Scrambling and Scope Economy*

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Abstract

This article analyzes the scope properties of scrambling of quantificational noun phrases in Japanese on the basis of a modified version of Fox's (2000) Scope Economy. While Fox (2000) and Takahashi (2008a) intend by Scope Economy to limit the application of quantifier raising and scrambling, respectively, I agree with Miyagawa (2006) that the Scope Economy limits the interpretation, instead of the application, of scrambling chains. Specifically, I propose that optional instances of movement, whether overt or covert, that do not affect scopal interpretation are subject to scope reconstruction, which is embodied by the semantic reconstruction analysis (Cresti (1995), Rullmann (1995)).

***Keywords*:** Scope Economy, parallelism, A/A´-asymmetry, reconstruction

1. Introduction

This paper aims to clarify the relationship between scrambling and quantifier scope. It is often assumed that scope alternation is achieved by quantifier raising (QR) in English while scrambling plays this role in Japanese (Bobaljik and Wurmbrand (2012), Oku (2018), Szabolcsi (1997)). However, it is not the case that all instances of scrambling contribute to scope alternation: non-quantificational nominals such as pronouns and R-expressions can undergo scrambling without scoping at all, and quantificational nominals (QPs) do not always expand their scope

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by scrambling.

On the basis of the behavior of quantified sentences involving VP-ellipsis, Fox (2000) proposes that the principle of Scope Economy constrains QR in English. In Fox (2000), Scope Economy was originally regarded as a condition on optional instances of *covert* scope shifting operations, such as QR and quantifier lowering (QL) in raising-to-subject constructions. However, the subsequent studies by Takahashi (2008a, 2008b) and Miyagawa (2006) have attempted to apply this condition to scrambling, which is an optional *overt* movement in Japanese. After reviewing their arguments and pointing out problems, this paper proposes a new formulation of the Scope Economy that comprehensively restricts overt as well as covert movements, according to which an optional instance of QP movement, whether overt or covert, must leave a trace of type <et, t> and accordingly undergo semantic reconstruction in the sense of Cresti (1995) and Rullman (1995).

This paper is organized as follows. In section 2, I survey Fox's (2000) theory of Scope Economy and its application to Japanese data involving ellipsis and long-distance scrambling by Takahashi (2008a) and Miyagawa (2006). In section 3, I propose to reformulate Scope Economy as a condition on the interpretation of movement chains. In section 4, I compare two approaches to scope reconstruction, i.e., semantic reconstruction and syntactic reconstruction, and argue that the former must be involved in the formulation of Scope Economy.

2. Previous Studies

2.1. Fox (2000)

Fox (2000: 75) presents a general condition called Output Economy, of which Scope Economy and Word Order Economy are special cases:

(1) Output Economy
Optional operations must affect the output. (Fox (2000: 75))

(2) a. Scope Economy

Covert optional operations (i.e., QR and QL) cannot be scopally vacuous (i.e., they must reverse the relative scope of two noncommutative quantificational expressions).

b. Word Order Economy

Overt optional operations cannot be string-vacuous (i.e., they must reverse the relative order of two—perhaps phonologically overt—expressions). (ibid.)

Each application of optional operations must satisfy (1) by satisfying either (2a) or (2b). In what follows, we review Fox's (2000) arguments for Scope Economy and Word Order Economy in turn.

2.1.1. Scope Economy

Fox (2000) justifies the concept of Scope Economy on the basis of quantified sentences involving VP-ellipsis. Consider the sequence of the sentences in (3). The antecedent sentence (3a) is followed by the ellipsis sentence (3b). Elided parts are indicated by strikethroughs.

(3) a. A boy admires every teacher.

b. A girl does ~~admire every teacher~~, too.

Containing two QPs, both sentences in (3) are scopally ambiguous between the subject wide scope and the object wide scope readings. However, Fox observes that these sentences must be consistent in their scope relations, as summarized in (4). Namely, if the antecedent sentence is read with surface scope, the ellipsis sentence also must be, and if the antecedent sentence is read with inverse scope, the ellipsis sentence must be, too.

(4) a. (3a) ∃>∀ ; (3b) ∃>∀ c.* (3a) ∃>∀ ; (3b) ∀>∃
b. (3a) ∀>∃ ; (3b) ∀>∃ d.* (3a) ∀>∃ ; (3b) ∃>∀

In light of this observation, Fox proposes a condition on ellipsis, called parallelism, in (5), where β_A and β_E stand for the antecedent sentence and the ellipsis sentence, respectively:

(5) Parallelism
In an ellipsis/phonological reduction construction the scopal relationship among the elements in β_A must be identical to the scopal relationship among the parallel elements in β_E (Fox (2000: 32))

Parallelism constrains the class of possible LFs for the pair of the sentences in (3). The pair of LFs in (6a), which corresponds to the reading in (4a), is structurally isomorphic, and hence meets the parallelism requirement, and so does the pair of LFs in (6b), which corresponds to the reading in (4b). On the other hand, those in (6c, d) violate parallelism.[1]

(6) a. [$_{IP}$ a boy$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ a girl$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]], too
b. [$_{IP}$ every teacher$_2$ [$_{IP}$ a boy$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ every teacher$_2$ [$_{IP}$ a girl$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]]], too
c. *[$_{IP}$ a boy$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ every teacher$_2$ [$_{IP}$ a girl$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]]], too
d. *[$_{IP}$ every teacher$_2$ [$_{IP}$ a boy$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ a girl$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]], too

Next, consider the sequence in (7). In this case, only the antecedent sentence

contains multiple QPs, and Fox argues that the antecedent sentence is disambiguated in favor of the surface scope.

(7) a. A boy admires every teacher. ∃>∀; *∀>∃
b. Mary does ~~admire every teacher~~, too.

The availability of the surface scope in the antecedent sentence is guaranteed by the pair of LFs in (8) meeting the parallelism condition. However, parallelism alone cannot account for the absence of the inverse scope in the antecedent sentence because that would license the LFs in (8b), contrary to fact:

(8) a. [$_{IP}$ a boy$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ Mary$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]], too
b. *[$_{IP}$ every teacher$_2$ [$_{IP}$ a boy$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ every teacher$_2$ [$_{IP}$ Mary$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]]], too
c. *[$_{IP}$ a boy$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ every teacher$_2$ [$_{IP}$ Mary$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]]], too
d. *[$_{IP}$ every teacher$_2$ [$_{IP}$ a boy$_1$ [$_{VP}$ t$_2$′ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ Mary$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]], too

Fox argues that it is Scope Economy, repeated in (9), that is responsible for excluding the pair of LF in (8b).

(9) Scope Economy
Covert optional operations (i.e., QR and QL) cannot be scopally vacuous (i.e., they must reverse the relative scope of two noncommutative quantificational expressions).

The QR of *every teacher* across *Mary* is scopally vacuous and is prohibited by Scope Economy. Therefore, the LF of the ellipsis sentence in (8b) is not derivable, even if it would be structurally isomorphic to that of the antecedent sentence.

2.1.2. Word Order Economy

Let us turn to the second component of Output Economy, namely, Word Order Economy, repeated in (10).

(10) Word Order Economy
Overt optional operations cannot be string-vacuous (i.e., they must reverse the relative order of two—perhaps phonologically overt—expressions). (ibid.)

Fox motivates this condition by considering extraposition from NP, which is an optional overt operation.

The contrast in (11) indicates that extraposition from NP serves to bleed the violation of Condition C of the Binding theory. In (11a), the direct object pronoun *him* cannot be coreferential with the R-expression *John*, which is embedded in the adjunct to the dative argument that it c-commands. However, when the adjunct is extraposed across the adverbial *yesterday*, which modifies the matrix VP, the Condition C effect disappears.

(11) a. ?? I [$_{VP}$ introduced him$_1$ [to the woman that John$_1$ likes]] yesterday.
b. I [$_{VP}$ introduced him$_1$ [to the woman _]] yesterday [that John$_1$ likes].
(Fox (2000: 76))

Then, he considers the sentence in (12). It is minimally different from those in (11) in lacking the VP modifier *yesterday*.

(12) ?? I introduced him$_1$ to the woman that John$_1$ likes.

The deviance of (12) under the coreference of *him* and *John* is expected given the analysis in (13a). However, if string vacuous extraposition were permitted as in (13b), the sentence would have to allow for the coreference. Word Order Economy is responsible for excluding such a derivation.

(13) a. I [$_{VP}$ introduced him$_1$ [to the woman that John$_1$ likes]].
b. I [$_{VP}$ introduced him$_1$ [to the woman _]] ∅ [that John$_1$ likes].

Word Order Economy, as well as Scope Economy, will be relevant to the description of Takahashi's (2008a) analysis of argument ellipsis of QPs, which will be reviewed in the next section.

2.2. Takahashi (2008a)

2.2.1. Argument Ellipsis and Parallelism

Takahashi (2008a) investigates sentences involving argument ellipsis in Japanese (see Oku (1998) and Saito (2004) for some arguments in favor of the ellipsis analysis of null arguments in Japanese). He found parallelism effects in argument ellipsis analogous to those in VP-ellipsis in English.[2]

(14) indicates that a QP can undergo argument ellipsis in Japanese. The antecedent sentence contains the QP object *taitei-no sensei-o* 'most teachers' while in the second sentence the object is missing. However, it can be interpreted as "Taroo respects most teachers, too."

(14) a. Hanako-ga taitei-no sensei-o sonkeisiteiru.
Hanako-NOM most-GEN teacher-ACC respect
'Hanako respects most teachers.'

b. Taroo-mo *e* sonkeisiteiru.
Taroo-also respect
'(Lit.) Taroo respects, too.' (Takahashi 2008a: 310)

This reading is expected if the second sentence has the object QP elided in PF under identity with the object QP in the antecedent sentence, as shown in (15):

(15) Hanako-ga taitei-no sensei-o sonkeisiteiru
Taroo-mo ~~taitei-no sensei-o~~ sonkeisiteiru

Takahashi then considers the pair in (16). The antecedent sentence involves the scrambling of the object QP across the subject QP, and the missing object in the second sentence is interpreted as *taitei-no sensei-o* 'most teachers.'

(16) a. Taitei-no sensei-o zyosi-no dareka-ga sonkeisiteiru.
most-GEN teacher-ACC girl-GEN someone-NOM respect
'(Lit.) Most teachers, some girl respects.'
b. Dansi-no dareka-mo *e* sonkeisiteiru.
boy-GEN someone-also respect
'(Lit.) Some boy respects, too.' (ibid.: 312)

The sentences in (16) are both scopally ambiguous. Furthermore, they exhibit the parallelism effect; when (16a) is interpreted with the object wide scope, so is (16b), and when (16a) is interpreted with the subject wide scope (via reconstruction), (16b) is, too.

Takahashi's analysis is as follows. When (16a) is read with the object wide scope, it has the LF representation (17a). The LF of (16b) that will satisfy the parallelism requirement is given in (17b), where the scrambled QP undergoes ellipsis

in PF under identity with the antecedent QP.

(17) a. [$_{TP}$ Taitei-no sensei-o$_1$ [$_{TP}$ zyosi-no dareka-ga [$_{VP}$ t$_1$ sonkeisiteiru]]]
b. [$_{TP}$ ~~Taitei-no sensei-o$_1$~~ [$_{TP}$ dansi-no dareka-mo [$_{VP}$ t$_1$ sonkeisiteiru]]]

Takahashi argues that the instance of scrambling involved in the LF (17b) conforms to Output Economy because the scrambling of the elided QP creates a new reading and hence satisfies Scope Economy though it violates Word Order Economy (i.e., the scrambling of null arguments does not affect word order).

When (16a) is interpreted with the subject wide scope, it is mapped to the LF (18a) by the reconstruction of the subject QP. For the ellipsis sentence (16b) to be licensed, it must be assigned a parallel LF like that in (18b) (the null object may or may not have undergone scrambling; if it has, it will be finally reconstructed and occupy the same position in LF as the object in the antecedent sentence; if it has not, it is interpreted in situ in LF):

(18) a. [$_{TP}$ __ [$_{TP}$ zyosi-no dareka-ga [$_{VP}$ Taitei-no sensei-o sonkeisiteiru]]]
|_____↑
b. [$_{TP}$ (_) [$_{TP}$ dansi-no dareka-mo [$_{VP}$ ~~Taitei-no sensei-o~~ sonkeisiteiru]]]
(|_____↑)

Let us turn to (19). It differs from (16) in that the subject in it is the non-QP *Taroo-mo* ‘Taroo also.’ Takahashi observes that the antecedent sentence in (19) is unambiguously interpreted with the subject wide scope.

(19) a. Taitei-no sensei-o zyosi-no dareka-ga sonkeisiteiru.
most-GEN teacher-ACC girl-GEN someone-NOM respect
‘(Lit.) Most teachers, some girl respects.’

b. Taroo-mo *e* sonkeisiteiru.
Taroo-also respect
'(Lit.) Taroo respects, too.' (ibid.: 314)

This is reminiscent of the disambiguation effect in (7). Consider what the LF of the ellipsis sentence (19b) could be like. If it is represented as in (20a), which does not involve scrambling, the parallelism requirement forces the antecedent sentence to be assigned the LF (18a) by reconstructing the scrambled QP. In this case, the antecedent sentence is interpreted with the subject wide scope. On the other hand, if the antecedent sentence were to be read with the object wide scope, its LF would have to be (17a) and hence the ellipsis sentence would have to involve the scrambling of the elided QP as in (20b) so that their LFs would be structurally isomorphic. However, such an LF, Takahashi argues, is unavailable to (19b) due to the violation of Output Economy; Word Order Economy is violated because the scrambling of the elided QP does not affect word order, and so is Scope Economy because the crossed subject is a non-QP and hence the scrambling does not affect semantic interpretation. With neither subcomponent of Output Economy satisfied, the application of scrambling as in (20b) is not allowed.

(20) a. [$_{TP}$ Taroo-mo [$_{VP}$ ~~Taitei-no sensei-o~~ sonkeisiteiru]]]
b. *[$_{TP}$ ~~Taitei-no sensei-o$_1$~~ [$_{TP}$ Taroo-mo [$_{VP}$ t_1 sonkeisiteiru]]]

2.2.2. A Problem

Takahashi does not discuss instances of QP-scrambling that obey Word Order Economy but not Scope Economy, such as the one given in (21a). With the subject being a non-QP, the scrambling of *taitei-no sensei-o* 'most teachers' is scopally vacuous.

(21) a. Taitei-no sensei-o Taroo-ga t sonkeisiteiru.
most-GEN teacher-ACC Taroo-NOM respect
'(Lit.) Most teachers, Taro respects.'
b. LF: [$_{TP}$ Taitei-no sensei-o [$_{TP}$ Taroo-ga [$_{VP}$ t sonkeisiteiru]]]

It should be noted that Takahashi assumes that Output Economy constrains the *applicability* of scrambling but not the interpretation of the chain created by scrambling. Thus, if the scrambling of a QP is scopally vacuous, nothing in Takahashi's assumptions prohibits that QP from occupying a landing site in LF as shown in (21b), (insofar as it affects word order, as in this example).

However, the following observation by Maeda (2019) poses a problem for positing the LF of (21b); when a scopally trivial antecedent sentence like (21a) (= (22a)) is followed by the ellipsis sentence (22b) containing multiple QPs, the disambiguation effect occurs; more specifically, the ellipsis sentence is unambiguously read with the subject wide scope:

(22) a. Taitei-no sensei-o Taroo-ga t sonkeisiteiru.
most-GEN teacher-ACC Taroo-NOM respect
'(Lit.) Most teachers, Taro respects.'
b. Zyosi-no dareka-mo *e* sonkeisiteiru.
girl-GEN someone-also respect
'(Lit.) Some girl respects, too.' (Maeda (2019: 427))

The following is the list of logically possible pairs of LFs for (22a) and (22b).

(23) a. [$_{TP}$ taitei-no sensei-o$_1$ [$_{TP}$ Taroo-ga [$_{VP}$ t$_1$ sonkeisiteiru]]]
[$_{TP}$ ~~taitei-no sensei-o$_1$~~ [$_{TP}$ zyosi-no dareka-mo [$_{VP}$ t$_1$ sonkeisiteiru]]]

b. [$_{TP}$ __ [$_{TP}$ Taroo-ga [$_{VP}$ taitei-no sensei-o sonkeisiteiru]]]
[$_{TP}$ (_) [$_{TP}$ zyosi-no dareka-mo [$_{VP}$ ~~taitei-no sensei-o~~ sonkeisiteiru]]]

c. [$_{TP}$ taitei-no sensei-o$_1$ [$_{TP}$ Taroo-ga [$_{VP}$ t$_1$ sonkeisiteiru]]]
[$_{TP}$ zyosi-no dareka-mo [$_{VP}$ ~~taitei-no sensei-o~~ sonkeisiteiru]]

d. [$_{TP}$ __ [$_{TP}$ Taroo-ga [$_{VP}$ taitei-no sensei-o sonkeisiteiru]]]
[$_{TP}$ ~~taitei-no sensei-o~~ [$_{TP}$ zyosi-no dareka-mo [$_{VP}$ t$_1$ sonkeisiteiru]]]

(23b) will derive the attested interpretation of (22). The scrambled QP undergoes reconstruction to VP in the antecedent sentence and the elided QP in the ellipsis sentence is interpreted in situ (or it may have undergone string-vacuous scrambling and subsequent reconstruction).[3] Parallelism excludes the options of (23c, d).

The question is how to prohibit the derivation of LF of (23a). The scrambling in the antecedent sentence affects word order, satisfying Word Order Economy while that in the ellipsis sentence creates a new scopal interpretation, satisfying Scope Economy. Thus, Output Economy should license both instances of scrambling. Despite that, the object wide scope, which should derive from (23a), is unavailable. Thus, the mechanisms assumed by Takahashi seem to overgenerate.

The source of the problem is the assumption that Output Economy constrains the application of scrambling. Instead, I propose the following:

(24) a. Scope Economy does not prohibit the *application* of scrambling that is scopally uninformative; rather it only restricts the *interpretation* of the chain created by scrambling in LF.

b. String vacuous scrambling does not count as a violation of Word Order Economy.

More specifically, by (24a), I intend that those instances of scrambling that do not affect scopal interpretation will be subject to obligatory scope reconstruction in LF,

the implementation of which will be discussed in sections 3 and 4.

(24b) is empirically motivated by (25), which involves long-distance scrambling.

(25) a. Tooru-o Taroo-wa zibun-no hahaoya-ga hometa to omotteiru
Tooru-ACC Taroo-TOP self-GEN mother-NOM praised C think
'(Lit) Tooru, Taro thinks that his mother praised.'

b. Kenta-o Ziroo-wa *e* hometa to omotteiru
Kenta-ACC Ziroo-TOP praised C think
'(Lit) Kenta, Ziro thinks that *e* (=his mother) praised.'

When the (a) sentence is followed by the (b) sentence, the null argument indicated by *e* can be understood as *zibun-no hahaoya-ga* 'self's mother' and be taken to refer to not Taroo's mother but Ziroo's mother (sloppy identity reading, a hallmark of ellipsis). Neither sentence contains a QP, so scrambling is scopally vacuous. Due to the boundary condition on long-distance movement, the sentences in (25) must be derived by successive-cyclic applications of movement, as shown in (26).

(26) a. [$_{CP}$ Tooru-o Taroo-wa [$_{CP}$ t′ zibun-no hahaoya-ga t hometa to]
↑_____|↑_____|
omotteiru]]

b. [$_{CP}$ Kenta-o Ziroo-wa [$_{CP}$ t′ ~~zibun-no gagaoya-ga~~ t hometa to]
↑_____|↑_____|
omotteiru]

Notice that the scrambling from *t* to *t′* in (26b) is scopally vacuous. Thus, to be able to derive the sentence in conformity with Output Economy, this instance of scrambling should be assumed to be compatible with Word Order Economy.

A comment is in order as to how to ensure that Word Order Economy bans string vacuous extraposition, as argued by Fox (2000), but not string vacuous scrambling. I guess the key difference between the two is the involvement of ellipsis. The string vacuity of an instance of extraposition can be detected at the stage of applying extraposition by looking at whether there is any intervening adverbial on the movement path. On the other hand, suppose that argument ellipsis is a deletion operation applied to PF. Then, we can presume that the PF-elided constituent is visible at the stage of derivation where scrambling is applied, which belongs to narrow syntax. In other words, the scrambling of a null argument as well as the scrambling *across* one affects word order at an abstract level and is licensed by Word Order Economy, but its effect will subsequently be neutralized by the deletion in PF.

Before re-analyzing Takahashi's and Maeda's data, let me move on to a review of Miyagawa (2006), which is another previous study that applies the idea of Scope Economy to Japanese.

2.3. Miyagawa (2006)

2.3.1. A/A´-Asymmetry

While Takahashi (2008a, b) attempted to explain the scopal parallelism and the disambiguation effect in Japanese argument ellipsis by Scope Economy (and Word Order Economy), Miyagawa (2006) is concerned with the scopal asymmetry between A-scrambling, which applies clause-internally, and A´-scrambling, which crosses a clause boundary. As the contrast in (27) indicates, A-scrambling allows the fronted QP to take scope at the landing site, but A´-scrambling does not (Oka (1989), Tada (1993)):

(27) a. daremo-o$_1$ dareka-ga t_1 aisiteiru
everyone-ACC someone-NOM love
'Everyone, someone loves.' ∀>∃, ∃>∀

b. daremo-o$_1$ dareka-ga [$_{CP}$ Taroo-ga t_1 aisiteiru to] itta
everyone-ACC someone-NOM Taroo-NOM love C said
'(Lit.) Everyone, someone said that Taroo loves.' *∀>∃, ∃>∀

Miyagawa relates the A/A´-asymmetry to the clause boundedness of QR (May (1977)). In (28a), *everyone* can take scope over *someone* while in (28b), where they are separated by a clause boundary, the inverse scope is not available.

(28) a. Someone loves everyone. ∀>∃, ∃>∀
b. Someone thinks [that Mary loves everyone]. *∀>∃, ∃>∀

Fox (2000) accounts for the clause boundedness by Scope Economy in the following fashion: Assuming QR applies successive-cyclically, the QR of *everyone* in (28b) cannot target a position above *someone* in one fell swoop. Instead, it must first move to the Spec of the embedded CP. However, that instance of QR is scopally vacuous and hence is not licensed due to Scope Economy. On the other hand, in (28a), the QR of *everyone* across *someone* affects the scope relation. Thus, it is licensed.

Although Miyagawa's analysis of the A/A´-asymmetry in (27) appeals to Scope Economy, it is unique in that rather than restricting the *application* of scope shifting operations, as Fox and Takahashi suggest, it places a restriction on the *interpretation* of scope shifting scrambling, as I sketched in (24a). In his view, QPs undergo scope reconstruction if their scrambling is scopally vacuous. Specifically, (27a) allows for the object wide scope because the scrambling of the object across the subject is scopally informative and is licensed by Scope Economy. On the other hand, (27b), whose derivation is given in (29), does not because the first step of the scrambling of the embedded object from t_1 to t_1´ crosses no scope bearing element. This movement, Miyagawa argues, violates Scope Economy and is destined to reconstruct for scope.

(29) daremo-o$_1$ dareka-ga [$_{CP}$ t$_1$′ Taroo-ga t$_1$ aisiteiru to] itta

2.3.2. How to Implement Scope Economy for Scrambling?

Scope Economy was originally formulated in Fox (2000) to limit the applicability of optional instances of scope shifting operations. For example, QR is not applicable unless it gives rise to a new interpretation. Takahashi (2008a) maintains this concept of Scope Economy as a condition on the application of operations, and he extends it to govern scrambling in combination with Word Order Economy. However, his analysis was found in section 2.2.2 to predict an unattested reading for Maeda's example (22). On the other hand, Miyagawa (2006) reinterprets Scope Economy as a constraint on the interpretation of scrambling. Given this conception, the lack of the object wide scope reading in (22), repeated in (30), can be accounted for; consider the LF (23a), repeated in (31), which is intended to give rise to the missing object wide scope. The LF for the antecedent sentence involves scopally vacuous scrambling, and hence the object QP is subject to reconstruction for scope. Due to the parallelism requirement, the elided object QP in the ellipsis sentence also must reconstruct. Thus, the subject wide scope results.

(30) a. Taitei-no sensei-o Taroo-ga t sonkeisiteiru.
most-GEN teacher-ACC Taroo-NOM respect
'(Lit.) Most teachers, Taro respects.'

b. Zyosi-no dareka-mo *e* sonkeisiteiru.
girl-GEN someone-also respect
'(Lit.) Some girl respects, too.'

(31) a. [$_{TP}$ taitei-no sensei-o$_1$ [$_{TP}$ Taroo-ga [$_{VP}$ t$_1$ sonkeisiteiru]]]

b. [$_{TP}$ ~~taitei-no sensei-o$_1$~~ [$_{TP}$ zyosi-no dareka-mo [$_{VP}$ t$_1$ sonkeisiteiru]]]

Though Miyagawa's view is more empirically motivated than Takahashi's, it is not

self-evident to assume that Scope Economy, which restricts the *applications* of QR, regulates only the *interpretations* of movement dependencies when it comes to scrambling. However, Miyagawa does not provide a concrete formulation of Scope Economy that would regulate scrambling, nor of the mode of reconstruction that would occur when it is violated. If we are going to appeal to Scope Economy, it is desirable to have a more general formulation of it that can be applied to both QR and scrambling, which is the task I will undertake in the next section.

3. Proposal

3.1. Assumptions

Before moving on to the core proposal, I will make a few assumptions about the syntax-semantics interface. (Fragments of) syntactic representations are interpreted in the way developed in Heim and Kratzer (1998). I assume the interpretation rules defined below, where, by $[\![\alpha]\!]^g$ is understood the interpretation of α under an assignment g:[4]

(32) Functional Application (FA)

If α is a branching node and {β, γ} the set of its daughters, then, for any assignment g, if $[\![\beta]\!]^g$ is a function whose domain contains $[\![\gamma]\!]^g$, then $[\![\alpha]\!]^g =_{FA} [\![\beta]\!]^g([\![\gamma]\!]^g)$.

(33) Predicate Modification (PM)

If α is a branching node and {β, γ} the set of its daughters, then, for any assignment g, if $[\![\beta]\!]^g$ and $[\![\gamma]\!]^g$ are both functions of type <e, t>, then $[\![\alpha]\!]^g =_{PM} \lambda x_{\in D_e}. [\![\beta]\!]^g(x) = [\![\gamma]\!]^g(x) = 1$.

(34) Predicate Abstraction Rule (PA)

If α is a branching node with daughters β and γ, where β (apart from vacuous material) dominates only an index <i, τ>, then, for any assignment g, $[\![\alpha]\!]^g =_{PA} \lambda x_{\in D_\tau}. [\![\gamma]\!]^{g[<i, \tau> \rightarrow x]}$

(35) Traces and Pronouns Rule (TP)
If α is a trace or a pronoun, and i and τ are a number and a type respectively, then, for any assignment g, $[\![\alpha_{<i, \tau>}]\!]^g =_{TP} g(i, \tau)$.

A moved object leaves behind a co-indexed trace, as shown in (36a). An index is the pair <i, τ> of an integer i and a semantic type τ. (36a) will subsequently be modified into (36b), which is required for PA to interpret γ as a λ-abstract.

(36) a. $[_{\alpha}\ XP_{<i, \tau>}\ [_{\beta}\ \ldots t_{<i, \tau>} \ldots]]$
b. $[_{\alpha}\ XP\ [_{\gamma\ <i, \tau>}\ [_{\beta}\ \ldots t_{<i, \tau>} \ldots]]]$

The type specification of the movement indices is relevant for whether the movement expands or reconstructs the scope of the moved QP. When we say that movement expands the scope, we mean that the moved QP, as a generalized quantifier (GQ, Barwise and Cooper (1981)), takes its sister constituent at the landing site as its semantic argument; since a GQ is a function $D_{<e, t>} \rightarrow D_t$ from properties to truth values, its sister must denote in the domain $D_{<e, t>}$. In this case, the movement index is specified for type e; i.e., the trace denotes an individual variable bound by the λ-operator introduced by PA. More concretely, consider the raising-to-subject construction in (37) for example, which is scopally ambiguous. The surface scope reading is obtained by assigning to (37) the LF in (38), where the movement index has its semantic type specified for e.

(37) Someone is likely to win the race. ∃>likely, likely>∃

(38) $[_{\alpha}$ someone $[_{\beta\ <1, e>}\ [_{\gamma}$ is likely $t_{<1, e>}$ to win the race]]
$[\![\text{someone}]\!]^g = \lambda P.\exists x[\text{person}(x) \ \&\ P(x)]$
$[\![\beta]\!]^g = \lambda x.[\![\gamma]\!]^{g[<1, e> \rightarrow x]} = \lambda x.\text{likely}'(\text{win-the-race}'(x))$
$[\![\alpha]\!]^g = [\![\text{someone}]\!]^g([\![\beta]\!]^g) = \exists x[\text{person}(x) \ \&\ \text{likely}'(\text{win-the-race}'(x))]$

In (38), PA interprets β as a function in $D_{<e, t>}$. The subject, denoting in $D_{<et, t>}$, takes β as an argument. α is interpreted by FA, with *someone* the function and β the argument. As a result, the subject ends up taking scope over the intensional predicate *likely*.

On the other hand, the inverse scope reading of (37) is obtained by assuming the LF in (39), where the type of the movement index is specified for <et, t>, instead of e. In this case, PA interprets the constituent β as a function $D_{<et, t>} \rightarrow D_t$ from GQs to truth values, and FA interprets the subject QP as the input to β, not *vice versa*.

(39) [$_{\alpha}$ someone [$_{\beta\ <1, ett>}$ [$_{\gamma}$ is likely $t_{<1, ett>}$ to win the race]]

$[\![\beta]\!]^{g}{}_{\in D<ett, t>} = \lambda q.[\![\gamma]\!]^{g[<1, ett> \rightarrow q]} = \lambda q.\text{likely}'(q(\lambda x.\text{win-the-race}'(x)))$

$[\![\alpha]\!]^{g}{}_{\in Dt} = [\![\beta]\!]^{g}([\![\text{someone}]\!]^{g})$

$= \text{likely}'(\exists x[\text{person}(x) \& \text{win-the-race}'(x)])$

This approach, which achieves scope reconstruction of the moved object by adjusting the semantic type of the trace, is called semantic reconstruction (SemR; (Cresti (1995), Rullmann (1995)).[5]

3.2. Scope Economy as a Condition on Trace Typing

I propose an alternative formulation of Scope Economy which is general enough to cover optional instances of covert movement (QR) as well as overt movement (scrambling).

(40) Scope Economy (revised)

An optional instance of movement of a QP, whether overt or covert, can leave a trace of type e only if it affects semantic interpretation; otherwise, it must leave a trace of type <et, t>.

While Fox's formulation of Scope Economy constrains the application of QR, in (40), Scope Economy is silent on the application of movement *per se*, but instead, it restricts the specification of the semantic type of traces, which bears on interpretation.

The intuition behind the revised Scope Economy is that, in principle, the members of a movement chain should be identical in their semantic type; it is costly to assign to a trace a type different from that of the antecedent, and it is permissible only if it contributes to producing an interpretation that would otherwise be unobtainable. Scrambling as well as QR can be applied freely insofar as they comply with the boundary conditions on movement like the Phase Impenetrability Condition (Chomsky (2000)). However, when scrambled or QRed, QPs leave <et, t>-type traces by default and must be licensed by Scope Economy to leave e-type ones.

Note that it is not only QPs that are subject to scrambling. Scrambling can also apply to non-QPs, such as names, pronouns, and definite descriptions, all of which denote in the domain D_e. These items can and in fact must leave e-type traces even though they are scopally vacuous. This is because the semantic type e is shared by the antecedent in such cases.

Imposing the same Scope Economy constraint on covert movement and overt movement would have caused a kind of conceptual unnaturalness in a framework such as Extended Standard Theory, which postulates separately the overt syntactic component from D-structure to S-structure and the covert syntactic component from S-structure to LF; why should Scope Economy, which is an interpretive constraint, refer to operations applied before S-structure? However, in the framework of phase theory, which assumes multiple spell-outs, the difference between overt movement and covert movement is simply reduced to the difference between pronouncing the head and the tail of the movement chain. Pronunciation being a matter of interfacing syntax and sensorimotor system, overt and covert movement is indistinguishable from each other as far as semantic interpretation is concerned. Therefore, it is natural that Scope Economy should be able to constrain (the

interpretation of) both types of movement.

3.3. Analysis

3.3.1. Parallelism and the Disambiguation Effects

We move on to the analysis of the data reviewed in section 2. Let us start with the parallelism and the disambiguation effects in ellipsis constructions. (3), repeated in (41), exhibits the parallelism effect.

(41) a. A boy admires every teacher.
b. A girl does ~~admire every teacher~~, too.

(42) a. (41a) ∃>∀ ; (41b) ∃>∀ c.* (41a) ∃>∀ ; (41b) ∀>∃
b. (41a) ∀>∃ ; (41b) ∀>∃ d.* (41a) ∀>∃ ; (41b) ∃>∀

Consider the list of LF-pairs in (43). From now on, for reasons of space, I omit the type component in the index on a moved DP and only append the integer component to the DP as a subscript, and a trace $t_{<i, \tau>}$ will be abbreviated as t_i for $\tau = e$ and T_i for $\tau = <et, t>$. Intermediate traces are represented as $[t_i]_j$, where the inner index i is created by the movement from there and bound by its antecedent DP_i while the outer one j is introduced by the movement to there and binds the bottom trace t_j. The LF-pair in (43a) corresponds to the reading (42a). Here, *every teacher* only undergoes type-driven obligatory QR to the adjoined position of VP, which Scope Economy is silent on. (43b), which corresponds to (42b), is derived by further QR-ing the object across the subject in both the antecedent and the ellipsis sentences. Since those instances of QR are scopally informative, Scope Economy licenses them to leave e-type traces on the edge of VP. The non-parallel interpretations of (42c, d) would be expected if the LF-pairs in (43c, d) were available, respectively, which is not the case; they violate parallelism in that the semantic type of the traces in the edge of VP is different between the antecedent and the ellipsis sentences.[6]

(43) a. [$_{IP}$ a boy$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ a girl$_1$ does [$_{VP}$ ~~every teacher~~$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]

b. [$_{IP}$ every teacher$_3$ [$_{IP}$ a boy$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ ~~every teacher~~$_3$ [$_{IP}$ a girl$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]]

c. *[$_{IP}$ every teacher$_3$ [$_{IP}$ a boy$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ ~~every teacher~~$_3$ [$_{IP}$ a girl$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]]

d. *[$_{IP}$ every teacher$_3$ [$_{IP}$ a boy$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ ~~every teacher~~$_3$ [$_{IP}$ a girl$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]]

Let us next turn to the disambiguation effect. We saw that (7), repeated in (44), only allowed the antecedent sentence to be read with the subject wide scope. Consider the LF-pairs in (45). (45a), which corresponds to the attested reading, does not violate parallelism nor Scope Economy. (45b) is ill-formed due to the violation of Scope Economy in the ellipsis sentence; it should have had the type of the intermediate trace specified for <et, t>. (45c) violates parallelism and the ellipsis sentence incurs the violation of Scope Economy. (45d) does not meet parallelism though it conforms to Scope Economy.

(44) a. A boy admires every teacher. ∃>∀; *∀>∃

b. Mary does ~~admire every teacher~~, too.

(45) a. [$_{IP}$ a boy$_1$ [$_{VP}$ every teacher$_2$ [$_{VP}$ t$_1$ admires t$_2$]]];
[$_{IP}$ Mary$_1$ [$_{VP}$ ~~every teacher~~$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]

b. *[$_{IP}$ every teacher$_3$ [$_{IP}$ a boy$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ ~~every teacher~~$_3$ [$_{IP}$ Mary$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]]

c. *[$_{IP}$ every teacher$_3$ [$_{IP}$ a boy$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ ~~every teacher~~$_3$ [$_{IP}$ Mary$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]]

d. *[$_{IP}$ every teacher$_3$ [$_{IP}$ a boy$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ admires t$_2$]]]];
[$_{IP}$ ~~every teacher~~$_3$ [$_{IP}$ Mary$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ ~~admires~~ t$_2$]]]]

Analysis along the same lines can be done for the Japanese argument ellipsis data. The discourse in (46) allows only for two parallel readings.

(46) a. Taitei-no sensei-o zyosi-no dareka-ga sonkeisiteiru.
most-GEN teacher-ACC girl-GEN someone-NOM respect
'(Lit.) Most teachers, some girl respects.'
b. Dansi-no dareka-mo *e* sonkeisiteiru.
boy-GEN someone-also respect
'(Lit.) Some boy respects, too.' (ibid.: 312)

In (47a), the scrambled object QP in both the antecedent and the ellipsis clause leaves the default <et, t>-type trace in the edge of VP, giving rise to an attested parallel interpretation, where the subject scopes over the object. On the other hand, since scrambling has interpretive effects in both statements, both intermediate traces can be designated as type e without violating Scope Economy, as in (47b). In that case, the other attested reading results in which the object scopes over the subject in both sentences. Non-parallel readings are excluded due to the ill-formedness of (47c, d), where the intermediate traces in the paired LFs have different semantic types, violating parallelism.

(47) a. $[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ some boy$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$
b. *$[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ some boy$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$
c. *$[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ some boy$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$
d. *$[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ some boy$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$

Next, (19) and (22), which illustrated the disambiguation effect in Japanese, are repeated below. The antecedent sentence in the former and the ellipsis sentence in the latter are only read with the subject wide scope. The scrambling across *Taroo* in the ellipsis sentence (48b) and the antecedent sentence (49a) is scopally vacuous, and hence the trace must be typed as <et, t> due to Scope Economy. Accordingly, due to parallelism, the scrambling across the QP subject in the antecedent sentence (48a) and the ellipsis sentence (49b), though scopally informative, also must leave <et, t>-type traces. As a result, we are only left with the LF-pairs (50a) and (51a), which correspond to the attested subject wide scope.

(48) a. Taitei-no sensei-o zyosi-no dareka-ga sonkeisiteiru.
most-GEN teacher-ACC girl-GEN someone-NOM respect
'(Lit.) Most teachers, some girl respects.'

b. Taroo-mo *e* sonkeisiteiru.
Taroo-also respect
'(Lit.) Taroo respects, too.'

(49) a. Taitei-no sensei-o Taroo-ga t sonkeisiteiru.
most-GEN teacher-ACC Taroo-NOM respect
'(Lit.) Most teachers, some girl respects.'

b. Zyosi-no dareka-mo *e* sonkeisiteiru.
girl-GEN someone-also respect
'(Lit.) Some girl respects, too.'

(50) a. $[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ Taroo$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$

b. *$[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ Taroo$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$

c. *$[_{IP}$ most teachers$_3$ $[_{IP}$ some girl$_1$ $[_{VP}$ $[T_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$;
$[_{IP}$ ~~most teachers~~$_3$ $[_{IP}$ Taroo$_1$ $[_{VP}$ $[t_3]_2$ $[_{VP}$ t_1 respects $t_2]]]]$

d. *[$_{IP}$ most teachers$_3$ [$_{IP}$ some girl$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]];
[$_{IP}$ ~~most teachers~~$_3$ [$_{IP}$ Taroo$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]]

(51) a. [$_{IP}$ most teachers$_3$ [$_{IP}$ Taroo$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]];
[$_{IP}$ ~~most teachers~~$_3$ [$_{IP}$ some boy$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]]

b. *[$_{IP}$ most teachers$_3$ [$_{IP}$ Taroo$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]];
[$_{IP}$ ~~most teachers~~$_3$ [$_{IP}$ some boy$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]]

c. *[$_{IP}$ most teachers$_3$ [$_{IP}$ Taroo$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]];
[$_{IP}$ ~~most teachers~~$_3$ [$_{IP}$ some boy$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]]

d. *[$_{IP}$ most teachers$_3$ [$_{IP}$ Taroo$_1$ [$_{VP}$ [t$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]];
[$_{IP}$ ~~most teachers~~$_3$ [$_{IP}$ some boy$_1$ [$_{VP}$ [T$_3$]$_2$ [$_{VP}$ t$_1$ respects t$_2$]]]]

3.3.2. Clause-Bounded QR and A/A´-Scrambling

(52) and (53) exemplify the clause-boundedness of QR and the A/A´-asymmetry of scrambling, respectively.

(52) a. Someone loves everyone. ∀>∃, ∃>∀

b. Someone thinks [that Mary loves everyone]. *∀>∃, ∃>∀

(53) a. daremo-o$_1$ dareka-ga t$_1$ aisiteiru
everyone-ACC someone-NOM love
'Everyone, someone loves.' ∀>∃, ∃>∀

b. daremo-o$_1$ dareka-ga [$_{CP}$ Taroo-ga t$_1$ aisiteiru to] itta
everyone-ACC someone-NOM Taroo-NOM love C said
'(Lit.) Everyone, someone said that Taroo loves.' *∀>∃, ∃>∀

These two are given a unified analysis. The only difference between QR and scrambling is that the former pronounces the tail of the movement chain, while the latter pronounces the head. Take (53b) for example and see how it is derived. In (54b), to avoid type mismatch (Heim and Kratzer (1998), Fox (2000)), the object QP

daremo-o ‘everyone’ moves to the edge of VP, leaving a trace of type e, which is obligatory and hence is exempted from Scope Economy. In (54c), the subject non-QP *Taroo-ga* moves to Spec, IP, and *daremo-o* moves further to the Spec, CP, the escape hatch to the matrix clause. However, this movement is scopally vacuous, and hence Scope Economy forces the intermediate trace to be typed as <et, t>. In (54d), the matrix V and its subject QP *dareka-ga* ‘someone’ are merged, and the object QP moves across them. Now notice that the trace in Spec, CP must be typed as <et, t>, not as e. Scope Economy is not responsible for this. Rather, this is enforced by the type-consistency; because the embedded IP, together with the index on its sister, is interpreted by PA as a function from GQs to truth values, it requires its sister, which is the trace in question, to denote in $D_{<et, t>}$, not D_e. If the trace were typed as e, it would cause type mismatch with IP. The same problem applies to all higher intermediate traces that may be created later in the derivation. Thus, once a QP has left a <et, t>-type trace (due to Scope Economy), all subsequent instances of the movement of the QP can only leave traces of type <et, t>, which results in the SemR down to the original clause. The semantic composition of (54d) is given in (55), where the scrambled object ends up scoping in the embedded clause due to SemR.

(54) a. $[_{VP_{emb}}$ Taroo-ga love daremo-o]

b. $[_{VP_{emb'}}$ daremo-o_1 $[_{VP_{emb}}$ Taroo love $t_1]]$

c. $[_{CP}$ daremo-o_3 $[_{IP}$ Taroo-ga_2 $[_{VP_{emb'}}$ $[T_3/*t_3]_1$ $[_{VP_{emb}}$ t_2 love $t_1]]]]$

d. $[_{VP_{mat'}}$ daremo-o_4 $[_{VP_{mat}}$ dareka-ga say $[_{CP}$ $[T_4/*t_4]_3$ $[_{IP}$ Taroo-ga_2 $[_{VP_{emb'}}$ $[T_3]_1$ $[_{VP_{emb}}$ t_2 love $t_1]]]]]]$

(55) $[\![VPemb']\!]^g = [\![T_3]\!]^g(\lambda x.[\![VPemb]\!]^{g[<1, e>\rightarrow x]})$

$= g(3, ett)(\lambda x.love'(g(2, e))(x))$

$[\![IP]\!]^g = [\lambda y.[\![VPemb']\!]^{g[<2, e>\rightarrow y]}]([\![Taroo]\!])$

$= [\lambda y.g(3, ett)(\lambda x.love'(y)(x))](Taroo')$

$= g(3, ett)(\lambda x.love'(Taroo')(x))$

$[\![CP]\!]^g = [\lambda q.[\![IP]\!]^{g[<3, ett>\rightarrow q]}]([\![T_4]\!])$
$= [\lambda q.q(\lambda x.love'(Taroo')(x))](g(4, ett))$
$= g(4, ett)(\lambda x.love'(Taroo')(x))$
$[\![VPmat]\!]^g = [\![dareka\text{-}ga]\!]([\lambda y.say'([\![CP]\!])(y)])$
$= someone'(\lambda y.say'(g(4, ett)(\lambda x.love'(Taroo')(x)))(y))$
$[\![VPmat']\!]^g = [\lambda q.[\![VPmat]\!]^{g[<4, ett>\rightarrow q]}]([\![daremo\text{-}o]\!])$
$= [\lambda q.someone'(\lambda y.say'(q(\lambda x.love'(Taroo')(x)))(y))](everyone')$
$= someone'(\lambda y.say'(everyone'(\lambda x.love'(Taroo')(x)))(y))$

4. Comparison between SemR and SynR

In this section, I compare SemR to another analysis of reconstruction, namely, the syntactic reconstruction approach (SynR), and argue that SynR is empirically inadequate compared to SemR, at least in the context of Scope Economy.

SynR is a cover term for approaches that, based on the assumption that the relative scope reflects the c-command relation in LF, achieve scope reconstruction by assigning an LF in which a QP is c-commanded by another operator to a surface representation in which that QP c-commands that operator. The literature has embodied SynR in the form of, for example, the covert lowering of QPs to their trace positions (May (1985)), the deletion of the copy of the landing site at the LF under the copy theory of movement (Chomsky (1993)), or PF movement that does not feed into the LF (Sauerland and Elbourne (2002)). Schematically, what they all have in common is that SynR maps the overt syntax in (56a) to the LF in (56b).

(56) a. $[QP_i \ldots Op [\ldots t_i \ldots]]$
b. [__ …Op […QP…]]

SynR is not a QP-specific operation, but also applicable to non-QPs, and interacts with other interpretive principles such as binding conditions, on the assumption that

they are constraints on LF. For example, while (57a) prohibits *his* from being bound by *every boy* due to the Weak Crossover Constraint, (57b) does not, which is accounted for by assigning to it the LF (57c), where SynR has put back the subject to the embedded clause so that *every boy* can c-command (and hence is licensed to bind) the pronoun.

(57) a. His$_{??1/2}$ father wrote to every boy$_1$ [PRO$_1$ to be a genius]
b. His$_{1/2}$ father seems to every boy$_1$ [t$_1$ to be a genius]
c. __ seems to every boy$_1$ [his$_{1/2}$ father to be a genius]
(Fox (2000: 147))

The sentences in (58) show that scope reconstruction of a *how-many* NP causes a violation of Condition A/C. When a *how*-many phrase is extracted out of an opaque domain like the complement to an attitude verb, it exhibits an ambiguity between the individual reading, where it takes the matrix scope, and the cardinal reading, where it scopes within that opaque domain by reconstruction. (58a), when *Diana* is understood to be the antecedent of *she*, is unambiguously interpreted with the individual reading, and (58b), where *John* is the only possible antecedent of *himself*, is grammatical only under the individual reading:

(58) a. [How many people from Diana's$_1$ neighborhood]$_i$ does she$_1$ think t_i are at the party? individual, *cardinal (Fox (1999: 168))
b. I asked John$_1$ [$_{CP}$ [how many books about himself$_1$]$_i$ Mary thinks t_i are in the library]. individual, *cardinal
(Fox and Nissenbaum (2004: 480))

Fox (1999) and Fox and Nissenbaum (2004) account for this by assuming that the scope reconstruction of *how-many* NP's takes the form of SynR. Suppose (58a, b)

are mapped by SynR to the LFs (59a, b), respectively, to yield the cardinal reading. Then, (59a) will violate Condition C because the pronoun *she* c-command its antecedent *Diana*, and (59a) will Condition A because the anaphor *himself* is not bound in its binding domain.

(59) a. How _ does she$_1$ think [many people from Diana's$_1$ neighborhood] are at the party? individual, *cardinal (Fox (1999: 168))

b. I asked John$_1$ [$_{CP}$ how _ Mary thinks [many books about himself$_1$] t_i are in the library]. individual, *cardinal (Fox and Nissenbaum (2004: 480))

Since the SynR strategy has such empirical support, one might wonder if it is possible to adopt SynR instead of SemR in the formulation of Scope Economy, which would look like (60):

(60) Scope Economy (SynR version)
An optional instance of movement of a QP, whether overt or covert, can escape SynR only if it affects semantic interpretation; otherwise, it must undergo SynR.

However, I argue below that such a formulation raises several issues.

First, the SemR version and the SynR version of Scope Economy make different predictions about the scrambling of non-QPs, which does not affect scopal interpretation due to the nature of the moved object. The SemR version is based on the intuition described in section 3.2 that the semantic type of a trace defaults to that of the antecedent unless movement affects interpretation, so it distinguishes without any stipulation between QPs and non-QPs; QP traces default to <et, t>-type, but non-QPs can leave e-type traces. On the other hand, the SynR version will

indiscriminately force reconstruction not only on some cases of QP scrambling that are scopally vacuous but also on all cases of non-QP scrambling, which are a priori scopally vacuous, unless we stipulate that Scope Economy is defined only for QPs and not for non-QPs.

The following discourse in (61) seems to be consistent with the prediction of the former. The null argument in (61b) is understood as *zyosi-ga san-nin* 'three girls,' which is elided in PF. The scrambled object in the antecedent sentence is quantified while that in the ellipsis sentence is not. Notice that the antecedent sentence can be read with the object wide scope.

(61) a. Taitei-no gakusei-ni zyosi-ga san-nin denwasita
most-GEN student-DAT girl-NOM three-CLS called
'(Lit.) Most students, three girls called.' √ most>three

b. Yamada-sensei-ni-mo e denwasita
Yamada-teacher-DAT-also called
'(Lit.) Prof. Yamada, three girls called, too.'

The SemR version of Scope Economy and parallelism will license the LF-pair in (62). The scrambling in the antecedent sentence affects the relative scopes, and hence can leave a trace t_3 of type e in conformity with Scope Economy. The scrambling in the ellipsis clause is scopally vacuous, but the scrambled object denotes in D_e, so its trace can also be typed as e. As a result, the pair (62) meets the parallelism requirement on ellipsis:

(62) a. [$_{IP}$ Taitei-no gakusei-ni$_3$ [$_{IP}$ zyosi-ga san-nin [$_{VP}$ t_3 denwasita]]]

b. [$_{IP}$ Yamada-sensei-ni-mo$_3$ [$_{IP}$ ~~zyosi-ga san-nin~~ [$_{VP}$ t_3 denwasita]]]

On the other hand, the SynR version of Scope Economy would force the

reconstruction of the non-QP object in the ellipsis sentence, as in (63b). Accordingly, the parallelism would require the scrambled QP in the antecedent clause to reconstruct too. As a result, the object wide scope would be erroneously excluded.

(63) a. [$_{IP}$ _ [$_{IP}$ zyosi-ga san-nin [$_{VP}$ taitei-no gakusei-ni denwasita]]]
b. [$_{IP}$ _ [$_{IP}$ ~~zyosi-ga san-nin~~ [$_{VP}$ Yamada-sensei-ni-mo denwasita]]]

Second, it is worth mentioning that scope reconstruction due to Scope Economy need not bleed the binding condition. (64) involves the A′-scrambling of the object QP out of CP2 to the edge of CP1. This QP cannot scope over the subject QP *dareka-ga* 'someone,' and must reconstruct to the original clause CP2. At the same time, the matrix subject *Taroo* can be the antecedent of the local anaphor *zibun-zisin* 'self' contained in the scrambled QP; compare (65), where the QP remains *in situ* and *Taroo* cannot bind the deeply embedded anaphor.

(64) Taroo-ga$_j$ [$_{CP1}$[zibunzisin-no$_j$ 2-satu-no hon-o]$_1$ dareka-ga
Taroo-NOM self-GEN 2-CLS-GEN book-ACC someone-NOM
[$_{CP2}$ Hanako-ga t_1 karidasita to] itta to] omotteiru (koto)
Hanako-NOM borrowed C said C think fact
'(Lit.) (The fact that) Taro$_j$ thinks that, two books of himself$_j$, someone said that Hanako borrowed.'
*two books>someone; someone>two books (Saito (2020: 3))

(65) Taroo-ga$_j$ [$_{CP1}$ dareka-ga[$_{CP2}$ Hanako-ga$_i$ zibunzisin-no$_{i/*j}$
Taroo-NOM someone-NOM Hanako-NOM self-GEN
2-satu-no hon-o karidasita to] itta to] omotteiru (koto)
2-CLS-GEN book-ACC borrowed C said C think fact
'(The fact that) Taro$_j$ thinks that someone said that Hanako borrowed two books of himself$_j$.' *two books>someone; someone>two books

The scope reconstruction in (64) is due to Scope Economy; the first step of successive-cyclic scrambling in CP2 crosses no scope bearing element.

The SemR and the SynR versions of Scope Economy will assign to (64) the LFs in (66) and (67), respectively. In the former, the scrambling across the non-QP *Hanako-ga* must leave a trace T_2 of type <et, t> due to Scope Economy, and so does the one from the Spec, CP2 to make the type calculation consistent (see section 3.3.2). On the other hand, in the latter LF, the scrambled QP is syntactically placed on the adjoined position of VP in CP2:

(66) Taroo-ga$_j$ [$_{CP1}$[zibunzisin-no$_j$ 2-satu-no hon-o]$_3$ dareka-ga [$_{CP2}$ [T_3]$_2$ Hanako-ga [$_{VP}$ [T_2]$_1$ [$_{VP}$ t_1 karidasita]] to] itta to] omotteiru

(67) Taroo-ga$_j$ [$_{CP1}$ _ dareka-ga [$_{CP2}$ _ Hanako-ga$_i$ [$_{VP}$ [zibunzisin-no$_{i/*j}$ 2-satu-no hon-o]$_1$ [$_{VP}$ t_1 karidasita]] to] itta to] omotteiru

Given that Condition A is checked at LF, (66) correctly predict that the anaphor can be bound by *Taroo* in its binding domain, while (67) does not.

In sum, although SynR may be used in other aspects of grammar, such as English how-many reconstruction and binding connectivity, we should conclude that SemR, not SynR, is used for the type of reconstruction that is required in cases of Scope Economy violation.

5. Conclusion

This article analyzed the scope properties of scrambling of quantificational noun phrases in Japanese based on a modified version of Fox's (2000) Scope Economy. Departing from the position of Fox (2000) and Takahashi (2008a) that the Scope Economy restricts the application of operations, I argued along the lines of Miyagawa that the Scope Economy restricts the interpretation of movement chains. Specifically, I proposed that scopally vacuous QP movement must leave a trace of

<et, t>-type and undergo SemR.

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Notes

1) The object QP first undergoes obligatory QR to the VP adjoined position to resolve a type mismatch. To derive the inverse scope, it further moves to the IP adjoined position by optional QR.

2) Takahashi (2008b) focuses on NP-deletion in Japanese and points out a similar parallelism effect.

3) It is not clear whether Takahashi will consider the LF-pair of (23b) to be grammatical or not. There, the antecedent LF involves the reconstruction of the scrambled object across *Taroo*, a non-QP, which should be prohibited if Scope Economy also applies to lowering operations, as Fox (2000) argues. Takahashi does not mention the relationship between the reconstruction of scrambling and the Scope Economy; if Fox's argument is dismissed, (23b) will be licensed; if it is retained, it will be excluded. In the latter case, Takahashi's system will have the problem of failing to predict the attested reading, in addition to the problem of overgeneration discussed below.

4) The definitions of FA and PM are borrowed from Heim and Kratzer (1998: 95),

and those of PA and TP from Heim and Kratzer (1998: 213).

5) I adopt the trace theory of movement only for the sake of exposition. It may seem at first glance that SemR relies on the theoretical construct of indexed traces, but it is worth mentioning that it is also applicable to the copy theory of movement by Chomsky (1993). See Ruys (2011, 2015) for the implementation of SemR under the copy theory.

6) Regarding the formulation of the parallelism requirement, we may not be able to appeal to syntactic parallelism as in Fox and Takahashi, unless we assume that the types of traces are syntactically discernable. Since the semantic type of traces should be visible at least in the mapping from syntax to semantics and in semantic calculation, it may be desirable to characterize the parallelism requirement semantically, but I will leave this as an issue for future research.

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