Comparatives and Degree Nominals

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1. Introduction

Cross-linguistic variations in comparatives have been one of the main concerns in recent years. The goal of this paper is to present with some empirical evidence the view that genuine clausal comparatives with degree abstraction structure do not exist in Japanese. I will make reference to the parameter advocated by Beck et al. (2004) and proceed with our argument in favor of the parameter. As argued by Beck et al. and Oda (2008), I will also argue that Japanese does not allow degree operator movement due to the negative setting of the parameter. I will also claim, with Sudo (2009), that the standard of clausal comparatives is not degree descriptions, but invisible degree nominals.

This paper is organized as follows: Section 2 presents a brief summary of the current studies of comparatives and looks at some interesting phenomena observed in Japanese clausal comparatives, getting into the controversial issue of whether degree abstraction is available in Japanese. In section 3, I will make a proposal that the (superficial) clausal comparative is not in fact clausal, but rather a nominal. In Section 4, I will finish the paper by adding several pieces of data supporting our argument.

2. Comparatives and DAP

English and other languages allow the standard of comparison to be phrasal, as in (1a) and to be clausal, as in (1b):

(1) a. Maki is taller than Tei. (Phrasal Comparative)
b. Maki is taller than Tei is (tall). (Clausal Comparative)

Japanese, on the other hand, has only a phrasal comparative in simple adjectival predicates, as shown in the contrastive behavior between (2a) and (2b):

(2) a. Maki-wa Tei-yori takai.
Maki-Top Tei-than tall
'Maki is taller than Tei.'
b. *Maki-wa Tei-ga takai-yori takai.
Maki-Top Tei-Nom tall-than tall
'Maki is taller than Tei is (tall).'

When simple clausal comparatives are used both in the matrix and embedded clauses, it is utterly ungrammatical in Japanese. As mentioned in Sudo (2009), the gradable predicate in (1b) can remain there with contrastive stress. In Japanese, on the other hand, neither the deletion of the predicate nor stress suffices to save (2b).

Let us next see some English cases in which a degree argument is involved in an object DP, as shown in (3).

(3) a. Maki scored more goals than Tei did/ scored.
b. Maki kicked a longer ball than Tei did/ kicked.

(3a) says that the maximal degree d such that Maki scored d-goals exceeds the maximal degree d such that Tei scored d-goals. Semantically, the comparatives require two maximal degrees on a relevant dimension to be compared. In order to create such semantic calculation, we need to construct feasible syntactic structures. Following the standard treatment, we assume that the comparative morpheme is a determiner of type <dt, <dt, t>>, which takes two sets of degrees and compares the maximal values of these two sets, as in (4):

(4) $[[\text{-er}]] = \lambda D.\, \lambda D'.\max(D') > \max(D)$ (Hackle 2000:50)

The DegP, which is a generalized quantifier over degrees, needs to quantifier raising, leaving a degree variable behind. I assume the LF structures for (3a) and (3b), as in (5a) and (5b), respectively.

(5) a. [$_{DegP}$ -er than Op_2 Tei scored [~~d_2-many goals~~]]
1[$_{TP}$ Maki scored [$_{DP}$ d_1-many goals]]
b. [$_{DegP}$ -er than Op_2 Tei kicked [a ~~d_2-long ball~~]]
1[$_{TP}$ Maki kicked [DP a d_1-long ball]

Notice also that a covert degree movement is conducted in the *than*-clause to yield degree descriptions. Thus, the semantic composition in each sentence in (5) involves two degree operator movements: a DegP movement and a cover degree operator movement in the *than* clause. In this way, the two degree descriptions are created via degree movement.

It has been held widely that Japanese comparatives show some unique characters that would fail to be explained with the analysis based on degree movement. Roughly two types of approaches have so far been proposed in the literature, based upon whether Japanese clausal comparatives in fact involve degree movement, just like English and other languages do. To account for variation in comparatives across languages, Beck et al. (2004) propose a parameter that governs the presence / absence of degree movement, as follows:

(6) Degree Abstraction Parameter (Beck et al 2004: 325)
A language {does, does not} have binding of degree variables in the syntax.

Due to the negative setting of the parameter, Japanese does not have degree movement nor degree abstraction in the syntax. Following this parameter analysis, I assume that (superficially) clausal comparatives cannot denote degree descriptions. Rather, I will later advocate an analysis in which they are syntactically headed by invisible nominals. In fact, there are some pieces of well-known evidence in the literature to contend that degree arguments do not undergo movement in Japanese.

First, it has been pointed out since Snyder (1995) that Japanese does not allow the so-called subcomparatives of degrees, as follows.

(7) a. *Kono tana-wa doa-ga hiroi yori(mo) (motto) takai.
this shelf-Top door-Nom wide than (more) tall
b. The shelf is taller than the door is wide.

The truth conditions of this sentence require that the two maximal degrees in different dimensions be compared. Unlike the case in English, the Japanese sentence is degraded. If the *than*-clause denoted a property of degrees as a consequence of the movement of a degree argument, as the counterpart of English in (7b) does, we would expect (7a) to be equally fine, contrary to fact.

Examples of intensional verbs with comparatives, too, show that degree arguments do not undergo movement in Japanese. As pointed out by Heim (2000: 224), when a DegP gets into scope interaction with an intensional verb, the sentences gives rise to ambiguous interpretations. However, at least in Japanese, such ambiguity cannot be observed (cf. Beck et al. 2004 and Oda 2008).

(8) (Sono sitagaki-wa 10 peeji desu.)
(That draft-top 10 pages copula)
Sono ronbun-wa sore yori(mo) tyoodo 5 peeji nagaku-nakerebanaranai.
that paper-top than than exactly 5 pages long-be_requuired
'The paper is required to be exactly 5 pages longer than that.'
(OK be_required > -er, *-er > be_required)
(Beck et al. 2004: 331)

In cases such as (8) it would make two possible interpretations if the DegP can stay either below or above the necessity operator introduced by the intensional verb. However, exemplified above, we cannot obtain the reading in which the DegP moves beyond the necessity operator.

Finally, we make reference to the possibility of long-distance movement of degree arguments. Suppose in (9) and (10), respectively, that the degree arguments of the adverb *fast* and its Japanese counterpart *hayaku*, undergo movement, respectively.

(9) a. Maki ran faster than Tei did/ ran.
b. Maki-wa Tei-ga hasiru-yori hayaku hasitta.
Maki-Top Tei-Nom run-than fast ran

(10) a. Maki ran faster than Tei thinks Ishii did/ ran.
b. *Maki-ha Tei-ga Ishii-ga hasiru-to omou yori hayaku hasitta.
Maki-Top Tei-Nom Ishi-Nom run-Comp think

than fast ran

(11) Max{d: ∃e.Agent(e)=m ∧run(e)∧fast(e)(d)}>
Max{d: think(t, ∀ w' ∈ Acc_w →∃e'.Agent(w')(e')∧run(w')(e')∧fast(e')(d))}

The truth conditions of (11) for the sentences in (10) say that the maximal degree *d* such that Maki ran d-fast exceeds the maximal degree d such that Tei thinks Ishii ran d-fast. Since the verb *think* in the *than*-clause is a bridge verb, the degree operator is predicted to successfully raise to the clause-initial position. Analogously, the same syntactic derivation would be expected to take place in (10b) as well. Nevertheless, (10b) is utterly ungrammatical. The degree operator analysis would have to give a stipulation to the reason why the movement is blocked.

Given the negative setting of DAP, we do not have to rely on the explanation based upon the movement of degree arguments. The above-mentioned data are all taken to be natural consequence from the assumption that Japanese lacks degree abstraction in the syntax.

However, it is true that a large number of researchers maintain that superficially clausal complements are in reality clausal in Japanese. The point is that underlying clausal comparatives are available in Japanese. This view is taken by many researchers, including those mentioned below in (12a). On the other hand, some researchers, including those in (12b), disagree and claim that clausal comparatives do not exist in Japanese.

(12) a. Clausal Comparatives: Kikuchi (1987), Ishii (1991), Hayashishita (2007), Bhatt and Takahashi (2010), Shimoyama (2008), Inada (2012)
b. Non-Clausal Comparatives: Beck et al. (2004), Kennedy (2005), Oda (2009), Sudo (2009)

The latter view, which is also mine, assumes that superficially clausal comparison is phrasal comparison. However, this view has received various challenges ---see Shimoyama (2011) and Hayashishita (2009) for relevant facts and discussion. I cannot afford to overview each critical view due to limited space, but we will proceed with our argument along the latter view, claiming that clausal comparatives are headed by invisible degree nominals (cf. Sudo 2009).

In Japanese it is possible to construct a (superficially) clausal comparison as in (13b). The following minimal pair shows that the verbal predicates in (13) denote a relation between individuals and events. Unlike simple predicates like *takai* 'tall' in (2b), the predicate, *ketta* 'kicked' has an event argument. This kind of predicate does not suffice to but are more likely to allow clausal comparison.

(13) a. Tei-wa Maki-yori takusan booru-o ketta.
Tei-Top Maki-than many ball-Acc kicked
'Tei kicked more balls than Tei.'
b. Tei-wa Maki-ga ketta yori takusan booru-o ketta.
Tei-Top Maki-Nom kicked than many ball-Acc kicked
'Tei kicked more balls than Maki did/kicked.'

Most notably, acceptability fluctuates in accordance to the dimension for the compared degrees. More specifically, 'amount' comparatives are relatively acceptable in Japanese, in contrast to comparatives in the other dimensions (cf. Bhatt and Takahashi 2010, Beck et al. 2004, Inada 2012 and many others).[1]

(14) a. Taro-wa Hanako-ga katta-yori takusanno hon-o katta.
Taro-Top Hanako-Nom bought than many book-Acc bought
'Taro bought more books than Hanako did/bought.'
b. *Taro-wa Hanako-ga katta-yori nagai kasa-o katta.
Taro-Top Hanako-Nom bought than long umbrella-Acc bought
'Taro bought a longer umbrella than Hanako did/bought.'

Suppose that (15a) and (15b) below are the underlying LF structures for (14a) and (14b), respectively, where the degree operators undergo movement and then the object NPs are deleted. However, if this is the case, we will not be able to find any reason why the grammatical difference appears.

(15) a. Taro-wa [Op_1 Hanako-ga [~~d_1 takusanno kasa-o~~] katta] -yori takusan hon-o katta.
Taro-Top Hanako-Nom many umbrella-Acc] bought]-than many book-Acc bought
'Taro bought more books than Hanako did/

bought.'

b. *Taro-wa [Op_1 Hanako-ga [~~d_1 nagai kasa-o~~] katta] -yori nagai kasa-o katta.
Taro-Top Hanako-Nom long umbrella-Acc bought] than long umbrella-Acc bought
'Taro bought a longer umbrella than Hanako did/bought.'

According to Beck et al. the sentences in (14) have a relative clause headed by a nominal, as shown in (16). Due to the negative setting of the DAP, Japanese does not allow degree abstraction in the syntax, so the apparent clausal comparison is underlyingly a phrasal comparison headed by an invisible nominal.

(16) a. Taro-wa [$_{DP}$[$_{CP}$ Hanako-ga katta]-(no)]-yori takusanno kasa-o katta.
Taro-Top Hanako-Nom bought NO than many umbrella-Acc bought
'Taro bought more umbrellas than Hanako-did.'

b. Taro-wa [$_{DP}$[$_{CP}$ Hanako-ga katta]-?*(no)] -yori nagai kasa-o katta
Taro-Top Hanako-Nom bought NO than long umbrella-Acc bought
'Taro bought a longer umbrella than Hanako did.'

However, as pointed out by Inada (2012), this analysis fails to explain why only the amount comparatives exhibit the possible deletion of the nominal. The (in) availability of the deletion of the nominals in (16), Inada further points out, can be observed in Comparative Sub-deletion (CSD) as well, as exemplified in (17) and (18).

(17) a. Taro-wa [Hanako-ga hon-o katta] yori ookuno zassi-o katta.
Taro-Top [Hanako-Nom book-Acc bought] than many magazine-Acc bought
'(lit.)Taro bought more magazines than Hanako bought books.'

b. Taro-wa [Op_1 Hanako-ga [[d_1-hon-o] kata] yori [ookuno zassi-o] kata.

(18) *Taro-wa [Hanako-ga syoosetu-o kaita] yori omosiroi ronbun-o kaita.
Taro-Top [Hanako-Nom novel-Acc wrote] than interesting paper-Acc wrote
'(lit.)Taro wrote a more interesting paper than Hanako wrote a novel.'

Beck et al. claim that the CSD, too, has a structure where a nominal is modified by a relative clause, namely, head-internal relative clauses. However, again, it does not make sense to just claim that only the 'amount' comparative is subject to the deletion of the head nominal. [2]

3. Against Degree abstractions

Cross-linguistic variation in the expression of comparison has received much attention in recent years (Beck et al. 2004, Bhatt and Takahashi 2010, Kennedy 2005, Oda (2009) and many). Beck et al.(2004) is not the only analysis to provide a parameter for the variation. Kennedy (2005) also has attempted to address this issue in detail by presenting the following parameter:

(19) a. $[[MORE_I]] = \lambda g.\, \lambda y.\, \lambda x.g(x) > g(y)$
b. $[[MORE_D]] = \lambda g.\, \lambda d.\, \lambda x.g(x) > d$
(Kennedy 2005)

Kennedy assumes two types of comparative morphology: a morphology selecting an individual standard, as in (19a) and that selecting a degree standard, as in (19b). Japanese comparatives have the former morphology, expressing orderings between arbitrary individuals (individual comparison). In addition to this type of morpheme, English comparatives have the other type of morphology as in (19b), expressing orderings between individuals and arbitrary degrees. [3]

What is common between Kenney and Beck et al. is that they both assume that the standard of comparison in Japanese is an individual-denoting element. In Beck et al. this is considered a consequence of the negative setting of DAP. On the other hand, Kennedy attributes it to the property of the degree morphology in Japanese. Either way, we agree with their views in that Japanese does not denote degree descriptions in the standard of comparatives. However, nevertheless, we will doubt that clausal comparatives in Japanese are underlyingly an individual-denoting element. If so, it would be tough to satisfactorily explain the distinction between the 'amount' comparatives and the other comparatives, as observed in the previous

section.

Let us, here, turn to the analysis outlined by Sudo (2009), according to which the judgment patterns of (apparent) clausal comparatives in Japanese can be attributed to the availability of overt degree nominals.

⑳ a. Taro-wa [Hanako-ga katta **ryoo**] -yori takusanno kasa-o katta.
Taro-Top [Hanako-Nom bought amount] -than many umbrella-Acc bought
'Taro bought more umbrella than the amount that Hanako bought.'
b .??Taro-wa [Hanako-ga katta **nagasa**]-yori nagai kasa-o katta.
Taro-Top [Hanako-Nom bought length] -than long umbrella-Acc bought

According to Sudo, clausal comparatives in Japanese are not in fact clausal, but are structures in which the covert counterparts of degree nominals are modified by relative clauses. This analysis suffices to cover a wide range of data in Japanese comparatives. One of the convincing cases comes from simple clausal comparatives, as repeated below:

㉑ a. John is smarter than Bill is (smart).
b .?*John-wa [Bill-ga (kasikoi)]-yori kasikoi.
John-Top [Bill-Nom smart]-than smart
(Sudo 2009: 5)

As shown in (21a), English allows the embedded predicate to be optionally deleted, if it receives a contrastive stress. However, in Japanese, neither the ellipsis nor the contrastive stress of the predicate is sufficient to save (b). Along the lines with Sudo, the ungrammaticality of (21b) can be straightforwardly explained.

㉒ ?*John-wa [Bill-ga kasikoi kasikosa]-yori kasikoi.
John-Top [Bill-Nom smart smartness]-than smart
'(lit.) John is smarter that the smartness that Bill is smart.' (Sudo 2009: 5)

In the upcoming section, we will develop our argument based on the invisible nominal approach proposed by Sudo. In other words, apparent clausal comparatives in Japanese are in reality a phrase headed by an invisible degree nominal of type *d*. More specifically, we will clarify the semantic and syntactic properties of the degree nominal in detail, for which Sudo does not offer a detailed explanation.

3.1.What is the Invisible Degree Nominal?

As we have seen in the previous sections, apparent clausal comparatives are somewhat restricted in Japanese, and it turned out that their distributions are explained well with Sudo's analysis. However, it is not yet clarified in what cases positing an invisible nominal is allowed and, more fundamentally, what the invisible nominal is like. As pointed out by Sudo, simple adjectives such as *kasikoi* 'smart' and *takai* 'tall' cannot modify relative clauses. The examples in ㉓, which involve simple adjectives and their relevant degree nominals, are significantly degraded.

㉓ a. *Tei-ga sakkaa-ga tokuina {umasa/teido}
Tei-Nom soccer-Nom good {goodness/ degree}
'(lit.) the degree that Tei is good at soccor'
b. *Maki-ga (se-ga) takai takasa
Maki-Nom (height-Nom) high height
'(lit.) the height that Maki is tall'
C. *Maki-ga asi-ga hayai {hayasa/supiido}
Maki-Nom feet-Nom fast speed
'(lit.) the speed that Maki is fast'

On the other hand, the examples below in ㉔ are all fine. Most notably, they involve eventuality in their interpretations. Given a neo-Davidsonian eventuality semantics, it is assumed that the predicates in ㉔ have an event argument in addition to individual arguments. It seems feasible to say that in most of the cases in which *yori* 'than' apparently takes a clausal type, the embedded predicates have an event argument.

㉔ a. Tei-ga booru-o ketta {kyori/ supiido}
Tei-Nom ball-Acc kicked {distance/ speed}
'(lit.) the distance/speed that Tei kicked a ball'
b. Maki-ga (se-ga) nobita {takasa/ sintyo}
Maki-nom (height-Nom) grew height
'(lit.) the height that Maki grew tall'
C. Maki-ga hasitta {kyori/ supiido}
Maki-Nom ran {distance/ speed}
'(lit.) the distance/speed that Maki ran'

Following Sudo's approach, we assume the head nominal modified by a clausal description as a degree

nominal of type *d*. More specifically, we make a proposal that the degree nominal involves a measure function μ (cf. Schwarzschild 2002), which takes a relevant event *e* as its input and returns an arbitrary degree. In terms of syntax-semantic compositionality, the degree nominal combines with a TP argument of type <ev,t> to return a degree-denoting element, as defined in (25a).

(25) a. $[[\varepsilon]] = \lambda R \in D_{<ev,t>}.\mathrm{Max}\{d: \exists e.\, R(e) \wedge \mu(e) = d\}$:<<ev,t>,d>
b. $[[\mathrm{TP}]] = \lambda e.\mathrm{Agent}(t, e) \wedge \mathrm{run}(e)$: <ev,t>

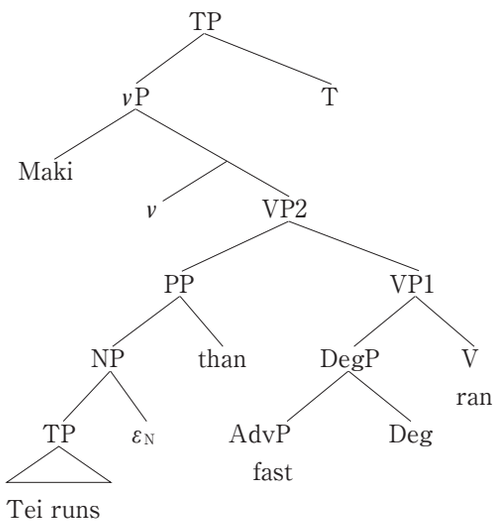
More specifically, a TP, which combines with the null element in (25a), is required to denote a property of events. However, once T(ense) applies to a VP, binding the event variable (cf. Higginbotham (1981), the TP denotes a type of proposition. The proposition is not an appropriate argument for the invisible function, so we need to assume a conversion of the TP into a predicate of type <ev, t>, as in (25b). Again, we assume the application of λ-abstraction over an event variable, yielding a property of events. This is along the line of the spirit of Partee (1987), according to which type-shifting operations are freely available in natural language, when necessary. Following Takeda (2000), I also assume that Japanese allows fairly free application of λ-abstraction in the semantic component irrespective of the presence of relative pronouns. Given this, the null degree function takes the event predicate as its argument and yields a degree nominal.

With the discussion so far, let us consider the following examples:

(26) a. Maki-wa Tei-ga hasiru-yori takusan hasitta.
Maki-Top Tei-Nom ran-than many ran
'Maki ran more than Tei did.'
b. Maki-wa Tei-ga hasiru-yori hayaku hasitta.
Maki-Top Tei-Nom run-than fast ran
'Maki ran faster than Tei did/ran.'
c. Maki-wa Tei-ga hasiru-yori nagaku hasitta.
Maki-Top Tei-Nom run-than long ran
'Maki ran longer than Tei did.'
d. Maki-wa Tei-ga hasiru-yori tookuni hasitta.
Maki-Top Tei-Nom run-than far ran
Maki ran farther than Tei did.

We assume, with Schwarchild (2002) and Nakanishi (2004, 2007), that what kind of measure function is available is determined by context. (26a) involves μ:cardinality of events, (26b) μ:speed, (26c) μ:time, and (26d) μ:distance. Take (26b) as an instance and see how syntax-semantic compositionality proceeds. (27) and (28) below spells out the brief structure and compositional semantics of (26b), respectively.[4, 5]

(27)



(28) a. $[[\mathrm{V}]] = \lambda e.{}^*\mathrm{run}(e)$
b. $[[\mathrm{AdvP}]] = \lambda e.\ \mathrm{fast}(e) = d$
c. $[[\mathrm{Deg}]] = \lambda g \in D_{<<ev,t>} \lambda d'.\lambda e.\mathrm{Max}\{d: g(e) = d\} > d'$
d. $[[\mathrm{DegP}]] = \lambda d'.\lambda e.\ \mathrm{Max}\{d: \mathrm{fast}(e) = d\} > d'$
e. $[[\mathrm{VP1}]]\ \lambda d'.\lambda e.{}^*\mathrm{run}(e) \wedge \mathrm{Max}\{d: \mathrm{fast}(e) = d\} > d'$
f. $[[\mathrm{PP}]] = \mathrm{Max}\{d: \exists e'.\ \mu(e') = d \wedge \mathrm{Agent}(e') = t \wedge {}^*\mathrm{run}(e')\}$
g. $[[\mathrm{VP2}]] = \lambda e.\ {}^*\mathrm{run}(e) \wedge \mathrm{Max}\{d: \mathrm{fast}(e) = d\} > \mathrm{Max}\{d: \exists e'.\ \mu(e') = d \wedge \mathrm{Agent}(e') = t \wedge {}^*\mathrm{run}(e')\}$
h. $[[v\mathrm{P}]] = \lambda e.\mathrm{Agent}(e) = m \wedge {}^*\mathrm{run}(e) \wedge \mathrm{Max}\{d: \mathrm{fast}(e) = d\} > \mathrm{Max}\{d: \exists e'.\ \mu(e') = d \wedge \mathrm{Agent}(e') = t \wedge {}^*\mathrm{run}(e')\}$
i. $[[\mathrm{TP}]] = \exists e.\ \mathrm{Agent}(e) = m \wedge {}^*\mathrm{run}(e) \wedge \mathrm{Max}\{d: \mathrm{fast}(e) = d\} > \mathrm{Max}\{d: \exists e'.\ \mu(e') = d \wedge \mathrm{Agent}(e') = t \wedge {}^*\mathrm{run}(e')\}$

I assume that adverbs are measure functions to map events to degrees on a relevant dimension, as in (28b). Following Kennedy (2005), I also assume that Japanese comparatives are explicit: thus they are compositionally made. More specifically, the (covert) comparative morpheme makes a comparative form that expresses orderings between individuals and degrees. As shown in (28f), the PP denotes a degree

as a consequence of the null degree nominal applying to an event predicate. Further, it saturates the degree argument in the denotation of VP1, which then projects up to VP2. The agent subject in the matrix is introduced via the voice morphology, *v* (Chomsky 1995), as in (28h), and finally, the truth conditions obtain when Tense functions as an operator over event variables, as in (28i).

Note incidentally that the measure function μ, as it is, works nicely by applying to events directly and thus, it yields the cardinality of events in (26a) and fastness of events in (26b), respectively. However, when it comes to μ:distance in (26c) or μ: time in (26d), it does not make sense to apply it to events directly, because an event itself does not have a length nor temporal span, but its path and run time do. To be more specific, consider the following example:

(29) Tei ran for one hour.

As Krifka (1989) points out, the measure phrase *for one hour* does not measure events directly but the run time of the events. Thus, in order to resolve such a dilemma, Krifka proposes to introduce a homomorphism *h*, which is a mapping function from events to entities in another domain. Given this function, the measure phrase in (29) ends up measuring events indirectly. In (29), *h* is defined with $h(e_1 \cup_E e_2) = h(e_1) \cup_T h(e_2)$, where $\cup_E$ and $\cup_T$ are sum operators for events and times, respectively. Put differently, a homomorphism is a structure-preserving function that maintains some relation among entities from one domain to the other. What is important here is that the measure function μ must apply to temporal spans mapped from events in a monotonic fashion, as discussed in details in Nakanishi (2007). In other words, the structure of a set of events, that is, a lattice consisting of e_1, e_2, e_3, $e_1 \cup_E e_2$, $e_1 \cup_E e_3$, $e_2 \cup_E e_3$, $e_1 \cup_E e_2 \cup_E e_3$, must be preserved to the other domain mapped from events: t_1, t_2, t_3, $t_1 \cup_T t_2$, $t_1 \cup_T t_3$, $t_2 \cup_T t_3$, $t_1 \cup_T t_2 \cup_T t_3$.

Thus, we assume that in (26c) and (26d), the measure function does not directly apply to events, but does indirectly via a homomorphism, as defined in (30), and that the truth conditions for (26d) is (31):

(30) a. $\mu_{time}(h(e)=d$
b. $\mu_{distance}(h(e))=d$

(31) $\exists e.\ Agent(e)=m \wedge {}^*run(e) \wedge Max\{d: far(h(e))=d\} > Max\{d:\exists e'.\ \mu_{distance}(h(e'))=d \wedge Agent(e')=t \wedge {}^*run(e')\}$

With the discussion so far in mind, let us finally consider where the different judgment patterns above in (14) stem from. As claimed in Sudo (2009), in examples such as (14), repeated in (32), their acceptability is determined on whether the (overt) degree nominals are available. The degradation of (32b) can be attributed to the fact that the degree nominal *nagasa* 'length' cannot be posited, as exemplified above in (20b).

(32) a. Taro-wa Hanako-ga katta-yori takusanno hon-o katta.
Taro-Top Hanako-Nom buy bought many book-Acc bought
'Taro bought more books than Hanako did/bought.'
b. *Taro-wa Hanako-ga katta yori nagai kasa-o katta.
Taro-Top Hanako-Nom bought than long umbrella-Acc bought
'Taro bought a longer umbrella than Hanako did/bought.'

Obviously, this fact is taken as evidence to indicate that superficially clausal comparatives in Japanese are in fact phrasal comparatives headed by invisible degree nominals. However, there still remains an unresolved issue in this approach. Why are cases such as (32b) not allowed to take degree nominals in the complement of *yori* 'than'?.

Our analysis based on the assumption that an event argument is an input for the measure function will feasibly account for the judgment pattern in (32). As we mentioned just above, a homomorphism is a function that preserves some structural relation among entities form one domain to the other. In (32a) a homomorphism applies to map a set of events to a set of individuals, namely, a set of umbrellas; the measure function μ applies to individuals in the range of *h*. Notably, the requirement of the measure function is met: the individuals mapped from events via *h* preserve the structural relation, forming a lattice consisting of x, y, z, x∪y, x∪z, y∪z, x∪y∪z. Thus, the measure function can apply to the domain of the mapped individuals in a monotonic fashion. The (34a) below is a denotation of the *yori*-phrase, yielding the

maximal degree (cardinality) of the umbrellas Taro bought.

On the other hand, (34b) cannot be defined. Even if a homomorphism maps events to individuals, the measure function μ:length fails to apply. As Krifka (1989) defines, for all events, the amount of the event e measured by μ' in E is equal to the amount of h(e) measured by μ in the other domain, as illustrated in (33).

(33) $\forall e[\mu'(e) = \mu h(e)]$ (Krifka 1989: 97)

(34) a. $\text{Max}\{d: \exists e.\, \mu_{\text{Cardinality}}(h(e)) = d \wedge \text{Agent}(e) = h \wedge *\text{buy}(e)\}$

b. $\text{Max}\{d: \exists e.\, \mu_{\text{length}}(h(e)) = d \wedge \text{Agent}(e) = h \wedge *\text{buy}(e)\}$ (undefined)

In (34a) the amount of events measured by the measure function is equal to the amount of h(e) measured in the other domain. For instance, the sum of two events amounts to the sum of the individuals in the corresponding events. The measure function μ':cardinality in the event domain is satisfied because it is well defined by μ and h. On the other hand, in (34b) the measure function cannot apply. The amount of events measured by the measure function μ' is not equal to the total length of the individuals measured by μ. What is needed as the standard value of the *yori*-phrase is the length of the umbrella, not the total length of the umbrellas Taro bought. Thus, the invisible nominal cannot duly output a value as the standard of comparison, which causes the sentence to be significantly degraded.

4.Concluding Remarks

We would like to close this paper by adding several pieces of empirical data for our argument. First, recall that only sentences with eventuality allow apparent clausal comparatives. This can be explained by our assumption that degree nominals involve a measure function whose input is an event argument.

Next, the examples below must be mysterious for the approach based on the movement of degree arguments in the syntax.

(35) a. *Maki-wa Isii-ga takai to Tei-ga omou-yori (se-ga) takai.
Mak-Top Isii-Nom tall Comp Tai-Nom think than (height-Nom) tall
'Maki is taller that Tei think that Isii is tall.

b. *Maki-wa Isii-ga hasiru to Tei-ga omou-yori hayaku hasitta.
Maki-Top Isii-Nom run Comp Tei-Nom think than fast ran
'Maki ran faster than Tei thinks that Ishi did.'

Since there is no island to block the degree argument, we would expect it to successfully raise to the initial position of the embedded clause. However, contrary to the expectation, the Japanese examples, unlike the English counterparts, are degraded. Further, this empirical fact is not only problematic for the movement approach, but raise a question to Sudo (2009). In cases such as (35) above, where a comparative clause is embedded in a bridge verb like 'think', positing an overt degree nominal will save the sentence, as shown below:

(36) a. Maki-wa Tei-ga Isii-ga hasiru to omou *(kyori) yori tookuni hasitta.
Maki-Top Tei-Nom Isii-Nom run comp think (distance) than far ran
'(lit.) Maki run farther than the distance that Tei thinks that Isii runs.'

b. Maki-wa Tei-ga Isii-ga nageru to omou *(supiido) yori hayaku nageta.
Mak-Top Tei-Nom Isii-Nom throw Comp think (speed) than fast threw
'(lit.) Maki threw fast than the speed that Tei thinks that Isii throws.'

Along the lines of the argument by Sudo, (36a) and (36b) both should be fine even without the visible degree nominals. According to Sudo, the judgment patters observed in superficially clausal comparatives are determined by the availability of the degree nominlas. The examples in (36) allow the corresponding degree nominals, but they do not have the invisible counterparts. This apparently tricky issue can be straightforwardly accounted for in our approach. The predicate to modify the invisible nominal *omou* 'think' is an intentional verb of type <<s,t>,<s,<e,t>>. We assumed above in (25) that the invisible degree nominal only combines with a one-place predicate of type <ev,t>. However, *omou* is a predicate to take a proposition, a world and an individual to return the truth conditions, as in (37).

(37) [[*omou* (think)]] = λP∈$D_{<s,t>}$ λw∈Ds. λx∈De. think(x ∀w' ∈Acc(w) → P(w'))

Thus, the sentences with intentional verbs cannot modify the invisible nominal we defined above. This stems from the presupposition of the nominal.

Finally, note also that Chinese, which is assumed by Oda (2008) to lack degree movement due to its negative setting of DAP, behaves similarly with Japanese. Gradable adjectives in *than*-clause are necessarily deleted, as in (38) and are not allowed to be embedded in the complements of verbs like 'think', as in (39).

(38) a. Maki is taller than Tei is (tall).
b. *Maki bi Tei-san gao hai gao.
Maki than Tei tall even tall

(39) a. Maki ran faster than Tei thinks Isii did.
b. *Maki pao de bi Mary renwei Isii pao de hai kuai.
Maki run DE than Tei think Isii run DE even fast

Most notably, the 'amount' clausal comparatives are more commonly acceptable in Chinese as well:

(40) Taro mai le bi Hanako mai de geng duo de san.
Taro buy LE than Hanako buy DE more many DE umbrella
'Taro bought more umbrellas than Nakako did.'

(41) ?Taro mai le bi Hanako mai de geng chang de san.
Taro buy LE than Hanako buy DE more long DE umbrella
'Taro bought a longer umbrella than Hanako did.'
athan re

These empirical data are taken to be supporting evidence for our analysis. Of course there are some variations between the two languages, but it would take more space to make a full analysis of the variations than we can devote here. We will leave it for the next research. [6]

The analysis explored here, I suppose, is compatible with Nakanishi's (2004, 2007) mechanism of measurement, according to which measurement is conducted with the help of a homomorphism from events to another domain. Nakanishi (2007) suggests that her mechanism is not just needed for the particular constructions she handled, namely, the floating quantifier construction in Japanese and Split NP Topicalization in German, but it applies to a range of empirical date. I presume that what has been presented here is not a mechanism particular to comparatives in Japanese, but rather an extension out of the measurement mechanism proposed by Nakanishi.

References

Bhatt, Rajesh and Takahashi Shoichi (2011) Reduced and Inreduced Phrasal Comparatives. *Natural Language and Linguistic Theory* 29: 581-620.

Beck, Sigrid, Toshiko Oda, and Koji Sugisaki. (2004) Parametric Variation in the Semantics of Comparison: Japanese vs. English. *Journal of East Asian Linguistics*, 13: 289-344.

Chomsky Noam. (1995) *The Minimalist Program*. MIT Press, Cambridge, MA.

Hackle, Martin. (2000) *Comparative Quantifiers*. Ph.D. dissertation, MIT.

Hayashishita, J.-R. (2009) Yori-comparative: A reply to Beck et al. (2004). *Journal of East Asian Linguistics* 18: 65-100.

Heim, Irene. (2000) Degree Operators and Scope. *The Proceedings of Semantics and Linguistic Theory X,* 40-64.

Heim, Irene and Angelika Kratzer. (1998) *Semantics in Generative Grammar*. Blackwell, Massachusetts and Oxford.

Higginbotham, James. (1985) On Semantics. *Linguistic Inquiry* 16, 547-593.

Hiraiwa, Ken. (2002) Nominative-Genitive Conversion Revisited. *Japanese/Korean Linguistics* 10: 546-559.

Inada, Shun'ichiro (2012) Hikakukoobun-niokeru d-henkoosokubaku-to sima-no seiyaku "Degree Variable Binding and Island Constraint" In H. Ohashi et. al. eds., *Kotoba-to Kokoro-no Tankyu,* 148-162. Kaitakusha, Tokyo.

Ishii, Yasuo. (1991) *Operators and Empty Categories in Japanese*. Ph.D. dissertation, University of Conneticut, Storrs.

Kennedy, Christopher. (2005) Parameters of Comparison. Ms. University of Chicago.

Kikuchi, Akira. (1987) Comparative Deletion in Japanese. Ms., Yamagata University.

Krifka, Manfred. (1989) Nominal Reference, Temporal

Constitution and Quantification in Event Semantics. In R. Bartsch, J. van Benthem and P. van Emde Boas eds., *Semantics and Contextual Expression,* 75-115. Foris, Dordrecht.

Nakanishi, Kimiko. (2004) *Domains of Measurement: Formal Properties of Non-Split/ Split Quantifier Constructions*. Ph.D. dissertation, University of Pennsylvania.

Nakanishi, Kimiko. (2007) Measurement in the Nominal and Verbal Domains. *Linguistic Philosophy* 30: 235-276.

Oda, Toshiko. (2008) *Degree Constructions in Japanese*. Ph.D. dissertation, University of Conneticut, Storrs.

Partee, Barbara. H. (1987) Noun Phrase Interpretation and Type-Shifting Principles. In J. Groenendijk et al. eds., *Studies in Discourse Representation Theory and the Theory of Generalized Quantifiers,* Foris, Dordrecht.

Schwarchild, R. (2002) The Grammar of Measurement. *The Proceedings of Semantics and Linguistics Theory XII,* 225-245.

Shimoyama, Junko. (2008) Clausal Comparatives and Closs-linguistic Variation. The Proceedings of the 39th Annual Meeting of the North East Linguistic Society.

Snyder, William. (1995) Language Acquisition and Language Variation: The Role of Morpholog. Ph.D. dissertation. MIT.

Sudo, Yasutada. (2009) Invisible Degree Nominals in Japanese Clausal Comparatives. In R. Vermeulen and R. shibagaki eds., *Proceedings of the 5th Workshop on Atlantic Formal Linguistics,* MITWPL, Cambridge, Mass.

Takeda, Kazue. (1999) Multiple Headed Relatives, Clefts with Multiple Foci, and Multiple 'Sluicing'. In D. Francesca and H. Hoshi eds., *UCI Working Papers in Linguistics* 5, 103-134.

Notes

[1] The judgments of this pair vary among linguists. Ishii (1991) judges (14a) to be completely grammatical and (14b) to be ??. Oda (2008) observes that even non-amount readings like (14b) can be grammatical when appropriate contexts are set up. Even my informants showed varying judgments for (14b) raging from ? to *. What mattes here is that (14a) is definitely more acceptable than (14b), though I cannot pursue for the account for the inter-speaker variation.

[2] Inada tackles this issue along the lines in favor of degree abstraction in the syntax. In his approach, the 'amount' degree argument is not so deeply embedded in the DP, hence it is relatively easy to take out. The difference between (14a) and (14b) in acceptability has to do with island phenomenon in principle. Unfortunately, we cannot afford to get into his discussion due to limited space.

[3] According to Beck et al.(2004), Japanese cannot count on the movement of degree arguments to yield a stand of comparison due to the negative setting of the parameter, but rather the standard is introduced via pragmatic process.

[4] I denote *e* as a type of individual, *ev* as a type of event, *d* as a type of degree, and s as a type of world, respectively.

[5] Following the standard notation, I will use * to refer to verbal pluralization in natural language.

[6] Apparently the following examples run counter to the argument here (cf. Shimoyama 2008).

(i) a. Maki-wa Tei-ga omotteiru-yori kakkoii.
Maki-Top Tei-Nom think than handsome.
'Maki is more handsome than Tei thinks.'

b. Maki-wa Tei-ga soozoosuru-yori kakkoii.
Maki-Top Tei-Nom imagine than handsome.
'Maki is more handsome than Tei imagines.'

c. *Maki-wa Tei-ga (jissai) mita-yori kakkoii.
Maki-Top Tei-Nom(actually)saw than handsome
'(lit)Maki is more handsome than Tei actually saw.'

When intensional contexts are set up in the *than*-clause, as in (ia-b), the sentences are completely fine. Tentatively I assume that these are the cases in which degree nominal are modified by relative clauses of type <e,t> and are subject to deletion, as claimed by Sudo (2009). As far as intensional verbs are concerned, they allow their subjects to receive the *ga/no* conversion, as shown in the contrast between (iia) and (iib).

(ii) a. Maki-wa Tei-{ga/no} omotteiru-yori kakkoii.
Maki-Top Tei-Nom think than handsome.
'Maki is more handsome than Tei thinks.'

b. *Maki-wa Tei-ga (jissai) mita-yori kakkoii.
Maki-Top Tei-Nom(actually)saw than handsome
'(lit)Maki is more handsome than Tei actually saw.'

Needless to say, in (iib) the conversion to the genitive does not save the sentence. As claimed by Hiraiwa (2002), the *ga/no* conversion is licensed by V-*v*-T-C movement. It seems feasible to say that (iia) has a relative structure headed by an invisible antecedent nominal via Predicate Modification (Heim and Kratzer 1998). This case is not exactly those we were facing in the main text, where the degree nominal applies to an event predicate via Functional Application. Thus, I need to assume that the invisible nominals in (ii) are individual-denoting DPs, which are arguments of the intensional verbs.