On the nature of inverse scope readings

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1. Introduction

Sentence interpretations involving quantifier scope have been extensively studied in the generative tradition. From the outset of the study, it has been observed that they may or may not reflect the surface order of a sentence (cf. Katz & Postal 1964). For example, every NP in the subject position can take wide scope with respect to some NP in its clause-mate object position – (1a) is understood to mean (1b).

(1)  a. Every boy loves some girl.
    b. For each boy, there is at least one girl he loves.

Furthermore, as we can see with (2a) giving rise to (2b), every NP in an object position is understood to scope over some NP in its clause-mate subject position.

(2)  a. Some boy loves every girl.
    b. For each girl, there is at least one boy loving her.

To describe the interpretations like (1b) for (1a) and (2b) for (2a) requires that two quantifiers corresponding to two nominal expressions are arranged in such a way that one is within the scope of the other. I refer to such interpretations as wide scope readings. Among wide scope readings, the interpretations like (1b) for (1a) (where the scope order of the two quantifiers reflects the surface order of the corresponding two nominal expressions) are called surface scope readings, and those like (2b) for (2a) (where the scope order of the two quantifiers is the reverse of the surface order of the corresponding two nominal expressions) inverse scope readings. The focus of investigation in this paper is wide scope readings, in particular, inverse scope readings.1

The standard approach analyzes inverse scope readings to be on a par with surface scope readings (e.g., Heim & Kratzer 1998). It assumes that the sentence-level syntax in the sense of Chomsky (1995) is solely responsible for the emergence of inverse scope readings – the compositional computation applied to an LF representation yields an inverse scope reading. As an implementation of this assumption, the standard approach maintains that (i) the wide-scope taking object is a generalized quantifier in the sense of Barwise & Cooper (1981), i.e., a set of properties, and (ii) via syntactic scope-shifting operation – quantifier-raising in May (1977) or its alternative – the relevant object is positioned in a place that allows it to take wide scope with respect to its clause-mate subject.2 According to this approach, when it gives rise to (2b), (2a) is analyzed as (3), where Op signifies an operator.
This paper argues against the standard approach at two levels. I maintain that the emergence of inverse scope readings requires more than the sentence-level syntax; it requires a discourse operation. In addition, I argue that when an inverse scope reading obtains, the wide-scope taking object is not analyzed as a generalized quantifier, i.e., a set of properties; I argue that assuming it to be a sum of singular-individuals in the sense of Link (1983) is a good approximation.

Informally, the analysis of inverse scope readings I will defend is as follows. In the situation where there are three girls, Hannah, Ruth, and Naomi, for example, the speaker detects (2b) for (2a) because he/she uses (2a) as a shorthand form of the three sentences in (4). In the situation under discussion, the conjunction of the propositional meanings of these sentences becomes logically equivalent to (2b). Hence, (2a) is understood to mean (2b).

The architecture of grammar I will propose is (5), where syntax\textsuperscript{S} is the sentence-level syntax in the standard sense and syntax\textsuperscript{D} is the discourse-level syntax. I maintain that the discourse-level syntax is equipped with an operation that allows a given sentence to be a shorthand form of two or more sentences.

When (2a) gives rise to (2b), the three sentences in (4) are each generated by the sentence-level syntax, and the discourse-level syntax makes sure that (2a) is a shorthand form of the three sentences and its meaning is the conjunction of their propositional meanings. It thus turns out that inverse scope readings are discourse phenomena.
Crucially, this proposal implies that among pairs of a sequence of sound corresponding to a sentence and a propositional meaning, some involve both the sentence- and discourse-level syntaxes while the others only the sentence-level syntax. Thus, the study of the sentence-level syntax through sound-meaning association is not as straightforward as it has been thought. We must first establish operational tests to determine which pairs of sound-meaning association should be accounted for by the sentence-level syntax alone. In this paper, the claims and generalizations I put forth are mainly supported by Japanese empirical materials.

The rest of the paper is organized as follows. Section 2 introduces three sets of generalizations which I believe the analysis of inverse scope readings must explain. Crucially, one of them indicates that the emergence of inverse scope readings requires a particular discourse context. Thus, we are led to give up the starting assumption of the standard approach – the sentence-level syntax is solely responsible for the emergence of inverse scope readings. Section 3 demonstrates that the quantity nominal expressions that support inverse-scope taking can be analyzed as sums of singular-individuals. Capitalizing on the demonstration in Section 3, I maintain that when a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions that occur as major constituents of the sentence (including the relevant wide-scope taking object expression) are analyzed as sums of singular-individuals. The question to be addressed is then how inverse scope readings emerge – how a given nominal expression being a sum of singular-individuals can take wide scope with respect to another nominal expression. In Section 4, I propose an analysis of inverse scope readings, and answer this question. According to the analysis I propose, the emergence of inverse scope readings involves the discourse-level syntax (as well as the sentence-level syntax). When an inverse scope reading obtains in a sentence, the sentence is a shorthand form of two or more sentences. Section 5 further confirms the direction suggested in Section 3 and the analysis of inverse scope readings proposed in Section 4. In Section 6, I consider the analysis of surface scope readings, and its implications. Finally, I conclude in Section 7, providing a brief summary of the paper and commenting on some related issues.

2. Observations that the analysis of inverse scope readings ought to explain

Let me start the discussion by presenting three sets of observations which I believe any viable analyses of inverse scope readings ought to account for. As we will see below, one of them clearly indicates that unlike that of surface scope readings, the emergence of inverse scope readings requires a particular discourse context.

2.1. Nominal expressions that do not support inverse-scope taking

It is observed by Liu (1990) that as the relevant object expression, not all nominal expressions support inverse-scope taking. Among the nominal expressions that Liu says do not support inverse-scope taking are so-called negative quantifiers such as no NP and few NP. Indeed, while they support surface-scope taking, they do not inverse-scope tak-
ing. For example, while (6a) and (7a) give rise to (6b) and (7b), respectively, (8a) and (9a) cannot be taken to mean (8b) and (9b), respectively.4

(6)   a. No reviewers read three abstracts.
    b. There are no reviewers who read three abstracts.

(7)   a. Few reviewers read three abstracts.
    b. There are not many reviewers who read three abstracts.

(8)   a. Three reviewers read no abstracts.
    b. There are no abstracts that were read by three reviewers.

(9)   a. Three reviewers read few abstracts.
    b. There are not many abstracts that were ready by three reviewers.

I thus submit that any viable analyses of inverse scope readings must explain (10).

(10)   So-called negative quantifiers in an object position cannot take wide scope with respect to its clause-mate subject.

2.2. The variation of speakers’ acceptability judgments

Another peculiarity of inverse scope readings is that speakers’ acceptability judgments vary. Over the past decade, for sentences in which the relevant object expression is a so-called negative quantifier, I encountered almost no informants who detected an inverse scope reading. However, when the relevant object is some other nominal expression, I received both answers. For example, for each of the sentences in (11), I encountered those who could detect the reading under discussion and those who could not.

(11)   a. Three reviewers read Abstract #1 and Abstract #2.
    b. Three reviewers read every abstract.
    c. Three reviewers read many abstracts.
    d. Three reviewers read two abstracts.
    e. Three reviewers read exactly two abstracts.
    f. Three reviewers read more than two abstracts.

At the same time, I also witnessed cases where an informant initially could not detect an inverse scope reading with a sentence but after consideration started detecting it with the same sentence.

In this connection, it is important to note that there is a tendency as to which nominal expressions are (un)likely to give rise to an inverse scope reading. Informants are more likely to detect an inverse scope reading when the relevant object expression is every NP
or $A$ and $B$ than they do when the expression is many NP, a bare numeral, or a modified numeral. Among the latter three, modified numerals seem to be the most difficult one.\textsuperscript{5}

The variation of speakers’ acceptability judgments is indeed a peculiarity of inverse scope readings. The same group of informants all detected a surface scope reading with any of the sentences in (12) effortlessly.

(12) a. Reviewer #1 and Reviewer #2 read three abstracts.
    b. Every reviewer read three abstracts.
    c. Many reviewers read three abstracts.
    d. Two reviewers read three abstracts.
    e. Exactly two reviewers read three abstracts.
    f. More than two reviewers read three abstracts.

The complexity of the phenomena at hand is not restricted to English. The situation is similar with Japanese. With the sentences like those in (13), I encountered those who detected an inverse scope reading as well as those who did not.\textsuperscript{6,7}

(13) a. Sannin no sinsain ga Abusutorakuto #1 to Abusutorakuto #2 o sadokusita.
    ‘Three reviewers read Abstract #1 and Abstract #2.’
    b. Sannin no sinsain ga subete no abusutorakuto o sadokusita.
    ‘Three reviewers read every abstract.’
    c. Sannin no sinsain ga takusan no abusutorakuto o sadokusita.
    ‘Three reviewers read many abstracts.’
    d. Sannin no sinsain ga hutatu no abusutorakuto o sadokusita.
    ‘Three reviewers read two abstracts.’
    e. Sannin no sinsain ga tyoodo hutatu no abusutorakuto o sadokusita.
    ‘Three reviewers read exactly two abstracts.’
    f. Sannin no sinsain ga hutatu izyoo no abusutorakuto o sadokusita.
    ‘Three reviewers read two or more abstracts.’

Regarding which nominal expressions are (un)likely to support inverse scope readings, the tendency is similar to the one of English.

Just as in English, surface scope readings contrast with inverse scope readings; the same set of informants detected a surface scope reading with the sentences like those in (14) without any difficulty.

(14) a. Sinsain #1 to Sinsain #2 ga mittu no abusutorakuto o sadokusita.
    Reviewer #1 and Reviewer #2 NOM three GEN abstract ACC reviewed
    ‘Reviewer #1 and Reviewer #2 read three abstracts.’
    b. Subete no sinsain ga mittu no abusutorakuto o sadokusita.
‘Every reviewer read three abstracts.’

c. Takusan no sinsain ga mittu no abusutorakuto o sadokusita.
   ‘Many reviewers read three abstracts.’

d. Hutari no sinsain ga mittu no abusutorakuto o sadokusita.
   ‘Two reviewers read three abstracts.’

e. Tyoodo hutari no sinsain ga mittu no abusutorakuto o sadokusita.
   ‘Exactly two reviewers read three abstracts.’

f. Hutari izyoo no sinsain ga mittu no abusutorakuto o sadokusita.
   ‘Two or more reviewers read three abstracts.’

Based on the above discussion, I maintain that the analysis of inverse scope readings must also explain (15).

(15)  a. Unless the relevant object expression is a so-called negative quantifier, speakers’ acceptability judgments on inverse scope readings vary.

b. Informants are more likely to detect an inverse scope reading with the relevant object expression being every NP or A and B than with the expression being many NP, a bare numeral, or a modified numeral. Among the latter three, modified numerals are the least likely ones to support inverse-scope taking.

2.3. Requiring a particular discourse context

I have reported above that when the relevant object is an expression other than so-called negative quantifiers, speaker’s acceptability judgments on inverse scope readings vary. As pointed out by Hayashishita (2004), it is also the case that a given single speaker’s judgments with respect to the same nominal expression α may also vary depending on the context where α is used; he/she cannot detect an inverse scope reading unless a certain context is present. Thus, as Hayashishita maintains, if we pursue a uniform analysis of inverse scope readings, we ought to admit that the emergence of the readings under discussion requires a particular discourse context.

For example, compare (16) and (17) below, which are constructed based on the examples Hayashishita (2004) provides. Despite the fact that in both cases the relevant object expression is a bare numeral hutari no NP ‘two NP’, the inverse scope reading is available in (16), but not in (17).

(16) (Based on Hayashishita 2004:Ch.2 [14a])
Gakubunaisenkyo de, suunin no gakusei ga hutari no kyoozyu ni department:election at some GEN student NOM two GEN professor DAT toohyosita.
voted
Demo hoka no kyoozyu ni wa daremo toohyosi-na-katta.
but other GEN professor DAT TOP no:one vote-NEG-PAST
‘At the departmental election, some students voted for two professors. But for the other professors, no one voted.’
In USC, each year some professors nominate two freshmen for the humanity award. But no student was nominated this year.

One might argue that the contrast between (16) and (17) does not indicate that the emergence of inverse scope readings requires a particular discourse context, citing Fodor & Sag’s (1982) thesis that base numerals are lexically ambiguous between their referential and non-referential interpretations. In other words, one might maintain that if the relevant object expression is a bare numeral, inverse scope readings are possible only when it is analyzed as a referential expression. Indeed, this is a legitimate argument in the context of (16) and (17), for while it is reasonable to assume *hutari no kyoozyu* ‘two professors’ in (16) to be a referential expression, it is not with *hutari no sinnyuusei* ‘two freshmen’ in (17). Since the extension of *sinnyuusei* ‘freshmen’ changes every year, we cannot assume it to refer to something.

This line of thinking is not tenable, however. The same point can be shown with modified numerals. Obviously, it is not reasonable to extend the Fodor & Sag lexical ambiguity thesis to modified numeral cases. (Once we do, nothing seems to prevent us from saying that every nominal expression can be referential.) As I reported above, some speakers can detect an inverse scope reading even when the relevant object expression is a modified numeral, but Hayashishita (2004) points out that it is not the case that they always do. For example, they detect the reading under discussion in (18), and rather easily with the context in (19). But they fail to do so in (20).

(18) (Based on Hayashishita 2004:Ch2 [16a])

*We got a bad luck. Two guards were standing in front of five or more buildings.*

(19) (Based on Hayashishita 2004:Ch2 [16a])

We agree that we will not execute the plan if five or more buildings on 5th Avenue are guarded. You go to spy, and see seven buildings each guarded by two security guards. You return and report your observation.

(20) Gaadoman to biru no kazu bara kangaeru to, sukunakutomo hutari no guard and building GEN number from considering if at least two GEN gaadoman ga itutu izyoo no biru o kanrisinakerebanaranai. guard NOM five more GEN building ACC must:supervise
‘Given the numbers of guards [available] and of buildings, at least two guards must supervise five or more buildings.’

We are thus led to conclude that the emergence of inverse scope readings requires a certain discourse context.

The question we now address is how we can describe the distribution of inverse scope readings. Hayashishita (2004) claims, based on the contrast between (16) and (17) and that between (18) and (20), that what is crucial for the emergence of inverse scope readings is that the speaker associates the wide-scope taking object expression with some specific group of individuals which he/she has in mind. Indeed, in processing (16), the speaker can, and in fact must in this situation, associate the relevant object expression with some specific group of individuals, in particular two certain professors. But in uttering (17), he/she cannot do so for the reason alluded above – as the extension of *sin-nyuusei* ‘freshmen’ changes every year, the speaker has no way of associating the object expression with some specific group of individuals. Similarly, uttering (18) in the context of (19), the speaker clearly associates the relevant object expression with specific seven buildings. On the other hand, the issue relevant in the context of (20) is how many buildings each guard needs to be responsible for, and it is unlikely that the speaker associates the relevant object with any specific group of individuals.

As pointed out by Axxxxxxx Rxxxxxxx (p.c. May 2008), however, Hayashishita’s generalization is too narrow. For example, consider (21) (which is supplied by Axxxxxxx Rxxxxxxx).

(21) Rainen no suupaabooru de, hanbunizyoo no hito ga saiyyusyyuu sensyu next:year GEN Super:Bowl at half:more GEN person NOM MVP player kouhosya no naka no ue kara hutari no sensyu ni toohoosuru daroo. candidate GEN among GEN top from two GEN player DAT vote probably ‘At next year’s Super Bowl, it will probably be the case that half or more of the people vote for the two players who occupy the first two places in the MVP candidate list.’

In the situation where the spectators can vote for more than one player, we can easily understand (21) to mean that the two best players yet to be decided would each receive votes from half or more of the spectators who come to the game next year. Since in uttering (21), the speaker cannot have two specific players in mind, Hayashishita’s generalization leaves out the inverse scope reading found with (21).

To state pre-theoretically, the generalization that captures the distribution of inverse scope readings seems to be (22).9

(22) Inverse scope readings are possible only when the following condition is met:

When the relevant object expression \( \alpha \) is interpreted, there is one and only one group of objects that can possibly be the extension of \( \alpha \).

The thesis that the emergence of inverse scope readings requires a particular discourse context is embedded here. Among the nominal expressions that support inverse-scope taking, some of them do not satisfy the condition in (22) unless discourse restricts the
domain individuals. Thus, in the interests of finding a uniform analysis, the thesis under discussion must be maintained.

(22) correctly captures that the speaker detects an inverse scope reading with (16), (18), and (21) but not with (17) and (20). In the context of (16) and (18), the speaker associates the relevant object expression with some specific group of individuals. In other words, in the discourse of consideration, there is only one group of individuals that can possibly be the extension of the relevant object expression. The discourse relevant to (21) leaves only one group of individuals as a candidate for the extension of the relevant object expression, namely the two players who are to occupy the first two positions in the MVP list. On the other hand, in the discourse relevant for (17) and in that relevant for (20), there is more than one group of individuals that can serve as the extension of the relevant object expression. The discourse relevant for (17) should include a number of freshmen. If there are 50 freshmen, for example, as a candidate for the extension of \textit{hutari-no sinnyuusei} ‘two freshmen’, we can conceive \((50 \times 49) / 2 =\) 1225 possibilities. Thus, it is expected that (17) and (20) do not give rise to an inverse scope reading.

Here I would like to make a clarification remark – (22) is not meant to entail that when an inverse scope reading obtains, the relevant object expression necessarily takes the widest scope. For example, (22) is compatible with the fact that (23a) can depict the situation in (23b), indicating that \textit{two books} can take scope above its clause-mate subject while taking scope below the matrix subject.

(23)  

a. John and Bill said that some student read two books.

b. John reported that two books, H and I, were read by Taro and Jiro respectively, and Bill independently reported that two books, J and K, were read by Saburo and Shiro, respectively.

What (22) says is the following. When the speaker computes the denotation of the embedded clause with respect to \textit{John}, there ought to be one and only one group of individuals available for the extension of \textit{two books}, and when he/she computes the denotation of the embedded clause with respect to \textit{Bill}, there ought to be one and only one group of individuals available for the extension of \textit{two books}. Thus, one possibility is that for the computation of the denotation of the embedded clause with respect to \textit{John}, the extension of two books is necessarily H and I, and for its computation with respect to \textit{Bill}, the extension is necessarily J and K. A situation that forces this would be where the speaker knows that John was talking about H and I, and Bill was taking about J and K. In fact, unless a context like this is present, it is difficult to take (23a) to mean (23b).

There are ways to facilitate the emergence of inverse scope readings. I report one of them here. For example, the provision of the context in (24) facilitates one to detect an inverse scope reading in the sentences of (11) and of (13); with this provision, even those who initially could not start detecting it.

(24) The conference organization committee would like to know which abstracts were read by three reviewers. You check the abstracts one by one. Was Abstract #1 read by three reviewers? How about Abstract #2? And so on. You then report to the committee, saying …
To the list of the things which the analysis of inverse scope readings ought to explain, I thus add the generalization in (22) and the contribution of the context in (24) to the detection of an inverse scope reading with the sentences of (11) and of (13).

Surface scope readings contrast with inverse scope readings. Speakers detect a surface scope reading in both (i) cases where there is one and only one group of individuals available for the extension of the relevant subject expression and (ii) cases where there is more than one such group of individuals available. For instance, we can detect a surface scope reading with (25) and (26) both, cf. (16) and (17).

(25) Gakubunaisenkyo de, hutari no kyooin ga suunin no gakusei ni toohyoosita. department:election at  two GEN teacher NOM some GEN student DAT voted
‘At the departmental election, two teachers voted for some students.’

(26) USC de wa, maitosi hutari no sinnin kyooin ga suunin no gakusei o USC  at TOP every:year two GEN newly:hired teacher NOM some GEN student ACC zinbunkagakusyoo ni suisensuru. humanity:award DAT nominate
‘In USC, each year two newly hired professors nominate some students for the humanity award.’

In addition, the presence of a context like the one in (27) does not make any differences for the detection of a surface scope reading in the sentences of (12) and of (14); both with and without such a context, they readily give rise to the reading under discussion.

(27) The conference organization committee would like to know which reviewers read three abstracts. You check the reviewers one by one. Did Reviewer 1 read three abstracts? How about Reviewer 2? And so on. You then report to the committee, saying …

We are thus led to Hayashishita’s (2004) position that the emergence of surface scope readings does not require the discourse context which the detection of inverse scope readings needs.

2.4. Summary

Given the observation in Section 2.3 – the emergence of inverse scope readings requires a certain discourse context, it is clear that the emergence of inverse scope readings involves more than the sentence-level syntax. Hence, the starting assumption of the standard approach – the sentence-level syntax is solely responsible for the emergence of inverse scope readings – must be dispensed with. In this light, the observation in Section 2.2 that speakers’ acceptability judgments vary is not surprising. Given that in linguistics experiments, informants were usually presented sentences without any provision of context, we may understand that some speakers can set up a context that inverse scope readings require on their own while the others cannot, and depending on what type of nominal expression the relevant object is, one may or may not be able to construct such a context. (I will further elaborate this point in Section 4.)
Incidentally, the first observation – so-called negative quantifiers do not support inverse-scope taking – still seems manageable with the sentence-level syntax alone. This requires that the standard approach of inverse scope readings be enriched. As Beghelli & Stowell 1997 do drawing on Szabolcsi 1997, we may, for example, assume that syntactic scope-shifting operation is restricted in such a way that so-called negative quantifiers cannot be situated in a position that allows them to take scope over their clause-mate subjects. Given the evidence that the emergence of inverse scope readings involve more than the sentence-level syntax, however, I will not pursue this line of thinking.

3. The denotation of the wide-scope taking object

Having dispensed with the thesis that the sentence-level syntax is solely responsible for the emergence of inverse scope readings, nothing motivates us to maintain the other assumptions of the standard approach, including the one that the wide-scope taking object expression is analyzed as a generalized quantifier (i.e., a set of properties). In this section, I argue that nothing prevents us from discarding this assumption – the quantity nominal expressions that support inverse-scope taking can all be analyzed as sums of singular-individuals.

3.1. Conjoined nominal expressions in Japanese

As pointed out by Hayashishita & Bekki (2011), descriptively nominal expressions resulted from combining two or more items with conjunctions (henceforth conjoined nominal expressions) can form three categories. The members of one category represented by $A$ to $B$ always ‘refer to’ a plural object, while those of another represented by $A$ ya $B$ may ‘refer to’ a plural or singular object depending on the environment where they are used. The members of the third category, represented by $A$ ka $B$, necessarily ‘refer to’ a singular object.

For example, for (28a) and (28b) to be true, both Mark and Luke must come; however, (28c) indicates that only one of Mark and Luke came.

\begin{align*}
(28) & \quad (= \text{Hayashishita & Bekki 2011 [2]}) \\
   a. & [\text{Mark to Luke}] \text{ ga kita.} \\
       & \quad \text{‘(Lit.) [Mark to Luke] came.’} \\
   b. & [\text{Mark ya Luke}] \text{ ga kita.} \\
       & \quad \text{‘(Lit.) [Mark ya Luke] came.’} \\
   c. & [\text{Mark ka Luke}] \text{ ga kita.} \\
       & \quad \text{‘(Lit.) [Mark ka Luke] came.’}
\end{align*}

Thus, in these examples, $A$ to $B$ and $A$ ya $B$ ‘refer to’ a plural object, and $A$ ka $B$ a singular object.

The sentences in (29) depict a different picture. (29a) states that Mary does not offer tea unless both Mark and Luke come, but with (29b) and (29c), Mary offers tea as long as one of Mark and Luke comes.
It is thus indicated that while $A \rightarrow B$ cannot ‘refer to’ a singular object, $A \bigvee B$ may pattern with $A \bigcap B$, being understood to ‘refer to’ a singular object.

One might pursue to analyze the conjoined nominal expressions under discussion to be quantifiers. However, Hayashishita & Bekki (2011) argue against it. In this pursuit, it is reasonable that $A \rightarrow B$ is analyzed as a universal quantifier $A \bigcap B$ as an existential quantifier; see (30).

$$
\text{(30) } a. \quad \lambda P. (P(a) \land P(b)) \quad \text{(i.e., } \lambda P \forall x \in \{a, b\} P(x))
$$

$$
\text{b. } \lambda P. (P(a) \lor P(b)) \quad \text{(i.e., } \lambda P \exists x \in \{a, b\} P(x))
$$

However, as they demonstrate, $A \bigvee B$ cannot be analyzed as a quantifier. Analyzing $A \bigvee B$ to be an existential quantifier, the observation we made with (28b) – it may ‘refer to’ a plural object – cannot be accounted for. Conversely, analyzing it to be a universal quantifier, the observation with (29b) – it may ‘refer to’ a singular object – remains unexplained.

One might argue that analyzing $A \bigvee B$ to be a universal quantifier, we still can account for its singular nature. For example, analyzing (29b) to be (31), the observed fact – with (29b), Mary offers tea as long as Mark or Luke comes – is expected, as (31) is logically equivalent to (32).

$$
\forall x (x \in \{m, l\} \rightarrow \forall w’ (wRw’ \land (x \text{ comes in } w’) \rightarrow \text{Mary offers tea in } w’))
$$

$$
\forall w’ (wRw’ \land \exists x (x \in \{m, l\} \land (x \text{ comes in } w’) \rightarrow \text{Mary offers tea in } w’))
$$

However, Hayashishita & Bekki demonstrate that this analysis cannot be maintained for two reasons. First, the assumption that $A \bigvee B$ can take scope over the entire conditional is not founded; prototypical scope bearing nominal expressions such as ‘o ounce no gakusei ‘a large number of students’ and ‘sanmin no gakusei ‘three students’ do not scope out of the antecedent clause of the conditional. Second, $A \bigvee B$ appears to ‘refer to’ a singular object even in the logical equivalence between the universal and existential quantifiers does not hold. For example, like (33c), (33b) (in contrast to (33a)) indicates that the coming of Mark or Luke alone is a possibility, despite the fact that (34) is not logically equivalent to (35).

$$
\text{(33) } a. \quad \text{Rainen } [\text{Mark to Luke}] \text{ ga nihon ni kuru kamosirenai.}
\quad \text{‘(Lit.) Next year, } [\text{Mark to Luke}] \text{ may come to Japan.’}
$$
   ‘(Lit.) Next year, [Mark ya Luke] may come to Japan.’

   ‘(Lit.) Next year, [Mark ka Luke] may come to Japan.’

(34) \( \forall x (x \in \{m, l\} \rightarrow \exists w' (\text{wR}w' \land (x \text{ comes in } w')) \)

(35) \( \exists w' (\text{wR}w' \land \exists x (x \in \{m, l\} \land (x \text{ comes in } w')) \)

Hayashishita & Bekki (2011), in addition, point out that (33b) states that the coming of Mark and Luke and the coming of Mark or Luke alone are both among the possibilities. In other words, \( A \text{ ya } B \) may have the plural and singular statuses at the same time. Analysing \( A \text{ ya } B \) to be a quantifier, we cannot capture this.

3.2. Hayashishita & Bekki’s (2011) theory of nominal expressions

Given the three types of conjunctions, \( \text{to, ya, and ka} \) can conjoin nominal expressions recursively, categorically, \( A \text{ ya } B \) should be treated on a par with \( A \text{ to } B \) and \( A \text{ ka } B \). Hayashishita & Bekki (2011) thus conclude that the conjoined nominal expressions cannot be analyzed as quantifiers, and assume that they are treated as individuals. To account for the three-way distinction, they propose a theory of nominal expressions, making use of interpretation through \textit{monad} in Bekki (2009). The proposed theory in effect treats \( A \text{ to } B \) and \( A \text{ ka } B \) as sums of singular-individuals and singular-individuals, respectively, and crucially allows \( A \text{ ya } B \) to be a sum of singular-individuals and a singular-individual at the same time.

I list the main assumptions of the theory in (36), referring the readers to Hayashishita & Bekki (2009) for its formal articulation.

(36) a. The set of individuals and a binary operator ‘+’ form a join-semilattice (cf. Link 1983)

b. Conjoined nominal expressions and verbs are represented as sets of individuals and sets of predicates, respectively at Semantic Representation (= SR).

c. When a conjoined nominal expression is combined with a verb, each member of the set is combined with the verb, yielding a set of propositions, and the resulting propositions are conjoined with disjunctions.

Accordingly, \( A \text{ to } B \), \( A \text{ ya } B \) and \( A \text{ ka } B \) are defined as (37a), (37b), and (37c), respectively, and in the situation where the singular-individuals of the domain of consideration are Mark, Luke, and John, \( \text{Mark to Luke, Mark ya Luke, Mark ka Luke} \) are represented as (38a), (38b), and (38c) at SR, respectively.

(37) a. \( [A \text{ to } B] = \{a + b \mid a \in [A], b \in [B]\} \)

b. \( [A \text{ ya } B] = \{x \mid a \leq x, a \in \max([A])\} \cup \{y \mid b \leq y, b \in \max([B])\} \)
   where \( \max(S) \) is a set of maximal elements in \( S \),
i.e., \( \max(S) = \{x \mid x \in S, \forall y (y \in S \land x \leq y \Rightarrow y = x) \} \)

\[
\begin{align*}
\text{c. } [A \text{ ka } B] &= [A] \cup [B]
\end{align*}
\]

(38) a. \( [\text{Make to Luke}] = \{m + l\} \)
b. \( [\text{Mark ya Luke}] = \{m, l, m + l, m + j, l + j, m + l + j\} \)
c. \( [\text{Mark ka Luke}] = \{m, l\} \)

In the same situation, (28a), (28b), and (28c) are thus analyzed as (39a), (39b), and (39c), respectively.

(39) a. \( [\text{Mark to Luke ga kita}] = \text{came}(m + l) \)
b. \( [\text{Mark ya Luke ga kita}] = \text{came}(m) \lor \text{came}(l) \lor \text{came}(m + l) \lor \text{came}(m + j) \lor \text{came}(l + j) \lor \text{came}(m + l + j) \)
c. \( [\text{Mark ka Luke ga kita}] = \text{came}(m) \lor \text{came}(l) \)

These assumptions allow us to account for the plural and singular contrast between (i) \( A \text{ to } B \) and (ii) \( A \text{ ya } B \) and \( A \text{ ka } B \), illustrated in (29). Since in the situation mentioned above, (29a), (29b), and (29c) are represented as (40a), (40b), and (40c) at SR, respectively, it is expected that with (29b) and (29c), Mary offers tea if one of Mark and Luke comes.

(40) a. \( \forall w' (wRw' \land (\text{come}(m + l) \text{ in } w') \rightarrow \text{Mary offers tea in } w') \)
b. \( \forall w' (wRw' \land ((\text{come}(m) \lor \text{come}(l) \lor \text{come}(m + l) \lor \text{come}(m + j) \lor \text{come}(l + j) \lor \text{come}(m + l + j)) \text{ in } w') \rightarrow \text{Mary offers tea in } w') \)
c. \( \forall w' (wRw' \land ((\text{come}(m) \lor \text{come}(l)) \text{ in } w') \rightarrow \text{Mary offers tea in } w') \)

The observation made with (33b) that \( A \text{ ya } B \) may have the plural and singular statuses at the same time is also captured, for in the situation mentioned above, (33b) is represented as (41) at SR.

(41) \( \exists w' (wRw' \land (\text{come}(m) \lor \text{come}(l) \lor \text{come}(m + l) \lor \text{come}(m + j) \lor \text{come}(l + j) \lor \text{come}(m + l + j)) \text{ in } w') \)

In explaining the fact that for (28b) to be true, it must be the case that both Mark and Luke came, Hayashishita & Bekki (2011) appeals to pragmatics. They assume that the speaker may utter a sentence whose SR consists of two or more conjuncts joined with disjunctions with a view to conveying the propositional meaning corresponding to one of those conjuncts. And this is allowed because of pragmatic necessity. According to them, (28b) is one such case. In the situation where the singular-individuals of the domain of consideration is Mark, Luke, and John, (28b) is understand to mean the proposition corresponding to \( \text{came}(m + l + j) \). That is because uttering (28b) is the only way for the speaker to be able to convey the very proposition without unveiling the identity of John.
3.3. The denotation of quantity nominal expressions

What is of interest to us is that the Japanese quantity nominal expressions which we saw support inverse-scope taking above can be conjoined with an individual-denoting expression like *Naomi* using any of the three types of conjunctions. I give a partial illustration in (42)-(43).

(42) a. Mary wa [Naomi to sannin no otokonoko] ga kita ra, ocha o dasu.
   Mary TOP Naomi three GEN boy NOM come if tea ACC serve
   ‘(Lit.) If [Maomi to three boys] come, Mary offers tea.’

b. Mary wa [Naomi ya sannin no otokonoko] ga kita ra, ocha o dasu.
   ‘(Lit.) If [Naomi ya three boys] come, Mary offers tea.’

c. Mary wa [Naomi ka sannin no otokonoko] ga kita ra, ocha o dasu.
   ‘(Lit.) If [Naomi ka three boys] come, Mary offers tea.’

(43) a. Mary wa [subete no otokonoko to Naomi] ga kita ra, ocha o dasu.
   Mary TOP all GEN boy Naomi NOM come if tea ACC serve
   ‘(Lit.) If [all boys to Naomi] come, Mary offers tea.’

b. Mary wa [subete no otokonoko ya Naomi] ga kita ra, ocha o dasu.
   ‘(Lit.) If [all boys ya Naomi] come, Mary offers tea.’

c. Mary wa [subete no otokonoko ka Naomi] ga kita ra, ocha o dasu.
   ‘(Lit.) If [all boys ka Naomi] come, Mary offers tea.’

Furthermore, if we treat them as individuals, in particular sums of singular-individuals, the resulting sentence meanings are just as we expect. In the situation where the singular-individuals in the domain of consideration are Naomi, Ruth, Mark, Luke, and John, (42a), (42b), and (42c) are, for example, represented as (44a), (44b), and (44c) at SR, respectively.

(44) a. $\forall w'(wRw' \land (\text{come}(n + m + l + j) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$

b. $\forall w'(wRw' \land ((\text{come}(n) \lor \text{come}(m + l + j) \lor \text{come}(n + r) \lor \text{come}(m + l + j + r) \lor \text{come}(n + m + l + j) \lor \text{come}(n + m + l + j + r)) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$

c. $\forall w'(wRw' \land ((\text{come}(n) \lor \text{come}(m + l + j)) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$

It is thus expected that with (42a), for Mary to offer tea, Naomi, Mark, Luke, and John all need to come, but with (42b) and (42c), Mary offers tea both when Naomi comes alone and when Mark, Luke, and John come without Naomi.

Based on the above discussion, I conclude that the quantity nominal expressions that support inverse-scope taking can be analyzed as sums of singular-individuals. In designing the analysis of inverse scope readings in Section 4, I will build on this conclusion. In particular, I will assume that when a given sentence gives rise to an inverse scope reading, all of the quantity nominal expressions that occur as major constituents in the sentence are so analyzed. We will see the evidence for this assumption in Section 5. I note
that once this assumption is adopted, the observation in Section 2.1 – so-called negative quantifiers cannot support inverse-scope taking – is no longer surprising, as it is reasonable that they are not analyzed as individuals.

4. The analysis of inverse scope readings

The assumption that when a given sentence gives rise to an inverse scope reading, all of the quantity nominal expressions occurring as major constituents in the sentence are analyzed as sums of singular-individuals naturally leads us to the question of how a given nominal expression whose denotation is a sum of singular-individuals can take scope over another nominal expression. In what follows, I will answer this question, spelling out my analysis of inverse scope readings.

Recall that the context in (24) facilitates the detection of an inverse scope reading in the sentences of (11) and of (13). (24), (11), and (13) are repeated here for convenience.

(24) The conference organization committee would like to know which abstracts were read by three reviewers. You check the abstracts one by one. Did Abstract #1 get reviewed by three reviewers? How about Abstract #2? And so on. You then report to the committee, saying …

(11) a. Three reviewers read Abstract #1 and Abstract #2.
   b. Three reviewers read every abstract.
   c. Three reviewers read many abstracts.
   d. Three reviewers read two abstracts.
   e. Three reviewers read exactly two abstracts.
   f. Three reviewers read more than two abstracts.

(13) a. Sannin no sinsain ga Abusutorakuto #1 to Abusutorakuto #2 o sadokusita.
   ‘Three reviewers read Abstract #1 and Abstract #2.’
   b. Sannin no sinsain ga subete no abusutorakuto o sadokusita.
   ‘Three reviewers read every abstract.’
   c. Sannin no sinsain ga takusan no abusutorakuto o sadokusita.
   ‘Three reviewers read many abstracts.’
   d. Sannin no sinsain ga hutatu no abusutorakuto o sadokusita.
   ‘Three reviewers read two abstracts.’
   e. Sannin no sinsain ga tyoodo hutatu no abusutorakuto o sadokusita.
   ‘Three reviewers read exactly two abstracts.’
   f. Sannin no sinsain ga hutatu izyoo no abusutorakuto o sadokusita.
   ‘Three reviewers read two or more abstracts.’
In building the analysis of inverse scope readings, I take this observation to be indicative. Suppose that the abstracts that have the relevant property are only Abstract #1 and Abstract #2. One straightforward way to respond to the committee’s inquiry would be to name Abstract #1 and Abstract #2. Considering an utterance solely consisting of a major constituent of a sentence as an elliptical form of the sentence (cf. Merchant 2005), we may assume that in this situation, one straightforward way to respond to the committee’s inquiry is to utter the sentences in (45).

(45)  a. Three reviewers read Abstract #1.
    b. Three reviewers read Abstract #2.

Given this assumption, my explanation of why the context in (24) facilitates the detection of an inverse scope reading with (11a) is as follows. The context in (24) contributes to the emergence of the two sentences, (45a) and (45b), and facilitates the speaker to use (11a) as a shorthand way of expressing them. Since the conjunction of the meanings of (45a) and (45b) (i.e., (46)), becomes logically equivalent to the inverse scope reading for (11a) (i.e., (47)), (24) facilitates the detection of an inverse scope reading with (11a).

(46)  \[
\text{read}(x, a\#1) \land \text{read}(x, a\#2), \text{where } x \in \{x \mid \exists X X \subseteq \text{reviewer} \land |X| = 3: \exists X X \subseteq \text{reviewer} \land |X| = 3: \}
\]

(47) \[
\forall y (y \in Y (Y = \{a\#1, a\#2\})) \text{read}(x, y), \text{where } x \in \{x \mid \exists X X \subseteq \text{reviewer} \land |X| = 3: \}
\]

We can also conceive that the speaker may choose to utter (11d) instead of (11a) for a pragmatic reason – e.g., the hearer does not know what Abstract #1 and Abstract #2 refer to. In other words, we can reasonably consider that (11d) can also be a shorthand form of (45a) and (45b). If the domain includes two and only two abstracts, namely, Abstract #1 and Abstract #2, the addition of (45a) and (45b) becomes logically equivalent to the inverse scope reading of (11d). It is thus expected that the context in (24) facilitates the detection of an inverse scope reading with (11d) as well. Furthermore, in the context of (24), if the matter of exactly two abstracts being read by three reviewers is equally important, the speaker may use (11e) instead of (11d) or (11a) as a shorthand form of (45a) and (45b). It is thus consistent that the context in (24) facilitates the detection of an inverse scope reading with (11e). With a similar reasoning, we can explain away why the context in (24) facilitates the detection of an inverse scope reading with the rest of sentences in (11), and with the sentences in (13).

To incorporate this line of thinking, as the architecture of grammar I propose the model in (5), where syntax^S stands for the sentence-level syntax and syntax^D for the discourse-level syntax. (5) is repeated here for convenience.

(5) \[
\text{syntax}^S \rightarrow S_1 \rightarrow \text{syntax}^D \rightarrow S \quad \text{syntax}^S \rightarrow S_2 \rightarrow \text{syntax}^D \rightarrow S \quad \text{....}
\]

\[
\text{syntax}^S \rightarrow S_n
\]
I assume syntax\textsuperscript{S} to be the system which Chomsky (1995) postulates. While I leave open the detailed description of syntax\textsuperscript{D} to my future work, I maintain two points here. (i) The meaning of S in (5) is the conjunction of $[S_1] \ldots [S_n]$. (ii) The operation that conjoins them is an operation in syntax\textsuperscript{D}, and it is constrained in such a way that (48) holds, where $A$ is a sum of singular-individuals.

\begin{equation}
\text{SHORTHAND}
\end{equation}

Let $S$ be an utterance containing a nominal expression $\alpha$, and $A$ is the extension of $\alpha$.

The speaker may utter $S_i$ in place of uttering $S'_1, \ldots, S'_n$ where $n$ is an arbitrary number, iff (i) $S'_1, \ldots, S'_n$ are identical to $S$ at SR except that $\alpha$ in $S$ is replaced with an expression denoting a part of $A$, (ii) $A$ has $n$ parts, and (iii) $S'_1, \ldots, S'_n$ are distinct.

This analysis of inverse scope readings makes it possible for a nominal expression denoting a sum of singular-individuals to take wide scope with respect to another nominal expression, and is thus able to incorporate the assumption that when a given sentence gives rise to an inverse scope reading, all of the quantity nominal expressions that occur as major constituents of the sentence are analyzed as sums of singular-individuals.

This analysis also accounts for all the other characteristics of inverse scope readings, which we have observed in Section 2. Let me explain this, starting with the generalization in (22), repeated here.

\begin{equation}
\text{Inverse scope readings are possible only when the following condition is met:}
\end{equation}

When the relevant object expression $\alpha$ is interpreted, there is one and only one group of objects that can possibly be the extension of $\alpha$.

(22) follows as long as the discourse-level syntax ensures (48). To check if the condition (i) in (48) is satisfied, the speaker needs to know what $A$ is; thus, if there is more than one candidate for $A$, he/she cannot proceed to do the checking.

I have been assuming that when a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions that occur as major constituents of the sentence are analyzed as an individual, in particular, a sum of singular-individuals. If we state the intuition recorded in (22) in terms of this assumption, and generalize the distribution of inverse scope readings as in (49), we are led to an interesting prediction.

\begin{equation}
\text{Inverse scope readings are possible only when the following condition is met:}
\end{equation}

When the relevant object expression $\alpha$ is interpreted, there is one and only one individual that can possibly be the extension of $\alpha$.

Recall that according to Hayashishita & Bekki’s (2011) proposal, which we have adopted above, we have (37a) and (37b), repeated here.

\begin{equation}
a. \; [A \text{ to } B] = \{a + b \mid a \in [A], \; b \in [B]\}
\end{equation}
b. \([A \text{ ya } B] = \{x \mid a \leq x, a \in \max([A])\} \cup \{y \mid b \leq y, b \in \max([B])\}\)

where \(\max(S)\) is a set of maximal elements in \(S\),

i.e., \(\max(S) = \{x \mid x \in S, \forall y (y \in S \land x \leq y \rightarrow y = x)\}\)

For \(A\) to \(B\), it is always the case that there is one and only one individual that can possibly its extension, namely \(a + b\). On the other hand, for \(A\) \text{ ya } \(B\), there are always three or more candidates – \(a, b,\) and \(a+b\) are always included. We are thus led to predict that \(A\) to \(B\) supports inverse-scope taking while \(A\) \text{ ya } \(B\) does not.

This prediction is indeed borne out. For example, (50a) can give rise to an inverse scope reading while (50b) cannot.

    hoka no gakusei wa dono kyoozyu kara mo suisen o ukenakatta.
    ‘(Lit.) Three or more professors recommended [Luke to Mark], but the other
    students received no recommendations from any professors.’

    hoka no gakusei wa dono kyoozyu kara mo suisen o ukenakatta.
    ‘(Lit.) Three or more professors recommended [Luke ya Mark], but the other
    students received no recommendations from any professors.’

The first clause of (50a) can be taken to mean that each of Luke and Mark was recommended by three or more professors; but we cannot associate the first clause of (50b) with the reading that each individual including Luke and Mark received recommendation from three or more professors.

Similarly, with respect to the availability of inverse scope readings, (51a) contrasts with (51b).

(51) a. Sanninizyoo no kyoozyu ga [hutari no zyogakusei to Mark] o suisensita ga
    hoka no gakusei wa dono kyoozyu kara mo suisen o ukenakatta.
    ‘(Lit.) Three or more professors recommended [two female students to Mark],
    but the other students received no recommendations from any professors.’

    b. Sanninizyoo no kyoozyu ga [hutari no zyogakusei ya Mark] o suisensita ga
    hoka no gakusei wa dono kyoozyu kara mo suisen o ukenakatta
    ‘(Lit.) Three or more professors recommended [two female students ya Mark],
    but the other students received no recommendations from any professors.’

We can take the first clause of (51a) to mean that for each of the two female students and Mark, there are three or more professors who recommended him/her, but the first clause of (51b) cannot be understood to mean that each individual including the two female students and Mark was recommended by three or more professors.

With the proposed analysis of inverse scope readings, we can also explain the observation in Section 2.2, which is repeated here.
(15) a. Unless the relevant object expression is a so-called negative quantifier, speakers’ acceptability judgments on inverse scope readings vary.

b. Informants are more likely to detect an inverse scope reading with the relevant object expression being *every NP or A and B* than with the expression being *many NP*, a bare numeral, or a modified numeral. Among the latter three, modified numerals are the least likely ones to support inverse-scope taking.

The emergence of inverse scope readings requires a set of two or more sentences, for which the speaker constructs a shorthand form. In other words, to detect an inverse scope reading, the speaker needs to imagine a context like the one in (24), which allows him/her to think of two or more sentences. As I noted in Section 2.4, in linguistics experiments, informants are usually presented sentences without any provision of context. Thus, it is conceivable that some speakers can come up with a necessary context on their own while the other cannot, leading us to expect (15a).

(15b) is also accounted for. Depending on the nominal expression we use as the relevant object expression, the necessary condition for inverse scope readings stated in (49) may not be satisfied without the aid of discourse narrowing down the domain of individuals. Let me explain this point with English expressions. (I assume that like those in Japanese, the quantity nominal expressions in English excluding so-called negative quantifiers can be analyzed as sums of singular-individuals in effect.) In approximation, we may assume that the object expressions of the sentences in (11) are characterized as (52).

(52) a. \([\text{Abstract #1 and Abstract #2}]=\{a_{\text{#1}} + a_{\text{#2}}\}\)

b. \([\text{every abstract}]=\{x \mid \exists X \text{abstract}: x = \bigcup X\}\)

c. \([\text{many abstracts}]=\{x \mid \exists X \text{abstract} \land |X| = k: x = \bigcup X\},\) where \(k\) is considered to be large in the relevant context

d. \([\text{two abstracts}]=\{x \mid \exists X \subseteq \text{abstract} \land |X| = 2: x = \bigcup X\}\)

e. \([\text{exactly two abstracts}]=\{x \mid \exists X \subseteq \text{abstract} \land |X| = 2: x = \bigcup X\}\)

f. \([\text{more than two abstracts}]=\{x \mid \exists X \subseteq \text{abstract} \land |X| > 2: x = \bigcup X\}\)

As the extensions of *Abstract #1 and Abstract #2* and *every abstract*, we have one and only one possibility – \(a_{\text{#1}} + a_{\text{#2}}\) and the sum of all the abstract individuals in the domain, respectively. On the other hand, depending on the domain content, the extensions of *many abstracts, two abstracts, exactly two abstracts, and more than two abstracts* may have more than one candidate. Suppose that the domain of consideration contains eight abstracts, and seven is considered to be many while six is not. Then, as the extension of *many abstracts*, there are eight candidates. In the same situation, the extensions of *two abstracts* and *exactly two abstracts* would allow \((8 \times 7) / 2 = 28\) possibilities, and the extension of *more than two abstracts* 56 possibilities. Given that *every NP and A and B* meet the necessary condition of inverse scope readings without the aid of discourse narrowing down the domain of individuals while *many NP*, bare numerals, and modified
numerals do not, we naturally expect that more speakers detect an inverse scope reading when the relevant object expression is of the former than when it is of the latter.

For *many NP* and bare numerals to satisfy the necessary condition stated in (49), what discourse needs to do is simply to restrict the domain of individuals so that we only consider a certain group of individuals. In the situation where seven is considered to be many while six is not, the extension of *many abstracts* allow one and only one possibility if discourse plays a role in such a way that the domain of consideration contains seven and only seven abstracts. Similarly, *two abstracts* meets the necessary condition, as long as the domain of consideration includes two and only two abstracts. But modified numerals need more. They need additional contextual information that justifies the speaker to use them in place of bare numerals. For example, when the speaker detects an inverse scope reading with (11e), he/she needs to ‘refer to’ a sum of two abstract individuals with *exactly two abstracts*; thus, the speaker needs to imagine a context that justifies him/her to use *exactly two abstracts* in place of *two abstracts*. Similarly, with (11f), in ‘referring to’ a sum of three abstract individuals, for example, the speaker needs a context to justify him/her to use *more than two abstracts* instead of *three abstracts*. In short, to give rise to an inverse scope reading, modified numerals need more contextual information than *many NP* and bare numerals do. It is thus expected that less speakers detect an inverse scope reading when the relevant object expression is a modified numeral. Hence, (15b) is expected to hold.

5. Further confirmation

This section provides further confirmation for the line of thinking I pursued above. In Sections 3 and 4, I have maintained that all the quantity nominal expressions excepting so-called negative quantifiers can be analyzed as sums of singular-individuals; in particular, when a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions that occur as major constituents of the sentence are so analyzed. I confirm this assumption below in Section 5.1. This assumption leads us to the question of how inverse scope readings obtain – how a given nominal expression analyzed as a sum of singular-individuals can take wide scope with respect to another nominal expression. In response to this question, I proposed above that a given sentence can be a shorthand form of two or more sentences (henceforth the shorthand strategy). Section 5.2 presents one set of generalization, which we can nicely explain if we assume that the inverse scope reading emerges via the shorthand strategy. The characteristic of the shorthand strategy identified in Section 5.2, together with the assumption that when a sentence gives rise to an inverse scope reading, the quantity nominal expressions in the sentence are analyzed as sums of singular-individuals, leads us to a particular prediction. Section 5.3 verifies this prediction, further confirming the line of thinking the paper advocates.

5.1. So-called negative quantifiers and inverse scope readings

Recall that in explaining the generalization that so-called negative quantifiers do not support inverse-scope taking, I have adopted two assumptions: (i) when a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions that occur as
major constituents of the sentence are analyzed as sums of singular-individuals and (ii) so-called negative quantifiers are not analyzed as sums of singular-individuals. These two assumptions lead us to a generalization which goes beyond the original one. That is, a given sentence does not give rise to an inverse scope reading if it contains a so-called negative quantifier as a major constituent. As we see directly, this generalization seems to hold.

First, as Sato (2003) points out, when a so-called negative quantifier is the subject of a sentence, its clause-mate object cannot take wide scope with respect to it. For example, neither (53a) nor (53b) can give rise to an inverse scope reading, contrasting with (53c).

(53)  a. No students read every book.
       b. Few students read every book.
       c. A few students read every book.

(53a) is understood to mean that there are no students who read each book; however, it cannot mean that for each book, there are no students who read it (i.e., no books were read by any students). Similarly, (53b) is understood to mean that there are not many students who read each book, but it cannot mean that for each book, there are not many students who read it. By contrast, the inverse scope reading obtains in (53c); (53c) can be taken to mean that for each book, there are a few students who read it.11

Second, inverse scope readings are not possible also when a so-called negative quantifier appears as a clause-mate of the relevant subject and object nominal expressions. For example, (54a) and (54b) contrasts with (54c) in that every student cannot take scope above some teachers.

(54)  a. Some teachers introduced every student to no companies.
       b. Some teachers introduced every student to few companies.
       c. Some teachers introduced every student to a few companies.

(54a) is understood to mean that there are some teachers who did not introduce any student to any company, but we cannot take (54a) to mean that for each student, there are some teachers who introduced him/her to no companies. Similarly, (54b) does not give rise to an inverse scope reading; it cannot mean that for each student, there are some teachers who introduced him/her to not many companies. By contrast, we can take (54c) to mean that for each student, there are some teachers who introduced him/her to a few companies.

The situation is similar with (55). With (55a) and (55b) every company cannot take wide scope with respect to some teachers, but with (55c) it can.

(55)  a. Some teachers introduced no students to every company.
       b. Some teachers introduced few students to every company.
       c. Some teachers introduced a few students to every company.
To the extent that the assumption of so-called negative quantifiers being unable to be analyzed as a sum of singular-individuals is correct, the empirical materials considered in this section serve as evidence for the thesis that when a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions that occur as major constituents of the sentence are analyzed as sums of singular-individuals.12

5.2. No more than one instance of inverse-scope taking per clause

Let me now introduce a generalization which we can explain away if we assume that the inverse scope reading emerges via the shorthand strategy. I maintain that (56) holds.

(56) No more than one instance of inverse-scope taking is allowed per clause.

For example, (57) allows us to verify that there is only one non-subject nominal expression can take wide scope respect to its clause-mate subject expression.

(57) Some teachers introduced John and Bill to Toyota and Nissan.

In this sentence, if John and Bill takes wide scope with respect to some teachers, each of John and Bill must be introduced to both Toyota and Nissan. Similarly, if Toyota and Nissan takes wide scope with respect to some teachers, to Toyota and Nissan each, both John and Bill must be introduced.

The same point can be illustrated with the examples in (58).

(58) a. Some teachers introduced two students to Toyota and Nissan.
    b. Some teachers introduced John and Bill to two companies.

With (58a), if two students takes wide scope with respect to some teachers, each of the students must be introduced to both Toyota and Nissan. Similarly, with (58b), if two companies takes wide scope with respect to some teachers, to each of the companies, both John and Bill need to be introduced.

As I demonstrate directly, the generalization in (56) follows from the assumption that the inverse-scope taking is possible only via the shorthand strategy. Recall that to constrain which set of sentences a given sentence can be a shorthand form of, I proposed that the discourse-level syntax ensures (48), repeated here.

(48) SHORTHAND

Let $S$ be an utterance containing a nominal expression $\alpha$, and $A$ is the extension of $\alpha$.

The speaker may utter $S$, in place of uttering $S'_1, \ldots, S'_n$ where $n$ is an arbitrary number, iff (i) $S'_1, \ldots, S'_n$ are identical to $S$ at SR except that $\alpha$ in $S$ is replaced with an expression denoting a part of $A$, (ii) $A$ has $n$ parts, and (iii) $S'_1, \ldots, S'_n$ are distinct.
While (48) is stated for cases where a given sentence is a shorthand form of two or more sentences with respect to one nominal expression, (48) indirectly rules out all cases where a given sentence is a shorthand form with respect to more than one nominal expression. For an illustration of the point, consider (59).

(59) Prof. Smith introduced John and Bill to Toyota and Nissan.

If (59) is a shorthand form only with respect to John and Bill, it is a shorthand form of (60a) and (60b).

(60) a. Prof. Smith introduced John to Toyota and Nissan.
   b. Prof. Smith introduced Bill to Toyota and Nissan.

Similarly, if (59) is a shorthand form only with respect to Toyota and Nissan, it is a shorthand form of (61a) and (61b).

(61) a. Prof. Smith introduced John and Bill to Toyota.
   b. Prof. Smith introduced John and Bill to Nissan.

However, if (59) were a shorthand form with respect to both John and Bill and Toyota and Nissan, there would be more than one candidate for which it is a shorthand form; the speaker would have trouble identifying for which set of sentences (59) serves as a shorthand form, (62) or (63).13

(62) a. Prof. Smith introduced John to Toyota.
   b. Prof. Smith introduced Bill to Nissan.

(63) a. Prof. Smith introduced John to Nissan.
   b. Prof. Smith introduced Bill to Toyota.

We are thus led to conclude that the shorthand strategy is possible only with respect to one nominal expression. Hence, if we assume that the inverse-scope taking is made possible only via the shorthand strategy, the generalization in (56) is explained away.

5.3. Freezing effects

I have argued that when an inverse scope reading obtains in a sentence, all the quantity nominal expressions that occur as major constituents of the sentence are analyzed as sums of singular-individuals, and as the way for a nominal expression denoting a sum of singular-individuals to take scope over another nominal expression, I proposed that a given sentence can be a shorthand form of two or more sentences. Given the characteristic of the shorthand strategy demonstrated above – the strategy is possible with respect to one and only one nominal expression, we are thus led to predict that when one object nominal expression takes wide scope with respect to its clause-mate subject, the latter
cannot take scope. As Hayashishita (2004) demonstrates, such is indeed the case – in that situation, the relevant subject nominal expression cannot take scope over another nominal expression or bind its dependent term. Hayashishita (2004) refers to the loss of the scope-taking ability of a given nominal expression as freezing effects.

5.3.1. Freezing effects on scope

Hayashishita (2004) demonstrates that when an object nominal expression takes wide scope with respect to its clause-mate subject, the latter cannot take wide scope with respect to another nominal expression. For example, we can detect an inverse scope reading with (64a) and a surface scope reading with (64b).

(64)  a. (Based on Hayashishita 2004:Ch.2 [20])
    Sannin no kyoozyu ga rei no hutari no gakusei o kaisya ni
    three GEN professor NOM the GEN two GEN student ACC company DAT
    suisensita.
    recommended
    ‘Three professors recommended the two students under discussion to
    companies.’

    b. (Based on Hayashishita 2004:Ch.2 [21])
    Sannin no kyoozyu ga John o hutatu no kaisya ni suisensita.
    three GEN professor NOM John ACC two GEN company DAT recommended
    ‘Three professors recommended John to two companies.’

However, the two wide scope readings, which we have just observed in isolation, cannot co-occur with each other. With (65), when the direct object scopes above the subject, the subject cannot take wide scope with respect to the indirect object, and conversely, when the subject scopes above the indirect object, the direct object cannot take wide scope with respect to the subject.

(65)    (Based on Hayashishita 2004:Ch.2 [22])
    Sannin no kyoozyu ga rei no hutari no gakusei o hutatu no kaisya ni
    three GEN professor NOM the GEN two GEN student ACC two GEN company DAT
    suisensita.
    recommended
    ‘Three professors recommended the two students under discussion to
    two companies.’

When the direct object takes wide scope with respect to the subject, the available reading is not (66a), but (66b).

(66)  a. \( \forall y (y \in Y \land |Y| = 2)) \exists x (X \subseteq \text{professor} \land |X| = 3) \forall x (x \in X) \exists z (Z \subseteq \text{company} \land |Z| = 2) \forall z (z \in Z) [x \text{ recommended } y \text{ to } z]]

    b. \( \forall y (y \in Y \land |Y| = 2)) \exists x (X \subseteq \text{professor} \land |X| = 3) \exists Z (Z \subseteq \text{company} \land |Z| = 2) \forall x (x \in X) \exists z (z \in Z) [x \text{ recommended } y \text{ to } z] \land \forall z (z \in Z) \exists x (x \in X) [x \text{ recommended } y \text{ to } z]]}
(66a) and (66b) are truth-conditionally distinguished; (66a) is true in both (67) and (68) while (66b) is true only in (68). The fact that (65) is true only in (68) thus further confirms the reported intuition.

(67) Elena and Victoria are the students under discussion.

For Elena, Professor A recommended her to Companies 1 & 2, Professor B to Companies 2 & 3, and Professor C to Companies 3 & 4.

For Victoria, Professor D recommended her to Companies 4 & 5, Professor E to Companies 5 & 6, and Professor F to Companies 6 & 7.

(68) Elena and Victoria are the students under discussion.

For Elena, Professor A recommended her to Companies 1 & 2, Professor B to Company 2, and Professor C to Company 1.

For Victoria, Professor D recommended her to Companies 3 & 4, Professor E to Company 3, and Professor F to Company 4.

Altering the linear order between the direct object and the indirect object in (65) as in (69) does not change the factual assessment. Like in (65), when the direct object takes wide scope with respect to the subject in (69), the available interpretation is not (66a), but (66b).

(69) (Based on Hayashishita 2004:Ch.2 [27])

Sannin no kyoozyu ga hutatsu no kaisya ni rei no hutari no gakusei o three GEN professor NOM two GEN company DAT the GEN two GEN student ACC suisensita.

recommended

‘Three professors recommended the two students under discussion to two companies.’

The fact that (65) and (69) cannot give rise to (66a) should not be dismissed since the reading itself is possible in minimally different constructions. The interpretation under discussion is available, for example, in (70a), their niyotte-passive counterpart, and in (70b), their scrambling construction counterpart.

(70) a. (Based on Hayashishita 2004:Ch.2 [28])

Rei no hutari no gakusei ga sannin no kyoozyu niyotte hutatsu no kaisya ni the GEN two GEN student NOM three GEN professor by two GEN company DAT suisens-are-ta.

recommend-PASSIVE-PAST

‘The two students under discussion were recommended to two companies by three professors.’

b. Rei no hutari no gakusei o sannin no kyoozyu ga hutatsu no kaisya ni the GEN two GEN student ACC three GEN professor NOM two GEN company DAT
suisensita.
recommended
‘(Lit.) The two students under discussion, three professors recommended to two
companies.’

As Hayashishita (2004) points out, surface scope readings contrast with inverse
scope readings, not showing freezing effects on scope. When a subject nominal expression
takes wide scope with respect to its clause-mate object, the latter can still take wide
scope with respect to another object nominal expression. For example, observe that the
subject can take wide scope with respect to the indirect object in (71a) and the indirect
object can take scope above the direct object in (71b).

(71) (= Hayashishita 2004:Ch.2 [32])
a. Maitosi takusan no kyoozyu ga gonin no gakusei ni Toyota o suisensuru.
every:year many GEN professor NOM five GEN student DAT Toyota ACC recommend
‘Each year, many professors recommend Toyota to five students.’
b. Maitosi Kimura kyoozyu ga gonin no gakusei ni hutatu no kaisya o
every:year Kimura professor NOM five GEN student DAT two GEN company ACC
recommend
‘suisensuru.’
‘Each year, Prof. Kimura recommends two companies to five students.’

Furthermore, the two instances of wide scope readings can occur simultaneously; (72)
can be taken to mean (73).

(72) (= Hayashishita 2004:Ch.2 [33])
Maitosi takusan no kyoozyu ga gonin no gakusei ni hutatu no kaisya o
every:year many-GEN professor-NOM five-GEN student-DAT two-GEN company-ACC
suisensuru.
recommend
‘suisensuru.’
‘Each year, many professors recommend two companies to five students.’

(73) \[ \exists X \left( X \subseteq \text{professor} \land \left| X \right| \geq k \right) \forall x \left( x \in X \right) \left( \exists Y \left( Y \subseteq \text{student} \land \left| Y \right| = 5 \right) \forall y \left( y \in Y \right) \left( \exists Z \left( Z \subseteq \text{company} \land \left| Z \right| = 2 \right) \forall z \left( z \in Z \right) \left[ x \text{ recommends } z \text{ to } y \right] \right) \],
where \( k \) is a positive integer considered to be large in the relevant context.

5.3.2. Freezing effects on binding

Hayashishita (2004) also demonstrates that when an object nominal expression takes
wide scope with respect to its clause-mate subject, the latter cannot bind a dependent
term. For example, as we can observe, in (74a) the direct object can take wide scope with
respect to the subject.

(74) a. (Based on Hayashishita 2004:Ch.2 [38])
Mittu no ginkoo ga rei no hutatu no kaisya o torihikisaki ni
three GEN bank NOM the GEN two GEN company ACC customer DAT
syookaisita.
introduced
‘Three banks introduced the two companies under discussion to customers.’

b. (Based on Hayashishita 2004:Ch.2 [39])
Mittu no ginkoo ga Toyota o soko no torihikisaki ni syookaisita.
three GEN bank NOM Toyota ACC that:place GEN customer DAT introduced
‘Three banks introduced Toyota to its customers.’

In addition, (74b) can be taken to mean there are three banks such that each of the banks introduced Toyota to its customer; thus, we understand that bound variable anaphora can be established between mittu-no ginkoo 'three banks' and soko 'that place'. Note that the anaphoric relation under discussion cannot be that of co-reference, for soko 'that place' is singular-denoting while mittu-no ginkoo 'three banks' is not. However, the instances of wide scope reading and bound variable anaphora, which we have observed in isolation, cannot co-occur with each other. This is illustrated in (75).

(75) (Based on Hayashishita 2004:Ch.2 [40])
Mittu no ginkoo ga rei no hutatu no kaisya o soko no torihikisaki
three GEN bank NOM the GEN two GEN company ACC that:place GEN customer
ni syookaisita.
DAT introduced
‘Three banks introduced the two companies under discussion to their customers.’

When the wide scope reading of the direct object over the subject obtains, the available reading is not (76a), but (76b). In fact, (75) cannot be true in (77).

(76) a. \( \forall y \ (y \in \{Y \subseteq \text{company} \land \mid Y \mid = 2\}) \ [\exists X (X \subseteq \text{bank} \land \mid X \mid = 3) \ \forall x (x \in X) \ [x \text{ introduced } y \text{ to } x \text{'s customer}]] \)

b. \( \forall y \ (y \in \{Y \subseteq \text{company} \land \mid Y \mid = 2\}) \ [\exists X (X \subseteq \text{bank} \land \mid X \mid = 3) \ \forall x (x \in X) \ [x \text{ introduced } y \text{ to } a \text{'s customer}]], \text{ where } a \text{ is an individual salient in the relevant context} \)

(77) Toyota and Nissan are the two companies under discussion. There are six banks, A, B, C, D, E, and F. For Toyota, A introduced it to A's customer, B to B's customer, and C to C's customer. For Nissan, D introduced it to D's customer, E to E's customer, and F to F's customer.

As the alternation of the linear order between the direct and indirect objects did not erase freezing effects on scope, the change of the linear order as in (78) also does not eliminate freezing effects on binding. That is, like (75), (78) cannot give rise to the reading in (76a); it must be taken to mean (76b).

(78) (Based on Hayashishita 2004:Ch.2 [43])
Mittu no ginkoo ga soko no torihikisaki ni rei no hutatu no kaisya
three GEN bank NOM that:place GEN customer DAT the GEN two GEN company o syookaisita.
ACC introduced
'Three banks introduced the two companies under discussion to their customers.'

The fact that (75) and (78) cannot give rise to the reading in (76a) is noteworthy, since (79a), their niyotte-passive counterpart, and (79b), their scrambling construction counterpart, allow the interpretation under discussion.\textsuperscript{16, 17}

(79) a. (Based on Hayashishita 2004:Ch.2 [44])
Rei no hutatu no kaisya ga mittu no ginkoo niyotte soko no
the GEN two GEN company ACC three GEN bank by that:place GEN
torihikisaki ni syookais-are-ta.
customer DAT introduce-PASSIVE-PAST
'The two companies under discussion were introduced to their customers by three banks.'

b. Rei no hutatu no kaisya o mittu no ginkoo ga soko no torihikisaki
the GEN two GEN company ACC three GEN bank NOM that:place GEN
customer ni syookaisita.
DAT introduced
'\text{(Lit.) The two companies under discussion, three banks introduced to their customers.}'

As Hayashishita (2004) points out, surface scope readings contrast with inverse scope readings also in terms of freezing effects on binding. For example, (80a) allows the subject to take wide scope with respect to the indirect object, and (80b) permits the indirect object to bind \textit{soko} 'that place'.

(80) (Based on Hayashishita 2004:Ch.2 [48])

a. Hutatuizyoo no ginkoo ga itutu no zidoosyagaissya ni Toyota no
two:more GEN bank NOM five GEN automobile:company DAT Toyota GEN
kranrengaisy o syookaisita.
related:company ACC introduced
'Two or more banks introduced Toyota's related company to five automobile companies.'

b. Sumitomo ginkoo ga itutu no zidoosyagaissya ni soko no
Sumitomo bank NOM five GEN automobile:company DAT that:place GEN
kranrengaisy o syookaisita.
related:company ACC introduced
'Sumitomo Bank introduced their related company to five automobile companies.'

Furthermore, the wide scope reading and the bound variable anaphora under discussion can co-occur with each other; (81) can be taken to mean (82).
(81) (Based on Hayashishita 2004:Ch.2 [49])
Hutatuzyoo no ginkoo ga itutu no zidoosyagaisya ni soko no two:more GEN bank NOM five:more GEN automobile:company DAT that:place GEN kanren gaisya o syookaisita.
related:company ACC introduced
‘Two or more banks introduced their related company to five automobile companies.’

(82) \[ \exists X (X \subseteq \text{bank} \land |X| \geq 2) \forall x (x \in X) \left[ \exists Y (Y \subseteq \text{automobile company} \land |Y| = 5) \forall y (y \in Y) [x \text{ introduced } y's \text{ related company to } y] \right] \]

As I noted at the outset of this section, the freezing effects we have just observed are expected once we assume that when an inverse scope reading obtains in a sentence, all the quantity nominal expressions occurring as major constituents of the sentence are analyzed as sums of singular-individuals, and that nominal expressions denoting a sum of singular-individuals may take scope only via the shorthand strategy. I thus take the empirical materials presented in this section as further confirming the analysis of inverse scope readings I advocated above.

6. The analysis of surface scope readings and its implications

Up to this point, we have been examining inverse scope readings. In this section I comment on surface scope readings. Let me first list the characteristics of surface scope readings we have observed so far.

(83) a. Surface-scope taking is possible with all the quantity nominal expressions we have considered, including so-called negative quantifiers (see Section 2.1).

b. There is no variation among speakers’ judgments on the availability of surface scope readings (see Section 2.2).

c. The quantity nominal expressions we have considered are all on a par in terms of how readily they can give rise to a surface scope reading (see Section 2.2).

d. The emergence of surface scope readings may not require the particular discourse context which that of inverse scope readings requires (see Section 2.3).

e. Surface-scope taking may not induce freezing effects (see Section 5.3).

Since the distribution of surface scope readings is larger than that of inverse scope readings, nothing prevents us from assuming that like inverse scope readings, surface scope readings may emerge via the shorthand strategy. In fact, it is conceivable that a given sentence is a shorthand form of two or more sentences with respect to the subject nominal expression. At the same time, the characteristics of surface scope readings in (83) lead us to conclude that surface scope readings may emerge via a strategy that does not give rise to inverse scope readings.
The question that needs to be addressed is what this strategy is. The three characteristics, (83b), (83c), and (83d), indicate that the standard assumption of the field – the sentence-level syntax can generate surface scope readings by itself, i.e., the compositional computation applied to an LF representation yields a surface scope reading – is reasonable. One implementation of this assumption is to assume that the quantity nominal expressions we have considered are analyzed as generalized quantifiers. Indeed, that (83a) and (83e) indicate that this assumption is reasonable.

Accepting these assumptions have several implications. First of all, we have (84).

(84) All the quantity nominal expressions we have considered above can be analyzed as generalized quantifiers, and the majority of them – every item except so-called negative quantifiers – can also be analyzed as sums of singular-individuals.

At the same time, we cannot assume that the quantity nominal expressions under discussion are always ambiguous; otherwise, the observation regarding so-called negative quantifiers (i.e., they cannot occur in a sentence giving rise to an inverse scope reading) and the fact of inverse scope readings invoking freezing effects cannot be accounted. We need something to ensure that all the quantity nominal expressions that are major constituents of a given sentence are analyzed in the same way – either as a generalized quantifier or as a sum of singular-individuals. This leads us to the two modes of sentence interpretation described in (85).

(85) Two modes of sentence interpretation:
A given sentence may employ either (i) the generalized quantifier mode – all the quantity nominal expressions occurring as major constituents in that sentence are analyzed as generalized quantifiers, or (ii) the individual mode – all the quantity nominal expressions occurring as major constituents in that sentence are analyzed as sums of singular-individuals.

Finally, the fact that inverse scope readings induce freezing effects indicates (86).

(86) A given sentence employing the generalized quantifier mode cannot be a shorthand form of two or more sentences

7. Summary and further remarks

I have argued above that when a given sentence gives rise to an inverse scope reading, all the quantity expressions that occur as major constituents of the sentence are analyzed as sums of singular-individuals, and the emergence of inverse scope readings is due to the discourse-level syntax, where a given sentence can be understood to be a shorthand form of two or more sentences. Like inverse scope readings, surface scope readings may emerge using the discourse-level syntax via the shorthand strategy, but we need to admit that some instances of them are generated by the sentence-level syntax alone – the compositional computation applied to an LF representation gives rise to a surface scope read-
When a surface scope reading is generated by the sentence-level syntax alone, the quantity nominal expressions in that sentence are understood to be generalized quantifiers. The chart in (87) summarizes the distribution of wide scope readings.

(87)  

<table>
<thead>
<tr>
<th></th>
<th>With Syntax$^a$ alone</th>
<th>with Syntax$^a$ and Syntax$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface scope readings</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Inverse scope readings</td>
<td>Not possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Since the outset of generative grammar, wide scope readings have been extensively utilized for the study of the sentence-level syntax, in particular for the study of LF hierarchical structure. The assumption that researchers in the field generally adopt is (88).

(88)  
Let $\alpha$ and $\beta$ be nominal expressions.
If $\alpha$ takes wide scope with respect to $\beta$, then $\alpha$ c-commands $\beta$ at LF.

I point out, however, that the validity of (88) depends on the assumption, which this paper clearly undermines, that all instances of wide scope readings are generated solely through the sentence-level syntax. This paper thus poses a serious challenge to all the studies embracing (88).

This paper suggests that if we study LF properties using wide scope readings, we should adopt (89) instead.

(89)  
Let $\alpha$ and $\beta$ be nominal expressions.
If $\alpha$ takes wide scope with respect to $\beta$ through the sentence-level syntax alone, then $\alpha$ c-commands $\beta$ at LF.

To utilize (89) in turn requires that we have operational tests to determine if a given wide scope reading involves the sentence-level syntax only. Using the observations I presented above, we may, for example, devise the following tests.$^{18}$

(90)  
Tests to check if $\alpha$ takes wide scope with respect to $\beta$ through the sentence-level syntax alone, where $\alpha$ and $\beta$ are nominal expressions

a. Test 1:
Can $\alpha$ take wide scope with respect to $\beta$ even if there are more than one group of individuals that can potentially be the extension of $\alpha$?

b. Test 2:
Can $\alpha$ take wide scope with respect to $\beta$ even if $\alpha$, $\beta$, or their clause-mate nominal expression is a so-called negative quantifier?

b. Test 3:
Can $\alpha$ take wide scope with respect to $\beta$ even if a clause-mate of $\alpha$ (e.g., $\beta$) takes wide scope with respect to another nominal expression?

c. Test 4:
Can $\alpha$ take wide scope with respect to $\beta$ even if a clause-mate of $\alpha$ (e.g., $\beta$) binds a dependent term?

If the answers to these questions are ‘yes’, then noting so far prevents us from assuming that the wide scope reading under examination involves the sentence-level syntax only.

In my impression, researchers in the field tend to assume that sentence interpretations in general are attributed to the sentence-level syntax alone. This tendency is also found with sentence interpretations that are closely tied to some discourse factors. One might try to justify such an assumption by saying that it is a null hypothesis for the research project in generative grammar attempting to uncover the LF hierarchical structure. The research result I presented in this paper, however, suggests that sentence interpretations in general may involve more than the sentence-level syntax.

Finally, I am aware that a number of reported generalizations in the field having to do with sentence interpretations are controversial. In fact, generative grammar as a research enterprise has received criticism for this very reason (see Newmeyer 1983 and Schütze 1996 for some reviews of such criticism). I would like to note that in the light of this paper, this state of affairs is expected. If a generalization that one attempts to maintain regards the (un)availability of sentence interpretation that involves the discourse-level syntax, there will be no guarantee that the others have access to the same contextual information that he/she does. (As we have witnessed above, one such example is inverse scope readings.) Until we sufficiently understand how discourse contributes to sentence interpretations, the variation among speakers’ introspective judgments is therefore inevitable. My optimism is that after studying the nature of the discourse-level syntax in details, we as the field of generative grammar would be able to present a wide range of converging (i.e., repeatable) generalizations to a wider linguistic community. I trust that this paper contributes to this end.

Abstract:

In generative grammar, inverse scope readings – e.g., the reading that each girl has a boy loving her for the sentence *some boy loves every girl* – are generally treated on a par with surface scope readings – e.g., the reading that each boy has a girl he loves for the sentence *every boy loves some girl*. According to the standard analysis, they are both generated through the compositional computation applied to an LF representation, and the quantity nominal expression taking wide scope is analyzed as a generalized quantifier. This paper argues that these assumptions are not suitable for inverse scope readings. It is argued that inverse scope readings are discourse phenomena – the emergence of an inverse scope reading involves a discourse process. It is furthermore maintained that when a given quantity nominal expressing supports inverse-scope taking, it is understood to be a sum of individuals rather than a quantifier. One crucial implication of the paper is that the study of the sentence-level syntax through sentence interpretation involving quantity nominal expressions is not as straightforward as it has been thought.
References:

Hoji, Hajime. 2003. "Falsifiability and Repeatability in Generative Grammar: A Case Study of


Tanaka, Daiki. 2009. *Rensetumeisiku no sukoopu to bun no imirikai moderu (The scope of conjoined nominal expressions and the model of sentence interpretation)*, Doctoral dissertation, Kyushu University, Fukuoka.


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1 The present investigation thus leaves out branching readings in the sense of Barwise (1979), e.g., (i-b) for (i-a), cumulative readings in the sense of Scha (1984), e.g., (ii-b) for (ii-a), and collective readings in the sense of Landman (1996), e.g., (iii-b) for (iii-a).

(i) a. (= Jackendoff 1972:307 [7.56])
   1 I told many of the men three of the stories.

   b. \( \exists X (X \subseteq \text{man} \land |X| \geq k) \exists Y (Y \subseteq \text{story} \land |Y| = 3) \forall x (x \in X) \forall y (y \in Y) [\text{I told } x y] \), where \( k \) is an integer considered to be large in the relevant context.
(I.e., there are many men and three stories such that I told each of the men each of the stories.)

(ii) a. (= Scha 1984:146 [1])

600 Dutch firms have 5000 American computers.

b. \[ \exists X (X \subseteq \text{dutch firm} \land |X| = 600) \forall Y (Y \subseteq \text{american computer} \land |Y| = 5000) \forall x (x \in X) \exists y (y \in Y) [x \text{ has } y] \land \forall y (y \in Y) \exists x (x \in X) [x \text{ has } y] \]

(i.e., the number of Dutch firms that have an American computer is 600, and the number of American computers possessed by a Dutch firm is 5000.)

(iii) a. (= Landman 1996:435 [17])

Forty journalists asked the president only seven questions.

b. \[ \exists X (X \subseteq \text{journalist} \land |X| = 40) \exists Y (Y \subseteq \text{question} \land |Y| = 7) [X \text{ asked the president } Y] \]

(i.e., there is a group of forty journalists and a group of seven questions such that the former asked the president the latter.)

On the other hand, the interpretations like (iv-b) for (iv-a) and (v-b) for (v-a) will be included.

(iv) a. The two girls confronted three boys.

b. \[ \forall x (x \in X (X \subseteq \text{girl} \land |X| = 2)) \exists Y (Y \subseteq \text{boy} \land |Y| = 3) \forall y (y \in Y) [x \text{ confronted } y] \]

(i.e., for each of the two girls, there are three boys she confronted.)

(v) a. Mary and Susan confronted three boys.

b. \[ \forall x (x \in X (X = \{m, s\})) \exists Y (Y \subseteq \text{boy} \land |Y| = 3) \forall y (y \in Y) [x \text{ confronted } y] \]

(i.e., for each of Mary and Susan, there are three boys she confronted.)

Alternatives to quantifier-raising include Cooper storage (Cooper 1975, 1983) and quantifying-in (Montague 1974).

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1 Alternatives to quantifier-raising include Cooper storage (Cooper 1975, 1983) and quantifying-in (Montague 1974).

2 The thesis that the formal basis of the sound-meaning association may involve a post-LF mechanism is not novel; see Zubizarreta (1998), Erteschik-Shir (2007), and Eilam (2011).

3 Since Japanese does not have so-called negative quantifiers (cf. Hayashishita & Ueyama in press), the examples analogous to (6)-(9) cannot be constructed.

4 Liu (1990) and Beghelli & Stowell (1997) claim that bare numerals support inverse-scope taking while modified numerals do not.

5 In this paper, I use the following abbreviations: NOM = nominative; ACC = accusative; DAT = dative; GEN = genitive; TOP = topic; NEG = negation; COMP = complementizer.

6 Regarding the scope interaction among nominal expressions, the standard generalization in Japanese is that while surface scope readings are possible, inverse scope readings are not (cf. Kuroda 1969/70 and Hoji 1985). However, this generalization has been challenged by a number of researchers. For example, Kitagawa (1990), Kuroda (1994), Kuno et al (1999), and Hayashishita (1999, 2000a, 2004) report that inverse scope readings are allowed in Japanese. In his later work, Hoji (2003) also acknowledges this possibility, citing Hayashishita (1999, 2000a).

7 In my reading, this is the position which Ben Shalom (1993) takes.

8 Incidentally, Ben Shalom (1993) maintains that inverse scope readings obtain only if the relevant object is a nominal expression that is interpreted as a principal filter. By definition, if \( \alpha \) is interpreted as a principal filter, the denotation of \( \alpha \) is a set including one and only one minimal member. Thus, the idea of inverse scope readings requiring the wide-scope taking object to be associated with a unique group of individuals is encoded here. Crucially, however, Ben Shalom assumes that whether or not a given nominal expression is interpreted as a principal filter is solely determined by its lexical definition. For example, Ben Shalom claims that by their lexical specifications, modified numerals are not principal filters, thus ruling out cases where the speaker detects an inverse scope reading with the object expression being a modified numeral. (22), on the other hand, does not preclude such cases as long as discourse restricts the domain individuals in such a way that there is one and only one group of individuals that can possibly be the extension of the relevant object expression.

9 I acknowledge that this formulation is problematic.
Sato (2003) considers examples like those in (53), but not examples like those in (54) and those in (55) below. She treats the effects of (53a) and (53b) being unable to give rise to an inverse scope reading (in contrast with (53c)) as instances of intervention effects, discussed in Hoji 1985 and Beck 1996, and proposes (i).

(i) In \([\beta \ldots \alpha \ldots t_\beta \ldots ]\), where \(\alpha\) denotes a set of properties, the chain whose head is \(\beta\) and whose tail is \(t_\beta\) is not well-formed.

But (i) is not tenable, as it does not account for the contrasts in (54) and those in (55).

12 As I noted in Section 2.1, Japanese does not have so-called negative quantifiers; thus, the point I made in this section cannot be illustrated in Japanese.

13 If we interpret (48) literally, (i)-(iv) would also be among the candidates.

(i) a. Prof. Smith introduced John to Toyota.
   b. Prof. Smith introduced Bill to Toyota.

(ii) a. Prof. Smith introduced John to Nissan.
    b. Prof. Smith introduced Bill to Nissan.

(iii) a. Prof. Smith introduced John to Toyota.
     b. Prof. Smith introduced John to Nissan.

(iv) a. Prof. Smith introduced Bill to Toyota.
     b. Prof. Smith introduced Bill to Nissan.

14 (Intended) bound variable anaphora will be indicated with the use of underlines.

15 It is argued in Hoji 1998 that \(soko\) ‘that place’ is singular-denoting on the basis of its incapability of co-referring to split antecedents. Hoji argues that assuming that \(soko\) ‘that place’ in (i-a) and (i-b) is singular-denoting while \(karera\) ‘them’ in (ii-a) and \(aitura\) ‘them’ in (ii-b) are not, we can account for the contrast between (i) and (ii). (See also Ueyama 1998 for an extensive discussion of the nature of so-NPs.)

(i) (= Hoji 1998:652 [3], slightly adapted)
   a. *Toyota1 ga Nissan2 ni \(\{z\text{eimusyo ga sok}o_{1,2} \text{ o sirabeteiru}\}\) to tugeta (koto)
      Toyota NOM Nissan DAT tax:office NOM that:place ACC is:investigating that told that
      ‘Toyota1 told Nissan2; that the tax office was investigating them1,2.’
   b. *Toyota1 wa Nissan2 ni sok0_{1,2} no goodoo paatii no kaizyoo o teiansita.
      Toyota TOP Nissan DAT that:place GEN joint party GEN place ACC suggested
      ‘Toyota1 suggested to Nissan2 a place for their1,2 joint party.’

(ii) (= Hoji 1998:650-651 [2a]-[2b], slightly adapted)
   a Tom1 ga Nick2 ni \(\{\text{CIA ga karera}_{1,2} \text{ o} \text{ sirabeteiru}\}\) to tugeta (koto)
      Tom NOM Nick DAT CIA NOM them ACC is:investigating that told that
      ‘Tom1 told Nick2 that the CIA was investigating them1,2.’
   b. Ano ninensei1 wa ano itinensei2 ni aiura_{1,2} no atarasii kooti o syookaisita.
      that sophomore TOP that freshman DAT them GEN new coach ACC introduced
      ‘That sophomore1 introduced to that freshman2 their1,2 new coach.’

16 The illustration of the point under discussion in English cannot be as extensive as in Japanese, for the number agreement disallows any pair of a plural-denoting element and a singular-denoting element to be related anaphorically. However, Hayashishita (2004) notes that the sentences in (i) illustrate the point, attributing the observation to Anthony Kroch – the binding relation in (i-a) is possible, and every student can take wide scope with respect to at least one professor in (i-b), but the binding and the wide-scope reading under discussion cannot co-occur in (i-c).
(i)  a. At least one professor recommended John to his favorite company.
    b. At least one professor recommended every student to Toyota.
    c. At least one professor recommended every student to his favorite company.

Fox (2000) also reports that the direct object can take wide scope with respect to the subject in (i-a), but not in (i-b) with the relevant binding.

(i)  (= Fox 2000:64 Ch.2, FN52 [ii], slightly adapted)
    a. A girl expected every boy to come to the party.
    b. A girl expected every boy to come to her party.

17 In the light of this paper, we may understand that Hayashishita (2000b) and Hoji (2003) attempt to study LF properties, restricting their attention to wide scope readings that involve the sentence-level syntax only.

18 One classic example is found in the beginning of generative grammar. Chomsky (1957:100-101) maintains the generalization that in the configuration of […α […β …]], where α and β are nominal expressions, surface scope readings are possible while inverse scope readings are not. But this generalization is challenged by Katz & Postal (1964), who say that inverse scope readings are also possible.