On the Interpretation of Verb-Modifying Measure Phrases in Japanese*

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1 Introduction

This paper focuses on hitherto-unaddressed expressions: a measure phrase (MP) in Japanese that modifies the co-occurring verb but does not accompany postpositions. The MP *5-kiro* 'five kilometers' in the following example is a case in point:

(1) Taroo-ga 5-kiro hasitta.
Taroo-NOM 5-kilometer ran
'Taroo ran 5km.'

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We call this type of MP a Verb-modifying Bare Measure Phrases (VBMP). The purpose of this paper is to illustrate the two semantic properties of VBMPs and to give a formal analysis of their semantics.

Previous literature on Japanese MPs has concentrated on their combination with gradable adjectives (Kubota 2011, Sawada and Grano 2011, among others. These studies address the interpretive effects that depend on the type of gradable adjective combined with the MP. The observations and generalizations in these previous studies are closely related to the proposal that we present, as will be discussed below. However, it is unclear how to deal with MPs when there is no co-occurring gradable expression. We will spell out the detailed steps of how VBMPs enter the composition of a sentence and interact with other elements to obtain their semantic properties.

The remainder of this paper is organized as follows. In Section 2, we reveal that VMBPs involve a covert measure function μ that is subject to the monotonicity requirement, and that this measure function exhibits the same behavior as lower-closed scale adjectives (see Kennedy and McNally 2005). In Section 3, we propose a formal analysis of VBMPs based on two covert morphemes: MON and MEAS. In Section 4, we extend the proposed analysis to verbal comparatives (i.e., comparatives of the verbal domain without overt adverbs), and discuss a new parametric variation in degree domains. Section 5 concludes this paper and identifies a remaining issue.

2 Semantic Properties of Verb-Modifying Bare Measure Phrases

2.1 Monotonicity Requirement

MPs are associated with various dimensions: *5-kiro* '5 km' (DISTANCE), *5-jikan* '5 hours' (DURATION), and *jisoku 5-kiro* 'at 5km per hour' (SPEED). However, not all the MPs can be used as a VBMP. For instance, the MP of speed *jisoku-5-kiro*, unlike the other two MPs above, cannot be used as a VBMP when it modifies the verb *hasitta* 'ran', as shown in the following examples:

(2) a. Taroo-ga 5-kiro hasitta. [DISTANCE]
Taroo-NOM 5-kilometer ran
'Taroo ran 5km.'

b. Taroo-ga 5-jikan hasitta. [DURATION]
Taroo-NOM 5-hour ran
'Taroo for 5 hours.'

c. #Taroo-ga jisoku-5-kiro hasitta. [SPEED]
Taroo-NOM per.hour-5-kilometer ran
'Taroo ran at 5km per hour.'

We claim that the MP *jisoku-5-kiro* in (2) is unavailable because VBMPs involve a measure function μ of type $\langle v, d\rangle$ (i.e. a function from an event to a degree in some dimension), and this measure function obeys the monotonicity requirement.

(3) Claim 1: Monotonicity Requirement

a. The measure function μ resolves only to monotonic dimensions with respect to a part-of structure of events.

b. A dimension δ is monotonic iff for any two events e_1, e_2 such that $e_1 \sqsubset e_2$ (e_1 is a proper subpart of e_2), $\delta(e_1) < \delta(e_2)$.
(cf. Schwarzschild 2002)

According to (3b), the dimensions DISTANCE and DURATION are monotonic with respect to a part-of structure of running events. Suppose that e_1 is an event in which Taroo ran. If e_1 is a part of another running event e_2, that is, Taroo's running in e_1 is a part of running in e_2, the running distance in e_2 and the temporal duration of e_2 are greater than those in e_1. That is, if $e_1 \sqsubset e_2$, then DISTANCE(e_1) $<$ DISTANCE(e_2) and DURATION(e_1) $<$ DURATION(e_2). Hence, the measure function μ can resolve to these monotonic dimensions and the VBMPs *5-kiro* and *5-jikan* are acceptable in (2).

The dimension SPEED, on the other hand, is non-monotonic with respect to a part-of structure of running events. Suppose again that e_1 is an event in which Taroo ran. If e_1 is a part of another running event e_2, that is, Taroo's running in e_1 is a part of running in e_2, it is not guaranteed that Taroo ran faster in e_2 than in e_1. Thus, the measure function μ involved in (2) cannot resolve to the non-monotonic dimension SPEED, and the VBMP *jisoku-5-kiro* is unacceptable in (2).

This claim is supported by the example below, which indicates that the VBMP *jisoku-5-kiro* becomes acceptable if we change the verb modified:

(4) Kuruma-no hasiru supiido-ga jisoku-5-kiro otita.
car-GEN run speed-NOM per.hour-5-kilometer dropped
'The running speed of the car decreased by 5km per hour.'

The relevant event in (4) is not a running event but a *speed-decreasing* event. If this event continues, Taroo's running speed will decrease more, which means that for two *speed-decreasing* events e_1 and e_2, if $e_1 \sqsubset e_2$, then the degree of decrease in speed in e_1 is smaller than that in e_2, satisfying (3b). Hence, the VBMP *jisoku-5-kiro* in (4), unlike that in (2), is acceptable.

2.2 The Scale Structure of the Measure Function μ

Let us proceed to the second semantic property of VBMPs: the scale structure of the measure function μ involved in them. According to Rotstein and Winter (2004), Kennedy and McNally (2005) and Kennedy (2007), gradable adjectives have different scale structures. They are classified into four types based on whether their associated scales are closed or not (i.e. the scales have a minimum or maximal endpoint):

(5) **A Typology of Scale Structures** (based on Kennedy 2007)

a. Open Scale Adjectives:
○————————-○
Example: *tall*, *hot*

b. Lower-closed Scale Adjectives
●————————-○
Example: *bent*, *wet*

c. Upper-closed Scale Adjectives
○————————-●
Example: *straight*, *dry*

d. Totally Closed Scale Adjectives
●————————-●
Example: *open*, *closed*

The distinction between the open and lower-closed scales is important for the current discussion. Sawada and Grano (2011), among others, point out that the interpretation of Japanese MPs depends on the scale structures of gradable adjectives with which they combine. In particular, Japanese MPs combined with open-scale adjectives lead to the comparative interpretation:

(6) a. Tue-ga 5-senti nagai. [Open-Scale]
stick-NOM 5-cm long
'Lit. The stick is 5cm long.'

b. *The length of the stick is 5cm. (Absolute)

c. ✓ The length of the stick is 5cm longer than a contextually salient individual. (Comparative)

In (6a), the MP *5-senti* '5 cm' is combined with the open scale adjective *nagai* 'long,' and the only available interpretation is the comparative one where the MP specifies not the the absolute length but the comparative length of the stick. Conversely, Japanese MPs combined with lower-closed scale adjectives lead to the absolute interpretation:

(7) a. Tue-ga 5-do magatteiru. [Lower-Closed Scale]
stick-NOM 5-degree bent
'Lit. The stick is 5 degrees bent.'

b. ✓ The bentness of the stick is 5 degrees. (Absolute)

c. * The bentness of the stick is 5 degrees longer than a contextually salient individual. (Comparative)

Unlike the previous case, the only available interpretation is the absolute one where the MP *5-do* '5-degree,' which is combined with the lower-closed scale adjective *magatteiru* 'bent', specifies the absolute bentness of the stick.

VBMPs exhibit the same behavior as MPs combined with lower-closed scale adjectives. In (2), the VBMPs *5-kiro* and *5-jikan* have the absolute interpretation just as the MP *5-do* used with the lower-closed scale adjective *magatteiru*:

(2) a. Taroo-ga 5-kiro hasitta. [DISTANCE]
Taroo-NOM 5-kilometer ran
'Taroo ran 5km.'

b. ✓ The distance of Taroo's running is 5km. (Absolute)

c. * The distance of Taroo's running is 5km longer than that of a contextually salient individual. (Comparative)

d. Taroo-ga 5-jikan hasitta. [Duration]
Taroo-NOM 5-hour ran
'Taroo ran for 5 hours.'

e. ✓ The duration of Taroo's running is 5 hours. (Absolute)

f. * The duration of Taroo's running is 5 hours longer than that of a contextually salient individual. (Comparative)

Based on this fact, we claim that the measure function μ involved in VBMPs possesses the same scale structure as lower-closed scale adjectives:

(8) Claim 2: The Scale Structure of the Measure Function μ
The measure function μ involved in VBMPs has a lower-closed scale structure.

This claim is supported by the fact that the measure function μ and lower-closed scale adjectives behave in the same way when they are not used with (VB)MPs. As shown below, the truth conditions of the positive form of open-scale adjectives refer to a contextually determined standard, whereas those of

the positive form of lower-closed scale adjectives refer to the minimum point of the scale (see Kennedy 2007):

(9) a. The stick is long. [Open-Scale]

b. (9a) is true iff the length of the stick is longer than a contextually determined standard (e.g. the average length of sticks).

c. The stick is bent. [Lower-Closed]

d. (9c) is true iff the length of the stick is longer than the minimum point of the scale (i.e. the zero).

Let us assume that (10a) involves the measure function μ although no overt MPs exist. In this case, the truth conditions of (10a) refer to the minimum endpoint just like lower-closed scale adjectives:

(10) a. Taroo-ga hasitta.
Taroo-NOM ran
'Taroo ran.'

b. (10a) is true if and only if Taroo's running distance or duration exceeds the minimum point (i.e. the zero).

Thus, the above fact supports our claim that the measure function μ has the same scalar structure as lower-closed scale adjectives.

Another similarity is the compatibility with the degree modifier *wazukani* 'slightly.' Kubota (2011) observes that lower-closed scale adjectives, but not open scale adjectives, are compatible with this modifier, as in (11a) and (11b).[1]

(11) a. #Tue-ga wazukani nagai. [Open Scale]
stick-NOM slightly long
'The stick is slightly long.'

b. Tue-ga wazukani magatteiru. [Lower-Closed Scale]
stick-NOM slightly bent
'The stick is slightly bent.'

What is crucial here is the fact that *wazukani* can be compatible with the measure function μ as in (12):

[1] Note that (11a) is acceptable under the comparative interpretation of *nagai* (i.e. the stick is slightly longer than a contextually relevant stick). The point here is that this adjective is incompatible with the degree modifier under the absolute interpretation.

(12) Taroo-ga wazukani hasitta. [DISTANCE / DURATION /*SPEED]
Taroo-NOM slightly ran
'Taroo ran just a little bit.'

Notably, the available interpretation of (12) is that Taroo ran a very short distance (DISTANCE) or ran for a very short time (DURATION), but not that Taroo ran very slowly (SPEED). This shows that the measure function μ is involved in (12), and the compatibility of μ and *wazukani* indicates that μ behaves as a lower-closed scale adjective. Hence, VBMPs in (2) are assigned absolute interpretation.

3 Implementation

To capture the semantic properties of VBMPs observed thus far, we assume two covert morphemes, MON and MEAS, the latter of which is based on Sawada and Grano (2011), as in (13), where $\partial(p)$ means that p is the presupposition (Beaver 2008):

(13) a. $[\![\text{MON}]\!] = \lambda e_v.\ \mu(e) \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$.

b. $[\![\text{MEAS}]\!] = \lambda g_{\langle v, d \rangle}.\lambda d_v.\lambda e_v.\ g(e) \geq d \wedge \partial(g \text{ has a minimum point})$.

MON introduces a measure function μ that takes an event e and returns a degree of e in some dimension that satisfies the monotonicity requirement (cf. Nakanishi 2007).[2] MEAS requires the measure function g with a minimum point, and relates the degree measured by g and another degree d.

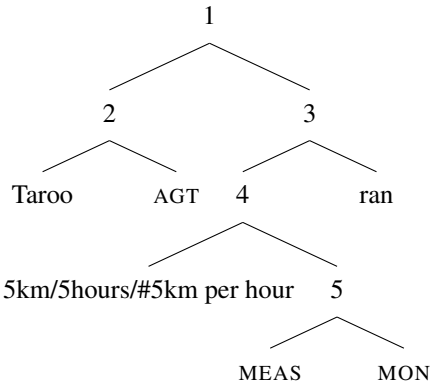
Based on the simplified LF in (14a), the truth conditions of (2) are derived as follows:[3]

[2] Nakanishi (2007) employs the same kind of monotonicity restriction for Japanese floating quantifiers. The current analysis, which claims that lexical items other than floating quantifiers are susceptible to the same constraint, leads to the view that the applicability of the monotonicity constraint is broader than thought in the previous literature.

[3] For the sake of simplicity, we adopt Neo-Davidsonian event semantics (e.g., Parsons 1990), but nothing hinges on this choice.

(14) Taroo-ga 5-kiro/5-jikan/#jisoku-5-kiro hasitta.

a.



$[\![5]\!] = \lambda d_d.\lambda e_v.\ \mu(e) \geq d \wedge \partial(\forall e',e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')]) \wedge \partial(\mu \text{ has a minimum point})$.

$[\![4]\!] = \lambda e_v.\ \mu(e) \geq \textbf{5km/5hours} \wedge \partial(\forall e',e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')]) \wedge \partial(\mu \text{ has a minimum point})$.

$[\![3]\!] = \lambda e.\ \textbf{run}(e) \wedge \mu(e) \geq \textbf{5km/5hours} \wedge \partial(\forall e',e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')]) \wedge \partial(\mu \text{ has a minimum point})$.

$[\![\text{AGT}]\!] = \lambda x_e.\lambda e_v.\ \text{Agent}(e) = x$.

$[\![2]\!] = \lambda e.\ \text{Agent}(e) = \mathbf{T}$.

$[\![1]\!] = \lambda e.\ \textbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \mu(e) \geq \textbf{5km/5hours} \wedge \partial(\forall e',e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')]) \wedge \partial(\mu \text{ has a minimum point})$.

b. Existential Closure applies:
$\exists e[\textbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \mu(e) \geq \textbf{5km/5hours} \wedge \partial(\forall e',e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')]) \wedge \partial(\mu \text{ has a minimum point})]$.

(14) is defined only if μ is monotonic relative to running events e and has a minimum point. The former presupposition ensures that μ cannot resolve to SPEED (i.e., *jisoku-5-kiro* is unavailable in (14)). (14) becomes true if there is a running event e whose agent is Taroo and the measure of e is greater than or equal to 5km/5hours (the *exactly 5km/5hours* interpretation is obtained via scalar implicature).

We assume that if there is no MP as in *Taroo-ga hasitta* 'Taroo ran', MON is combined with the covert morpheme *pos*:

(15) $[\![pos]\!] = \lambda g_{\langle v,\, d\rangle}.\lambda e_v.g(e) > d_s(g)(c)$
(based on Svenonius and Kennedy 2006)

The covert morpheme *pos* takes a measure function g and returns a set of events e such that $g(e)$, the measure of e, is greater than $d_s(g)(c)$, the contextually determined standard for g.

Following Kennedy (2007), we assume that the contextual standard introduced by *pos* is determined by the principle of Interpretive Economy:

(16) **Interpretive Economy**
Maximize the contribution of the conventional meanings of the elements of a sentence to the computation of its truth conditions.
(Kennedy 2007:35)

This principle dictates that in the selection of a standard of comparison, an adjective's scale structure, which is part of its conventional meaning, takes precedence over contextual properties. Given this principle, the standard function $d_s(g)(c)$ returns different standard values depending on the scale structure of the adjective:

(17) Standards for Each Type of Adjectives

a. $d_s(g)(c) = \begin{cases} \text{min(g) if min(g) is defined} \\ \text{max(g) if max(g) is defined} \\ d_s(g)(c) \text{ otherwise} \end{cases}$

b. Open Scale: a context-dependent point on the scale

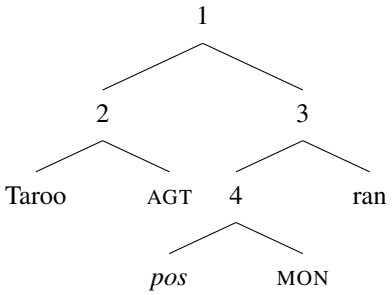
c. Lower Closed Scale: the scale's minimum endpoint

d. Upper Closed Scale: the scale's maximum endpoint

e. Totally Closed Scale: the scale's minimum or maximum endpoint

Based on the covert morpheme *pos* and Interpretive Economy, we can capture the intuitive truth conditions of *Taroo-ga hasitta.* 'Taro ran' as in (18). (18) is defined only if μ is monotonic relative to running events, and becomes true if there is a running event e whose agent is Taroo and the measure of e (e.g. the distance or duration of e) is greater than the minimum point (i.e. the zero). This is what we observed in (10a).

(18) Taroo-ga hasitta. 'Taroo ran.'

a. 

$[\![4]\!] = \lambda e.\ \mu(e) > d_s(\mu)(c) \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$.

$[\![3]\!] = \lambda e.\ \mathbf{run}(e) \wedge \mu(e) > \underline{d_s(\mu)(c)} \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$.
$= \lambda e.\mathbf{run}(e) \wedge \mu(e) > \underline{\min(\mu)} \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$. [Because μ has a lower-closed scale]

$[\![2]\!] = \lambda e.\ \text{Agent}(e) = \mathbf{T}$

$[\![1]\!] = \lambda e.\ \mathbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \mu(e) > \min(\mu)$

b. Existential Closure applies:
$\exists e[\mathbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \mu(e) > \min(\mu) \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])]$.

Thus, we have demonstrated that the monotonicity requirement imposed by MON and the lower-closedness of μ's scale derive the desired results. However, one might claim that it is ad hoc to posit a covert morpheme for one particular construction (i.e., VBMPs). The next section shows that MON is applicable to the derivation of the semantic property of another construction.

4 Implications

4.1 Verbal Comparatives

The current proposal can be extended to verbal comparatives, i.e., comparatives of the verbal domain without overt adverbials, which have not been studied extensively in the literature. As in the VBMP construction, the possible dimension of comparison in verbal comparatives must be monotonic:

(19) Taroo-wa Hanako-yori hasitta. [DISTANCE / DURATION / *SPEED]
Taroo-TOP Hanako-than ran
'Taroo ran [a longer distance / for a longer time / *faster] than Hanako.'

This property can be captured by incorporating MON into the composition. We assume that the lexical entry of *yori* 'than' for adverbial comparatives is (20):[4]

(20) $[\![yori]\!] = \lambda Q_{\langle v, t\rangle}.\lambda g_{\langle v, d\rangle}.\lambda P_{\langle v, t\rangle}.\lambda e.\ \exists e'[P(e) \wedge Q(e') \wedge g(e) > g(e')]$.

We further assume that the complement of *yori* is a reduced clause that denotes objects of type $\langle v, t\rangle$. Then, the truth-conditions of (19) can be derived as in (21). According to (21b), (19) is defined only if μ is monotonic relative to running events e, and becomes true if there are events e and e' such that e is a running event whose agent is Taroo and e' is a running event whose agent is Hanako and $\mu(e)$ is greater than $\mu(e')$. Because DISTANCE and DURATION are monotonic to running while SPEED is not, μ in (21b) can resolve to DISTANCE and DURATION, but not to SPEED, which is what we observe in (19).

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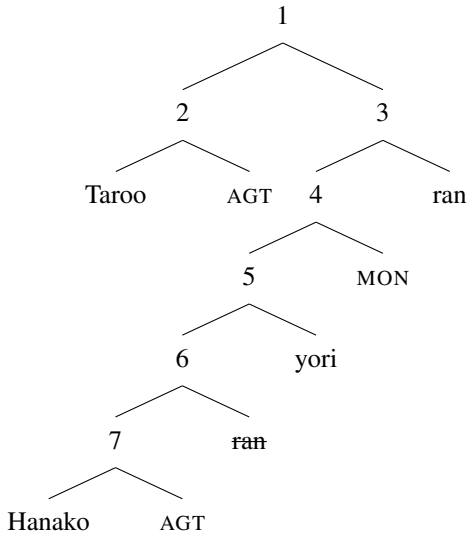
[4] Note that the lexical entry of *yori* in (20a) is not designed solely for verbal comparatives; it can be applied to adverbial comparatives in general. Consider (i-a) below. In the composition of this sentence, the overt adverb *hayaku* 'fast' saturates the slot of g in (20a). Assuming that the semantics of *hayaku* is as in (i-b), we arrive at (i-c), which is the correct meaning of (i-a).

(i) a. Taroo-wa Hanako-yori hayaku hasitta.
Taroo-TOP Hanako-than fast ran.
'Taroo ran faster than Hanako.'

b. $[\![hayaku]\!] = \lambda e.$ SPEED(e).

c. $[\![$ (i-a) $]\!] = \exists e, e'[\mathbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \mathbf{run}(e') \wedge \text{Agent}(e') = \mathbf{H} \wedge \text{SPEED}(e) > \text{SPEED}(e')]$.

(21) a.



$[\![7]\!] = \lambda e.\ \text{Agent}(e) = \mathbf{H}$

$[\![6]\!] = \lambda e.\ \mathbf{run}(e) \wedge \text{Agent}(e) = \mathbf{H}$

$[\![5]\!] = \lambda g.\lambda P.\lambda e.\ \exists e'[P(e) \wedge \mathbf{run}(e') \wedge \text{Agent}(e') = \mathbf{H} \wedge g(e) > g(e')]$.

$[\![4]\!] = \lambda P.\lambda e.\ \exists e'[P(e) \wedge \mathbf{run}(e') \wedge \text{Agent}(e') = \mathbf{H} \wedge \mu(e) > \mu(e')] \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$.

$[\![3]\!] = \lambda e.\ \mathbf{run}(e) \wedge \exists e'[\mathbf{run}(e') \wedge \text{Agent}(e') = \mathbf{H} \wedge \mu(e) > \mu(e')] \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$.

$[\![2]\!] = \lambda e.\text{Agent}(e) = \mathbf{T}$

$[\![1]\!] = \lambda e.\ \mathbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \exists e'[\mathbf{run}(e') \wedge \text{Agent}(e') = \mathbf{H} \wedge \mu(e) > \mu(e')] \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])$.

b. Existential Closure applies:
$\exists e[\mathbf{run}(e) \wedge \text{Agent}(e) = \mathbf{T} \wedge \exists e'[\mathbf{run}(e') \wedge \text{Agent}(e') = \mathbf{H} \wedge \mu(e) > \mu(e')] \wedge \partial(\forall e', e''[e' \sqsubset e \sqsubset e'' \rightarrow \mu(e') < \mu(e) < \mu(e'')])]$.

We have illustrated that the semantic properties of verbal comparatives can be captured by postulating the covert morpheme MON. This implies that the morpheme is not designed solely to account for the properties of VBMPs.

4.2 Parametric Variation in Degree Domains

The current analysis suggests that there is a parametric variation in degree domains other than the degree abstraction parameter (Beck et al. 2004).[5] Wellwood (2019) claims that in English, *much* shows the monotonicity requirement as shown in (22), where *more* is analyzed as *much* + *-er*:

(22) a. Al ran more than Bill did. [DISTANCE / DURATION / *SPEED]

b. Al ran as much as Bill did. [DISTANCE / DURATION / *SPEED]

(Wellwood 2019: 42)

These examples pattern with the Japanese verbal comparatives observed in the previous subsection, which means that *much* has the same properties as MON.[6] This implies that in Japanese, *much* is always covert while it is not in English, and that there is possibly a cross-linguistic parameter as to whether *much* appears overtly (as in English) or covertly (as in Japanese).

5 Conclusion

In this paper, we illustrated the semantic properties of VBMPs. We argued that VBMPs involve the measure function μ in their semantics and that μ possesses the following two properties. First, VBMPs must comply with the monotonicity requirement (Schwarzchild 2002): the value in the dimension measured by VBMPs must be correlated with the size of the event described by the predicate. Second, μ patterns with lower-closed scale adjectives such as *magatteiru* 'bent', which provide the absolute interpretation when combined with MPs. We offered a formal analysis of VBMPs by employing two

[5] Based on the syntactic and semantic difference between *than*-clauses and *yori*-clauses, Beck et al. (2004) propose the following parameter:

(ii) Degree Abstraction Parameter(DAP):
A language { does / does not } have binding of degree variables in the syntax.

[6] While the Japanese verbal comparatives and sentences in (22) show parallelism, VBMPs and their English counterparts do not. In English, MPs of DISTANCE can appear without a preposition, as in Japanese; however, those of DURATION require the preposition *for*, just as those of SPEED require *at*:

(iii) John ran [5 km / *(for) 5 hours / *(at) 5km per hour].

If monotonicity plays a crucial role in the presence or absence of prepositions in English, the English DURATION MPs should be used without *for*, which is not the case. This suggests that the cross-linguistic variation regarding whether MPs need prepositions/postpositions might not be a purely semantic matter but has something to do with language-specific morphosyntactic reasons.

covert morphemes MON and MEAS, the latter of which is based on Sawada and Grano (2011). We also demonstrated that our analysis can be extended to verbal comparatives, and that there may be a parametric variation as to whether a morpheme that requires monotonicity is overtly expressed.

However, the optima combination of MPs and verbal comparatives is a remaining issue. MPs can be attached to adjectival and adverbial comparatives:

(23) a. Taroo-wa Hanako-yori 2cm se-ga takai.
Taroo-TOP Hanako-than 2cm height-NOM high
'Taroo is 2cm taller than Hanako.' [Adjectival Comparatives]

b. Taroo-wa Hanako-yori 2-kiro nagaku hasitta.
Taroo-TOP Hanako-than 2km long ran
'Taroo ran 2km longer than Hanako.' [Adverbial Comparatives]

c. Taroo-wa Hanako-yori hon-o 2-satu ooku yonda.
Taroo-TOP Hanako-than book-ACC 2-CL many read
'Taroo read two more books than Hanako.'
[Adverbial Comparatives]

However, the verbal comparatives in the following examples cannot tolerate MP attachment:

(24) a. ??Taroo-wa Hanako-yori 5-kiro hasitta. [DISTANCE]
Taroo-TOP Hanako-than 5km ran
'Lit. Taroo ran 5km more than Hanako.'

b. ??Taroo-wa Hanako-yori 5-satu yonda. [NUMBER]
Taroo-TOP Hanako-than 5-CL read
'Lit. Taroo read 5-book more than Hanako.'

Note that the dimensions of the comparison (DISTANCE and NUMBER) satisfy the monotonicity constraint: the more Taroo runs, the longer the running distance should be, and the more Taroo reads books, the larger the number of books that he reads. Nevertheless, these sentences sound weird. The contrast between (23b) and (23c), in which adverbs are overtly expressed, and (24a) and (24b), in which there are no overt adverbs, should be explored in the future studies.

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