On Comparative Quantification in the Verbal Domain*

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1. Introduction

The central goal of this paper is to provide a mechanism of comparative quantification in the verbal domain, where the degree of comparison is associated with an event argument. The empirical data comes from the comparative construction in Japanese with *sugiru*, which is an intransitive verb meaning 'to pass, to exceed', as in (1)a. *Sugiru* can attach to an adjective or a verb and express excessiveness just like *too* in English, as in (1)b-c.

(1) a. Simekiri-ga sugi-ta.
deadline-NOM exceed-PAST 'The deadline has passed.'
b. Kono sukaato-ga naga-sugi-ru.
this skirt-NOM long-exceed-PRES 'This skirt is too long.'
c. John-ga ne-sugi-ta.
John-NOM sleep-too much-PAST 'John slept too much.'

When *-sugiru* occurs with a measure phrase (MP), we observe strikingly different semantic interpretations depending where the MP appears. For instance, (2)a with the MP adjacent to the measured noun means that John overdid the reading of three particular books (read them too many times or for too long). In contrast, (2)b with the 'split' MP means that John read three more books than he was supposed to (e.g. he was supposed to read five, but ended up reading eight). One of the central questions addressed in this paper is how to obtain these two readings. I show that *-sugiru* in these examples involves comparative quantification in the verbal domain, which calls for a homomorphism (or a structure-preserving mapping) from events to anther domain. The difference comes from the fact that, in (2)b, the MP specifies that a homomorphism is from events to individuals (i.e. from reading events to books), while the MP in (2)a does not.

(2) a. John-ga [*hon* **san-satu**]-o kinoo yomi-sugi-ta.
John-NOM [book three-CL(ASSIFIER)]-ACC yesterday read-exceed-PAST
'John read (the) three books too much yesterday.'
b. John-ga *hon*-o kinoo **san-satu** yomi-sugi-ta.
John-NOM book-ACC yesterday three-CL read-exceed-PAST
'John read three books too many yesterday.'

R. Young (ed), *SALT XIV* 179-196, Ithaca, NY: Cornell University.

Section 2 presents a brief summary of the previous studies on comparative constructions. In section 3, I show that *-sugiru* is a comparative quantifier which is analogous to *too* in English. I argue that *-sugiru* in the V-*sugiru* construction expresses excessiveness of 'events'. In section 4, I extend the proposed analysis to *too many* / *too much* in English. Section 5 is a conclusion of this paper.

2. Assumptions on Comparative Constructions

2.1. Adjectival Comparatives

This section briefly summarizes the existing analyses of adjectival comparatives (see also Kennedy 1999). Gradable adjectives such as *tall* and *dense* denote relations between individuals and degrees, as in (3). They are monotone, satisfying the definition in (4). The LF and the compositional semantics of *John is six feet tall* are given in (5). The denotation of the MP *six feet*, which is a degree phrase (DegP), is a degree argument of type d, and it directly combines with the adjective.

(3) $[\![\textit{tall}]\!] = \lambda d_d.\lambda x_e.\ \text{tall}(x,d)$ i.e. x is tall to degree d

(4) A function f of type <d,et> is monotone iff
$\forall x \forall d \forall d' [\ f(d)(x) = 1 \wedge d' < d \rightarrow f(d')(x) = 1\ ]$ (Heim 2000:41)

(5) LF: John is $[_{AP}\ [_{DegP}$ six feet] tall]
a. $[\![\textit{six feet}]\!] = 6'$
b. $[\![\textit{John is six feet tall}]\!] = \text{tall}(j,6')$

A DegP can be a complex predicate headed by *-er*, as in *-er than six feet*. The comparative morpheme *-er* 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 (6). 'max' is a function from a set D of degrees to the degree d in D such that, for all other degrees d' in D, d is greater or equal to d', as defined in (7) (cf. Rullmann 1995:54).

(6) $[\![\textit{-er}]\!] = \lambda D_{<d,t>}.\lambda D'_{<d,t>}.\ \max(D') > \max(D)$ (Hackl 2000:50)

(7) $\max(D) := \iota d.\ D(d) = 1 \wedge \forall d'[D(d') = 1 \rightarrow d' \leq d]$ (Heim 2000:42)

The DegP *-er than six feet* is a generalized quantifier over degrees. In *John is taller than six feet*, the DegP undergoes quantifier raising, leaving a trace of type d:[1]

(8) LF: $[_{DegP}$ -er than 6 feet$]_1$ $[_{IP}$ John is $[_{AP}\ t_1$ tall]]
a. $[\![\textit{John is}\ t_1\ \textit{tall}]\!]^g = \text{tall}(j,g(1))$
b. $[\![1\ \text{IP}]\!]^g = \lambda d_d.\ [\![\text{IP}]\!]^{g\,d/1} = \lambda d_d.\ \text{tall}(j,g^{d/1}(1)) = \lambda d_d.\ \text{tall}(j,d)$[2]

c. $[\![\textit{-er than six feet}]\!]^g = \lambda D'_{<d,t>}.\ \max(D') > 6'$
d. $[\![\textit{John is taller than six feet}]\!]^g = \max\{d: \text{tall}(j,d)\} > 6'$

The *-er* comparative construction can have a differential MP (von Stechow 1984), such as *one inch* in *John is one inch taller than Mary*. The denotation of *-er* that takes a differential MP is given in (9).[3] The mathematical operations of subtraction (−) and equalization (=) require the three relevant degrees − that is, max(D'), max(D), and d − to be of the same sort, which excludes deviant examples like **John is two pounds taller than Mary*, where degrees are not of the same sort.

(9) $[\![\textit{-er}]\!] = \lambda D_{<d,t>}.\lambda d_d.\lambda D'_{<d,t>}.\ \max(D') - \max(D) = d$

(10) LF: $[_{DegP}$ one inch -er than Mary$]_1$ $[_{IP}$ John is $[_{AP}\ t_1$ tall$]]$
a. $[\![1\ IP]\!]^g = \lambda d_d.\ [\![IP]\!]^{g\,d/1} = \lambda d_d.\ \text{tall}(j,g^{d/1}(1)) = \lambda d_d.\ \text{tall}(j,d)$
b. $[\![\textit{one inch -er than Mary}]\!]^g = \lambda D'_{<d,t>}.\ \max(D') - \max\{d: \text{tall}(m,d)\} = 1"$
c. $[\![\textit{John is 1" taller than Mary}]\!]^g = \max\{d:\text{tall}(j,d)\} - \max\{d:\text{tall}(m,d)\} = 1"$

2.2. Comparative Quantification in the Nominal Domain

It has been argued that a complex determiner such as *more than six* is decomposed into MANY followed by the DegP *-er than six*. Hackl (2000) proposes the denotation of MANY in (11), where MANY takes a degree argument and yields the characteristic function of a set of individuals that are numerous to degree d.[4] In this analysis, what MANY does is to associate a degree argument with the cardinality of a (pluralized) individual x. (12) spells out the LF and the compositional semantics of *more than six boys danced*. The *-operator is an operator for semantic pluralization that applies to a one-place predicate *P* and generates all the individual sums of members of the extensions of *P*, as exemplified in (13) (Link 1983).[5]

(11) $[\![\text{MANY}]\!] = \lambda d_d.\lambda x_e.\ |x|=d$ (Hackl 2000:53)

(12) LF: $[_{DegP}$ -er than 6$]_1$ $[_{IP}$ $[_{DP}\ t_1$ MANY boys$]$ danced$]$
a. $[\![t_1\ \text{MANY}]\!]^g = \lambda x_e.\ |x|=g(1)$
b. $[\![DP]\!]^g = \lambda x_e.\ *\text{boy}(x) \wedge |x|=g(1)$
$\exists$: <e,t> → <et,t> $\exists X = \lambda P_{<e,t>}.\ \exists y\ [X(y) \wedge P(y)]$ (Partee 1987)
c. $\exists + [\![DP]\!]^g = \lambda P.\ \exists y\ [*\text{boy}(y) \wedge |y|=g(1) \wedge P(y)]$
d. $[\![1\ IP]\!]^g = \lambda d_d.\ [\![IP]\!]^{g\,d/1} = \lambda d_d.\ \exists y\ [*\text{boy}(y) \wedge |y|=d \wedge *\text{dance}(y)]$
e. $[\![\textit{-er than six}]\!]^g = \lambda D'_{<d,t>}.\ \max(D') > 6$
f. $\max\{d: \exists y\ [*\text{boy}(y) \wedge |y|=d \wedge *\text{dance}(y)]\} > 6$
'The maximal degree d such that d-many boys danced exceeds six.'

(13) a. $[\![\textit{boy}]\!] = \{ x, y, z \}$
$[\![*\textit{boy}]\!] = \{ x, y, z, x\cup_I y, x\cup_I z, y\cup_I z, x\cup_I y\cup_I z \}$

b. $[\![\textit{dance}]\!] = \{ e_1, e_2, e_3 \}$
$[\![*\textit{dance}]\!] = \{ e_1, e_2, e_3, e_1 \cup_E e_2, e_1 \cup_E e_3, e_2 \cup_E e_3, e_1 \cup_E e_2 \cup_E e_3 \}$

2.3. The Semantics of Too

In this section, I propose a (simplified) semantics of *too*, which later provides an adequate tool to express the parallelism between comparative quantifications in the nominal and verbal domains.[6] Most notably, Heim (2000) and Meier (2003) consider the *too* construction as a comparison between two values, where the standard of comparison is modalized. In this paper, I pursue Heim's and Meier's idea that *too* is a comparison between two sets of degrees, but I will simplify their analysis by not modalizing the standard of comparison. Recall that *-er* expresses a comparison between two maximal values, one associated with a main clause and the other with a *than*-clause (see (6)). Like *-er*, *too* is a comparison between two maximal values. However, instead of the maximal value associated with a *than*-clause, *too* takes a context-sensitive value C provided by context, as in (14). For example, as in (15), the LF of *John is too tall* is analogous to the LF of *-er* comparatives (see (8), for instance). The sentence is true if the maximal degree d such that John is d-tall is greater than C (e.g. a standard degree of tallness).

(14) a. $[\![\textit{too}]\!] = \lambda D_{<d,t>}.\ \max(D) > C$
b. $[\![\textit{too}]\!] = \lambda d_d.\lambda D_{<d,t>}.\ \max(D) - C = d$ (with a differential MP)

(15) LF: $[_{DegP}$ too$]_1$ $[_{IP}$ John is $[_{AP}$ t_1 tall$]]$
a. $[\![1\ IP]\!]^g = \lambda d_d.\ [\![IP]\!]^{g\,d/1} = \lambda d_d.\ \text{tall}(j, g^{d/1}(1)) = \lambda d_d.\ \text{tall}(j,d)$
b. $[\![\textit{John is too tall}]\!]^g = \max\{d: \text{tall}(j,d)\} > C$

Just like *-er*, *too* can occur in the nominal domain, as in *too many boys danced* in (16) (see section 4 for more examples). We saw in section 2.2 that *more than six* is decomposed to MANY and the DegP *-er than six*. The decomposition of *too many* is obvious from the surface syntax: *many* and the DegP *too*.

(16) LF: $[_{DegP}$ too$]_1$ $[_{IP}$ $[_{DP}$ t_1 many boys$]$ danced$]$
a. $[\![1\ IP]\!]^g = \lambda d_d.\ \exists y\ [*\text{boy}(y) \wedge |y| = d \wedge *\text{dance}(y)]$ (see (12))
b. $\max\{d: \exists y\ [*\text{boy}(y) \wedge |y| = d \wedge *\text{dance}(y)]\} > C$

3. The Semantics of *-Sugiru* 'to exceed' as a Comparative Quantifier

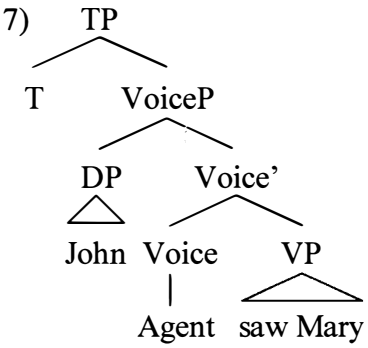
We are now ready to examine the data with *-sugiru* in Japanese. In section 3.2, I propose an analysis for *-sugiru* when it attaches to an adjective. By assuming that the denotation of *-sugiru* in this sequence is analogous to that of *too* in English, we obtain correct interpretations of the sentences. In section 3.3, I discuss examples

where *-sugiru* attaches to a verb. I claim that *-sugiru* is decomposed into two parts: a part which expresses excessiveness as DegP *too* and a part which relates degrees with events (cf. MANY in (11)). I further argue that there is a homomorphism from events to other domains such as times, paths, individuals, etc.

3.1. Syntactic Assumptions

Before examining the semantics of *-sugiru*, some syntactic assumptions need to be stated. I assume that verbs have an extra slot for the event argument (Davidson 1967). Moreover, I adopt Kratzer's (1996, to appear) syntactic structure and semantic computation given in (17). I use type v for events.

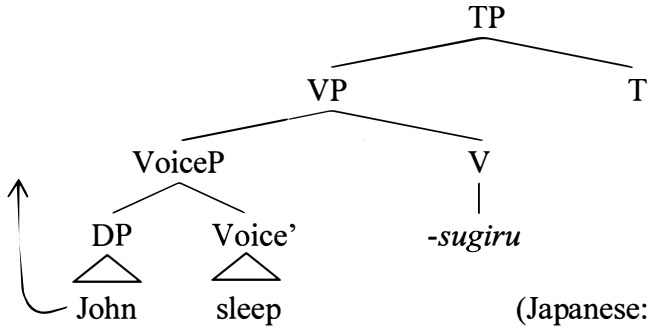
(17)



$[\![see]\!] = \lambda x_e.\lambda e_v.$ *see(x,e)
$[\![see\ Mary]\!] = \lambda e_v.$ *see(m,e)
$[\![\text{Agent}]\!] = \lambda x_e.\lambda e_v.$ Agent(e)=x
$[\![\text{Voice'}]\!] = \lambda x_e.\lambda e_v.$ Agent(e)=x $\wedge$ *see(m,e)[7]
$[\![\text{VoiceP}]\!] = \lambda e_v.$ Agent(e)=j $\wedge$ *see(m,e)
$[\![\text{TP}]\!] = \exists e$ [Agent(e)=j $\wedge$ *see(m,e)]

-Sugiru in V-*sugiru* is considered to be a raising verb that takes a sentential complement, as in (18) (Sugioka 1985, Kageyama and Yumoto 1997, Koizumi 1998). In contrast, *-sugiru* with an adjective first combines with the adjective, and the complex predicate adjective+*-sugiru* combines with the subject. This is analogous to *too* in English whose structure is given in (19)a. Indeed, in section 3.2, I claim that *-sugiru* with adjectives is semantically the same as *too* in English. Thus, I assume the structure in (19)b, abstracting away from the existence of VoiceP.

(18)



(Japanese: head-final language)

(19) a. English *too* comparative: [$_{IP}$ John [$_{VP}$ is [$_{AP}$ too tall]]]
b. Japanese *-sugiru* comparative: [$_{IP}$ John [$_{VP}$ tall *-sugiru*]]

3.2. Adjectival Comparatives

Let us first examine the semantics of *-sugiru* with adjectives. (20) shows that, like *too* in English, *-sugiru* is compatible with open scale adjectives (e.g. *long*, *deep*, *expensive*), but not with closed scale adjectives (e.g. *empty*, *open*, *visible*).

(20) a. Kono sukaato-ga naga-sugi-ru.
this skirt-NOM long-exceed-PRES 'This skirt is too long.'
b. *Kono hako-ga kara-sugi-ru.
this box-NOM empty-exceed-PRES *'This box is too empty.'

Thus, I assume that [[*-sugiru*]] is the same as [[*too*]], as in (21). Although *-sugiru* and *too* are syntactically different in that *-sugiru* is a verb and *too* is an adverbial element, this difference does not cause any problems for compositionally deriving the interpretation of adjective+*-sugiru*, as in (22), which correlates with (20)a.

(21) $[\![\textit{-sugiru}]\!] = \lambda D_{<d,t>}.\ \max(D) > C$ (=(14)a)

(22) LF: [*-sugiru*]$_1$ [$_{IP}$ this skirt [$_{VP}$ long t_1]]
a. $[\![1\ IP]\!]^g = \lambda d_d.\ [\![IP]\!]^{g\ d/1} = \lambda d_d.$ long(this skirt,d)
b. [[*this skirt long*-sugiru]]^g = max{d: long(this skirt,d)} > C

3.3. Comparative Quantification in the Verbal Domain

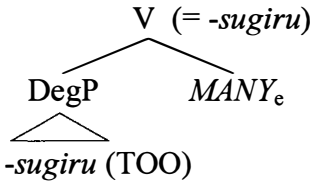
Turning now to the semantics of *-sugiru* with verbs, I first consider (23), which has the reading that what is excessive is how many times John went shopping.

(23) John-ga kaimono-ni iki-sugi-ta.
John-NOM shopping-to go-exceed-PAST
'John went shopping too many times.'

Based on the structure in (18), *-sugiru* in (23) combines with the sentential complement *John-ga kaimono-ni iki-* '(lit.) John go shopping' in the syntax. Assuming that *-sugiru* is a comparative quantifier over degrees of type <dt,t>, as in (21) above, *-sugiru* takes a set of degrees as an argument.[8] However, the sentential complement lacks a degree argument; it simply denotes a set of John's-going-shopping events of type <v,t>. To obtain the relevant interpretation, we need to somehow express '(lit.) John go shopping d-many times'. I argue that this is possible by introducing a component which associates a degree with an event introduced by a sentential complement. This component is analogous to MANY in (11): a complex determiner *more than six* is decomposed into DegP *-er than six* and MANY that associates a degree with individuals, which makes the comparative quantifier combinable with the nominal predicate (e.g. *boys* in *more than six boys*).

Similarly, in the verbal domain, *-sugiru* is semantically decomposed into two parts, as in (24): one part expresses excessiveness like *too* (in (25)) and the other part, which is expressed as $MANY_e$, relates events with degrees (in (26)).[9]

(24)



(25) a. $[\![\text{-}sugiru]\!] = \lambda D_{<d,t>}.\ \max(D) > C$
b. $[\![\text{-}sugiru]\!] = \lambda d_d.\lambda D_{<d,t>}.\ \max(D) - C = d$ (with a differential MP)

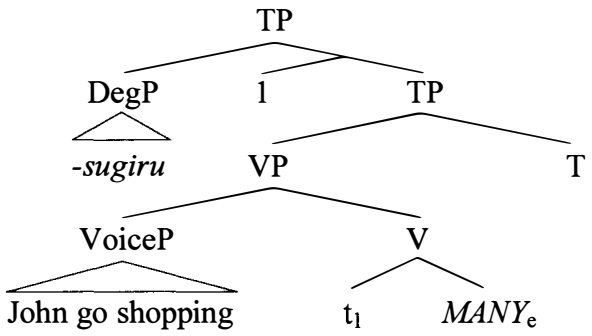
(26) $[\![MANY_e]\!] = \lambda d_d.\lambda e_v.\ |e|=d$ (first version)

Although a decomposition of a complex determiner such as *more than six* is morpho-syntactically transparent (*more* = *many* + *-er*), *-sugiru* does not have a morphological realization of the relevant two parts, i.e. MANY and TOO. However, this is true not just for Japanese, but also for languages like Spanish. As shown in (27)a, *demasiado* is a comparative quantifier like *too* in English. It can combine with a nominal predicate, as in (27)b, or with a verbal predicate, as in (27)c.[10] Based on this fact, I assume that a morpho-syntactic decomposition and a semantic decomposition do not always correlate with each other.

(27) a. Esta falda es demasiado larga.
this skirt is too much long 'This skirt is too long.'
b. Bailaron demasiados chicos.
danced too many boys 'Too many boys danced.'
c. Juan sale de juerga demasiado.
Juan goes out of party too much
'Juan goes out partying too much.'

We have now established the analysis of *-sugiru* as a comparative quantifier in the verbal domain. (28) spells out the LF and compositional semantics of (23).

(28)



$[\![\text{VoiceP}]\!]^g = \lambda e_v.\ \text{Agent}(e)=j \wedge *\text{go.shopping}(e)$ (see (17))
$[\![\ t_1\ \text{MANY}_e]\!]^g = \lambda e_v.\ |e|=g(1)$
$[\![\text{VP}]\!]^g = \lambda e_v.\ \text{Agent}(e)=j \wedge *\text{go.shopping}(e) \wedge |e|=g(1)$
$[\![\text{TP}]\!]^g = \exists e\ [\text{Agent}(e)=j \wedge *\text{go.shopping}(e) \wedge |e|=g(1)]$
$[\![1\ \text{TP}]\!]^g = \lambda d_d.[\![\text{TP}]\!]^{g\ d/1} = \lambda d_d.\ \exists e[\text{Agent}(e)=j \wedge *\text{go.shopping}(e) \wedge |e|=d]$
$[\![\text{DegP}]\!]^g = \lambda D_{<d,t>}.\ \max(D) > C$
$[\![\text{TP}]\!]^g = \max\{d: \exists e\ [\text{Agent}(e)=j \wedge *\text{go.shopping}(e) \wedge |e|=d]\} > C$
'The maximal degree d such that there is a plural John's-going-shopping event e whose cardinality (of atomic events) is d-many exceeds C.'

(23) can take a differential MP like *san-kai* 'three times', as in (29). The LF and compositional semantics of (29)a are given in (30).

(29) John-ga konsyuu kaimono-ni **san-kai** iki-sugi-ta.
John-NOM this week shopping-to three-time go-exceed-PAST
'John went shopping three times too many this week.'

(30) LF: $[_{\text{DegP}}$ three times *-sugiru*$]_1$ $[_{\text{TP}}$ John went shopping t_1 MANY$]$
a. $[\![1\ \text{TP}]\!]^g = \lambda d_d.\ \exists e[\text{Agent}(e)=j \wedge *\text{go.shopping}(e) \wedge |e|=d]$ (see (28))
b. $[\![\text{DegP}]\!]^g = \lambda D_{<d,t>}.\ \max(D) - C = 3$ times
c. $\max\{d: \exists e\ [\text{Agent}(e)=j \wedge *\text{go.shopping}(e) \wedge |e|=d]\} - C = 3$ times
'The maximal degree d s.t. there is a plural John's-going-shopping event e whose cardinality (of atomic events) is d-many exceeds C by 3 times.'

Excessiveness in V-*sugiru* is not just with respect to the cardinality of events. For instance, (31)a refers to the excessive amount of time that John slept, and (31)b means that John swam three miles excessively in terms of distance. To account for these examples, I propose (32), where μ is a measure function and a degree d is obtained by applying μ to the relevant event e. Following Schwarzschild (2002), I assume that μ is a measurement scheme (e.g. cardinality, temporal/spatial length, etc.) obtained from context. (31)a and (31)b involve μ: temporal-length and μ: spatial-length, respectively, and (29) involves μ: cardinality-of-events.

(31) a. John-ga **san-jikan** ne-sugi-ta.
John-NOM three-hour sleep-exceed-PAST
'John slept three hours too long.'
b. John-ga **san-mairu** oyogi-sugi-ta.
John-NOM three-mile swim-exceed-PAST
'John swam three miles too far.'

(32) $[\![\text{MANY}_e]\!] = \lambda d_d.\lambda e_v.\ \mu(e)=d$ (revised version)

Note that μ cannot always apply to events directly. What is relevant for us here is Krifka's (1989) claim that temporal adverbials like *for three hours* in 'John

slept for three hours' cannot measure events directly, but they can measure entities which bear a relation to events, most notably times. That is, *for three hours* indirectly measures the sleeping event by measuring the run time of the event. Formally, he assumes that there is a homomorphism h from events E to event run times T, 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.[11] In the same vein, in (31)a, the John's-sleeping event *per se* cannot be directly measured by μ: temporal-length, but its run time can. Thus, μ applies to run times mapped from events by h. Likewise, in (31)b, μ: spatial-length applies to paths mapped from events by h.[12]

Let us now examine the compositional semantics of (31)a spelled out in (33). As discussed in section 2.2, the mathematical operations (− and =) in (33)b require the three relevant degrees, i.e. max(D), C, and 3 hours, to be of the same sort. Since 3 hours is a temporal expression, max(D) and C must also be temporal expressions. D in max(D) is saturated by a set of degrees in (33)a, hence max(D) would be max{d: ∃e[Agent(e)=j ∧ *sleep(e) ∧ μ(e)=d]}, as in (33)c. For max(D) to express a time, the relevant measure function must be μ: temporal-length. As discussed shortly above, μ: temporal-length cannot directly apply to events, but to times. Thus, in (33)c, a homomorphism h from events to temporal traces is introduced by a type-mismatch rule, yielding the sub-formula $\mu(h(e))=d$. The same analysis obtains for (31)b, where the relevant measure function is μ: spatial-length, which requires a homomorphism from events to their paths.

(33) LF: $[_{DegP}$ three hours *-sugiru*$]_1$ $[_{TP}$ John slept t_1 MANY$]$
a. $[\![1\ TP]\!]^g = \lambda d_d.\ \exists e[Agent(e)=j \wedge *sleep(e) \wedge \mu(e)=d]$
b. $[\![DegP]\!]^g = \lambda D_{<d,t>}.\ max(D) - C = 3$ hours
c. $max\{d: \exists e[Agent(e)=j \wedge *sleep(e) \wedge \mu(h(e))=d]\} - C = 3$ hours
'The maximal degree d such that there is a plural John's-sleeping event e which is mapped to d-long time exceeds C by three hours.'

In sum, in (29) and (31), the differential MPs (*san-kai* 'three times', *san-jikan* 'three hours', *san-mairu* 'three miles') indicate which measure function μ is needed. If μ cannot directly apply to events, we need to introduce a homomorphism from events to other domain where μ is applicable:

(34) a. *three times* → μ: cardinality-of-events, no h required
b. *three hours* → μ: temporal-length, h from events to temporal traces
c. *three miles* → μ: spatial-length, h from events to paths

It is predicted that, without differential MPs, we obtain an ambiguity of interpretation: when a measure function is not specified by a differential MP, there should be some flexibility in choosing which measure function is relevant. This prediction is borne out, as in (35), which corresponds to (31). For instance, (35)b can express the excessiveness of cardinality of events, of temporal distance, or of

spatial distance. Any measure function can be used as long as it is compatible with the relevant event. Such a condition explains why (35)a lacks a spatial length interpretation: it does not make sense for the sleeping event to have a spatial length.

(35) a. John-ga ne-sugi-ta.
John-NOM sleep-exceed-PAST
'John slept too much.' (too many times, too long)
b. John-ga oyogi-sugi-ta.
John-NOM swim-too much-PAST
'John swam too much.' (too many times, too long, too far)

The generalization so far then is that a differential MP signals what kind of measure function μ for events is needed, which in turn determines what kind of homomorphism *h* is called for. The relation between the measure function μ and the homomorphism *h* is schematized in (36). Possible combinations of the two are not completely random. We first obtain a measure function that can be indicated by a differential MP, if any, or that can be specified by a relevant context. Then the measure function determines what kind of homomorphism is required.

(36) $\mu_\sigma(h_\tau(e))$
$\mu_1, \mu_2, \mu_3, \mu_4, \ldots, \mu_\sigma$ (cardinality, temporal-length, spatial-length, etc.)
$h_1, h_2, h_3, h_4, \ldots, h_\tau$ (from events to times, to paths, to individuals, etc.)

3.4. Homomorphism to Individuals

There is yet another possible interpretation of the V-*sugiru* construction, as in (37)a, where the sentence has the reading that John read too many books. The availability of this reading becomes apparent in (37)b, where *san-satu* 'three-CL(ASSIFIER)' specifies the number of books that were excessive.

(37) a. John-ga hon-o kinoo yomi-sugi-ta.
John-NOM book-ACC yesterday read-exceed-PAST
'John read too many books yesterday.'
b. John-ga *hon*-o kinoo **san-satu** yomi-sugi-ta.
John-NOM book-ACC yesterday three-CL read-exceed-PAST
'John read three books too many yesterday.' (=(2)b)

I propose to analyze (37)b in a way parallel to the previous examples, treating the MP 'three-CL' as a differential MP, which is the argument of *-sugiru*. Based on the discussion in section 3.3, 'three-CL' as a differential MP should express which measure function is called for. It is well known that numerals in Japanese must be followed by a classifier, i.e. a morpheme that indicates the semantic class of the host noun in terms of shape, size, animacy, etc. (Downing 1996). A classifier phrase

such as *san-satu* 'three-CL' necessarily express the cardinality of individuals of a certain kind (cf. Krifka 1995). Hence, the measure function associated with a classifier phrase is μ: cardinality-of-individuals. Then, in (38)b, the relevant degree d must be a cardinality of individuals. In (38)c, [[DegP]] combines with [[1 TP]], initially yielding the sub-formula μ(e)=d. However, μ: cardinality-of-individuals cannot measure events directly; rather, this measure function should apply to individuals. Following the analysis in section 3.3, there needs to be a homomorphism *h* from events to individuals.[13] It follows that, in (38)c, μ(e)=d needs to be type-shifted to μ(*h*(e))=d, where *h* is a homomorphism from reading events to books. As a result, μ: cardinality-of-individuals applies to books, correctly yielding the degree d that expresses a cardinality of books.

(38) LF: $[_{DegP}$ three-CL *-sugiru*$]_1$ $[_{TP}$ John read books t_1 MANY]
a. $[\![1\ TP]\!]^g = \lambda d_d.\ \exists e \exists x\ [Agent(e)=j \wedge *book(x) \wedge *read(x,e) \wedge \mu(e)=d]$
b. $[\![DegP]\!]^g = \lambda D_{<d,t>}.\ max(D) - C = 3$ individuals
c. $max\{d: \exists e \exists x\ [Agent(e)=j \wedge *book(x) \wedge *read(x,e) \wedge \mu(h(e))=d]\} - C =$ 3 individuals
'The maximal degree d such that there is a plural John's reading event e which is mapped to d-many individuals (namely, books) exceeds C by three individuals.'

Let us return to the question posed at the beginning of this paper: how can we explain the difference between (2)b (repeated in (37)b) and (2)a (in (39))?

(39) John-ga [*hon* **san-satu**]-o kinoo yomi-sugi-ta.
John-NOM [book three-CL]-ACC yesterday read-exceed-PAST
'John read (the) three books too much yesterday.' (=(2)a)

I argue that the two sentences differ in how the MP *san-satu* 'three-CL' is syntactically combined with the rest of the sentence. In (37)b, the MP is a differential MP taken as an argument of *-sugiru*, which signals that the relevant measure function is μ: cardinality-of-individuals, as shown in (40). Thus, the MP denotes an excessive amount of books. In contrast, in (39), the MP forms a nominal constituent with its host NP, as shown in the structure in (40); hence the sentential complement VoiceP of *-sugiru* is a non-split MP construction denoting 'John read (the) three books'. If there is no overt differential MP, the excessiveness of *-sugiru* can be associated with any degree compatible with a reading-three-books event (see (35)). For instance, the measure function can be cardinality-of-events, in which case a homomorphism is not necessary ('John read (the) three books too many times'), or it can be temporal-length, which involves a homomorphism from events to their run times ('John read (the) three books for too long'). Crucially, it cannot be cardinality-of-individuals: the non-split MP in a sentential complement expresses

the cardinality of books; thus, by the time *-sugiru* combines with the complement, the cardinality of books is already specified.

(40) LF: $[_{DegP}$ *-sugiru*$]_1$ $[_{TP}$ John read three books t_1 MANY]
a. $[\![1\ TP]\!]^g = \lambda d_d.\ \exists e \exists x\ [Ag(e)=j \wedge *book(x) \wedge |x|=3 \wedge *read(x,e) \wedge \mu(e)=d]$
b. $[\![DegP]\!]^g = \lambda D_{<d,t>}.\ max(D) > C$
c. $max\{d: \exists e \exists x\ [Ag(e)=j \wedge *book(x) \wedge |x|=3 \wedge *read(x,e) \wedge \mu(e)=d]\} > C$

Summing up, we saw in section 3.2 that *-sugiru* with adjectives has the same distribution as *too* in English, leading to the claim that *-sugiru* is semantically analogous to the comparative quantifier *too*. Section 3.3 presented examples of the V-*sugiru* construction where *-sugiru* expresses excessiveness of 'events'. In these examples, I argued that *-sugiru* is decomposed into two parts: TOO and MANY, where MANY associates events with degrees. When a differential MP is present, it signals which μ is needed, and further determines which *h* is called for.

4. Extensions to *Too Many / Too Much* in English

In this section, I extend the analysis of the V-*sugiru* construction to *too many / too much* in English. As in (41), *too much* can express the excessiveness of the cardinality of events, of temporal length, and of spatial length. Hence, I assume that the analysis of *-sugiru* as comparative quantification in the verbal domain proposed in section 3.3 straightforwardly extends to *too much* in English in (41).

(41) a. John went shopping **(three times)** too much.
b. John slept **(three hours)** too much.
c. John swam **(three miles)** too much.

My main interest is in *too many / too much* occurring in the nominal domain, as in *John bought too many apples* and *John drank too much wine*. Based on the analysis proposed in section 2.3, the LF and compositional semantics of *John bought too many apples* are presented in (42).[14]

(42) LF: $[_{DegP}$ too$]_1$ $[_{IP}$ John bought $[_{DP}$ t_1 many apples]]
a. $[\![t_1$ *many apples*$]\!]^g = \lambda x_e.\ *apple(x) \wedge \mu(x)=g(1)$
b. $[\![1\ IP]\!]^g = \lambda d_d.\ \exists y\ [*apple(y) \wedge \mu(y)=g(1) \wedge *buy(j,y)]$ (see (12))
c. $[\![too]\!]^g = \lambda D'_{<d,t>}.\ max(D') > C$
d. $max\{d: \exists y\ [*apple(y) \wedge \mu(y)=d \wedge *buy(j,y)]\} > C$
'The maximal degree d s.t. John bought d-many apples exceeds C.'

Too in comparative quantification in the nominal domain can take a differential MP, as in *John bought three too many apples*. As proposed above, assuming that a

differential MP is an argument of the comparative quantifier *too*, the compositional semantics of this sentence can be spelled out as in (43). Following the analysis proposed in section 3, I modify the semantics of MANY as in (43)a.[15]

(43) LF: $[_{DegP}$ three too$]_1$ $[_{IP}$ John bought $[_{DP}$ t_1 many apples]]
a. $[\![\text{MANY}]\!] = \lambda d_d.\lambda x_e.\ \mu(x)=d$
b. $[\![1\ \text{IP}]\!]^g = \lambda d_d.\ \exists y\ [*\text{apple}(y) \wedge \mu(y)=g(1) \wedge *\text{buy}(j,y)]$
c. $[\![\textit{three too}]\!]^g = \lambda D'_{<d,t>}.\ \max(D') - C = 3$
d. $\max\{d: \exists y\ [*\text{apple}(y) \wedge \mu(y)=d \wedge *\text{buy}(j,y)]\} - C = 3$
'The maximal degree d s.t. John bought d-many apples exceeds C by 3.'

I now direct our attention to an intriguing semantic differences between *too many* and *too much*. In (44)a, we obtain the reading spelled out in (43), that is, John exceeded the number of apples that he was supposed to buy by three.[16] In contrast, (44)b has an additional reading that John exceeded the amount of stuff that he was supposed to buy by three apples, which I call the stuff reading.

(44) a. John bought three apples too many.
b. John bought three apples too much.

The fact that *too much* can appear in argument position, as in *John bought too much*, indicates that it must be a nominal predicate of some sort that can serve as an argument. Moreover, *John bought too much* roughly means that John bought too much stuff. *Too much* can take an overt NP as a head, as in *too much wine*. Thus, I assume that, whenever *too much* appears in argument position, it takes a covert NP *stuff* as a head, i.e. *too much stuff*. I further claim that *too much* can take a differential MP such as *three apples*. The intuition behind this claim is that *apples* functions like a classifier in Japanese. The LF of (44)b with the covert NP *stuff* is given in (45), which is similar to the LF of (44)a given in (43).

(45) LF: $[_{DegP}$ three apples too$]_1$ $[_{IP}$ John bought $[_{DP}$ t_1 much (stuff)]]
a. $[\![t_1\ \textit{much (stuff)}]\!]^g = \lambda x_e.\ \mu(x)=g(1)\ (\wedge\ \text{stuff}(x))$
b. $[\![1\ \text{IP}]\!]^g = \lambda d_d.\ \exists y\ [\mu(y)=g(1) \wedge *\text{buy}(j,y)]$
c. $[\![\textit{three apples too}]\!]^g = \lambda D'_{<d,t>}.\ \max(D') - C = 3$ apples
d. $\max\{d: \exists y\ [\mu(y)=d \wedge *\text{buy}(j,y)]\} - C = 3$ apples
'The maximal degree d such that John bought d-much stuff exceeds C by three apples.'

The question arises as to why the stuff reading is unavailable in (44)a. Recall that the interpretation of (44)a is the same as the one of *John bought three too many apples*. Given the semantic similarity between the two sentences, I propose that these two sentences are derived by an NP-deletion from the same underlying structure, as in (46).

(46) a. John bought three apples *too many* ~~apples~~.
b. John bought three ~~apples~~ *too many* apples.

Too many is a complex comparative quantifier that combines with an NP, as in *too many apples* in (43). Moreover, as we saw in (45), we can consider *three apples* to be a differential MP, as shown in (47). Although (47) is different from (43) in that the differential MP is *three apples*, not *three*, the denotations in (47) and in (43) are almost identical. Hence, it is natural to assume the underlying structure [John bought three apples too many apples]. I suggest that there is a constraint that prohibits having two identical NPs in the surface form. Depending on which NP is deleted, we obtain either *John bought three apples too many* or *John bought three too many apples*, as in (46). In contrast, the comparative construction with *too much* does not involve an NP-deletion.[17] As proposed in (45), the DegP *too much* in *John bought three apples too much* takes the differential MP *three apples*, and the DegP combines with the covert NP *stuff*.

(47) LF: $[_{DegP}$ three apples too$]_1$ $[_{IP}$ John bought $[_{DP}$ t_1 many apples]]
a. $[\![1\ IP]\!]^g = \lambda d_d.\ \exists y\ [*apple(y) \wedge \mu(y)=g(1) \wedge *buy(j,y)]$
b. $[\![\textit{three too}]\!]^g = \lambda D'_{<d,t>}.\ max(D') - C = 3$ apples
c. $max\{d: \exists y\ [*apple(y) \wedge \mu(y)=d \wedge *buy(j,y)]\} - C = 3$ apples
'The maximal degree d such that John bought d-many apples exceeds C by three apples.'

Just like *too many* in English, the V-*sugiru* in Japanese lacks the stuff reading: (48)a has the same reading as (44)a, that is, John exceeded the number of apples that he was supposed to buy by three. The denotation of this sentence is given in (48)b, based on the analysis proposed in section 3.3. (48)b is analyzed as comparative quantification in the verbal domain, where *san-ko* 'three-CL' as a differential MP specifies that the measure function is cardinality-of-individuals, hence there needs to be a homomorphism *h* from events to individuals. The lack of the stuff reading is due to this homomorphism: since *h* is a homomorphism from buying events to apples, the differential MP must be necessarily associated with apples. In sum, although the English *too many* construction and Japanese V-*sugiru* construction both lack the stuff reading, the absence is explained by different systems: while *too many* involves comparative quantification in the nominal domain, *-sugiru* involves comparative quantification in the verbal domain.[18]

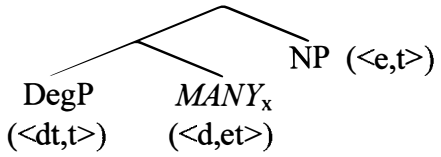
(48) a. John-ga *ringo*-o **san-ko** kai-sugi-ta.
John-NOM apple-ACC three-CL buy-exceed-PAST
'John bought three apples too many.'
b. $max\{d: \exists e \exists x\ [Agent(e)=j \wedge *apple(x) \wedge *buy(x,e) \wedge \mu(h(e))=d]\} - C = 3$ individuals

'The maximal degree d such that there is a plural John's buying event e which is mapped to d-many individuals (namely, apples) exceeds C by three individuals.'

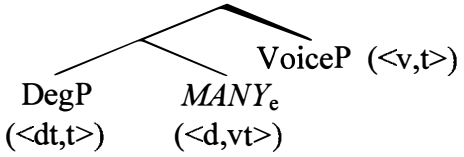
5. Conclusion

The central claim in this paper is that the V-*sugiru* construction is an instance of comparative quantification in the verbal domain. Extending the analysis of *-sugiru* with an adjective, I argued that *-sugiru* with a verb is a comparative quantifier like *too* in English. Furthermore, since verbal predicates generally do not have a degree argument, I proposed a component relating events with degrees, parallel to MANY introduced in section 2.2 that relates individuals with degrees in complex determiners. This parallelism is illustrated in (49).

(49) a. In the nominal domain



b. In the verbal domain



Another important claim made in this paper is that the V-*sugiru* construction involves a mechanism of measurement in the verbal domain using a homomorphism from events to another domain. Independently, I argued in Nakanishi (2003, 2004, in press) that the floating quantifier construction in Japanese and Split NP Topicalization in German measure in the verbal domain with the help of a homomorphism from events to another domain. Thus, I would like to emphasize that the proposed mechanism is not just needed for one particular construction, but it applies to a range of empirical data.

Endnotes

* I would like to thank Maribel Romero, Irene Heim, Chris Kennedy, and Shoichi Takahashi for valuable comments and discussions. Thanks are also due to the audience at SALT 14.

[1] MPs can be interpreted either as a degree argument or as a set of degrees (Hackl 2000:50). {d: d=6'} is a singleton {6'}, hence max{d: d=6'} is equal to 6'.

(i) $[\![\textit{six feet}]\!] = 6'$ (ii) $[\![\textit{six feet}]\!] = \lambda d_d.\ d=6'$

[2] Following Heim and Kratzer (1998), I assume that the trace is a variable and that it is bound by an index adjoined right below the moved phrase. I use the Predicate Abstraction Rule defined in (i) and the Trace and Pronouns Rule defined in (ii).

(i) Predicate Abstraction Rule: Let α be a branching node with daughters β and γ, where β dominates only a numerical index i. Then, for any variable assignment g, $[\![\alpha]\!]^g = \lambda x \in D.\ [\![\gamma]\!]^{g\,x/i}$. (Heim and Kratzer 1998:186)

(ii) Trace and Pronouns Rule: If α is a pronoun or a trace, g is a variable assignment, and i ∈ dom(g), then $[\![\alpha_i]\!]^g = g(i)$ (Heim and Kratzer 1998:186)

[3] Since an MP can be either a degree argument or a set of degrees (see footnote 1), *-er* can alternatively have the denotation in (i).

(i) $[\![\textit{-er}]\!] = \lambda D_{<d,t>}.\lambda D'_{<d,t>}.\ \lambda D''_{<d,t>}.\ \max(D'') - \max(D) = \max(D')$

[4] Hackl (2000) later proposes that MANY denotes a gradable determiner, i.e. a degree function that takes a degree argument and returns a determiner meaning:

(i) $[\![\text{MANY}]\!] = \lambda d_d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.\ \exists x\ [\ P(x) \wedge Q(x) \wedge |x|=d\ ]$

[5] For lack of a better notation, I will use the symbol * to refer to verbal pluralization also in natural language, not just in the formal language. For example, *boy* pluralizes into *boys*, and *dance* pluralizes into **dance*.

[6] See Nakanishi (2004: Chapter IV) for further advantages of simplifying the semantics of *too*.

[7] The neo-Davidsonian agent head of type <e,vt> and the VP of type <v,t> are combined by Event Identification in (i).

(i) Event Identification (Kratzer 1996:122)

f	g	→	h	
<e,<v,t>>	<v,t>		<e,<v,t>>	$\lambda x_e.\lambda e_v.\ f(x)(e) \wedge g(e)$

[8] Besides introducing comparative quantification like *too* in English, *-sugiru* has a kind of negative implication like the prefix *over-* (e.g. *overeat*, *oversleep*) or the adverb *excessively* in English. See Nakanishi (2004: Chapter IV) for details.

[9] The sentential complement can have a degree argument when it includes a gradable verb (e.g. *mijikakusuru* 'to shorten') or a gradable adverb (e.g. *hayaku* 'early'). In this case, MANY_e is not necessary. See Nakanishi (2004: Chapter IV, section 3.4) for the analysis of this type of comparatives.

[10] When *demasiado* 'too much' is a nominal modifier, it has to show morphological agreement with the following nominal predicate in terms of gender and number.

[11] A homomorphism is a function that preserves some structural relation defined on its domain in a similar relation defined on the range: a homomorphism of the semilattice $S_1 = <S_1, \circ>$ into the semilattice $S_2 = <S_2, \circ>$ is a mapping F: $S_1 \rightarrow S_2$ such that $F(a \circ b) = F(a) \circ F(b)$, where '$\circ$' denotes a composition of two functions (Partee et al. 1990:286).

[12] It has been argued that a homomorphism from one domain to the other is independently required to account for a wide variety of empirical data, such as the semantics of pluractional markers (Lasersohn 1995), of split quantifier constructions in German and Japanese (Nakanishi 2003, 2004, in press), etc.

[13] In Nakanishi (2004: Chapter III, section 4), I argued that verb denotations that are functional relations between individuals and events can serve as a homomorphism from events to individuals. In (37), the denotation of *yomu* 'to

read' can be a homomorphism, which is considered to be a function from a reading event to its internal argument *hon* 'book(s)'.

[14] I ignore event arguments, since they are irrelevant to the semantic of comparative quantification in the nominal domain. See Nakanishi (Chapter IV: section 4) for comparative quantification in the nominal domain with event arguments.

[15] The analysis proposed in (43) will be slightly modified in (47) below.

[16] Later in this section, I discuss how (44)a is related to *John bought three too many apples.*

[17] Jason Merchant (p.c.) provided me the following examples indicating that the NP deletion is possible with *too many*, but not with *too much*.

(i) a. John revealed too many of his secrets. Bill concealed too many.
b.*John revealed too much of his background. Bill concealed too much.

[18] There is a potential difference between English *too many* and Japanese *-sugiru*, which indicate that they involve comparative quantification in different domains. As shown in (i)a, the *too many* construction can be ambiguous between distributive and collective readings. Differential MPs in the V-*sugiru* construction cannot generally be associated with external arguments. For this reason, the acceptability of (i)b is controversial. However, some informants accepted it, and judged that only a distributive reading is available. In Nakanishi (2004: Chapter II), I argued that constructions involving measurement in the verbal domain lack a collective reading. Following the same reasoning, the V-*sugiru* construction lacks a collective reading because it involves quantification in the verbal domain. In contrast, the *too many* construction involves quantification in the nominal domain, hence it is immune to the constraint on distributivity.

(i) a. Three too many boys carried the piano. √distributive, √collective
b. Otokonoko-ga **san-nin** piano-o hakobi-sugi-ta.
boy-NOM three-CL piano-ACC carry-exceed-PAST
'Three too many boys carried the piano.' √distributive, *collective

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