telicity are independent (Abusch 1986; Pastelovsky 1991; Van Valin and LaPolla 1997).

The lexical semantic analysis is made explicit in (24), where  $Gr_V$  is the gradable property associated with the verb,  $d$  is the degree of change argument, and BEG and END are functions from events to times that return an event’s beginning and end points, respectively.

- (24) a.  $V_\Delta = \lambda x \lambda d \lambda e [_{INCREASE}(Gr_V(x))(d)(e)]$   
 b.  $\llbracket INCREASE(Gr(x))(d)(e) \rrbracket = 1$  iff  $Gr(x)(END(e)) = Gr(x)(BEG(e)) + d$

This analysis is similar to the one developed in Jackendoff 1996, but differs in that the latter is based on movement along a path, rather than change in a gradable property.

The following lexical semantic representations illustrate the analysis as applied to various members of the three classes of verbs, where “ $d$ -much” corresponds to the (syntactically optional) degree of change argument.

- (25) *Degree achievements*

- a.  $\llbracket \text{lengthen } x \text{ (by } d\text{-much)} \rrbracket = \lambda e [_{INCREASE}(LONG(x))(d)(e)]$   
 b.  $\llbracket \text{shorten } x \text{ (by } d\text{-much)} \rrbracket = \lambda e [_{INCREASE}(SHORT(x))(d)(e)]$

- (26) *Verbs of directed motion*

- a.  $\llbracket x \text{ ascend (} d\text{-much)} \rrbracket = \lambda e [_{INCREASE}(UP(x))(d)(e)]$   
 b.  $\llbracket x \text{ descend (} d\text{-much)} \rrbracket = \lambda e [_{INCREASE}(DOWN(x))(d)(e)]$

- (27) *Verbs of creation/destruction*

- a.  $\llbracket \text{write (} d\text{-much of) } x \rrbracket = \lambda e [_{INCREASE}(WRITTEN(x))(d)(e)]$   
 b.  $\llbracket \text{eat (} d\text{-much of) } x \rrbracket = \lambda e [_{INCREASE}(EATEN(x))(d)(e)]$

### 3.2 Telicity Corresponds to Degree of Change

It follows from this analysis that the semantic value of the degree of change argument — whether or not it is quantized — determines the predicate’s telicity.

- (28) *Quantized  $d \rightarrow$  Quantized, telic VP*

- a.  $\llbracket \text{lengthen the icicle by 3 centimeters} \rrbracket$   
 b.  $\lambda e [_{LONG}(icicle)(END(e)) = LONG(icicle)(BEG(e)) + 3 \text{ cm}]$

- (29) *Non-quantized  $d \rightarrow$  Non-quantized, atelic VP*

- a.  $\llbracket \text{lengthen the icicle (by some amount)} \rrbracket$   
 b.  $\lambda e [_{LONG}(icicle)(END(e)) = LONG(icicle)(BEG(e)) + d]$

This example involves a degree achievement, but the same sort of analysis applies to all verbs of gradual change, as we will show in detail below. We thus achieve our initial goal of providing a fully general account of all three classes of verbs.

Moreover, on this approach, whether a predicate is telic or not is strictly a function of the scalar properties of the degree of change — we do not need to establish a mapping from the degree of change (or any other argument) to the event.

Of course, it now becomes absolutely crucial that we answer the following question: how is the value — in particular, the quantization — of the degree of change determined?

This is the question we address in the next section, where we show in more detail how the proposal accounts for variable telicity in a variety of different contexts.

### 3.3 Aside: Why INCREASE and not (also) DECREASE?

We defined gradual change in terms of an *increase* in the degree to which an object possesses a gradable property.

Why shouldn’t we also have a notion of *DECREASE*? Wouldn’t this be the right way to analyze verbs like *descend*, *shorten* or *eat*?

Why don’t we find pairs like *lengthen* and *lengthas*?

In fact, decreasing changes can (and should) be characterized as *increases in negative properties*:

- “Change” involves a shift from  $\neg P$  to  $P$ .
- If an object possesses a gradable property  $P$  to degree  $d$ , then for any  $d' < d$ , that object also possesses property  $P$  to degree  $d'$  (where  $d$  and  $d'$  may be positive or negative; see Kennedy (to appear)).
- Therefore, change in the degree to which an object possesses some gradable property should involve an increase (of a positive or negative degree).

That verbs incorporate both positive and negative gradable properties is suggested by monotonicity properties:

$$(30) \quad a < b$$

(31) *Monotone increasing functions*

- WIDE( $a$ ) < WIDE( $b$ )
- WRITTEN( $a$ ) < WRITTEN( $b$ )
- BUILT( $a$ ) < BUILT( $b$ )
- UP( $a$ ) < UP( $b$ )

(32) *Monotone decreasing functions*

- SHORT( $b$ ) < SHORT( $a$ )
- EATEN( $b$ ) < EATEN( $a$ )
- TORN-DOWN( $b$ ) < TORN-DOWN( $a$ )
- DOWN( $b$ ) < DOWN( $a$ )

#### 4 Capturing (A)telicity

How is the value of the degree of change determined? In particular, what determines whether this argument is quantized or non-quantized?

As noted above, there are (at least) four ways to determine the value of this (possibly implicit) argument. It may be:

- explicitly provided by linguistic material (e.g., measure phrases)
- inferred based on the lexical semantics of the verb or its arguments (e.g., open/closed scale, mass/count distinction?)
- inferred based on real-world knowledge (e.g., pants vs. icicles)
- bound by an existential quantifier: the elsewhere condition

#### 4.1 Explicitly Specified Degree of Change

**Measure phrases:** A measure phrase may explicitly provide a value for  $d$ . If the measure phrase is quantized, we get a telic interpretation:

(33) *Some quantized measure phrases*

- 5 meters
- 40 fathoms
- 10 pages
- a scoop
- a bowl (of rice)

(34) a. They are widening the road 5 meters.  $\not\Rightarrow$  They have widened the road 5 meters.

b. The lake cooled 4 degrees in two days/?for two days.

(35) a. The curtains are falling 10ft.  $\not\Rightarrow$  The curtains have fallen 10ft.

b. The submarine ascended 40 fathoms in an hour/?for an hour.

(36) a. Kim is eating a scoop.  $\not\Rightarrow$  Kim has eaten a scoop.

b. Kim wrote 10 pages in 45 minutes/?for 45 minutes.

(37) a. Kim is drinking a bottle of water.  $\not\Rightarrow$  Kim has drunk a bottle of water.

b. Kim ate a bowl of rice in 5 minutes/?for 5 minutes.

**NB:** The fact that all three classes of verbs take overt measure phrase arguments — which are standardly assumed to denote degrees — further supports the claim that they all have the same underlying scalar semantics.

Entailments indicate that non-quantized measure phrases give rise to atelic predicates.

(38) *Some non-quantized measure phrases*

- a bit
- a quantity
- a part

(39) The soup is cooling a bit.  $\Rightarrow$  The soup has cooled a bit.

(40) Kim is drinking a quantity of milk.  $\Rightarrow$  Kim has drunk a quantity of milk.

(41) The sub is ascending a part of the way towards the surface.  $\Rightarrow$  The sub has ascended a part of the way towards the surface.

We appear to run into problems with *for*-PPs.

(42) a. The soup cooled a bit ?for 10 minutes/in 10 minutes.

b. Kim drank a quantity of milk ?for 30 seconds/in 30 seconds.

c. The sub ascended a part of the way towards the surface ?for an hour/in an hour.

This is not surprising — see Zucchi and White’s (2001) discussion of twigs, sequences and quantities of milk. We will return to an explanation below.

**Scalar adverbs:** A “maximizing” adverb may specify that some point on the scale must be reached, in which case the degree of change is quantized, and the predicate has a telic interpretation.

- (43) *Maximizing adverbs*
- completely
  - totally
  - halfway
- (44) a. They are totally straightening the rope.  $\nrightarrow$   
They have totally straightened the rope.
- b. The cake is cooling completely.  $\nrightarrow$  The cake has cooled completely.
- (45) a. Kelly drank the milkshake halfway in 10 minutes/?for 10 minutes.  
b. The curtains fell halfway in 10 seconds/?for 10 seconds.

In contrast, “minimizing” adverbs, which specify that the change cannot go past some point on a scale, result in a non-quantized degree of change and an atelic predicate.

- (46) *Minimizing adverbs*
- slightly
  - partially
  - somewhat
- (47) a. They are straightening the rope slightly.  $\Rightarrow$   
They have straightened the rope slightly.
- b. The independent counsel is broadening the investigation somewhat.  $\Rightarrow$   
The independent counsel has broadened the investigation somewhat.
- (48) a. The submarine is ascending slightly.  $\Rightarrow$  The submarine has ascended slightly.  
b. The curtains are falling a bit.  $\Rightarrow$  The curtains have fallen a bit.
- Again, though, we seem to have a problem with *for*-PPs!
- (49) a. ? They straightened the rope slightly for 10 minutes.  
b. ? The independent counsel broadened the investigation somewhat for 3 weeks.

#### 4.2 Lexically Inferred Implicit Degree of Change

As shown by Hay (1998) and Kennedy and McNally (1999) (see also Lehrer 1985), the scale associated with a gradable predicate may be *closed* — have a maximal value (e.g. *straight, empty, dry*) — or *open* — lack a maximal value (e.g., *long, wide, short*). This property influences the default telicity of the predicate.

This effect is clearest with degree achievements since their scale structure is most transparent (see Hay et al. 1999, for additional discussion).

- (50) A diagnostic: “proportional” modifiers.
- completely/half/partially/straight/empty/flat (*closed-scale adjectives*)
  - ? completely/half/partially long/wide/short (*open-scale adjectives*)

When the base of a degree achievement is a closed-scale adjective, a quantized degree of change is inferable from scale structure: it is the degree of change required to get to the end of the scale.

- (51) a. They are straightening the rope.  $\nrightarrow$  They have straightened the rope.  
b. The tub is emptying.  $\nrightarrow$  The tub has emptied.

When the base is an open-scale adjective, the default interpretation is atelic (see section 4.4 below).

- (52) a. They are lengthening the rope.  $\Rightarrow$  They have lengthened the rope.  
b. They are widening the road.  $\Rightarrow$  They have widened the road.

Precisely the same effects are seen in verbs of directed motion:

- (53) a. Kim entered the house completely.  
b. ? Kim approached the house completely.

- (54) a. Kim is entering the house.  $\nrightarrow$  Kim has entered the house.  
b. Kim is approaching the house.  $\Rightarrow$  Kim has approached the house.

- (55) a. The curtains are falling.  $\nrightarrow$  The curtains have fallen.  
b. The temperature is falling.  $\Rightarrow$  The temperature has fallen.

On our analysis, the effect of the mass/count distinction in verbs of creation/destruction is analyzed in essentially the same way: count nouns (with determiners) give rise to a closed scale structure (where the maximal value is the degree that corresponds to affecting the argument completely); mass nouns do not.

- (56) a. Kim ate a sandwich completely.  
b. ?? Kim ate rice completely.

- (57) a. Kim is eating a sandwich.  $\nrightarrow$  Kim has eaten a sandwich.  
b. Kim is eating rice.  $\Rightarrow$  Kim has eaten rice.

#### 4.3 Contextually Inferred Degree of Change

When the meaning of the verb’s arguments are such that a quantized value of change can be inferred, a telic interpretation results, even though in the absence of such information the same verbs are atelic:

- (58) a. The tailor is lengthening my pants.  $\nrightarrow$  The tailor has lengthened my pants.  
b. Kim is lowering the blind.  $\nrightarrow$  Kim has lowered the blind.

- (59) a. The traffic is lengthening my commute.  $\Rightarrow$   
The traffic has lengthened my commute.  
b. Kim is lowering the heat.  $\Rightarrow$  Kim has lowered the heat.

#### 4.4 The Elsewhere Case

If neither a measure phrase, nor the scalar properties of the underlying predicate, nor other contextual factors conspire to provide a value for  $d$ , it is existentially bound at the level of the verbal predicate.

The result is a non-quantized, atelic predicate (see (29b) above).

- (60) a. They are lengthening the rope.  $\Rightarrow$  They have lengthened the rope.  
 b. The metal cooled for an hour.  
 c. The sub is ascending.  $\Rightarrow$  The sub has ascended.  
 d. Kim pushed the cart for an hour.  
 e. Lee is reading.  $\Rightarrow$  Lee has read.  
 f. Kim ate for 15 minutes.

#### 4.5 Telicity and Context

The inference to a quantized degree of change in the cases discussed above arises through *conversational implicature* (cf. Krifka 1989; Filip 1999; Jackendoff 1996; Hay et al. 1999): as shown by (61), the inference is cancellable.

- (61) a. I straightened the rope, but not completely.  
 b. The tailor lengthened my pants, but not completely.

The implicature can be explained in terms of principles of informativeness.

For example, in the case of scale structure influencing telicity, what is unique about closed-scale adjectives is that the endpoint of the scale is a possible reference point. It follows that the most informative interpretation of, e.g., *I emptied the tub*, is the one in which the rope is straightened completely (cf. *The tub is empty*).

In contrast, when a quantized value for the degree of change is explicitly supplied, as in the following examples, telicity is not cancellable.

- (62) a. # They straightened the rope completely, but the rope isn't completely straight.  
 b. # They widened the road 5 feet, but the road didn't increase in width by 5 feet.
- (63) a. She ate the sandwich in 5 minutes.  
 b. She ate the sandwich for 5 minutes.
- (64) a. She ate the sandwich but as usual she left a couple of bites.  
 b. ?? She ate the whole sandwich, but as usual she left a couple of bites.
- (65) a. She ran a race but didn't quite finish it.  
 b. ?? She ran a mile but didn't quite finish it.

#### 5 Bits and Quantities

What is wrong with *for*-PPs in the following examples if the measure phrases are non-quantized?

- (66) The soup cooled a bit ?for 10 minutes/in 10 minutes.  
 (67) Kim drank a quantity of milk ?for 30 seconds/in 30 seconds.  
 (68) The sub ascended a part of the way towards the surface ?for an hour/in an hour.  
 (69) ? They straightened the rope slightly for 10 minutes.  
 (70) ? The independent counsel broadened the investigation somewhat for 3 weeks.

These are not a problem if we adopt Zucchi and White's (2001) analysis of twigs and sequences (in predicates like *write a sequence of numbers*).

First, we assume that the degree variables introduced by these expressions are existentially bound from outside the VP (unlike the implicit argument examples above, which are bound inside VP).

- (71) a. The soup cooled a bit.  
 b.  $\lambda e[\text{COOL}(\text{soup})(\text{END}(e)) = \text{COOL}(\text{soup})(\text{BEG}(e)) + d]$

What is crucial here is that  $d$  is free inside the VP. Since its value is determined by an assignment function, the VP is quantized: (71b) is true only of events that involve an increase in coolness by  $g(d)$ -much.

Assuming that *for*-PPs presuppose that the predicate they modify is quantized, we account for the incompatibility.

#### 6 Conclusions

Verbs of gradual change contain gradable properties as part of their meaning. Telicity is determined solely by the semantic properties of the degree of change; it is not determined by a lexical diacritic (e.g., [+/- bounded]) or some kind of morpho-syntactic feature(s).

Contrary to what is often taken to be the conventional wisdom (i.e. Dowty 1991; Krifka 1989), the incremental theme argument does not (directly) determine telicity. The incremental theme does *indirectly* determine telicity to the extent that its structure affects possible values of the degree of change.

More generally, we see that telicity and degree of change (our functional analogue of the traditional incremental theme) are to some extent independent: a verb may have a degree of change (and an incremental theme) without being telic (cf. Krifka 1986, 1989; Filip 1999; Jackendoff 1996; but see Dowty 1991, p. 607 for a different view).

Most generally, our analysis indicates that scalar representations play a much broader role in natural language semantics than has previously been assumed.

## References

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