

On the Nature of Inverse Scope Readings

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Abstract: In generative grammar, inverse scope readings, for example the reading that each girl has a (different) boy loving her for the sentence *some boy loves every girl*, are generally treated as being on a par with surface scope readings, for example the reading that each boy has a (different) 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 demonstrates that inverse scope readings are discourse phenomena: the emergence of inverse scope readings necessarily involves a discourse process. Furthermore, it maintains that when a given quantity nominal expression supports inverse-scope-taking, it is understood to be a sum of singular-individuals rather than a generalized quantifier. One crucial implication of the paper is that the study of sentence-level syntax through sentence interpretations involving quantity nominal expressions is not as straightforward as previously thought.*

Key words: sentence-level syntax, discourse, quantifiers, plurals, inverse scope readings

1. Introduction

Sentence interpretations involving quantifier scope have been extensively studied in the generative tradition. It was observed from the outset that they may or may not reflect the surface order of a sentence (Katz and Postal 1964: 72). For example, (1a) can be true in the situation where each boy loves a different girl, indicating that (1a) has (1b) as its interpretation.

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

It is thus understood that *every NP* in the subject position can take wide scope

* This paper has a long history. In 1997 I became acquainted with Hajime Hoji's work, from which I derived the central theme of the paper: among propositional meanings associated with sentences, some are understood to be directly generated by sentence-level syntax, while others require the active contribution of discourse in addition to sentence-level syntax. My attempts to publish work on quantifier scope, embracing this theme, started as early as 1999. Among those who fully supported and mentored me for this journey are Hajime Hoji, Ayumi Ueyama, and Dorit Ben Shalom, to whom I am deeply indebted.

with respect to *some NP* in its clause-mate object position. At the same time, we observe that (2a) can be true in the situation where each girl is loved by a different boy, leading us to conclude that (2a) has (2b) as its interpretation.

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

We thus understand that *every NP* in an object position can scope over *some NP* in its clause-mate subject position.

To describe 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, 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

The content of the article or portions thereof have been presented in various preliminary forms at (i) the *23rd Annual Penn Linguistics Colloquium*, University of Pennsylvania in 1999, (ii) the *9th Japanese/Korean Linguistics Conference*, Ohio State University in 1999, (iii) *WCCFL XIX*, University of California, Los Angeles in 2000, (iv) *Workshop on Issues of Scope Interpretation from the Perspective of Syntax*, organized by the Kansai Linguistics Society, Kobe City University of Foreign Studies in 2003, and (v) *On Linguistic Interfaces*, University of Ulster in 2007. I had the privilege to present some of the paper content at a Kyushu University intensive graduate course in 2007, and at Osaka University in 1999, Kyushu University in 1999, University College London in 2008, and the University of Edinburgh in 2008. Comments from the audiences have been very valuable to me. I have also tried to publish some preliminary versions of the present paper in *Language* from 2003 through 2004 and in *Linguistics and Philosophy* from 2007 through 2009. The anonymous reviewers' comments allowed me to improve the paper greatly, and especially, the critical yet very constructive comments from one of the *Linguistics and Philosophy* reviewers gave me much encouragement. It was a pity that the paper was turned down at the end on the basis of 'not being ready' despite the fact that both reviewers were in favor of publishing it there.

I do not think I could have continued working on the same topic for such a long time without people who have remained sympathetic to my research theme and who have been excited about the Japanese data I presented. They include, besides the three people mentioned above, Daisuke Bekki, Teruhiko Fukaya, Maki Irie, Yasuo Ishii, Kiyoko Kataoka, Ai Kawazoe, Satoshi Kinsui, Tomohide Kinuhata, Yasuhiko Miura, Emi Mukai, Iwao Takai, Yukinori Takubo, Daiki Tanaka, and Yukiko Tsuboi. I would like to thank them for their endless support. Over the years, I have consulted with a number of people about my work on quantifier scope, among whom are Hagit Borer, Chris Kennedy, Anthony Kroch, Audrey Li, Jason Merchant, Barry Schein, Tim Stowell, Ed Stabler, and Donny Fox, to whom I wish to express my gratitude. I am grateful to two anonymous *Gengo Kenkyu* reviewers for their insightful and constructive comments. Their comments allowed me to improve the paper in terms of both its content and organization. Finally, I have to confess that without Florence Stone's editorial help, the paper would not be as readable as it is now, and Daiki Tanaka helped me improve the Japanese abstract of the paper. This research is partially supported by the 2008 University of Otago Research Grant.

order of the corresponding two nominal expressions) *inverse scope readings*. The focus of this paper is wide scope readings, in particular, inverse scope readings.¹

The standard approach analyzes inverse scope readings as being on a par with surface scope readings (e.g. Heim and Kratzer 1998: 178–208). It assumes that sentence-level syntax in the sense of Chomsky (1995: 219–394) generates inverse scope readings; thus, like surface scope readings, inverse scope readings result from the compositional computation applied to an LF representation. As an implementation of this assumption, the standard approach maintains two points. First, the wide-scope-taking object is a generalized quantifier in the sense of Barwise and Cooper (1981), i.e. a set of properties. Second, via a syntactic scope-shifting operation – quantifier-raising in May (1977) or some alternative – the relevant object is positioned in a higher place, and this 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)

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 Example [7.56])
I told many of the men three of the stories.
b. $\exists X (X \subseteq \text{man} \wedge |X| \geq k) \exists Y (Y \subseteq \text{story} \wedge |Y| = 3) \forall x (x \in X) \forall y (y \in Y) [I \text{ told } x \ y]$, 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 Example [1])
600 Dutch firms have 5000 American computers.
b. $\exists X (X \subseteq \text{dutch_firm} \wedge |X| = 600) \exists Y (Y \subseteq \text{american_computer} \wedge |Y| = 5000) [\forall x (x \in X) \exists y (y \in Y) [x \text{ has } y] \wedge \forall y (y \in Y) \exists x (x \in X) [x \text{ has } y]]$
(i.e. the number of Dutch firms that have American computers is 600, and the number of American computers possessed by Dutch firms is 5000.)
- (iii) a. (= Landman 1996: 435 Example [17])
Forty journalists asked the president only seven questions.
b. $\exists X (X \subseteq \text{journalist} \wedge |X| = 40) \exists Y (Y \subseteq \text{question} \wedge |Y| = 7) [X \text{ asked the president } Y]$
(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. $\forall x (x \in \iota X (X \subseteq \text{girl} \wedge |X| = 2)) \exists Y (Y \subseteq \text{boy} \wedge |Y| = 3) \forall y (y \in Y) [x \text{ confronted } y]$
(i.e. for each of the two girls, there are three boys she confronted.)
- (v) a. Mary and Susan confronted three boys.
b. $\forall x (x \in \iota X (X = \{m, s\})) \exists Y (Y \subseteq \text{boy} \wedge |Y| = 3) \forall y (y \in Y) [x \text{ confronted } y]$
(i.e. for each of Mary and Susan, there are three boys she confronted.)

² Alternatives to quantifier-raising include *Cooper storage* (Cooper 1983: 52–78) and *quantifying-in* (Montague 1974: 247–270).

is analyzed as (3), where Op signifies an operator.

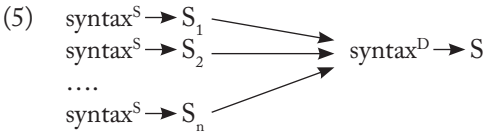
- (3) a. LF representation:
 $[[_{IP_1} \text{ every girl}_2 [[_{IP_2} Op_2 [[_{IP_3} \text{ some boy}_1 [[_{IP_4} Op_1 [[_{IP_5} t_1 [[_{VP} \text{ loves } t_2]]]]]]]]]]]]]$
- b. Semantic composition:
 $[[\text{some boy}]] = \lambda P \in D_{\langle et \rangle} \exists X (X \subseteq boy \wedge |X| \geq 1) \forall x (x \in X) P(x)$
 $[[\text{every girl}]] = \lambda P \in D_{\langle et \rangle} \exists Y (Y = girl) \forall y (y \in Y) P(y)$
 $[[\text{love}]] = \lambda y \in D_{\langle e \rangle} \lambda x \in D_{\langle e \rangle} [x \text{ loves } y]$
 $[[VP]] = \lambda x \in D_{\langle e \rangle} [x \text{ loves } v_2]$
 $[[IP_5]] = [v_1 \text{ loves } v_2]$
 $[[IP_4]] = \lambda v_1 [v_1 \text{ loves } v_2]$
 $[[IP_3]] = \exists X (X \subseteq boy \wedge |X| \geq 1) \forall x (x \in X) [x \text{ loves } v_2]$
 $[[IP_2]] = \lambda v_2 \exists X (X \subseteq boy \wedge |X| \geq 1) \forall x (x \in X) [x \text{ loves } v_2]$
 $[[IP_1]] = \exists Y (Y = girl) \forall y (y \in Y) \exists X (X \subseteq boy \wedge |X| \geq 1) \forall x (x \in X) [x \text{ loves } y]$

This paper argues against the standard approach at two levels. I maintain that the emergence of inverse scope readings requires more than sentence-level syntax; it involves 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).

- (4) a. Some boy loves Hannah.
 b. Some boy loves Ruth.
 c. Some boy loves Naomi.

The architecture of grammar I will propose is (5), where syntax^S is the sentence-level syntax in the standard sense and syntax^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 others involve only the sentence-level syntax.³ Thus, the study of the sentence-level syntax through sound-meaning association is not as straightforward as previously 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. The arguments presented in this paper are mainly based on Japanese empirical materials.

The rest of the paper is organized as follows. Section 2 introduces two sets of generalizations which I believe the analysis of inverse scope readings must explain. One of them indicates that the emergence of inverse scope readings is not possible unless a particular discourse context is present. It thus turns out that the sentence-level syntax does not generate inverse scope readings, contrary to the starting assumption of the standard approach, and discourse actively contributes to 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. In Section 4, capitalizing on the demonstration in Section 3, I maintain the thesis that when a given sentence gives rise to an inverse scope reading, the relevant wide-scope-taking object expression is analyzed as a sum of singular-individuals, and I build an analysis of inverse scope readings that incorporates it. According to the analysis, 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 analysis of inverse scope readings proposed in Section 4, introducing a generalization that directly follows from it. In Section 6, to present a comprehensive picture, I further investigate the nature of inverse scope readings, and consider what is involved for the emergence of surface scope readings. I suggest that there are two modes of sentence interpretation: the quantity nominal expressions occurring in a clause as its major constituents must all be interpreted in the same way either (i) as a generalized quantifier or (ii) as a sum of singular-individuals. Finally, in Section 7, I comment on the implications that this paper has for the study of LF hierarchical structure.

2. Observations that the Analysis of Inverse Scope Readings Ought to Explain

I start the discussion by presenting two sets of observations which I believe any viable analysis of inverse scope readings ought to account for. As we will see below, one of them clearly indicates that unlike the emergence of surface scope readings, that of inverse scope readings is not possible unless a particular discourse context is present.

³ 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).

2.1. Variation in speakers' acceptability judgments

One peculiarity of inverse scope readings is that speakers' acceptability judgments vary. Over the past decade, in response to the sentences like those in (6), some speakers detected an inverse scope reading, and some did not.^{4,5}

- (6) a. Sannin no sinsain ga Abusutorakuto #1 to Abusutorakuto #2
 three GEN reviewer NOM Abstract #1 and Abstract #2
 o sadokusita.
 ACC reviewed
 '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.'

There are patterns according to which particular quantity 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 a universal quantifier nominal or *A to B* 'A and B' than when the expression is *takusan no NP* 'many NP', a bare numeral, or a modified numeral. Among the latter three, modified numerals seem to make detection the most difficult.

The variation in speakers' acceptability judgments is indeed a peculiarity of inverse scope readings. The same group of informants all effortlessly detected a surface scope reading with sentences like those in (7).

- (7) a. Sinsain #1 to Sinsain #2 ga mittu no abusutorakuto o
 Reviewer #1 and Reviewer #2 NOM three GEN abstract ACC
 sadokusita.
 reviewed
 'Reviewer #1 and Reviewer #2 read three abstracts.'

⁴ In this paper, I use the following abbreviations: NOM = nominative; ACC = accusative; DAT = dative; GEN = genitive; TOP = topic; NEG = negation; COMP = complementizer.

⁵ Regarding the scope interaction among quantity nominal expressions, the standard generalization in Japanese is that while surface scope readings are possible, inverse scope readings are not (cf. Kuroda 1970: 138 and Hoji 1985: 243–248). 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, 2000b, 2004) report that inverse scope readings are allowed in Japanese. In his later work, Hoji (2003: 404–407) also acknowledges this possibility, citing Hayashishita (2000b).

- 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.'

The complexity of such phenomena is not restricted to Japanese. The situation is similar in English. For example, in response to sentences like those in (8), some speakers I consulted could detect the reading being discussed here, and some could not. Nominal expressions (un)likely to support inverse scope readings are similar to those Japanese expressions which are (un)likely to give rise to them.

- (8)
- 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.

Just as in Japanese, surface scope readings contrast with inverse scope readings; the same set of informants detected a surface scope reading with sentences like those in (9) without any difficulty.

- (9)
- 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.

Based on the above discussion, I maintain that the analysis of inverse scope readings must explain (10).⁶

- (10)
- a. Speakers' acceptability judgments on inverse scope readings vary.
 - b. Informants are more likely to detect an inverse scope reading when the relevant object expression is a universal quantifier nominal or *A to B* 'A

⁶ Liu (1990: 12–20) notes that the availability of inverse scope readings differs depending on what type of nominal expression the relevant object expression is. However, the variation of the speakers' judgments has not been acknowledged. Liu (1990: 15–19) and subsequent studies such as Beghelli and Stowell (1997: 79–84), for example, claim that bare numerals support inverse scope readings while modified numerals do not.

and B' than when the expression is *takusan no NP* 'many NP', a bare numeral, or a modified numeral. Among the latter three, modified numerals are the least likely to support inverse scope readings.

2.2. Requiring a particular discourse context

I have reported above that speakers' acceptability judgments on inverse scope readings vary. As pointed out by Hayashishita (2004: 12–19), it is also the case that a 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 are led to conclude that the sentence-level syntax does not generate inverse scope readings, and discourse actively contributes to their emergence.

For example, compare (11) and (12), which are based on the examples Hayashishita (2004) provides.

(11) (Based on Hayashishita 2004: Ch.2 Example [14a])

Gakubunaisenkyo de, suunin no gakusei ga hutari no kyoozyu
 department:election at some GEN student NOM two GEN professor
 ni toohyoosita.
 DAT voted

Demo hoka no kyoozyu ni wa daremo toohyoosi-na-katta.
 but other GEN professor DAT TOP no:one vote-NEG-PAST

'In the departmental election, some students voted for two professors. But for the other professors, no one voted.'

(12) (Based on Hayashishita 2004: Ch.2 Example [15a])

USC de wa maitosi suunin no kyoozyu ga hutari no
 USC at TOP every:year some GEN professor NOM two GEN
 sinnyuusei o zimbunkagakusyoo ni suisensuru koto ni
 new:student ACC humanity:award DAT nominate that DAT
 natteiru. Demo kotosi wa daremo suisensare-na-katta.
 is:supposed:to but this:year TOP no:one be:recommended-not-PAST

'At USC, each year some professors nominate two freshmen for the humanities award. But no student was nominated this year.'

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 (11), but not in (12).

The same point can be shown with modified numerals. 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: 12–19) points out that it is not the case that they always do. For example, they detect the reading under discussion in (13), and even more easily with the context in (14), but they fail to do so in (15).

- (13) (Based on Hayashishita 2004: Ch.2 Example [16a])
 Dame da. Hutari no gaadoman ga itutu izyoo no biru
 bad COPULA two GEN guard NOM five more GEN building
 no mae ni tatteita.
 GEN front DAT was:standing
 ‘We had bad luck. Two guards were standing in front of five or more build-
 ings.’
- (14) (Based on Hayashishita 2004: Ch.2 Example [16a])
 We are wondering if we should rob some shops on 5th Avenue in New York.
 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.
- (15) Gaadoman to biru no kazu kara kangaeru to,
 guard and building GEN number from considering if
 sukunakutomo hutari no gaadoman ga itutu izyoo no biru
 at:least two GEN guard NOM five more GEN building
 o kanrisinakerebanaranai.
 ACC must:supervise
 ‘Given the numbers of guards deployed and buildings, at least two guards
 must supervise five or more buildings.’

We are thus led to conclude that discourse actively contributes to the emergence of inverse scope readings.⁷

Incidentally, one might argue that the contrasts between (11) and (12) and between (13) and (15) can be accounted for without admitting the contribution of discourse, if we accept Fodor and Sag’s (1982) thesis that numerals are lexically ambiguous between their referential and non-referential interpretations. (In fact, this seems to be the position Ben Shalom 1993 takes.) However, attributing a nominal expression’s ability to support inverse scope readings to its referential interpretation leaves no room for explaining the variation in the speakers’ acceptability judgments in Section 2.1. In addition, this position entails that when a given nominal expression does take inverse scope, it must take the widest scope. However, as we observe below, such is not the case.

⁷ A clarification remark is in order. The availability of surface scope readings may be affected by discourse; for example, the surface scope reading of the sentence *a guard is standing in front of every building* is not possible. I emphasize, however, that surface scope readings are available as long as they are compatible with our world knowledge; the surface scope reading of the sentence is not available simply because our world knowledge precludes it. The situation is different with inverse scope readings. (12) and (15) cannot give rise to an inverse scope reading despite the fact that their inverse scope readings are compatible with our world knowledge. The point I am making here is that we may detect an inverse scope reading with (11) and (13) because, unlike (12) and (15), they present a situation where some discourse requirement, necessary for the emergence of inverse scope readings, is satisfied. That is, discourse actively contributes to their emergence.

The question we must address is how we can describe the distribution of inverse scope readings. Hayashishita (2004: 12–19) claims, based on the contrasts we have observed above, 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 (11), the speaker can, and in fact must in this situation, associate the relevant object expression with some specific group of individuals, two particular professors. But in uttering (12), he/she cannot do so; since 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 (13) in the context of (14), the speaker clearly associates the relevant object expression with seven specific buildings. On the other hand, the issue relevant in the context of (15) is how many buildings each guard needs to be responsible for, and it is unlikely that the speaker associates the relevant object expression with any specific group of individuals.

However, a reviewer for *Linguistics and Philosophy* pointed out to me (p.c. May 2008) that Hayashishita’s generalization is too narrow. For example, consider (16).

- (16) Rainen no suupaabooru de, hanbunizyoo no hito ga
 next:year GEN Super:Bowl at half:more GEN person NOM
 saiyuusyuu sensyu koohosya no naka no ue kara hutari no
 MVP player candidate GEN among GEN top from two GEN
 sensyu ni toohyoosuru daroo.
 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 (16) 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 (16), the speaker cannot have two specific players in mind, Hayashishita’s generalization leaves out the inverse scope reading detected in (16).

Stated pre-theoretically, the generalization that captures the distribution of inverse scope readings seems to be (17).⁸

⁸ Incidentally, Ben Shalom (1993:20) maintains that inverse scope readings obtain only if the relevant object expression is a nominal expression that is interpreted as a principal filter. By definition, if α is interpreted as a principal filter, the denotation of α 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 determined solely by its lexical definition. For example, she 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. (17), on the other hand, does not preclude such

- (17) Inverse scope readings are possible under the following condition:
 When the relevant object expression α is interpreted, there is one and only one group of objects that can possibly be the extension of α .

Among the nominal expressions that support inverse scope readings are some which do not satisfy the condition in (17) without discourse restricting the domain individuals. (17) thus embeds the thesis that discourse actively contributes to the emergence of inverse scope readings.

(17) correctly captures all the data we have observed above. In the context of (11) and (13), the speaker associates the relevant object expression with some specific group of individuals; thus, in the discourse under consideration, there is only one group of individuals that can possibly be the extension of the relevant object expression. The discourse relevant to (16) leaves only one group of individuals as a possible 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, with (12) and (15), there is more than one group of individuals that can serve as the extension of the relevant object expression. For example, the discourse relevant for (12) includes a number of freshmen. If there are 50 freshmen, there are $((50 \times 49) / 2 =)$ 1225 possible candidates for the extension of *butari-no sinnyuusei* ‘two freshmen’. Thus, (17) states that (12) and (15) do not give rise to an inverse scope reading.

Here it should be noted that (17) does not require that the relevant object expression taking inverse scope necessarily takes the widest scope. For example, (17) is compatible with the fact that (18a) can depict the situation in (18b), indicating that *nisatu no hon* ‘two books’ can take scope above its clause-mate subject while taking scope below the matrix subject.

- (18) a. John to Bill ga hitori no gakusei ga nisatu no hon o
 John and Bill NOM one GEN student NOM two GEN book ACC
 yonda to itteita.
 read COMP said
 ‘John and Bill said that one 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 (17) states is as follows. When the speaker computes the denotation of the embedded clause with respect to *John*, there ought to be one and only one group of individuals available for the extension of *nisatu no hon* ‘two books’, and when he/she computes the denotation of the embedded clause with respect to *Bill*, there ought to be one and only one group of individuals available for the extension of *nisatu no hon* ‘two books’. Thus, one possibility is that for the computation of the denotation of the embedded clause with respect to *John*, the extension of *nisatu no*

cases as long as discourse restricts the domain of 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.

hon ‘two books’ is necessarily H and I, and for its computation with respect to *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 talking about J and K. In fact, unless a context like this is present, it is difficult to take (18a) to mean (18b).

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 (19) helps one to detect an inverse scope reading for the sentences in (6) and (8); with this provision, even those informants who initially could not detect an inverse scope reading started detecting it.

- (19) 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 ...

Thus, to the list of the things which the analysis of inverse scope readings ought to explain, I add the generalization in (17) and the observation that the context in (19) facilitates the detection of an inverse scope reading for the sentences in (6) and (8).

Surface scope readings contrast with inverse scope readings. Speakers detect a surface scope reading in cases where there is one and only one group of individuals available for the extension of the relevant subject expression and also in cases where there is more than one such group of individuals available. For instance, we can detect a surface scope reading with both (20) and (21) (cf. (11) and (12)).

- (20) Gakubunaisenkyo de, hutari no kyoojin ga suunin no gakusei
 department:election at two GEN teacher NOM some GEN student
 ni toohyoosita.
 DAT voted
 ‘In the departmental election, two teachers voted for some students.’
- (21) USC de wa, maitosi hutari no sinnin kyoojin ga
 USC at TOP every:year two GEN newly:hired teacher NOM
 suunin no gakusei o zimbunkagakusyoo ni suisensuru.
 some GEN student ACC humanity:award DAT nominate
 ‘At USC, each year two newly hired professors nominate some students for the humanities award.’

In addition, the provision of the context in (22), which is analogous to the one in (19) for inverse scope readings, does not make any difference to the detection of a surface scope reading for the sentences in (7) and (9); both with and without such a context, these sentences readily give rise to the reading under discussion.

- (22) 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: 45–92) position that the active contribution of discourse may not be necessary for the emergence of surface scope readings, and it is reasonable to assume that the sentence-level syntax generates surface scope readings.

2.3. Summary and implications

As I noted at the outset, the standard approach to wide scope readings treats surface and inverse scope readings as being on a par with each other, assuming that the sentence-level syntax generates both. The asymmetry between surface and inverse scope readings, which we have observed in this section, thus indicates that the standard approach is not adequate.

The observations in this section also present a novel view regarding the role of discourse in relation to the sentence-level syntax. In the standard approach, discourse is important only when the sentence-level syntax generates both the LF representations of the surface and inverse scope readings, allowing us to choose one over the other. However, the observation in Section 2.2, where the emergence of inverse scope readings requires a certain discourse context, leads us to conclude that the sentence-level syntax does not generate inverse scope readings, and discourse actively contributes to their emergence. This conclusion is consistent with the observation in Section 2.1 that speakers' acceptability judgments on inverse scope readings vary. Given that in linguistics experiments, informants are usually presented with sentences without context, we may speculate that some speakers can by themselves set up a context that inverse scope readings require while others cannot, and one may or may not be able to construct such a context, depending on what type of nominal expression the relevant object expression is. I will further elaborate this point in Section 4.

There have been attempts to capture the differences among nominal expressions in their capacity to support inverse scope readings, by enriching the sentence-level syntax. One notable attempt is Beghelli and Stowell (1997), who, drawing on Szabolcsi (1997), assume that the syntactic scope-shifting operation is feature-driven, and the landing sites differ depending on the nominal expression types.⁹ However, no matter how enriched we assume the sentence-level syntax to be, such attempts fail to account for the observation that speakers' acceptability judgments on inverse scope readings vary. In addition, they fail to account for the data to be presented in Section 6.1.2, which indicate that when a given object

⁹ An anonymous reviewer noted that another way to consider the problem is to extend Watanabe's (2006) approach, which assumes that noun phrases have an elaborate structure, and quantity expressions may be located in different positions within them, depending on their types. In capturing the differences among nominal expressions in their capacity to support inverse scope readings, one might extend Watanabe's approach, claiming that the syntactic scope-shifting operation from some of the positions within a noun phrase is prohibited. I note, however, that the extension of Watanabe (2006) fails in the same way as Beghelli and Stowell (1997).

expression takes wide scope with respect to its clause-mate subject expression, the latter loses the capacity to take scope over another nominal expression and bind a dependent term.

3. The Denotation of the Wide-Scope-Taking Object

Having dispensed with the thesis that the sentence-level syntax generates inverse scope readings, there is no reason to maintain the other assumptions of the standard approach, including the assumption that the wide-scope-taking object expression is analyzed as a generalized quantifier, i.e. as a set of properties. In this section, I argue that nothing prevents us from discarding this particular assumption, demonstrating that 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

Hayashishita and Bekki (2012: 54) point out that, descriptively speaking, nominal expressions resulting from combining two or more items with conjunctions (henceforth conjoined nominal expressions) form three categories. The members of the first category, represented by *A to B*, always ‘refer to’ a plural object, while those of the second, 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 (23a) and (23b) to be true, both Mark and Luke must come; however, (23c) indicates that only one of Mark and Luke came.

- (23) (= Hayashishita and Bekki 2012: 54 Example [1])
- a. [Mark to Luke] ga kita. ‘(Lit.) [Mark to Luke] came.’
Mark Luke NOM came
 - b. [Mark ya Luke] ga kita. ‘(Lit.) [Mark ya Luke] came.’
 - c. [Mark ka Luke] ga kita. ‘(Lit.) [Mark ka Luke] came.’

It thus appears that *A to B* and *A ya B* ‘refer to’ a plural object, and *A ka B* a singular object.

The sentences in (24) show a different picture. (24a) states that Mary does not offer tea unless both Mark and Luke come, but with (24b) and (24c), Mary offers tea as long as one person, Mark or Luke, comes.

- (24) (= Hayashishita and Bekki 2012: 54 Example [2])
- a. Mary wa [Mark to Luke] ga kita ra, otya o dasu.
Mary TOP Mark Luke NOM come if tea ACC offer
‘(Lit.) Mary offers tea if [Mark to Luke] come.’
 - b. Mary wa [Mark ya Luke] ga kita ra, otya o dasu.
‘(Lit.) Mary offers tea if [Mark ya Luke] come.’
 - c. Mary wa [Mark ka Luke] ga kita ra, otya o dasu.
‘(Lit.) Mary offers tea if [Mark ka Luke] come.’

It is thus indicated that while *A to B* cannot ‘refer to’ a singular object, *A ya B* may

behave similarly to *A ka B*, being understood to ‘refer to’ a singular object. (The observation that *A ya B* shows this singular-nature in the antecedent of a conditional is first reported in Tanaka 2009: 16–19.)

One reasonable approach is to analyze the conjoined nominal expressions under discussion as generalized conjunctions and disjunctions (cf. Gazdar 1980). Thus, we may analyze *A to B* as a generalized conjunction, and *A ka B* as a generalized disjunction; see (25).

- (25) a. $\llbracket A \text{ to } B \rrbracket = \lambda P. (P(a) \wedge P(b))$ (i.e. $\lambda P \forall x \in \{a, b\} P(x)$)
 b. $\llbracket A \text{ ka } B \rrbracket = \lambda P. (P(a) \vee P(b))$ (i.e. $\lambda P \exists x \in \{a, b\} P(x)$)

Hayashishita and Bekki (2012: 56), however, demonstrate that *A ya B* cannot be analyzed as a generalized conjunction or disjunction. They show that if it is treated as a generalized conjunction, its singular nature cannot be explained; conversely, if it is analyzed as a generalized disjunction, its plural nature remains unaccounted for.

One might maintain that analyzing *A ya B* as a generalized conjunction still allows us to capture its singular nature. For example, analyzing (24b) as (26), the observed fact in (24b), where Mary offers tea as long as Mark or Luke comes, is expected, for (26) is logically equivalent to (27).

- (26) $\forall x (x \in \{m, l\} \rightarrow \forall w' (wRw' \wedge (x \text{ comes in } w') \rightarrow \text{Mary offers tea in } w'))$
 (27) $\forall w' (wRw' \wedge \exists x (x \in \{m, l\} \wedge (x \text{ comes in } w')) \rightarrow \text{Mary offers tea in } w')$

Hayashishita and Bekki, however, argue that this assumption cannot be maintained for two reasons. First, the assumption that *A ya B* can take scope over the entire conditional is unfounded; prototypical scope bearing nominal expressions such as *oozei no gakusei* ‘a large number of students’ and *sannin no gakusei* ‘three students’ do not take scope outside the antecedent clause of the conditional. Second, *A ya B* appears to ‘refer to’ a singular object even in the situation where the logical equivalence between the universal and existential quantifiers does not hold. For example, like (28c), (28b) (in contrast to (28a)) indicates that the coming of Mark or Luke alone is a possibility; thus, the interpretation of (28b) should entail (29).

- (28) a. Rainen [Mark to Luke] ga nihon ni kuru kamosirenai.
 next:year Mark Luke NOM Japan DAT come may
 ‘(Lit.) Next year, [Mark to Luke] may come to Japan.’
 b. Rainen [Mark ya Luke] ga nihon ni kuru kamosirenai.
 ‘(Lit.) Next year, [Mark ya Luke] may come to Japan.’
 c. Rainen [Mark ka Luke] ga nihon ni kuru kamosirenai.
 ‘(Lit.) Next year, [Mark ka Luke] may come to Japan.’
 (29) $\exists w' (wRw' \wedge \exists x (x \in \{m, l\} \wedge (x \text{ comes in } w')))$

But the reading which we obtain for (28b) by analyzing *A ya B* as a generalized conjunction (i.e. (30)) is not logically equivalent to (29), nor does it entail (29).

- (30) $\forall x (x \in \{m, l\} \rightarrow \exists w' (wRw' \wedge (x \text{ comes in } w')))$

Another piece of evidence Hayashishita and Bekki provide for the thesis that $A ya B$ cannot be treated as a generalized conjunction or disjunction is the fact that (28b) states that the coming of Mark and Luke and the coming of Mark or Luke are among the possibilities. In other words, $A ya B$ may have plural and singular status at the same time. If we analyze $A ya B$ as a generalized conjunction or disjunction, we fail to capture this.

3.2. Hayashishita and Bekki's (2012) theory of nominal expressions

Given that the three types of conjunctions, *to*, *ya*, and *ka* can conjoin nominal expressions recursively, in terms of theoretical categories, $A ya B$ should be treated on a par with $A to B$ and $A ka B$. Hayashishita and Bekki (2012) thus conclude that conjoined nominal expressions cannot be analyzed as generalized conjunctions and disjunctions, 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 *monad* as in Bekki (2009). The proposed theory in effect treats $A to B$ and $A ka B$ as a sum of singular-individuals and a singular-individual, respectively, and allows $A ya B$ to be a sum of singular-individuals and a singular-individual at the same time.

Here I list the main assumptions of the theory in (31), referring the reader to Hayashishita and Bekki (2012) for its formal articulation.

- (31) a. The set of individuals and a binary operator '+' form a join-semilattice (cf. Link 1983)
- b. Conjoined nominal expressions and verbs are represented respectively as sets of individuals and sets of predicates in 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, $A to B$, $A ya B$ and $A ka B$ are defined as (32a), (32b), and (32c), respectively, and in the situation where the singular-individuals of the domain under consideration are Mark, Luke, and John, *Mark to Luke*, *Mark ya Luke*, *Mark ka Luke* are represented as (33a), (33b), and (33c), respectively in SR.

- (32) a. $\llbracket A to B \rrbracket = \{a + b \mid a \in \llbracket A \rrbracket, b \in \llbracket B \rrbracket\}$
- b. $\llbracket A ya B \rrbracket = \{x \mid a \leq x, a \in \llbracket A \rrbracket\} \cup \{y \mid b \leq y, b \in \llbracket B \rrbracket\}$
- c. $\llbracket A ka B \rrbracket = \llbracket A \rrbracket \cup \llbracket B \rrbracket$
- (33) a. $\llbracket \text{Mark to Luke} \rrbracket = \{m + l\}$
- b. $\llbracket \text{Mark ya Luke} \rrbracket = \{m, l, m + l, m + j, l + j, m + l + j\}$
- c. $\llbracket \text{Mark ka Luke} \rrbracket = \{m, l\}$

In the same situation, (23a), (23b), and (23c) are thus analyzed as (34a), (34b), and (34c), respectively.

- (34) a. $\llbracket \text{Mark to Luke ga kita} \rrbracket = \text{came}(m + l)$

- b. $\llbracket \text{Mark ya Luke ga kita} \rrbracket = \text{came}(m) \vee \text{came}(l) \vee \text{came}(m + l) \vee \text{came}(m + j) \vee \text{came}(l + j) \vee \text{came}(m + l + j)$
 c. $\llbracket \text{Mark ka Luke ga kita} \rrbracket = \text{came}(m) \vee \text{came}(l)$

These assumptions allow us to account for the plural and singular contrast between (i) *A to B* and (ii) *A ya B* and *A ka B*, illustrated in (24). Since in the situation mentioned above, (24a), (24b), and (24c) are represented as (35a), (35b), and (35c), respectively, in SR, it is expected that with (24b) and (24c), Mary offers tea if one person, Mark or Luke, comes.

- (35) a. $\forall w' (\omega R w' \wedge (\text{come}(m + l) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$
 b. $\forall w' (\omega R w' \wedge (\text{come}(m) \vee \text{come}(l) \vee \text{come}(m + l) \vee \text{come}(m + j) \vee \text{come}(l + j) \vee \text{come}(m + l + j) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$
 c. $\forall w' (\omega R w' \wedge (\text{come}(m) \vee \text{come}(l) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$

The observation regarding (28b) that *A ya B* may have plural and singular status at the same time is also captured, for in the situation mentioned above, (28b) is represented as (36) in SR.

- (36) $\exists w' (\omega R w' \wedge (\text{come}(m) \vee \text{come}(l) \vee \text{come}(m + l) \vee \text{come}(m + j) \vee \text{come}(l + j) \vee \text{come}(m + l + j) \text{ in } w'))$

In explaining the fact that for (23b) to be true, it must be the case that both Mark and Luke came, Hayashishita and Bekki (2012: 60) put forward a pragmatic argument.

3.3. The denotation of quantity nominal expressions

What is of interest to us is that the Japanese quantity nominal expressions we have considered in Section 2 can all be conjoined with an individual-denoting expression like *Naomi*, using any of the three conjunction types. This is partially illustrated in (37)–(38).

- (37) a. Mary wa [Naomi to sannin no otokonoko] ga kita ra, ocha
 Mary TOP Naomi three GEN boy NOM come if tea
 o dasu.
 ACC serve
 '(Lit.) If [Naomi 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.'
- (38) a. Rainen [(kokoni iru) subete no otokonoko to Naomi] ga
 next:year here exist all GEN boy Naomi NOM
 nihon ni kuru kamosirenai.
 Japan to come may
 '(Lit.) Next year, [all the boys (here) to Naomi] may come to Japan.'

- b. Rainen [(kokoni iru) subete no otokonoko ya Naomi] ga nihon ni kuru kamosirenai.
'(Lit.) Next year, [all the boys (here) *ya* Naomi] may come to Japan.'
- c. Rainen [(kokoni iru) subete no otokonoko ka Naomi] ga nihon ni kuru kamosirenai.
'(Lit.) Next year, [all the boys (here) *ka* Naomi] may come to Japan.'

Importantly, assuming that *sannin no otokonoko* 'three boys' and *subete no otokonoko* 'all the boys' are individuals, in particular sums of singular-individuals, the interpretations of these sentences are exactly what we expect. Using Hayashishita and Bekki's (2012) theory, in the situation where the singular-individuals in the domain of consideration are Naomi, Ruth, Mark, Luke, and John, (37a), (37b), and (37c) are, for example, represented as (39a), (39b), and (39c), respectively, in SR.

- (39) a. $\forall w' (\tau R w' \wedge (\text{come}(n + m + l + j) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$
 b. $\forall w' (\tau R w' \wedge (\text{come}(n) \vee \text{come}(m + l + j) \vee \text{come}(n + r) \vee \text{come}(m + l + j + r) \vee \text{come}(n + m + l + j) \vee \text{come}(n + m + l + j + r) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$
 c. $\forall w' (\tau R w' \wedge (\text{come}(n) \vee \text{come}(m + l + j) \text{ in } w') \rightarrow \text{Mary offers tea in } w')$

It is thus expected that with (37a), for Mary to offer tea, Naomi, Mark, Luke, and John all need to come, but with (37b) and (37c), Mary offers tea even when Naomi comes alone and when Mark, Luke, and John come without Naomi. Based on the discussion in this section, I conclude that the Japanese quantity nominal expressions we have discussed in Section 2 may all be analyzed as sums of singular-individuals.

4. The Analysis of Inverse Scope Readings

In this section, I put forward an analysis of inverse scope readings. First, based on the conclusion in the preceding section, I assume that when a given sentence gives rise to an inverse scope reading, the wide-scope-taking object expression is a sum of singular-individuals. I point out that this assumption has an immediate advantage. It is observed by Liu (1991: 16-17) that while so-called negative quantifiers support surface scope readings, they cannot give rise to inverse scope readings. For example, (40a) and (41a) cannot be taken to mean (40b) and (41b), respectively.^{10,11}

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

¹⁰Since Japanese does not have so-called negative quantifiers (Hayashishita and Ueyama 2012: 571-574), examples analogous to (40)-(41) cannot be constructed.

¹¹An anonymous reviewer reported that *no book* can take wide scope with respect to *every student* in the sentence *Every student read no book*, if we, for example, think of this as an answer to the question *What books got read by every student?* I acknowledge that this observation, if valid, remains unaccounted for in this paper.

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

The assumption mentioned above explains this observation, for it is reasonable to assume that so-called negative quantifiers cannot be individuals.

Assuming that when a given sentence gives rise to an inverse scope reading, the wide-scope-taking object expression is a sum of singular-individuals, our next question is how a given nominal expression whose denotation is a sum of singular-individuals can take scope over another nominal expression. I will answer this question below, explaining how inverse scope readings come about.

Recall the observation that the context in (19) facilitates the detection of an inverse scope reading for the sentences in (6) and (8). (19) and (6) are repeated here for convenience.

- (19) 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 ...
- (6) a. Sannin no sinsain ga Abusutorakuto #1 to Abusutorakuto #2
 three GEN reviewer NOM Abstract #1 and Abstract #2
 o sadokusita.
 ACC reviewed
 ‘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 the observation above to be indicative.

Suppose that the abstracts having 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 consisting solely of a major constituent of a sentence to be 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 (42).

- (42) a. Sannin no sinsain ga Abusutorakuto #1 o sadokusita.
 ‘Three reviewers read Abstract #1.’
 b. Sannin no sinsain ga Abusutorakuto #2 o sadokusita.

Given this assumption, my explanation of why the context in (19) facilitates the detection of an inverse scope reading for (6a) is as follows. The context in (19) contributes to the emergence of the two sentences, (42a) and (42b), and helps the speaker to use (6a) as a shorthand way of expressing them. Since the conjunction of the meanings of (42a) and (42b) (i.e. (43)) becomes logically equivalent to the inverse scope reading for (6a) (i.e. (44)), (19) facilitates the detection of an inverse scope reading for (6a).

$$(43) \exists X (X \subseteq \text{reviewer} \wedge |X|=3) \forall x (x \in X) [x \text{ read } a_1] \wedge \exists X (X \subseteq \text{reviewer} \wedge |X|=3) \forall x (x \in X) [x \text{ read } a_2]$$

$$(44) \forall y (y \in \iota Y (Y = \{a_1, a_2\})) \exists X (X \subseteq \text{reviewer} \wedge |X|=3) \forall x (x \in X) [x \text{ read } y]$$

We can also conceive of a situation where the speaker may choose to utter (6d) instead of (6a) for a pragmatic reason, e.g. when the hearer does not know what Abstract #1 and Abstract #2 refer to. In other words, we can reasonably consider that (6d) can also be a shorthand form of (42a) and (42b). If the domain includes two and only two abstracts, Abstract #1 and Abstract #2, the addition of (42a) and (42b) becomes logically equivalent to the inverse scope reading of (6d). So we may expect that the context in (19) also facilitates the detection of an inverse scope reading with (6d). Furthermore, in the context of (19), if the matter of exactly two abstracts being read by three reviewers is equally important, the speaker may use (6e) instead of (6a) or (6d) as a shorthand form of (42a) and (42b). It is thus consistent that the context in (19) facilitates the detection of an inverse scope reading for (6e). With similar reasoning we can explain why the context in (19) facilitates the detection of an inverse scope reading for the rest of the sentences in (6), and for the sentences in (8).

To record this line of thinking, I propose as the architecture of grammar 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.

$$(5) \begin{array}{l} \text{syntax}^S \rightarrow S_1 \\ \text{syntax}^S \rightarrow S_2 \\ \dots \\ \text{syntax}^S \rightarrow S_n \end{array} \begin{array}{l} \searrow \\ \longrightarrow \\ \longrightarrow \\ \searrow \end{array} \text{syntax}^D \rightarrow S$$

I assume *syntax*^S to be the system which Chomsky (1995: 219–394) postulates. While I leave the detailed description of *syntax*^D for my future work, I maintain two points here. (i) The meaning of **S** in (5) is the conjunction of $\llbracket S_1 \rrbracket \dots \llbracket S_n \rrbracket$. (ii) The operation that conjoins them is an operation in *syntax*^D, and it is constrained in such a way that (45) holds, where *A* is a sum of singular-individuals.

(45) SHORTHAND

Let *S* be an utterance containing a nominal expression α , where *A* is the extension of α .

The speaker may utter *S* in place of uttering S'_1, \dots, S'_n , where *n* is an arbitrary number, iff (i) S'_1, \dots, S'_n are identical to *S* in SR except that α in *S* is

replaced with an expression denoting a part of A , (ii) A has n parts, and (iii) S'_1, \dots, S'_n are distinct.

This analysis of inverse scope readings makes it possible for a nominal expression denoting a sum of singular-individuals to effectively 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, the wide-scope-taking object expression is analyzed as a sum of singular-individuals.

This analysis also accounts for all the other characteristics of inverse scope readings. Let me start with the generalization in (17), repeated here.

- (17) Inverse scope readings are possible under the following condition:
When the relevant object expression α is interpreted, there is one and only one group of objects that can possibly be the extension of α .

(17) follows as long as the discourse-level syntax ensures (45). To check if the condition (i) in (45) 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, the wide-scope-taking object expression is an individual, in particular, a sum of singular-individuals. If we state the intuition recorded in (17) in terms of this assumption, we have (46), which leads us to an interesting prediction.

- (46) Inverse scope readings are possible under the following condition:
When the relevant object expression α is interpreted, there is one and only one individual that can possibly be the extension of α .

Recall that according to Hayashishita and Bekki's (2012) proposal, which we have adopted above, we have (32a) and (32b), repeated here.

- (32) a. $\llbracket A \text{ to } B \rrbracket = \{a + b \mid a \in \llbracket A \rrbracket, b \in \llbracket B \rrbracket\}$
b. $\llbracket A \text{ ya } B \rrbracket = \{x \mid a \leq x, a \in \llbracket A \rrbracket\} \cup \{y \mid b \leq y, b \in \llbracket B \rrbracket\}$

If $\llbracket A \rrbracket$ and $\llbracket B \rrbracket$ are singleton sets, $A \text{ to } B$ can satisfy (46). On the other hand, $A \text{ ya } B$ never satisfies it; there are always three or more candidates because a , b , and $a+b$ are always included. We are thus led to predict that $A \text{ to } B$ may support inverse scope readings while $A \text{ ya } B$ does not.

The prediction is indeed borne out. For example, the first clause of (47a) can give rise to an inverse scope reading while that of (47b) cannot.

- (47) a. Sanninizyoo no kyoozyu ga [Luke to Mark] o suisensita
three:more GEN professor NOM Luke Mark ACC recommended
ga hoka no gakusei wa dono kyoozyu kara mo
but other GEN student TOP which professor from also
suisen o ukenakatta.
recommendation ACC not:received
'(Lit.) Three or more professors recommended [Luke to Mark], but the other students received no recommendations from any professors.'

- b. Sanninizyoo no kyoozyu ga [Luke ya Mark] o suisensita ga 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 (47a) can be taken to mean that Luke and Mark were each recommended by three or more professors; but we cannot associate the first clause of (47b) with the reading that each individual including Luke and Mark received a recommendation from three or more professors.

Similarly, the first clause of (48a) allows the inverse scope reading, but that of (48b) does not.

- (48) a. Sanninizyoo no kyoozyu ga [hutari no zyogakusei to Mark]
three:more GEN professor NOM two GEN female:student Mark
o suisensita ga hoka no gakusei wa dono
ACC recommended but other GEN student TOP which
kyoozyu kara mo suisen o ukenakatta.
professor from also recommendation ACC not:received
'(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 (48a) to mean that the two female students and Mark were each recommended by three or more professors, but the first clause of (48b) cannot be understood to mean that all the members of the group including the two female students and Mark were each recommended by three or more professors.

The proposed analysis of inverse scope readings can also explain the observation in Section 2.1, repeated here.

- (10) a. Speakers' acceptability judgments on inverse scope readings vary.
b. Informants are more likely to detect an inverse scope reading when the relevant object expression is a universal quantifier nominal or *A to B* 'A and B' than when the expression is *takusan no NP* 'many NP', a bare numeral, or a modified numeral. Among the latter three, modified numerals are the least likely to support inverse scope readings.

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 (19), which allows him/her to think of two or more sentences. As I noted in Section 2.3,

in linguistics experiments, informants are usually presented with sentences without context. Thus, it is conceivable that some speakers can come up with a necessary context by themselves while others cannot, leading us to expect (10a).

(10b) is explained as follows. Depending on the quantity nominal expression we select as the relevant object expression, the necessary condition for inverse scope readings in (46) may not be satisfied without discourse narrowing down the domain of individuals. As an approximation, we may assume that the object expressions of the sentences in (6) are characterized as (49).

- (49) a. $\llbracket \text{Abusutorakuto \#1 to Abusutorakuto \#2} \rrbracket = \{a_1 + a_2\}$
 b. $\llbracket \text{subete no abusutorakuto} \rrbracket = \{x \mid \exists X X = \text{abstract}: x = \sqcup X\}$
 c. $\llbracket \text{takusan no abusutorakuto} \rrbracket = \{x \mid \exists X X \subseteq \text{abstract} \wedge |X| \geq k: x = \sqcup X\}$,
 where k is a positive integer considered to be large in the relevant context
 d. $\llbracket \text{hutatu no abusutorakuto} \rrbracket = \{x \mid \exists X X \subseteq \text{abstract} \wedge |X| = 2: x = \sqcup X\}$
 e. $\llbracket \text{tyoodo hutatu no abusutorakuto} \rrbracket = \{x \mid \exists X X \subseteq \text{abstract} \wedge |X| = 2: x = \sqcup X\}$ ¹²
 f. $\llbracket \text{hutatu izyoo no abusutorakuto} \rrbracket = \{x \mid \exists X X \subseteq \text{abstract} \wedge |X| \geq 2: x = \sqcup X\}$

As the extension of *Abusutorakuto #1 to Abusutorakuto #2*, we have one and only one possibility, i.e. $a_1 + a_2$. Similarly, there is only one possibility for the extension of *subete no abusutorakuto* ‘all the abstracts’, i.e. the sum of all the abstract individuals in the domain. On the other hand, depending on the domain content, the extensions of *takusan no abusutorakuto* ‘many abstracts’, *hutatu no abusutorakuto* ‘two abstracts’, *tyoodo hutatu no abusutorakuto* ‘exactly two abstracts’, and *hutatu izyoo no abusutorakuto* ‘two or more 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 *takusan no abusutorakuto* ‘many abstracts’, there are eight candidates. In the same situation, the extensions of *hutatu no abusutorakuto* ‘two abstracts’ and *tyoodo hutatu no abusutorakuto* ‘exactly two abstracts’ would allow $((8 \times 7) / 2 =)$ 28 possibilities, and the extension of *hutatu izyoo no abusutorakuto* ‘two or more abstracts’ would have more possibilities.

¹² I acknowledge that this formulation is problematic, for without saying anything further, this leads us to expect that (i) can be truthfully uttered if John read more than two abstracts, contrary to fact.

- (i) John ga tyoodo hutatu no abusutorakuto o sadokusita.
 John NOM exactly two GEN abstract ACC reviewed
 ‘John read exactly two abstracts.’

I tentatively assume that the meaning of *tyoodo* ‘exactly’ projects the presupposition that the situation where the relevant sentence is uttered minimally satisfies its truth condition. In the case of (i), the situation that minimally satisfies its truth condition is not the one where John read more than two abstracts, but the one where he read two and only two abstracts. Thus, if (i) is uttered in the former situation, it is judged to be infelicitous due to presupposition failure.

Given that universal quantifier nominals and *A to B* ‘A and B’ meet the necessary condition of inverse scope readings without discourse narrowing down the domain of individuals, while *takusan no NP* ‘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 type than when it is of the latter.

For *takusan no NP* ‘many NP’ and bare numerals to satisfy the necessary condition in (46), what discourse needs to do is simply to restrict the domain of individuals so that we consider a certain group of individuals only. In the situation where seven is considered to be many while six is not, the extension of *takusan no abusutorakuto* ‘many abstracts’ allows 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, *hutatu no abusutorakuto* ‘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’s use of them in place of bare numerals. For example, when the speaker detects an inverse scope reading for (6e), he/she needs to ‘refer to’ a sum of two abstract individuals with *tyoodo hutatu no abusutorakuto* ‘exactly two abstracts’; thus, the speaker needs to imagine a context that justifies using it in place of *hutatu no abusutorakuto* ‘two abstracts’. Similarly, for (6f), in ‘referring to’ a sum of three abstract individuals, for example, the speaker needs a context to justify using *hutatu izyoo no abusutorakuto* ‘two or more abstracts’ instead of *mittu no abusutorakuto* ‘three abstracts’. In short, to give rise to an inverse scope reading, modified numerals need more contextual information than *takusan no NP* ‘many NP’ and bare numerals do. It is thus expected that fewer speakers will detect an inverse scope reading when the relevant object expression is a modified numeral.

5. Further Confirmation

In the preceding section, I maintained that when a given sentence gives rise to an inverse scope reading, the wide-scope-taking object expression is analyzed as a sum of singular-individuals. I proposed that a given nominal expression analyzed as a sum of singular-individuals can take wide scope with respect to another nominal expression because a given sentence can be a shorthand form of two or more sentences (henceforth *the shorthand strategy*). In this section, I present a generalization which we can explain if we assume that inverse scope readings emerge via the shorthand strategy.

First consider (50).

- (50) Suunin no kyozyu ga John to Bill o Toyota to Nissan
 several GEN professor NOM John and Bill ACC Toyota and Nissan
 ni suisensita.
 DAT recommended
 ‘Several professors recommended John and Bill to Toyota and Nissan.’

In this sentence, if *John to Bill* ‘John and Bill’ takes wide scope with respect to

suunin no kyoozyu ‘several professors’, each of John and Bill must be recommended to both Toyota and Nissan. Similarly, if *Toyota to Nissan* ‘Toyota and Nissan’ takes wide scope with respect to *suunin no kyoozyu* ‘several professors’, to each of Toyota and Nissan, both John and Bill must be recommended. We are thus led to conclude (51).

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

The same point can be illustrated with the examples in (52).

- (52) a. *Suunin no kyoozyu ga hutari no gakusei o Toyota*
 several GEN professor NOM two GEN student ACC Toyota
 to Nissan ni suisensita.
 and Nissan DAT recommended
 ‘Several professors recommended two students to Toyota and Nissan.’
 b. *Suunin no kyoozyu ga Toyota to Nissan ni hutari no gakusei o suisensita.*

With these sentences, if *hutari no gakusei* ‘two students’ takes wide scope with respect to *suunin no kyoozyu* ‘several professors’, each of the students must be recommended to both Toyota and Nissan.

As I now demonstrate, the generalization in (51) follows from the assumption that the inverse-scope-taking is possible only via the shorthand strategy. Recall that to constrain for which set of sentences a given sentence can be a shorthand form, I proposed that the discourse-level syntax ensures (45), repeated here.

(45) SHORTHAND

Let S be an utterance containing a nominal expression α , where A is the extension of α .

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

(45) is stated for cases where a given sentence is a shorthand form of two or more sentences with respect to one nominal expression. We can easily modify (45) so that it covers cases where a given sentence is a shorthand form with respect to more than one nominal expression. But note that even if we make the relevant modification, those additional cases are independently ruled out.

For an illustration of the point, consider (53).

- (53) *Smith kyoozyu ga John to Bill o Toyota to Nissan ni*
 Smith professor NOM John and Bill ACC Toyota and Nissan DAT
 suisensita.
 recommended
 ‘Prof. Smith recommended John and Bill to Toyota and Nissan.’

If (53) is a shorthand form only with respect to *John to Bill* ‘John and Bill’, we understand it to be a shorthand form of (54a) and (54b). Here I am assuming that

a sentence cannot be a shorthand form of two or more shorthand forms.

- (54) a. Smith kyoozyu ga John o Toyota to Nissan ni suisensita.
 b. Smith kyoozyu ga Bill o Toyota to Nissan ni suisensita.

Similarly, if (53) is a shorthand form only with respect to *Toyota to Nissan* ‘Toyota and Nissan’, it is understood to be a shorthand form of (55a) and (55b).

- (55) a. Smith kyoozyu ga John to Bill o Toyota ni suisensita.
 b. Smith kyoozyu ga John to Bill o Nissan ni suisensita.

However, if (53) were a shorthand form with respect to both *John to Bill* ‘John and Bill’ and *Toyota to Nissan* ‘Toyota and Nissan’, there would be more than one candidate set for which it is a shorthand form, namely, (56) and (57).¹³

- (56) a. Smith kyoozyu ga John o Toyota ni suisensita.
 b. Smith kyoozyu ga Bill o Nissan ni suisensita.
 (57) a. Smith kyoozyu ga John o Nissan ni suisensita.
 b. Smith kyoozyu ga Bill o Toyota ni suisensita.

Thus, the speaker would have trouble identifying for which set of sentences (53) serves as a shorthand form. I thus conclude that the shorthand strategy is possible only with respect to one nominal expression, and the generalization in (51) follows from the assumption that inverse scope readings emerge via the shorthand strategy.¹⁴

Incidentally, the generalization in (51) indicates that the analysis of inverse scope readings using the shorthand strategy is preferable to an alternative analysis that makes use of event semantics (cf. Parsons 1990; Landman 1996), which was suggested by an anonymous reviewer. The reviewer noted that when (50), for example, is taken to mean that John and Bill were each recommended by several professors to Toyota and Nissan, it can be analyzed as (58), and it is not necessary to appeal to the discourse-level syntax.

- (58) $\exists e \exists e_1 \exists e_2 (\sqcup\{e_1, e_2\} = e)$ [recommendation(e_1) \wedge Agent(e_1 , *several professors*)]

¹³ Depending on how (45) is modified, (i)–(iv) would also be among the candidates.

- (i) a. Smith kyoozyu ga John o Toyota ni suisensita. b. Smith kyoozyu ga Bill o Toyota ni suisensita.
 (ii) a. Smith kyoozyu ga John o Nissan ni suisensita. b. Smith kyoozyu ga Bill o Nissan ni suisensita.
 (iii) a. Smith kyoozyu ga John o Toyota ni suisensita. b. Smith kyoozyu ga John o Nissan ni suisensita.
 (iv) a. Smith kyoozyu ga Bill o Toyota ni suisensita. b. Smith kyoozyu ga Bill o Nissan ni suisensita.

¹⁴ An anonymous reviewer pointed out that the conjunction of the meanings of (56a) and (56b) and that of the meanings of (57a) and (57b) are specific instances of cumulative readings. We are thus led to assume that the emergence of cumulative readings is not via the shorthand strategy.

$$\wedge \text{Theme}(e_1, j) \wedge \text{Goal}(e_1, t + n) \wedge \text{recommendation}(e_2) \wedge \text{Agent}(e_2, \textit{several professors}) \wedge \text{Theme}(e_2, b) \wedge \text{Goal}(e_2, t + n)]$$

Note, however, that once this line of analysis is assumed, nothing prevents us from analyzing (50) as (59), which incorrectly leads us to predict that (50) can be taken to mean that John was recommended by several professors to Toyota, and Bill was recommended by several professors to Nissan.

(59) $\exists e \exists e_1 \exists e_2 (\sqcup\{e_1, e_2\} = e)$ [recommendation(e_1) \wedge Agent(e_1 , *several professors*) \wedge Theme(e_1, j) \wedge Goal(e_1, t) \wedge recommendation(e_2) \wedge Agent(e_2 , *several professors*) \wedge Theme(e_2, b) \wedge Goal(e_2, n)]

6. Towards Obtaining a Comprehensive Picture

In this section, in an effort to obtain a comprehensive picture, I further investigate the nature of inverse scope readings (cf. Section 6.1) and consider what is involved for the emergence of surface scope readings (cf. Section 6.2).

6.1. Further investigation of inverse scope readings

I have maintained above that when a given sentence gives rise to an inverse scope reading, the wide-scope-taking object expression is analyzed as a sum of singular-individuals. In this subsection, I maintain a stronger position: in the same situation, all the quantity nominal expressions occurring as major constituents of the sentence are understood to be sums of singular-individuals.

6.1.1. So-called negative quantifiers and inverse scope readings

Recall the observation that so-called negative quantifiers do not support inverse scope readings. To explain it, I have assumed that so-called negative quantifiers are not analyzed as sums of singular-individuals. It turns out that this observation is part of a larger generalization: a given sentence cannot give rise to inverse scope readings if the sentence contains a so-called negative quantifier as a major constituent.

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 (60a) nor (60b) can give rise to an inverse scope reading, in contrast to (60c).

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

(60a) 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, (60b) 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 (60c); (60c) can be taken to mean that for each book, there are a few

students who read it.¹⁵

Second, inverse scope readings are also not possible when a so-called negative quantifier appears as a clause-mate of the relevant subject and object nominal expressions. For example, (61a) and (61b) contrast with (61c) in that *every student* cannot take scope above *some teachers*.

- (61) 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.

(61a) is understood to mean that there are some teachers who did not introduce any student to any company, but we cannot take (61a) to mean that for each student, there are some teachers who introduced him/her to no companies. Similarly, (61b) 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 (61c) to mean that for each student, there are some teachers who introduced him/her to a few companies.

The situation is similar with (62). In (62a) and (62b), *every company* cannot take wide scope with respect to *some teachers*, but in (62c) it can.

- (62) 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.

Given that it is reasonable not to analyze so-called negative quantifiers as sums of singular-individuals, the generalization under discussion – a given sentence cannot give rise to inverse scope readings if the sentence contains a negative quantifier as a major constituent – leads us to (63).¹⁶

- (63) When a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions occurring as major constituents of the sentence are analyzed as sums of singular-individuals.

6.1.2. Freezing effects

We have concluded in Section 5 that the shorthand strategy is possible with respect to one and only one nominal expression. Assuming that for a quantity

¹⁵ Sato (2003) treats the effects of (60a) and (60b) being unable to give rise to an inverse scope reading (in contrast with (60c)) as instances of *intervention effects*, discussed in Hoji (1985: 262-271) and Beck (1996), and proposes (i).

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

But (i) is not tenable, as it does not account for the contrasts reported in (61) and (62) below.

¹⁶ Since Japanese does not have so-called negative quantifiers, the point I made in this section cannot be illustrated in Japanese.

nominal expression analyzed as a sum of singular-individuals to take scope over another nominal expression, it must use the shorthand strategy, the conclusion in (63) leads us to Hayashishita's (2004: 20-34) generalization: when the direct or indirect object takes wide scope with respect to its clause-mate subject, the latter 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 a *freezing effect*.

6.1.2.1. Freezing effects on scope

Hayashishita (2004: 20-27) demonstrates that when the direct or indirect object 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 in (64a) and a surface scope reading in (64b).

- (64) a. (Based on Hayashishita 2004: Ch.2 Example [20])
 Sannin no kyoozyu ga rei no hutari no gakusei o
 three GEN professor NOM the GEN two GEN student ACC
 kaisya ni suisensita.
 company DAT recommended
 'Three professors recommended the two students under discussion to companies.'
- b. (Based on Hayashishita 2004: Ch.2 Example [21])
 Sannin no kyoozyu ga John o hutatu no kaisya ni
 three GEN professor NOM John ACC two GEN company DAT
 suisensita.
 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. In (65), when the direct object takes scope above the subject, the subject cannot take wide scope with respect to the indirect object, and conversely, when the subject takes scope above the indirect object, the direct object cannot take wide scope with respect to the subject.

- (65) (Based on Hayashishita 2004: Ch.2 Example [22])
 Sannin no kyoozyu ga rei no hutari no gakusei o
 three GEN professor NOM the GEN two GEN student ACC
 hutatu no kaisya ni suisensita.
 two GEN company DAT 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. $\forall y (y \in \iota Y (Y \subseteq \textit{student} \wedge |Y| = 2)) [\exists X (X \subseteq \textit{professor} \wedge |X| = 3)$
 $\forall x (x \in X) [\exists Z (Z \subseteq \textit{company} \wedge |Z| = 2) \forall z (z \in Z) [x \textit{ recommended } y$
to $z]]]$
- b. $\forall y (y \in \iota Y (Y \subseteq \textit{student} \wedge |Y| = 2)) [\exists X (X \subseteq \textit{professor} \wedge |X| = 3)$
 $\exists Z (Z \subseteq \textit{company} \wedge |Z| = 2) [\forall x (x \in X) \exists z (z \in Z) [x \textit{ recommended } y$
to $z] \wedge \forall z (z \in Z) \exists x (x \in X) [x \textit{ recommended } y \textit{ to } z]]]$

(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), therefore, 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. As with (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 Example [27])
Sannin no kyoozyu ga hutatu no kaisya ni rei no hutari no gakusei o suisensita.

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 (70), their scrambling construction counterpart.

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

As Hayashishita (2004: 25–27) points out, surface scope readings contrast with inverse scope readings, not showing freezing effects on scope. When the subject takes wide scope with respect to its clause-mate object, the latter can still take wide scope with respect to another nominal expression. For example, (71) can be taken to mean (72).

- (71) (= Hayashishita 2004: Ch.2 Example [33], slightly adapted)
 Maitosi takusan no kyoozyu ga gonin no gakusei ni
 every:year many GEN professor NOM five GEN student DAT
 hutatu no kaisya o suisensuru.
 two GEN company ACC recommend
 ‘Each year, many professors recommend two companies to five students.’
- (72) $\exists X (X \subseteq \textit{professor} \wedge |X| \geq k) \forall x (x \in X) [\exists Y (Y \subseteq \textit{student} \wedge |Y| = 5)$
 $\forall y (y \in Y) [\exists Z (Z \subseteq \textit{company} \wedge |Z| = 2) \forall z (z \in Z) [x \textit{ recommends } z \textit{ to } y]]]$, where k is a positive integer considered to be large in the relevant context.

6.1.2.2. Freezing effects on binding

Hayashishita (2004: 27–34) also demonstrates that when the direct or indirect object takes wide scope with respect to its clause-mate subject, the latter cannot bind a dependent term. For example, as we can observe in (73a), the direct object can take wide scope with respect to the subject.

- (73) a. (Based on Hayashishita 2004: Ch.2 Example [38])
 Mittu no ginkoo ga rei no hutatu no kaisya o
 three GEN bank NOM the GEN two GEN company ACC
 torihikisaki ni syookaisita.
 customer DAT introduced
 ‘Three banks introduced the two companies under discussion to customers.’
- b. (Based on Hayashishita 2004: Ch.2 Example [39])
Mittu no ginkoo ga Toyota o soko no torihikisaki
 three GEN bank NOM Toyota ACC that:place GEN customer
 ni syookaisita.
 DAT introduced
 ‘Three banks introduced Toyota to their customers.’

In addition, (73b) can be taken to mean there are three banks such that each of the banks introduced Toyota to its customers; thus, we understand that bound variable anaphora can be established between *mittu no ginkoo* ‘three banks’ and *soko* ‘that place’.¹⁷ 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.¹⁸

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 illus-

¹⁷(Intended) bound variable anaphora will be indicated by underlining.

¹⁸It 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 if we assume 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: 179–181; 229–231; 208–222 for an extensive discussion of the nature of *so*-NPs.)

trated in (74).¹⁹

(74) (Based on Hayashishita 2004: Ch.2 Example [40])

Mittu no ginkoo ga rei no hutatu no kaisya o soko
 three GEN bank NOM the GEN two GEN company ACC that:place
 no torihikisaki ni syookaisita.
 GEN customer 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 (75a), but (75b). In fact, (74) cannot be true in (76).

- (75) a. $\forall y (y \in \iota Y (Y \subseteq \textit{company} \wedge |Y| = 2)) [\exists X (X \subseteq \textit{bank} \wedge |X| = 3) \forall x (x \in X) [x \textit{ introduced } y \textit{ to } x\textit{'s customers}]]$
 b. $\forall y (y \in \iota Y (Y \subseteq \textit{company} \wedge |Y| = 2)) [\exists X (X \subseteq \textit{bank} \wedge |X| = 3) \forall x (x \in X) [x \textit{ introduced } y \textit{ to } a\textit{'s customers}]]$, where *a* is an individual salient in the relevant context

(76) 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.

(i) (= Hoji 1998: 652 Example [3], slightly adapted)

a.*Toyota₁ ga Nissan₂ ni [_{IP} zeimusyo ga soko₁₊₂ o Toyota NOM Nissan DAT tax:office NOM that:place ACC sirabeteiru] to tugeta (koto)
 is:investigating that told that
 ‘Toyota₁ told Nissan₂ that the tax office was investigating them₁₊₂.’

b.*Toyota₁ wa Nissan₂ ni soko₁₊₂ no goodoo paatii no kaizyoo Toyota TOP Nissan DAT that:place GEN joint party GEN place o teiansita.
 ACC suggested
 ‘Toyota₁ suggested to Nissan₂ a place for their₁₊₂ joint party.’

(ii) (= Hoji 1998: 650–651 Examples [2a]–[2b], slightly adapted)

a. Tom₁ ga Nick₂ ni [_{IP} CIA ga karera₁₊₂ o sirabeteiru] to Tom NOM Nick DAT CIA NOM them ACC is:investigating that tugeta (koto)
 told that
 ‘Tom₁ told Nick₂ that the CIA was investigating them₁₊₂.’

b. Ano ninensei₁ wa ano itinensei₂ ni aitura₁₊₂ no atarasi kooti o that sophomore TOP that freshman DAT them GEN new coach ACC syookaisita.
 introduced
 ‘That sophomore₁ introduced to that freshman₂ their₁₊₂ new coach.’

¹⁹ An anonymous reviewer pointed out that (74) can be understood to mean (75a) if *soko* is replaced with *so*. Hoji (2006: 148–163), however, shows that *so* cannot be considered as a ‘proper’ bindee.

As reversing the linear order between the direct and indirect objects did not erase freezing effects on scope, a change of linear order as in (77) also does not eliminate freezing effects on binding. That is, like (74), (77) cannot give rise to the reading in (75a); it must be taken to mean (75b).

(77) (Based on Hayashishita 2004: Ch.2 Example [43])

Mittu no ginkoo ga soko no torihikisaki ni rei no hutatu no kaisya o syookaisita.

The fact that (74) and (77) cannot give rise to the reading in (75a) is noteworthy, since (78), their scrambling construction counterpart, allows the interpretation under discussion.^{20,21}

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

As Hayashishita (2004: 32–34) points out, surface scope readings also contrast with inverse scope readings in terms of freezing effects on binding. For example, (79) can be taken to mean (80).

(79) (Based on Hayashishita 2004: Ch.2 Example [49])

Hutatuizyoo no ginkoo ga itutu no zidoosyagaisya
 two:more GEN bank NOM five:more GEN automobile:company
 ni soko no kanrengaisya o syookaisita.
 DAT that:place GEN related:company ACC introduced
 ‘Two or more banks introduced their related companies to five automobile companies.’

²⁰ 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: 32) notes that the sentences in (i) illustrate the point, attributing the observation to Anthony Kroch (p.c.): 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.

²¹ Fox (2000: 64) 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: Ch.2, Footnote 52 Example [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.

- (80) $\exists X (X \subseteq \textit{bank} \wedge |X| \geq 2) \forall x (x \in X) [\exists Y (Y \subseteq \textit{automobile company} \wedge |Y| = 5) \forall y (y \in Y) [x \textit{ introduced } y\text{'s related companies to } y]]$

Given that the freezing effects we have just observed are expected once we assume (63), repeated here, I consider the empirical data presented in this section to support it.

- (63) When a given sentence gives rise to an inverse scope reading, all the quantity nominal expressions occurring as major constituents of the sentence are analyzed as sums of singular-individuals.

6.2. The analysis of surface scope readings

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.

- (81) a. There is no variation among speakers' judgments on the availability of surface scope readings (see Section 2.1).
 b. 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 2.1).
 c. The emergence of surface scope readings does not require the particular discourse context needed by inverse scope readings (see Section 2.2).
 d. Surface-scope taking is possible with all the quantity nominal expressions, including so-called negative quantifiers (see Section 4).
 e. Surface-scope taking does not induce freezing effects (see Section 6.1).

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 (81) 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 (81a), (81b), and (81c) indicate that the standard assumption of the field, i.e. that the sentence-level syntax can generate surface scope readings, is reasonable. One way of implementing this assumption is to assume that the quantity nominal expressions we have considered are also analyzed as generalized quantifiers. Indeed, (81d) and (81e) indicate that this assumption is reasonable.

6.3. Implications

There are several implications from the above discussion. First of all, the distribution of wide scope readings can be summarized as in (82).

(82)	With <i>Syntax</i> ^S alone	With <i>Syntax</i> ^S and <i>Syntax</i> ^D
Surface scope readings	Possible	Possible
Inverse scope readings	Not possible	Possible

Second, we have (83).

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

We cannot assume, however, that the quantity nominal expressions under discussion are always ambiguous. If they were, we could not account for the observations in Section 6.1: (i) inverse scope readings are not possible if a given sentence contains a negative quantifier as a major constituent, and (ii) inverse scope readings invoke freezing effects. We need something more to ensure that all the quantity nominal expressions that are major constituents of a given sentence are analyzed in the same way, either as generalized quantifiers or as sums of singular-individuals. This leads us to the two modes of sentence interpretation described in (84).

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

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

7. Further Remarks

An anonymous reviewer noted that in B's turn in the discourse in (86) below, *everyone* can take wide scope with respect to *someone* if it is uttered with a particular intonation, despite the fact that *everyone* is embedded in a *wh*-island, a complex NP island, and a subject island. He/She noted that pronouncing *some* and *every* with an emphatic accent, indicated by capital letters in (86B), facilitates the detection of the inverse scope reading under discussion.

- (86) A: Someone thinks that whether people who Bill knows are all crazy is an interesting question.
 B: SOMEone thinks that whether people who EVERYone knows are all crazy is an interesting question.

This observation is consistent with the analysis proposed in this paper (but not with the analyses making use of a syntactic scope-shifting operation), for nothing so far prevents us from assuming that the shorthand strategy may be involved in a complex sentence like (86B). However, the fact that the inverse scope reading under discussion requires a particular intonation suggests that the shorthand strategy makes reference to the theory of focus. I will investigate the relation between the shorthand strategy and focus in my future research.

From the beginning 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 generally adopt is (87).

- (87) Let α and β be quantity nominal expressions.
If α takes wide scope with respect to β , then α *c*-commands β at LF.

I point out, however, that the validity of (87) depends on the assumption, which this paper clearly undermines, that all instances of wide scope readings are generated by the sentence-level syntax directly. This paper thus poses a serious challenge to all studies embracing (87).

The paper instead suggests that if we study LF properties using wide scope readings, we should adopt (88).

- (88) Let α and β be quantity nominal expressions.
If α takes wide scope with respect to β through the sentence-level syntax alone, then α *c*-commands β at LF.

To utilize (88) in turn requires that we have operational tests to determine if a given wide scope reading is generated directly from the sentence-level syntax. Using the observations I presented above, we may, for example, devise the following tests.²²

- (89) Tests to check if α takes wide scope with respect to β through the sentence-level syntax alone, where α and β are quantity nominal expressions:
- a. Test 1:
Can α take wide scope with respect to β even if there is more than one group of individuals that can potentially be the extension of α ?
 - b. Test 2:
Can α take wide scope with respect to β even if α , β , or their clause-mate nominal expression is a so-called negative quantifier?
 - c. Test 3:
Can α take wide scope with respect to β even if a clause-mate of α (e.g. β) takes wide scope with respect to another nominal expression?

²² 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.

d. Test 4:

Can α take wide scope with respect to β even if a clause-mate of α (e.g. β) binds a dependent term?

If the answer to these questions is ‘yes’, then nothing so far prevents us from assuming that the wide scope reading under examination is generated directly from the sentence-level syntax.

In my view, researchers in the field generally tend to attribute sentence interpretations to the sentence-level syntax alone. This tendency is also found with sentence interpretations that are closely tied to discourse factors. Researchers might try to justify such an assumption by saying that it is the null hypothesis for the research project in generative grammar, whose aim is to uncover LF hierarchical structure. The research results I have presented in this paper, however, suggest 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.²³ 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 expect the controversy over such generalizations to continue. If a generalization that one attempts to maintain concerns the (un)availability of a sentence interpretation that involves the discourse-level syntax, there is no guarantee that others have access to the same contextual information that he/she does. Until we sufficiently understand how discourse contributes to sentence interpretations, the variation among speakers’ introspective judgments is inevitable. My optimistic expectation is that after studying the nature of the discourse-level syntax in detail, we researchers in the field of generative grammar will be able to present a wide range of converging (i.e. repeatable) generalizations to the wider linguistic community. I trust that my paper contributes to this end.

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²³ 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 quantity nominal expressions, surface scope readings are possible while inverse scope readings are not. But this generalization is challenged by Katz and Postal (1964: 72), who say that inverse scope readings are also possible.

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【要旨】

逆スコープ解釈の本質について

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生成文法の標準的な分析では、逆スコープ解釈（例えば (1a) における (1b) の解釈）は順スコープ解釈（例えば (2a) における (2b) の解釈）と並列的に扱われることが多い。

- (1) a. Some boy loves every girl.
b. すべての女の子一人一人に対して、その子を愛している男の子が少なくとも一人はいる
- (2) a. Every boy loves some girl.
b. すべての男の子一人一人に対して、その子が愛している女の子が少なくとも一人はいる

つまり、どちらの解釈の場合も広いスコープを取っている方の数量表現は一般量量子であり、いずれの解釈も、Computational System の出力である LF 表示（におけるそれぞれの数量表現の構造的上下関係）を直接反映したものであると分析されるのが一般的である。

しかし、本稿ではそのような分析に異議を唱えたい。逆スコープ解釈というのは、Computational System の働き（文レベルの要因）のみによって生じるのではなく、談話レベルの情報が関係する複合的な現象なのであり、また、広いスコープを取っている方の数量表現は一般量量子ではなく単数個体群の総和（a sum of singular-individuals）と分析されるべきなのである。

数量表現を含む文の意味解釈を観察することによって Computational System の働きに迫るといえるのは生成文法でよく見られる方法であるが、本稿が示したように、スコープ解釈のすべてが文レベルのみで決定するものではない以上、観察されたスコープが何に基づくものであるのかを正しく見極めることが極めて重要である。