

## Measure of Change

### 1 More questions about measurement in VP

Some of the questions we were asking last time:

1. Do we see ‘Schwarzschild Effects’ of monotonicity/dissectivity in the verbal domain?
2. Is there such a thing as ‘verbal classifiers’?
3. What are the ways that events can be measured, and how is this sort of measurement encoded grammatically?

### 2 Floated measure phrases in Japanese

Nakanishi (2002a,b) discusses a set of data in Japanese involving contrasts between floated and non-floated measure phrases and numeral+classifier constituents which seems to give ‘yes’ answers to the first two questions above, and makes some interesting suggestions about the third question.

First, the contrast between the examples in (1) and those in (2) shows that floated and non-floated MPs have the same requirements in Japanese that they have in English: they must be monotonic for the noun that they (appear to) modify.

- (1) a. [*Mizu san-rittoru*]-ga tukue-nouede koboreta (koto)  
[water three-liter]-NOM table-on spilled (the fact that)  
‘(the fact that) three liters of water spilled on the table.’  
b. *Mizu-ga* tukue-nouede **san-rittoru** koboreta (koto)  
water-NOM table-on three-liter spilled (tft)  
‘(the fact that) three liters of water spilled on the table.’
- (2) a. \* [*Mizu san-do*]-ga tukue-nouede koboreta (koto)  
[water three-degree]-NOM table-on spilled (tft)  
‘Three degrees of water spilled on the table.’  
b. \* *Mizu-ga* tukue-nouede **san-do** koboreta (koto)  
water-NOM table-on three-degree spilled (tft)  
‘Three degrees of water spilled on the table.’

What is more interesting is that floated MPs, but not non-floated ones, are also sensitive to the meaning of the VP: they are good with atelic verbs, but bad with telic ones.

- (3) a. [*Yuki san-ton*]-GA yane-noueni tumotta (koto)  
[snow three-ton]-NOM roof-on piled-up (tft)  
‘(the fact that) three tons of snow piled up on the roof’  
b. *Yuki-GA* yane-noueni **san-ton** tumotta (koto)  
snow-NOM roof-on three-ton piled-up (tft)  
‘(the fact that) three tons of snow piled up on the roof’

- (4) a. [*Yuki san-ton*]-GA kinoo John-no ie-o ositubisita (koto)  
 [snow three-ton]-NOM yesterday John-GEN house-ACC destroyed (tft)  
 ‘(the fact that) three tons of snow destroyed John’s house yesterday’  
 b. \**Yuki*-GA kinoo **san-ton** John-no ie-o ositubisita (koto)  
 snow-NOM yesterday three-ton John-GEN house-ACC destroyed (tft)  
 ‘(the fact that) three tons of snow destroyed John’s house yesterday’

Nananishi’s proposal, in a nutshell, is that floated MPs measure the event denoted by the verb (VP?), and that they are subject to the same monotonicity requirement as MPs that modify nouns/NPs.

- (5) *Monotonicity in VP*  
 A measure function  $\mu$  is monotonic relative to the domain of events  $E$  iff:  
 $\forall e_1, e_2 \in E [e_1 \subset e_2 \rightarrow \mu(e_1) \prec \mu(e_2)]$

According to Nakanishi, the contrast between (4b) and (5b) is completely parallel to the contrast between pseudopartitive MPs with mass and count nouns, respectively (*three tons of snow* vs. ??*three tons of truck/a three ton truck*):

- The floated MP is acceptable in (4) because the atelic predicate *pile-up* has a domain with a part-whole structure that supports monotonicity.
- The floated MP is bad in (5) because the telic predicate *destroy* does not have a domain with part-whole structure, so monotonicity cannot be satisfied.

More specifically, atelic predicates are *cumulative*, and so give rise to the sort of part-whole structure we need to calculate monotonicity. Telic predicates, on the other hand, are *quantized*, and so do not give rise to part-whole structure on the domain of events.

In order to get part-whole structure from a telic predicate, we would have to pluralize it. This is what happens in examples like the following:

- (6) a. *Hako-ga* tukue-kara **juk-ko** yuka-ni otita (koto)  
 box-NOM desk-from ten-CL floor-to fell (tft)  
 ‘(the fact that) ten boxes fell from the desk to the floor’  
 b. *Gakusei-ga* kinoo **juu-nin** *Harui Pottaa-o* yomi-oeta (koto)  
 student-NOM yesterday ten-CL *Harry Potter*-ACC read-finished (tft)  
 ‘(the fact that) ten students finished reading *Harry Potter* yesterday’

If world knowledge precludes a plural interpretation of the predicate, the result is bad:

- (7) a. \**Otoko-ga* kinoo **san-nin** John-no hahaoya-o korosita (koto)  
 man-NOM yesterday three-CL John-GEN mother-ACC killed (tft)  
 ‘(the fact that) three men killed John’s mother yesterday’  
 b. *Otoko-ga* kinoo **san-nin** John-no hahaoya-o koros-ootosita (koto)  
 man-NOM yesterday three-CL John-GEN mother-ACC kill-tried (tft)  
 ‘(the fact that) three men tried to kill John’s mother yesterday’  
 c. *Otoko-ga* kinoo **san-nin** John-no hahaoya-o nagutta (koto)  
 man-NOM yesterday three-CL John-GEN mother-ACC hit (tft)  
 ‘(the fact that) three men hit John’s mother yesterday’

Furthermore, examples like the following show that floated MPs force distributive interpretations of sentences that otherwise show a collective/distributive ambiguity. This is expected if distributive, but not collective, interpretations correspond to pluralized predicates.

- (8) a. [*Gakusei* **san-nin**]-ga mitibata-de hon-o hirotta (koto)  
 [student three-CL]-NOM street-on book-ACC found (tft)  
 ‘(the fact that) three students found a book on the street’  
 (*collective or distributive*)
- b. *Gakusei*-ga mitibata-de **san-nin** hon-o hirotta (koto)  
 student-NOM street-on three-CL book-ACC found (tft)  
 ‘(the fact that) three students found a book on the street’  
 (*distributive only!*)

This is all pretty cool. Moreover, Nakanishi provides a number of arguments that the floated MPs are syntactically adjoined to VP, rather ‘stranded’ by the NP they seem to modify, so syntactically and semantically it really looks like we have a case of VP-classification here, subject to exactly the same constraints we saw for NP classification!

**Not so fast:** How on earth could a measure phrase like *three tons* modify an event?

In fact, it can’t. Nakanishi’s solution to this problem takes advantage of a crucial feature of the constructions that allow floating: the NP that the MP is ‘floated’ from is an *incremental theme* argument — the argument that ‘measures out’ the event.

According to Krifka (1989, 1992), a defining characteristic of the incremental theme argument/ role is that it satisfies ‘Mapping to Objects’ and ‘Mapping to Events’:

- (9) a. *Mapping to Objects*  
 $\forall R[\text{MAP-O}(R) \leftrightarrow \forall e, e', x[R(e, x) \wedge e' \geq e \rightarrow \exists x'[x' \geq x \wedge R(e', x')]]]$
- b. *Mapping to Events*  
 $\forall R[\text{MAP-E}(R) \leftrightarrow \forall e, x, x'[R(e, x) \wedge x' \geq x \rightarrow \exists e'[e' \geq e \wedge R(e', x')]]]$

The result is that there is a homomorphic relation between the structure of the incremental theme argument and the progress of the event.

Nakanishi suggests that the floated MPs are ‘parasitic’ on this relation, and in fact do not modify the event directly, but rather the output of applying the homomorphism to the event, which gets us back to the incremental theme argument.

- (10) *Monotonicity in VP* (revised)  
 A measure function  $\mu$  is monotonic relative to the domain of events  $E$  iff:  
 $\forall e_1, e_2 \in E[h(e_1) \subset h(e_2) \rightarrow \mu(h(e_1)) \prec \mu(h(e_2))]$ , where  $h$  is a homomorphism from  $E$  to the domain of individuals  $I$  such that  $h(e_1 \cup_E e_2) = h(e_1) \cup_I h(e_2)$ .

This sounds plausible, but it raises some questions that Nakanishi hasn’t (yet) answered:

1. What exactly is the compositional semantics of the floated MP construction, and Do we have to posit an ambiguity somewhere (presumably in the meaning of MPs)?
2. At the end of the day, doesn’t this analysis really just get us back to measurement of objects, not events, and if so, why should event structure matter in the way that it evidently does?



- Since rice is not quantized, the predicate *eat rice* in (12a) is true of any event of rice-eating, regardless of endpoint.

**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)

Krifka focuses specifically on verbs of creation/destruction, and in fact when we look at the other verb classes exemplified by (13) and (14), we end up with somewhat different analyses (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*).

**Solution 1:** Stipulate that the thematic relation/argument/semantic parameter that is relevant for calculating telicity is different in these three classes of verbs: I-THEME, PATH, PROPERTY (cf. Ramchand 1997).

This approach misses the generalization that these verbs all describe events in which one participant (underlined in (12)-(14)) undergoes some sort of gradual change — in volume or spatial extent, in location along a path, or in the degree to which it possesses some gradable property.

**Solution 2:** Handle everything in terms of (metaphoric) movement along a path (Jackendoff 1996).

Isn't there a more direct characterization of what's going on here?

**Solution 3:** Analyze all of these verbs as describing events that involve a change in the degree to which an object (the ‘affected argument’/incremental theme) undergoes a change in the degree to which it possesses some gradable property: a change in degree of volume or spatial extent, a change in degree of progress along a path, a change in degree of some arbitrary property (provided by a gradable adjective).

The idea can most transparently illustrated by the case of degree achievements:

(16)  $\llbracket \llbracket \text{VP lengthen the icicle} \rrbracket \rrbracket = \lambda e. \text{the length of the icicle at the beginning of } e + d = \text{the length of the icicle at the end of } e$

Telicity is determined by whether the ‘degree of change’ argument  $d$  is quantized or not:

- If  $d$  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  $d$ .
- In contrast, if  $d$  is not quantized, *lengthen the icicle* is true of any event of icicle-lengthening.

As we will see below, this sort of analysis can be extended to the entire class of verbs of gradual change.

This analysis differs crucially from Krifka’s in that it dispenses with stipulations about the mapping from argument structure to events — in particular, the idea that we need to define particular thematic roles in terms of a homomorphic relation between the structure of that role’s argument and the progression of the event.

Instead, the relation between (non-)quantization of an argument (the degree of change) and (a)telicity follows from the basic semantic analysis given to verbs of gradual change.

#### 4 Extending scalar semantics to verbs of gradual change

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:

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).

##### 4.1 Lexical semantics

For any verb of gradual change  $V_\Delta$  with associated gradable property  $\mathbf{g}_v$ ,  $[\text{VP } V_\Delta \text{ x } d\text{-much}]$  is true of an event  $e$  if and only if  $x$  increases in  $\mathbf{g}_v$ -ness by  $d$ -much.<sup>1</sup>

- (17) a. The tilting of the earth lengthened the day by 5 minutes.  
 b. (The tilting of the earth caused) the day to increase in (temp) length by 5 min.
- (18) a. The balloon ascended 100 meters.  
 b. The balloon increased in vertical position by 100 meters.
- (19) a. Kim ate two bowls of rice.  
 b. (Kim caused) some quantity of rice to increase in eatenness by two bowls.

The lexical semantic analysis is made explicit in (20a) (abbreviated in (20b)), where  $\mathbf{g}_v$  is the gradable property associated with the verb,  $d$  is the degree of change argument, and BEG and END are functions that return an event’s beginning and end points, respectively.

- (20) a.  $\llbracket V_\Delta \rrbracket = \lambda x \lambda d \lambda e. \mathbf{g}_v(x)(\text{END}(e)) = \mathbf{g}_v(x)(\text{BEG}(e)) + d$   
 b.  $\llbracket V_\Delta \rrbracket = \lambda x \lambda d \lambda e. \text{INCREASE}(\mathbf{g}_v(x))(d)(e)$

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<sup>1</sup>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; Pustejovsky 1991; Van Valin and LaPolla 1997).

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.

(21) *Degree achievements*

- a.  $[\text{VP lengthen } x \text{ (by } d\text{-much)}] = \lambda e.\text{INCREASE}(\mathbf{long}(x))(d)(e)$
- b.  $[\text{VP shorten } x \text{ (by } d\text{-much)}] = \lambda e.\text{INCREASE}(\mathbf{short}(x))(d)(e)$

(22) *Verbs of directed motion*

- a.  $[\text{VP } x \text{ ascend (} d\text{-much)}] = \lambda e.\text{INCREASE}(\mathbf{up}(x))(d)(e)$
- b.  $[\text{VP } x \text{ descend (} d\text{-much)}] = \lambda e.\text{INCREASE}(\mathbf{down}(x))(d)(e)$

(23) *Verbs of creation/destruction*

- a.  $[\text{VP write (} d\text{-much of) } x] = \lambda e.\text{INCREASE}(\mathbf{written}(x))(d)(e)$
- b.  $[\text{VP eat (} d\text{-much of) } x] = \lambda e.\text{INCREASE}(\mathbf{eaten}(x))(d)(e)$

## 4.2 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.

(24) *Quantized  $d \rightarrow$  telic VP*

- a.  $[\text{VP lengthen the icicle by 3 centimeters}]$
- b.  $\lambda e[\mathbf{long}(\textit{icicle})(\text{END}(e)) = \mathbf{long}(\textit{icicle})(\text{BEG}(e)) + 3 \textit{cm}]$

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

- a.  $[\text{VP lengthen the icicle (by some amount)}]$
- b.  $\lambda e\exists d[\mathbf{long}(\textit{icicle})(\text{END}(e)) = \mathbf{long}(\textit{icicle})(\text{BEG}(e)) + d]$

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 crucial that we answer the following question: how is the semantic value and corresponding (non-)quantizedness of the degree of change argument determined?

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

We have characterized gradual change as an *increase* in the degree to which an object possesses a gradable property. But couldn’t gradual change involve a *decrease* in some property? Wouldn’t this be the right way to analyze verbs like *descend*, *shorten* or *eat*?

In fact, decreasing changes can be characterized as *increases in negative properties*, as we have already seen. However, we might still wonder why don’t we find pairs like ‘lengthen’ (*increase in length*) and ‘lengthness’ (*decrease in length*)?

A possible explanation?

- Assume that change involves a shift from  $\neg P$  to  $P$  (Wright 1963, 1968; Dowty 1979).
- If an object possesses a gradable property  $P$  to degree  $d$ , then for any  $d' < d$ , that object also possesses property  $P$  to degree  $d'$ .
- Therefore, change in the degree to which an object possesses some gradable property should involve an increase (of a positive or negative degree).

## 5 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? There appear to be four ways to determine the value of this (possibly implicit) argument. It may be:

1. explicitly provided by linguistic material (e.g., measure phrases),
2. inferred based on the lexical semantics of the verb or its arguments (e.g., open/closed scale, mass/count distinction?),
3. inferred based on real-world knowledge (e.g., pants vs. icicles), or
4. it may be bound by a default existential quantifier (the ‘elsewhere’ case).

### 5.1 Explicitly specified degree of change

#### 5.1.1 Measure phrases

A quantized or non-quantized measure phrase may explicitly provide a value for  $d$ .

(26) *Some quantized measure phrases*

- a. 5 meters
- b. 40 fathoms
- c. 10 pages
- d. a scoop
- e. a bowl (of rice)

If the measure phrase is quantized, we get a telic interpretation:

- (27) a. They are widening the road 5 meters.  $\nrightarrow$  They have widened the road 5 meters.  
b. The lake cooled 4 degrees in two days/?for two days.
- (28) a. The curtains are falling 10ft.  $\nrightarrow$  The curtains have fallen 10ft.  
b. The submarine ascended 40 fathoms in an hour/?for an hour.
- (29) a. Kim is eating a scoop.  $\nrightarrow$  Kim has eaten a scoop.  
b. Kim wrote 10 pages in 45 minutes/?for 45 minutes.
- (30) a. Kim is drinking a bottle of water.  $\nrightarrow$  Kim has drunk a bottle of water.  
b. Kim ate a bowl of rice in 5 minutes/?for 5 minutes.

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.

Note that verbs of creation/consumption, unlike the other two classes, cannot express both the measure argument and affected argument independently — we get one or the other, or a ‘combination’ of the two (as in (30)). We will return to this point below.

- (31) *Some non-quantized measure phrases*
- a. a bit
  - b. a quantity
  - c. a part

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

- (32)
- a. The soup is cooling a bit.  $\Rightarrow$  The soup has cooled a bit.
  - b. Kim is drinking a quantity of milk.  $\Rightarrow$  Kim has drunk a quantity of milk.
  - c. 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.

- (33)
- 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.

### 5.1.2 *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.

- (34) *Maximizing adverbs*
- a. completely
  - b. totally
  - c. halfway

- (35)
- 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.

- (36)
- 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.

- (37) *Minimizing adverbs*
- a. slightly
  - b. partially
  - c. somewhat
- (38) 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.
- (39) 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!

- (40) a. ??They straightened the rope slightly for 10 minutes.
- b. ??The independent counsel broadened the investigation somewhat for 3 weeks.

### 5.1.3 Bits and quantities

We can deal with the problematic cases above if we adopt Zucchi and White's (2001) analysis of twigs and sequences (in predicates like *write a sequence of numbers*).

Specifically, we can 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):

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

What is crucial here is that  $\mathbf{d}$  is free inside the VP. Since its value is determined by an assignment function, the VP is quantized: (41b) is true only of events that involve an increase in coolness by  $g(\mathbf{d})$ -much.

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

## 5.2 Lexically inferred implicit degree of change

As we have already seen, the scale associated with a gradable adjective may be closed or open. 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).

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.

- (42) 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 5.4 below).

- (43) 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. Proportional modifiers can be used here to test for scale structure, just as with gradable adjectives:

- (44) a. Kim entered the house completely.
- b. ??Kim approached the house completely.
- (45) a. Kim is entering the house.  $\nRightarrow$  Kim has entered the house.
- b. Kim is approaching the house.  $\Rightarrow$  Kim has approached the house.

The open/closed scale distinction may be at the root of the mass/count effect on telicity of verbs of creation/destruction: count nouns (with determiners) are associated with a closed scalar structure (where the maximal value is the degree that corresponds to affecting the argument completely); mass nouns are associated with an open scalar structure.

- (46) a. Kim ate a sandwich completely.
- b. ??Kim ate rice completely.
- (47) a. Kim is eating a sandwich.  $\nRightarrow$  Kim has eaten a sandwich.
- b. Kim is eating rice.  $\Rightarrow$  Kim has eaten rice.

Alternatively, we may want to say that direct objects of creation/consumption verbs directly supply the value of both the affected argument and the measure argument (see the discussion above) — this is a question that still needs to be resolved. More on this next week too.

### 5.3 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 in cases in which the same verbs are atelic in the absence of such information.

In the examples in (48), context and world knowledge provides information about what the final degree should be — the specified length of alteration, the windowsill, the stage — which means that the degree of change is quantized.

- (48) 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.
- c. The curtain is falling.  $\nRightarrow$  The curtain has fallen.

This is not the case in the examples in (49), and the predicates are atelic:

- (49) 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.
- c. The temperature is falling.  $\Rightarrow$  The temperature has fallen.

#### 5.4 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 (25b) above).

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

#### 5.5 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 (53), the inference is cancellable.

- (53) 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.

- (54) 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.
- (55) a. She ate the sandwich in 5 minutes.  
b. She ate the sandwich for 5 minutes.
- (56) 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.
- (57) a. She ran a race but didn't quite finish it.  
b. ??She ran a mile but didn't quite finish it.

#### 5.6 Summary

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).

## 6 Back to Japanese

Can we account for Nakanishi’s data if we analyze floated MPs as expressions of the degree of change argument? I don’t actually know yet, but here are some initial thoughts.

The basic idea would be that in (58a), the MP is modifying the noun and subject to whatever constraints it is normally subject to (monotonicity, dissectivity, whatever), while in (58b), it is saturating the degree of change argument of the verb (a kind of verb of motion?).

- (58) a. [*Yuki san-ton*]-GA yane-noueni tumotta (koto)  
           [snow three-ton]-NOM roof-on piled-up (tft)  
           ‘(the fact that) three tons of snow piled up on the roof’  
       b. *Yuki*-GA yane-noueni **san-ton** tumotta (koto)  
           snow-NOM roof-on three-ton piled-up (tft)  
           ‘(the fact that) three tons of snow piled up on the roof’

(59a) is explained in the normal way; (59b) would be explained by saying that ‘degrees’ are the wrong sort of units to measure changes in spill-amounts.

- (59) a. \* [*Mizu san-do*]-ga tukue-nouede koboreta (koto)  
           [water three-degree]-NOM table-on spilled (tft)  
           ‘Three degrees of water spilled on the table.’  
       b. \* *Mizu*-ga tukue-nouede **san-do** koboreta (koto)  
           water-NOM table-on three-degree spilled (tft)  
           ‘Three degrees of water spilled on the table.’

So the badness of (59b) is comparable to the badness of (60b).

- (60) a. Lee’s cup is three ounces fuller than Kim’s.  
       b. \*Lee’s cup is three degrees fuller than Kim’s.

Finally, maybe the problem with (61b) is just that a lexically telic verb like *destroy* doesn’t even have a degree of change argument? This is almost certainly not right, though — need to think about the ‘plural’ telic predicates.

- (61) a. [*Yuki san-ton*]-GA kinoo John-no ie-o ositubisita (koto)  
           [snow three-ton]-NOM yesterday John-GEN house-ACC destroyed (tft)  
           ‘(the fact that) three tons of snow destroyed John’s house yesterday’  
       b. \* *Yuki*-GA kinoo **san-ton** John-no ie-o ositubisita (koto)  
           snow-NOM yesterday three-ton John-GEN house-ACC destroyed (tft)  
           ‘(the fact that) three tons of snow destroyed John’s house yesterday’

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