SCOPE OF COMPARATIVE QUANTIFIERS:

AN EXPERIMENTAL INVESTIGATION

By

ATSUSHI OHO

A thesis submitted to the

Graduate School—New Brunswick

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Master of Arts

Graduate Program in Linguistics

Written under the direction of

Kristen Syrett

And approved by

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New Brunswick, New Jersey

October 2015

ABSTRACT OF THE THESIS

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by ATSUSHI OHO

Thesis Director:

Kristen Syrett

This thesis examines the scope taking property of comparative quantifier phrases (CQPs) in English. It has been widely acknowledged that scope of CQPs in non-subject position is frozen at the surface position: CQPs must take narrow scope relative to a subject quantifier. Experimental evidence provided in this thesis, however, suggests that CQPs in non-subject position can take wide scope over a quantifier in subject position. Given the findings, I argue that scope of non-subject CQPs is not absolutely frozen at the surface position and the scope taking property is significantly influenced by contextual factors.

The experimental results show that participants are able to access the inverse scope reading when a test sentence is given under a context in which the surface scope interpretation is not compatible with general world knowledge. The results also indicate that the scope taking property of CQPs with respect to a subject quantifier is not different from that of plural numerals, which are assumed to take wide scope over a subject quantifier.

The findings raise the possibility that the widely believed scope rigidity of CQPs is governed not by the grammar, but by extragrammatical factors: taking wide scope is strongly disfavored but crucially not ungrammatical. This possibility can be extended to other quantifiers and languages that have shown scope freezing phenomena. I take Japanese, a scope rigid language, as an example and discuss the defreezing effect of the contextual manipulation.

Acknowledgements

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1 Introduction

Scope taking properties of quantifiers in natural language have been a central topic in linguistics. Linguistic investigation of these properties makes it possible to develop a theory of quantifiers and to have better understandings on human language. The phenomenon of scope ambiguity gives a good source of investigation, especially when potentially ambiguous sentences do not show ambiguity. Whether or not a certain interpretation is available is of importance for theoretical development. However, intuitive acceptability judgments are sometimes not so clear. It is often the case that there are disagreements on scope judgments even among linguists. This is because various factors (not only grammatical ones but also extragrammatical ones) affect the availability of the scope taking and/or simply because scope judgments themselves are difficult tasks. The disagreements on judgments lead to a debate on explanations for scope taking properties of quantifiers. The purpose of this thesis is to contribute to such debate by presenting experimental evidence on the scope taking properties of quantifiers.

This thesis focuses on comparative quantifier phrases (CQPs), such as *more than two books*, particularly when they appear in non-subject position such as an object of a transitive verb or a preposition of doubly quantified sentences. It has been reported that CQPs show a peculiar scope taking property. For example, it has been observed that CQPs in object position cannot take wide scope over quantificational DPs in subject position (Beghelli & Stowell 1997, Fleisher 2013, Liu 1997, Szabolcsi 1997, Takahashi 2006, among others). On the other hand, they can take wide scope over scope-baring non-DPs such as sentential negation and modals (Fleisher 2013, Heim 2000, Hackl 2000, Mayr & Spector 2012, Nouwen 2010, Takahashi 2006, among others). However, there are disagreements on the judgments in the literature and also some exceptional cases have been reported. Since the judgments are different, and each theoretical proposal is built upon each judgment, the proposals make different predictions not only about the scope taking property of CQPs

but also about other cases. Although a large number of theoretical studies have been made on the scope taking property theoretical of CQPs, to the best of my knowledge, no experimental investigations have been made on this topic so far. Given the conflicting judgments reported in the literature, empirical evidence is of great value. The experimental findings reported in the thesis thus shed new light on the property of CQPs and contribute to the development of theoretical proposal.

The goal of this thesis is threefolod: First, the thesis provides empirical evidence for/against previous theories about the scope taking property of CQPs in object position. Second, it demonstrates that pragmatic and processing factors play a role to the scope taking property. Third, it discusses that some scope rigidity is best accounted for within a framework of performance. I will present the experimental findings that suggest that CQPs in object position can in fact take wide scope over subject indefinites. A key observation is that the manipulation of contextual factors such as pragmatic plausibility plays a crucial role for making the wide scope accessible. Accordingly, the findings of the thesis require us to revisit the proposals about the scope taking property of CQPs. Moreover, they call for reexamination into scope taking properties of other quantifies in English and scope taking properties in other languages. It has been reported that there are several quantifiers that show peculiar scope taking properties just like CQPs, and that there are several languages in which the inverse scope reading is generally not available. The findings of the thesis then indicate a possibility that such observations are not empirically supported.

The structure of the thesis is as follows: Section 2 presents the core data and the judgments debated in the literature. In order to give theoretical backgrounds for the observations, Section 3 reviews three theoretical proposals for the scope taking property of CQPs in object position. Section 4 reports the experiment findings. Section 5 discusses the relevance of the experimental findings to the theoretical proposals and addresses topics for future research. Section 6 concludes the thesis.

2 Scope of Comparative Quantifier Phrases in Object Position

This section reviews core data for the thesis. When a sentence contains two quantificational expressions, it may have two distinct readings (May 1985). In a simple case, when a sentence contains an indefinite in subject position and a universal in object position, two distinct interpretations are allowed.

(1)   Some student read every book.

(SOME > EVERY, EVERY > SOME)

However, a doubly quantified sentence does not always show scope ambiguity. It has been reported that comparative quantifier phrases (CQPs) such as *more than three books* in object position show a peculiar wide scope taking property (Beghelli & Stowell 1997,Fleisher 2013, Hackl 2000, Liu 1997, Szabolcsi 1997, Takahashi 2006, among others). A widely acknowleged observation is illustrated in (2). When a sentence contains an indefinite in subject position and a CQP in object position, wide scope of the CQP over the subject indefinite is not possible.

(2)   a.   Some student read more than five books.

(SOME > MORE THAN 5, *MORE THAN 5 > SOME)
(Takahashi 2006: 58(2) acknowledged to come from Beghelli (1995: 48))

b.   One student read fewer than three bookss.

(ONE > FEWER THAN 3, *MORE THAN 3 > ONE)
(Takahashi 2006: 59(3))

This scope pattern of CQPs in object position is also observed with respect to other types of quantifiers in subject position such as a universal quantifier (*every*, non-monotonic DPs (*exactly two*, and downward entailing DPs (*no*) (Takahashi 2006).

This scope restriction is somewhat puzzling if we assume that CQPs are generalized quantifiers just like the universal quantifier every, which in general can take scope over a quantifier in subject position as seen in (1). Though CQPs in object position shows the scope limitation, it does not mean that they have no ability of taking scope at a different position. The fact that CQPs can host Antecedent-Contained Deletion (ACD) as shown in (3) indicates that the CQPs in object position can move out of the VP.

(3)   John speaks more than three of the languages that Mary does [speak it]

(Takahashi 2006: 61 (10))

It is generally assumed that ACD is resolved/licensed by applying Quantifier Raising (QR) to a quantified element. Thus, Example (3) shows that QR of CQPs in object position is allowed.

In addition, CQPs in object position can also take wide scope over negation as in (4) (Fleisher 2013, Hackl 2013, Heim & Kratzer 1998, Mayr & Spector 2012, Takahashi 2006, among others)

(4)   John didn't meet more than three students on time.
        (NOT > CQP, CQP > NOT)

(Mayr & Spector 2012: (2))

These examples show that CQPs in object position shows the scope rigidity effect with respect to a quantifier in subject position, which is a strikingly distinct behavior from generalized quantifiers.

However, several exceptional cases have been reported. For example, Farkas (1997) points out that when the surface scope reading is not compatible with world knowledge, the inverse scope reading is possible as shown in (5).

(5)   A body guard has been assigned to more than fifteen officials.

(A > CQP, *CQP > A)

<div align="right">(Farkas 1997: 210 (8))</div>

Mayr & Spector (2012) makes a similer observation.[1]

(6)   A soldier is standing on more than ten government buildings.

(A > CQP, *CQP > A)

<div align="right">(Mayr & Spector 2012: (25))</div>

Moreover, Szabolcsi (1997) notes that when a sentence contains a CQP in both subject and object position, the inverse scope reading is available.

(7)   More than three men read more than six books.

(MORE THAN 3 > MORE THAN 6, MORE THAN 6 > MORE THAN 3)

<div align="right">(Szabolcsi 1997: 115(17))</div>

Szabolcsi (1997) points out that "inverse scope is very difficult but, …, can be forced by context" (116), though she dose not mention what kind of context forces the inverse scope but her statement implies the importance of contexts.

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1 Reinhart (2006) observes that this is also the case with *less*-comparative as shown in (i). I will not discuss *less*-comparatives in this thesis.
(i) A doctor will examine less than twenty patients.(Reinhart 2006: 122 (129))

3   Theoretical Background

The examples in the previous section have shown that (i) CQPs in object position cannot take wide scope over a subject quantifier, (ii) under certain circumstances, they may take wide scope over a subject quantifier. In this section, we review three theoretical proposals for the scope taking property of CQPs in object position: Takahashi 2006, Mayr & Spector 2012, Fleisher 2013. These three proposals differ in the treatment of CQP and this difference in the particular treatmetns lead to the different predictions about the scope taking property of object CQPs. whether a CQP in object position can take scope over an indefinite in subject position. I also discuss several issues in the proposals and factors that might influence the acceptability of inverse scope.

3.1   Takahashi (2006)

Takahashi (2006) accounts for the limited scope taking property of CQPs in object position by appealing to two assumptions. First, following Hackl (2000) and Heim (2000), he assumes that CQPs are decomposed into two generalized quantifiers. For example, *more than three books* is analyzed as in (8), in which it is decomposed into a comparative operator *er than 3* and the DP *many books.*[2]

(8)   [DP [DegP er than three] many books]

(Takahashi 2006: 62(11))

Therefore, a sentence with a CQP in object position such as in (9a) has an LF configuration as in (9b). The subject is moved to Spec,TP to satisfy the EPP. The object CQP undergoes QR for solving type mismatch and the comparative operator adjoins to *v*P for interpretability (under the assumption that QR targets *v*P, which is a node of type t (Heim

2 The decompositional approach is motivated by the scope splitting phenomena (Hackl 2000, Heim 2000, Wold 1995) in which the comparative operator and the DP take scope at different positions.

& Kratzer 1998)). The comparative operator must scope over the DP, since it must bind its trance in the DP.

(9) a. One student read more than three books.

b. [$_{TP}$ one student$_1$ [$_{vP}$ [$_{DegP}$ er than three]$_2$ [$_{vP}$ [$_{DP}$ t$_2$ many books]$_3$ [$_{vP}$ t$_1$ read t$_3$]]]]

The second assumption Takahashi (2006) makes is that covert Scope Shifting Operations (SSOs) are subject to two constraints proposed by Fox (1995, 2000). The first constraint is a locality constraint known as *Shortest Move.*

(10) *Shortest Move*

A QP[quantifier phrase] must target the closest node of type t that dominates it.

(Fox 2000: 23)

Shortest Move applies not only to obligatory SSOs (which are for interpretability) but also to optional SSO such as Quantifier Lowering (QL) of a subject DP (which invert scope orders).[3]

The other constraint on SSOs is known as *Scope Economy*, which requires that truth-conditions of the input and output of an SSO must be semantically distinct.

(11) *Scope Economy*

SSOs cannot be semantically vacuous.

(Fox 2000: 3)

Let us now see how Takahashi (2006) accounts for the limited scope taking of CQPs in object position. The LF representation for surface scope is shown in (12a) in which the
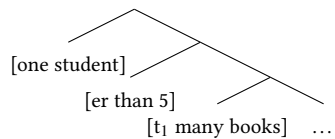
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3 Takahashi (2006) assumes that inverse scope is achieved by QL of a subject DP, following Johnson & Tomioka (1997), but his proposal does not hinge upon this particular operation.

subject is moved to TP and the object CQP is decomposed. Each element of the CQP adjoins to a node of type t for solving type mismatch. In order for the object CQP to take wide scope over the subject QP, both the decomposed elements of the CQPs must take scope over the subject QP. This is a representation illustrated in (12c). However, the subject QP cannot make this inversion in one step, because Shortest Move forces the subject QP to target a closest node of type t, which is a sister of the comparative operator *er*. As a result, an intermediate step as shown in (12b) must be taken.

(12)

a. Surface scope

SOME > ER > MANY

[one student]
 [er than 5]
  [t₁ many books] …

b. Intermediate scope

ER > SOME > MANY

[one student]
 [er than 5]
  [t₁ many books] …
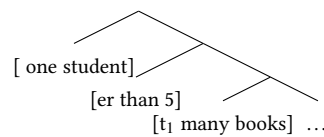
c. Inverse scope

ER > MANY > SOME

[one student]
 [er than 5]
  [t₁ many books] …
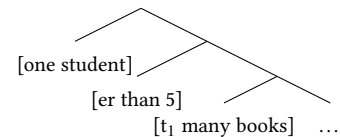
After the first SSO (from surface to intermediate scope), the legitimacy of the operation is evaluated via Scope Economy. Heim (2000) points out and Takahashi (2006) proves that the existential and the comparative operator *er* are scopally commutative.[4] In other words, the inversion of *some/a/one* and *er* does not affect truth-condition. Thus, the SSO to intermediate scope is banned by Scope Economy. Takahashi addresses that when a step of an optional SSO violates Scope Economy, the SSO is ruled out immediately; any further application of SSOs is also barred. Therefore, no SSO being allowed, the object CQP cannot take wide scope over the subject QP.

Takahashi (2006) also argues that optional SSO must occur after all obligatory SSOs are completed. If QL of the subject precedes the decomposition of the object CQP, inverse scope is achieved without violating Shortest Move and Scope Economy. This option is

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4 See Takahashi 2006: 79-80 for detail of the proof.

not available and the only operative procedure is the one demonstrated in (12). Thus, no inverse scope is available.

Takahashi (2006) acknowledges the case where an object CQP can take scope over negation as repeated in (13).

(13)   John doesn't speak more than three (of the) language).

         (NOT > CQP, CQP > NOT)

<div align="right">(Takahashi 2006: 89 footnote 23)</div>

However, he notes that his theory fails to account for the availability of inverse scope. He suggests that scope-bearing non-DP elements such as negation or modals cannot be constrained in the same way as scope-bearing DPs.

3.2   Mayr & Spector (2012)

Mayr & Spector (2012) report that the sentence as in (14) makes perfect sense, even though the surface scope reading is pragmatically implausible (marked by #). This is because the pragmatically plausible inverse scope interpretation is available. In other words, if the sentence does not make sense, then the sentence only has the implausible surface scope reading. This is not the case in the example (14). Thus, wide scope of the object CQP is possible.

(14)   A soldier is standing on more than ten government buildings.

         (#A>CQP, CQP>A)

<div align="right">(Mayr & Spector 2012: (25))</div>

Mayr & Spector (2012) account for the availability of the object wide scope reading by appealing to an analysis of CQPs as generalized quantifiers, an extension of Fox' Scope Economy, and a distributive operator.

Mayr & Spector (2012) do not adopt the decompositional analysis on CQPs but treat them as simplex generalized quantifier.[5] They give the following lexical entry for *more than n*.

(15) $\llbracket \text{more than n} \rrbracket = \lambda P.\lambda Q.\exists X(\#X > n \wedge P(X) \wedge Q(X))$

(assuming an ontology in which the domain of individuals includes both atomic and plural individuals, and is structured by a part-whole relation, satisfying the axioms of a meet-semilattice.$\#X$ denotes the cardinality of the set of atomic individuals which are part of X.)

(Mayr & Spector 2012: (20))

Mayr & Spector (2012) propose an extension of Fox's Scope Economy which they dug *Generalized Scope Economy Contion (GSEC)* as defined in (16).

(16)   *Generalized Scope Economy Contion*

A CSSO[Covert SSO] is licensed in a sentence S only if there exists a constituent C of S (possibly S itself) such that the CSSO does not make the semantic value of C stronger than or equivalent to what it would be without the covert SSO.

(Mayr & Spector 2012: (41))

The GSEC prohibits semantically vacuous SSOs just like Fox's Scope Economy. In addition, it disallows SSOs that make the output of the SSO entail the input of the SSO.

Mayr & Spector (2012) also assume the following lexical entry for a distributive operator *DIST*.

(17) $\llbracket \text{DIST} \rrbracket = \lambda P_{\langle e,t \rangle}.\lambda X_e.\forall x[(\text{x is an atom} \wedge x \leq X) \rightarrow P(x)]$ (where $\leq$ represents the part-whole relation.)

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5 Mayr & Spector (2012) refer to neither Hackl 2000 nor Takahashi 2006.

Let us now see Mayr & Spector's (2012) analysis on the sentence (14). The LF structure for inverse scope and its corresponding meaning are illustrated in (18). Mayr & Spector (2012) assume that this structure is derived by (a) obligatory adjunction of the object CQP to the VP for solving the type mismatch, (b) insertion of DIST just above the lambda-abstract created by the QR, and (c) reconstruction of the subject into its VP-internal position. Note that in Mayr & Spector (2012), the subject can be reconstructed across the CQP and DIST in one step.

(18)   [More than ten government buildings] [$DIST$ [λX.(a soldier stands on X)]]

⤳ There is a plurality G made up of more than ten government buildings such that each atomic part g of G is such that there is a soldier standing on g.

(Mayr & Spector 2012: (26))

The surface reading and its structure are also shown in (19), in which the subject is interpreted in the overt position and the movement from the VP-internal position to Spec,TP creates its own lambda-abstract.

(19)   [a soldier][λy.(more than ten government buildings) [$DIST$ [λX.(y stands on X)]]]

⤳ There is a soldier s such that there is a plural individual G made up of ten government buildings such that s is standing on every atomic part of G.

(Mayr & Spector 2012: (27))

Given the GSEC, the inverse scope reading is allowed, since (i) the inverse and surface scope readings are distinct, thanks to the distributive operator, and (ii) the inverse scope reading (18) does not entail the surface scope reading (19). Assume a situation where more than ten buildings have a different soldier standing on them but no soldier is standing on several building simultaneously. In this situation, the inverse scope reading is true, but the surface is false. Therefore, the GSEC does not block the inverse scope reading. As

shown, Mayr & Spector (2012) make the different prediction from Takahashi in the scope taking property of CQPs in object position. That is, in Mayr & Spector 2012, CQPs in object position can take wide scope over an indefinite in subject position, while in Takahashi 2006, they cannot.

Recall that Takahashi (2006) fails to account for the case in which object CQPs can take wide scope over negation. Mayr & Spector (2012), on the other hand, capture the case.

(20)   John didn't meet more than three students on time.

(NOT > CQP, CQP > NOT)

(Mayr & Spector 2012: (2b))

In (20), the surface scope reading (NEG > CQP) asymmetrically entails the inverse scope reading (CQP > NEG).[6] That is, the inverse scope reading is stronger than the surface scope reading. Thus, the GSEC allows the inverse scope reading.

3.3 Fleisher (2013)

We have seen two different proposals on CQPs and their scope taking property: one proposed by Takahashi (2006) and the other by Mayr & Spector (2012). Fleisher (2013) makes a proposal which combines Takahashi and Mayr & Spector: the decompositional analysis of CQPs and a revised version of the GSEC, in order to account for the interaction between negation and CQPs. First, Fleisher (2013) points out that under the decompositional treatment of CQPs, Mayr & Spectors's GSEC cannot account for the case where an object CQP takes wide scope over negation. He notes that the scope configuration *-er* > NEG asymmetrically entails the scope configurationNEG > *-er*. That is, *-er* > NEG is logically stronger than NEG > *-er*. Thus, the first SSO which converts NEG > *-er* to *-er* > NEG is blocked by Mayr & Spector's GSEC.

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6 Mayr & Spector (2012) assume that quantifiers presuppose their restrictor to be non-empty (i.e., non-empty smallest live-on set).

Fleisher (2013) offers a revised version of the GSEC as follows:

(21)   *Generalized Scope Economy Condition*

A covert SSO is licensed in a sentence *S* only if there exists a constituent *C* of *S* (possibly *S* itself) such that the covert SSO does not make the semantic value of *C* non-vacuously entail (N-entail) what it would be without the covert SSO.

p N-entails *q* iff

a. *p* entails *q*

b. there is a proposition *p'* such that *p'* does not entail *q*; and

c. there is a proposition *q'* such that *p* does not entail *q*

(Fleisher 2013: (20))

Fleisher's GSEC is just like Mayr & Spector's GSEC in that it blocks semantically vacuous and logically strengthening SSOs. What is unique about Fleisher's GSEC is that it allows strengthening SSO in which the input is entailed by every proposition (a tautology) and the output entails every proposition (a contradiction). Fleisher shows that this is the case when an object CQP interacts negation. Therefore, though the inversion from NEG > *-er* to *-er* > NEG is a strengthening SSO, the GSEC licenses this SSO. The next SSO which changes *neg > many* to *many > neg* is allowed, since it is a logical weakening SSO. Hence, the object CQP can take wide scope over negation.

Although Fleisher (2013) accounts for the interaction between negation and CQPs in object position, he is unable to capture the case in which a CQP in object position takes wide scope over an indefinite when the surface scope reading is implausible as in (14) repeated below as (22), because of the same reason as (Takahashi 2006).

(14)   A soldier is standing on more than ten government buildings.

(#A>CQP, CQP>A)

(Mayr & Spector 2012: (25))

Fleisher acknowledges the possibility of the inverse scope reading (Fleisher 2013: footnote 13),but he states that this might be an exceptional case. He suggests that the availability might be due to a special behavior of an indefinite *a*, since changing *a* to *some* or *one* makes the inverse scope reading unavailable.

3.4   Interim Summary

We have seen three proposals which deal with the scope taking property of CQPs in object position, focusing on the interaction with a subject indefinite and negation. What is common among the three proposals is that they adopt some version of Scope Economy. However, they offer the different predictions about the scope taking property of object CQPs. It is revealed that the proposals that take the decompositional approach to CQPs (i.e., Fleisher 2013, Takahashi 2006 show that an object CQP cannot take scope over a subject indefinite. In addition, they do not take the surface scope implausibility into account. That is, even when the surface scope reading is not compatible with world knowledge, there is no inverse scope of CQPs in object position over an indefinite in subject position, since the grammar does not allow it. In contrast, the generalized quantifier analysis (i.e., Mayr & Spector 2012) predicts that a CQP in object position can take wide scope over a subject indefinite, but Mayr & Spector do not say anything about the case where the surface scope reading is plausible. It is not clear whether or not the distributive operator *DIST* is inserted only in the surface implausible case. In fact, if *DIST* is not inserted, then the surface and inverse readings become equivalent, and hence the GSEC blocks the SSO, resulting in the impossibility of the inverse scope reading.

As is well known, the inverse scope reading is harder to get in general. It is possible that the intended interpretation would be just hidden or masked. One way to detect such hidden interpretation is to manipulating pragmatic factors by making one reading implausible, as seen in the surface implausible examples. With such manipulation, if the potentially ambiguous sentence is not pragmatically deviant, it means that the other pragmatically

plausible reading is available (Hirschbühler 1982, Reinhart 2006, Ruys 1992, Ruys & Winter 2011, Szabolcsi 2010). That is, even though one reading seems unavailable, we should not simplistically conclude that the grammar cannot derive the reading, but we should control relevant factors to see whether the reading is really not available.

Again, Fleisher (2013) and Takahashi (2006) predict that even if the surface scope reading is not compatible with world knowledge, wide scope of object CQPs is never possible, whereas Mayr & Spector (2012) predict that it is possible. Thus, the (un)availability of wide scope of CQPs in object position will be a central concern for these proposals. If wide scope of object CQPs is impossible, Mayr & Spector are required to revise the proposal. If, on the other hand, it is available, then Fleisher and Takahashi need to reexamine their proposals or at least need to account for the surface implausible case. The (un)availability of wide scope of object CQPs over subject indefinites will thus affect the proposals and consequently, it will affect other predictions made by each proposal, since the (un)availability of wide scope is based on the core assumptions of each proposal.

Regarding the interaction between negation and CQPs in object position, Fleisher (2013), Mayr & Spector (2012) and Takahashi (2006) all agree on the availability of inverse scope. However, on the one hand, Fleisher and Mayr & Spector capture the availability, on the other hand, Takahashi does not and he needs some *ad hoc*:1 assumption to account for it.

3.5   CQP… CQP

As introduced in the previous section, Szabolcsi (1997) notes that an object CQP can take wide scope over a subject CQP as in (22).[7]

(22)   More than three men read more than six books.

(more than 3 > more than 6, more than 6 > more than 3)

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7 Szabolcsi (1997) assumes Beghelli & Stowell's (1997) cartographic analysis and argues that the subject CQP can in general reconstruct into its VP-internal position.

Fleisher (2013), Mayr & Spector (2012) and Takahashi (2006) do not touch this case at all. In the remaining section, I will show what these proposals would predict the scope possibility of the CQP... CQP case. To anticipate the consequence, the decompositional approach predicts that inverse scope is not possible, while the generalized quantifier approach predicts that inverse scope is possible.

Let us first examine the prediction made by the decompositional approach. Since CQPs are decomposed, the sentence contains four generalized quantifiers (each of the CQPs contains *er* and *many*). In addition, Shortest Move forces an SSO to cross only one quantifier in one step. Given these conditions, there need four steps to go from the surface to the inverse structure, as illustrated in (23) (an index indicates from which CQP the element comes from). Crucially, each SSO must be licensed by Scope Economy. Note that the version of Scope Economy does not matter here: we will see that a point is whether the quantifiers are commutative not.

(23) $CQP_1 \ldots CQP_2 = [\ldots er_1 \ldots [\ldots many_1 \ldots]] \ldots [\ldots er_2 \ldots [\ldots many_2 \ldots]]$

     a.   er1> many1 > er2 > many2   *surface scope*

     b.   er1 > er2 > many1 > many2   *intermediate scope 1*

     c.   er2 > er1 > many1 > many2   *intermediate scope 2*

     d.   er2 > er1> many2 > many1   *intermediate scope 3*

     e.   er2 > many2 > er1 > many1   *inverse scope*

In the first SSO, the relative order between *many1* and *er2* is reversed. This SSO, however, violates Scope Economy, since these two quantifiers are scopally commutative.

In order to see the scopally commutative nature, let us first examine a simpler case as in (24), which is from (Heim 2000).

(24)   More than 20 girls are taller than 4 feet.

(Heim 2000: 44 (14a))

Given the decomposition of the CQP, there are three quantifiers: the DegP [*er than 20*], the DP [*n-many girls*] and the DegP [*er than 4'*] as illustrated in (25). The interaction among these quantifiers and its consequence are amount to suggest the scopal relations between *er* and *many* and between *er* and *er*.

(25)   [$_{DP}$ [$_{DegP}$ er than 20] many girls]…[er than 4']

Heim (2000) reports that the surface scope and the inverse scope readings in (25) are equivalent. Heim's observation suggests that *er* and *many*, and *er* and *er*; are scopally commutative. Since Heim leaves the detailed analysis to the reader, let us examine her observation in more detail. I will use the following simplified example.

(26)   More than 3 girls are taller than 4 feet.

I assume the following lexical entries and definitions of monotonicity and maximum.

(27) $[\![\text{tall}]\!] = \lambda d_d.\lambda x_e.x$ is tall to degree d (Heim 2000: 41)

(28) $[\![\text{-er}]\!] = \lambda D_{\langle d,t\rangle}.\lambda D'_{\langle d,t\rangle}.\ \max(D') > \max(D)$ (Hackl 2000: 50)

(29) $[\![\text{many}]\!] = \lambda n.\lambda P_{\langle e,t\rangle}.\lambda Q_{\langle e,t\rangle}.\exists x[|x| = n \wedge P(x) \wedge Q(x)]$ (Hackl 2000: 83)

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

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

The LFs for the three scope configurations are illustrated in (32)–(34). Following Hackl (2000), I use capital X as variables that is n-many and small x to refer to individuals in X. Distribution is stated as $\forall x \in X$…

(32)   er1 > many1 > er2 (surface scope)

    a.   [er than 3 [λn. [n-many girls [λx.[er than 4' [λd. x is d tall]]]]]]

    b.   max $\{n: \exists X$ [X is n-many & girl(X) & $\forall x$ [$x \in X \rightarrow$ max$\{d : x$ is d-tall$\}$ > 4']$\}$ > 3

(33)   er1 > er2 > many1 (intermediate scope)

    a.   [er than 3 [λn. er than 4' [λd. n-many girls [$\lambda x.x$ is d tall]]]]

    b.   max $\{n:$ max $\{d: \exists X$ [X is n-many & girl(X) & $\forall x$ [$x \in X \rightarrow x$ is d-tall]$\}$ > 4']$\}$ > 3

(34)   er2 > er1 > many1 (inverse scope)

    a.   [er than 4' [λd. er than 3 [λn. n-many girls [$\lambda x.x$ is d tall]]]]

    b.   max $\{d:$ max $\{n: \exists X$ [X is n-many & girl(X) & $\forall x$ [$x \in X \rightarrow x$ is d-tall]$\}$ > 3]$\}$ > 4'

Consider a situation with four girls (G1,… G4) where G1 is 4'5", G2 is 5', G3 is 5'5", and G4 is 6'. The surface scope reading as in (32b) is true in this situation, because the maximum number of girls whose height is above 4' is 4 and 4 is bigger than 3. The intermediate scope reading (33b) is also true in this situation. Give the monotonicity, the maximum degree such that n-many girls are tall to d means the set of degrees to which the shortest girl is tall. In the situation, the shortest girl's height is 4'5", which is above 4', and there are 4 girls that satisfy such condition. Finally the inverse scope reading as in (34b) is also true in the situation. The maximum number of girls who are d-tall is 4, which is above 3, and the height of the shortest girl among the girls is 4'5", which is above 4'. Therefore, all the

scopal configurations have the same truth-conditions. This means that any shift of the order between *er* and *many* and *er* and *er* does not have semantic effects, namely, there are all scopally commutative.

With this fact in mind, let us consider the derivations in (23). The first SSO which changes the order between*many1* and *er2* is blocked by Scope Economy, since as we have just seen, *many* and *er* are scopally commutative,that is, the first SSO is semantically vacuous. The derivations cannot go further. Thus, for the CQP…CQP case, the decompositional approach predicts that there is no inverse scope reading. Note that the version of Scope Economy (Fox, Fleisher, or even Mayr & Spector) is not relevant, since all of the Scope Economy conditions prohibit semantically vacuous SSOs.

Turning to Mayr & Spector (2012), their proposal predicts that the inverse scope is possible. For their analysis, the inverse scope is available when the inverse scope reading does not entail the surface scope reading and when the two readings are not equivalent. Let us look at this in detail. Recall that the structure for the inverse scope reading is derived by (a) obligatory adjunction of the object CQP to the VP for interpretability, (b) insertion of DIST just above the lambda-abstract created by the QR, and (c) reconstruction of the subject into its VP-internal position. (35) shows the representation for the inverse scope and the corresponding reading.

(35)   *surface scope*

[more than six books] [$DIST$ [λX.(more than three men read X)]]

$\rightsquigarrow$ There is a plurality B made up of more than six books such that for each atomic part b of B, there is a plurality M made up of more than three men such that M read b.

The surface scope configuration and its interpretation are illustrated in (36). The subject CQP is interpreted in the Spec,TP and the movement from the VP-internal position to

the surface position creates the lambda-abstract. The distributive operator is inserted just above this lambda-abstract.

(36)   *inverse scope*

[more than three men][$DIST$ [λY.(more than six books) [λX.(Y read X)]]]

$\rightsquigarrow$ There is a plurality M made up of more than three men such that for each atomic part m of M, there is a plurality Bmade up of more than six books such that m read B.

First, these two readings are not equivalent, thanks to $DIST$. Second, the inverse scope reading (35) does not entail the surface scope reading (36). Assume a situation illustrated in (37) where there were seven books (b1...b7) and each book was read by four men. Further, each book had a different set of four men and hence totally there were 28 men (m1...m28). For example, b1 was read by m1-4, and b2 by m5-8 and so forth.

(37)   b1(m1, m2, m3, m4), b2(m5, m6, m7, m8),..., b7(m25 m26, m27, m28)

In this situation, the inverse scope reading is true, but the surface scope reading is false, since each man only read one book. Now we found a situation where the surface scope is false and the inverse scope is true. This is sufficient to show that the inverse scope reading does not entail the surface scope reading. That is, this SSO is a weakening SSO. Therefore, the GSEC does not block the SSO and hence Mayr & Spector's analysis predicts that the inverse scope reading is available.

3.6   Summary and Other factors

The predictions made by each proposals are summarized in Table 1. A striking difference is that the generalized quantifier approach proposed by Mayr & Spector (2012) allow inverse scope in all the cases, whereas the decompositioanl approach propsed by Takahashi (2006)

and Fleisher (2013) does not allow an object CQP to take scope over a subject quantifer. Further, Fleisher (2013) captures the scope interaction between negation and an object CQP, while Takahashi (2006) does not.

	Decomposition		Generalized Quantifier
	Takahashi (2006)	Fleisher (2013)	Mayr & Spector (2012)
a…CQP	*	*	√
n't…CQP	*	√	√
CQP…CQP	*	*	√

*: inverse scope is impossible; √: inverse scope is possible.

Table 1   Summary of predictions about inverse scope of CQPs in object position

Finally, I point out several factors that could affect the availability of taking wide scope, which are not taken into consideration in Takahashi 2006, Mayr & Spector 2012, Fleisher 2013 . One such factor is a type of indefinites in subject position. It has been assumed that an indefinite such as *a N*, *some N* and a bare singular *one N* show the same scopal property (Beghelli & Stowell 1997). However, Ionin (2010) have shown that they are different in terms of the scope taking property. Further, Scontras et al. (2014) report experimental findings that *one*-indefinites in subject position show a stronger tendency to take wide scope over universals in object position than *a*-indefinites. The authors argue that *one* yields a strong specificity inference. That is, the use of a *one* indefinite in subject positoin infers a speaker's intention that there is only a single referent, resulting in the subject wide scope. It is thus possible that one cannot access the wide scope reading of an object CQP over a subjece indefinite, when the subject is a *one*-indefinite, even though the CQP in object position is able to take scope over a subject quantifier. Since the type of subject indefinites could affect the (un)availability of wide scope of CQPs in object position, they must be taken into consideration.

In addition to the form of subject indefinites, there is a possibility that the form of quantifiers in object position could affect the availability of scope taking. It has been discussed that indefinite DPs receive presuppositional or specific interpretations when

they are modified with a partitive form (of N) and such indefinites exhibit wide scope interpretation (Enç 1991, Geurts 2010, among others). In addition, pcycholinguistic study gives evidence that the patitivity plays a role for facilitating wide scope. Miller & Schmitt (2004) showed that the partitive reading, regardless of whether it is marked by an overt form or covertly marked by discourse, gave rise to the availability of inverse scope interpretations for both children and adults. They tested object wide scope of indefinites over negation. Musolino & Gualmini (2004) showed similar findings. Further, Takahashi (2006) reports that the partitive form of the CQP facilitates the availability of wide scope with respect to negation, though his theory cannot capture the availability. Thus, in addition to the form of indefinites in subject position, the form of quantifiers in object position could affect the scope taking property.

I have mentioned that the context factors such as the surface implausibility would affect the accessibility of the object CQP wide scope. However, it is not clear how such factors are implemented in the grammar. If there is a case where the manipulation of the surface implausibility results in a sigfinicant difference, then we would say that it is not the grammar *per se* that prevents invser scope of CQPs in object position. Rather, it would be possible that some extragramamtical factos (pragmatics and/or processing) causese the limited scope taking property. In addition, as I have just discussed, the form of a quantifier in both subject and object may affect the scope taking property. The aim of this thesis is thus to control these factors exprimetally to assess what the scope taking property of CQPs in object position is, that is, whether object CQPs can take scope over an indefinite in subject position to generate the inverse scope reading. To anticipate experimental findings, I show that participants access the inverse scoep reading when the surface scope reading is implausible, indicating that CQPs in object position can take wide scope over an indefinite in subject position. In addition, the form of subject indefintie and the partitivity of object quantifier do influence the scope taking property. Therefore, the findigns require any theory of CQPs to account for the possibility of inverse scope. Among the proposals we

have reviewed in this section, it is the generalized quantifier approach that can capture the pattern of the scope taking property.

4   Experiment

The purpose of the experiment was (i) to establish a baseline of availability of inverse scope reading for a sentence containing an indefinite in subject position and a CQP in object position when the implausibility of the surface scope reading is manipulated, (ii) to examine the role of the type of indefinite in subject position and (iii) to see the influence of the partitivity of quantifier in object position.

4.1   Participants

68 adult native speakers of English participated in this experiment. All were undergraduate students at Rutgers University and they received course credit for participation. Data from four subjects of these participants were excluded from the analysis because they were not native speakers of English.

4.2   Method

4.2.1   Procedure

The procedure was an acceptability rating task, which was designed based on the truth-value-judgment task (TVJT) (Crain & Thornton 1998). After giving an instruction to the participant about the task, an experimenter moved to the task. The experimenter told a story accompanied by picture slides describing relevant scenes in the story. The picture slides appeared on a computer screen and the experimenter manipulated the computer to change the slides at the appropriate point in the story. The story was designed to favor one possible reading of a potentially ambiguous sentence, but to make an alternative reading accessible up until a certain point in the story, in order to satisfy the principle of Plausible Dissent.

At the end of each story, the target sentence was uttered and it also appeared on the screen. Unlike the usual TVJT, the participant was asked to judge how acceptable the

sentence was with respect to the given story, using the 5-point scale as in Table 2. We used the 5-point scale instead of a binomial choice, in order to see the degree of variation that exits in judgment. The 5-point scale for each story was on a response sheet. After the participant marked their judgment on the response sheet, the experimenter moved to the next story. The participant was tested in small groups (1 to 2 participants at a time). The experiment took approximately 20 minutes.

totally unacceptable	unacceptable	reasonable acceptable	acceptable	completely acceptable
1	2	3	4	5

Table 2   5-point acceptability scale used in the experiment

4.2.2 Stimuli

There were seven test sentences, five control sentences and two filler sentences. The seven test sentences were classified into five types which were treated as a within subject variable. Table 3 shows a sample set of the test sentence types, in which the truth-values for the given story, the number of items, and each abbreviation are also listed.

Sentence Type	Surface	Inverse	N	Abbreviation
One student read more than two books.	F	T	1	One-in-Subj
A student read more than two books.	F	T	1	A-in-Subj
A guard was posted in front of more than two hotels.	F	T	2	Surf-Impl
More than two students read more than two books.	F	T	1	CQP-in-Subj
John didn't read more that two books.	F	T	2	Neg

Table 3   Five types of test sentences

There were three classes based on the quantificational expression which interacts with an object quantifier: a subject indefinite, a subject CQP and negation. The subject indefinite class, there were three types of sentences. One type used a *one*-indefinite (One-in-Subj) and another used an *a*-indefinite (A-in-Subje). This contrast was expected to show whether a *one*-indefinite shows stronger tendency to take wide scope than an *a*-indefinite. For

these classes, though both the surface and inverse scope readings were plausible, only the inverse scope was true under the story. A sample story and the target sentence for a *one*-indefinite subject are shown in (38). The story explicitly contained someone's wondering of something or someone's prediction of something, which was intended to make the use of the CQP felicitous.

(38)   Last week, the local bike shop had two red tricycles, and both of them sold imme-diately – each one to a woman. This was a little surprising to the owner, because usually it's the dads who buy the tricycles in his shop. This week, the shop received a new shipment of five red tricycles. Based on last week's sales, the owner of the bike shop predicted that at least two red tricycles would be sold today, and that each one would be purchased by a woman, not a man. At 10 am this morning, a woman came to the shop, looked around, and bought a red tricycle for her son. At 11am, another woman bought a red tricycle for her son, too. The owner of the bike shop began to wonder if his prediction was on target. At 2 pm, a man came in looking for a tricycle, but wanted a blue one, so he walked out without purchasing anything. At 4 pm, however, a woman came in by herself looking for a birthday present for her nephew. She tried to decide between a red tricycle and an orange scooter, and eventually bought a red tricycle. The owner was happy, because his predictions were right on.

Target sentence: One woman bought more than two tricycles.

The other class in the indefinite class used an *a*-indefinite but the surface scope reading was implausible, that is, the reading was not compatible with world knowledge (Surf-Impl). This contrast was intended to make it clear whether the implausibility affects the accessibility to the reading. The following shows a example story and the sentence.

(39)   A convention for NY Times Bestsellers was being held in Gary, Indiana. Many
        VIPs were expected to come and stay in the city during the convention, so Officer
        Hendricks, Officer Wilson, and Officer Murray were assigned as guards to two
        hotels where the VIPs were staying. They were told to be at their posts in front of
        their assigned hotels at 9 am sharp. Initially, all of the VIPs were expected to stay
        at only two hotels, since the city didn't want to pay the fees for more locations.
        So Officer Hendricks and Officer Wilson were assigned to the Marriott, and Office
        Murray was assigned to the Hyatt Regency. However, at the last minute, more
        VIPs decided to come, so a hasty arrangement was made to have some guests stay
        at the Embassy Suites hotel. The city officials knew that using more than two
        hotels would mean more fees, but they didn't care; this convention was going to
        bring in a lot of much-needed revenue for the city. Officer Wilson was instructed
        to proceed to the Embassy Suites. At 9 am, each guard was standing at his post.
        Target sentence: A guard was posted in front of more than two hotels.

In addition, the subject CQP and negation were included to examine the availability of the
object CQP wide scope. While the availability for the subject CQP is predicted differently
according to the proposals, the literature reviewed in the previous section agree on the
possibility of the object CQP to take scope over negation. For these classes only the inverse
scope readings were true under the story, but the surface scope reading was plausible.

Participants were randomly assigned to one of four between-subject conditions, based
on whether the test sentence contained a CQP or a plural numeral in object position
(±CQP) and whether or not this object phrase was modified by a partitive phrase *of the
Ns* (±PART). The phrase in object position was held constant: *more than two* (+CQP)
and *three* (−CQP), in order for the truth-conditions to be constant. This manipulation
made it possible to use the same story and visual stimuli across conditions. The following
illustrates the quantificatioanal phrase in the four conditions

(40)   a.   +CQP,−PART: more than two books

          b.   +CQP,+PART: more than two of the books

          c.   −CQP,−PART: three books

          d.   −CQP,+PART: three of the books

Plural numerals were included in order to establish a baseline of acceptability of the inverse scope reading. It has been noticed in the theoretical literature that plural numerals in object position can take wide scope over a subject indefinite, but they cannot *easily* take wide scope (Liu 1997, Ruys & Winter 2011, among others). It has also been reported that they can scope over negation and it was shown experimentally (e.g., Musolino & Lidz 2003). Thus, given the observation about the scope taking property of CQPs in object position, using plural numerals in object position would be a good comparison with CQPs in object position to examine the availability of inverse scope. Particularly, it was of interest to examine whether or not CQPs show a similar pattern to plural numerals.

Control items and filler items were included in order take control response biases. Given the discussion about the limited scope taking property of CQPs in object position, we predicted that participants would assign low rating to the test sentences (totally unacceptable or unacceptable). Thus, the control and filler items were designed to elicit higher ratings in order to vary participants responses.

The control sentences were all doubly quantified sentences. All of them had an object quantificational DP(a universal, an indefinite, CQPs, plural numerals) and either a subject quantificational DP (an indefinite or a universal) or negation. The control items were included to ensure that the participants could properly interpret doubly quantified sentences and give appropriate ratings for them. Table 4 shows types of the control sentences. Among them, one sentence (*a. . . every book*, which was given under the context where the surface reading was false and the inverse reading was true, would serve as a baseline of

the acceptability of the inverse scope reading. This is a basic type of doubly quantified sentence and generally inverse scope is possible.

Sentence Type	Surface	Inverse
A...every	F	T
A...every	T	T
Every...a	F	F
A...[more than two (of the)/three (of the)]	T	T
neg... three	T	F

Table 4 Types of control sentences

There were two filler items which contained antecedent-contained deletion, as shown in Table 5. One filler was grammatical under the intended reading and acceptable under the story. The other filler was ungrammatical under the co-referential reading, and further even when the pronoun and the reference expression were not co-referential (She$_i$...Katie$_k$), the sentence was intended to be judged unacceptable under the given story. Thus, the grammatical filler was clearly good, while the other filler was clearly bad. The acceptability of these filler were to be compared with the one of the test sentences in order to see whether or the inverse scope reading was accessible.

Item	Types
Julie$_i$ sang every song she$_i$ wanted to.	clearly good
She$_i$ tried on every dress that Katy$_{*i/k}$ wanted to.	clearly bad

Table 5 Filler sentences

To sum up, these manipulations resulted in a 2 ($\pm$CQP) $\times$ 2 ($\pm$PART–) $\times$ 5 (sentence type) design in which CQP and PART were treated as between subject variables and sentence type was treated as a within subject variable. For each condition, we had 7 test items, 5 control items, and 2 fillers and totally 14 items. For each condition, two pseudorandom orders were created, such that the distributions of the test, control and filler items were balanced, resulting in 8 lists. Each condition had 16 participants. All stimuli are found in Appendix.

4.3 Prediction

Given the literature reviewed in the previous section, each proposal makes a different prediction about the results of the experiment. The summary of each prediction is shown in Table 6.

	Decomposition		GQ
Sentence Type	Takahashi	Fleisher	Mayr & Scpetor
a…CQP (A-in-Subj)	low	low	(high)
a…CQP (Surf-Impl)	low	low	high
one…CQP (One-in-Subj)	low	low	high
n't…CQP (Neg)	high	high	high
CQP…CQP (CQP-in-Subj)	low	low	high

Table 6　　Summary of predicted ratings (high/low) for the experimental stimuli

The decompositional approach proposed by Takahashi (2006), Fleisher (2013) predict low rating for A-in-Subj, Surf-Impl, One-in-Subj and CQP-in-Subj and these ratings should be similar, since it dose not allow any scope inversion between a CQP in object position and an indefinite/CQP in subject position. On the other hand, the generalized quantifier approach proposed by Mayr & Spector (2012) predicts high rating for these sentence types. Note that Mayr & Spector (2012) predicts that theoretically, A-in-Subj and One-in-Subj would be assigned high rating, but if as we discussed the distributive operator is inserted only when the surface implausible context, then these two types would be rated lower than Surf-Impl. Both the approach predict that Neg sentence would be rated high, even though Takahashi (2006) is not able to account for the availability. Given the previous experimental findings (e.g., Ionin 2010, Scontras et al. 2014), we expect that One-in-Subj is rated lower than A-in-Subj. Further, given the discussion and the experimental findings in the literature (e.g., Enç 1991, Geurts 2010, Miller & Schmitt 2004), we expect a main effect of PART, that is +PART is rated higher than −PART.

Finally, let me briefly comment on the prediction about plural numerals (−CQP) with respect to the interaction with a subject quantifier. As mentioned, it has been

observed that wide scope of plural numerals in object is possible, though it is difficult. The decompositional approach thus predicts that there is a different between +CQP and −CQP with respect to A-in-Subj, A-in-Subj, One-in-Subj and CQP-in-CQP. In contrast, the generalized quantifier approach predicts that there is no such a difference.

4.4 Results

Let us first start with performance on the control and filler items. We found that participants patterned as expected. Participants assigned high ratings to the clearly good filler item (*mean* $= 4.50, SD = 0.76$) and low ratings to the clearly bad filler item (*mean* $= 1.91, SD = 1.08$). For the doubly quantified control sentences, they assigned low ratings for the clearly unacceptable item (*mean* $= 1.69, SD = 1.11$), in which neither the surface nor inverse scope reading was false. They assigned high ratings to the clear acceptable control items, in which both the interpretations were true with respect to the story, (for *a… every*, *mean* $= 3.86, SD = 1.19$; for a...±CQP,±PART, *mean* $= 4.66, SD = 0.89$). For the surface-true, inverse-false control item (*n't… CQP*), they assigned relatively high ratings (*mean* $= 3.86, SD = 1.32$) and for the surface-false, inverse-true item (*a… every*), they also assigned relatively high ratings (*mean* $= 3.84, SD = 0.98$). This last item was a baseline of the acceptability of the inverse scope reading.

We now turn to the test items. The means for the test sentences are presented in Figure 1. Here, the dependent measure was the mean ratings and they were entered into a 2 ($\pm$CQP) $\times$ 2 ($\pm$PART−) $\times$ 5 (sentence type) mixed design ANOVA in which CQP and PART were treated as between subject variables and sentence type was treated as a within subject variable. The analysis revealed a significant main effect of sentence type ($F(4, 240) = 45.697, p < .001$), a significant main effect of PART ($F(1, 60) = 8.32, p < .001$) and no main effect of CQP ($F(1, 60) = 1.41, p = .26$). There was a significant interaction between sentence type and CQP ($F(4, 240) = 8.37, p < .001$), and no interactions between sentence type and PART ($F(4, 240) = .54, p < .71$), CQP and PART ($F(1, 60) = .97, p = .33$), and

sentence type, CQP and PART ($F(4,240) = .27, p = .90$). The effect of CQP was only found in Neg, in which the mean for −CQP was significantly higher than the mean for +CQP ($p < .001$). Given the fact that the there was no interaction with respect to PART and that the effect of CQP was only found in Neg, for the rest of the thesis, I will focus on +CQP, −PART condition (more than two books) and report the result of it and make a discussion.
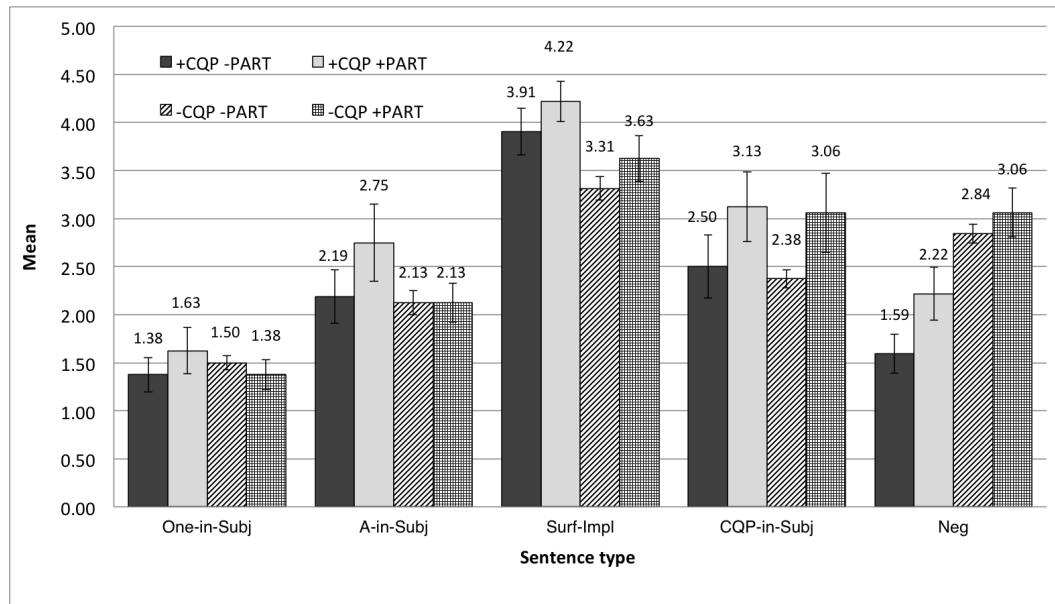

Figure 1   Mean ratings for the test sentences.

In order to examine the predictions for the $+$CQP, $-$PART condition, the mean ratings for $+$CQP, $-$PART were entered into a repeated measures ANOVA. The analysis revealed a significant main effect of sentence type ($F(4,92) = 21.734, p < .001$). Pairwise comparisons with Bonferroni adjustment revealed that the mean for Surf-Impl was significantly higher than the means for A-in-Subj ($p < .05$), $One-in-Subj$ ($p < .001$), Neg ($p < .001$), but was not different from the mean for CQP-in-Subj ($p = .49$). No other difference was found.

I further compared the mean for Surf-Impl with the means for four other items: A-in-Subj (*mean* $= 2.19, SD = 1.11$), the two fillers (clearly good (*mean* $= 4.56, SD = .63$) and

clearly bad (*mean* $= 2.44, SD = 1.15$)) and one control item (*a... every*) (*mean* $= 4.06, SD =$ .93) in which the surface scope is false, but the inverse scope is true under the story. The means are represented in Figure 2. Pairwise comparisons with Bonferroni adjustment revealed that Surf-Impl was significantly higher than the clearly bad filler ($p < .05$) and A-in-Subj ($p < .05$), but it was not different from the clearly good filler ($p = .24$) and the control ($p = .88$). The control was higher than the bad filler ($p < .001$) and A-in-Subj ($p < .01$), but not different from the good filler ($p = .88$). The good filler was higher than the bad filler ($p < .001$) and A-in-Subj ($p < .001$). No difference was found between A-in-Subj the bad filler ($p = 14$).
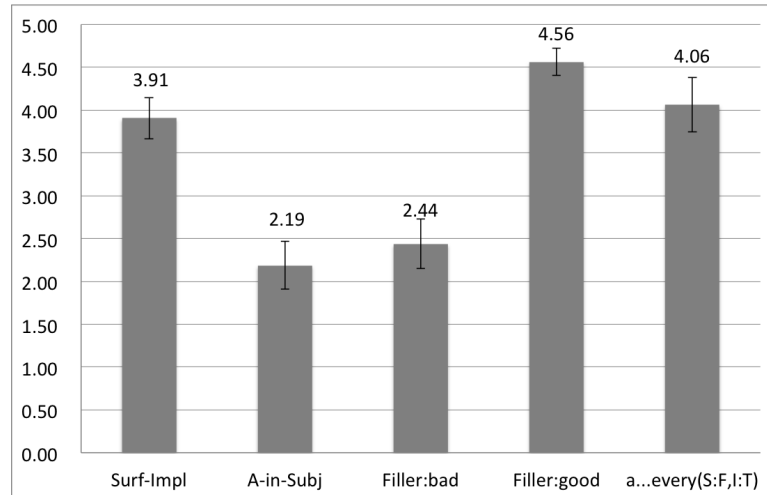
Figure 2   Mean ratings for Surf-Impl, A-in-Subj,fillers and control

4.5   Discussion

The results of the experiment suggest that a CQP in object position *can* take scope over an indefinite in subject position and generate the inverse scope reading when the surface scope reading is implausible. Participants robustly access the reading under the implausible case. On the contrary, the results indicate that participants cannot access the inverse scope reading of an object CQP over a subject indefinite when the surface scope reading is plausible and when the subject is an *one*-indefinite. This contrast suggests that the inverse

scope reading may be strongly dispreferred and hard to access. In other words, the grammar does not block the scope shifting operation and the inverse scope reading is generated. Therefore, what makes the inverse scope reading strongly difficult to access it might not be the grammar (syntax, semantics and/or its interface) but some extragrammatical factors (pragmatics and/or processing).

This assumption is further confirmed by the results of plural numerals ($-$CQP). The results show that there is no difference between CQPs and plurals numerals except for Neg item. Again, nothing in the grammar prevents an object numeral plural from taking scope over an indefinite in subject position. However, as have been observed in the literature, the inverse scope reading is difficult to access. That is, the inverse scope reading of the object numeral plural is possible but dispreferred. The experimental results indicate that the same is true for CQPs in object position. Further, just like the CQPs case, the surface implausibility facilitates the accessibility of the inverse scope reading.

Moreover, the results of Neg items are suggestive. We find that the ratings were low, indicating that the inverse scope of an object CQP over negation is not accessible. Recall that the possibility of inverse scope is predicted by all the proposals reviewed in the previous section. That is, this low ratings are not expected. From the results, we can assume that this low rating is a reflection of extragrammatical factors and not the grammatical factor. In general, the inverse scope reading is not readily accessible. The inverse scope reading of CQPs in object position is thus much more difficult to access among quantifies in object position.

Next, let us discuss the effect of the form of subject indefinites and the partitivity of object quantifiers. We predicted that a *one*-indefinite is more likely take wide scope than an *a*-indefinite. That is, the object CQP wide scope is more difficult with respect to a *one*-indefinite than an *a*-indefinite. However, the results suggest that there is no difference in terms of the average of the ratings. Nevertheless, we can see the effect in the distribution of the ratings. For example, in One-in-Subj,$+$CQP,$-$PART, 87.5% of the participants assigned
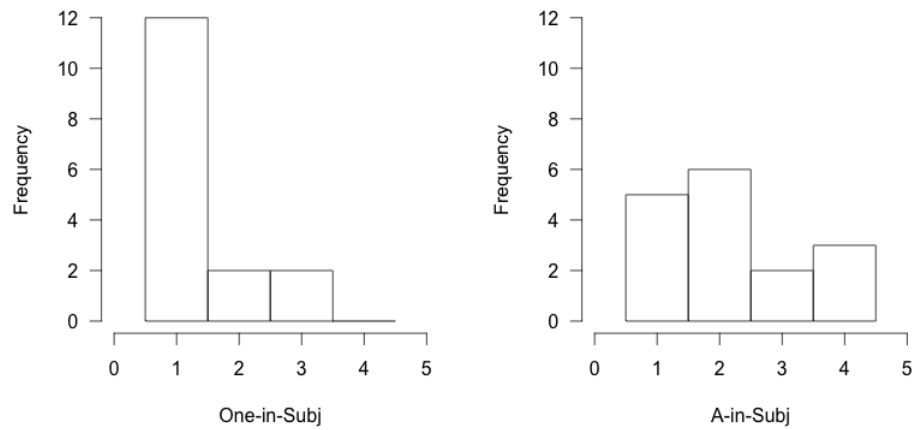
Figure 3   Distribution of ratings in One-in-Subj and A-in-Subj,+CQP,−PART

1 and 2 (75%, 12.5%, respectively), while in A-in-Subj,+CQP,−PART, 68.8% assigned 1 and 2 (31.3% and 37.5%, respectively). Figure 3 shows the shift to more ratings to the higher end of the scale. Therefore, the form of the indefinite in subject position effects the acceptability of the inverse scope reading, though the effect does not seem strong.

A similar observation can be made about the role of the partitive phrase in the object quantifier. We predicted that the partitivity facilitate the inverse scope reading. It is true that the main effect of PART was found, but for each ±PART pair, there was no significant difference. However, the effect of the partitivity appears on the distribution of the ratings. Figure 4 shows the distribution of the rating in the CQP-in-Subj, +PART case, which illustrates that the ratings are moved toward the higher end. Thus, the form of the object quantifier too play a role to make the inverse scope reading more acceptable.

Finally, let us discuss the results of CQP-in-Subj. Recall that on the one hand, the decompositional approach predicts that an object CQP cannot take scope over a subject CQP and hence the inverse scope reading is not possible. On the other hand, the generalized quantifier approach predicts that an object CQP can take wide scope and the inverse scope reading is available. It should be noted that the experimental results show that CQP-in-Subj
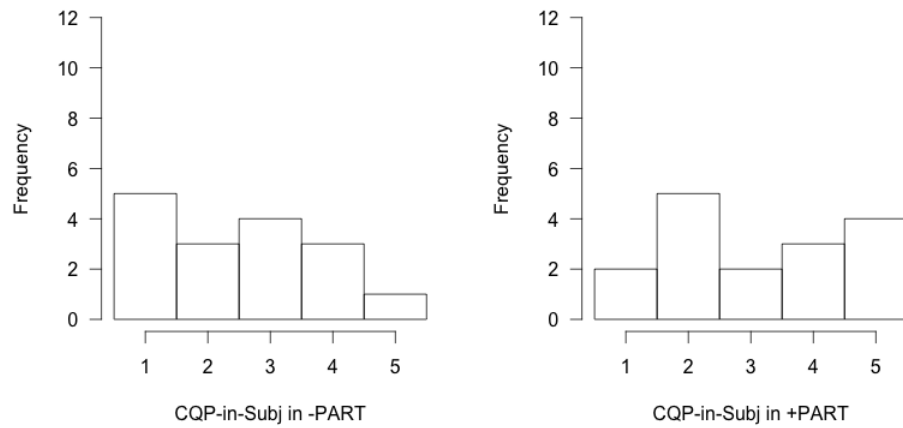
Figure 4   Distribution of rating in QP-in-Sbuj ±PART

1	2	3	4	5
31.3% (5/16)	18.8% (3/16)	25% (4/16)	18.8%(3/16)	6.3% (1/16)

Table 7   Distribution of ratings in CQP-in-Subj, +CQP, −PART

was not different from any other target sentence types. Thus, whether or not the inverse scope reading is available is not clear from the results.[8]

Take a look at Table 7 which shows the distribution of the ratings in CQP-in-Subj, +CQP, −PART. As seen, the rating varied. It suggests that for some participants, the wide scope seemed available, while for the others, it was not possible. Roger Schwarzschild (p.c.) pointed out to me that a salient reading for the sentence *More than two students read more than three books* is a scope-less cumulative reading, which is different from the surface distributive and the inverse distributive reading.[9] For example, suppose there are six students (s1, s2, . . ., s6) and there are four books (b1, b2, b3, b4). In a situation described in (41) where s1, s2, and s3 read b1 and b2, s4, s5 and s6 read b3 and b4, a cumulative

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8 The paired *t*-test reveled that CQP-in-Subj was rated lower than the control (*a*. . .*every*), in which the inverse scope is true and the surface scope is false under the story ($t(15) = 3.36, p < .01$).

9 I thank Roger Schwarzschild (p.c.) and Kristen Syrett (p.c.) for pointing out the possibility of cumulative readings.

reading is true, since there are more than 2 students such that they read totally more than 3 books.

(41)   s1 [b1, b2]   s4 [b3, b4]

         s2 [b1, b2]   s5 [b3, b4]

         s3 [b1, b2]   s6 [b3, b4]

Consider a situation as in (42) in which under this situation, the inverse distributive reading is true, since for more than three of books, there are more than two students who read them.

(42)   b1 [s1, s2, s3]

         b2 [s1, s2, s3]

         b3 [s4, s5, s6]

         b4 [s4, s5, s6]

As can be noticed, (42) depicts exactly the same situation as (41) from the different perspective. This means that there is a situation in which both the inverse distributive reading and the cumulative reading are true. The story used in the experiment described such situation. That is, the test sentence is true in the inverse distributive reading as well as the cumulative reading. If the participants assigned the cumulative reading to the sentence, they rated it relatively higher. Since we did not collect the participants' justification for their ratings, we cannot tell which reading they assigned to the sentence. Therefor, the experimental result for CQP-in-Subj is not conclusive.

5   General Discussion

5.1   Main findings

The central aim of the current thesis is to investigate the scope taking property of CQPs in object position. The widely acknowledged nature of object CQPs is that they cannot take scope over an indefinite in subject position. This observation seems strong enough for several authors to propose a way to restrict inverse scope of CQPs in object position. Among them is Takahashi (2006), who adopts the decompositional approach to CQPs, Fox's Scope Economy and Shorted Move. His analysis accounts for the limited scope taking property of CQPs in object position. Fleisher (2013) also adopt the decompositional approach and his Generalized Scope Economy Condition, accounting for the limited scope taking property. In contrast, Mayr & Spector (2012) adopt an alternative approach to CQPs, in which CQPs are treated as generalized quantifiers. This approach, together with Mayr & Spector's Generalized Scope Economy Condition and the distributive operator, predicts that CQPs in object can take wide scope over a subject indefinite. In this study, we tested the scope raking property of object CQPs, by manipulating the surface scope implausibility, the form of subject indefinite and the partitivity of object quantifiers.

The experimental findings reported in this thesis suggest that a CQP in object position *can* take wide scope over a subject indefinite when the surface scope reading is not compatible with world knowledge, namely, when the surface reading is implausible. Thus, they provide empirical evidence for Mayr & Spector's (2012) analysis but against Takahashi's (2006) and Fleisher's (2013) proposal. In other words, the findings favor the generalized quantifier approach, not the decompositional approach. Table 8 shows the predictions made by each analysis and the results of the experiment (the mean ratings) (I omit CQP-in-Subj, because as I pointed out, the experiment seems inconclusive)

A crucial finding is again Surf-Imple was rated high, indicating that the CQP object wide scope is available. This result is predicted by Mayr & Spector, but not by Takahashi

Sentence Type	Decomposition		GQ	Mean ratings
	Takahashi	Fleisher	Mayr & Spector	
a...CQP (A-in-Subj)	low	low	(high)	2.19
a...CQP (Surf-Impl)	low	low	high	3.91
one...CQP (One-in-Subj)	low	low	high	1.38
n't...CQP (Neg)	high	high	high	1.59

Table 8   Summary of predicted ratings and mean ratings for the test sentences (+CQP,−PART)

and Fleisher. For A-in-Subj, One-in-Subj, and Neg, the low mean ratings indicate that the inverse scope readings are not acceptable. The low acceptability of the object wide scope reading over a subject quantifier is expected by Takahashi and Fleisher but not by Mayr & Scpector. However, given the fact that an object CQP can take scope over a subject indefinite when the surface scope reading is implausible, the low ratings do not result from the constraint for SSOs, but from some extragrammatical factors. If they are due to the grammatical constraint on SSO, Surf-Imple should also be rated low as predicted by Takahashi and Fleisher. Therefore, the ratings for Surf-Imple suggest that the grammar allows for inverse scope and generates the inverse scope reading. The other ratings show object CQPs' great reluctance to take wide scope.

The great reluctance is also shown by the unexpected low ratings for Neg. Though all the proposals agree on the availability of inverse scope in Neg, the results do not support the availability. The result however do not immediately come the counterexample against the theoretical observation. First, it is a general trend that inverse scope readings are difficult to access. Second, as discussed, it is strongly dispreferred to access the object CQPs wide scope. Third, in order for an object CQP to take wide scope, it needs strong contextual support such as the implausibility of the surface reading. Thus, the low rating for Neg is not surprising, given the experimental settings. The object CQP wide scope is not impossible, but difficult to access.

It is thus not surprising that many linguists have assumed that CQPs in object position cannot take wide scope over subject quantificational DPs. However, as shown, the

experimental findings suggest that it is too haste to conclude that object CQPs never take wide scope. It is true that the wide scope reading is difficult to obtain, but it does not mean that wide scope of object CQPs is impossible. With the manipulation of the contextual factors, we see that wide scope of object CQPs over subject indefinites is available. In addition, the results of plural numerals suggest that even though the availability of inverse scope is widely supported, there is a strong preference for the surface scope reading and the preference can be overridden by the manipulation of the contextual factors. It is thus safe to assume that the great reluctance of inverse scope found in CQPs in object position is due not directly to the grammar (syntax, semantics and/or its interface), but to some constraints on performance (pragmatics and/or processing). Thus, any theory treating syntactic and/or semantic nature of CQPs should be able to account for the availability of the object CQP wide scope. At this point, the leading candidate might be Mayr & Spector's generalized quantifier approach. The analysis is able to capture not only the surface implausible case but also the surface plausible case. Though Mary & Spector does not mention the case where the surface scope reading is plausible, it might be possible to assume that in that case, the distributive operator is not inserted. Or it might be the case that in order to access the inverse scope reading in the surface plausible context, there needs the insertion of *DIST* which might be a costly operation for processing (see Anderson 2004 for the discussion of processing and scope). I leave the further discussion for future work.

Next, we find that the form of subject indefinites and object quantifiers influences the acceptability. If the scope taking property of CQPs is investigated based on a sentence *One student read more than two books*, one would find that the inverse scope reading is not available and hence conclude that the grammar does not allow for the required SSO. However, as shown in the experimental results, a *one*-indefinite shows the strong preference to take wide scope. The unavailability of the object wide scope might be due to the use of a *one*-indefinite. Thus, we must make a careful manipulation of the choice

of a quantifier in subject position and also contextual factors. Otherwise, theoretical development would go wrong direction.

Lastly, let us consider one remaining concern about our findings on Surf-Impl. The test sentences for Surf-Impl contained the non-eventive verb (*grace*) and the passive construction (*was posted*). Given the discussion about the importance of controlling factors, I should consider whether the verb type and the passive construction influence scope ambiguity, particularly, whether they yield the object wide scope readings in different ways from the usual eventive verbs or active constructions. To investigate such possibilities as a whole is beyond the scope of the current thesis and it is too involved a subject to be treated here in detail. I should leave this for future study. However, I will report the results of a small follow-up experiment (14 participants). The purpose of this experiment was to investigate whether the passive construction affects the availability of wide scope of CQPs in Surf-Impl. The test sentence forthe follow-up experiment is shown in (43a). For comparison, the counterpart of the sentence used in the experiment is also listed in (43b).

(43)   a.   A guard stood in front of more than two hotels.

          b.   A guard was posted in front of more than two hotels.

The analysis revealed that there was no difference between these two sentences ($t(28) = .86, p = .39$). The results of the follow-up experiment demonstrate that the availability of wide scope of object CQPs is not due to the use of the passive form. It is thus safe to assume that object wide scope of CQPs over subject indefinites is generally available with the manipulation of the contextual factors, though the possibility that the wide scope reading is derived differently for the sentence with *grace* is still open to question.

5.2   Summary

In sum, we have seen that CQPs in object position can take scope over an indefinite in subject position, when the surface scope reading is implausible. In addition, we have

discusses that CQPs may be extremely reluctant to take wide scope. The findings indicate that the wide scope reading of object CQP over a subject indefinite is a matter of accessibility to the reading, not a matter of grammaticality. The wide scope reading is generated by the grammar, but the reading is hard to access.

In English, there are quantifiers whose scope taking property is restrictect just like CQPs. The findings reported in this thesis suggest that we need to reconsider the scope taking property of these quantfiers as well. I arugue that the restricted scope taking property of CQPs in object position is a result of constraints on performance and the grammar generates the inverse scope reading. If this hypothesis is on the right track and can be extended to other quantifiers, then it is worth investigating the scope taking property of other quantifiers. Even though the experimental findings show that CQP in object position can take wide scope over subject indefinites, this generalization is not directly applicable to different types of quantificational DP in subject position. It has been widely reported that CQPs in object position cannot take wide scope over universal DPs (every N), non-monotonic DPs (exactly two Ns), downward entailing DPs (no N). The findings reported in the thesis require us to revisit these widely assumed observations. Recall that our experiment manipulated the contextual factors that make the surface scope reading implausible. Under this context, we are able to detect the availability of wide scope of object CQPs. It is thus crucial to use similar senteFITnces to investigate whether the wide scope reading object CQPs is also possible with respect to the different quantificational DPs in subject position, though it does not seem as simple as in the case with the indefinite subject to construct such sentences. In addition, since this thesis has only focused on *more than* CQPs, it is thus interesting to examine whether or not *fewer than* CQPs behave similarly.

5.3   Future research: Scope Rigidity

Let us call the phenomena that show the limited scope taking property *scope rigidity*. Even in a language which usually allows for scope flexibility such as in English, the use of specific quantifier results in Scope rigidity. CQPs in object position is a case of scope rigidity in English. Scope rigidity is also found in languages which do not allow scopal interactions. These languages are often called scope rigid languages. This subsection discusses scope rigidity given the experimental findings reported in the thesis and address topics that must be investigated in future work.

A question that we must answer ultimately is: what would be a proper treatment of scope rigidity. Is it a phenomenon of the grammar (syntax, semantics and/or their interfaces)? Of is it a phenomenon of performance (including pragmatics and processing)? Or both? I argue that at least some case of scope rigidity is best captured in theories of performance.

We have seen that CQPs in object position takes wider scope than previously assumed and that the (im)plausibility plays a crucial role to detect the scope taking property. Given these findings, two questions arise: are other quantifiers which have shown scope rigidity able to take wider scope? Do languages which are categorized into scope rigid languages allow quantifiers to take inverse scope? These questions must be addressed in future work. In the remaining section, I will focus on what we call "Scope rigid languages". Taking Japanese for example, I discuss the extension of the method we used in the experiment.

5.3.1   Extension to scope rigid laguages: A case study in Japanese

It has been widely assumed that Japanese is scopally rigid (Kuroda 1970, Hoji 1985, among others). Unlike English, a doubly quantified sentence such as (44) does not show the

ambiguity when it is in a canonical SOV word order. The only possible interpretation is the surface scope reading and the inverse scope distributive reading is not available. [10]

(44) Dareka-ga   daremo-o   semeta.
someone-NOM everyone-ACC criticized
'Someone criticized everyone'

(SOME > EVERY, *EVERY > SOME)

(Hoji 1985: 340(68))

If covert scope shifting operations such as QR or QL are the only way to yield inverse scope, then the lack of inverse scope means that there are relevant constraints on SSOs. That is, unlike English, Japanese has a restriction on SSOs in the grammar, resulting in the scope rigidity. For example, Hoji (1985) proposes the following condition as in (45) which restricts the scope relations at LF. The condition states that the c-commanding relation cannot be reversed by the application of movement and hence the grammar in Japanese cannot generate inverse scope.[11]

(45)   at LF *QP_i QP_j t_j t_i

where each member c-commands the member to its right.

(Hoji 1985: 344 (56))

The theoretical claim that it is the grammar that disallow inverse scope is supported by several experimental works (e.g., Sano 2004, Han et al. 2008, Marsden 2009)

This long-standing observation, however, has been challenged and the availability of the inverse scope reading has been claimed (Hayashishita 1999, Kitagawa 1984, Kuno et al 1999). Further, to the best of my knowledge, the effect of the surface implausibility for the

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10 Another case of scope rigidity in Japanese is found in the double object contraction similar to English. I will not discuss this case in this thesis.

11 Lasnik & Saito (1992) propose a similar condition:
Scope Rigidity Condition: Suppose that Q_1 and Q_2 are operators (quantified NP or WH). Then, Q_1 cannot take wide scope over Q_2 if t_2 c-commands t_1.   (Lasnik & Saito 1992: 155 (52))

Japanese case has not been pointed out until at least Goro (2007), who notes that when the surface scope reading is implausible, the inverse scope reading becomes accessible as exemplified in (46)[12].

(46) a. Dareka-ga   dono-biru-no   mae-ni-mo   tatteiru.
          someone-NOM every-building-GEN front-DAT-also standing
          'Someone is standing in front of every building'

          (#SOME > EVERY, EVERY > SOME)

          (Goro 2007: 101(83))

      b. (Choudo ima) dareka-ga   dono-oudan-hodou-mo watatteiru.
          (right   now) someone-NOM every-crosswalk-also   crossing
          'Right now, someone is crossing every crosswalk'

          (SOME > EVERY, EVERY > SOME)

          (Goro 2007: 101(84))

What is important about Goro's example in (46) is that the manipulation of the contextual factor does influence the acceptance of the inverse scope reading in Japanese just like the case of CQPs in English. As pointed out elsewhere in the current thesis, the manipulation of the contextual factors makes the supposedly ungrammatical interpretation accessible in the case with CQPs in object position. As Goro shows, this generalization seems to be applicable to the case for the scope rigid language in which the inverse scope reading has been regarded as ungrammatical.

Moreover, the availability of inverse scope in Japanese is predicted, given the hypothesis that the difficulty of taking inverse scope is due to extragrammatical reasons.[13] Just like

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12 Goro (2007) points out that the past/perfect tense makes the surface scope reading plausible, rsulting in the unavailability of the inverse scope reading. I can however access the inverse scope reading in the sentence with the past/perfect tense as well. If my judgment is shared by Japanese speakers, then it seems that the plausibility is not the factor which makes the inverse scope reading available.

13 Goro 2007 gives an analysis that the unavailability of inverse scope as in (45) is due to a pragmatic implicature associated with a subject indefinite. He proposes that when a subject is marked with a nominative marker -*ga*, it yields an implicature that there is a unique individual that satisfies the predicate. Since there is only one individual, a subject cannot be varied with an object DP, resulting in the unavailability of the inverse scope reading. On the other hand, in the surface implausible case as in (46), he assumes that the listener ignores the implicature and hence the inverse scope reading is available. He does not provide any detailed

English CQPs, inverse scope in Japanese is not ungrammatical, but is strongly disfavored. By manipulating contextual and/or other factors, we can find the disfavored reading available. Thus, it is worth investigation other "scopally rigid" languages and other quantificational expressions with the manipulation of the plausibility and other factors. The findings in this thesis as well as Goro's findings indicate that we need to make a careful control over several factors which influence the acceptance of the inverse scope reading. Without such manipulation, we cannot discuss the (un)availability of scope reading and build theories about the scope taking properties.

As mentioned, the theoretical claim that scope in Japanese is rigid is supported by several experimental results. It should be noted however that there is no experiment which manipulated contextual factors, especially the (in)plausibility of surface scope readings. It is thus worthwhile to examine experimentally the scope rigidity in Japanese in the surface implausible case. If the manipulation of the plausibility finds that an object quantifier may be able to take scope over a subject quantifier, then the theoretical claim that inverse scope is not generated may be discarded.

The experimental findings reported in the thesis impact not just on the theories about CQPs, but on the scope rigidity in general. We have shown that it may be dangerous to assume that the low acceptance means that the reading is ungrammatical. If we find that under certain conditions, scope in Japanese shows flexibility, then such findings would have an impact on the theory of Japanese grammar and give us an opportunity to have a better understanding on the scope taking property in Japanese. Furthermore, they would make it possible to offer an unified treatment of the scope taking property of languages under the current hypothesis that scope rigidity is due to extragrammatical reasons. Scope rigidity might be not categorical, but gradient in nature. That is, there is a degree of difficulty to take inverse scope, or more precisely there is a degree of difficulty to access inverse scope readings. It is an open question What aspects of extragrammatical factors

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explanation as to how and why in the implausible case the implicature can be ignored. In addition, there seem several issues on his pragmatic analysis which I will not discuss in this thesis.

make the access to inverse scope readings strongly difficult. One possibility is that it is processing mechanisms that affect the accessibility to inverse scope readings (see, for example, Anderson 2004, Kurtzman & MacDonald 1993, Reinhart 2006, Tunstall 1998. Another possibility is that it is pragmatics that causes the strongly disfavored nature of inverse scope readings (see, for example, AnderBois et al. 2012, Goro 2007, Ioup 1975, Saba & Corriveau 2001, Srinivasan & Yates 2009). Or, it may be possible to assume that both would play a role. I am assuming that these lines of approaches will shed new light on scope rigidity.

6 Concluding remarks

In this thesis, I have discussed the scope taking property of CQPs especially when they appear in object position. The experimental findings reported in the thesis have shown that contrary to the widely believed observation, CQPs in object position can take wide scope over subject indefinites. Among the manipulation made in the experiment, the crucial one is the manipulation of the plausibility. The surface scope reading is made to be incompatible with world knowledge. With the manipulation, the wide scope reading of object CQPs is available, whereas it is strongly disfavored without such manipulation. It is thus not surprising that there is a debate in the literature about the judgment on the scope taking property of CQPs in object position. Musolino (2009) points out that manipulation of certain contextual factors makes disfavored wide scope readings available. He also notes, "... acceptance rates on a given reading should not automatically lead to the conclusion that the reading in question is in principle unavailable" (36). This should also be applied to intuitive judgments. Thus, it is important to distinguish something disfavored from something ungrammatical. The current thesis has shown a experimental way to detect such difference.

I believe that the experimental evidence reported here contributes the debate on the scope taking property of CQPs. Given the assumption that the contextual factors do not override the grammar, the grammar should generate the configuration for the wide scope reading. From the experimental results, we can recognize the significance of controlling several factors from lexical choice to context when investigating scope properties of quantifiers. Further, the results of the experiment require us to revisit scope taking properties of other quantificational expressions and scope ambiguity in other languages as well.

Appendix

test-SURFACE FALSE, INVERSE TRUE

Last week, the local bike shop had two red tricycles, and both of them sold immediately – each one to a woman. This was a little surprising to the owner, because usually it's the dads who buy the tricycles in his shop. This week, the shop received a new shipment of five red tricycles. Based on last week's sales, the owner of the bike shop predicted that at least two red tricycles would be sold today, and that each one would be purchased by a woman, not a man. At 10 am this morning, a woman came to the shop, looked around, and bought a red tricycle for her son. At 11am, another woman bought a red tricycle for her son, too. The owner of the bike shop began to wonder if his prediction was on target. At 2 pm, a man came in looking for a tricycle, but wanted a blue one, so he walked out without purchasing anything. At 4 pm, however, a woman came in by herself looking for a birthday present for her nephew. She tried to decide between a red tricycle and an orange scooter, and eventually bought a red tricycle. The owner was happy, because his predictions were right on.

One woman bought [three/more than two] (of the) tricycles.

Test–SURFACE FALSE, INVERSE TRUE

A popular talk show host wanted to do a segment on physical fitness. She had an NBA basketball player appear on the show, and invited five audience members up on the stage to shoot hoops with him. The talk show host said that the audience members had to compete with the NBA player. The only catch was that he was going to be blindfolded! Once blindfolded, the basketball player took his first shot, but wasn't even close to making it! The second try was better, but the ball bounced off the backboard. The ball hit the

rim on the third try. The player took a deep breath, set himself up, and made his last two shots—this time making them both. What a relief! Everyone the audience members might also have a difficult time, and would only be able to make two goals total. However, the first and second audience members made their shots. Amazing! The third and fourth people didn't, though. Everyone held their breath for the fifth person—would she make it? She did! The NBA player was shocked the audience members did as well as they had, and gracefully admitted defeat. All of the participants got tickets to the next game as a prize.

An audience member made [three/more than two] (of the) goals.

Test– SURFACE FALSE, INVERSE TRUE

A middle school teacher wanted to pick a book for summer reading, but he couldn't decide which one he should choose. So he picked five books and asked ten of his current students to choose a book among these. They could only select one book. Based on their selections, he would choose the book for summer reading for the incoming class. The five book choices were Holes, Fantastic Mr. Fox, The Golden Compass, A Wrinkle in Time, and Little Women. The teacher worried that the selections would be evenly distributed among the books. But that's not what happened. After the students made their selections, he found out that four chose Fantastic Mr. Fox, three chose Holes, and three chose Little Women. Surprisingly, no one chose The Golden Compass or A Wrinkle in Time.

More than two students selected [three/more than two] (of the) books.

Test–SURFACE FALSE, INVERSE TRUE

In art class, the students were assigned to do projects for the school fundraiser. Each student was assigned six items to complete. Mary was assigned little wooden birdhouses, which she had to paint. John had to paint six toy boats. John was a diligent worker. He painted two boats before lunch, and two after lunch, leaving only two to paint the next day. He knew Mary was a slow painter and wondered how many she would leave for tomorrow. He suspected it would be more than he had. In the morning, Mary painted two birdhouses. But after lunch, she was tired and sluggish, and only got around to painting one more by the end of the day. She had to leave the rest for the next day.

Mary didn't paint [three/more than two] (of the) birdhouses.

Test– SURFACE FALSE, INVERSE TRUE

Sarah's and Kate's daughters were on the same dance team. The dance team was going to travel to a competition in California, so the moms decided to hold a bake sale to raise money for the trip. They each choose six different cake recipes to bake, and thought it was best to try them out first and make sure they were ready to sell. Each mom went to work baking and tasting her six cakes. Sarah was a pro. She baked four cakes in one day, tasted them, and thought they were very good. She baked her last two, tasted them, and congratulated herself with her success. Meanwhile, Kate was working in her kitchen. She had to admit that it had been a long time since she had baked cakes, so she proceeded more cautiously. She chose the first cake recipe, baked the cake, tasted it, and thought it was all right. She continued to the second cake. She baked it, tasted it, and decided that it was okay, too, but not great. Worried about the time this was taking, she decided to work more quickly, hoping she could do more. She chose a third recipe. But this time she forgot the eggs. When she tasted the cake, she was discovered it was terrible. Kate was really disappointed with herself and gave up baking for the day, leaving the rest of the cakes for

tomorrow.

Kate didn't taste [three/more than two] (of the) cakes

Test – SURFACE FALSE, INVERSE TRUE

A convention for NY Times Bestsellers was being held in Gary, Indiana. Many VIPs were expected to come and stay in the city during the convention, so Officer Hendricks, Officer Wilson, and Office Murray were assigned as guards to two hotels where the VIPs were staying. They were told to be at their posts in front of their assigned hotels at 9 am sharp. Initially, all of the VIPs were expected to stay at only two hotels, since the city didn't want to pay the fees for more locations. So Officer Hendricks and Officer Wilson were assigned to the Marriott, and Office Murray was assigned to the Hyatt Regency. However, at the last minute, more VIPs decided to come, so a hasty arrangement was made to have some guests stay at the Embassy Suites hotel. The city officials knew that using more than two hotels would mean more fees, but they didn't care; this convention was going to bring in a lot of much-needed revenue for the city. Officer Wilson was instructed to proceed to the Embassy Suites. At 9 am, each guard was standing at his post.

A guard was posted in front of [three/more than two] (of the) hotels.

Test – SURFACE FALSE, INVERSE TRUE

Emily was planning a dinner for her parents' 50th anniversary at a nearby restaurant. The staff set aside the back dining room for the event. She had asked them to place a centerpiece on each of the five tables in the room. The day of the event, Emily went to see how things were coming along. She was hoping that she could see at least a couple of

the centerpieces in place. She was pleasantly surprised with what she saw. The staff were busy at work, and had already put a beautiful vase of roses on not one, not two, but three tables! And it looked like they were planning on setting out more shortly. This was going to be a wonderful anniversary dinner.

A vase of roses graced [three/more than two] (of the) tables.

Control – SURFACE FALSE, INVERSE TRUE

The students in a film class were compiling information about previous winners at the Oscars, and were specifically interested in how successful African Americans had been in acting roles. They started naming the major categories of Oscar awards for acting and the African Americans they knew had won the awards. One student remembered that Denzel Washington had been nominated for five or six awards, but knew he had only won two (Best Actor and Best Supporting Actor). Another student mentioned that Jamie Foxx and Forest Whitaker had also won Best Actor. As for the women, a third student remembered that Halle Berry had won Best Actress, and that Jennifer Hudson had won Best Supporting Actress for her work in Dreamgirls.

An African American won every major Oscar for acting.

Control – SURFACE TRUE, INVERSE TRUE

A group of teenage girls wanted to start their own band. They'd never been in a band before, but they had some musical expertise. Each of them needed to pick their instrument. They thought they'd start with a guitar, a bass, and drums. Annie had the most experience with these instruments. She played the drums for a little, then switched over to the guitar.

She was tempted to stick with the guitar, but when she tried out the bass, she thought she'd stick with that instrument. Jessica went next. She knew she loved the drums, so she sat right down and started playing them. Hillary was last, but that was okay with her, since she loved the guitar. She picked it up and started playing it right away. They had a band! Now all they had to do was pick a name.

A girl played every instrument.

Control – SURFACE TRUE, INVERSE FALSE

The Middle School teachers are hosting a big Career Day for their students. Each of the three teachers has to invite a guest to speak about his or her career. Ms. Granger thought about her choice, and decided to invite Dr. Greg Hammond, who is a pediatrician. Ms. Bailey had also wanted to invite him, but she instead invited Collette Phillips, who is a graphic designer. Ms. Allen had also considered Dr. Hammond, and then thought about Bob Montgomery, who owns his own organic café and has a farmer's market stand in the summer. She ended up inviting him. The middle school students were going to have an excellent group of Career Day speakers.

Every teacher invited a guest.

Control – SURFACE TRUE, INVERSE FALSE

The local petting zoo has three new animals and they're allowing the public to visit and feed them. There is a goat, and two sheep. This morning, a kindergarten class is visiting the zoo. Little Timmy is happy to see the animals, but he is also very shy. He approaches the goat with an apple. The goat gobbles it right up, startling Timmy. He is uncertain

about whether or not he wants to feed any more animals. But the zookeeper hands Timmy a handful of feed and encourages him to approach one of the sheep. Timmy holds out his hand to the sheep, and the sheep gobbles up the feed, licking Timmy's hand. Timmy decides he has had enough, and it is time to go wash his hands! He doesn't feed the second sheep.

Timmy didn't feed three animals.

Control – SURFACE TRUE, INVERSE TRUE

The children in Mr. Wilson's class were going to decorate some boxes to deliver their valentines. There were five boxes to decorate. Mr. Wilson didn't anticipate that any boys would be eager to decorate the boxes. He thought a boy would decorate one or two at most— and do it reluctantly. Little did he know that Michael had been looking forward to this all month, and had come to school equipped with stickers, ribbons, and bows! When it was time to decorate, Michael eagerly volunteered to decorate. He set to work on one box, and covered it with bows and stickers. He then turned to a second box and did the same. Just when Mr. Wilson thought he was done, Michael volunteered to do one more box, and went all out, covering it with bows, stickers, glitter, and sequins. Michael was very pleased with his work, and challenged a girl to do just as well with the remaining two boxes. This was going to be a great Valentine's Day!

A boy decorated three/more than two (of the) boxes.

Filler

The school choir is getting ready to perform their songs at the annual Winter Wonderland Holiday concert. Julie is very picky about Christmas songs and only likes to sing "Joy to the World," "Silver Bells," and "Carol of the Bells." But she knows that she will have to sing whatever song the choirmaster selects. When Julie finally sees the list of songs the choirmaster has selected, she is thrilled that her three favorite songs are among those selected. At the concert, she sings her heart out to each and every song. Happy holidays!

Julie$_i$ sang every song she$_i$ wanted to.

Filler

Katy and her friend Faith were out shopping, and discovered a sale on dresses. They were so excited! They both picked out three dresses that they each wanted to try on, and handed these to the clerk to set up dressing rooms for them. Each girl had a very different style, and it was clear from the dresses they chose: Faith's choices were subtle and demure, while Katy's were vibrant and bold. Faith went into her dressing room and tried on the three dresses she picked out. After much consideration, she decided on one she really liked. In another dressing room, Katy tried out the three dresses she had selected, and found one that fit perfectly. Faith walked away with a great little black dress, and Katy got a stunning red dress. Now all they needed was a place to wear them!

She$_i$ tried on every dress that Katy$_{*i/k}$ wanted to.

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