

Why can bare NPs in Japanese have universal readings in certain environments?

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This paper first observes that a bare NP in Japanese can bear a wide scope universal reading over negation, and that its universal reading is not available unless it is a clause-mate of the sentential negation. Then, I propose that the sentential negation marker in Japanese (*nai*) is not a simple truth-functional connective, but a total adjective which induces a universal reading of a bare NP.

1. Universal readings of bare NPs in Japanese

Bare NPs in Japanese, which lack overt determiners, are ambiguous in several ways. As is shown in (1), the bare NP topic *kudamono* ‘fruit’ bears a kind reading. (2) is ambiguous in several ways, depending on the interpretations of its bare NP object. What is remarkable in (2) is that it can bear a universal reading, as is indicated by the translation (2b).

- (1) **kudamono-wa** yasai-to-kurabete vitamin A-ga sukunai.
fruit-TOP vegetable-to-comparing vitamin A-NOM little
‘Compared to vegetables, fruits have little vitamin A.’
- (2) John-ga **kudamono-o** tabe-nakat-ta (koto).
John-NOM fruit-ACC eat-NEG-PAST (fact)
a. ‘(the fact that) John did not eat the fruit(s)/a certain fruit/certain fruits.’
b. ‘(the fact that) for all fruits, John did not eat them.’

Note that, for the meaning of total negation¹ that is intended by (2b), people might think that *kudamono* is not a universally but an existentially quantified element that stays in the scope of negation. The following subsections show, however, that (2) does not use the narrow scope

¹ I am using ‘total negation’ as a cover term to refer to the meanings expressed e.g. by the sentences in (i): none of these sentences allows the existence of a person that John saw. The idea behind total negation is that the relation between the two relevant sets in (i), i.e. the set of people and the set denoted by the (negative) predicate, is total. Thus, I will not connect total negation to a particular logical form.

- (i) a. For everyone, John did not see him or her. b. John did not see anybody.
c. John saw nobody. d. John did not see even one person.
e. John saw zero persons.

existential quantification under negation (3b), but the wide scope universal quantification over negation (3a) as a strategy for total negation, and therefore, *kudamono* really bears a universal reading.

- (3) a. $\forall x[\text{fruit}(x) \rightarrow \neg \text{eat}(j,x)]$
 b. $\neg \exists x[\text{fruit}(x) \wedge \text{eat}(j,x)]$

Before that, I would like to note one important aspect of the universal reading of a bare NP: as is shown in (4) and (5), universal readings of bare NPs are not available in non-negative environments or in embedded clauses without negation.

- (4) John-ga **kudamono-o** tabe-ta (koto).
 John-NOM fruit-ACC eat-PAST (fact)
 a. ‘(the fact that) John ate a fruit/fruits/the fruit(s).’
 b. *‘(the fact that) John ate every fruit.’
- (5) Mary-wa [John-ga **kudamono-o** tabe-ta to] iw-anakat-ta.
 Mary-TOP [John-NOM fruit-ACC eat-PAST COMP] say-NEG-PAST
 a. ‘Mary did not say that John ate a fruit/fruits/the fruit(s).’
 b. *‘Mary did not say that John ate every fruit.’

1.1 Modifiability by almost-type adverbs

Modifiability by *almost*-type adverbs is used as a diagnostic for universality of a modified element (e.g. *every*, *no*, etc.); *almost* does not modify existentially quantified expressions like *anyone*.² Modification by *hotondo* ‘almost’ in (6b) confirms universality of *kudamono*.³

- (6) a. They didn’t talk to (*almost) *anyone*. (Horn 2000)
 b. John-ga hotondo **kudamono-o** tabe-nakat-ta (koto).
 John-NOM almost fruit-ACC eat-NEG-PAST (fact)
 ‘(the fact that) for almost all fruits, John did not eat them.’

² Lee and Horn (1994) and Horn (2000) point out that *almost* can modify existential quantifiers with higher values in scales. As is shown in (ib), however, *hotondo* in Japanese does not do this; it does not modify existential quantifiers. Note that, *hotondo* is ambiguous between ‘almost’ and (floated) ‘most’, but prenominal *hotondo* unambiguously means ‘almost’.

(i) a. I could solve almost {all / any / half / none / 50 / *many / *most / *few} of the problems. (Horn 2000)
 b. boku-wa hotondo {subete/*gojuu-mon}-no-mondai-o toi-ta.
 I-TOP almost {all/50-CL}-GEN-problem-ACC solve-PAST
 ‘I solved almost {all/50} of the problems.’

³ As is shown in the previous footnote, *hotondo*-modification is more reliable as a diagnostic for universality than *almost*-modification. However, (6b) is still weak evidence for universality of bare NPs. We will see later that *nai* is an instance of total adjectives (such as *complete*, *dry*, *pure*, *straight*, etc.). As is shown in (ia), total adjectives are basically compatible with modification by *almost*-type adverbs, and this also applies to total adjectives in Japanese (see ib). If *hotondo* does not modify (universally quantified) bare NPs but *nai*, compatibility with its modification in (6b) may not be a piece of evidence for their universality.

(i) a. This road is almost *straight*.
 b. kono-miti-wa hotondo *massugu* da.
 this-road-TOP almost straight CPL

The absence of its universal reading in non-negative environments or embedded clauses without negation is confirmed by its incompatibility with *hotondo*-modification.

- (7) a. John-ga (??hotondo) **kudamono-o** tabe-ta (koto).
 John-NOM almost fruit-ACC eat-PAST (fact)
 ‘(the fact that) for almost all fruit, John ate them.’
- b. Mary-wa [John-ga (??hotondo) **kudamono-o** tabe-ta to]
 Mary-TOP [John-NOM almost fruit-ACC eat-PAST COMP]
 iw-*anakat*-ta.
 say-NEG-PAST
 ‘Mary did not say that John ate almost all fruits.’

1.2 Association by exception phrases

Since an exception phrase requires a universally quantified host NP for an exceptive meaning (cf. Moltmann 1995), its associativity also confirms universality of its host NP. In Japanese, exception phrases are followed by a particle *sika*. As is shown in (8), bare NPs cannot host exception phrases unless they are clause-mates of the sentential negation. For details of exception phrases in Japanese, I refer readers to Furukawa (2005).

- (8) a. John-ga rigo-sika **kudamono-o** tabe-*nakat*-ta (koto).
 John-NOM apple-except fruit-ACC eat-NEG-PAST (fact)
 ‘(the fact that) for all fruits except apples, John did not eat them.’
- b. John-ga (*rigo-sika) **kudamono-o** tabe-ta (koto).
 John-NOM apple-except fruit-ACC eat-PAST (fact)
- c. Mary-wa [John-ga (*rigo-sika) **kudamono-o** tabe-ta to]
 Mary-TOP [John-NOM apple-except fruit-ACC read-PAST COMP]
 iw-*anakat*-ta.
 say-NEG-PAST

1.3 Relative scope

Bare NPs exhibit scope interactions with other quantificational elements. Both (9) and (10) contain three scope bearing elements, i.e. the Q-adverb *taitei* ‘mostly’, negation *nai* and the bare NP *gakusei* ‘student’. While (9) has the intermediate reading of ‘every student’ (9b),⁴ (10) has its highest reading (10a).⁵ Especially, (10) is strong evidence for the universality of a

⁴ The continuations in (i) confirm the intermediate reading of ‘every student’ in (9).

(i) ...(*dare-ka*) *iru-to sureba*, {Peter-*da/getuyoo-noasa-da*}.
 (someone) exist-if {Peter-is/Monday-gen morning-is}

‘If anyone is ever there, {it’s Peter / it’s Monday mornings}.’ (cf. Shimoyama 2004)

⁵ The highest reading of ‘every student’ in (10) is confirmed by (i); while (10) can be followed by the continuation (ib), it cannot be followed by (ia).

(i) a. #*iru-to sureba*, Peter-*da*.
 exist-if Peter-is
 ‘If anyone is ever there, it’s Peter.’

bare NP, since it is impossible to create an equivalent reading to (10a) in terms of an existential QP like ‘any/some student’ (instead of ‘every student’): a pragmatic import based on $\forall\neg \approx \neg\exists$ does not play any role.

- (9) zizitu-tosite kopiisitu-ni nitiyou-ni taitei(-no baai) **gakusei-ga** i-nai.
 fact-as copy.room-in Sunday-on in.most.cases student-NOM exist-NEG
 a. *every student_x [mostly \neg [x is in the copy room...]] (\forall >mostly> \neg)
 b. \sqrt mostly [every student_x \neg [x is in the copy room...]] (mostly> \forall > \neg)
 (cf. Shimoyama 2004)
- (10) zizitu-tosite **gakusei-ga** kopiisitu-ni nitiyou-ni taitei(-no baai) i-nai.
 fact-as student-NOM copy.room-in Sunday-on in.most.cases exist-NEG
 a. \sqrt every student_x [mostly \neg [x is in the copy room...]] (\forall >mostly> \neg)
 b. *mostly [every student_x \neg [x is in the copy room...]] (mostly> \forall > \neg)
 (cf. Shimoyama 2004)

To summarize, this section mainly observed three things about universality of bare NPs (see (11)). Then, why are their universal readings unavailable unless they are clause-mates of the sentential negation? I suspect that something happens not within bare NPs but in *nai* (the sentential negation in Japanese). In Section 2, I will focus my attention on the status of *nai*.

- (11) a. Bare NPs in Japanese can bear universal readings.
 b. In fact, their universal readings are wide scope universal readings over negation.
 They do not exhibit narrow scope universal readings.
 c. Their universal readings are not available unless they are clause-mates of negation.

2. Status of the sentential negation *nai*

As is observed in the previous section, a universal reading of a bare NP is not available unless it is a clause-mate of the sentential negation *nai*. Here, I do not want to say that a covert determiner, which corresponds to *every*, can be associated with a bare NP for the reading. If it can, it would be impossible to predict the absence of its universal reading in other environments.

Rather, I would like to cast a doubt on the naïve assumption that *nai* is a simple truth-functional connective \neg . The reason why I am suspicious about this assumption is that *nai* is an adjective. As indicated by its inflection pattern (12), it is morphologically an adjective. In addition to this, it has a predicative usage (13a) and a modificational usage (13b). Furthermore, we will see in Section 4 that it is semantically an adjective.

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- b. iru-to sureba, {getuyoo-no asa-da / zibun-no happyoo-no mae-dake-da}.
 exist-if {Monday-gen morning-is / self-GEN presentation-GEN before-only-is}
 ‘For each person, if he or she is ever there, it’s {on Monday mornings
 / only before his or her presentation}.’ (cf. Shimoyama 2004)

(12)	+present tense ⁶	+conditional	+past tense
	siro-i ‘white’	sirok-ere	sirok-at
	ooki-i ‘large’	ookik-ere	ookik-at
	waka-i ‘young’	wakak-ere	wakak-at
	na-i	nak-ere	nak-at

- (13) a. **tama-ga** *nai* (koto).
 ball-NOM NEG (fact)
 ‘(the fact that) for all balls, they are not (t)here.’
- b. Yukio-wa [*nai* **kane-o**] youkyuusi-ta.
 Yukio-TOP [NEG money-ACC] request-PAST
 ‘Yukio asked for money that I did not have.’

To explain universality of a bare NP in its local domain, two analyses about *nai*, listed in (14), seem plausible. Section 3 discusses (14a), first.

- (14) a. Since *nai* is the adjectival form of ‘always not’, a universal reading of a bare NP is obtained through unselective binding by the universal Q-adverb in *nai*.
- b. Since *nai* is a total adjective, quantity of a bare NP must be maximized through a comparison with the maximal standard.

3. Analysis 1: decomposing *nai* into a universal Q-adverb and \neg

3.1 The status of bare NPs

According to research on genericity (see Carlson & Pelletier 1995), the indefinite subject in (15a) (*a Moroccan*) cannot bear a universal reading but has a generic reading. Contrary to (15a), *a Moroccan* in (15b), by association with a universal Q-adverb *always*, bears a universal reading, which is confirmed by *almost*-modification. This line of research claims that *always* is a universal quantifier, but lacks a variable, contrary to QPs such as *everyone* or *every Moroccan*. Since the matrix predicate is an individual-level predicate, the only variable that *always* in (15b) can bind is *a Moroccan*. In short, its universal reading is due to unselective binding by the universal Q-adverb.

- (15) a. **A Moroccan** knows French.
 b. **A Moroccan** (almost) *always* knows French.

The paradigm of unselective binding in (15b) also tells us that bare NPs in Japanese can be variables. Assuming (i) that *tuneni* ‘always’ is a universal Q-adverb and (ii) that *eigo-ga umai* ‘be good at English’ is an individual-level predicate that lacks its situational variable, it can be concluded that, since its universal reading is available due to unselective binding by *tuneni*, the bare NP subject *gakusei* ‘student’ in (16b) is a variable bound by the universal Q-adverb.

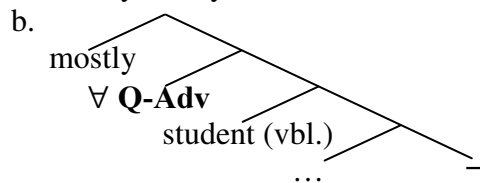
⁶ There is a debate about the status of *-i* suffix in this series, i.e., whether it is an inflectional suffix or a present tense morpheme (see Murasugi 1991) or something else. Basically, this issue is independent of the issue of this paper, and the point in (12) that *nai* is morphologically an adjective is maintained even without discussing it. Note that, to avoid any complication, *nai* is glossed as ‘NEG’ throughout this paper.

- (16) a. (??hotondo) **gakusei-ga** eigo-ga umai (koto)
 almost student-NOM English-NOM good (fact)
 ‘(the fact that) a student is (?almost) good at English’
 b. (hotondo) *tuneni* **gakusei-ga** eigo-ga umai (koto)
 (almost) always student-NOM English-NOM good (fact)
 ‘(the fact that) a student is (almost) always good at English’

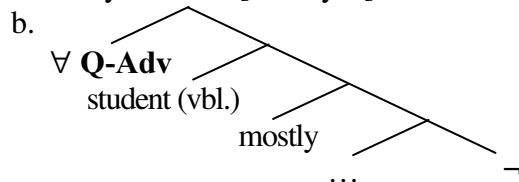
3.2 Unselective binding by a universal Q-adverb in *nai*

By decomposing *nai* into a universal Q-adverb-like element and \neg , the universality of a bare NP can be analyzed in the same way as (16b), i.e., the universal Q-adverb in *nai* binds a bare NP as its variable. Then, the intermediate reading of ‘every student’ in (9), repeated in (17a), and its highest reading in (10), repeated in (18a), can be analyzed as (17b) and (18b), respectively.⁷

- (17) a. zizitu-tosite kopiisitu-ni nitiyou-ni taitei(-no baai) **gakusei-ga** i-*nai*.
 fact-as copy.room-in Sunday-on in.most.cases student-NOM exist-NEG
 mostly [every student_x \neg [x is in the copy room...]] (mostly> \forall > \neg)



- (18) a. zizitu-tosite **gakusei-ga** kopiisitu-ni nitiyou-ni taitei(-no baai) i-*nai*.
 fact-as student-NOM copy.room-in Sunday-on in.most.cases exist-NEG
 every student_x [mostly \neg [x is in the copy room...]] (\forall >mostly> \neg)



Note that this analysis independently needs (i) a vocabulary insertion rule about *nai*, and (ii) a locality condition on unselective binding by its universal Q-adverb.

As for vocabulary insertion, *nai* cannot be divided into two morphemes that may correspond to the universal Q-adverb and \neg . Under this analysis, however, they should structurally be disjointed from each other for the scope relations in (17) and (18). To pronounce those disjointed components as a single word, a vocabulary insertion rule, which is often discussed by Distributed Morphology (see Harley & Noyer 1999), is independently necessary.

As for locality of unselective binding, we observed in (5) that bare NPs in embedded clauses without negation do not bear universal readings. To predict the absence of their universal readings, this analysis has to somehow define locality of unselective binding that

⁷ The discussion here puts aside the issue about whether or not the universal Q-adverb can occur in a left branch in the structure.

can be sensitive to clause boundaries. Even if these two points are stipulated, however, this analysis has at least three problems.

3.3 Three problems in the unselective binding analysis

First, to explain the scope relations in (17a) and (18a), this analysis has to claim that the structural position for the universal Q-adverb must be lower than *mostly* in (17a) but higher than *student* (and *mostly*) in (18a), as is shown in (17b) and (18b). Needless to say, this is very *ad hoc*, and there seems to be no fundamental reason to define its structural position in this way.

Second, just like (19a), (19b) may end up with vacuous quantification in this analysis; for the sake of the individual-level predicate and the definite expressions, it contains no variable that the universal Q-adverb can bind. Hence, its ungrammaticality is predicted, though it is, in fact, grammatical.⁸

- (19) a. ??John always knows French. (Chierchia 1995)
 b. Yukio-ga eigo-ga umak-*nai* (koto)
 Yukio-NOM English-NOM good-NEG (fact)
 ‘the fact that Yukio is not good at English’

Finally, if this decomposition is correct, *nai* may not contain any element that forces it to be adjectival, since neither its universal Q-adverb nor \neg is specifiable as an adjective. Hence, this analysis has no fundamental explanation for its adjectival nature.⁹

To summarize, although this decomposition may have an explanation about universality of a bare NP, it has several problems. Especially, I think that the problem of individual-level predicates is fatal. Therefore, I do not adopt this analysis. Section 4 examines the second analysis in (14), i.e. the total adjective analysis.

4. Analysis 2: *nai* as a total adjective

In Section 2, we observed two pieces of evidence for the adjectival nature of *nai* (i.e. its inflection pattern, and its predicative and modificational usage). However, one might argue against this view (i.e., *nai* is an adjective) for the following reason: as is shown in (20), *nai* does not accommodate comparative phrases or clauses.

- (20) **tama-ga** (*guroobu-yori) *nai* (koto)
 ball-NOM glove-than NEG (fact)
 ‘(the fact that) there are fewer balls than gloves.’

⁸ An anonymous reviewer points out that grammaticality in (19b) is not problematic if it is assumed that *nai* is ambiguous between \neg and \forall Q-adverb + \neg . This assumption is wrong, however. If *nai* is ambiguous in such a way, it is predicted that total negation with a bare NP and *nai* should be ambiguous between a wide scope universal reading and a narrow scope existential reading: existential readings of bare NPs have no restriction, as is observed earlier. As we have seen, however, total negation with a bare NP and *nai* is obtained as a wide scope universal reading, and it never bears a narrow scope existential reading. Therefore, *nai* should not be \neg .

⁹ Old Japanese had two types of negation, i.e. a non-adjectival negation marker *zu* (see (38)) and an adjectival negation marker *nasi*, which is the origin of *nai*. In fact, Old Japanese did not use *nasi* but *zu* as its sentential negation. As far as I can see, the sentential negation began to be shifted from *zu* to *nasi* in Middle Japanese, and, except for a few cases, *zu* has not been used as the sentential negation anymore in Modern Japanese.

Example (20) apparently shows that no scale is associated with *nai*. However, its incompatibility with comparative phrases or clauses does not necessarily mean absence of scales for *nai*. It can accommodate modification by a *fully*-type adverb (*mattaku*) and a proportional modifier *hanbun* ‘half’: scales are necessary for their modification. Hence, I propose that *nai* is a predicate with a scale, i.e. a gradable adjective.

- (21) a. mizu-ga mattaku *nai* (koto).
 water-NOM fully NEG (fact)
 ‘(the fact that) there is no water at all.’
 b. migi-asi-ga hanbun *nai* (koto).
 right-leg-NOM half NEG (fact)
 ‘(the fact that) half of the right leg is missing.’

Especially, modification by ‘fully’ or ‘half’ is only compatible with one class of adjectives, i.e. total adjectives. I propose (i) that *nai* is a total adjective, and (ii) that comparison against its maximized standard forces universality of a bare NP. The next subsection gives a brief introduction to total adjectives, and observes that *nai* exhibits the properties of total adjectives.

4.1 Total adjectives

Adjectives like *complete*, *dry*, *pure*, *straight*, etc. have several distinct properties from those that adjectives like *tall*, *short*, *heavy*, *light*, etc. have. Compare the two antonymous pairs *dry-wet* and *tall-short*. As is shown in (22b), *John is not tall* does not entail *John is short*, since *John is not tall but he is not short* is not contradictory. Contrary to *tall-short*, *this towel is not dry* entails *this towel is wet*, since *this towel is not dry, but it is not wet* is contradictory.¹⁰

- (22) a. This towel is not dry; therefore/?moreover, it is wet.
 b. John is not tall; moreover/?therefore, he is short. (Rotstein & Winter 2004)

Following Kennedy & McNally (1999, 2004), Rotstein & Winter (2004), Yoon (1996), let us assume the distinction between these two classes of adjectives. Furthermore, let us call adjectives in the former class (*complete*, *dry*, *pure*, *straight*, etc.) ‘total adjectives’ and adjectives in the latter class (*tall*, *short*, *heavy*, *light*, *expensive*, etc.) ‘partial adjectives’.

As the contrast between (23) and (24) shows, modification by, e.g., *100%*, *completely*, *fully*, *half*, etc. is only compatible with total adjectives. Kennedy & McNally (2004) conclude that total adjectives use bounded (or closed) scales to accommodate their modifications.

- (23) a. Her brother is (??completely) tall/short.
 b. The pond is (??100%) deep/shallow.
 c. Max is (??fully) eager/uneager to help. (Kennedy & McNally 2004)

¹⁰ (i) expresses this entailment relation, more schematically.

(i) a. dry ≈ has no degree of wetness = has the maximal degree of dryness
 ≠ has some degree of dryness
 b. wet ≈ has some degree of wetness
 ≠ has no degree of dryness

(cf. Rotstein & Winter 2004)

- (24) a. This towel is completely dry.
 b. This product is 100% pure.
 c. The pipe is now fully straight. (cf. Kennedy & McNally 2004)

They further claim that not only partial adjectives but also total adjectives are gradable adjectives, which undergo comparisons against standards. Contrary to partial adjectives (like *tall*),¹¹ the standard of comparison for *dry* in (25a) is defined as the maximal degree of dryness. (In (25b), ‘max’ is defined as a function from a scale associated with an adjective S_{adj} to its maximal degree.) In this sense, standards for total adjectives are absolute, and contextually independent.

- (25) a. This towel is dry.
 b. $\llbracket [\text{dry}] \rrbracket(\text{this towel}) = \exists d [d = \max(S_{dry}) \wedge [\text{dry}](\text{this towel}) \geq d]$
 c. $\max(S_{dry}) =$ the maximal degree of dryness = no degree of wetness

Coming back to *nai*, modification by *100%*, *completely*, *fully*, *half*, etc. is compatible with *nai*, as is shown in (21) and (26).¹² I conclude that *nai* is a total adjective.

- (26) a. kanousei-ga hyaku-paasento *nai* (koto).
 possibility-NOM 100-percent NEG (fact)
 ‘(the fact that) there is no possibility at all.’
 b. syooko-ga kampekini *nai* (koto).
 evidence-NOM completely NEG (fact)
 ‘(the fact that) there is no evidence, completely.’

4.2 A compositional meaning of *nai*

Consider, first, two antonymous partial adjectives *ooi* and *sukunai*, which correspond to predicative ‘many/much’ and ‘few/little’, respectively. Degrees returned by the degree functions $[ooi]$ and $[sukunai]$ are quantities of their bare NP subjects.

- (27) a. **gakusei-ga** *ooi* (koto).
 student-NOM many (fact)
 ‘(the fact that) students are many.’

¹¹ The standard of comparison for *tall* is relative and context dependent. Then, the meaning of (ia) is compositionally obtained by (ib) (cf. Kennedy 1997). Note that, following Kennedy (1997), I differentiate $\llbracket [\text{Adj}] \rrbracket$ from $[\text{Adj}]$. The former corresponds to an adjective as a predicate, and the latter corresponds to an adjective as a degree function. While the former is a function from its argument to a truth value, the latter simply returns a degree on a relevant scale from its argument.

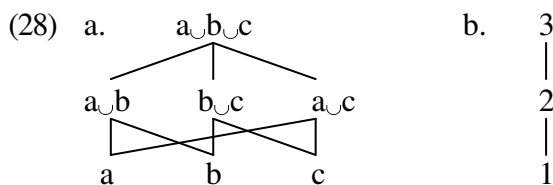
(i) a. John is tall.
 b. $\llbracket [\text{tall}] \rrbracket(\text{john}) = [\text{tall}](\text{john}) \geq d_{s(\text{tall})}$ (The value of the standard $d_{s(\text{tall})}$ is contextually determined.)

¹² (i) apparently shows that falsity of *mizu-ga nai* ‘no water is (t)here’ entails truth of ‘some water is (t)here’. However, (i) might simply show either $\neg\neg\exists = \exists$ or $\neg\forall \approx \exists$. In this sense, entailment relation in (i) is weak evidence for totality of *nai*, contrary to (22a).

(i) mizu-ga *nai* koto-wa *nai*. yueni mizu-ga aru.
 water-NOM NEG fact-FOC NEG therefore water-NOM exist
 ‘It is not the case that no water is (t)here; therefore, some water is (t)here.’

- b. **gakusei-ga** *sukunai* (koto).
 student-NOM few (fact)
 ‘(the fact that) students are few.’

Let us assume that a bare NP in Japanese is structured as a join semi-lattice, following Chierchia 1998ab, and Kobuchi-Philip 2003 (cf. Link 1983). For convenience of explanation, consider a small world. Suppose that the present world has exactly three students, namely a, b, and c. Then, *gakusei* ‘student’ in (27) has a structure like (28a).¹³ Suppose that context defines that 2 and 3 are many as a quantity of students. Since the partial order about individuals in (28a) is homomorphic to the partial order about quantity (28b), for the truth of (27a) in this context, *gakusei* must denote one of the four elements, i.e. $a \cup b$, $b \cup c$, $a \cup c$ and $a \cup b \cup c$.



Coming back to *nai*, let us call the adjectival aspect of *nai* ‘Adj_{nai}’. The translation of (29) apparently indicates that the scale associated with Adj_{nai} is also a scale about the quantity of its bare NP subject and hence, that, because of its nature as a total adjective, Adj_{nai} maximizes the quantity of *gakusei* ‘student’ through the comparison against its absolute standard (cf. Kennedy 1997, Kennedy & McNally 1999, 2004). However, maximizing (or totalizing) its quantity does not necessarily result in the total negation meaning of (29) that additionally requires that each atomic element in the maximal member should be negated.

- (29) **gakusei-ga** *i-nai* (koto).
 student-NOM exist-NEG (fact)
 ‘(the fact that) for all students, they are not (t)here.’

We need to assume that *nai* somehow creates negative context for a negative meaning, since, e.g. in (29), nothing but *nai* has a negative force. Let us call this negative aspect of *nai* ‘Neg_{nai}’. Here, I propose that two functions (i.e. the negative function $\llbracket \text{Neg}_{\text{nai}} \rrbracket$ and the total adjective function $\llbracket [\text{Adj}_{\text{nai}}] \rrbracket$) are pronounced as a single word *nai*.

- (30) **gakusei-ga** *eigo-ga* *umak-unai* (koto)
 student-NOM English-NOM good-NEG (fact)
 ‘(the fact that) for all students, they are not good at English.’

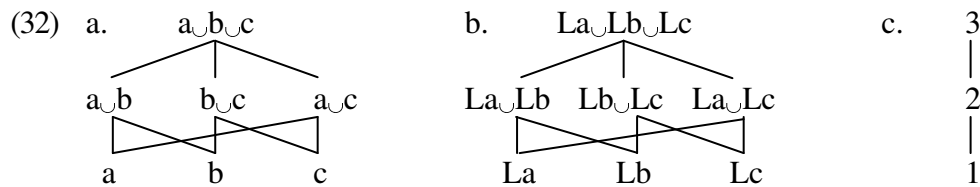
Consider total negation in (30). It is widely assumed that Japanese is productive about compound predicates such as V-V compounds, A-V compounds, N-A compounds, and so on (see Matsumoto 1996). I propose that, through the compound predicate formation (though I am neutral at this stage about whether the compound predicate formation is a morphosyntactic operation or a lexical-semantic operation), $\llbracket \text{Neg}_{\text{nai}} \rrbracket$ is defined as a function from a predicate

¹³ In (28a), I use \cup as a symbol for the join operation.

to its complement set (see (31)). Then, in (30), $[[\text{Neg}_{\text{nai}}]]$ returns $\lambda x.\neg\text{good.at.english}(x)$ from the non-negative predicate $\lambda x.\text{good.at.english}(x)$.

(31) $[[\text{Neg}_{\text{nai}}]](\gamma) = \neg\gamma$ where γ is the predicate to which *nai* attaches¹⁴

As is claimed earlier, $[[\text{Adj}_{\text{nai}}]]$ is a total adjective. For the meaning of total negation in (30), the quantity of *gakusei* should be totalized with the restriction of the negative predicate. What I would like to suggest here is that the totality of $[[\text{Adj}_{\text{nai}}]]$ maximizes the relation between the two sets, i.e. the set denoted by *gakusei* and the set denoted by the negative predicate. The basic idea is the following. Let us define ‘L’ as a link from a member in the domain $[[\text{gakusei}]]$ to a member in its co-domain, i.e. the set denoted by the negative predicate $\lambda x.\neg\text{good.at.english}(x)$. Furthermore, let us assume that ‘La’ is defined if and only if an individual ‘a’ is both in the domain and in its co-domain.



Consider (30) in the small world which I used earlier. In (32), we can easily find a partial order isomorphism between the individuals (32a) and the relations (32b), and a partial order homomorphism between the relations (32b) and the quantity (32c). As is shown in (32b), the maximal relation is defined as $La \cup Lb \cup Lc$ where each of the students (a, b and c) establishes a link in the negative predicate, in other words, a, b and c are also members of the set denoted by $\lambda x.\neg\text{good.at.english}(x)$. Remember, ‘La’ is defined if and only if an individual ‘a’ is both in the domain (the set of students) and in its co-domain (the set denoted by the negative predicate). Therefore, its intended meaning ‘for all students, they are not good at English’ is obtained. I propose (33) as a definition of $[[\text{Adj}_{\text{nai}}]]$.

- (33) a. $[[\text{Adj}_{\text{nai}}]]$ is a function from a set of relations R to a relation R such that R is the maximal relation of R .
- b. R is a set of all relations between the two sets α and β where α is a quantity bearing element (i.e. a bare NP) and β is the negative predicate obtained by $[[\text{Neg}_{\text{nai}}]]$.
- c. The maximal relation R is defined if and only if the quantity of the links between the two sets is maximal.

¹⁴ (31) has a prediction: negation obligatory takes narrower scope than QPs in the same clause. As far as I can see, this may be the case, as is shown in (i) (further investigations are warranted). However, Miyagawa (2001) reports that there exists a case where the object universal QP in (ii) takes narrower scope than negation. I have strong suspicions both about his judgment about (ii) and about his assumption that *zen'in* is a universal quantifier, but, since this issue is beyond the scope of this paper, I postpone its discussion to another paper.

(i) John-ga itu-tu-izyōu-no-kudamono-o tabe-nakat-ta (koto).
 John-NOM 5-CL-more.than-GEN-fruit-ACC eat-NEG-PAST (fact)
 ‘(the fact that) There are more than five fruits such that John did not eat them.’ (more than 5 > ¬)

(ii) Taroo-ga zen'in-o home-nakat-ta (yo).
 Taroo-NOM all-ACC praise-NEG-PAST (PRT)
 ‘Taro did not praise all.’ $\sqrt{\neg} > \text{all}, (*)\text{all} > \neg$ (Miyagawa 2001)

4.3 Three remaining issues

In this subsection, I would like to discuss three remaining issues. The first one is the case seen in (34). Since (34) does not contain any bare NP, it apparently lacks an element that participates in creating the maximal relation. However, I assume that maximization by $\llbracket [\text{Adj}_{\text{nai}}] \rrbracket$ trivially occurs even in (34). Otherwise, the meaning of (34) is undefined, though it is really meaningful. Suppose (i) that $\llbracket \text{Yukio} \rrbracket$ is a set consisting of one atomic member (i.e. Yukio), and (ii) that $\llbracket [\text{Adj}_{\text{nai}}] \rrbracket$ maximizes the relation between the singleton set and the negative predicate. Then, since, by the partial order isomorphism between the individuals and the relations, the maximal relation is also atomic, i.e. L_{Yukio} , the comparison with the standard trivially occurs. Therefore, its meaning, ‘Yukio is not good at English’ is obtained.

- (34) Yukio-ga eigo-ga umak-*unai* (koto)
 Yukio-NOM English-NOM good-NEG (fact)
 ‘(the fact that) Yukio is not good at English.’

The second issue that I have to address is the following. As is observed in (5), repeated in (35), a bare NP in an embedded clause without *nai* cannot bear a universal reading. Absence of its universal reading is predictable in the total adjective analysis. I assume that the predicate to which *nai* attaches is not $\llbracket \text{said that John ate fruits} \rrbracket$ but $\llbracket \text{said the proposition} \rrbracket$. Since the dimension of quantity of fruits is not involved in its maximization, its universal reading is absent in (35).

- (35) Mary-wa [John-ga **kudamono-o** tabe-ta to] iw-*anakat*-ta.
 Mary-TOP [John-NOM fruit-ACC eat-PAST COMP] say-NEG-PAST
 a. ‘Mary did not say that John ate a fruit/fruits/the fruit(s).’
 b. *‘Mary did not say that John ate every fruit.’

Finally, total negation in (13a), repeated in (36), also bears a wide scope universal reading of the bare NP subject, but the predicate where *nai* attaches is apparently absent in (36). Then, how can $\llbracket [\text{Adj}_{\text{nai}}] \rrbracket$ define the maximal relation in (36)? There seem to be two accounts of its wide scope universal reading. One analysis is to associate with *nai* a covert predicate (or a covert verb) that may correspond to ‘exist’, such that its total negation meaning is defined in the same way as (30). The other analysis is to define the predicative *Negnai* as a truth value 0, such that *Adjnai* evaluates and totalizes the quantity of links from the set of balls to the truth value.¹⁵ At this stage, I have not found any decisive evidence yet, and I leave it as an open question.

- (36) **tama-ga** *nai* (koto).
 ball-NOM NEG (fact)
 ‘(the fact that) for all balls, they are not (t)here.’

¹⁵ In this case, it might be possible to say that (36) denotes a characteristic function such that *Adjnai* evaluates and totalizes the quantity of the members that are falsified (or have 0 as a value of their image).

5. Conclusion

In this paper, I observed (i) that a bare NP in Japanese bears a wide scope universal reading over negation, and (ii) that this reading is not available unless it is a clause-mate of the sentential negation *nai*. By appealing to the adjectival nature of *nai*, I proposed that this reading is induced by its totality effect. Note that, if the adjectival nature of *nai* is simply a morphological matter, the unselective binding analysis that I rejected in Section 3 might survive. Even so, however, the problem about individual-level predicates raised in Section 3.3 still remains. Moreover, as is observed in Section 4.1, *nai* is semantically an adjective. Thus, I believe that the total adjective analysis is more plausible than the unselective binding analysis.

One intriguing issue remains, however. As is shown in (37), *nai* can attach to a partial adjective *ooi* ‘many/much’. Consider (37) in the small world that I used in Section 4.2, again. (37) is true in this world and context if and only if the quantity of the students is less than two. The problem in (37) is that maximization of the quantity of the students seems absent (see (37b) where *hotondo*-modification is incompatible). Its meaning apparently suggests that *nai* in (37) is either a simple truth-functional connective \neg or a scale reverser.

- (37) a. *gakusei-ga ook-unai (koto).*
 student-NOM many-NEG (fact)
 ‘(the fact that) students are not many.’
 b. (*??hotondo*) *gakusei-ga ook-unai (koto).*
 almost student-NOM many-NEG (fact)

At this stage, I have no idea about why maximization by *Adjnai* is apparently absent in (37), but one thing that I would like to note here is that negation of an adjectival sentence may not be so simple at least in Old Japanese. As is mentioned in Footnote 9, Old Japanese used a non-adjectival sentential negation *zu*. Interestingly, while *zu* can directly attach to verbs, it cannot attach to adjectives (see the contrast between (38a) and (38b)). As is shown in (38b), a verb *ar(u)*, which corresponds to ‘exist’, mediates between an adjective and *zu*. If *ar(u)* in (38b) retains the meaning of ‘exist’, it might be the case that adjectives in Old Japanese somehow rejected negation and that negation of an adjectival sentence in Old Japanese was not obtained by negating its adjective but by negating the proposition (containing it) that was taken by *ar(u)* as its argument. If adjectives in Modern Japanese retain this property, we might have to take additional factors that are absent in (30) into consideration in the case of (37). I leave this issue for future research.

- (38) a. *Asihiki-no yama-ni ik-ikemu yamabito-no*
 Asihiki-GEN mountain-to go-seem mountain.man-GEN
kokoro-mo-sir-azu yamabito-ya tare
 mind-even-know-NEG mountain.man-Q who
 ‘I don’t understand the reason why the person went to the mountain, who is the person?’
 (Man’ youshuu, maki 20: 4294, cf. Sawada 2005)
 b. *onazi-hodo, sore-yori geharu-no-kaui-tati-ha masite*
 same-level that-than low.ranked-GEN-maid-PL-FOC moreover
yasuk-ar-azu.
 calm-exist-NEG
 ‘Those maids who were not only of the same status as hers, but also in lower positions, became nervous.’
 (Genji, Kiritsubo)

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