

Investigating an Asymmetry in the Semantics of Japanese Measure Phrases^{*}

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0. Introduction

It is often claimed that in Japanese when a measure phrase combines directly with an adjective, it has only a differential interpretation, with a contextually determined standard (Snyder et al. 1995; Schwarzschild 2005; Kikuchi 2006; Nakanishi 2007; Hayashishita 2009), as in the following examples:

- (1) a. Kono tana-wa 2-meetoru takai.
This shelf-TOP 2-meter tall
'This shelf is 2 meters taller.'
NOT: 'This shelf is 2 meters tall.'
- b. Kono roopu-wa 5-inchi nagai.
This rope-TOP 5-inch long
'This rope is 5 inches longer.'
NOT: 'This rope is 5 inches long.'
- c. Kinoo-wa 5-do atataka-katta.
Yesterday-TOP 5-degree warm-PAST
'It was 5 degrees warmer yesterday.'
NOT: 'It was 5 degrees warm yesterday.'

Note that in the above examples, there is no comparative morpheme like English *-er/more*.

Although this observation about Japanese is correct, we find that Japanese does give rise to a 'direct measurement' reading in certain environments, e.g.:

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- (2)
- a. Kono sao-wa 5-do magat-teiru.
This rod-TOP 5-degree bend-PERF
'This rod is 5 degrees bent.'
NOT: 'This rod is 5 degrees more bent.'
 - b. Kono fusuma-wa 3-senti ai-teiru.
This sliding door-TOP 3-centimeter open-PERF
'This door is 3 centimeters open.'
NOT: 'This door is 3 centimeters more open.'
 - c. Pisa-no syatoo-wa 3.97-do katamui-teiru.
Pisa-GEN leaning tower-TOP 3.97-degree incline-PERF
'The Leaning Tower of Pisa is 3.97 degrees inclined.'
NOT: 'The Leaning Tower of Pisa is 3.97 degrees more inclined.'

Whereas in (1), the combination of a measure phrase with a gradable predicate results in an obligatory differential interpretation, (2) shows the opposite patterning: only the direct interpretation is available. The purpose of this paper is to propose a formal semantics that captures the asymmetry between (1) and (2) in a principled way, and to compare the phenomenon to similar data in other languages.

Svenonius and Kennedy (2006) argue that measure phrases are introduced by a special degree morpheme *Meas*. We propose that unlike English, Japanese has two morphemes, *MeasJP_{dir}* and *MeasJP_{diff}*: one for direct measurement and one for differential measurement. We then claim that *MeasJP_{dir}* has a stronger selectional restriction than English *Meas*. *MeasJP_{dir}* selects only for absolute gradable adjectives that have a well-defined zero point (in the sense of Kennedy 2007). *MeasJP_{diff}*, on the other hand, measures the interval between the target and a contextually determined standard. We further argue that *MeasJP_{dir}* and *MeasJP_{diff}* are in complementary distribution and the choice between them is governed by Kennedy's (2007) principle of Interpretive Economy. We also consider cases where measure phrases occur in comparative constructions with an overt standard of comparison and show that our analysis trivially derives the right semantics for such constructions: *MeasJP_{dir}* is automatically selected in such cases because a standard of comparison always introduces a well-defined absolute point.

The main theoretical implication of our proposal is that the interpretation of measure phrases in Japanese is sensitive to the scale structure of gradable adjectives, and that the difference between Japanese and English can be captured as a matter of variation in the inventory of *Meas* heads. At the end of the paper we also show that the proposed inventory of *Meas* heads predicts a third kind of system which is borne out in Spanish, Korean, and Russian.

1. Previous Analyses of Japanese Measure Phrases

As stated above, in previous literature it is claimed that when a measure phrase combines directly with an adjective in Japanese, it has only a differential interpretation, with a contextually determined standard (Snyder et al. 1995;

Schwarzschild 2005; Kikuchi 2006; Nakanishi 2007; Hayashishita 2009), as in the examples in (1) above.

To explain the obligatory differential reading for sentences like (1), Hayashishita (2009), following similar proposals in Fukui (1986) and Snyder et al. (1995), claim that AdjP in Japanese lacks the specifier position that hosts a degree variable:

- | | |
|--|----------------------|
| (3) a. English | b. Japanese |
| [_{AdjP} _ [_{Adj} A]] | [_{AdjP} A] |

In Hayashishita's system, measure phrases in Japanese can combine with gradable adjectives only through the mediation of covert morphology that gives rise to a differential interpretation.

In a different vein, Kikuchi (2006) attempts to derive the facts from the proposal that degree constructions give rise to a default comparative meaning in languages that do not have an overt morphological contrast between positive- and comparative-form adjectives. Since Japanese lacks an overt comparative morpheme like English *-er/more*, the default comparative value is chosen when a measure phrase is present.

An empirical shortcoming of both approaches is that neither considers examples like those in (2) above which show that Japanese does allow direct measurement in certain environments.¹ The goal of the rest of this paper is to develop an account of Japanese measure phrases that overcomes this difficulty.

2. Theoretical Background

In this section we introduce some theoretical tools that will give us a starting point for analyzing the Japanese data. Following Bartsch and Vennemann (1973), Kennedy (1999, 2007), and other work, we take gradable adjectives to denote functions of type $\langle ed \rangle$; i.e., they are measure functions which take an individual and return a degree:

- (4) $[[\text{tall}]] = \lambda x. \text{TALL}(x)$

¹ There is a tendency for the predicates that give rise to a direct measurement reading to be deverbal, as signaled by their use of the perfective morpheme *-teiru* (see also footnote 2), and in this sense might be considered not true 'adjectives' and hence outside the empirical scope of these previous treatments. However, as the following example shows, the (non-deverbal) adjective *hayai* 'fast' gives rise to direct measurement as well:

- (i) Kono tokai-wa 2-fun hayai.
 This clock-TOP 2-minute fast
 'This clock is 2 minutes fast.' NOT: 'This clock is 2 minutes faster.'

Thus the asymmetry between (1) and (2) is not entirely traceable to the categorial status of the gradable predicate. See also Schwarzschild (2005) on the semantics of *late/early*.

One consequence of this analysis is that bare predicative adjectives must co-occur with a null morpheme *pos* which is what gives them their positive interpretation relative to some context. A semantics for *pos* is given in (5), with a sample derivation in (6). As we see here, *pos* takes a gradable adjective measure function and an individual as its two arguments, and it orders the individual on the scale associated with the adjective relative to some contextually determined standard.

- (5) $[[\text{Deg } pos]]^c = \lambda g_{\langle e,d \rangle} \lambda x. g(x) > d_{s(g)(c)}$
- (6) $[[\text{John is tall}]] = [[pos]]([[tall]])([[John]])$
 $= \lambda g_{\langle e,d \rangle} \lambda x. g(x) > d_{s(g)(c)} (\text{tall})(\text{John})$
 $= \text{TALL}(\text{John}) > d_{s(\text{tall})(c)}$
 ‘John’s height is greater than a contextually determined standard.’

See Kennedy (2007) for a fuller exploration of the semantics of *pos*.

In some cases, a gradable adjective can combine directly with a degree-denoting measure phrase:

- (7) John is four feet tall.

Note that (7) does not entail *John is tall*, indicating that *pos* is not involved in such cases.

An important fact about measure phrases is that there is lexical idiosyncrasy in their distribution. In English, for example, they are compatible with *tall* but not with *heavy* even though both adjectives are associated with scales amenable to numerical measurement:

- (8) *This book is [two pounds heavy].

This is a matter of crosslinguistic variation: German *schwer* ‘heavy’, e.g., is compatible with a measure phrase, as is Italian *pesante* ‘heavy’ (Schwarzschild 2005).

In part to account for this lexical idiosyncrasy, Svenonius and Kennedy (2006) propose that measure phrases are introduced by a special Deg head *Meas*, with the syntax as in (9) and semantics as in (10):

- (9)
-
- ```

 graph TD
 DegP["DegP <e,t>"] --- NumP["NumP <d>"]
 DegP --- Deg_prime["Deg' <d, et>"]
 NumP --- four_feet["four feet"]
 Deg_prime --- Deg["Deg"]
 Deg_prime --- AP["AP <e, d>"]
 Deg --- Meas["Meas"]
 AP --- tall["tall"]
 Deg --- sem["<<e,d>, <d, et>>"]

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- (10)  $[[Meas_{Eng}]] = \lambda g_{\langle e, d \rangle}: g$  is a function from objects to measurable degrees  
 $\lambda d \lambda x. g(x) \geq d$

$Meas_{Eng}$  can combine only with (a subset of) gradable adjectives that are associated with a measurable scale. Thus, it is compatible with the adjectives like *tall* but not with adjectives like *tired* for which no system of measurement is defined. (7) is thus computed as follows:

- (11)  $[[\text{John is four feet tall}]] = [[Meas]]([[tall]])([[four feet]])([[John]])$   
 $= \lambda g \lambda d \lambda x. g(x) \geq d$  ( $[[tall]]$ )( $[[four feet]]$ )( $[[John]]$ )  
 $= TALL(\text{John}) \geq 4 \text{ ft.}$   
 ‘John’s height is greater than or equal to four feet.’

The lexical idiosyncrasy is captured as a matter of selectional restriction: In English, for example, *Meas* does not select for *heavy* whereas in German and Italian, it does. See Svenonius and Kennedy (2006) for details of this proposal.

### 3. Analysis of Japanese Measurement System

#### 3.1. Direct Measurement in Japanese

We propose that as in English, Japanese also has a morpheme *Meas*, but it has a stronger selectional restriction:  $Meas_{JPdir}$  can combine only with measurable adjectives having a well-defined absolute point (zero point) such as *bent* and *open*:

- (12) a.  $[[Meas_{Eng}]] = \lambda g_{\langle e, d \rangle}: g$  is a function from objects to measurable degrees  $\lambda d \lambda x. g(x) \geq d$   
 b.  $[[Meas_{JPdir}]] = \lambda g_{\langle e, d \rangle}: g$  is a function from objects to measurable degrees and **g has a well-defined absolute point**  
 $\lambda d \lambda x. g(x) \geq d$

Here we can interpret having a “well-defined absolute point” as being a lower-closed scale. According to Kennedy (2007), lower-closed scale (or minimum standard) adjectives “simply require their arguments to possess some minimal degree of the property they describe” (p. 21). One empirical test for this property is that lower-closed scale adjectives are generally felicitous with *partially* whereas lower-open scale adjectives are not (Rotstein and Winter 2004):

- (13) a. ??John is partially tall.  
 b. ??The rope is partially long.  
 c. ??The weather is partially warm.
- (14) a. The rod is partially bent.  
 b. The door is partially open.  
 c. The tower is partially inclined.

In Japanese (and English), lower closed scale adjectives are also discernible based on entailment patterns: In (15), the negation of a lower-closed scale adjective entails its antonym, whereas in (16) the negation of a relative gradable adjective does not:

- (15) (Entailment patterns of a lower-closed scale adjective)  
 a. Kono sao-wa magat-tei-**nai**. => b. Kono sao-wa masugu-da.  
 This rod-TOP bend-PERF-NEG This rod-TOP straight-PRED  
 ‘This rod is not bent’ ‘This rod is straight.’
- (16) (Entailment patterns of a relative gradable adjective)  
 a. Taro-wa se-ga takaku-**nai**. ≠> b. Taro-wa se-ga hikui.  
 Taro-TOP height-NOM tall-NEG Taro-TOP height-NOM short  
 ‘Taro is not tall.’ ‘Taro is short.’

Because Japanese *magat-teiru* ‘bent’ is a lower-closed scale adjective, it has a well-defined zero point and hence is compatible with *Meas<sub>JPdir</sub>*, thus correctly predicting the meaning in (17).<sup>2</sup>

- (17) Kono sao-wa 5-do magat-teiru.  
 This rod-TOP 5-degree bend-PERF  
 ‘This rod is 5 degrees bent.’  
 NOT: ‘This rod is 5 degrees more bent.’

Japanese *takai* ‘tall’, on the other hand, has no well-defined absolute point and thus does not express direct measurement when combined with a measure phrase, unlike its English counterpart:

- (18) a. This shelf is 2 meters tall. (English)  
 b. Kono tana-wa 2-meetoru takai. (Japanese)  
 This shelf-TOP 2-meter tall  
 ‘This shelf is 2 meters taller.’

A key point is that when an **upper**-closed scale adjective like *simat-teiru* ‘closed’ combines with a measure phrase, the resulting sentence is odd (cf. Kubota 2009):<sup>3</sup>

<sup>2</sup> One might object here that because *magat-teiru* ‘bent’ consists of a verbal root *maga* ‘bend’ and perfective morpheme *-teiru*, (17) and the other examples in (2) are actually resultative constructions that do not involve adjectival predication at all. While we agree that *5 do magat-teiru* ‘five degrees bent’ could be analyzed in such a way, something would still need to be said about how the degree semantics associated with *5 do* ‘5 degrees’ combines with the resultative predicate, and so *Meas<sub>JPdir</sub>* would still be applicable. See, among others, Oda (2005) for a semantics for *-teiru*. A direction for further research is to investigate the important relation between *-teiru* and scale structure.

<sup>3</sup> Note that if we add an additive particle *moo* ‘additionally/more’ (e.g. *moo 2-meetoru*), the sentence can be interpreted as having a differential interpretation.

- (19) ??Kono fusuma-wa 3-senti simat-teiru. (cf. 2b)  
 This sliding door-TOP 3-centimeter close-PERF  
 NOT: ‘This door is 3 centimeters closed.’  
 NOT: ‘This door is 3 centimeters more closed than a contextually determined standard.’

Upper-closed scale adjectives have a well-defined absolute point, namely, a maximum point. Therefore, in principle, they combine with *Meas<sub>JPdir</sub>*. However, since a maximum point cannot be a starting point in an upward directed scale, the resulting interpretation is infelicitous.

### 3.2. Differential Measurement in Japanese

In order to derive the correct interpretation of sentences like (20), we propose that unlike English, Japanese has another degree morpheme *Meas<sub>JPdiff</sub>* that is used for differential measurement:

- (20) Kono tana-wa 2-meetoru takai.  
 This shelf-TOP 2-meter tall  
 ‘This shelf is 2 meters taller.’

- (21)  $[[Meas_{JPdiff}]] = \lambda g_{\langle e, d \rangle} \lambda d \lambda x. g(x) - g(s) = d$  (where *s* is a contextually determined object)

*Meas<sub>JPdiff</sub>* introduces a contextually determined standard from which a new zero point is defined so that the measurement is computable.

We further propose that *Meas<sub>JPdir</sub>* and *Meas<sub>JPdiff</sub>* are in complementary distribution and the choice between them is governed by the following economy principle:

- (22) *Interpretive Economy*: Maximize the contribution of the conventional meanings of the elements of a sentence to the computation of its truth conditions. (Kennedy 2007:36)

This economy principle requires that if a given adjective has a well-defined absolute point, *Meas<sub>JPdir</sub>* should be used, since this morpheme relies on the zero point (absolute point) associated with the adjective (conventional meaning) to compute the measurement rather than introducing a contextual standard.

An advantage of positing *Meas<sub>JPdiff</sub>* is that we do not need to posit a null comparative morpheme MORE in the semantics of (20). This would be problematic given that the equivalent of (20) without a measure phrase cannot mean ‘this shelf is taller’: Only in the presence of an overt measure phrase is there a differential interpretation.

### 3.3. Semantics of Comparatives with Measure Phrases

In a regular Japanese comparative construction, the standard of comparison is introduced by *yori*, and an optional measure phrase measures the gap between the subject and the standard of comparison:

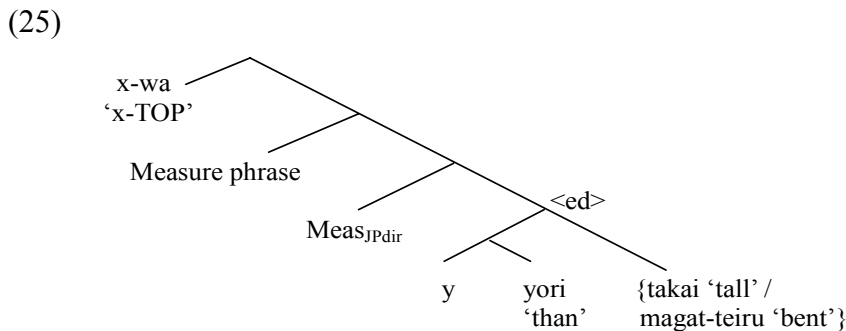
- (23) a. Kono tana-wa ano tana-yori (2-meetoru) takai.  
 This shelf-TOP that shelf-than 2-meter tall  
 ‘This shelf is 2 meters taller than that shelf.’  
 b. Kono sao-wa ano sao-yori (5-do) magat-teiru.  
 This rod-TOP that rod-than 5-degree bend-PERF  
 ‘This rod is 5 degrees more bent than that rod.’

Following Kennedy and Levin (2008) and Kennedy and McNally (2005), we adopt the idea that the function of comparative morphology is to turn a basic measure function into a difference function with a scale whose minimal element – the “derived zero”- corresponds to the degree introduced by the comparative standard. Thus we posit the following denotation for *yori*:

$$(24) \quad [[yori]] = \lambda x \lambda g_{\langle e,d \rangle} \lambda y. g_{g(x)}^{\uparrow}(y)$$

Here, *yori* takes an entity  $x$  and a gradable adjective  $g$  as arguments and returns a function  $\lambda y. g_{g(x)}^{\uparrow}(y)$  which maps entities to a derived scale  $g_{g(x)}^{\uparrow}$ . The starting point of the derived scale corresponds to the degree introduced by the comparative standard  $x$ .

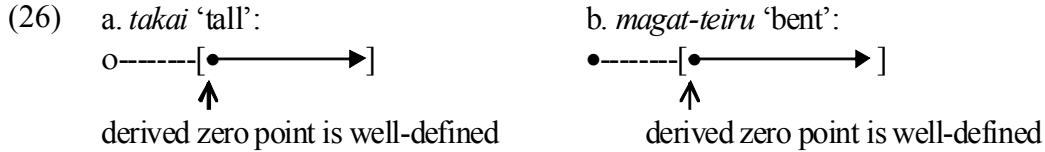
A consequence of this analysis is that like morphologically bare adjectives, comparative adjectives are type  $\langle e,d \rangle$ . Since a standard of comparison provides a well-defined zero point, comparative constructions with a measure phrase **always** use *Meas<sub>JPdir</sub>* regardless of the scale structure of the adjective itself, as in (25):<sup>4</sup>



<sup>4</sup> We acknowledge Kubota (2009) for suggesting the application of Kennedy and Levin’s (2008) semantics of comparatives to Japanese comparatives with measure phrases. Kubota (2009) does not posit *Meas<sub>JPdir</sub>* but his analysis uses the semantics of *yori* in (24).

Note: We assume here that at LF, the measure phrase precedes the standard of comparison (Kubota 2009). In syntax, it can also appear following the *yoru* phrase.

(26) shows the scale structure of *takai* ‘tall’ and *magat-teiru* ‘bent’ graphically. Although ‘tall’ has an undefined zero point and ‘bent’ has a well-defined zero point as indicated by o and • respectively, the crucial insight is that both take on a well-defined derived zero point when a standard of comparison is introduced:



#### 4. Theoretical Implications and Typological Investigation

In our analysis, the difference between Japanese and English is captured via cross-linguistic variation in the inventory of *Meas* heads:

(27)  $[[Meas_{Eng}]] = \lambda g_{\langle e, d \rangle} : g$  is a function from objects to measurable degrees  
 $\lambda d \lambda x. g(x) \geq d$

(28) a.  $[[Meas_{JPdir}]] = \lambda g_{\langle e, d \rangle} : g$  is a function from objects to measurable degrees and **g has a well-defined absolute point**  
 $\lambda d \lambda x. g(x) \geq d$

b.  $[[Meas_{JPdiff}]] = \lambda g_{\langle e, d \rangle} \lambda d \lambda x. \max g(x) - \max g(s) = d$  (where *s* is a contextually determined object)

Whereas English *Meas<sub>Eng</sub>* allows measurement from an undefined zero point for certain adjectives such as *tall*, in Japanese, *Meas<sub>JPdir</sub>* and *Meas<sub>JPdiff</sub>* conspire to disallow measurement from an undefined zero point. A prediction of this *Meas<sub>JPdir</sub> / Meas<sub>JPdiff</sub>* “lexical split” approach to Japanese measure phrase semantics is that we might find other languages that have only one of these two lexical items. Indeed, this prediction bears out: We find languages that are just like Japanese except that they only have *Meas<sub>JPdir</sub>* and not *Meas<sub>JPdiff</sub>*.

**Spanish** disallows measure phrases with open-scale adjectives (29), but allows them in comparative constructions and with adjectives that have a well-defined absolute point (30):

(29) \*Pedro es un metro alto. (open-scale)  
 Pedro is one meter tall

(30) a. Pedro es un metro **más alto** (que Jorge). (lower-closed scale)  
 Pedro is one meter more tall than Jorge  
 ‘Pedro is one meter taller (than Jorge).’

b. Esta varilla está **doblada** noventa grados. (lower-closed scale)  
 This rod is bent ninety degrees  
 ‘This rod is ninety degrees bent.’

- c. El reloj está **adelantado** cinco minutos. (lower-closed scale)  
 the clock is early five minutes  
 ‘The clock is five minutes fast.’

**Korean** behaves the same way:

- (31) \*i kenmwul-un sip mite **khu-ta**. (open-scale)  
 this building-TOP ten meter tall-DECL  
 Intended: ‘This building is 10 meters tall.’
- (32) a. i kenmwul-un sip mit **te khu-ta**. (lower-closed scale)  
 this building-TOP ten meter more tall-DECL  
 ‘This building is ten meters taller.’
- b. i hwoychori-nun i-to (cengto)**hwies-ta**. (lower-closed scale)  
 this rod-TOP two-degree about bent-DECL  
 ‘This rod is (about) two degrees bent.’
- c. i sikyey-nun o pwun **pparu-ta**. (lower-closed scale)  
 this clock-TOP five minute fast-DECL  
 ‘This clock is five minutes fast.’

**Russian** also exhibits this patterning:

- (33) \*On dva metra **vysokij**. (open-scale)  
 he two meters tall  
 (Matushansky 2002:241)
- (34) a. On na metr **vyshe** (Billa) (lower-closed scale)  
 he by meter high.MORE Bill.GEN  
 ‘He is one meter taller (than Bill).’
- b. Etot prut **pognut** na p'at' gradusov. (lower-closed scale)  
 this rod bent by five degrees  
 ‘This rod is five degrees bent.’
- c. Eti chasy **speshat** na p'at' minut. (lower-closed scale)  
 This clock hurries by five minute  
 ‘This clock is five minutes fast.’

The generalization is that in Spanish, Korean and Russian, a measure phrase can combine with a gradable predicate just in case there is a well-defined zero point; otherwise, the result is ungrammatical. This fact follows from the proposal that these languages have one *Meas* morpheme corresponding to Japanese *Meas<sub>JPdir</sub>*, and it suggests the following implicational universal in the inventory of *Meas* heads:

- (35) *Meas<sub>JPdiff</sub>* > *Meas<sub>JPdir</sub>*

In addition to accounting for the above patterning, (35) derives Schwarzschild's (2005) generalization that every language that allows measure phrases with positive-form adjectives allows them with comparatives but not vice versa.

## 5. Conclusions

This paper proposed a semantics that captures an asymmetry in the semantics of Japanese measure phrases. We proposed that unlike English, Japanese has two *Meas* morphemes, *Meas<sub>JPdir</sub>* for direct measurement and *Meas<sub>JPdiff</sub>* for differential measurement. *Meas<sub>JPdir</sub>* has a stronger selectional restriction than English *Meas* in that it selects only for absolute gradable adjectives with a lower closed scale. *Meas<sub>JPdir</sub>* and *Meas<sub>JPdiff</sub>* are in complementary distribution and the choice between the two morphemes is governed by the principle of Interpretive Economy.

The theoretical implication of this proposal is that the interpretation of measure phrases in Japanese is sensitive to the scale structure of gradable adjectives and the difference between Japanese and English can be captured as a matter of variation in the inventory of *Meas* heads. Spanish, Korean and Russian represent a third cross-linguistically available option. They are just like Japanese except that they only have *Meas<sub>JPdir</sub>*.

One direction for future study is to investigate the relationship between *Meas* head inventory and overt comparative morphology. English, Spanish, Korean and Russian all have overt comparative morphology, and all were analyzed as having only one *Meas* head. Japanese, on the other hand, does not have overt comparative morphology,<sup>5</sup> and was analyzed as having two *Meas* heads. Thus there may be a correlation between the presence/absence of overt comparative morphology and the richness of the inventory of *Meas* heads in a given language.

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<sup>5</sup> Note that Modern Japanese does have a comparative use of the morpheme *yori*, which normally functions only as a standard marker. However, it is used in highly restricted contexts and is a relatively recent development in Japanese. See Sawada (to appear) and references therein.

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