DISTRIBUTIVITY AND THE JAPANESE FLOATING NUMERAL QUANTIFIER

by

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ABSTRACT

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by

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This dissertation proposes a semantic analysis of Japanese numeral quantifiers that contain classifiers such as *nin* and *hon* within the framework of generative grammar and generalized quantifier theory. The focus of the investigation is the observation that the Japanese sentence with a floating numeral quantifier generally only gives rise to a distributive reading, while that with a DP-internal numeral quantifier may be interpreted nondistributively as well as distributively.

The numeral quantifier is an expression consisting of a numeral and a classifier and occurs either in a DP-internal position or in a floating position. On the basis of the observation that the classifier is semantically significant, it is proposed that the classifier functions as a restrictive domain of quantification for the numeral. However, syntactically the DP-internal numeral quantifier and the floating numeral quantifier differ in that the former combines with an NP, while the latter combines with a predicate. Accordingly, it is proposed that in DP-internal numeral quantification, the nuclear scope of the numeral is the NP, while in the case of floating numeral quantification it is the predicate. Under this analysis, the Japanese classifier denotes a set of only atomic individuals, a logical

requirement for it to function as the restrictive domain of quantification for the numeral. These atoms may be either individual objects or individual events, as determined by the lexical specification of each classifier.

In the case of floating numeral quantification, an obligatory distributive reading follows directly from the numeral quantifier's immediate composition with the predicate, given the denotation of the classifier. In the DP-internal numeral quantification, the ambiguity follows from the fact that a plural term is generated, in which case the mechanisms yielding collective and cover readings are always optionally applicable. These mechanisms are restricted to the nominal domain, however, and therefore cannot apply in the case of floating numeral quantification.

The proposed semantic analysis offers a unified account of Japanese DP-internal and floating numeral quantification, both with classifiers that denote sets of atomic objects and classifiers that denote sets of atomic events.

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CONTENTS

CHAPTER 1

INTRODUCTION

This thesis investigates the semantics of the Japanese numeral quantifier (NQ), the quantificational expression that contains a numeral. In particular, it focuses on the kind of NQ that consists of a numeral and what is usually called a 'numeral classifier', e.g. *san-nin* '3-CL', as opposed to NQs containing a unit of measure classifier like *guramu* 'gram'. Syntactically, an NQ containing a numeral classifier can appear both in the nominal domain and in the verbal domain. In the latter case, it is typically regarded as a kind of floating quantifier (FQ). A central concern of this thesis is a peculiar asymmetry that is observed in the interpretation of Japanese sentences containing numeral classifier NQs. When such an NQ occurs as an FQ, the sentence is virtually always assigned a distributive interpretation. In contrast, when an NQ containing a numeral classifier occurs in the nominal domain, the sentence can readily have nondistributive as well as distributive interpretations. The principal aim of this thesis is to provide a formal explanation of this asymmetry.

In what follows in this chapter, we describe the Japanese floating numeral classifier NQ, briefly review the relevant literature on floating quantifiers, introduce the focus of the thesis, and, finally, describe the organization of the thesis.

1.1. The Japanese Floating Numeral Quantifier

Certain quantifiers, such as English *all* and *each*, exhibit what is called 'quantifier-float' (Q-float).[1] This phenomenon is illustrated in (1) through (3):

(1)a. [**All** the boys] ate ice cream.

b. The boys **all** ate ice cream.

(2)a. [**Each** boy] took two cards.

b. The boys **each** took two cards.

(3)a. [**Both** boys] left.

b. The boys **both** left.

In (1a), (2a), and (3a) the quantifiers *all*, *each*, and *both* are inside DPs and are construed with the nominal expressions in construction with them, namely *the boys* and *boy*.[2] In (1b), (2b), and (3b) these same quantifiers do not appear inside the DP, but rather occupy a

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[1] Throughout this thesis we use the term 'quantifier'(Q) to refer to a single word that has quantificational force. We will not use it to refer to a multi-word syntactic constituent such as a DP or QP (cf. Barwise and Cooper 1981). However, when discussing the internal components of the Japanese NQ we will also use the term 'quantifier' to refer to just the numeral.

[2] In the context (2a) and (3a), *each* and *both* can readily be identified as determiners. *All* in (1a) cooccurs with the determiner *the*, thus it must be distinct from the determiner element. Nonetheless, even as a so-called 'predeterminer', *all* is clearly part of the nominal constituent, as seen by movement tests (*All the boys were seen.* vs. **The boys were seen all.*) We will discuss the status of these quantifiers in chapter 7.

preverbal position, as if they were adverbs, and yet they are still construed with a nominal expression, namely *the boys* in all cases. Such quantifiers which do not appear to be contained in a DP are called floating quantifiers. For descriptive purposes, we will call the former type of quantifiers 'DP-internal quantifiers' (DQ). In addition, let us adopt Hasegawa's (1991) term 'host NP' to refer to the nominal expression construed with a quantifier, whether this is a DQ or an FQ.

Q-float is also observed in Japanese with the quantificational expressions equivalent to English *all*, *each*, and *both*, as shown below:

(4)a. **subete**-no otokonoko-ga aisukuriimu-o tabeta.
all-GEN boy-NOM ice cream-ACC ate

b. otokonoko-ga, **subete** aisukuriimu-o tabeta.
boy-NOM all ice cream-ACC ate

'All the boys ate ice cream.'

(5)a. **sorezore**-no otokonoko-ga aisukuriimu-o tabeta.
each-GEN boy-NOM ice cream-ACC ate

b. otokonoko-ga, **sorezore** aisukuriimu-o tabeta.
boy-NOM each ice cream-ACC ate

'Each boy ate ice cream.'

(6)a. **ryoohoo**-no otokonoko-ga aisukuriimu-o tabeta.
both-GEN boy-NOM ice cream-ACC ate

b. otokonoko-ga, **ryoohoo** aisukuriimu-o tabeta.
boy-NOM both ice cream-ACC ate

'Both boys ate ice cream.'

In (4a), (5a), and (6a), the NQ is followed by the postposition *no*. Since *no* normally combines two nominal expressions, the NQ in these sentences can be considered to be syntactically connected to the host NP.[3] In contrast, the NQ in (4b), (5b) and (6b) takes the preverbal position by itself.

In a language such as English, Q-float is limited to a small number of particular quantifiers, typically *all*, *each*, and *both*.[4] Other quantifiers construed with an NP may only appear as DQs (e.g. *many*, *most*, *some*, *no*, etc.). The kind of quantificational expression that typically occurs in a preverbal position is, rather, the adverb of quantification, e.g. words such as *always* and *sometimes*. Such quantifiers directly modify the predicate and are usually not construed with an NP.[5] [6] Thus, in a language like English, there is a general distributional distinction between quantifiers that are construed with an NP, which appear inside a DP, and quantifiers that are not construed with an NP, which occur in adverbial positions. The few FQs that exist are the noteworthy exceptions to this general rule. In Japanese, in contrast, a great many quantifiers besides those shown above can appear both

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[3] The form [Q-*no*] is only one form of the DQ. In chapter 3, we discuss some other forms of the Japanese DQ.

[4] These are all universal quantifiers. However, certainly not all universal quantifiers are associated with Q-float. For example, *every* does not float anywhere but must stay put in the prenominal position. We address the question as to why Q-float is limited to certain quantifiers in English in chapter 7.

[5] This is too simple a description. In certain contexts, an adverb of quantification can have about the same meaning as a DQ. For example, *A waitress always expects some tip* can have essentially the same truth conditions as *Every waitress expects some tip*. We will not discuss such matters in this thesis.

[6] We should note that in addition there are a few quantificational expressions which directly follow the NPs they modify. For example, in English, the so-called 'binominal' *each* (Safir and Stowell, 1987) can even occur in the position directly following a direct object, e.g. *The men saw two women each*, and numeral quantifiers and *all* can occur directly after pronouns, e.g. *we three got together*, and *I liked them all*. We will not discuss these special constructions in this thesis.

as a DQ and an FQ. This is illustrated in (7), where the quantifiers that can appear both ways are marked with a plus sign. The underlined part of each entry can appear as an FQ. (7) is not an exhaustive list of English quantifiers or corresponding Japanese quantifiers, and the semantic correspondence between English and Japanese is only approximate. However, it gives one a good idea of the significant difference between the two languages as regards Q-float.

(7) Some English and Japanese quantifiers and their floatability

ENGLISH		JAPANESE	
the/that N		*sono* N	
all N *every* N *each* N	+ +	*subete-no* N *zenbu-no* N *zen'in-no* N *dono* N-*mo*[7] *sorezore-no* N	+ + + + +
both N	+	*ryoohoo-no* N *dochira-no* N-*mo*	+ +
most N		*hotondo-no* N	+
some N		*iku-tsu-ka-no* N *nan-nin-ka-no* N	+ +
many N *a lot of* N[8] *relatively many* N		*takusan-no* N *ooku-no* N *nan-nin-mo-no* N *kanari-no* N	+ + + +
a little N		*sukoshi-no* N *shooshoo-no* N	+ +
no N		*dono*-N-*mo* (...NEG)	+
three N *at least two* N *at most two* N		3-CL-*no* *sukunaku-tomo* 2-CL -*no* N *ooku-tomo* 2-CL-*no* N (*shika*)(..NEG)	+ + +

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[7] E.g.:
paatii-ni kita-hito-ga [**dono-hito-mo** kaisha-no shachoo-da-tta].
party-to came-person-NOM which-person-Q company-GEN president-COP-PAST
'Every person who came to the party was a company president.'

[8] This could appear as an adverbial element as follows:
(i) John slept a lot.
However, *a lot* in the nominal domain and in the verbal domain are distinct (cf. Doetjes 1997). For example, consider the following contrast:
(ii) John goes to a lot of movies.
(iii) John goes to the movies a lot.
In (ii) *a lot* clearly quantifies over the noun *movies*. In contrast, in (iii) it is an adverb of quantification quantifying over the predicate and is equivalent to *a lot of times*.

As can be seen in (7), virtually all Japanese quantifiers may appear both as a DQ and as an FQ. Q-float is not an exception but rather a general phenomenon in Japanese.

In addition, some Japanese quantifiers occur as FQs but not as DQs. For example, the universal quantifier *minna* 'all' cannot occur as a DQ of the form [Q no NP]:[9]

(8)a. ***minna**-no gakusei-ga kyoo shomeishita.
all-GEN student-NOM today signed

b. gakusei-ga kyoo, **minna** shomeishita.
student-NOM today all signed

'The students all gave a signature today.'

Such 'anti-prenominal' quantifiers are also occasionally found in English-like languages. For example, when it means 'all' and quantifies exhaustively over objects, Dutch *allemaal* can only occur in an adverbial position, as in (9a); it cannot occur in a predeterminer position, as shown in (9b). When *allemaal* occurs in a prenominal position, as in (9c), it means 'a lot of' rather than 'all':[10]

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[9] *Minna* can in principle occur inside a DP, however, as in the following sentences:
(i) [gakusei minna]-ga shomeishita.
student all-NOM signed
'All students signed.'
(ii) [gakusei-no minna]-ga shomeishita.
student-GEN all-NOM signed
'All of the students signed.'
(iii) [minna]-ga shomeishita.
everyone-NOM signed
'Everyone signed.'

[10] In so far as *allemaal* can occur as a DQ, it can only have the weak quantificational 'a lot of' meaning (M. den Dikken, p.c.) This secondary reading is isolated in *there*-sentences such as (i), where the usual strong quantificational 'all' meaning of *allemaal* cannot possibly be assigned (cf. **There are all students in the room.* vs. *There are a lot of students in the room.*) Here *allemaal* clearly forms a constituent with the following nominal (E. Ruys, p.c.):

(9)a De studenten hebben **allemaal** getekend.
the students have all signed

'The students have all signed.'

b. ***Allemaal** de studenten hebben getekend.
all the students have signed

c. **Allemaal** studenten hebben getekend.
all students have signed

'*A lot of* students have signed.' (but not '*All* the students have signed.')

Although the cross-linguistic comparisons in (7), (8), and (9) raise a number of interesting questions, in this thesis we will focus our attention on just one kind of Japanese quantifier that undergoes Q-float. This is the Japanese NQ with a numeral classifier.

To refer to a specific number of objects in English, one produces a nominal expression in which an NP is directly preceded by a numeral, as in *three boys* or *three little boys*. In contrast, in Japanese a numeral cannot be directly combined with an NP in the manner observed in English. For example, the numeral *san* 'three' cannot be combined with the noun *otokonoko* 'boy' to yield **san otokonoko* 'three boy', nor can it be combined with the noun phrase *chiisai otokonoko* 'little boy' to yield **san chiisai otokonoko* 'three little boy'. A numeral such as *san* 'three' cannot stand by itself but rather must be morphologically combined with a 'classifier' (CL), which appears to express a certain unit of measure for the objects or quantity whose number is specified. Moreover, when the

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(i) Er hebben [allemaal studenten] getekend.
there have all/a lot students signed
'A lot of students have signed.'

Since Japanese *minna* does not have a secondary 'a lot of' reading, (8a) is simply ungrammatical.

numeral is interpreted as quantifying over individuals (rather than quantities of substance), it generally must combine morphologically with a 'numeral classifier', a classifier which appears to refer to a kind of individual. For example, to count human beings the numeral classifier *nin* must be used. Thus, 'three boys' is typically expressed as ***san-nin-no*** *otokonoko* '3-CL-GEN boy' and 'three little boys' as ***san-nin****-no chiisai otokonoko* '3-CL-GEN little boy'.[11] The numeral and the classifier are regularly combined as the form [Num-CL]. This is the expression we label NQ. The classifier exists in English as well, as in *three* ***glasses*** *of water* and *three* ***boxes*** *of apples*. However, the English classifier is not obligatorily used when a count noun refers to a set of objects. Thus, while in English the presence of a classifier appears to be obligatory only in certain contexts, in the Japanese a classifier must always be present when a numeral is used.

In English, the numeral is never subject to Q-float (cf. **The boys three left*). In contrast, the Japanese NQ is readily subject to Q-float, as illustrated in (10):

(10)a. **san-nin-**no otokonoko-ga sakki kono mise-de aisukuriimu-o katta.
3-CL-GEN boy-NOM earlier this store-at ice cream-ACC bought

'Three boys bought some ice cream earlier in this store.'

b. otokonoko-ga sakki kono mise-de, **san-nin** aisukuriimu-o katta.
boy-NOM earlier this store-at 3-CL ice cream-ACC bought

'Three boys bought some ice cream earlier in this store.'

In (10a), the NQ *san-nin* '3-CL' directly combines with the genitive case marker *no*, and this unit further composes with the noun *otokonoko* 'boy' to form the nominal constituent. In (10b), the NQ is in a pre-VP position, as if it were an adverb, though it is construed with the

[11] As we indicated in (7), the NQ needs *no* (genitive) to modify the NP.

subject NP *otokonoko* 'boy'. Thus, this NQ behaves in the same way as the English FQ. The main topic of this thesis is the semantics of the Japanese floating NQ sentence exemplified in (10b), as contrasted with that of the DP-internal NQ sentence exemplified in (10a). Henceforth we will use the acronym 'FNQ' to stand for floating NQ and 'DNQ' to stand for DP-internal NQ.

1.2. Major Issues and Overview of the Literature

The Japanese sentence with an FNQ exhibits various interesting properties and has been much discussed in the syntactic literature (e.g. Okutsu 1969, 1996, Harada 1976, Kuno 1978, Shibatani 1978, Kitagawa 1980, Haig 1980, Inoue 1978, Kamio 1983, Takano 1984, 1986, Ueda 1986, Miyagawa 1989, Terada 1990, Yatabe 1990, Kitahara 1992a, b, Kawashima 1994, Fujita 1994). As Fukushima (1991) notes, the major syntactic issues concerning the Japanese FNQ are the following:

I. Accounting for its distribution

II Explaining the relationship between the FNQ and its host NP

These two issues are distinct but they are related to each other and often are discussed together.

The first issue, i.e. the proper treatment of word order facts, has attracted a great deal of attention since FNQs which are construed with the subject do not have the same distribution as FNQs which are construed with an object. The matter is further complicated by the existence of host NPs that are neither the subject nor the direct object, some of which allow an FNQ while others do not.

Accounting for the distributional facts naturally leads to the second issue, namely, identifying the relationship between the FNQ and its host NP. This has been examined in relation to two different basic hypotheses about the generation of the FNQ construction, i.e. the transformational approach and the base-generation approach. The transformational approach adopts the view that the FNQ is transformationally related to a DNQ. In contrast, the base-generation approach proposes that the Japanese FNQ is base-generated as an adverb and is independent of any DNQ. The former approach became extremely popular after Sportiche (1988) proposed a particular syntactic theory which treated the FQ construction as a derived form of the DQ construction (the stranding theory). In this theory, the host NP undergoes syntactic movement out of a DQ (rather than the Q moving out, as in previous transformational theories of Q-float, e.g. Kayne 1969; 1975, Dougherty 1970). Under the influence of Sportiche's theory, the view that the quantifier itself undergoes syntactic movement seems to have vanished, while some Japanese linguists adopt versions of the stranding theory. On the other hand, others maintain a base-generation approach. Furthermore, apart from the attention of these two contrasting approaches, the relationship between the FNQ and its host NP has been discussed in relation to various syntactic factors such as surface case, argument relations, the predication relation, rank of the host NP in a theta-hierarchy, and the relation between a predicate modifier and an argument. In addition, some linguists argue that functional and pragmatic factors explain the grammaticality and ungrammaticality of Japanese sentences with an FNQ.[12]

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[12] E.g. Ooki 1987, Naito 1993, 1995, Iwahata 1994, Hamano 1997, Takami 1998.

In the semantics literature, Q-float in languages other than Japanese has also been much discussed (e.g. Dowty and Brodie 1984, Link 1987, Roberts 1986, Junker 1990, Hoeksema 1996). The major semantic issues are the followings:

I. The proper treatment of quantification

II. The mechanism that yields a distributive reading

As regards the first issue, the floating quantifier is by and large treated as a VP-quantifier by semanticists, i.e. as an operator which directly operates on the VP. As regards the second issue, the floating quantifier is often analyzed as a distributivity operator.

With the notable exception of Fukushima (1991), McClure (1999) and (2002a,b), there appears to be no research of the Japanese FNQ from a formal semantic perspective. Fukushima (1991), McClure (1999) and Nakanishi (2002a,b) argue that the Japanese FNQ should be analyzed as a VP-quantifier (adverbs). There are some other linguists who discuss the Japanese FNQ in relation to semantic notions such as specificity (Kitahara 1992a), presuppositionality (Kawashima and Kitahara 1993), distributivity (Kitagawa and Kuroda 1992, Kato 1997, Sasaki Alam 1997, Ishii 1998), and aspectuality (Mihara 1998). However, the discussion of these semantic notions is rather informal.

In sum, Japanese Q-float phenomena have been much studied, but predominantly from a syntactic point of view. In particular, as regards the Japanese NQ, there is a need for a better understanding of the semantics of the FNQ and the DNQ and of the relationship between syntax and semantics in NQ quantification over individuals.

1.3. Focus of the Thesis

In this thesis, we will be focusing on the use of Japanese DNQs and FNQs to count individuals, i.e. NQs containing numeral classifiers. We will call such NQs 'quantificational' when distinguishing them from other kinds of NQs. We will be primarily concerned with a semantic issue that arises in connection with the Japanese quantificational FNQ, namely its special relation to distributivity. Consider the following contrast in Japanese:

(11)a. **futa-tsu**-no **suiso-genshi**-ga kono ondo-de
2-CL-GEN hydrogen atom-NOM this temperature-at

hito-tsu-no suiso-bunshi-o tsukuru.
1-CL-GEN hydrogen molecule-ACC form

'Two hydrogen atoms form a hydrogen molecule at this temperature.'

b. * **suiso-genshi**-ga kono ondo-de,
hydrogen-atom-NOM this temperature-at

futa-tsu hito-tsu-no suiso-bunshi-o tsukuru.
2-CL 1-CL-GEN hydrogen-molecule-ACC form

(intended) 'Two hydrogen atoms form a hydrogen molecule at this temperature.'

In (11a), the NQ *futa-tsu* '2-CL' is a DNQ. The sentence is well-formed and has the interpretation that a set of two hydrogen atoms forms a single hydrogen molecule. This is an example of what we will be calling a 'collective reading' since no single hydrogen atom can form a hydrogen molecule. Now, the same proposition cannot be expressed with (11b), which has an FNQ rather than a DNQ. (11b) can only be interpreted as asserting that two hydrogen atoms each forms a hydrogen molecule. This is a distributive reading and it describes an impossible state of affairs, given our knowledge of the world. Thus, the sentence is ill-formed. What we observe here is that a collective reading is not available for the FNQ sentence in (11b). As we will show with a number of other data, this meaning restriction, which we will call the 'distributivity phenomenon', is a general semantic property of the quantificational FNQ sentence. While quantificational DNQ sentences can have either a distributive or a collective reading, a quantificational FNQ sentence normally can only have a distributive reading.

The FNQ in Japanese is syntactically distinct from the FQ in English-like languages in two respects: (i) The FQ contains a numeral and (ii) the FQ contains a classifier. The central objective of this thesis, then, is to provide a comprehensive account of the semantics of the Japanese quantificational FNQ that covers these two core facts while simultaneously explaining the distributivity phenomenon.

1.4. Organization of the Thesis

The thesis is organized as follows: Chapter 2 is devoted to establishing the fact that the Japanese quantificational FNQ sentence normally requires the assignment of a distributive reading. This is a comprehensive, theory-neutral, description of the facts and constitutes the empirical grounds for the analysis that will eventually be proposed.

In chapter 3, we discuss the syntactic assumptions we adopt in this thesis. This includes some preliminary discussion of the classifier and the NQ construction in Japanese, an investigation of the syntactic distinction between the DNQ and the FNQ, and a syntactic analysis of the Japanese FNQ construction.

Chapter 4 is devoted to the semantic assumptions that we will be making in this study. Here we discuss the denotation of nouns, the different interpretations of sentences containing a plural term, and the formal description of such interpretations in relation to the denotation of plural terms.

Chapter 5 and 6 are the main chapters of this thesis. Here we present our semantic analysis of the Japanese quantificational NQ. In chapter 5, we examine the quantificational FNQ. This begins with a review of the relevant literature. We show that previous assumptions regarding the basic components of FQ quantification lead to empirical problems. We propose an alternative analysis of FNQ quantification in which the quantifier is the numeral, its first argument is the classifier, and its second argument is the predicate. The assignment of a distributive reading to the quantificational FNQ sentence falls out as a natural consequence under this analysis. We also discuss here our account of FNQs that contain what we call the 'event classifier', which is a unit of measure for events. This is contrasted with ordinary NQs which have an 'object classifier'.

In chapter 6, we turn our attention to the Japanese DP-internal NQ. Given that its syntax is different from that of the FNQ, its way of participating in the compositional assignment of meaning to a sentence is seen to differ from the way the FNQ participates in semantic interpretation, though both the FNQ and the DNQ are analyzed as having the same basic lexical meaning. Specifically, in the case of a DNQ, while the first argument of the quantifier is still the classifier, its second argument is the host NP, rather than the predicate. In accordance with our semantic assumptions of chapter 4, the interpretation ambiguity of the DNQ sentence is accounted for on a par with the ambiguity of any sentence containing a plural term, as occurs also in English.

In chapter 7, we conclude with a summary of the thesis and a brief discussion of how our analysis can be extended to cover numeral quantification in other languages, such as English.

CHAPTER 2

THE JAPANESE FNQ AND ITS DISTRIBUTIVE READING

That the Japanese FNQ bears a special relationship to the distributive reading has occasionally been mentioned in the literature (Terada 1990, Kitagawa and Kuroda 1992, Kato 1997, Sasaki Alam 1997, Ishii 1998). However, in most cases the discussion remains informal and brief, sometimes without a clear definition of the term 'distributive reading', though it may include some example sentences. Since attention to distributivity in association with the FQ forms a substantial part of the research on the semantics of the FQ in other languages such as English and French (e.g. Roberts 1986, Link 1983, 1987, Junker 1990, Hoeksema 1996, among others), the need for a systematic investigation of this aspect of the Japanese FNQ is long overdue.

This chapter provides the starting point for our semantic investigation of Japanese quantificational FNQs, FNQs containing standard numeral classifiers such as *-nin* and *-hon.*[13]

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[13] Japanese NQs can be sub-divided into several different types on the basis of classifier they contain. The sub-divisions would include at least the followings:
(i) Numeral + Numeral Classifier e.g. *nin*, *kumi*, *kai*, etc.
(ii) Numeral + Standard Measuring Unit e.g. *rittoru* 'liter', *guramu* 'gram', *do* '°C/°F', etc.
(iii) Numeral + Monetary Unit e.g. *en* 'yen', *doru* 'dollar', *yuuro* 'euro', etc.
(iv) Numeral + Time Interval e.g. *byoo* 'second', *jikan* 'hour', *nen* 'year', etc.

It presents a collection of data which show that such FNQs are predominantly associated with a distributive reading.

Let us first define the terms 'distributive reading' and 'collective reading'. We will assume a traditional, object-based, definition of distributivity (e.g. Bennett 1974). The term 'distributive reading' will refer to a reading in which the entire property denoted by a predicate applies fully to each individual member of a set of relevant objects. For example, consider the sentence *Three students wrote a paper.* The distributive reading of this sentence is the reading under which three students individually have the property of having entirely written a paper. That is, the reading that entails that each of three students wrote a different paper.[14] In contrast, the 'collective reading' is the reading under which only a group of individuals has the property denoted by the predicate and none of the members of this group alone has this property. Thus, with the same example sentence above, a collective reading is such that the group of three students has the property of having written a paper and none of the members of this group alone has this property. That is, each student participated in the writing of a paper but not that each wrote a different paper. Suppose j, b, and t represents

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The standard measuring unit (ii), the monetary unit (iii), and the time interval (iv) are classifiers that usually do not combine with a numeral to form an NQ that quantifies over individuals. Rather, they typically compose with a numeral to form a component of an amount term in the sense of Parsons (1970). This involves quantification over quantities of a substance, where the classifier denotes a measure function (Krifka 1990) and the numeral specifies a point on a scale. We will not examine this kind of quantification in Japanese in depth in this thesis, though we briefly discuss it below in section 2.2.

[14] For purely expository purposes, we will generally abstract away from the "at most N" and the "at least N"-readings of numerals and discuss Japanese NQs as if they only had the "exactly N" -reading. The intrinsic ambiguity or vagueness here has no bearing on whether an NQ is interpreted distributively or collectively.

three students John, Bill, and Tom, respectively, and WROTE-A-PAPER represents the property denoted by the predicate, then the difference could be expressed somewhat more formally as shown in (1b) and (1c):[15]

(1)a. Three students wrote a paper.

b. Distributive: $j \in$ WROTE-A-PAPER $\wedge$ $b \in$ WROTE-A-PAPER $\wedge$ $t \in$ WROTE-A-PAPER

c. Collective: $(j \wedge b \wedge t)_{group} \in$ WROTE-A-PAPER

Under the collective reading, the predication relation does not distribute over the three students. It is a relation between the predicate and a single agent that is a group of three students. Because of this, the collective and distributive readings have distinct entailments. Consider the semantic relation between the a and b sentences in (2) and (3):

(2)a. A group of men carried the piano upstairs. (collective)

b. A man carried the piano upstairs alone.

(3)a. The principal awarded a class of 8^{th} graders the first prize for team spirit. (collective)

b. The principal awarded the first prize to an 8^{th} grader.

Every group of men contains a man and every class of 8^{th} graders contain an 8^{th} grader, yet (2a) does not entail (2b) and (3a) does not entail (3b). This is because the terms *group* and *class* license collective readings.[16] When (2a) and (3a) are true under a collective reading,

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[15] The exact formalization of distributive and collective interpretations will be discussed in chapter 4.

[16] Although a collective reading appears to be strongly preferred for (2a) and (3a), some native speakers we have consulted claim that these sentences in principle allow a distributive reading as well. This does not affect our point. It is simply the availability of the collective reading that invalidates the two entailments.

(2b) and (3b) are false. Next, consider the semantic relationships between the sets of sentences in (4) and (5):

(4)a. Three students walked. (distributive.)

b. A student walked.

c. #Three students walked as a group but no individual student walked.

(5)a. John bought three books. (distr.)

b. John bought a book.

c. #John bought a set of three books but he bought no individual book.

Here we find that (4a) does entail (4b) and (5a) does entail (5b). If it is true that three students walked, it must be true that each one walked. Thus, (4c) is ill-formed because it is self-contradictory. Likewise, if John bought three individual books he must have bought a book; (5c) is self-contradictory. The fact that the entailments hold in (4a-b) and (5a-b) shows that predicate *walk* does not allow a collective reading with regard to its subject and that the predicate *buy* does not allow a collective reading with respect to its object. Of course, this is not to say that (4a) would be false of a single event of three students walking together, nor that the first sentence of (5a) would be false of a single event of John simultaneously buying three books. Such 'single-event verifications' of the distributive reading of a sentence are in principle possible.[17] They should not be confused with a true collective reading, though.

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[17] Kitagawa and Kuroda (1992) and Ishii (1998) describe 'distributive reading' in terms of reference to events. According to these authors, the distributive construal necessarily implies the occurrence of multiple events while the non-distributive construal implies the occurrence of only a single event. Kitagawa and Kuroda's data to illustrate this distinction are the following:

According to the distinction between distributive and collective readings that we will be using throughout this thesis, entailment relations such as in (4) and (5) are a diagnostic of the distributive reading. In this regard, consider also the entailments in (6) and (7):

(6)a. Three students walked together.

b. A student walked.

(7)a. John bought three books all at once.

b. John bought a book.

(6a) and (7a) are minimally different from (4a) and (5b) in that *together* and *all at once* are added, respectively. *Together* in (6a) implies that the walking of three students occurred at the same time and place, and *all at once* in (7a) implies that John's buying of three books occurred as a single event. Thus, in an intuitive sense, three students and three books form groups in (6a) and (7a). However, the entailment test shows that the perception of a group here does not amount to the assignment of a collective reading. Even if the walking of the three students occurred at the same time and place, the sentence still entails that each student

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(i) Distributive

kono isshuukan-no aidani shuujin-ga **san-nin** nigedashita.
this one week-GEN during prisoner-NOM 3-CL escaped
'There have been three jailbreaks this week.'

(ii) Non-distributive

sonotoki totsuzen shuujin-ga **san-nin** abaredashita.
then suddenly prisoner-NOM 3-CL started to act violently
'Then, a group of three prisoners suddenly started acting violently.'

According to Kitagawa and Kuroda's description of distributivity, (i) is distributive, while (ii) is non-distributive, since in the interpretation of (ii) there is just a single event (occasion) of violent behavior by three prisoners. Under our definition of the term, (ii) is still distributive since 'started to act violently' applies to each prisoner, even if the actions of the three prisoners occur suddenly and at the same time. In chapter 5,we will also adopt an event semantic analysis, but only for a subclass of FNQs, namely those whose classifiers are lexically event-oriented.

walked, and even if John bought three books in a single act, the sentence still entails that each book is bought by John. In sum, in this chapter and throughout the thesis the reader should bear in mind that the notion of acting together as a group is a necessary but not a sufficient condition for satisfying the truth conditions of a collective reading, at least not under our definition of this reading. We will come back to the question of how a distributive reading can have what we call a 'single-event verification' in chapter 6.

Turning to another terminological matter, we will say that an FNQ is 'subject-oriented' when its host NP is the subject, 'object-oriented' when its host NP is the direct object. To be precise about the identity of the host NP for the NQ under discussion, we will always boldface both the NQ and its host NP.

In this chapter we will use only canonical FNQ sentences when presenting the data. By 'canonical', we mean that the FNQ is in a preverbal position, rather than in some other position (e.g. sentence-initial position). To be precise, the subject-oriented FNQ canonically occupies a pre-VP position, while the object-oriented FNQ canonically occupies a pre-V position. The syntax will be discussed in chapter 3 in detail, where we show why these are unmarked positions for these two types of FNQ. For now, let us simply assume this.

Before presenting the data concerning the FNQ sentence, we must point out one more important distinction which could cause confusion if not borne in mind during this chapter. There exists a kind of DNQ sentence which, in written form, looks just like an FNQ sentence, although it is syntactically quite distinct. That is, the two sentence types have identical word order but distinct constituent structures:

(8)a. **otoko**-ga **san-nin** ofisu-ni kita.
man-NOM 3-CL office-to came
?FNQ/?DNQ
'Three men came to the office.'

b. **o toko** ga [**sa nnin** o fisuni kita]. (*san-nin*: FNQ)

c. [**o toko** ga **sannin**] o fisuni kita. (*san-nin*: DNQ)

This is not to say that the syntactic distinction between an FNQ sentence such as (8b) and a DNQ sentence of the same surface form (8c) is not at all detectable. In actual speech, the difference is quite audible due to a prosodic contrast as indicated by the line representing the pitch contour. In an FNQ sentence, there is always a rise in pitch on the FNQ, and this may be preceded by a slight pause. In the similar-looking DNQ sentence, on the other hand, there is no pitch rise on the NQ but on the material after the NQ, and a slight pause may only occur here after the NQ, if at all. These prosodic effects follow from a basic syntactic difference between the FNQ sentence and the similar-looking DNQ sentence: In the former case, the NQ forms a constituent with the predicate while in the latter it is part of the nominal constituent as indicated by the brackets. We will discuss the syntactic distinction exemplified in the contrast between (8b) and (8c) in chapter 3. In presenting the data, we will use a comma before the FNQ to mark the position of the prosodic boundary, as illustrated in (9a). As for DNQ sentences, we will deliberately not use the form that resembles an FNQ sentence but rather only show another type of DNQ sentence at this point, namely the type in which the DNQ is in a prenominal position, as in (9b):

(9)a. FNQ: indicating prosodic/syntactic boundary
otoko-ga, **san-nin** kita.
man-NOM 3-CL came
FNQ

b. DNQ: NQ in the prenominal position
[**san-nin**-no **otoko**]-ga kita.
3-CL-GEN man-NOM came
DNQ

2.1. Once-Only Predicates

First, let us consider 'once-only predicates'. A once-only predicate denotes a type of event that cannot occur more than one time in a possible world of the same sort as the actual world. In the example sentences below, the once-only reading arises due to the combination of the lexical characteristics of the verb and the type of direct object NP, i.e. a proper name or a definite NP. First consider the following pair of sentences:

(10)a. DNQ with an iterative predicate
san-nin-no **otoko**-ga Hibiyakooen-no baiten-de chizu-o katta.
3-CL-GEN man-NOM H-GEN kiosk-at map-ACC bought

'Three men bought a map at the kiosk in Hibiya Park.'

b. DNQ with a once-only predicate
san-nin-no **otoko**-ga Hibiyakooen-no baiten-de Tanaka-o koroshita.
3-CL-GEN man-NOM H.-GEN kiosk-at T.-ACC killed

'Three men killed Tanaka at the kiosk in Hibiya Park.'

(10a) has a DNQ and an iterative predicate. This sentence is logically ambiguous since it is true of the following distinct situation types, each of which can be labeled by the reading it verifies:[18]

(11) Situation types verifying (10a):

(i) Distributive:
Three men each bought a different map.
(three maps were bought)

(ii) Collective:
Three men bought a single map together.
(a single map was bought and not by only one man)

(iii) Partially Collective:
Two men bought one map together and the third man bought another map.
(two maps were bought)

Thus, we observe that a DNQ can be used to describe all three situation types; its truth conditions include all three readings.

Now consider (10b) which has a DNQ and a once-only predicate. The sentence is in principle true of the same three situation types:

(12) Situation types verifying (10b):

(i) Distributive:
Three men each killed Tanaka.
(Tanaka was killed three times)

(ii) Collective:
Three men killed Tanaka together.
(Tanaka was killed once and not by only one man)

[18] Here we use the terms 'logically ambiguous' and 'reading' in a theory-neutral descriptive sense.

(iii) Partially Collective:
Two men killed Tanaka together while the third man killed Tanaka on his own. (Tanaka was killed twice)

However, the situation types of the distributive and partially collective readings are obviously not possible; in a possible world of the sort we actually live in a particular person can be killed only once. Only reference to the collective situation type would make any sense. That is, the meaning of the DNQ sentence (10b) is pragmatically constrained. It can only be felicitously used to assert that a collective situation type exists. Assignment of the distributive or partially collective reading would always be infelicitous with respect to the actual world (since it would always be false).[19]

Now, compare (10b) with (13), which contains a subject-oriented FNQ:

(13) FNQ with a once-only predicate

# **otoko**-ga	Hibiyakooen-no	baiten-de,	**san-nin**	Tanaka-o	koroshita.
man-NOM	H.-GEN	kiosk-de	3-CL	T.-ACC	killed

'Three men killed Tanaka at the kiosk in Hibiya Park.'

This sentence again involves three men and the same once-only predicate as (10b). Thus, the pragmatic constraint that applies to (10b) also applies to (13), leaving only the collective reading as felicitous. However, unlike (10b), sentence (13) is infelicitous. This sentence sounds quite odd since it must be interpreted as asserting that three men each killed the same person, namely Tanaka, as if he could be killed three times. In other words, the sentence is

[19] We assume that a sentence or a reading of a sentence is infelicitous if it cannot in principle be true, given the common ground of the listener and the speaker. The distributive reading of (10b), which is always false relative to the actual world, is a special case of this. To accommodate the infelicity, the listener must consider non-actual possible worlds in which it is possible in principle for (10b) to be true under a distributive reading.

always pragmatically ill-formed. This shows that it can only receive a distributive reading.[20] This is the first piece of evidence that the FNQ is strongly associated with a distributive reading.

How about the partially collective situation type? Consider the following discourse fragment:

(14)a. kesa **Newsweek**-ga, **ni-bu** nokotteita.
this morning N.-NOM 2-CL remained

'Two copies of Newsweek remained this morning.'

b. # sono Newsweek-o **kyaku**-ga, **san-nin** katta.
the N.-ACC customer-NOM 3-CL bought

'Three customers (each) bought them.'

(14a) asserts the existence of two copies of Newsweek. The continuation sentence (14b), which is an FNQ sentence with the object scrambled to the sentence initial position, asserts that three customers bought the two specific copies of Newsweek mentioned in (14a). Thus, the only way it could be true for three customers to have bought the two copies of Newsweek is if one customer bought one copy and the other two bought the other copy together.

[20] Contrary to our own judgement, some native speakers reportedly find (13) acceptable under a reading in which each of the three men "participates in", or has equal responsibility for, the murder of Tanaka (thanks to H. Hoji, p.c. for this observation). However, even if this is truly a judgement of grammaticality, rather than of acceptability, notice that it still calls for a kind of distributive reading: the agency or responsibility is attributed to each of the men individually. This marginally acceptable, but in our view ungrammatical, reading can perhaps be likened to that of the underlined English sentence in the following context (thanks to W. Philip, p.c. for this judgement): *It is not that only Brutus killed Caesar. All the senators present were equally responsible for this heinous crime.* ***Each of them killed Caesar****, and each must hang.* Strictly speaking, the boldfaced sentence cannot possibly be true in the actual world, although it may well be the case that each senator stabbed Caesar with the intent of killing him and that therefore, in some legal sense, is equally guilty of the crime of assassination.

However, the sentence (14b) cannot ever be true of such a situation. Consequently, (14) as a whole is an incoherent discourse fragment. The FNQ sentence (14b) cannot be true of any situation of the partially collective situation type. This shows that an FNQ cannot have a partially collective reading either. For (14b) to be felicitous, there must exist at least three copies of Newsweek. In sum, the descriptive generalization we obtain from the data (10) through (14) is that the FNQ is only compatible with a distributive reading.

That a DNQ sentence is usually ambiguous, while an FNQ sentence usually allows only a distributive reading, can be observed in the following set of data as well:

(15)a. DNQ with an iterative predicate

san-nin-no	**kodomo**-ga	oya-no	shi-go	tochi-o	utta.
3-CL-GEN	child-NOM	parent-GEN	death-after	land-ACC	sold

'Three children sold a piece of land after the death of the parents.'

b. DNQ with a once-only predicate

san-nin-no	**kodomo**-ga	oya-no	shi-go	sono	tochi-o	utta.
3-CL-GEN	child-NOM	parent-GEN	death-after	the	land-ACC	sold

'Three children sold the land after the death of the parents.'

c. FNQ with a once-only predicate

# **kodomo**-ga	oya-no	shi-go,	**san-nin**	sono	tochi-o	utta.
child-NOM	parent-GEN	death-after	3-CL	the	land-ACC	sold

'Three children (each) sold the land after the death of the parents.'

d FNQ with an iterative predicate

kodomo-ga	oya-no	shi-go,	**san-nin**	tochi-o	utta.
child-NOM	parent-GEN	death-after	3-CL	land-ACC	sold

'Three children (each) sold a piece of land after the death of the parents.'

(15a) and (15d) have the predicate *tochi-o utta*, which literally means just 'sold land'. The bare noun *tochi* 'land' here is most naturally interpreted as 'a piece of land'. Since selling a piece of land can occur iteratively as long as there remains some unsold land after each land-selling event, this predicate is categorized as an iterative predicate. In (15a), which has a DNQ and this iterative predicate, the sentence is true of the three distinct situation types discussed in connection with previous data. It might be that three children each sold a different piece of land, or that three children together sold one piece of co-owned land, or that one child sold one piece of land he or she owned while the other two together sold another piece of land that they co-owned. Thus, (15a) is thoroughly ambiguous. In contrast, (12b) has the predicate 'sono tochi-o utta' *sold the land.* Unlike (15a), in (15b) the direct object refers to a particular piece of land, specified by the demonstrative *sono* 'that'. Consequently, the predicate virtually becomes a once-only predicate with respect to the actual world, since one cannot sell the same land twice unless it is repurchased after the first sale (which is a situation so bizarre that it cannot easily be conceived as possible). Because of the presence of this predicate (and assuming normal circumstances), the only felicitous reading is the collective one, i.e. that the three children together sold one particular piece of land. Thus, the DNQ sentence (15b) is pragmatically constrained; it can only be felicitously used to assert that a collective situation type exists. Now consider (15c), which contains the same once-only predicate but an FNQ rather than a DNQ. Due to the presence of the once-only predicate, the same pragmatic constraint applies and only the collective situation type can be felicitously referred to. However, the sentence is infelicitous because, once again, the collective reading is not available in (15c). It can only mean that three children each sold the same piece of land, which is too improbable to be true in the actual world. (15c) cannot mean that three children together sold a piece of land, not in any possible world. Unlike

(15b), (15c) has an FNQ. This shows again that a collective reading is not available with an FNQ. Finally, consider (15d), which is well-formed with an FNQ and an iterative predicate. (15d) is true of the situation in which three children are each responsible for selling a piece of land, i.e. the distributive situation type.

The data above show that an FNQ with a once-only predicate always produces an infelicitous sentence because the once-only predicate is not compatible with a distributive reading. In contrast, an FNQ is always felicitous with an iterative predicate because such a predicate is compatible with a distributive reading. In sum, the FNQ appears to force a distributive reading. It is important to note that the infelicity here arises from an interaction of semantics with pragmatics. The semantics of the FNQ requires a distributive reading while the pragmatics of a once-only predicate does not allow such a reading. While killing a particular person and selling a particular piece of land are perceived as once-only events with respect to the actual world, this perception does not hold in all possible worlds. For example, *kill Tanaka* is not a once-only predicate in a Voodoo possible world inhabited by zombies. Thus, the FNQ's compatibility with a particular predicate depends on the relevant possible world. However, it generally holds that an FNQ sentence is infelicitous in every possible world in which the predicate is perceived as a once-only predicate, because a once-only predicate is intrinsically incompatible with a distributive reading.

2.2. Collective Predicates

The second kind of data concerns so-called 'collective' predicates. A collective predicate requires that a plural entity collectively shares a single thematic relation in a given event type. To get a clear idea of how the FNQ might interact with such predicates, let us first consider how it interacts with a typical non-collective predicate.[21] Consider the set of data in (16). Note that, due to the presence of the classifier *nin*, which is for counting human beings, the FNQs in (16) are unequivocally subject-oriented:

(16)a. DNQ with a non-collective predicate
san-nin-no **gakusei**-ga sono mise-de terebi-o katta.
3-CL-GEN student-NOM the store-at tv-ACC bought

'Three students bought a tv set at the store.'

b. FNQ with a non-collective predicate
gakusei-ga sono mise-de, **san-nin** terebi-o katta.
student-NOM the store-at 3-CL tv-ACC bought

'Three students (each) bought a tv set at the store.'

First consider (16a), which has a DNQ and a non-collective predicate. This sentence is true of the following three distinct situation types; (i) three students each bought a tv set (distributive); (ii) three students together bought a tv set (collective); (iii) some of the three students each bought a tv set while others bought a tv set together (partially collective). Since (16a) is true of any of these types of situation, it is logically ambiguous: A sentence with a DNQ and a non-collective predicate is compatible with a distributive reading, a collective reading, or a partially collective reading.

Next consider (16b) which is minimally different from (16a) in that it has an FNQ occurring with the same non-collective predicate. This sentence is well-formed. However, in stark contrast with (16a), it is only interpreted under a distributive reading, i.e. as asserting

[21] A 'non-collective' or 'mixed' predicate is lexically compatible with either a distributive or a collective reading. We will discuss such lexical semantic verb classifications in chapter 4.

that each of three students bought a tv set. Because only a distributive reading is available, (16b) entails that a single student bought a tv. (16a) does not have this entailment because its DNQ also allows a collective reading. This minimal pair suggests that an FNQ will not be compatible with collective predicates. Let us examine this prediction with the predicate *gasshoosuru* 'sing in a chorus', which only allows a collective reading. Consider (17):

(17)a. DNQ with a collective predicate
yo-nin-no **otoko**-ga michikado-de gasshooshita.
4-CL-GEN man-NOM street corner-at sang in chorus

'Four men sang in chorus on a street corner.'

b. FNQ with a collective predicate
? **otoko**-ga michikado-de, **yo-nin** gasshooshita.
man-NOM street corner-at 4-CL chorused

'Four men (each) sang in chorus on a street corner.'

In (17a), *gasshoosuru* 'sing in chorus' occurs with a DNQ. Here, the lexical semantics of the predicate forces a collective reading: Only a group of individuals can sing in a chorus; no single person can sing in a chorus all alone. We saw in (16a) that a DNQ can in principle be ambiguous. However, due to the presence of the collective predicate, for (17a) only the collective reading is semantically well-formed. (17a) is lexically semantically constrained; it can only describe a collective situation type.

Now, consider (17b), which is minimally different from (17a) in that it has an FNQ rather than a DNQ. If an FNQ sentence must have a distributive reading, the prediction is that (17b) should be lexically semantically ill-formed due to the incompatibility of the FNQ with the collective predicate. In fact, native speaker judgements split here. Some native speakers report that this sentence cannot make any sense at all. They report that the sentence means that the four men each sang in chorus and this is semantically incoherent. The existence of such a judgement is extremely significant. It supports the hypothesis that the FNQ sentence contains some mechanism that blocks a collective reading. However, other native speakers claim that (17b) can actually be well-formed if the sentence is interpreted as a report on a quantity of men. That is, those who find (17b) acceptable understand it as an assertion that four men, rather than some other number of men, sang together in a chorus.

We believe both these judgements are accurate. To see this, we must look more closely at the nature of the interpretation which makes this sentence well-formed. For the well-formedness of (17b), the sentence must be understood as a report of an amount. That is, it is implied that the amount of the men has a possible range. In the case of singing in chorus, any number of individuals that is greater than one can be involved. The presence of range of amount (or quantity or number) seems to be the licensing condition for this reading. Thus, when the NQ itself cannot be taken as the actual amount among other possible amounts, an FNQ sentence with a collective predicate is ungrammatical. In light of this, consider the following sentences:

(18)a. * **suiso-genshi**-ga kono ondo-de,
hydrogen-atom-NOM this temperature-at

futa-tsu hito-tsu-no suiso-bunshi-o tsukuru.
2-CL 1-CL-GEN hydrogen-molecule-ACC form

(intended) 'Two hydrogen atoms form a hydrogen molecule at this temperature.'

b. *bokushi-ga **watashi-no tomodachi**-o, **futa-ri** fuufu-to mitometa.
minister-NOM my friend-ACC 2-CL man & wife-as recognized

(intended) 'The minister pronounced two friends of mine man and wife.'

In both cases, the number referred to by the sentence is some invariant number, the exact value of which is determined by world knowledge. There is no range of possibilities under normal circumstances.[22] On the other hand, when there is a range of different possible numbers under normal circumstances, such an FNQ sentence can be well-formed because the sentence can be taken as a report on an actual quantity out of a range of possible quantities. Consider the following sentences in contrast to (18):

(19)a. **gakusei**-ga, **gojuu-nin** atsumatta.
student-NOM 50-CL gathered

ok: 'Fifty (but not another number) students gathered.'

b. John-ga **sara**-o, **juu-mai** kasaneta.
J-NOM plate-ACC 10-CL piled up

ok: 'John piled up ten (but not another number) plates.'

The sentences in (19) both have a collective predicate. (19a) can be taken to assert that the number of the students who gathered in the context in question was fifty, rather than some other number. Likewise, (19b) can be understood as asserting that the number of the plates John piled up in the relevant context is ten, rather than some other number.

The contrast we have presented in (18) and (19) shows that in one sense the FNQ is semantically incompatible with a collective predicate, while in another sense it is compatible with such a predicate. However, it is compatible only when in principle the number could

[22] The point here can perhaps be clarified by a comparison. Consider reports on rainfall. One can never know in advance how much rain will fall. There is always a range of possibilities: 10 milliliters, 20 milliliters, 50 milliliters, etc. In contrast, one does know in advance that atoms are supposed to combine to form a molecule only in some fixed number of very specific ways (whatever science tells us that is). There is no range of arbitrary ways in which atoms may form molecules.

have been other than what is asserted, because there is a range of possibilities. Now, this is precisely the licensing conditions for an amount term NQ, which does not quantify over individuals. Consider the following FNQ sentences with amount term NQs containing the unit of measure classifiers *miririttoru* 'ml' and *ton* 'ton':

(20)a. **ame**-ga, senshuu **sanbyaku-miririttoru** futta.
rain-NOM last week 300-ml fell

'300 mls of rain fell last week.'

b. seifu-wa **shokuryoo**-o, iraku-ni **gojit-ton** yusooshita.
government-TOP food-ACC Iraq-to 50-ton transported

'The government transported 50 tons of food to Iraq.'

With an amount term NQ, neither the distributive nor the collective reading is available because the NQ is not quantifying over objects. In (20a), '300 mls of rain' is interpreted neither as 300 individual objects which have the milliliter property, nor as a group of 300 objects that has this property. Rather, the rainwater which fell last week is taken as a single entity, and the classifier *ml* denotes a scale or a measure. To paraphrase Parsons (1970), the amount of the rainwater referred to in (20a) is a single entity that can be measured out as 300 in the milliliter scale. Similarly, the amount of food referred to in (20b) is taken as a single entity can be measured out as 50 in the ton scale.[23] Now, our claim is that exactly the same kind of reading arises in the case of the grammatical FNQ sentences in (19). In (19a), the amount of the relevant set of students, taken as a single entity, can be measured out as 50 in the 'nin scale', while in (19b), the amount of the relevant set of plates, taken as a single entity

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[23] For specific semantic analyses of amount term quantification, see Lønning (1987) and Krifka (1990), among others.

of plates, can be measured out as 10 in the 'mai scale'. Thus, the classifiers in (19) are being used to refer to a scale, just like the classifiers in the ordinary amount term NQs in (20). In other words, the FNQs in (19) are not really quantifying over individuals. Rather, there has been a shift to amount term quantification.[24] The shift has occurred in order to satisfy the truth conditions of the collective predicate.[25] This is why such co-occurrences of an FNQ with a collective predicate can be well-formed. The principle evidence in support of this claim is that when the licensing conditions for an amount term reading of an NQ are not satisfied, an FNQ cannot grammatically occur with a collective predicate, as we saw in (18). It is only when, under ordinary circumstances, there is a range of possible amounts with respect to which a specific actual amount can be asserted that an amount term NQ is licensed, as we saw in (20). Precisely this situation obtains for the well-formed FNQ sentences in (19). Finally, the fact that native speaker judgements split in cases such as (17b) is additional evidence that the co-occurrence of an FNQ with a collective predicate requires special licensing. Individuals may vary in the degree to which they allow a shift from a quantificational to amount term reading of an FNQ whose classifier is normally only used

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[24] Individual-denoting classifiers can behave as measure denoting classifiers and vice versa (see Lønning 1987).

[25] Note that, in general, the truth conditions of a collective predicate can be satisfied by a mass term, (i), or an amount term, (ii), as well as by a group-denoting term, (iii) and (iv):

(i) **Snow** gathered in the courtyard.
(ii) **Two tons of snow** gathered in the courtyard.
(iii) **The family** gathered in the courtyard.
(iv) **50 students** gathered in the courtyard.

Evidently, the only denotational constraint that a collective predicate places on its subject is that this denote a singular entity (a single quantity of substance or a single group of objects).

for a quantificational reading. In sum, FNQs can in principle co-occur with collective predicates but this is thanks to a special interpretation mechanism, a mechanism that is never needed to assign a collective reading to a DNQ sentence.

2.3. Predicates with NQ-*de*

The third kind of data concerns the phrase NQ-*de*, for example, *san-nin-de* '3-CL-by'. The NQ-*de* phrase is an adverbial expression that can give rise to a collective reading of the predicate it modifies. Consider the following example:

(21) gakusei-ga san-nin-de repooto-o kaita.
student-NOM 3-CL-by paper-ACC wrote

'The (three) students wrote a paper (together) in a three-person group.'

The most natural interpretation of (21) is that a single group of three students wrote a paper together.[26] However, this is not the only possible interpretation. A sentence containing an

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[26] NQ-*de* does not necessarily give rise to the collective reading we have been discussing. NQ-*de* can be used to mean *together* in the following sentence:

(i) Keiko-wa sengetsu tomodachi-to san-nin-de kyooto-e itta.
K-TOP last month friend-with 3-CL-with Kyoto-to went
'Keiko went to Kyoto last month with her friends in a group of three.'

Meanwhile, the use of NQ-*de* is conditioned in some ways. For example, the following sentence is awkward:

(ii) ?tsukue-no ue-no hon-ga san-satsu-de yuka-ni ochita
desk-GEN on-GEN book-NOM 3-CL-with floor-on fell
'Three books on the desk fell on the floor together.'

The source of the awkwardness of (ii) seems to have something to do with the lack of agency or no involvement of intention. Yet, the following sentence is perfectly natural:

(iii) kyoo daikon-ga san-bon-de hyaku-en-da-tta
today radish-NOM 3-CL-with 100-yen-COP-PAST
'Today radish was 100 yen for three.'

We will not explore the precise syntactic condition of the use of NQ-*de* since it goes beyond the scope this section. However, since NQ-*de* adds a groupness to the meaning, it can gives rise to a collective reading of the relevant sentence.

NQ-*de* adverbial can also be true if the individuals denoted by the subject did not all belong to the same group, so long as they all belonged to some group or other of the cardinality specified by the NQ. Thus, (21) would be true of any number of students if each student worked together with two others to write a paper. In fact, (21) could even be true if just one student wrote a paper, provided he or she did so collectively with two other unspecified people.[27]

Now, let us consider the interaction of an FNQ and an NQ-*de* phrase. Consider (22):

(22)a. DNQ with NQ-*de*
futa-ri-no **kyooju**-ga kyonen-kara futa-ri-de sundeiru.
2-CL-GEN prof.-NOM last year-from 2-CL-by live

'Two professors have lived as a couple since last year.'

b. FNQ with NQ-*de*
kyooju-ga kyonen-kara, **futa-ri** futa-ri-de sundeiru.
prof.-NOM last year-from 2-CL 2-CL-by live

'Two professors (each) have lived as a couple since last year.'

The sentence (22a) has a DNQ, while (22b) has a subject-oriented FNQ. In (22a), the predicate *futa-ri-de sundeiru* 'live as a couple' is a property of the two professors mentioned in the subject, but the question of whether this property applies to the set of two professors as a group or to each of the two professors individually is left unspecified. The sentence is ambiguous in this regard. Under the collective reading, there is a set of two professors, and

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[27] For example, this sentence is true of a situation in which John, who is a student, wrote a paper about his ancestors together with his brother and sister. In such a case (21) can be pharaphrased with the following sentence:
(i) John-wa ani-to ane-to san-nin-de senzo-ni tsuite-no sakubun-o kaita.
J-TOP brother-and sister-with 3-CL-by ancestor-about-GEN paper-ACC wrote
'John wrote a paper about his ancestors in a group of three with his brother and his sister'.

living together as a couple is a property of this set. Under the distributive reading, there are two professors, and living together as a couple with someone else is a property of each of the professors. To see the difference, the following illustrations may be helpful. In (23), A and B represent two professors and X and Y other people.

(23) (a) collective reading

live together as a couple —— A + B

(b) distributive reading

live together as a couple
A + X
B + Y

(22a) is true of either situation type. In sharp contrast with this, (22b) may only be true of the situation type represented in (23b). We should note, however, that under the distributive reading of (22b) there still is a possibility that the two professors in question in fact turn out to be living together, as in (23a). That is, two professors A and B each live together with another person but in the case of professor A that other person happens to be B and in the case of professor B that other person happens to be A, as follows:

(24)

live together as a couple
A + B
B + A

Under this (very marked) 'reciprocal verification' of *futari-de*, the situation happens to be identical with what the collective reading independently denotes. However, the property 'live together with another' still holds individually for professor A and professor B. Thus, intensionally if not extensionally, this 'reciprocal verification' of the distributive reading available for (22b) is distinct from the collective reading available for (22a).

In sum, when a predicate is modified by an NQ-*de* adverbial, it predicates a collective property of its subject. When an FNQ is present, this collective property must be distributed over the subject and cannot be assigned to the subject as a whole. This constraint does not apply when a DNQ is present. Thus, this set of data also suggests that the FNQ somehow blocks a collective reading.

2.4. Homogeneous Event Predicates

The fourth kind of data concerns predicates that denote a 'homogeneous' event. This term, directly adopted from Sasaki Alam (1997), refers to an event that is perceived as continuous and lacking distinguishable subevents throughout a given time interval.[28] Specifically, we

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[28] Event homogeneity is closely related to telicity. A telic predicate denotes an event that has an end-point, while an atelic predicate denotes an event that has no end-point. Using compatibility with an expression of temporal duration as a test (cf. Vendler 1967, Dowty 1979), Sasaki Alam shows that there is a telicity distinction between the homogeneous event predicate *matsu* 'wait' and the non-homogeneous event predicate *yomu* 'read':

(i) Taro-ga Harvard-no gakusei-o, san-nin **san-jikan** matta.
T-NOM H-GEN student-ACC 3-CL 3-hour waited
'Taro waited for three Harvard students for three hours.'

(ii) #Taro-ga gengogaku-no hon-o, san-satsu **san-jikan** yonda.
T-NOM linguistics-GEN book-ACC 3-CL 3-hour read
'Taro read three linguistics books for three hours.'

(i) is felicitous with the duration expression *san-jikan* 'three hours', while (ii) is not. This shows that the predicate in (i) is atelic, while that in (ii) is telic. Sasaki Alam connects this to the claim that the predicate in (i) denotes a homogeneous event, while that in (ii) denotes a non-homogeneous event. She concludes that "the verb *matsu* 'wait' inherently denotes an atelic event with no indication of an endpoint or an intermission." (pp.390-391)

Note, however, that the telicity is not generally a fixed lexical property of verbs. Rather, a predicate is telic or atelic as a whole (cf. Verkuyl 1972, 1993). For example, *built houses* is atelic because it denotes a continuous activity of building some unspecified number will focus on sentences with the verb *matsu* 'wait', a verb which denotes a homogeneous event in the context given below in that it cannot easily be divided into subevents of waiting.

Miyagawa (1989) had observed that there is a distributional constraint on the NQ in sentence-initial position, as shown by the contrast between (25) and (26). He assumes that this is a constraint on NQ scrambling.

(25)a. Taroo-ga **hon**-o **san-satsu** yonda.
T-NOM book-ACC 3-CL read

'Taro read three linguistics books.'

b. **san-satsu**, Taroo-ga **hon**-o yonda.
3-CL T-NOM book-ACC read

'Taro read (each of) three linguistics books.'

(26)a. Taroo-ga **gakusei**-o **san-nin** matta.
T-NOM student-ACC 3-CL waited

'Taro waited for three students.'

b. #**san-nin**, Taroo-ga **gakusei**-o matta.
3-CL T-TOP student-ACC waited

'Taro waited for (each of) three students.'

Sasaki Alam argues that the ill-formedness of (26b) follows from the circumstances that (i) only FNQs can scramble and (ii) FNQs can never modify predicates like *matsu* 'wait' which denote a homogeneous event.[29] The argument runs as follows: The surface form in (26a) can

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of houses, while *built two houses* is telic because the numeral establishes a boundary for the building event.

[29] Prior to presenting her own account of the contrast between (25) and (26), Sasaki Alam (1997) argues against Kitahara's (1992a) claim that the contrast is due to a specificity effect. Kitahara assumes that the host NP and the NQ form a constituent as a DP and argues that either element can be extracted if the DP is non-specific, while neither element can be

only have the structural analysis shown in (27a) below; which contains a postnominal DNQ, rather than an FNQ. It cannot have the structural analysis in (27b), which does contain an FNQ, because *matsu* 'wait' is a homogeneous event. NQ scrambling is impossible from (27a) because NQs can never scramble out of a DP; therefore, (27b) is ungrammatical:

(27)a. DNQ structural analysis:
Taroo-ga [**gakusei**-o **san-nin**] matta.
T-NOM student-ACC 3-CL waited

b. FNQ structural analysis:
Taroo-ga **gakusei**-o [**san-nin** matta].
T-NOM student-ACC 3-CL waited

In contrast, the verb *yonda* 'read' in (25a) does not denote a homogeneous event. Specifically, the event referred to by *yonda* 'read' can be divided into three subevents, each corresponding to an event of reading a different book. Thus, (25a) can alternatively have the FNQ structural analysis shown in (28).[30] Since an FNQ analysis is grammatically possible, scrambling of the FNQ is also possible, as attested by (25b).

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extracted if the DP is specific (cf. Fiengo and Higginbotham 1981). According to Kitahara, certain verbs such as *matsu* 'wait' (but not *yomu* 'read') give rise to a specific interpretation of their object DP due to their lexical semantic characteristics (Kawashima 1992, Kitahara 1992b). However, Sasaki Alam offers counter-examples to Kitahara's claim, empirically challenging his analysis. In addition, we find Kitahara's specificity-based account of the contrast in (25) and (26) problematic in a far more general way since it entails that non-specificity is a licensing condition for all FNQs, a robustly false claim.

[30] In accordance with what we noted earlier about the possible difference between FNQ sentences and sentences containing a postnominal DNQ, (25a) would have a prosodic boundary just before the FNQ when it received the structural analysis in (28). Sasaki Alam would predict that (25a) could have a prosodic boundary just before the NQ, while (26a) could not. In our judgement, this predication is borne out, unless contextual factors license a non-homogeneous event reading of *matsu* 'wait'.

(28) 25a with FNQ structural analysis
Taroo-ga **hon-o** [**san-satsu** yonda].
T-NOM book-ACC 3-CL read

'Taro read (each of) three linguistics books.'

In this manner, Sasaki Alam accounts for the grammaticality contrast between (25b) and (26b) in terms of the FNQ's incompatibility with a predicate denoting a homogeneous event. Sasaki Alam offers the following descriptive generalization:

> "...when the predicate is interpreted as an integrated mass or in the totalization mode, 'quantifier floating' is not allowed."
> (pp.389-390)

This generalization is empirically supported by the following data. Consider the following situation: Suppose Taro is standing at the Line 6 platform of the IRT at Grand Central Station in New York City. His friend Jiro is supposed to be on one of the Line 6 trains that arrive between 2pm and 2:30pm, but exactly which one is not known. So, Taro waits for trains until Jiro comes out of one. In this context, the following sentence is perfectly well-formed even though it has the same syntactic structure as (26b) and also contains the verb *matsu* 'wait':

(29) (Taroo-wa 2-ji choodo-ni roku-ban-no hoomu-ni tsuita.)
T-TOP 2-o'clock exactly-at six-number-GEN platform-to arrived

nana-dai, kare-wa sorekara **densha**-o matta.
7-CL he-TOP then train-ACC waited

'(Taro arrived at the platform of 6 exactly at 2.) He then waited for (each of) seven trains.'

Here, Taro does not wait for seven trains all at once, but rather he waits for one train, which arrives and leaves, then another, which arrives and leaves, and then a third train, and so on.

Thus, there are all together seven trains, which he separately waits for, and thus *matsu* 'wait' does not denote a homogeneous event in terms of the seven trains. In such a situation, the FNQ is indeed compatible with the predicate just as Sasaki Alam's generalization predicts, and the scrambled FNQ sentence in (29) is perfectly grammatical. Crucially, though, what licenses the NQ-scrambling here is the fact that the NQ is an FNQ, which is only compatible with a distributive reading. Likewise, even for the sentence in (29b), if the situation is that Taro has an appointment with Ichiro, Jiro, and Saburo, at 1pm, 1:30, and 2pm, respectively, then the sentence is perfectly acceptable (although, admittedly, it is a bit unnatural to describe such an event with the verb *matta* 'waited'[31]). In sum, the general observation is that the ability to scramble an NQ, as in (25b) and (29), correlates with the ability to interpret the predicate distributivity. On the assumption that only FNQs may scramble, this correlation follows naturally from the circumstance that FNQs require a distributive reading. This provides indirect support for our claim, since otherwise an additional stipulation would be required to account for the observed correlation.

2.5. Individual Responsibility

The fifth kind of data concerns sentences such as in (30) that contain a subject-oriented FNQ and a determinerless direct object, i.e. a DP lacking a demonstrative such as *sono* 'that' or *kono* 'this'. Such DPs are ambiguous both as to definiteness and plurality; however, they are perhaps most naturally interpreted as singular indefinites.

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[31] The unnaturalness, however, is due to an implicature that *matsu* 'wait' establishes. For some reason, the use of *matsu* here suggests that the students actually didn't come, or that 'waiting' is something Taro does (or used to do) regularly.

(30)a. DNQ sentence
futa-ri-no **butsurigakusha**-ga sono genshoo-ni tsuite
2-CL-GEN physicist-NOM the phenomenon-on pertaining

atarashii riron-o happyooshita.
new theory-ACC presented

b. FNQ sentence
butsurigakusha-ga sono genshoo-ni tsuite,
physicist-NOM the phenomenon-on pertaining

futa-ri atarashii riron-o happyooshita.
2-CL new theory-ACC presented

'Two physicists presented a new theory about the phenomenon.'

Given that its direct object is interpreted as 'a new theory', (30a) is ambiguous as to whether the two physicists present a new theory together (collective reading) or individually (distributive reading). Under the collective reading, the predicate *atarashii riron-o happyooshita* 'presented a new theory' is a property of the two physicists as a group. Thus, only one new theory is presented. Under the distributive reading, the predicate is a property of each of the two physicists. That is, each is "individually responsible" for the presentation of a new theory. Thus, it must be the case that two different theories are presented.[32] In contrast to (30a), the FNQ sentence in (30b) only has a distributive reading. For this sentence to be true, two physicists each must have presented a new theory; two different theories must have been presented.

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[32] Of course, in an unusual situation, the two new theories could turn out to be identical. But even in this case, there are two presentations, not one. Likewise, in (30b) it is not the exact identity of the two theories that matters so much as the number of presentations of a theory.

The same contrast due to the use of a DNQ or an FNQ can be observed in (31) and (32) when the respective direct objects are interpreted as 'a written protest' and 'a Zero' (a one-pilot Japanese WWII fighter airplane).

(31)a. DNQ sentence

juumin	**nanajuuyo-nin**-ga	shichoo-ni	koogibun-o	okutta.
resident	74-CL-NOM	mayor-to	written protest-ACC	sent

b. FNQ sentence

juumin-ga	shichoo-ni,	**nanajuuyo-nin**	koogibun-o	okutta.
resident-NOM	mayor-to	74-CL	written protest-ACC	sent

'Seventy four residents sent a written protest to the mayor.'

(32)a. DNQ sentence

shichi-nin-no	**amerikasuihei**-ga	paaruhaabaa-de	zerosen-o	uchiotoshita.
7-CL-GEN	American sailor-NOM	Pearl Harbor-at	Zero-ACC	shot down

b. FNQ sentence

amerikasuihei-ga	paaruhaabaa-de,	**shichi-nin**	zerosen-o	uchiotoshita.
American sailor-NOM	Pearl Harbor-at	7-CL	Zero-ACC	shot down

'Seven American sailors shot down a Zero at Pearl Harbor.'

(31a) is ambiguous as to whether seventy-four people sent a letter together (collective) or individually (distributive), while (31b) can only be interpreted as asserting that seventy-four people each sent a different letter (or possibly a different copy of the same letter).[33] Under the distributive reading of (31a), and always for (31b), if we assume an indefinite singular reading of the direct object, it must be the case that seventy-four different letters were sent, because each individual is responsible for sending a letter. (32a) is ambiguous as to whether

[33] (33a) and (34a) also have what we referred to above as "partially collective" readings. For example, (33a) can also be true if, say, four people sent a letter together and seventy people each sent a letter (seventy-one letters total). Since partially collective readings are available whenever collective readings are, here and henceforth we will only call attention to the presence or absence of a collective reading.

seven American sailors together shot down a Zero (collective) or individually shot down a Zero (distributive), while (32b) can only be true if seven American sailors each shot down a Zero. Under the distributive reading of (32a), and always for (32b), it must be the case that seven different Zero airplanes were shot down.

To see more clearly the "individual responsibility" in the case of the FNQ sentence, observe how each sentence above interacts with a continuation sentence in the following discourse fragments:

(33)a. **futa-ri**-no **butsurigakusha**-ga sono genshoo-ni tsuite (=30a: DNQ)
2-CL-GEN physicist-NOM the phenomenon-on pertaining

atarashii riron-o happyooshita.
new theory-ACC presented

'Two physicists presented a new theory about the phenomenon.'

b. hi-tori-ga sono riron-no zenhan-o happyoshi
1-CL-TOP the theory-GEN first half-ACC present

moo hi-tori-ga koohan-o happyoshita.
another 1-CL-NOM second half-ACC presented

'One presented the first half of the theory and the other presented the second half.'

(34)a. **butsurigakusha**-ga sono genshoo-ni tsuite, (=30b: FNQ)
physicist-NOM the phenomenon-on pertaining

futa-ri atarashii riron-o happyooshita
2-CL new theory-ACC presented

'Two physicists (each) presented a new theory about the phenomenon.'

b. #hi-tori-ga sono riron-no zenhan-o happyoshi
1-CL-TOP the theory-GEN first half-ACC present

moo hi-tori-ga koohan-o happyoshita.
another 1-CL-NOM second half-ACC presented

'One presented the first half of the theory and the other presented the second half.'

(33a) and (34a) are followed by the same continuation sentence, which, under the most natural reading, asserts the existence of only one theory. In (33), the continuation is perfectly natural and felicitous. However, in (34) the continuation makes the discourse incoherent, since the first sentence entails that two new theories were presented while the second sentence asserts that only one new theory was presented.

Next, consider the following:

(35)a. **juumin nanajuuyo-nin**-ga shichoo-ni koogibun-o okutta. (=31a: DNQ)
resident 74-CL-NOM mayor-to written protest-ACC sent

'Seventy-four residents sent a written protest to the mayor.'

b. John-ga bunmen-o kaki, juumin-ga sono shita-ni .
J-NOM content-ACC write, resident-NOM the below-at

shomeishita tegami-ga shichooshitsu-ni todoker-are-ta.
signed letter-NOM mayor's office-to send-PASS-PAST

'The letter which John wrote and the residents signed underneath was sent to the Mayor's office.'

(36)a. **juumin**-ga shichoo-ni, **nanajuuyo-nin** koogibun-o okutta. (=31b: FNQ)
resident-NOM mayor-to 74-CL written protest-ACC sent

'Seventy four residents (each) sent a written protest to the mayor.'

b. #John-ga bunmen-o kaki, juumin-ga sono shita-ni .
J-NOM content-ACC write, resident-NOM the below-at

shomeishita tegami-ga shichooshitsu-ni todoker-are-ta.
signed letter-NOM mayor's office-to send-PASS-PAST

'The letter which John wrote and the residents signed underneath was sent to the Mayor's office.'

Again, (35a) and (36a) are followed by the same continuation sentence, which asserts that there exists only a single-letter. In (35) the continuation is perfectly coherent, while in (36) it is not. (36) is an incoherent discourse because (36a) entails that seventy-four different letters were sent to the Mayor's office, yet (36b) asserts, contradictorily, that only one letter was sent to the Mayor's office.

Finally, consider the following discourse fragments (neither of which are historically accurate descriptions of the actual world, as far as we know):

(37)a. **shichi-nin**-no **amerikasuihei**-ga
7-CL-GEN American sailor-NOM

paaruhaabaa-de zerosen-o uchiotoshita. (=32a)
Pearl Harbor-at Zero-ACC shot down

'Seven American sailors shot down a Zero at Pearl Harbor.'

b. Yamamoto-no choonan-ga sono zerosen-o soojuushiteita.
Y-GEN oldest son-NOM the Zero-ACC piloted

'Admiral Yamamoto's oldest son was the pilot of that Zero.'

(38)a. **amerikasuihei**-ga paaruhaabaa-de,
American sailor-NOM Pearl Harbor-at

shichi-nin zerosen-o uchiotoshita. (=32b)
7-CL Zero-ACC shot down

'Seven American sailors (each) shot down a Zero at Pearl Harbor.'

b #Yamamoto-no choonan-ga sono zerosen-o soojuushiteita.
Y-GEN oldest son-NOM the Zero-ACC piloted

'Admiral Yamamoto's oldest son was the pilot of that Zero.'

(37a) and (38a) are both followed by the same continuation sentence. This continuation sentence forces a collective reading of (37a), since Admiral Yamamoto can only have one oldest son and the Zero was a one-pilot aircraft. Since the DNQ sentence in (37a) can have a collective reading, (37) is a perfectly coherent discourse fragment. In contrast, (38) is incoherent because, while (38a) asserts that seven different Zeros were shot down, (38b) entails that only one was shot down.

As the continuation tests show, the logical ambiguity observed with a DNQ sentence is not present with an FNQ sentence. With a determinerless direct object denoting individuals of type X, an FNQ containing the numeral N always asserts the existence of N-many individuals of type X. This is possible only if the predicate applies distributively to the individuals in question. Thus, the data here also suggest that FNQs force a distributive reading.

2.6. Distributional Diversity of the Host NP

The last kind of data to be considered consists of sentences with an FNQ whose host NP is not case-marked nominative (*ga*) or accusative (*o*). These sentences are considered atypical, since the host NP of the FNQ is usually either the subject (*ga*-marked) or the direct object (*o*-marked).[34] However, we will examine below sentences in which the host NP of the FNQ is neither the subject nor the object. We will show that these sentences have a common characteristic in that they too require a distributive reading.

First, consider some examples of an FNQ whose host NP is *ni*-marked. The sentences (39a), (39b), (39c), (39d) and (39e) are taken from Inoue (1978), Kuno (1978), Harada (1976), Haig (1980), and Miyagawa (1989), respectively:

[34] For example, Okutsu (1969) suggested that the FNQ is derived from the DNQ inside either subject or object via transformations.

(39)a. Hanako-wa **dantaikyaku-o tomeru yadoya**-ni, **san-gen** atatta.[35] [36]
H-TOP group-guest-ACC accommodate inn-at 3-CL inquired

'Hanako inquired at (each of) three inns that accommodate group-guests.'

b. John-wa **tomodachi**-ni, **san-nin** denwashita.[37]
J-TOP friend-DAT 3-CL called

'John called (each of) three friends.'

c. Taroo-wa **sensei**-ni, **futa-ri** suisenjoo-o kaite-moratta.
T-TOP teacher-DAT 2-CL recom.letter-ACC write-got

'Taro had (each of) two teachers write a letter of recommendation.'

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[35] This is slightly different from Inoue's original sentence, which was:
watashi-wa dantaikyaku-o tomeru yadoya-ni ni,san-gen atattemita
I-TOP group-guest-ACC accommodate inn-at 2,3-CL inquired
'I inquired at two or three inns that accommodate group-guests.'
Here, the numeral of the NQ is not a specific number but an approximate number. Haig (1980) observes that FNQ sentences with non-subject, non-object host NPs are usually better when NQs are approximate (also see Kawashima 1994). However, we do not consider that this necessarily means that such sentences are ungrammatical when the NQ is specific. Thus, the sentences in the text are, in our view, grammatical, though atypical.

[36] The verb *ataru* might be translated as 'directly inquire', in the sense that the inquiry is made via direct personal contact.

[37] Again, this is slightly different from Kuno's original sentence, which was:
(?) tomodachi-ni shi,go-nin tegami-o kaita
friend-to 4,5-CL letter-ACC wrote
'(I) wrote a letter to four or five friends.'

d. kyonen boku-wa **fuyuyama**-ni, **mit-tsu** nobotta.[38]
last year I-TOP winter mountain-to 3-CL climbed

'Last year I climbed (each of) three winter mountains.' (i.e. made three winter climbs)

e. kodomotachi-wa **kooen**-ni, **ni-kasho** itta.[39]
children-TOP park-to 2-CL went

'The children went to (each of) two parks.'

Putting aside the question of exactly what grammatical function each of these host NPs has, we see that all these sentences only admit a distributive reading. (39a) can only mean that Hanako made an inquiry at each of the three inns, (39b) that Taro made a phone-call to each of the three friends, and (39c) that Taro received from each of the two teachers a recommendation letter. Likewise, (39d) only means that the speaker climbed each of the three mountains, and (39e) that the children went to each of the two parks.

It must be admitted that it would be difficult for (39a), (39d) and (39e) to have collective readings even if they had had DNQs instead of FNQs. Under normal

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[38] Haig's original sentence was:
(i) kyonen fuyuyama-ni too-gurai nobotta-yo.
last year winter-mountain-on 10-about climbed-prt
'I made about ten winter climbs last year.'
This NQ is associated with an approximation morpheme *gurai* 'or so'. Thus *too-gurai* is a kind of approximate quantifier.

[39] I thank S. Tomioka for pointing this out to me. Miyagawa's original sentence was:
(i) kodomotachi-wa kooen-ni futa-tsu itta.
children-TOP park-to 2-CL went
'The children went to two parks.'
Our sentence in the text is different from (i) only in terms of the classifier for 'park'. *-Tsu* in (i) is a classifier that is used when the object is not suitable with any other classifier. It can be considered some sort of a 'default' classifier, though this classifier only goes up to nine. *-Kasho* is a classifier for locations. According to Miyagawa, sentence (i) is ungrammatical. We ourselves do not have clear judgements about it. However, we do have a clear judgement about the sentence in (39e): with *-kasho* present, (39e) is completely acceptable.

circumstances, one cannot 'directly' inquire at more than one inn in a single inquiry, nor can one climb more than one mountain in a single climb or go to more than one park on a single park-visit.[40] On the other hand, (39b) and (39c) could in principle have collective readings if they had DNQs instead of FNQs. However, the FNQ sentences (39b) and (39c) are only true under a distributive reading. Consider a situation in which three friends live together and John makes one phone call to the house to talk to these three friends one after the other. If this is what happened, then the sentence (39b) is not true, because Taro made only one phone call, not three. Likewise, consider a situation in which Taro received a letter of recommendation jointly written by two teachers. (This may not be likely in reality, but that is irrelevant.) Again, if this were what had happened, (39c) would be false, because Taro would not have received two separate letters. Thus, these FNQ sentences are simply false of collective situations.

Next, let us consider the host NP associated with other postpositions:

(40)a. shichoo-ga **shinai-no shoogakkoo**-kara, **san-koo** hookoku-o uketa.
mayor-NOM city-GEN elem.school-from 3-CL report-ACC received

'The mayor received a report from (each of) three elementary schools in the city.

b. minatosho-wa **jiken-no** **mokugekisha**-kara, **yon-mei** jijoochooshu shita.
Minato P.D.-TOP incident-GEN witness-from 4-CL hearing did

'Minato P.D. collected testimony from (each of) four witnesses of the incident.'

[40] Not all of these cases are equally implausible, though. For example, it seems that people who climb Mt. Washington may well also climb Mt. Monroe and Mt. Jefferson along the way, since Mt. Washington is part of a mountain range (in the Northeastern United States).

c. Taroo-wa **sensei**-kara, **futa-ri** suisenjoo-o kaite-moratta.[41]
T-TOP teacher-from 2-CL recom.letter-ACC write-got

'Taro had (each of) two teachers write a letter of recommendation.'

d. Taroo-wa **kurasu-no onnanoko**-kara, **futa-ri** chokoreeto-o moratta.
T-TOP class-GEN girl-from 2-CL chocolate-ACC received

'Taro received (a box of) chocolates from (each of) two girls in the class.'

e. John-wa yuube **baa**-de, **san-gen** utatta.
J-TOP last night bar-at 3-CL sang

'John sang at (each of) three bars last night.'

f. toritsuke-ga sengetsu kanryooshita shinshiki-no shingoo-ga
fixing-NOM last month finished new type-GEN traffic lights-NOM

kooshuukaidoo-zoi-no koosaten-de kesa, **yon-kasho** koshooshita.
koshu ave.-long-GEN intersection-at this morning 4-CL went wrong

'The new type of traffic lights whose installation was completed last month went haywire this morning at (each of) four intersections along Koshu Kaido avenue.'

g. Machiko-wa **kaisha-no hito**-to, **san-nin** tsukiatta.
M-TOP company-GEN person-with 3-CL dated

'Machiko dated (each of) three people at her office.'

h. **suieikyoogi**-de orandajin-ga, **go-shumoku** kinmedaru-o totta.
swimming event-on Dutch-NOM 5-CL gold medal-ACC won

'In swimming, the Dutch won a gold medal in (each of) five events.'

The degree of acceptability of the sentences in (40) may vary from one sentence to another and from one speaker to another. For example, (40e) seems highly controversial. This sentence might sound quite odd initially. But we consider this sentence acceptable given the

[41] This sentence is slightly different from (39c). The dative *ni* in (39c) has been replaced by a postposition *kara* 'from' in (40c).

following hypothetical context: Suppose John is a busy professional singer based in New York City who often performs at more than one bar on a single night. He was particularly busy last night and had a contract for one-hour performances at three different downtown bars. In this case, the sentence is perfectly acceptable. In our judgement, these sentences are all acceptable given an appropriate context. More importantly, though, in so far as they are acceptable, they are only acceptable under a distributive reading. For example, (40a) expresses the proposition that the mayor received a report from each of the three schools; (40b) that the police collected testimony from each of the four witnesses, and so on.

Readers will observe that, for pragmatic reasons, a collective reading would be odd in any case for (40e)-(40h), even if a DNQ were used. That is indeed the case. However, (40a)-(40d) could readily have collective readings if the sentences had DNQs instead of FNQs. Since they have FNQs, though, they are false of the situations that would be truthfully described by the collective reading of a DNQ sentence. Consider (40a) as a description of a situation in which three schools made a joint report to the mayor. If this were the case, (40a) would simply be false, because the mayor did not receive three separate reports. Or consider (40b) as a description of a situation in which the police gathered together four witnesses and conducted one collective hearing from them all at once. Again, (40b) would be false in this case, since there would only have been one hearing. For (40c), the same description as (39c) applies. Finally, consider (40d) as a description of a situation in which two girls in the class together gave Taro one box of chocolates on a Valentines Day. In this case, the sentence would not be true because Taro would not have received two boxes of chocolates. Thus, again, these FNQ sentences are well-formed only under a distributive reading. Apparently, the syntactic relation between the host NP and its FNQ is not uniform in terms of grammatical relations. What is uniform, rather, is the association with an apparently obligatory distributive reading.

2.7. Summary

In this chapter, we have examined six different kinds of data each of which independently shows that a Japanese FNQ with a standard numeral classifier such as *-nin* or *-hon* is predominantly associated with a distributive reading, a reading in which the predicate applies to each individual that the host NP denotes. In section 2.2, we saw that an FNQ could in principle co-occur with a collective predicate, but found that this required special licensing and entailed a shift from a quantificational to an amount term reading. Putting this exception aside, the descriptive generalization is that quantificational FNQ sentences require a distributive reading while quantificational DNQ sentences do not. We conclude, therefore, that the distributivity phenomenon must follow from a basic aspect of the semantics of the Japanese FNQ. Much of the remainder of this thesis will be devoted to accounting for this fact and explaining why the DNQ, in contrast, readily allows a collective reading.

CHAPTER 3

SYNTACTIC ASSUMPTIONS

In the previous chapter, our presentation of the semantic data was organized in accordance with an implicitly assumed syntactic distinction between the DNQ and the FNQ. This syntactic distinction is extremely relevant to the semantics of Japanese NQ, given the principle of compositionality. The computation of sentential meaning is constrained by syntactic structure in that function composition ("merger") occurs in a bottom-up fashion. The semantic value of a smaller constituent must be computed before another element is computed in combination with it. Accordingly, the syntactic difference between the DNQ construction and the FNQ construction will directly affect semantic interpretation. In this chapter, then, we will review the empirical grounds for the DNQ/FNQ syntactic distinction.

The chapter is organized as follows: In 3.1, we describe the classifier and show that its agreement with the host NP is not syntactic but semantic and context sensitive. In 3.2, we present an overview of the numerous NQ constructions that Japanese has. There are six all together. In section 3.3, we discuss the syntax of the first four NQ constructions, showing that they are all DNQs. In section 3.4 we discuss the syntax of the fifth and the sixth NQ constructions, showing that these are FNQs. Here we start by showing that the fifth type of NQ has the syntactic properties of an adverb. This leads us to adopt Doetjes' (1997) adverbial analysis of the FQ, making certain modifications to account for the language-specific properties of Japanese syntax. We next discuss the sixth type of NQ construction, arguing that it is a scrambled FNQ.[1] Finally we consider the LF representation of an FNQ sentence.

3.1. The Classifier and Its Agreement with the Host NP

As we briefly mentioned in chapter 1, Japanese has a set of closed class lexical elements called 'numeral classifiers' (henceforth simply 'classifiers'), which compose morphologically with a numeral to form a numeral quantifier (NQ), i.e. [Num+CL].[2] The numeral and the classifier are bound together as a single word.[3] The classifier itself appears to denote a unit

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[1] The sixth type of NQ construction is fundamentally different from the other types in that it is not base-generated.

[2] The Japanese numeral classifier should be distinguished from another kind of linguistic expression that is also called a classifier because it morphologically attaches to a verb, 'classifying' it as taking a certain kind of direct object. For example, in the Tuscarora sentence (i), the verbal affix *-taskw-* licenses the direct object *tsi:r* 'dog':

(i) Ae-hra-**taskw**-ahk-hwaʔ haʔ **tsi:r**.
DU-3M-domestic.animal-pickup-ASP PRT dog
'He regularly picks up dogs [he is a dog-catcher].'
(Williams, 1976, cited in Baker, 1988)

Although there may be a close relationship between this other kind of classifier and the Japanese numeral classifier, we will not examine that relationship in this thesis.

[3] This suggests that the NQ is generated by a process of derivational morphology in the lexicon (or, alternatively, by a syntactic process of incorporation). The hypothesis that the NQ is a single word is supported by the occurrence of the Japanese voicing phenomenon called *rendaku*, which is only found within words. The rendaku phenomenon is such that, in the composition of two morphemes within a word, the first consonant of the second

in terms of which certain types of objects are counted. This can be compared with English expressions such as (*a*) ***box*** (*of books*) or (*a*) ***glass*** (*of water*). The objects that are counted by means of the same classifier can be grouped together to form a natural class at a certain conceptual level. For example, objects that are counted with the classifier *-nin* can be considered to form a natural class 'human beings'. This class is distinct from another natural class of small animate objects such as cats, dogs, grasshoppers and such, which are counted by means of another classifier *-hiki*.[4] (1) shows some examples of classifiers:

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morpheme becomes voiced. This can be observed in various cases of compounding and affixation (incorporation):

(i)N+N compound:

tankoo + *hon* => *tankoo**bon***
single-publication book single edition

(ii)V+Adj compound:

yomi + *tsurai* => *yomi**z**urai*
read hard hard to read

(iii) V+Past morpheme affixation (incorporation)

asob + *ta* => *asonda*
play Past played

Rendaku does not occur, however, between two independent words in a sentence, as shown below:

(iv) *omoshiroi* + *hon* => *omoshiroi **h**on* but **omoshiroi **b**on*
interesting book interesting book

We can see that rendaku occurs in NQs, as shown below:

(iv) *san* + *hon* => *sanbon*
3 CL 3-CL 'three units of the long objects'.

Although it is not the case that rendaku occurs in all the NQs, the occurrence of rendaku in some NQs does strongly suggest that it is a compound (See Ito and Mester 1986 and Vance 1987 for a general discussion of the rendaku phenomenon).

[4] For a discussion of the factors determining the natural classes distinguished by classifiers, see e.g. Allan (1977), Matsumoto (1993), and Downing (1996).

(1) **-nin**: human beings (people, men, girls, students, etc.)[5]
san-nin, yo-nin, go-nin
3-CL 4-CL 5-CL

-hiki: insects and small animals (ants, cats, fish, etc.)
san-biki, yon-hiki, go-hiki
3-CL 4-CL 5-CL

-satsu: bound volumes (books, dictionaries, notebooks, etc.)
san-satsu, yon-satsu, go-satsu
3-CL, 4-CL 5-CL

-kyoku: pieces of music (songs, compositions, etc)
san-kyoku, yon-kyoku, go-kyoku
3-CL 4-CL 5-CL

The classifier is a nominal element. This can be seen from the fact that many classifiers can also function as ordinary nouns, e.g. *hito-**hako*** '1-box', *hito-**fukuro*** '1-sack'. Furthermore, there are many classifiers that have the nominalized form of a verb, e.g. *hito-**keri*** '1-kick', *hito-**tsumami*** '1-pinch'.[6] However, there is an important semantic difference between a classifier and an ordinary noun in that the classifier functions as a unit for counting.[7] For example, the noun *hako* 'box' refers to boxes, while the classifier *-hako* refers to the 'box-

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[5] This particular classifier takes a different form when the numeral is either one or two. Namely, one and two human individual are counted *hito-ri* and *futa-ri*. The classifier *ri*, as well as the numerals *hito-* 'one' and *futa-* 'two', are suppletive forms retained from the Old Japanese counting system, which predated the Chinese influence on Japanese (cf. Downing 1996).

[6] In traditional Japanese linguistics, this is called the *renyoo* form of the verb. The renyoo form can be followed by a case marker, showing that it is a noun morphologically derived from a verb:

John-wa Tom-no sune-ni **keri**-o ireta
J-TOP T-GEN shin-to kick-ACC put-in
'John put a kick into Tom's shin.'.

[7] As we will see later, when a nominal element that denotes objects functions as a classifier it can only denote a set of singular individuals.

unit', a unit for counting contents in boxes. The host NP, which often occurs in the same sentence containing the NQ, indicates the specific kind of objects being counted. For example, an NQ such as *futa-hako* 'two-box' could be construed with an NP *mikan* 'mandarin' so as to be understood as 'two box(ful)s of mandarins'.[8]

The selection of a classifier for a host NP is semantically restricted, and a given type of object might be compatible only with a small set of classifiers. A sentence with an NQ whose classifier meaning does not match the kind of objects being counted will be ill-

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[8] We should note that, due to accidental gaps in the classifier system, there also exists a phonetically null default classifier that can be used when the regular overt form happens not to exist (or cannot be recalled). For example, a commonly used classifier for *seki* 'seat' is *-tsu*, which derives from Old Japanese and which therefore can only be suffixed to Old Japanese numbers. To be exact, it can only be used for numbers one to nine. Thus, for the number 3, *tsu* must be used, as shown in (i) and (ii). However, there is no Old Japanese number greater than 10 and also no analog of *-tsu* derived from Chinese. Thus, when counting 12 seats, say, the phonetically null classifier is morphologically licensed, as seen by the well-formedness of (iii):

(i) seki-ga mit-tsu tarinai.
seat-NOM 3-CL lack
'Twelve seats are missing to be sufficient.'

(ii) *seki-ga mi/san tarinai.
seat-NOM 3(OJ)/3(C) lack
(intended) 'Three seats are missing.'

(iii) seki-ga juuni tarinai.
seat-NOM 12 lack
'Three seats are missing.'

There is also another marginally acceptable strategy for dealing with such accidental gaps, namely using the host NP itself as a classifier:

(iv) ?seki-ga juuni-seki tarinai.
seat-NOM 12-CL(seat) lack

In Thai, repeating the noun as the classifier is a systematic phenomenon (cf. Singhapreecha 2000). In Japanese, however, a sentence such as (iv) is slightly ill-formed, sounding a bit redundant. Finally, in some dialects (or perhaps idiolects) the classifier *ko* can function as an overt default classifier, though there are some constraints on its use (e.g., it cannot be used when counting human beings).

formed. Consider the following data (the classifier of the NQ and the NQ's host NP are boldfaced):

(2)a. go-**nin**-no **gakusei**-ga kita.
5-CL-GEN student-NOM came

'Five students came.' (lit. 'Five person-units of students came.')

b. go-**kumi**-no **gakusei**-ga kita.
5-CL-GEN student-NOM came

'Five groups of students came.' (lit. 'Five group-units of students came.')

c. #go-**ken**-no **gakusei**-ga kita.
5-CL-GEN student-NOM came

(lit. 'Five building-units of students came.')

(3)a. John-ga go-**hon**-no **biiru**-o nonda.
J-NOM 5-CL-GEN book-ACC bought

'John drank five bottles of beer.' (lit. 'John drank five long object-units of beer.')

b. John-ga go-**hai**-no **biiru**-o nonda.
J-NOM 5-CL-GEN book-ACC bought

'John drank five glasses of beer.' (lit. 'John drank five glass-units of beer.')

c. #John-ga go-**mai**-no **biiru**-o nonda.
J-NOM 5-CL-GEN book-ACC bought

(lit. 'John drank five sheet-units of beer.')

In (2a), the host NP *gakusei* 'student' is counted out individually with *-nin*, which is the classifier for individual human beings. However, if the context is such that students are counted by groups rather than individuals, then another classifier *-kumi*, which is for groups, is appropriate, as in (2b). On the other hand, students cannot possibly be counted with *-ken* , which is the classifier for buildings, as shown by the ill-formedness of (2c). In (3a), the host NP *biiru* 'beer' is counted out with *-hon*, which is the classifier for long slender objects, since beer usually comes in a bottle or a can. However, if the beer in the context is in glasses, then *-hai* , which is for glasses or cups of some substance, is more appropriate, as in (3b).[9] On the other hand, beer cannot usually be counted with *-mai*, which is for sheet-like, thin and flat, objects (e.g. paper), as shown by the ill-formedness of (3c).

The ill-formedness of (2c) and (3c) is essentially semantic in nature. However, like the selectional restrictions of predicates, the well-formedness of the semantic agreement between a classifier and a host NP is sensitive to contextual factors. That is, the classifier has fixed lexical semantic properties and in the default case semantic ill-formedness arises whenever the measured objects do not have these properties. This is what happens in (2c), since students can never have the essential properties of buildings. On the other hand, contextual factors can in principle override the default ill-formedness of a semantic mismatch between a classifier and a host NP. An example of this is seen in (3c). Because beer is not usually purchased in a flat solid form, (3c) is semantically ill-formed in the default case. However, (3c) would become perfectly well-formed if beer were packaged in flat objects, e.g. as wafers on a spaceship.

Three salient properties of classifier-host NP agreement show that this agreement is not syntactic. First, given a particular host NP, the classifier can freely vary as a function of nongrammatical factors, as can be seen in (2a-b) and (3a-b). This contrasts sharply with true syntactic agreement, where if there is any variation it is strictly controlled by grammatical features. Consider, for example, subject-verb agreement. In Italian, if the

[9] Even if a glass is long and slender, *-hai* is the appropriate classifier as long as the glass only temporarily contains a certain amount of beer.

subject is *noi* 'we', then the verbal suffix can only be *-iamo* in the present tense indicative form of *parle-* 'speak', i.e. *parliamo* 'we speak'. Or consider gender and number agreement in Spanish adjectives. If the noun is *casa* (feminine, singular) 'house', then *roj-* 'red' must take the form *roja*, i.e. *casa roja* 'red house'. There is no optionality in true syntactic agreement.[10]

A second basic property of the agreement between a classifier and a host NP that shows that this agreement is not syntactic is the fact that the classifier clearly has a meaning of its own. This can be seen in the meaning difference between (2a) and (2b), and between (3a) and (3b). Again, this is simply not the case with true syntactic agreement morpheme. The Italian verbal suffix *-iamo* contributes no meaning to any Italian sentence. Rather, the meaning is supplied by the nominal argument that it agrees with, even when this is covert. The semantic emptiness of syntactic agreement is even more obvious in the case of adjectival agreement in Spanish. Quite generally, a morphological element that expresses syntactic agreement does not have any semantic effect.

Finally, the fact that contextual factors can in principle override a default classifier-host NP mismatch, as we discussed with regard to (3c), is another piece of evidence that the agreement in question is semantic rather than syntactic. True syntactic agreement is strictly insensitive to discourse context. Semantic agreement, on the other hand, is typically context-sensitive. Consider, for example, the contrast in (4):

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[10] There can be underspecification, but this always takes the form of a systematic neutralization of overt agreement morphology, not the kind of idiosyncratic, grammar-independent, alternation we find in, say, the *nin/kumi* (people/groups) alternation.

(4)a. *John don't want to start.

b. This car doesn't want to start.

(4a) is ill-formed in every context of use because *don't* does not syntactically agree in number with *John*. (4b) is perfectly acceptable, even though *car* violates the [+animate] selectional restrictions of *want*.

Based on these observations, we do not consider there to be any motivation for the view that the classifier and the host NP instantiate syntactic agreement. In particular, there is absolutely no grounds for assuming they must be in a spec-head relationship at some point in the derivation of an NQ sentence.[11]

3.2. The Six Japanese NQ Constructions

Japanese has a strictly head-final SOV word order. Thus, we assume that a sentence such as (5a) has the basic syntactic properties shown in (5b):[12]

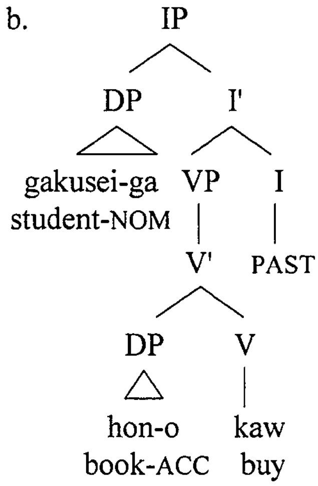
[11] If we took the semantic agreement of the classifier and the host NP as sufficient evidence that they must be in a spec-head relation, then we also ought to conclude (absurdly) that the obligatory gender agreement in (i) is necessarily mediated by a spec-head relation:
(i) The father of $Mary_1$ saw her_1 ($*him_1$) leave.

[12] We use the simpler phrase structure with IP (Chomsky 1986), rather than the more fine-grained phrase structure of the Split-Infl hypothesis (Pollock 1989), since such details are irrelevant to our analysis.

(5)a. gakusei-ga hon-o katta.
student-NOM book-ACC bought

'A student bought a book.'

b.



That is, we assume X-bar theory (Jackendoff 1977), binary branching (Kayne 1984) and the 'configurational hypothesis' (e.g. Saito and Hoji 1983), according to which the lexical elements of a sentence are arranged in hierarchical fashion reflecting VP constituency.[13] We will assume the presence of the DP in Japanese as well (Abney 1987). We abstract away from the VP-internal subject hypothesis (Koopman and Sportiche 1985, 1991) here, though we will come back to this topic later. Due to the head-finalness, the heads V and I follow their respective complements DP and VP.[14] Japanese case markers such as nominative *ga* and accusative *o* are attached postpositionally to argument nominal constituents.[15] Let us

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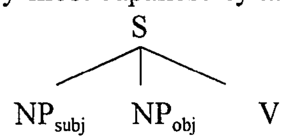
[13] Under the nonconfigurational hypothesis (e.g. Hinds 1973), which is no longer accepted by most Japanese syntacticians, Japanese has a flat structure without a VP, as follows:



[14] In this thesis we will not adopt Kayne's (1994) unified analysis of word order phenomena across all languages. However, we do not intend to suggest by this that we reject such an approach.

[15] Tateishi (1991) suggests that Japanese case markers occupy the D-head position, assuming that DP is the highest maximal projection in the nominal domain in Japanese. However, Kawashima (1994) argues that QP, rather than DP, is the highest maximal

now add to (5a) a subject-oriented NQ *san-nin* '3-CL' (*nin* for counting human beings), which yields the interpretation 'three students'. As can be seen in (6), there are six different ways this can be done, all of which can convey the same meaning, namely 'three students each bought a book':

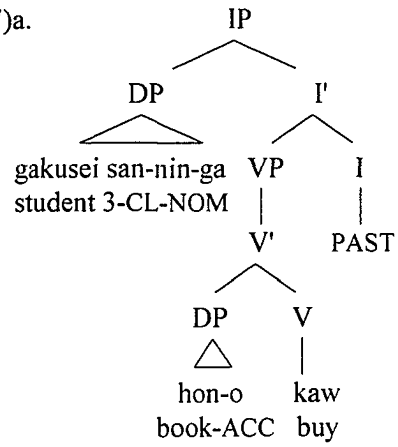
(6)a.	[**gakusei**	**san-nin**]-ga	hon-o	katta.	[NP NQ-NOM] VP
	student	3-CL-NOM	book-ACC	bought	
b.	[**gakusei**-no	**san-nin**]-ga	hon-o	katta.	[NP-GEN NQ-NOM] VP
	student-GEN	3-CL-NOM	book-ACC	bought	
c.	[**san-nin**-no	**gakusei**]-ga	hon-o	katta.	[NQ-GEN NP-NOM] VP
	3-CL-GEN	student-NOM	book-ACC	bought	
d.	[**gakusei**-ga	**san-nin**]	hon-o	katta.	[NP-NOM NQ] VP
	student-NOM	3-CL	book-ACC	bought	
e.	**gakusei**-ga	[**san-nin**	hon-o	katta].	NP-NOM [NQ VP]
	student-NOM	3-CL	book-ACC	bought	
f.	**san-nin**	**gakusei**-ga	hon-o	katta.	NQ [NP-NOM] VP
	3-CL	student-NOM	book-ACC	bought	

The six different types of NQ sentences in (6), which we call 'constructions', are represented in greater detail in (7), in which NQP stands for Numeral Quantifier Phrase:[16]

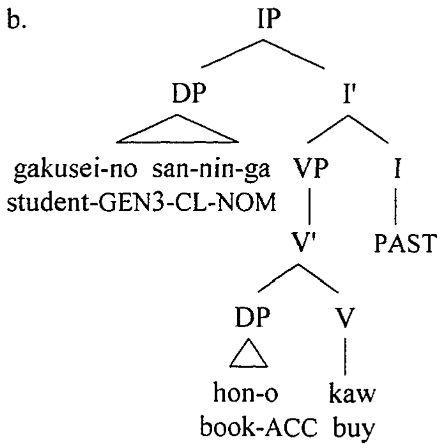
projection within the nominal domain in Japanese. Since nominative *ga* and accusative *o* can follow material which belongs to the QP, such as *subete* 'all', the exact position of the case markers in Japanese is unclear. What is clear, though, is that any constituent immediately to the left of a case marker is a nominal constituent.

[16] We call these 'constructions' because each is really an equivalence class of sentence types defined by the relative positions of the NQ, the host NP, and the predicate.

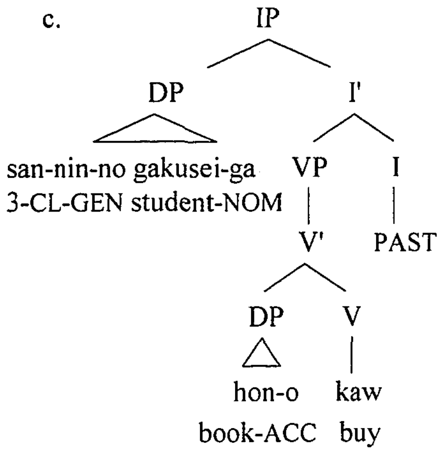
(7)a.


IP
DP
I'
gakusei san-nin-ga
student 3-CL-NOM
VP
I
V'
PAST
DP
V
hon-o
book-ACC
kaw
buy

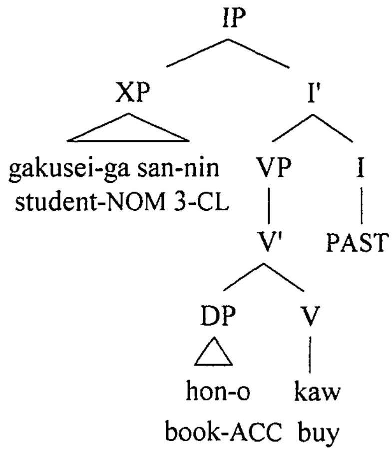
b.


IP
DP
I'
gakusei-no san-nin-ga
student-GEN3-CL-NOM
VP
I
V'
PAST
DP
V
hon-o
book-ACC
kaw
buy

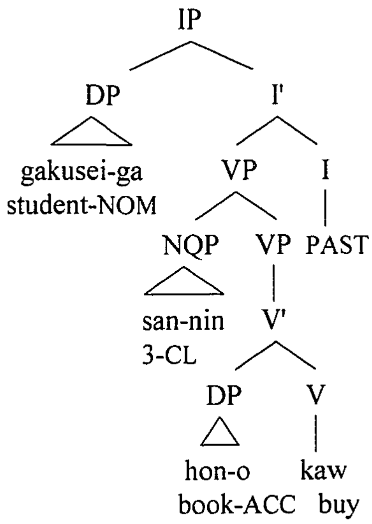
c.


IP
DP
I'
san-nin-no gakusei-ga
3-CL-GEN student-NOM
VP
I
V'
PAST
DP
V
hon-o
book-ACC
kaw
buy

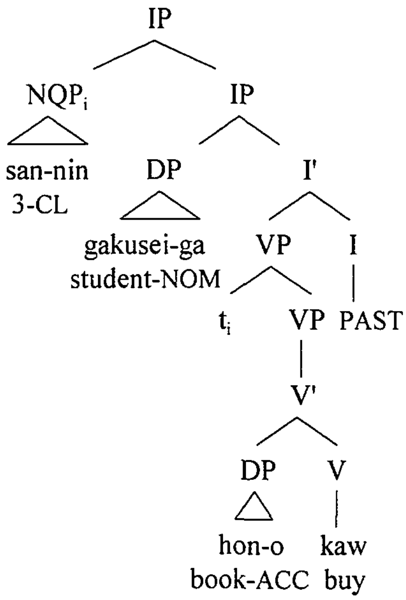
d.


IP
XP
I'
gakusei-ga san-nin
student-NOM 3-CL
VP
I
V'
PAST
DP
V
hon-o
book-ACC
kaw
buy

e.


IP
DP
I'
gakusei-ga
student-NOM
VP
I
NQP
VP
PAST
san-nin
3-CL
V'
DP
V
hon-o
book-ACC
kaw
buy

f.


IP
NQPi
IP
san-nin
3-CL
DP
I'
gakusei-ga
student-NOM
VP
I
ti
VP
PAST
V'
DP
V
hon-o
book-ACC
kaw
buy

The tree configurations in (7) are only rough approximations based on observable differences in the surface form (we provisionally label the element in spec IP position in 7d simply XP). The NQs in (7a-c) are contained inside nominal constituents that also include the host NP. Although the sentences (6d) and (6e) have the same surface order: [NP-ga NQ VP], we distinguish them as shown in (7d) and (7e): In (7d), the NQ forms a constituent with the host NP, while in (7e) it forms a constituent with the predicate.[17] In (7f), the NQ is scrambled from the preverbal NQ in (7e).

We argue below that there is a basic syntactic distinction between the first four constructions (6a-d) and the last two (6e-f). The former are DNQ constructions, the latter FNQ constructions.

3.3. The DNQ

In this section, we focus on the first four of the six NQ constructions presented above, repeated here as (8a-d):

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[17] The distinction here is based on the prosodic data rather than what is visible in the written form (as we also discussed in chapter 2). Observe the following prosodic contrast:
(i)a. gakusei-ga san-nin (pause) hon-o katta. (=6d)
b. gakusei-ga (pause) san-nin hon-o katta. (=6e)
The prosodic differences are (in careful speech): (1) In (ia) the NP and the NQ are in a continuous prosodic unit, while in (ib) there is a slight pause between the NP and the NQ, and (2) in (ia) a higher pitch may be assigned to the direct object, while in (ib) it may be assigned to the NQ. Selkirk and Tateishi (1991) have shown that the left edge of a Japanese VP is aligned with a phonological domain. Given this independently motivated generalization, we may conclude that the NQ in (ia) belongs to the same syntactic domain as the preceding NP, while the NQ in (ib) belongs to the same syntactic domain as the predicate following it.

(8)a. [**gakusei san-nin**]-ga hon-o katta. [NP NQ]-ga VP
student 3-CL-NOM book-ACC bought

b. [**gakusei**-no **san-nin**]-ga hon-o katta. [NP-no NQ]-ga VP
student-GEN 3-CL-NOM book-ACC bought

c. [**san-nin**-no **gakusei**]-ga hon-o katta. [NQ-no NP]-ga VP
3-CL-GEN student-NOM book-ACC bought

d. [**gakusei**-ga **san-nin**], hon-o katta. [NP-ga NQ] VP
student-NOM 3-CL book-ACC bought

The question we address in this section is whether or not the square brackets in (8) indicate true syntactic constituents. Regarding (8a-c), the answer seems pretty clear. In each of (8a-c), the fact that a postpositional case marker immediately follows the string strongly suggests that this string is a nominal constituent. Thus, we will skip a full-fledged discussion of this matter. For completeness, though, we include in Appendix A the relevant constituency tests.

A more interesting question is whether or not the bracketed lexical string in (8d) is a constituent. In fact, the constituency of [NP-ga NQ] has been argued for in the literature on the basis of the following tests:[18]

(9) Coordination

a. moma-de [**pikaso**-ga **ni-mai**]-to [**machisu**-ga **san-mai**] nusumareta.
MOMA-at Picasso-NOM 2-CL-and Matisse-NOM 3-CL stolen

'Two Picasso's and three Matisse's were stolen at MOMA.'

b. hanako-wa [**aji**-o **san-biki**]-to [**iwashi**-o **yon-hiki**] tairageta.
H.-TOP mackerel-ACC 3-CL-and sardine-ACC 4-CL ate up

'Hanako ate up three mackerels and four sardines.'

[18] (9b) is taken from Terada (1990) and (10b) is taken from Kamio (1983).

(10) Pseudo-cleft construction

a. kinoo hon-o katta-no-wa [**gakusei**-ga **san-nin**]-da.
yesterday book-ACC bought-that-TOP student-NOM 3-CL-COP

'It was three students that bought a book yesterday.'

b. Taroo-ga katta-no-wa [**hon**-o **san-satsu**]-da.
T.-NOM bought-that-TOP book-ACC 3-CL-COP

'What Taro bought is three books.'

The well-formedness here strongly supports the view that [NP-ga/o NQ] is indeed a nominal constituent. The fact that the postnominal NQ can be coordinated by means of the conjunct *to* 'and', as shown in (9), and the fact that it can form a predicate with the copula *da*, as shown in the pseudo-cleft data in (10), both show this because Japanese *-to* and *-da* can only compose with nominal elements. Consider (11) and (12):[19]

(11) a. hon-**to** enpitsu
book-and pencil
'books and pencils'

b. kyoo-**to** ashita
today-and tomorrow
'today and tomorrow'

(12) a. kore-wa hon-**da**.
this-TOP book-COP
'This is a book'

b. kaigi-wa kyoo-**da**.
meeting-TOP today-COP
'The meeting is today'

---

[19] Postpositions with semantic content such as *kara* 'from' can compose with *to* and *da* as well, as shown below:

(i) Tokyo-kara-to Nagoya-kara
T.-from-and N.-from
'from Tokyo and from Nagoya

(ii) kono densha-wa Tokyo-kara-da.
this train-TOP T.-kara-COP
'This train is (one) from Tokyo.'

The nominality of such postpositions is also demonstrated by the fact that they can be followed by a genitive Case marker:

(iii) Tokyo-kara-no densha
T.-from-GEN train
'a train from Tokyo'

c. yomi-**to** kaki
read-and write
'reading and writing'

d. *aoi-**to** kiiroi
blue-and yellow

e. *hayaku-**to** kakujitsuni
quickly-and reliably

f. *keru-**to** naguru
kick-and hit

c. hitsuyoona-no-wa yomi-**da**.
necessary-that-TOP reading-COP
'What is necessary is reading.'

d. *kono booshi-wa aoi-**da**.[20]
this hat-TOP blue-COP

e. *John-no haisoo-wa kakujitsuni-**da**.
J.-GEN delivery-TOP reliably-COP

f. *John-wa booru-o keru-**da**.[21]
J.-TOP ball-ACC kicked-COP

The well-formedness of (11a-c) and (12a-c) shows that *-to* and *-da* can compose with elements that may function as nominals. The ill-formedness of (11d-f) and (12d-f) shows that these morphemes cannot compose with elements that cannot function as nominals.[22]

Based on the above data, we may conclude that the lexical string [NP-case NQ] is a nominal constituent. However, perhaps it is worth elaborating on its syntactic status a bit

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[20] This would be grammatical with the polite speech copula *desu*, but that just shows that *desu* is not a phonological allomorph of *da*.

[21] It seems that this sentence is well-formed in some Northern dialects, especially when the verb stem is in the past tense (*ketta-da*). Unfortunately, we do not know enough about these dialects to offer any further comment at this moment. The judgement here is accurate as far as standard Japanese is concerned.

[22] In general, Japanese words ending with the predicative adverbial suffixes *-ku* and *-ni* can only function as adverbs. This is why *hayaku*, which derives from *hayai* 'fast', cannot occur with *to* in (11e) and why *kakujitsuni*, which derives from the attributive-denoting noun *kakujitsu* 'reliable', cannot occur with *da* in (11e). Being a noun, *kakujitsu* can combine directly with *da* to form a predicate, as in (i). A *ku*-adverb such as *hayaku* also cannot compose with *da*: **hayaku-da*. Rather, a predicate is formed directly from the adjectival form, as in (ii):

(i) John-no haisoo-wa kakujitsu-da.
J-NOM delivery-TOP reliable-COP
'John's delivery is reliable.'

(ii) John-no haisoo-wa hayai.
J-GEN delivery-TOP quick
'John's delivery is quick'

Note also that *kyoo* 'today' and *ashita* 'tomorrow' in (11b) are lexically nominal, though they can function as adverbs in a clause (cf. English *today*).

further. It is apparently not an ordinary nominal constituent, since the case marker is embedded inside it, rather than occurring to the right of the NQ, which is the rightmost element. One interesting piece of data that demonstrates a significant difference between this nominal constituent and ordinary nominal constituents is that an adverb can be inserted between the NP and the NQ, without affecting grammaticality:

(13) [**gakusei**-ga asahiya-de **san-nin**]-to, [**kyooju**-ga kinokuniya-de **yo-nin**],
student-NOM Asahiya-at 3-CL and professor-NOM Kinokuniya-at 4-CL

kono hon-o chuumonshita.
this book-ACC ordered

'Three students ordered this book at Asahiya bookstore, and four professors ordered this book at Kinokuniya bookstore.'

In an ordinary Japanese nominal constituent, a modifier within it would have to have an adjectival rather than an adverbial form. Given that adverbs generally modify predicates, the compatibility with an adverb preceding the NQ in (13) suggests that the NQ of this construction itself may be a predicate. The exact syntactic analysis of this construction is unclear. Terada (1990) analyzes [NP-Case NQ] as a QP, Kitahara (1992b) as a DP, and Koizumi (1995) as a remaining portion of an IP. However, there are empirical and theoretical problems for each of these analyses (Kobuchi-Philip, 2003). Alternatively, Cho (2000) analyzes [NP-Case NQ] in a similar construction in Korean as a small clause. This line of analysis seems promising for Japanese as well. That is, in the constituent [NP-Case NQ], the NP functions as a subject for the NQ, which functions as the predicate of a small clause.[23]

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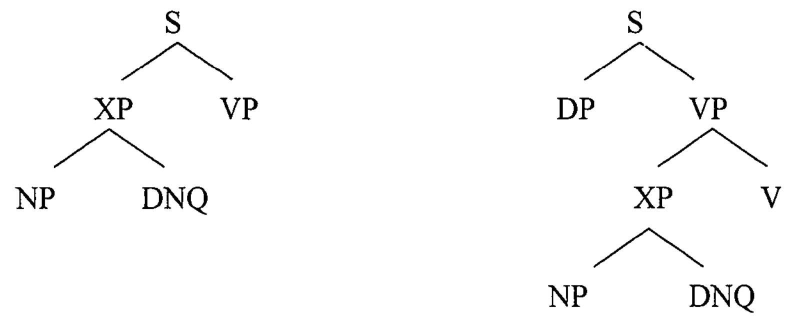
[23] We omit detailed discussion on this problem since the matter goes beyond the concerns of this thesis.

Going back to our main discussion, we may conclude that all the bracketed lexical strings in the sentences in (8) are nominal constituents. This means that all the NQs in (8) are DNQs. Whatever the differences in internal syntactic structure may be, in all cases the NP and the NQ form a constituent as follows:

(14)a. subject-oriented DNQ construction b. object-oriented DNQ construction



Given this syntax, in the computation of meaning the composition of the NP and the NQ must occur prior to composition with other elements of the sentence (i.e. the VP or V). This is the syntactic property of the DNQ that significantly affects the meaning of any sentence containing it. Recall that, as we showed in chapter 2, the DNQ constitutes a semantic natural class in that, unlike the FNQ, it readily allows a collective and partially collective reading. In chapter 6, we will see how this semantic property follows from the basic syntax of the DNQ.

Note that the internal syntax of the nominal constituents containing a DNQ can be quite intricate. A close examination of the DNQ construction in (8) reveals that at least (8b) and (8c) have additional ambiguity. For [NP-no NQ] in (8b), we observe at least the following three different meanings:

(15)a. [gakusei-no san-nin]-ga sono hon-o katta.
student-GEN 3-CL-NOM that book-ACC bought

'Three of the students bought the book.' (partitive)

b. kuizu bangumi-de
quiz show-at

[shufu-no san-nin]-ga [gakusei-no san-nin]-o makashita.
housewife-GEN 3-CL-NOM student-GEN 3-CL-ACC defeated

'The housewife threesome defeated the student threesome in a quiz show.' (restrictive NP)

c. [gakusei-no san-nin]-wa ashita shiken-ga aru-node kaerimashita.
student-GEN 3-CL-TOP tomorrow exam-NOM be-because went home

'The three, the students, have gone home because there is an exam tomorrow.' (non-restrictive NP)

These three readings of [NP-no NQ] can be roughly described as follows: (15a) is a partitive reading, as indicated by the English gloss. In this case, the prima facie NP can be assumed to be a DP. In contrast, (15b) is a reading in which the DNQ restricts the meaning of the host NP, much as if it were a kind of restrictive relative clause. That is, from among some set of three individual-sets, one is identified as the 'housewife threesome', and another as the 'student threesome'. Finally, (15c) is the reading in which the NP is an additional description of a referential NQ. This is similar to a non-restrictive relative clause. Again, in such a case, the prima facie NP would actually be a DP.

In addition, [NQ-no NP] in (8c) shows at least the following ambiguity:

(16)a. John-wa [mit-tsu-no ringo]-o katta.
J-TOP 3-CL-GEN apple-ACC bought

'John bought three apples.' (quantificational NQ)

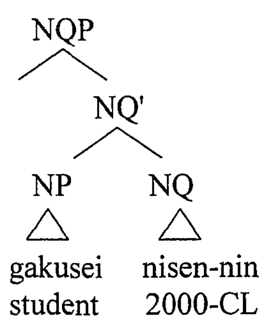
b. kono uchi-ni [go-nin-no kazoku]-ga sundeiru.
this house-in 5-CL-GEN family-NOM live

'There lives a five-membered family in this house.' (adjectival NQ)

These two readings can be roughly described as follows: (16a) is a reading in which the NQ is quantifying over the NP that follows it. (16b) is a reading in which the NQ does not quantify over the NP but describes it as a property (cf. Okutsu 1974). The classifier of the adjectival NQ usually does not match the host NP (*kazoku* 'family' is not counted with *nin*). However, sometimes it is hard to see this. For example, the NQ in (16a) could be used as an adjectival NQ if there are several kinds of packages of apples, e.g. twosome, threesome, and foursome. In that case, (16a) would be interpreted as 'John bought a package of threesome apples.'

We will not discuss the syntactic details of each nominal constituent containing a DNQ, since that goes beyond the topic of this thesis. However, we consider one particular DNQ construction, namely [NP NQ], as the most basic and minimal form of the DNQ. We identify this as a pseudopartitive construction and assume it to have the following syntactic structure:

(17)



This is basically what has been suggested by Kitahara (1992b) with his category 'NCP' renamed 'NQP'. However, unlike Kitahara's analysis, we do not consider movement of the

NP to spec NQP necessary. We include in Appendix B some discussion of the syntactic issues here. We assume that the NQP can be inserted in the relevant argument position (the XP position in 14a and 14b).

3.4. The FNQ

In this section, we discuss the fifth and the sixth NQ constructions we introduced at the outset in section 3.2. We start with the fifth, in which the bare NQ immediately precedes the predicate. First we will go over a set of data that demonstrates that this NQ essentially has the syntactic properties of an adverb. This NQ is thereby designated the FNQ, as opposed to the DNQ. Given that the FNQ is an adverb, we then discuss Doetjes' (1997) analysis of FQs, which is based precisely on this assumption. Adopting two key aspects of Doetjes' analysis, we then make some modifications in order to accommodate language-specific properties of Japanese FNQs. Next, on the basis of our proposed syntactic analysis of the FNQ construction, we go on to discuss the scrambled FNQ, which is the sixth NQ construction. Finally, we address issues of the scope of an FNQ at the level of the LF representation.

3.4.1. Empirical Grounds for an Adverbial Analysis

The syntax literature on Japanese contains a huge number of studies of the FNQ. Within this literature, there are two basic approaches to the syntactic analysis of the FNQ, namely the transformational approach and the base generation approach (as an adverb). The general observation that clearly emerges from this research is that the FNQ is syntactically in an adverbial position when it is semantically interpreted. Let us review the empirical evidence for this claim.

First, consider the coordination data shown below:[24]

(18)a.	**shoonin**-ga,	[**san-nin**]	katsu	[tashikani]	sono	jiko-o	mokugekishita.
	witness-NOM	3-CL	and	certainly	the	accident-ACC	witnessed
		NQ_{subj}		Adv			

'Three witnesses witnessed the accident for certain.'

b.	**terorisuto**-ga,	[**juu-nin**]	katsu	[kotogotoku]	taihos-are-ta.
	terrorist-NOM	10-CL	and	entirely	arrest-PASS-PAST
		NQ_{subj}		Adv	

'All ten terrorists were arrested.'

(19)a.	Mary-ga	**raamen**-o,	[**san-bai**]	katsu	[kireini]	tairageta.
	M-NOM	soup noodle-ACC	3-CL	and	cleanly	ate up
			NQ_{obj}		Adv	

'Mary ate up three bowls of soup noodles completely'

b.	John-ga	**ita**-o,	[**go-mai**]	katsu	[sude-de]	watta.
	J-NOM	plank-ACC	5-CL	and	bare hand-with	split
			NQ_{obj}		Adv	

'John split five planks bare handedly just now.'

These sentences contain strings of the form [NQ-and-Adv]. The Adv elements here are lexically as well as functionally adverbs.[25] Thus, the fact that such adverbs can coordinate with NQs is prima facie evidence that the NQs in these constructions are also functioning as adverbs, given the universal prohibition against coordinating expressions of distinct

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[24] The sentences in (18) are from Fukushima (1991). Note that these sentences cannot be translated literally into English; the glosses are the closest possible approximations of their meanings expressible in English.

[25] All of the words labeled 'Adv' in these and subsequent examples are lexically or morphologically specified as such and can have no other grammatical function, not even that of an adjective.

grammatical function.[26] [27] Second, consider another kind of coordination data shown in (20):

(20)a. **gakusei**-ga sono gakkai-de,
student-NOM the conference-at

[**futa-ri** peepaa-o happyooshi] katsu [**san-nin** postaa-o dashita].
2-CL paper-o present and 3-CL poster-ACC presented
NQ_{subj} VP & NQ_{subj} VP

'Two students presented a paper and three students presented a poster at the conference.

b. kodomotachi-ga gakugeikai-de,
children-NOM school performance-at

[kireini uta-o utai] katsu [joozuni odori-o odotta].
beautifully song-ACC sing and neatly dance-ACC danced
Adv VP & Adv VP

'Children sang songs beautifully and danced neatly at the school performance.'

---

[26] Violating this constraint gives rise to a type of ill-formedness known as the 'zeugma' (Lyons 1977, P405). Generally this universal constraint prohibits the coordination of expressions of distinct syntactic category as well, viz. *[[every boy]$_{DP}$ and [quickly]$_{AdvP}$]. In the case of adverbs, though, this latter more stringent effect does not always hold, viz. [[quickly]$_{AdvP}$ and [without hesitation]$_{PP}$].

[27] In our judgement, *katsu* cannot be used to coordinate nominal constituents to express cumulative reference. Thus, (i) can not mean 'A student and a plumber came':
(i) gakusei katsu suidooya-ga kita.
student and plumber-NOM came
'A student and plumber came.'
(ii) *san-nin-no gakusei katsu go-nin-no sensei-ga kita.
3-CL-GEN student and 5-CL-GEN teacher-NOM came
Thus, the existence of sentences like (18) and (19) constitutes a severe problem for a stranding theory account of the Japanese FNQ since such a theory claims, precisely, that an FNQ is underlyingly a DNQ. Note also the sharp contrast with English on this point:
(iii) *The planks were all **and** roughly chopped in half.
(cf. The planks were all roughly chopped in half.)

This shows that the coordination of two predicates of the form [NQ VP] is as well-formed as the coordination of two predicates of the form [Adv VP]. The simplest hypothesis is that the NQ in such a construction is itself an adverb. It may be objected, however, that the constructions in (20a-b) possibly involve coordination at the sentence-level plus ellipsis (gapping) or a null argument. On this view, (20a) would not have the underlying structure in (21a) but rather that in (21b) or (21c):

(21)a. S [NQ_{subj} VP] & [NQ_{subj} VP]

b. [S NQ_{subj} VP] & [~~S~~ NQ_{subj} VP]

c. [S NQ_{subj} VP] & [pro NQ_{subj} VP]

The gap ~~S~~ in (21b) would delete under identity with the subject of the first clause. The pro in (21c) would be interpreted as coreferent with the subject of the preceding clause. However, there is evidence that neither (21b) nor (21c) can be the correct analysis of (20a). Consider first the following sentence:

(22)

[**otokonoko**-ga	shawaashitsu-de,	**san-nin**	shawaa-o	abi]	katsu
boy-NOM	shower room-at	3-CL	shower-ACC	take	and
[S	Adv	FNQ	VP	]	&

[**onnanoko**-ga,	**fu-tari**	hon-o	yonde-ita].	
girl-NOM	2-CL	book-ACC	read-were	
[S	FNQ	VP		]

'Three boys were taking a shower in the shower room and two girls were reading a book.'

In this sentence, the adverbial element *shawaashitsu-de* 'in the shower room' appears only in the first clause and its scope is restricted to the first clause. This adverbial element could in principle be interpreted with scope over the second clause (i.e. the two girls were reading a book in the shower room), but this would require contextual motivation.[28] Now, consider the following sentence (23) which is minimally different from (22) in that the subject of the second clause is omitted:

(23)	**otokonoko**-ga	shawaashitsu-de,	**san-nin**	shawaa-o	abi	katsu
	boy-NOM	shower room-at	3-CL	shower-ACC	take	and
	S	Adv	NQ	VP		&

futa-ri	hon-o	yonde-ita.
2-CL	book-ACC	read-was
NQ	VP	

'Three boys were taking a shower in the shower room and two were reading a book.'

In this sentence, the only interpretation available is precisely the pragmatically odd one in which the adverbial element has scope over both the first clause and the second clause. That is, (23) means that two boys were reading in the same shower room where three other boys were taking a shower. This cannot be accounted for under the ellipsis or the pro analysis, since both make available the pragmatically appropriate restricted scope reading of the adverbial element. Certainly there is no pro that stands for an adverb, and an adverb cannot be deleted in combination with a subject, since a subject and an adverb do not form any constituent. Thus, the correct analysis of (23) must be that of a simple coordination, specifically, [NP [Adv [[X and X]]], where X is the constituent consisting of the FNQ and the VP. The same must hold for (20). That is, [NQ VP] forms a constituent.

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[28] Such bridging occurs, for example, in (i), where Mary's purchase of an orange may easily be taken to occur at the same store as John's purchase of an apple:
(i) John bought an apple at the store and Mary bought an orange.

Third, consider the sentence type illustrated in (24), in which a DNQ and an FNQ co-occur in a single sentence. We call this the 'DNQ-FNQ construction':[29]

(24)a. narande hashitteita **suu-dai**-no **torakku**-ga gaadoreeru-ni,
in a row running some-CL-GEN truck-NOM guardrail-to

san-dai butsukatta. (Inoue 1978)
3-CL hit

'Three of the several trucks that were driving in tandem hit the guardrail.'

b. Hanako-ga soko-ni aru **san-mai**-no **kaado**-o, **ichi-mai** mekuru-to
H-NOM there-at be 3-CL-GEN card-ACC 1-CL flip-when

sore-wa baba-dat-ta. (Fukushima 1991)[30]
it-TOP joker-COP-PAST

'When Hanako flipped one of the three cards, that was a joker.'

As indicated in the English gloss, a DNQ-FNQ sentence obligatorily has a partitive reading with the DP containing the DNQ functioning as the whole-denoting expression. In these sentences it is clear that the FNQ refers to only the number of the objects which have the property denoted by the predicate. In (24a), the subject-oriented FNQ *san-dai* 'some-CL' refers to the number of the trucks that hit the guardrail. Likewise, in (24b) the object-

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[29] Prior to Inoue's (1978) work, the FQ was analyzed in the traditional fashion of a movement analysis in which the FQ was moved from the relevant nominal constituent (Dougherty 1970, Kayne 1969, 1975), rather than the new movement analysis in which the NP is moved from the relevant nominal constituent. Inoue makes the point that the presence of the two NQs in a single sentence is evidence against any movement analysis, since the latter entails complementary distribution of the DQ and FQ. To make matters worse (for a movement analysis), in a typical DNQ-FNQ sentence, the numeral of the DNQ differs from that of the FNQ, ruling out the possibility of some sort of 'resumptive quantifier' treatment.

[30] This sentence is slightly different from Fukushima's original sentence. We added a relative clause *soko-ni aru* 'which is there' to his sentence to make the meaning clearer.

oriented FNQ *ichi-mai* '1-CL' refers to the number of the cards that Hanako flipped. This shows that the numeral in the FNQ is interpreted with respect to the predicate.

Fourth, as Fukushima (1991) points out, the classifier of the FNQ has a direct logical relation with the predicate, not the host NP, in the case of what we will call 'event classifier' NQs:

(25)a. Taroo-ga **hachimaki**-o, **hito-maki** maita.
T-NOM headband-ACC 1-CL rolled

'Taro rolled on the headband once.'

b. *Taroo-ga [hito-maki-no hachimaki]-o maita.
T-NOM 1-CL-GEN headband-ACC rolled

(26)a. Taroo-ga **pisutoru**-o, **ip-patsu** utta.
T-NOM pistol-ACC 1-CL shot

'Taro shot a pistol once.'

b. *Taroo-ga [ip-patsu-no pisutoru]-o utta.
T-NOM 1-CL-GEN pistol-ACC shot

The event classifier cannot appear in a DNQ, as shown by (25b/26b). The event classifier is a unit for counting events, not objects. For example, the classifier *maki* 'role' in (25a) is licensed for a rolling event, and the classifier *hatsu* 'shot' in (26a) is licensed for a shooting/blasting event.[31] As we can see in (25/26a), such an event is expressed by the predicate and the FNQ is interpreted in terms of this predicate. These data also support the

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[31] *Hatsu* in this sentence is used to refer to a shooting/blasting event. Thus, it functions as an event classifier here. However, *hatsu* can also be a classifier for counting bullets as exemplified below:
(i) kono pisutoru-ni tama-ga mada ni-hatsu haitteiru.
this pistol-in bullet-NOM still 2-CL contain
'There are still two bullets in this pistol.'
In this case, *hatsu* is not an event classifier, but an object classifier.

claim that the FNQ is an adverb since predicate dependency is a distinctive characteristic of adverbs. Given that an FNQ with an event classifier and an FNQ with an object classifier have an identical form at the phrasal level and at the sentence level, a natural assumption is that both types of FNQ are adverbs and that both are generally dependent on the predicate.[32]

The final piece of evidence for an adverbial analysis of the FNQ concerns an observation made by Nakayama and Koizumi (1991) and the generalization made by Fujita (1994), on the basis of this observation. Nakayama and Koizumi (1991) note that a subject-oriented FNQ may not be clefted along with a VP. In contrast, an object-oriented FNQ can readily be clefted along with a VP. In this regard, Fujita (1994) points out that the different distributions of subject-oriented and object-oriented FNQs exactly parallel the different distributions of sentential and manner adverbs:

(27)a. **kodomotachi**-ga, **go-nin** / tashikani piza-o tabeta.
children-NOM 5-CL certainly pizza-ACC ate
FNQ_{subj} / s-adv

'Five children ate pizza./Children certainly ate pizza'

b. ***kodomotachi**-ga shita-no-wa
children-NOM did-COMP-TOP

[**go-nin** /tashikani piza-o taberu-koto]-dat-ta.
5-CL certainly pizza-ACC eat-COMP-COP-PAST
FNQ_{subj} /s-adv

'What children did was (*five/*certainly) eat pizza.'

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[32] The alternative hypothesis that the FNQ with an event classifier differs syntactically from the FNQ with an object classifier would lack independent motivation and would miss an obvious generalization since the two type of FNQs have exactly the same surface distribution, abstracting away from classifier agreement restrictions.

(28)a. John-ga **piza**-o, **ni-mai** / isoide tabeta.
J-NOM pizza-ACC 2-CL hurriedly ate
FNQ$_{obj}$ / m-adv

'John ate two slices of pizza./ John ate pizza in a hurry'

b. John-ga shita-no-wa [**piza**-o **ni-mai** /isoide taberu-koto]-da-tta.
J-NOM did-COMP-TOP pizza-ACC 2-CL hurriedly eat-COMP-COP-PAST
FNQ$_{obj}$ / m-adv

'What John did was eat two slices of pizza./ What John did was eat pizza in a hurry.'

The subject-oriented FNQ and the sentential adverb in (27a) cannot be a part of the VP-cleft, as shown in (27b). On the other hand, the object-oriented FNQ and the manner adverb in (28a) can be a part of the VP-cleft, as shown in (28b). Note that the object-oriented FNQ could alternatively precede the object:

(29) John-ga shita-no-wa [**ni-mai** /isoide **piza**-o taberu-koto]-da-tta.
J-NOM did-COMP-TOP 2-CL hurriedly pizza-ACC eat-COMP-COP-PAST
FNQ$_{obj}$ / m-adv

'What John did was eat two slices of pizza./ What John did was eat pizza in a hurry.'

This set of data suggests not only that the Japanese FNQ should be treated syntactically as an adverb, but also that the specific syntactic classification of the subject-oriented FNQ is that of a sentential adverb and the specific syntactic classification of the object-oriented FNQ is that of a manner adverb. The common syntactic properties of the object-oriented FNQ and the manner adverb can be further observed in the fact that they can both occupy the position between the direct object and the verb, as follows:

(30)a. John-ga [**ringo-o** **mit-tsu** tabeta].
J-NOM apple-ACC 3-CL ate

'John ate three apples.'

b. John-ga [ringo-o kirazuni tabeta].
J-NOM apple-ACC without cutting ate

'John ate an apple without cutting it.'

It seems that the object-oriented NQ and the manner adverb here are sisters to the verb itself. Such a local relation between a manner adverb and a verb has been previously noted in the literature (cf. Stowell 1981, Belletti 1982). The parallel grammaticality of (30a) and (30b) suggests that the object-oriented FNQ has the same local relation to a verb.

To summarize, the data presented in this section demonstrate that i) FNQs can be coordinated with adverbs, ii) FNQs can be contained in coordinated VPs, iii) the numeral of the FNQ in the DNQ-FNQ construction only indicates the number of the objects that has the property denoted by the predicate, iv) event classifiers do not agree with the host NP but rather show a direct relation to the predicate, and v) the subject-oriented FNQ and the object-oriented FNQ show the syntactic behavior of sentential and manner adverbs, respectively. Taken together, these facts strongly suggest that the FNQ is a predicate modifier, i.e. an adverb. Therefore, we reject syntactic analyses of the FNQ that derive it from an underlying DNQ via movement and adopt instead a base-generated adverbial analysis.

3.4.2. The Generalized L-*Tous* Analysis

Having reviewed the evidence for an adverbial treatment of the Japanese FNQ, in this section we turn our attention to a specific syntactic analysis of the FQ as an adverb. In particular, we will adopt a modified version of the generalized L-*tous* analysis of Doetjes' (1997), which is mainly based on French data. Consider the French FQ sentences in (31), which were first discussed by Kayne (1969, 1975):

(31)a. **Les enfants** ont **tous** dormi.
the children have all slept

'The children all slept.'

b. J'ai **tous** voulu **les** voir.
I-have all wanted them see

'I wanted to see them all.'

Under a movement analysis which assumes that the host NP and the FQ are a constituent underlyingly (Dougherty 1970, Kayne 1969, 1975, Jaeggli 1982, Belletti 1982, Sportiche 1988), the subject-oriented FQ in (31a) and the object-oriented FQ in (31b) are derived in two different syntactic processes. The former is often referred to as R-*tous* and the latter as L-*tous*. Doetjes' generalized L-*tous* analysis provides a unified account for both types of *tous*. Under this analysis, the FQ is uniformly base-generated as an adverb, which binds the trace of the subject DP or the trace of a cliticized pronominal object. Thus, Doetjes analyzes the sentences in (31) as follows:

(32)a. **Les enfants**$_i$ ont $[_{VP}$ **tous**$_i$ $[_{VP}$ t_i dormi]].
the children have all slept

'The children all slept.'

b. J'ai $[_{VP}$ **tous**$_i$ $[_{VP}$ voulu **les**$_i$ voir t_i]].
I-have all wanted them see

'I wanted to see them all.'

In both (32a) and (32b), the FQ *tous* is base-generated in the spec of an adjoined VP as an adverb. In (32a), the subject *les enfants* 'the children' is base-generated in spec VP, assuming the VP-internal subject hypothesis, and moves to the spec IP position in order to have its case features checked, leaving a trace in its original position. In (32b), the pronominal direct object undergoes cliticization to a pre-V position, likewise leaving a trace. Thus, in both cases, the host NP undergoes movement and its trace remains in the original site. Doetjes argues that this is the licensing condition for the occurrence of any FQ. She generalized this as follows:

(33) $[_{XP}$ FQ$_i$ $[_{XP}$ ...ec$_i$ ...]] (XP is generally VP)

The empty category is a trace created by the movement of the host NP, namely a subject or an object. In addition, the FQ and the empty category are coindexed. This syntactic relation among the moved host NP, the FQ, and the empty category is an important aspect of Doetjes' theory since it provides an account of the agreement between the host NP and the FQ in languages such as French and German. As the contrast in (34) shows, the French FQ *tous* 'all' must agree syntactically with the host NP in gender.[33] Similarly, the German FQ *alle* 'all' must agree syntactically in Case with its host NP, as shown by the contrasts in (35):

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[33] Of course, *tous* 'all' must also agree in number with the host NP, as shown by (i), but this can be analyzed as semantic agreement, analogous to the semantic number agreement found with English FQ *each* in (ii). The ill-formedness of (iii) cannot be due to a failure of syntactic agreement since syntactically *each* is singular: cf. *each boy* vs. **each boys*.

(i) *Le garçon est tous allé à la plage.
the boys(sg) is all (pl) gone to the beach
(ii) The boys have each gone to the beach.
(iii) *The boy has each gone to the beach.

(34)a. ***Elles** sont **tous** allées à la plage.
they(f) have all(m) gone to the beach

'They (the women) all went to the beach.'

b. **Elles** sont **toutes** allées à la plage.
they (f) are all (f) gone to the beach

'They (the women) all went to the beach.'

(35)a. Peter hat **seinen Freunden** **allen / *alle** ein Buch gegeben.
Peter has his friends (DAT) all(DAT) / all(ACC) a book given

'Peter gave all of his friends a book.'

b. Peter hat **seine Freunde** * **allen / alle** gesehen.
Peter has his friends (ACC) all(DAT) / all(ACC) seen

'Peter has seen all of his friends.'

These facts are accounted for in Doetjes' theory by the circumstance that both the FQ and the host NP independently bind the same empty category. The host NP binds the empty category because it is movement of the host NPs that creates this empty category in the first place (subject NP from spec VP to spec IP and the cliticization of the pronominal object). The FQ also binds the trace because it c-commands and is coindexed with it. Since a binder and a bindee must agree in phi-features, and since the DP-trace is bound by both the FQ and the moved DP, it necessarily follows that the host NP and the FQ must agree with each other in phi-features as well.

In addition, Doetjes claims that the FQ is associated with a silent pronominal which, taking the host NP as its antecedent, provides the FQ with a restriction on its domain of quantification.[34] [35]

(36) $[_{QP}$ tous $[_{DP}$ pro $]]$

This claim receives some independent motivation from a peripheral aspect of French grammar. As discussed in Sportiche (1988), in some varieties of French *chacun d'eux* 'each of them', which is a full DP with a pronoun, can function as an FQ:

(37) **Les enfants** ont **[chacun d'eux]** acheté une voiture.
the children have each of- them bought a car

'The children each bought a car.'

Similarly, there are a few other full DPs, such as *tous les deux* 'both' (and *tous les trois* 'all the three'), which seem to contain a pronominal element and which can occur only in the floated position:

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[34] In Doetjes' theory, this hypothesized implicit pronominal is actually bound by the host NP, since the latter always c-commands the former. The binding principles do not apply, though, since the silent pronominal is not in an argument position. Note that Doetjes' account requires this restriction of the domain of application of the binding principles. In order to satisfy Principle A for the trace of the subject in (32a), Doetjes must assume that the entire IP is its governing category. Thus, if the hypothesized pronominal element in *tous* were subject to the binding principles, it would violate Principle B.

[35] This is to say that the FQ is a full-fledged noun phrase functioning as an adverb. An immediate question is how this nominal entity is syntactically licensed. While the answer to this question is not immediately obvious, Doetjes points out that nominals such as *yesterday* and *last week* in English, for example, can function as adverbs, and suggests that FQs are partially licensed in a similar way.

(38)a. **Les enfants** sont [**tous les trois**] allés à la plage.
the children are all the three gone to the beach

'All three of the children went to the beach.'

b. *[**Tous les trois**] (**les**) **enfants** sont allés à la plage.
all the three the children are gone to the beach

3.4.3. Modifications for Japanese

Since we now assume that the Japanese FNQ is an adverb, the generalized L-*tous* analysis is quite attractive in that it starts from the premise that all FQs are adverbs. In addition, Doetjes makes the interesting suggestion that a nominal element within the FQ determines its domain of quantification. We find this last point particularly attractive since in our view the Japanese classifier is precisely such a nominal element, only it is actually phonologically realized. Therefore, we follow Doetjes with regard to these two key aspects of her theory. However, since the Japanese facts cannot be accommodated if we adopt the generalized L-*tous* analysis as it is, we will make a few independently motivated modifications. In addition, we will argue that, in Japanese in any case, the nominal element internal to the FNQ, i.e. the classifier, is not pronominal but rather simply nominal; it does not depend on the host NP for the reference.

Assuming the VP-internal subject hypothesis, Doetjes assumes a single adverb position, i.e. the VP-adjoined position, for both the subject- and the object-oriented *tous*. However, our VP-cleft data show that the two Japanese FNQs must be generated in two distinct positions. Schematically, the VP-cleft data can be summarized as follows:

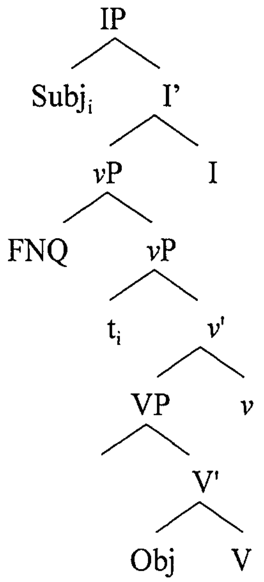
(39)a. *$[FNQ_{subj}$ O $V]_{VP}$

b. [O FNQ_{obj} $V]_{VP}$ or $[FNQ_{obj}$ O $V]_{VP}$

The subject-oriented FNQ cannot be a part of a clefted VP, while the object-oriented FNQ can. Thus, the Japanese clause structure must be such that the subject-oriented FNQ occupies a position outside the VP while the object-oriented FNQ occupies a position inside the VP. This is not compatible with a clause structure which allows only a single adverb position as a part of VP.

Let us first consider the position of the subject-oriented FNQ. It has to be outside the VP, so it cannot be in a VP-adjoined position. It has to be in a higher distinct maximal projection. The problem can be solved by adopting the 'little *v*P' hypothesis of the Minimalist Program (Chomsky 1995). According to this extension of Larson's (1988) analysis of ditransitive predicates, the VP-internal hypothesis of Koopman and Sportiche (1985, 1991) is modified so that subject DPs may be base-generated in spec *v*P, rather than in spec VP, where VP is the complement of *v*P. Given this set of basic assumptions, we propose that the syntax of the subject-oriented FNQ sentence is as shown in (40), where "Subj" and "Obj" stand for subject and object DPs, respectively:

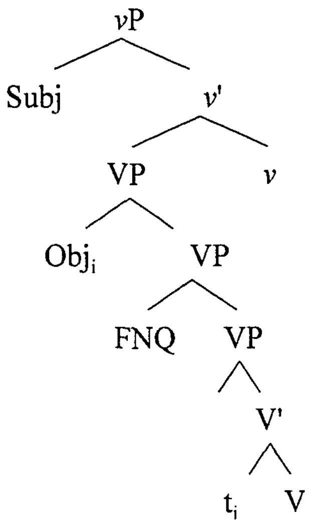
(40)



In accordance with Doetjes' adverbial analysis of the FQ, we assume that the FNQ is generated at an adjunction to *v*P. The subject is base-generated in spec *v*P, and raises to spec IP. Thus, the FNQ c-commands the trace of the host NP, satisfying Doetjes' licensing condition for FQs in (33). This accounts for the VP-cleft data, since in this position, the subject-oriented FNQ is not a part of a VP which undergoes clefting. This also captures the fact that the subject canonically precedes the FNQ on the assumption that the subject obligatorily raises to spec IP.

Let us now consider the object-oriented FNQ. In view of the VP-cleft data, it must occupy a position inside VP. Assuming that adverbs are uniformly base-generated in an adjoined position to a maximal projection as above, the object-oriented FNQ would be generated in the adjoined position to VP, as follows:

(41)



In (41), the object is generated as the complement to V and scrambled to the VP-adjoined position, which creates a trace c-commanded by the FNQ. This accounts for the VP-cleft data since the FNQ is inside a VP. Assuming that FNQ scrambling optionally occurs, with the FNQ moving up to another VP-adjoined position above the object DP, (41) also captures the fact that the object-oriented FNQ can naturally appear either to the right or to the left to the object. Thus, the linear order of the elements of such a predicate freely alternate between [Obj-FNQ-V] or [FNQ-Obj-V], depending on whether or not FNQ scrambling has occurred. Note here that the FNQ's optional leftward movement is assumed to yield the latter word order. The order [FNQ-Obj-V] could not alternatively be derived by reconstructing the object to its original position, for then the FNQ would not satisfy Doetjes' general licensing condition in (33). Furthermore, the scrambled object must be allowed to land in a VP-adjoined position, aside from a higher *v*P-adjoined position or an IP-adjoined position, since [Obj-FNQ-V] can form a constituent as we can see in the VP-cleft data, repeated below:

(42) John-ga shita-no-wa **[piza**-o **ni-mai** taberu-koto]-da-tta. (from 29)
J-NOM did-COMP-TOP pizza-ACC 2-CL eat-COMP-COP-PAST
FNQ_{obj}

'What John did was eat two slices of pizza./ What John did was eat pizza in a hurry.'

Thus, by upgrading the analysis of basic clause structure with recent assumptions of the Minimalist framework, we can successfully capture the Japanese data, while maintaining the key aspects of Doetjes' analysis.[36] Given that the licensing condition for an FNQ is its c-command of a trace of the host NP, we must assume that the subject and the object in Japanese obligatorily raise to higher positions in FNQ sentences. The obligatory subject-raising can be theoretically justified by assuming that the EPP (or some equivalent mechanism) is also at work in Japanese. As for the assumption that the object also obligatorily raises, it is not clear that this is as well motivated for Japanese as for French. In French, when an FQ is coindexed with the object, this object must be a pronominal clitic.

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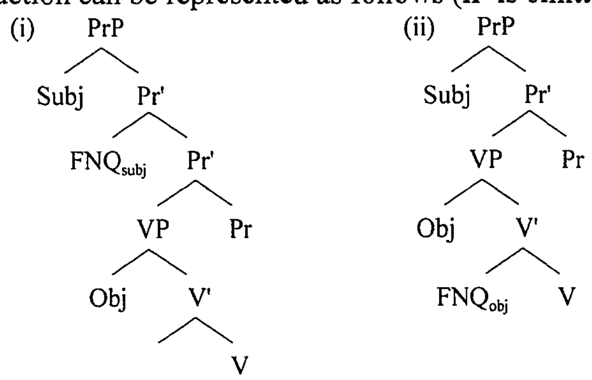
[36] It is worth noting, however, that an alternatiave, somewhat simpler, analysis is also possible under Bowers' (1993) account of basic clause structure. Bowers proposes a new maximal projection called Predicate Phrase (PrP) which occupies a position between the IP projection and the VP projection. (The semantic function of the head Pr is predication, which F-selects XP of V, A, P, N.) Under this analysis, the subject and the object are systematically base-generated under spec PrP and spec VP, respectively. Furthermore, adverbs are base-generated under an intermediate projection. Within this framework, then, the Japanese FNQ construction can be represented as follows (IP is omitted):



Since for independent reasons such a clitic is always raised to a preverbal position (beyond the FQ), its trace will always lie in the c-commanded domain of the FQ. In Japanese, on the other hand, the host NP of an object-oriented FNQ need not be pronominal and cannot be a clitic, so there seems to be little independent motivation for the hypothesized obligatory object movement. However, the simplest hypothesis is that UG provides only one licensing condition for FQs, not one for French and another for Japanese, so, on the basis of the French and German facts, we simply adopt Doetjes' general formulation of this licensing condition.[37]

Returning to Doetjes' analysis, another modification that we need to make concerns the status of the nominal element within an FQ that functions semantically as its first logical argument. As already noted, we find this suggestion extremely insightful and will argue that the classifier within the Japanese FNQ is precisely a nominal element with this semantic function. However, we reject the claim that it is a pronominal element dependent on the host NP for its reference. The problem with this hypothesis is that it posits, without independent motivation, a more complex semantic relation to the host NP than is needed to capture the facts. Let us first note that the hypothesis that the classifier is pronominal will not in any way restrict the distribution of the host NP. This is because the classifier does not occupy a

[37] There is another way of looking at Doetjes' licensing condition, though. Rather than taking (33) as a 'licensing' condition, for the Japanese FNQ, one might consider it a necessary consequence of forming an FNQ-modified predicate. On this alternative account, an FNQ needs no more licensing than any other adverb. However, if it is attached to a predicate, the host NP must "get out of the way" for semantic reasons. In other words, both the subject raising in (40) and the object raising in (41) would have to occur for type-logical reasons; the FNQ must be local to the predicate it modifies in order to be semantically interpreted. Thus, Doetjes' (33) would always result, though it would not actually license the FNQ. This alternative view of (33) will become more plausible later, after we have presented our semantic analysis. (Note also that it differs empirically from Doetjes' claim in that the hypothetical object raising would only be obligatory in an FNQ sentence.)

syntactic argument position, so the binding principles should not apply. However, something must supply a locality constraint to the host NP. Consider the following:

(43)a. ***otokonoko**-ga [Ken-ga **san-nin** dekaketa]-to itta.[38]
boy-NOM K-NOM 3-CL left-COMP said

(Intended) 'Three boys said that Ken left.'

b. *hikooki-ga **hikoojoo**-kara, **yon-kasho** tobitatta. (Fukushima 1991)
airplane-NOM airport-from 4-CL departed

(Intended) 'Airplanes departed from four airports.'

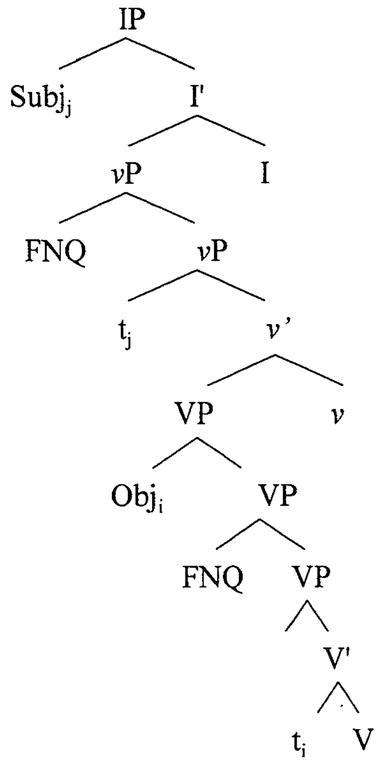
Not only must the host NP be in the same clause as its FNQ, as shown by the ungrammaticality of (43a), it generally must c-command its FNQ as well, as shown by the ungrammaticality of (43b). As we saw in chapter 2, there exist FNQ sentences in which the host NP does not c-command its FNQ, but these are special cases deserving special treatment. In general, there is a locality constraint on the distribution of the host NP in Japanese FNQ sentences, just as there is a locality constraint on the distribution of the host NP in FQ sentences in other languages. Given our adverbial analysis of the FNQ, there is no need to posit any special mechanism to explain this. It follows simply from the fact that, quite generally, adverbs must be semantically interpreted as affecting the meaning of the predicate they modify syntactically. Thus, the host NP must be local to its FNQ for the same reason that an NP semantically related to an adverb must be local to this adverb. For example, the sentence *John said Mary wisely answered the question* cannot mean 'John wisely said that Mary answered the question'. Likewise, *John's mother wisely answered the*

[38] This could be a grammatical sentence with a scrambled embedded subject, but it would then mean 'Ken said that three boys left'.

question attributes wisdom to John's mother, not to John. In both cases the 'subject-oriented' adverb *wisely* can only interact semantically with a local 'host NP'. Exactly the same general constraint accounts for the ungrammatical Japanese sentences in (43). Now, given that the FNQ has access to the host NP simply because it composes with a predicate which in turn composes with the host NP, there is no need for any anaphoric relation between the FNQ and its host NP. There is no work left for such an anaphoric relation to do. Thus, there is a theoretical reason (Occam's Razor) not to adopt the hypothesis that the classifier is a pronominal element. In addition, note that this 'pronoun hypothesis' would complicate, and conceivably preclude, the possibility of formulating a unified semantic analysis of the DNQ and FNQ. If the classifier is a pronoun taking the host NP as an antecedent in the case of the FNQ, what is the classifier doing in the case of a DNQ? What is its antecedent when the NQ is syntactically composed with the host NP? It is difficult to see how this question can be answered without positing very different semantic values for the DNQ and the FNQ. Thus, for theoretical reasons, we reject the pronominal hypothesis regarding the classifier. What we will propose instead is that the classifier is lexically more like a general noun such as *mono* 'thing', though it also has a crucial semantic property that is also found in singular pronouns. We return to this matter in chapter 5, when we give a formal account of the semantic relationship between the host NP and the NQ.

To sum up, we adopt two key assumptions of Doetjes' analysis, namely that the FNQ is an adverb and that it contains a nominal element. With the modifications we have discussed, we arrive at the basic structures schematically represented together in (44):[39]

(44)



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[39] The schema in (44) suggests that it should be syntactically possible for both a subject- and an object-oriented FNQ to occur in the same sentence. In our view, this is a correct prediction, though such sentences are semantically ill-formed (or they are at least too difficult to process to be acceptable) so intuition cannot attest to their syntactic well-formedness:

(i) ? **otokonoko**$_i$-ga kyoo **san-nin**$_i$ **hon**$_j$-o soko-de **ni-satsu**$_j$ katta.
boy-NOM today 3-CL book-ACC there-at 2-CL bought
'Three boys bought two books there.'

3.4.4. Scrambled NQs

In the last section we determined the syntactic structure of the FNQ construction. We saw that the subject-oriented FNQ occupies a position between the subject and the object at Spell Out, forming the word order [S-FNQ$_{subj}$-O-V], and the object-oriented FNQ occupies a position between the object and the verb at Spell Out, forming the word order [S-O-FNQ$_{obj}$-V]. In sum, the FNQ canonically follows its host NP. Thus, among the six NQ constructions we introduced at the outset of this chapter, the sixth one, exemplified in (45), does not follow this pattern, nor is it clear that if it is a DNQ:

(45) **san-nin** **gakusei**-ga hon-o katta.
3-CL student-NOM book-ACC bought
FNQ$_{subj}$ S O V

'Three students bought a book.'

Here, the subject-oriented NQ precedes the subject host NP. In addition, in the following sentences with object-oriented NQs, the NQ precedes the object host NP:

(46)a. John-ga **san-ko** **ringo**-o katta.
J-NOM 3-CL apple-ACC bought
S FNQ$_{obj}$ O V

'John bought three apples.'

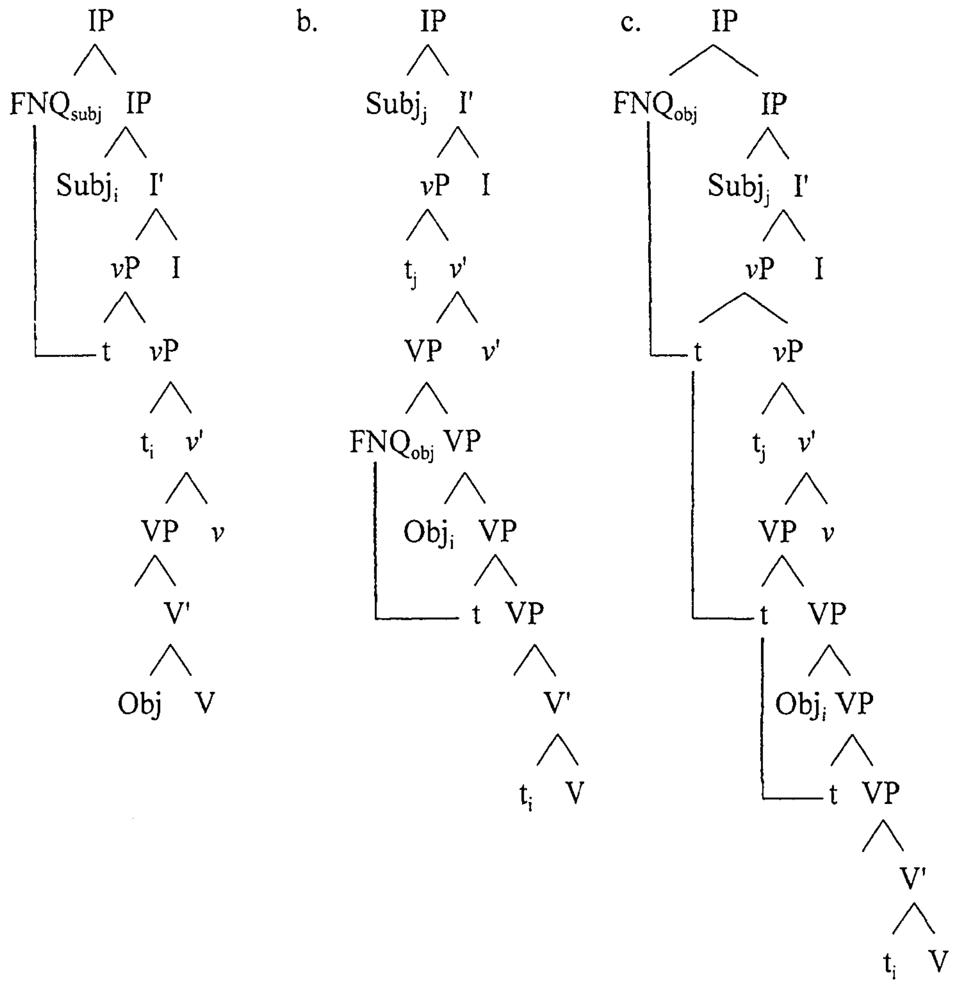
b. **san-ko** John-ga **ringo**-o katta.
3-CL J-NOM apple-ACC bought
FNQ$_{obj}$ S O V

'John bought three apples.'

We will claim that, structurally, these NQs are FNQs scrambled from their original base-generated adverbial position. This can be justified if such an analysis is grammatically feasible and if we can rule out alternative accounts of the sixth NQ construction.

First, let us address the question of how such a scrambling operation would work. In fact, this is quite simple. The word order shown in (45) and (46) can be quite easily obtained, assuming optional movement of the FNQ, as shown in (47):

(47)a. b. c.



FNQ_{subj} - S - O - V S - FNQ_{obj} - O - V FNQ_{obj} - S - O - V

In (47a), the subject-oriented FNQ can move upward and land in an IP-adjoined position. In (47b), the object-oriented FNQ can move upward and land in a VP-adjoined position. In (47c), the object-oriented FNQ can further move upward to an IP-adjoined position beyond the subject.[40] In either case, the FNQ scrambles to a higher position as an instance of optional XP-movement. Thus, our FNQ scrambling account is straightforward and poses no technical problem.

Next, let us consider whether we can eliminate alternative accounts of the sixth NQ construction. There are three conceivable alternatives. One is the hypothesis that the NQ and the host NP form a constituent in the observed surface word order, namely [NQ NP] in the case of (45) and (46a). (For the sake of the argument, let us put aside 46b when examining this alternative hypothesis.) A second alternative hypothesis is that the NQ is base-generated in surface position (though without forming a constituent with the NP), rather than moved from somewhere else. The third alternative hypothesis is that the NQs in the sentences in (45) and (46) are base-generated as DNQs and extracted out of their host nominal constituent (Kitahara 1992b).

Let us consider first the alternative hypothesis that [NQ NP] forms a constituent in the case of (45) and (46a). The coordination data and the pseudo-cleft data below argue against such an analysis:

[40] In (47c), the FNQ first moves to the VP-adjoined position, then to the *v*P-adjoined position, instantiating successive cyclic movement. As Marcel den Dikken points out to me, it is not exactly clear whether this is absolutely necessary in consideration of Relativized Minimality (Rizzi 1982). At this point, however, we will follow Chomsky's (1999) suggestion that extraction of material from a 'phase' requires a 'stop-over' at the edge of that phrase.

(48) Coordination: subject-oriented NQ

a. ?* [**san-nin nihonjin**]-to [**yo-nin kankokujin**]-ga kaisha-o tsukutta.
3-CL Japanese-and 4-CL Korean-NOM company-ACC founded

'Three Japanese and four Koreans founded a company.'

b. ?* kono eigakan-de kyoo
this movie theater-at today

[**ni-hon amerikaeiga**]-to [**ip-pon huransueiga**]-ga jooeisareru.
2-CL American movie-and 1-CL French movie-NOM be shown

'At this theater, two American movies and one French movie will be shown today.'

(49) Coordination: object-oriented NQ [41]

a. ?* Hanako-wa [**san-biki aji**]-to [**yon-hiki iwashi**]-o tairageta.
H.-TOP 3-CL mackerel-and 4-CL sardine-ACC ate up

'Hanako ate up three mackerels and four sardines.'

b. ?* Yuriko-wa kinoo, [**ni-hon amerika-eiga**]-to [**ip-pon huransu-eiga**]-o mita.
Y.-TOP yesterday 2-CL America movie-and 1-CL France movie-ACC saw

'Yuriko saw two American movies and one French movie yesterday.'

(50) Pseudocleft

a. * John-o mita-no-wa [**san-nin gakusei**]-da.
J.-ACC saw-that-TOP 3-CL student-COP

b. * yuriko-ga mita-no-wa [**san-bon gaikokueiga**]-da.
Y.-NOM saw-that-TOP 3-CL foreign movie-COP

Furthermore, Takano (1984) offers the following argument against the hypothesized constituency: If [NQ NP] were a constituent, it would have to be a nominal constituent, since it is followed by a case marker. If it were a nominal constituent, then the NQ would

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[41] (49) is taken from Terada (1990).

have to be a modifier of the NP, since Japanese is head-final. Furthermore, if the NQ modified the NP in [NQ NP], then it would be possible to add another modifier, such as a relative clause, forming either [NQ RC NP] or [RC NQ NP]. Takano then shows that neither of these two predicted sentence types are in fact grammatical:

(51)a. * [[oozei-no teki-to tatakatta]$_{\text{rel.cl.}}$ [**san-nin**] [**samurai**]$_{\text{headN}}$]- ga
a lot-GEN enemy-and fought 3-CL soldier-NOM

mura-ni kaettekita.
village-to came back

b. *[[**san-nin**] [oozei-no teki-to tatakatta]$_{\text{rel.cl.}}$ [**samurai**]$_{\text{headN}}$]-ga
3-CL a lot-GEN enemy-and fought soldier-NOM

mura-ni kaettekita.
villege-to came back

Thus, we may reject the first alternative hypothesis: [NQ NP] does not form a constituent.

The second alternative hypothesis is that the NQs in sentences such as (45) and (46) are base-generated in their surface positions, rather than scrambled there from an underlying canonical position. This might initially seem plausible since certain adverbs are base-generated in their surface position and take scope over whatever they c-command at this position.[42] However, a problem with such an analysis of the NQ construction in (45) and (46) is that it is unclear how it could possibly provide a uniform compositional account of the semantics of NQ sentences. Worse, there is a severe empirical problem. As we will see

[42] For example, Thomason and Stalnaker (1973) observe that (i) has a strong preference for the reading in which each bulb was tested slowly, while (ii) can be true if each bulb was tested quickly provided the bulb-testing event as a whole took a long time (due, say, to long coffee breaks between the testing of each bulb):

(i) He tested some bulbs **slowly.**

(ii) He **slowly** tested some bulbs.

in the next section, the scope of these NQs, which we claim to be scrambled FNQs, is precisely the scope of an unscrambled FNQ. Thus, we may reject this alternative hypothesis.

The third alternative hypotheses is that these NQs are extracted from DPs. This can also be immediately rejected on the basis of the observation we have just mentioned, i.e. NQs of the type in (45) and (46) have the same scopal interaction with other scope-taking operators as canonical FNQs.

In this section, we have shown how the construction in which the NQ precedes the host NP can be derived from the basic FNQ construction. We have discussed and rejected three possible alternative hypotheses, namely i) that it forms the constituent [NQ NP], ii) that the NQ is base-generated in the surface position and iii) that this NQ is a relocated DNQ. In conclusion, the NQ that precedes the host NP is a scrambled FNQ.

3.4.5 LF and Scope Relations

In this section, we consider the LF representation of the Japanese FNQ construction. Specifically, we will argue, following Hasegawa (1991), that the FNQ does not undergo QR, and that a scrambled FNQ is reconstructed into the canonical FNQ position.

Kuroda (1970) observed that in Japanese the scope interaction between the subject and the object is observed only when the object is scrambled over the subject, yielding the OSV order. Thus, while (52a) with the canonical SOV order yields only one interpretation, its scrambled version (52b) gives rise to a two-way ambiguity:[43]

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[43] The reading of (52b) which (52a) lacks can be paraphrased as "there are two specific languages which everybody knows." There is a strong preference for understanding (52a) as having a meaning paraphrasable as "everybody knows two different languages."

(52)a. daremo-ga [futa-tsu-no kotoba]-o shitteiru. S > O
everyone-NOM 2-CL-GEN language-ACC know
S O V

b. [futa-tsu-no kotoba]-o$_i$ daremo-ga t_i shitteiru. S > O / O > S
2-CL-GEN language-ACC everyone-NOM know
O S V
'Everyone knows two languages.'

In his influential work of quantification in Japanese, Hoji (1985) takes up this observation and offers a QR analysis of it. Under this analysis, the S-structure representation (52b) yields the following two LF representations:[44]

(53)a. LF1
[daremo-ga$_j$ [futa-tsu-no kotoba-o$_i$ [t_j t_i shitteiru]]]. S > O
everyone-NOM 2-CL-GEN language-ACC know

QR

b. LF2
[futa-tsu-no kotoba-o$_i$ [daremo-ga$_j$ t_i [t_j t_i shitteiru]]. O > S
2-CL-GEN language-ACC everyone-NOM know

QR(i)

QR(ii)

LF1 is derived from the scrambled S-structure representation (52b) via an application of QR to the subject, as shown in (53a). LF2 is derived from the scrambled S-structure

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However, strictly speaking, (52a) would be true of a situation in which the two languages that everybody knew happened to be the same. Thus, the meaning contrast between (52a) and (52b) is not really extensional but rather intensional.

[44] For expository purposes, in the discussion of QR in this section we will treat LF as a level of representation at which scopally ambiguous sentences are disambiguated syntactically, as in May (1977). All of the points that we will make would still hold if we alternatively assumed the LF theory of May (1985).

representation (52b) via two consecutive applications of QR; first an application of QR to the subject, and then an application of QR to the scrambled object. (This creates an intermediate trace at the scrambled site of the object.) For (52a), the only interpretation is LF1, in which the subject takes wide scope. Behind this absence of ambiguity is a general principle of relative scope preservation found in several languages, including Chinese and Japanese, but not in others.[45]

(54) If a quantifier Q1 takes scope over another quantifier Q2, Q1 must c-command Q2 or a trace of Q2 at S-structure. (Hoji 1985, cf. Huang 1982)

This accounts for the semantic difference between (52a) and (52b): In the S-structure representation in (52a), the object *futa-tsu-no kotoba* 'two languages' does not c-command the subject *daremo* 'everyone', nor a trace of it. Thus, only the LF representation in (53a) is licensed. In the scrambled sentence in (52b), in contrast, *futa-tsu-no kotoba* does c-command *daremo*, so both LFs in (53) are available for this sentence.

Hoji (1985) follows May (1977, 1985) in assuming that all quantificational phrases obligatorily undergo QR from their S-structure positions to higher A-bar positions at LF. More recently, however, Hornstein (1995) has proposed that a given quantificational phrase can in principle be interpreted even in its surface A-position. The data above can be accounted for under this proposal as well, retaining the scope order preservation principle in (54) but dropping the requirement that the S > O reading of (52a) and the O > S reading

[45] This principle does not apply in English, for example. Observe that the sentence in (i) is ambiguous between readings (ii) and (iii):

(i) A boy is holding every balloon.
(ii) $\exists$x [boy(x) [$\forall$y [balloon(y) [x is holding y]]]]
(iii) $\forall$x [balloon(x) [$\exists$y [boy(y) [y is holding x]]]]

of (52b) be derived by applications of QR. Instead, these scope readings would be read directly off s-structure.

Turning now to the Japanese FNQ sentence, Hasegawa (1991) points out that the same kind of scope interaction is not found in a sentence with an FNQ. Consider the following:

(55)a.	**kotoba**-o$_i$	daremo-ga	t$_i$	**futa-tsu**	shitteiru.	S > O
	language-ACC	everyone-NOM		2-CL	know	
	O	S		FNQ$_{obj}$	V	

b.	**kotoba**-o$_j$	**futa-tsu**$_i$	daremo-ga	t$_j$	t$_i$	shitteiru.	S > O
	language-ACC	2-CL	everyone-NOM			know	
	O	FNQ$_{obj}$	S			V	

'Everyone knows two languages.'

In (55a) the object is scrambled, and in (55b) the FNQ is scrambled in addition. Hasegawa notes that both sentences yield only one scope interpretation, namely S > O. While for (55a) this is not surprising since the subject *daremo-ga* 'everybody' c-commands the FNQ at Spell Out, it is noteworthy that (55b) has the same scope properties as (55a). In (55b), both the object host NP and its FNQ are in higher positions than the subject. Contrary to the scope order preservation principle, (55b) is not ambiguous, yielding only the narrow scope reading of the object.

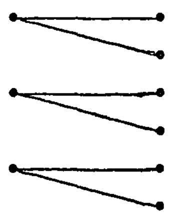
One may object to the choice of DPs here. The subject *daremo-ga* 'everyone' is a strong DP, while the object *kotoba-o* 'language' associated with the FNQ is a weak DP. The licensing of QR might be affected by this asymmetry in strength, resulting in the necessary narrow scope reading of the object. Therefore, it needs to be checked whether a sentence with a weak quantificational subject yields the same result. Consider, then, the sentence in (56), which differs minimally from (55b) in that the subject is a weak DP:

(56) **kotoba-o**$_j$ **futa-tsu**$_i$ san-nin-no gakusei-ga t_j t_i shitteiru.
language-ACC 2-CL 3-CL-GEN student-NOM know
O FNQ$_{obj}$ S V

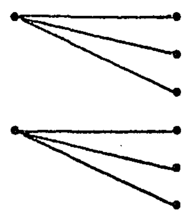
'Three students know two languages.'

In (56), the subject is now the weak DP *san-nin-no gakusei-ga* 'three students', a canonical instance of DNQ. The two logically possible scope readings may be represented as follows:

(57)a. wide students (subject) narrow languages (object)



b. wide languages (object) narrow students (subject)



What we observe, however, is that (57a) is the only reading available for (56).[46] Thus, Hasegawa's generalization holds: The object-oriented FNQ does not interact scopally with the subject DP; it always takes narrower scope, even when it precedes the subject in surface form.

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[46] For (56), the direct object *kotoba-o* 'language-ACC' and the scrambled FNQ *futa-tsu* '2-CL' are uttered without a pause. If a pause is inserted after *futa-tsu*, then the reading changes and (56) easily yields a wide scope reading of the direct object. However, as we have already pointed out, when the direct object forms a constituent with a postnominal NQ, it is not an FNQ but a DNQ. It is important to see that the wide scope reading of the object is not available when the NQ does not form a constituent with the preceding direct object, i.e. when it is truly an FNQ.

Following Hasegawa (1991), we take the absence of scopal ambiguity in FNQ sentences such as (55b) and (56) as strong evidence that the FNQ cannot undergo QR and moreover must reconstruct to its original pre-verbal position if it has been scrambled. Thus, (56), repeated as (58a), can only have the LF shown in (58b), abstracting away from movement of the subject.[47]

(58)a.	**kotoba-o**$_j$	**futa-tsu**$_i$	[san-nin-no	gakusei-ga	[t_j [t_i [t_j shitteiru]$_{VP}$]$_{VP}$]$_{VP}$]$_{IP}$.
	language-ACC	2-CL	3-CL-GEN	student-NOM	know
	O	FNQ$_{obj}$	S		V

'Three students know two languages.'

b. **kotoba-o**$_j$ (t_i) [san-nin-no gakusei-ga [t_j [**futa-tsu**$_i$ [t_j shitteiru]$_{VP}$]$_{VP}$]$_{VP}$]$_{IP}$.

reconstruction

We argue that the reason why the FNQ in (58a) must reconstruct at LF is that in general an FNQ can only be semantically interpreted in a predicate-modifying position, just like other adverbs.[48] In chapter 5 we will give a precise type-logical account of this. For the moment, let us simply note that the fact that an FNQ's scope is obligatorily determined by its original, base-generated, position local to a predicate is additional evidence of its adverbial nature.

We have argued that an FNQ cannot undergo QR and that a scrambled FNQ must reconstruct at LF. However, we have only examined sentences containing object-oriented FNQs. For completeness, we should check that these claims are not counter-evidenced by

[47] Note incidentally that the scrambled object *kotoba* 'language' cannot optionally reconstruct back to its base position sister to the verb because then the licensing condition for the FNQ would not be satisfied (see 33 above).

[48] Hasegawa also suggests that this obligatory reconstruction is due to 'some general principle that dictates interpretation'.

the behavior of subject-oriented FNQs. Consider, then, the following sentence, which contains a subject-oriented FNQ and a scrambled object (that contains a DNQ):

(59) futa-tsu-no kotoba-o$_i$ **gakusei**-ga, **san-nin** t$_i$ shitteiru. O > S / S > O
2-CL-GEN language-ACC student-NOM 3-CL know
O S FNQ_{subj} V

'Three students know two languages.'

In accordance with the scope order preservation principle in (54), this sentence is scopally ambiguous; it has both of the readings represented in (57). However, this does not challenge the claim that the FNQ is unable to undergo QR. Rather, the scopal ambiguity of (59) can be seen to follow simply from the fact that the scrambled object may optionally move to a lower scope position at LF. According to Saito (1989, 1992), reconstruction at LF is always an option for any scrambled material in Japanese. Thus, whether we take the position that all DPs (even scrambled ones) obligatorily undergo QR at LF,[49] or rather adopt Hornstein's (1995) view that QR is optional, as long as it is assumed that reconstruction at LF is an option, there will be two possible LFs for (59), as schematically represented in (60):

(60)a. LF1: O > FNQ_{subj}

No reconstruction; relative s-structure order of O and FNQ preserved

b. LF2: S > FNQ_{subj}

Reconstruction occurs; scrambled object returns to its pre-scrambled position

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[49] Since a scrambled DP already occupies an A-bar position, even within May's (1977, 1985) framework there would seem to be little motivation for the claim that it must obligatorily undergo further movement at LF.

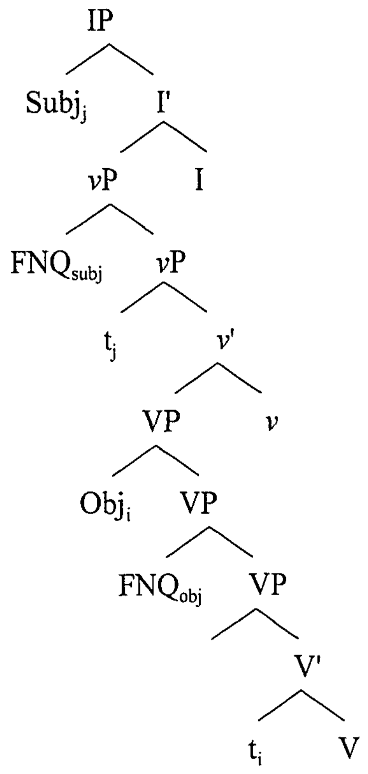
This accounts for the scopal ambiguity of (59) without requiring that the FNQ move at LF. The S>O scope order is obtained by taking the option of reconstructing the scrambled object and the O>S scope order is obtained by not taking this option.

In this section, we discussed the LF representation of the FNQ sentence. We examined Hasegawa's (1991) claim that the FNQ does not undergo QR and that a scrambled FNQ is reconstructed to the canonical pre-verbal FNQ position. We have concluded that this claim is justified: The scope of an FNQ is determined by its canonical position.

3.5. Summary

In this chapter, we have examined the syntax of the Japanese NQ construction. We argued for a basic syntactic distinction between the DNQ constructions and the FNQ constructions. The DNQ forms a constituent with the host NP, while the FNQ forms a constituent with the predicate and may be syntactically identified as an adverb. For the FNQ construction, we adopted two key aspects of Doetjes' FQ analysis, namely i) the hypothesis that the FNQ is an adverb, and ii) the hypothesis that the FNQ contains a nominal element, namely the classifier, that supplies the domain of quantification for the numeral. However, we rejected the hypothesis that the classifier is prenominal and, in order to make the analysis descriptively adequate for Japanese, we made some minor modifications. Adopting the *v*P hypothesis (Chomsky 1995), we concluded that the general schema of the syntactic structure of the Japanese FNQ construction is as shown in (63), which conforms to Doetjes' general licensing condition for FQs:

(63)



Given this canonical representation, we showed how the FNQ can be scrambled to a higher position preceding the host NP. Furthermore, we confirmed Hasegawa's (1991) claim that the FNQ does not undergo QR at LF and that a scrambled FNQ must reconstruct at LF. We promised to offer a semantic motivation for this obligatory reconstruction in a subsequent chapter. In our examination of the semantics of the FNQ in chapter 5 we will take it for granted that the FNQ is an adverb. As such, it must initially compose with the predicate.

CHAPTER 4

SEMANTIC ASSUMPTIONS

Leaving syntax behind, we now turn to semantics. In this chapter, we outline the background assumptions we will be making in our semantic analysis of the Japanese quantificational NQ in the next two chapters.

In English, a numeral typically is semantically associated with a common noun, e.g. *student* in *three students*, *glass* and *beer* in *three glasses of beer*.[50] The numeral does not directly modify a DP, but rather a plural count noun NP within it (*these three glasses* vs. **three these glasses*). Also in Japanese, the host NP of an NQ is a nominal expression of the common type, such as *gakusei* 'student' and *biiru* 'beer', but unlike English this is typically not overtly pluralized.[51] In order, then, to have a precise semantic analysis of the Japanese

[50] Note that *three glasses of beer* can either refer to three objects (glasses) or to a quantity of substance (beer) that has a certain measurement (three glasses worth). The former involves a quantificational reading of *three* (quantification over individuals) and the latter an amount term reading (quantification over a substance).

[51] It is grammatically possible for the host NP to have the overt plural-like suffix *-tachi*, as in *san-nin-no gakusei-tachi* '3-CL-GEN student-tachi'. In addition, it is possible for the host NP to be modified by an overtly plural demonstrative, as in *san-nin-no korera-no gakusei* '3-CL-GEN these-GEN student'. In the latter case, the numeral is used as an extra description of the phrase *korera-no gakusei* 'these students', much as if it were a non-

quantificational NQ, we must begin with a precise analysis of the denotation of the common noun in Japanese. This is what we discuss in section 4.1.

In chapter 2 we observed that the Japanese quantificational FNQ sentence is basically unambiguous, normally requiring a distributive reading, while the Japanese quantificational DNQ sentence is fully ambiguous between a distributive, collective, or partially collective reading. It is important to note that this latter sort of ambiguity is not particular to Japanese. In section 4.2, we observe that the ambiguity of the Japanese quantificational DNQ is paralleled in English with plural terms such as *three boys* or even bare plurals such as *boys*. In this section we also check the generality of the ambiguity of the DNQ. As we have seen in chapter 3, there are several different types of DNQ in Japanese. We show that the same ambiguity is found in all of them. In section 4.3, then, we review the relevant hypotheses in the semantics literature and formulate our assumptions.

4.1. The Denotation of the Noun

From a semantic perspective, a noun in a specific sentence can be categorized as a count term or a mass term on the basis of how it refers. Typically, a noun such as *book* is of the count type, and a noun such as *water* is of the mass type. In languages like English, the count term can be further divided into two types; singular terms, such as *(a) book*, and plural terms, such as *books*. In this section, we discuss the denotation of the nouns of these three types in English and Japanese.

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restrictive relative clause. The whole nominal expression is interpreted as 'these students, who are three in number'.

4.1.1. English

We start our discussion with some empirical observations and Link's (1983, 1984) analysis of the denotation of the NP. In English, the mass terms/count term is distributionally observable. For example, a count term can have a plural suffix while a mass term cannot (without a shift in meaning), as illustrated in (1); a count term can directly compose with a numeral while a mass requires a classifier, as illustrated in (2); and certain non-numeral quantifiers can only occur with count terms while certain other non-numeral quantifiers can only occur with mass terms, as illustrated in (3).[52]

(1)a. count:[53] b. mass:

a. count:	b. mass:
book —— books	water —— *waters (understood as quantities of water)
child —— children	sugar —— *sugars (understood as quantities of sugar)
man —— men	wood —— *woods (understood as quantities of wood)

(2)a. count: b. mass:

a. count:	b. mass:
three books	three glasses of wine
three buildings	three pinches of salt

(3)a. count: b. mass:

a. count:	b. mass:
many books —— *much book(s)	much water —— *many water
few books —— *little book(s)	little water —— *few water

These syntactic reflexes make it easy to distinguish a count term from a mass term in English. However, quite independently of formal properties, there is also a salient

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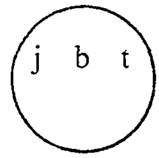
[52] See, e.g. Chierchia (1998b) for a more thorough review of the distributional differences.

[53] There are a few exceptional cases like *deer* whose singular and plural forms are identical, but these can be taken to have a phonetically null plural suffix when pluralized.

intuitive difference between referents of count and mass terms. As Pelletier and Schubert (1989) put it, a count term refers to a 'discrete, well-delineated group of entities' while a mass term refers 'without making it explicit how its referent is to be individuated or divided into objects'. To a large extent, this intuitive difference corresponds to a logical or perceptual distinction, namely the object/substance distinction. Thus, the count term *book* refers to a kind of object while the mass term *wine* refers to a kind of substance. An object may have parts but none of its parts are objects of the same type as the object they are parts of. In contrast, smaller portions of a given type of substance are just as much portions of that type of substance as the larger portions of it. However, as is well-known, the logical object/substance distinction does not correspond exactly to the linguistic mass/count distinction. There exist mass terms like *furniture* that do not refer to a substance but rather vaguely denote objects, and there are cases where a mass term and a plural count term refer to the same kind of object, e.g. *footwear* and *shoes*, *change* and *coins*. Moreover, the count/mass distinction varies arbitrarily across languages: e.g. English *leek* is a count term but Dutch *prei* 'leek' is a mass term; English *hair* (in the sense of a head of hair) is a mass term, but Italian *capello* 'head of hair' is a count term. We must conclude, then, that the mass/count distinction is fundamentally a linguistic (grammatical) distinction, though it bears some relation to an independent logical distinction between objects and substances.

Granted that the mass/count distinction is linguistic and that the actual classification of mass and count terms is language-specific, we still must determine what the semantic difference is between a count term and a mass term. Let us start with the count term. As noted in (1a), the English count term generally subdivides into singular and plural count terms.[54] Let us consider first the denotation of a singular count term such as *boy*. Traditionally, it is taken to denote a set of individuals each of which has the property of being a boy. Thus, if there are three boys, John, Bill, and Tom in a given context, then the denotation of *boy* is the set consisting of John, Bill, and Tom. This can be illustrated as in (4a), or alternatively as in (4b):

(4)a. ⟦boy⟧ = {j, b, t}   b. boy



Consider next a plural count term such as *boys*. Obviously, the set shown in (4) cannot represent the denotation of *boys*, since none of the elements in (5) has the property of being a group of boys. To capture the desired meaning here, Link (1983) proposes that a plural count term such as *boys* denotes a set of 'sums' of boys, where each sum is a plural individual consisting of some boys in the relevant context. So, for example, given again the three boys John, Bill, and Tom, a sum consisting of John and Bill would be an individual element of the set denoted by *boys*, since this sum does have the property of being a group of boys. Here Link makes use of the mathematical notion of a join-semilattice: Sums can be obtained by taking elements of a semilattice formed by joining the individuals in the context.[55] For the context consisting of three boys mentioned above, we can form a join-

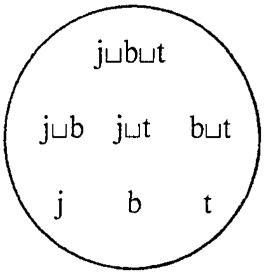
[54] A well-known exception to this generalization is the so-called 'pluralia tantum', which only has a plural form and which behaves like a mass term in that it can only be counted with the aid of a classifier:

(i) *a scissor — scissors
(ii) a pair of scissors

[55] It is a semilattice rather than a lattice because it contains no null element.

semilattice as shown in (5). The operator '$\sqcup$' creates sums by combining (joining) an object or sum, with another object or sum. For example, '$a \sqcup b$' stands for a sum consisting of a and b:

(5)



If we assume (5) for the denotation of *boys*, each sum in the upper two rows indeed has the property 'boys' in the model of the context in question. Each sum is an individual group of boys. However, each of the bottom three elements, namely j, b, and t does not have the property 'boys'. Rather, it is a singular or 'atomic' individual and has the property 'boy'. In view of this, it might seem that these atomic individuals ought to be excluded from the denotation of the plural count term *boys*. We will return to this question shortly. However, first let us examine the lattice structure in (5) a bit more closely.

In (5), any upper element and any immediately connected lower element are ordered by an 'individual part of' (i-part) relation. Link uses 'Π' as a label for the operation defining this relation. To be concrete, $\alpha \Pi \beta$ states that α is an i-part of β. Thus, given (5), the following formulas are valid:

(6) $j \Pi j \sqcup b$, $b \Pi j \sqcup b$, $j \sqcup b \Pi j \sqcup b \sqcup t$, $j \sqcup t \Pi j \sqcup b \sqcup t$, and so forth.

The i-part relation is transitive. That is, if α is an i-part of β and β is an i-part of γ, then α is an i-part of γ. Thus, the following also holds:

(7) $(j \Pi j \sqcup b) \wedge (j \sqcup b \Pi j \sqcup b \sqcup t) \rightarrow (j \Pi j \sqcup b \sqcup t)$

In addition, the i-part relation satisfies the following biconditional:

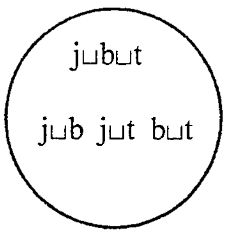
(8) $\alpha \Pi \beta \leftrightarrow \alpha \sqcup \beta = \beta$

Since $j \sqcup b$ is an i-part of $j \sqcup b \sqcup t$, the sum of the two sums, namely $(j \sqcup b) \sqcup (j \sqcup b \sqcup t)$, is $j \sqcup b \sqcup t$.

Link also notes that another relation may be defined for a join-semilattice such as (5), namely the 'atomic individual part of' (atomic i-part) relation. The operation defining this relation, which Link refers to with the symbol '$\bullet\Pi$', isolates the atomic individuals of a semilattice such as (5). Thus, for example $j \bullet\Pi j \sqcup b$ states that j is an atomic individual part of the sum $j \sqcup b$.

Returning to our examination of the plural count term, as we mentioned above, it seems as though the atomic individuals that generate a join-semilattice for a plural count term should not themselves be included in the denotation of this plural count term. Rather, it seems we should assume, following Hoeksema (1983), that the denotation of *boys* for the model we described above is as illustrated in (9):

(9) boys



Lasersohn (1988) and Schwarzschild (1990) take issue with this analysis, pointing out that it gives rise to an empirical problem with sentences like (10):

(10) No **boys** carried a chair upstairs.

Suppose there are three boys in the context, John, Bill, and Tom, and John carried a chair upstairs but Bill and Tom did not. According to the analysis in (9), (10) ought to be true in this case, since none of the sum individuals in (9) have the property 'carried a chair upstairs'. This is a very counter-intuitive result; (10) is clearly false if someone did carry a chair upstairs, even if this boy did so all by himself. However, Chierchia counters this argument by pointing out that a similar empirical problem arises when the quantifier *no* composes with a singular count term. Consider the sentence in (11) uttered as a description of a situation in which no boy carried a chair upstairs all on his own but a pair of boys together carried a chair upstairs:

(11) No **boy** carried a chair upstairs.

The analysis of singular count terms illustrated in (4) above predicts that (11) should be true of this situation, yet clearly (11) is false. Chierchia argues that the empirical problem brought to light by (10) and (11) indicates there is something wrong with our understanding of the semantics of *no* but has no bearing on the proper analysis of the English plural count term. We find this argument persuasive and therefore will assume, following Hoeksema (1983) and Chierchia (1998b), that a plural count term such as *boys* has a denotation such as illustrated in (9), where all atomic individuals are excluded. In sum, an English singular count term denotes a set of atomic individuals and an English plural count term denotes a set of sum individuals.

Link notationally distinguishes the singular and plural count terms as *P* and **P*, respectively. Thus, the plural term *boys* is associated with the plural operator '*', which in

English corresponds to the plural morpheme *-s* and its allomorphs. What we see in (9) is that the plural count term denotation is the closure of the singular count term denotation under the sum operation minus the atomic individuals. Thus, the following entailments hold:

(12)a. If BOY={j,b}, then *BOY={j⊔b}.

b. If BOY={j,b,t}, then *BOY={j⊔b, j⊔t, b⊔t, j⊔b⊔t}.

Given these denotations of the singular and plural count terms, now let us consider the definite article *the* in association with them. Link introduces 'σ' to represent the semantic value of this determiner. It composes with *boy* and *boys*, as follows:

(13) the boy: σ(BOY)

the boys: σ(*BOY)

A noun with the definite article *the* denotes the supremum, i.e. the sum of all the atomic individuals, if that supremum itself is a member in the set. Therefore, given the plural term *boys*, σ(*BOY) denotes the sum of all the atomic individuals (e.g. j⊔b⊔t in 9). Given the singular term *boy*, σ(BOY) also denotes the supremum. If there is only one boy in the given context, say John, then this entity j is itself the supremum. Thus, σ(BOY) denotes j. It is undefined if there is no boy, since in that case there is no supremum. It is also undefined if there are two or more boys, since in that case the supremum, the sum formed with all the entities, is not itself a member of the denotation of BOY: there are no sums in the set denoted by BOY .[56]

Furthermore, consider a complex NP with the conjunct *and* such as *John and Bill.* Following Link (1983) and Landman (2000), we will assume that the conjunct *and*

[56] In the singular case, σ is identical with the iota operator.

corresponds to the sum operator itself. Since *John* and *Bill* each denotes a singular individual, namely John and Bill, respectively, the plural NP *John and Bill* denotes the sum $j \sqcup b$. Thus, in Link's system, plural NPs such as *the boys* and *John and Bill* can be generally treated as denoting sums.

Let us now move on to the mass term. As Link (1983) observes, predication with a mass term is remarkably similar to predication with a plural term in that both show the 'cumulative reference property' (Quine 1960) illustrated below:

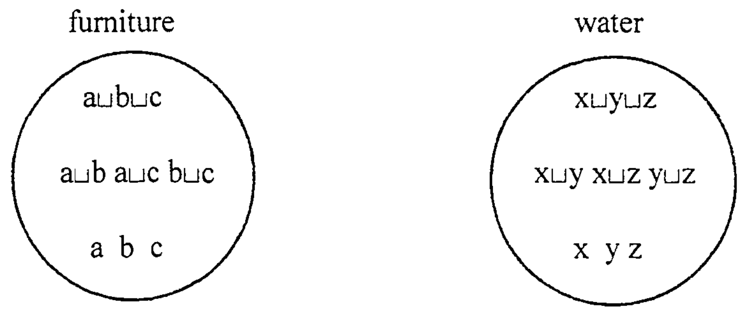
(14)a. If *a* is **water** and *b* is **water** then the sum of *a* and *b* is **water**.

b. If the animals in this camp are **horses**, and the animals in that camp are **horses**, then the animals in both camps are **horses**.

In both cases, if the term individually applies to two entities, then it applies to the sum of the two entities as well. Link argues that this shows that, for the most part, the denotation of a mass term has the same mereological structure as the denotation of a plural term. The amount of a given substance denoted by a mass term can be divided into ever smaller parts, with the term applying as much to the parts as to the whole. Similarly, the number of objects denoted by a plural term can be divided into smaller subsets to which the same plural term applies, at least down to a certain level (i.e. to sums consisting of 2 atomic individuals). The difference between the denotation of a mass term and the denotation of a plural term derives from the lexical semantic difference between a mass term and a count term. A count term identifies a discrete, countable, unit, i.e. an object of some type, so a plural count term has a lower bound defined by its atomic individuals. A mass term identifies a substance of a given type but not in terms of any kind of object that consists of that substance, so the mereological structure of the denotation of a mass term has no lower bound. In sum, Link proposes that the denotation of a mass term is a set of amounts that has the same kind of semilattice structure as the set of sums denoted by a plural term, only it lacks a lower bound; it is a bottomless hierarchy of ever smaller amounts of a substance of a given type.

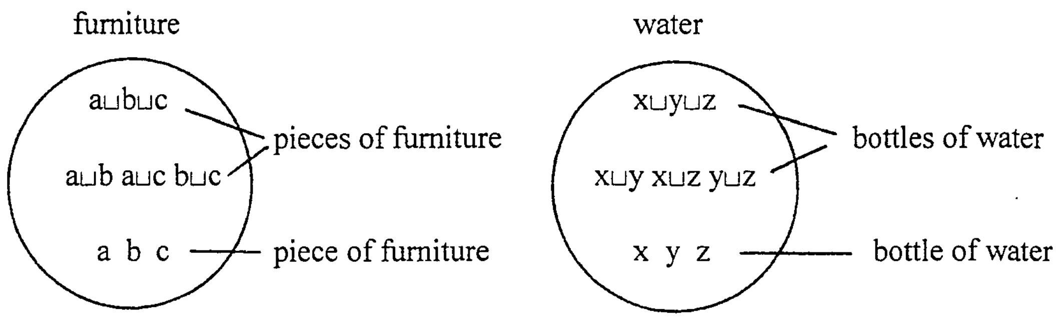
Link's analysis of the mass term takes us a long way towards unified theory of count and mass terms. However, Chierchia (1998a, b) proposes a revision that goes even further. He argues that the mereological structure of the denotation of a mass term is not only similar to that of a plural term; it is identical to it. Chierchia proposes that the denotation of a mass term is also generated by atomic entities; however, they are vague and undefined by the lexical semantics of the mass term. The vague atomic elements of a mass term can receive precise definition, though, from a classifier. In other words, while the atomic individuals of a count term denotation receive their definition lexically, the atomic amounts of a mass term denotation can only receive definition compositionally. In the case of English, where classifiers are themselves count terms, when a classifier composes with a mass term, the resulting expression has the structure of a singular term if the classifier is singular, of a plural term if the classifier is plural. For example, consider the mass terms *furniture* and *water*. The denotata of these two terms are logically or perceptually different; *furniture* vaguely refers to a kind of object while *water* refers to a kind of substance. However, this logical or perceptual difference is irrelevant. As far as grammar is concerned, both are mass terms and therefore they have the same denotation structure. Abstracting away from the vagueness of their atomic elements, the lexical denotations of *furniture* and *water* under Chierchia's analysis would be as illustrated in (15), assuming a model in which a, b, and c are objects having the property 'furniture' and x, y, and z atomic amounts of water:

(15)



Because the atomic objects in (15a) and the atomic quantities in (15b) are not lexically defined, the mass term *furniture* and *water* behave like plural count terms, which lack atomic individuals. For example, they compose with *the* in a exactly the same way. However, 'potential' atomic elements of a mass term become 'actual', so to speak, when a classifier gives them definition. In this case, the denotation of a mass term splits into a singular or a plural count term, depending on whether the classifier is singular or plural, as illustrated in (16) using the same context as for (15):

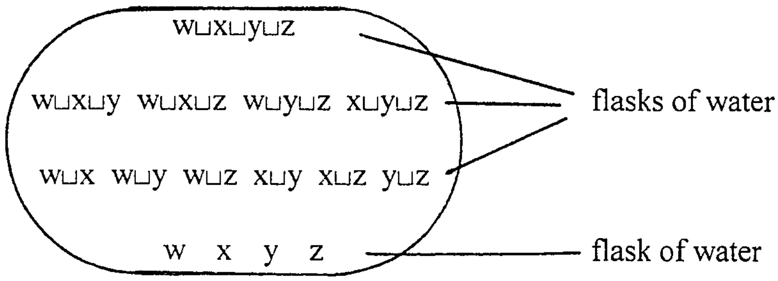
(16)



For the same context, if a different classifier were used, the atomic elements would receive a different definition, which in turn would give rise to a different instantiation of the semilattice structure, as illustrated in (17) (cf. 16b):

(17) (For concreteness, let us assume here that 1 bottle = 1.33 flasks.)

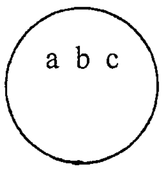
water



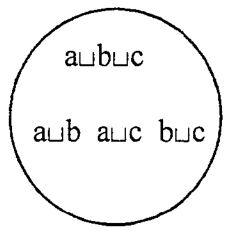
Summing up the discussion so far, under Chierchia's unified analysis of English count and mass terms, there are four kinds of quantifiable terms in total, as illustrated in (18) and (19):

(18) singular count | plural count

boy

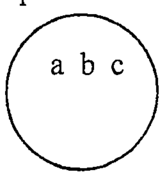


boys

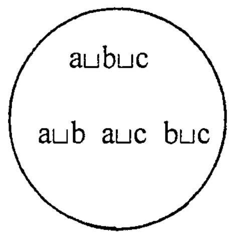


(19) singular mass-derived | plural mass-derived

piece of furniture



pieces of furniture



We will adopt this analysis for English and, in the next section, its extension to languages like Japanese that lack the linguistic count/mass distinction.

Before turning to Japanese, we should also mention the well-known 'shift' phenomenon observed with count and mass terms in English. The shift from count to mass is called 'grinding', and that from mass to count 'packaging' (Bach 1986).[57] For example, in non-standard usage a noun such as *rabbit*, which is lexically specified to be a count term, can alternatively be interpreted as a mass term in certain contexts, as illustrated in (20):

(20)a. Maria and Marty keep many rabbits in their backyard. (count)

b. Let's go shoot some more rabbit today. (mass)

Conversely, in non-standard usage a noun such as *sugar*, which is lexically specified to be a mass term, can be made into a count terms in certain contexts, as illustrated in (21):

(21)a. Peter bought two sacks of sugar. (mass)

b. "Two sugars, please," he said to the grocery store clerk. (count)

Packaging and grinding are clearly in special phenomena in some sense, since they are not unconstrained processes. For example, according to native speakers informants we have consulted, grinding cannot easily make (22a) acceptable, nor can packaging save (22b) from ill-formedness:

[57] In addition, mass terms can shift to a 'kind' reading, as in *Belgium has many beers*. We will ignore this phenomenon, since in this thesis we are systematically ignoring the generic reading of terms and sentences. As is well known (e.g. Carlson 1977), under a generic reading even an obligatorily distributive quantifier ceases to force the distributive reading of a sentence. Thus, for example, a generic reading of *Every Dutchman is a good sailor* would not be falsified by the existence of some Dutchmen who were not good sailors.

(22)a. #There's not enough chair in this room. (Some of us will have to stand.)

b. #I'd like two gasolines, please. (at a gas station, where gasoline is not sold in containers)

4.1.2. Japanese

At the outset of the previous section, we noted that the count/mass term distinction is grammaticized in English as obligatory selection of a plural marking suffix for plural count terms. This is not true of Japanese:

(23)a. is-satsu-no **hon**
1-CL-GEN book
'one book'

b. ni-satsu-no **hon**
2-CL-GEN book
'two books'

The same form *hon* 'book' is used for both the singular interpretation in (23a) and the plural interpretation in (23b). There is no obligatory plural morpheme comparable to English *-s*.[58]

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[58] Japanese does have pluralizing suffixes such as *tachi*, *ra*, *domo*; however, their use is always optional and their distribution is restricted to nouns denoting human beings:

(i) kodomo-tachi
child-tachi
'children'

(ii) gakusei-tachi
student-tachi
'students'

(iii) *ringo-tachi
apple-tachi

(iv) *hon-tachi
book-tachi

While the well-formed nominal expressions in (i) and (ii) can be interpreted as simply a plural number of the objects specified by the nouns in them, *-tachi* can also be attached to a pronoun such as *kanojo* 'she/her' or a proper noun:

(v) kanojo-tachi
'she and her people'

(vi) John-tachi
'John and his people'

Notice that, in these cases, *tachi* does not simply multiply the number of the people specified by the DP. Rather, as Kawasaki (1989) points out, DP-*tachi* refers to a set of people for whom the DP denotes the chief representative (in the speaker's mind).

Next, observe that the presence of a classifier is required both for counting things like books, that are logically objects, and for counting fluids like wine, that are logically substances:[59]

(24)a. ni-satsu-no hon
2-CL-GEN book

'two books'

b. *ni hon
2 book

c. ni-hai-no wain
2-CL-GEN wine

'two glasses of wine'

d. *ni wain
2 wine

Furthermore, we find cases where the same classifier can be used for both logical types of nouns:

(25)a. ni-**hon**-no enpitsu
2-CL-GEN pencil

'two pencils'

b. ni-**hon**-no biiru
2-CL-GEN beer

'two bottles of beer'

In sum, there is no overt indication of the count/mass distinction in Japanese. Rather, all Japanese nouns superficially seem to be mass terms.

In view of these basic facts, it has been suggested that all Japanese nouns are mass terms (cf. Muromatsu 1995, Chierchia 1998a, b for Chinese). That is, Japanese nouns are

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[59] There are several cases in which a numeral directly precedes a noun as shown below:

(i) san-ken
3-right
'three national rights'

(ii) san-gai
3-world
'three worlds' (Buddhism term)

(iii) ni-gon
2-word
'contradictory restatement'

(iv) ichi-ri
1-reason
'legitimacy'

However, these words are lexicalized and have special idiosyncratic meanings. Often they appear only in fixed expressions. Such direct composition of a numeral and a noun is by no means productive.

grammatically mass terms and it is only the nature of the classifier used with them that determines whether they have an interpretation that corresponds to an English count term or an English mass term. We might call this the 'mass hypothesis'. Under the version of this hypothesis developed in Chierchia (1998a, b), a Japanese object-denoting noun is lexically comparable to an English mass noun like *furniture* while a substance-denoting noun is lexically like English *water*. In both cases the atomic elements are undefined until a classifier gives them definition.[60] In addition, where a language like English has homophonous mass and count pairs such as count noun *brick* and mass noun *brick*, Japanese will simply have a single lexical entry that has a count or mass interpretation depending on which classifier is used (e.g. *biiru* 'beer').[61] Of course, the absence of the count/mass grammatical distinction does not in any sense weaken the perception of a logical difference between objects and substances. When no classifier is present, *hon* 'book' has a preferred object-denoting reading and *mizu* 'water' a preferred substance-denoting reading.

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[60] Note, however, that this relation between a classifier and the denotation of a noun is not the same as the agreement relation between a classifier and a host NP in an NQ sentence. The former relation, whereby the vagueness of a term's atomic elements is eliminated, has no effect on the distribution of nouns. The latter agreement relation, in contrast, does affect distribution, as we saw in chapter 3. We will return to this matter in section 5.2.2 in chapter 5.

[61] In (i) *brick* is a count term; in (ii) it is a mass term. In (iii) *biiru* 'beer' is an object; in (iv) it is a substance:

(i) He threw a **brick**.
(ii) This wall is made of **brick**.
(iii) **biiru**-o ip-pon kudasai
beer-ACC 1-CL give me
'Give me a bottle of beer.'
(iv) John-wa **biiru**-o ichi-deshirittoru koppu-ni sosoida.
J-TOP beer-ACC 1-CL glass-in poured
'John poured one deci-liter of beer into a glass.'

Now, if the Japanese grammar does not distinguish count and mass and all nouns are grammatically mass, how shall we describe the denotations of the Japanese noun? As we showed in (23), an object-denoting noun can have either a singular or a plural interpretation in Japanese without any overt sign of singularity or plurality. To be more explicit, the ambiguity can be shown in the following way:

(26)a. gakusei-ga kita.
student-NOM came

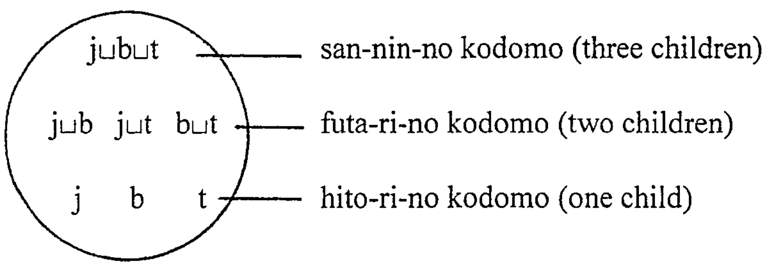
'A/the student came.'
'Some/the students came.'

b. John-ga hon-o katta.
J-NOM book-ACC bought

'John bought a/the book.'
'John bought some/the books.'

On the basis of parallel facts in Korean, Kang (1994) argues that the denotation of the Korean object-denoting noun includes both atoms and sums. Following Kang, then, we will assume that the denotation of the Japanese noun *kodomo* 'child/children' would be as follows:

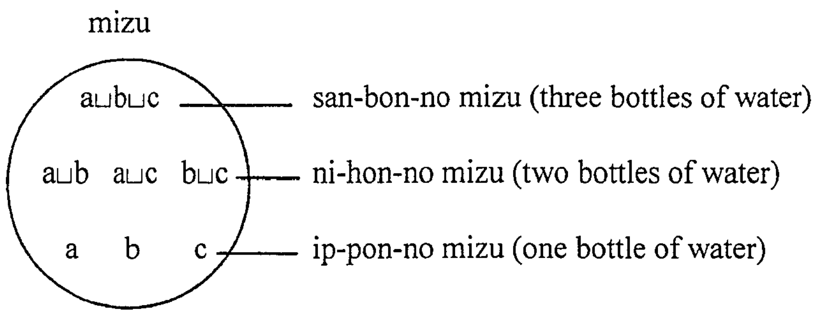
(27) kodomo



Note that (27) includes atoms j, b and t. These are undefined in the lexical denotation of *kodomo* but receive a precise definition from the classifier *nin*. The presence of atomic individuals in its denotation allows *kodomo* to have a singular reading. The fact that sum individuals are also included makes the plural reading of the same form possible. Thus, when a classifier is present, the denotation of the Japanese object-denoting noun is equivalent to the union of the denotations of an English singular term and an English plural term. This analysis allows us to capture the singular/plural ambiguity of the Japanese object-denoting noun with extreme simplicity.

Now, let us consider Japanese nouns such as *mizu* 'water', which intuitively denote substances. In the last section, following Chierchia, we adopted the view that the denotation of the mass noun is structured in terms of the unit specified by the classifier that occurs with it. Thus, if we are given the classifier *hon* (for bottles or cans), then the denotation of the substance-denoting noun such as *mizu* 'water' will be organized in terms of this particular unit. Furthermore, since there is no grammatical distinction between count and mass in Japanese, the denotation of the substance-denoting noun *mizu* 'water' would be equivalent in structure to that of the object-denoting noun *kodomo* 'children' in (27), including both atoms and sums. The denotation of *mizu*, then, can be represented as follows:

(28)



Thus, both the objects in the denotation of an object-denoting noun and quantities of substance in the denotation of a substance-denoting noun acquire a semilattice structure on the basis of the unit specified by the classifier. On the other hand, a Japanese sentence can contain an object- or substance-denoting noun without an NQ, as follows:

(29)a. John-wa tada mizu-o nonda.
J-TOP just water-ACC drank

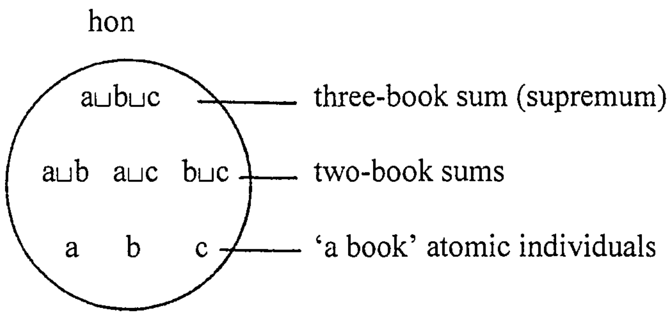
'John just drank some water.'

b. John-wa tada hon-o yonda.
J-TOP just book-ACC read

'John just read a book/some books.'

In such cases, the atomic elements are lexically undefined. We assume that here the speaker/listener accommodates a specific definition of the atomic elements as needed, often making use of perceptual information (knowledge of the world) in the case of object-denoting nouns, as represented in (30).[62]

(30)



To sum up, we adopt for Japanese Chierchia's (1998a, b) analysis of nouns in languages that lack the count/mass distinction. Specifically, following Kang (1994) as well, we assume that the denotation of the Japanese object-denoting noun includes atomic individuals as well as sum individuals and is structured in terms of the unit specified by the

[62] The same kind of perception-based accommodation seems to occur in English as well with object-denoting mass nouns like *furniture*. Consider the well-formedness of *John counted the furniture* (cf. **John counted the water*).

classifier. Lexically, such a noun is like the English mass term *furniture*. Together with a classifier, its denotation is equivalent to the union of the denotations of a singular and a plural count term in English.

4.2. The Ambiguity of the DNQ

Having outlined the basics of the noun denotation which we will be assuming, our next task is to show how the interpretation of plurality gives rise to the distributive, collective and partially collective readings discussed in chapter 2. Before turning this topic, though, let us briefly review and refine our description of these readings. In addition, in this section we will confirm that the four syntactically distinct types of DNQ identified in chapter 3 are all equally ambiguous as regards these three readings.

Observe first that the three readings arise with any plural term. Here, since our concern is the plural term, from this point on we focus on the object-denoting Japanese nouns compatible to English *furniture*, putting aside the substance-denoting nouns.[63] The English sentence in (31a) has a plural term *they* for the subject and the Japanese sentence in (31b) has a null subject. Suppose both these subjects refer to three boys, say, John, Bill, and Tom:

---

[63] Distributive and collective readings are irrelevant for sentences with an amount term, e.g. *three liters of milk*:

(i) Three liters of milk was consumed.

In such a sentence, the most natural interpretation is that the predicate *was consumed* applies to a single quantity of milk (hence *was* not *were*), which the sentence reports is three liters. Exactly the same observation holds in Japanese:

(ii) san-rittoru-no gyuunyuu-ga shoohisareta.
3-liter-GEN milk-NOM was-consumed
Three liters of milk was consumed.

Here, there is no sense of distributivity or collectivity.

(31)a. They bought books.

b. pro hon-o katta.
book-ACC bought

'(they) bought books.'

It is easy to see that for both sentences there are at least two distinct readings, a distributive one and a collective one, resulting from the interaction of the plural pronoun *they* and the null subject with the predicate:

(32)a. Distributive
John bought a book; Bill bought a book; and Tom bought a book.
(Three different books bought)

b. Collective
John, Bill, and Tom together bought a book.
(One book bought and not by any one person)

In addition, (31a) and (31b) would be true if, say, John and Bill bought a book together and Tom bought another book. This is what in chapter 2 we called the 'partially collective' reading. At this point, let us refine our conception of this. The partially collective reading is actually as much partially distributive as partially collective. This reading can be seen to be an instance of what is commonly called the 'cover reading' in the literature (Scha 1981). Consider the following sentences:

(33)a. Three composers wrote musicals. (Gillon 1987)

b. Four hundred firefighters put out the fires in Colorado. (Scha 1981)

As Gillon (1987) points out, (33a) is also true of the following situation type:

(34) Musician A wrote some musicals on his own, and
musician B wrote some musicals on her own, and
musician A collaborated with musician C to write some more musicals, and
musician B collaborated with musician C to write yet more musicals.

Similarly, (33b) can be true if different subsets of the 400 firefighters in question worked together to put out different fires. The only requirement for truth under the cover reading of (33a) and (33b) is that the total number of agents be three in the former case and four hundred in the latter. Likewise, the only requirement for truth under the cover reading of (31) above is that all the boys referred to participated in one way or another, individually or collectively, in the purchase of a book or books. Thus, the distributive, collective, and cover readings arise with any plural term; they are not semantically dependent on the presence of a cardinal quantifier.

Next, let us look again at the possible meanings of the Japanese DNQ sentence. We saw in chapter 2 that one type of DNQ, namely that of the form [NQ-no NP], is thoroughly ambiguous. For completeness, let us check that the other syntactically distinct Japanese DNQ constructions identified in chapter 3 are equally ambiguous between a distributive, collective, and cover readings.[64] First, consider (35), where each of the four different types of DNQ occurs in a sentence with a collective predicate, lexically forcing a collective reading if it is available.[65]

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[64] As we showed in chapter 3, section 3.3, two of the four different DNQ constructions have other kinds of ambiguity as well, i.e. partitive, restrictive, non-restrictive readings. In what follows we will abstract away from these other sorts of interpretations and focus on the quantificational interpretation of each of the four DNQ constructions.

[65] Recall that if a collective reading is not available, as in the case of an FNQ sentence, the truth conditions of a collective predicate can also be satisfied by a shift to amount quantification. In the case of a DNQ sentence, this is not necessary since, as (35) shows, the collective reading is readily available.

(35)a. [otokonoko kyuu-nin]-ga yakyuu chiimu-o henseishita.
boy 9-CL-NOM baseball team-ACC formed

b. [otokonoko-no kyuu-nin]-ga yakyuu chiimu-o henseishita.
boy-GEN 9-CL-NOM baseball team-ACC formed

c. [kyuu-nin-no otokonoko]-ga yakyuu chiimu-o henseishita.
9-CL-GEN boy-NOM baseball team-ACC formed

d. [otokonoko-ga kyuu-nin] yakyuu chiimu-o henseishita.
boy-NOM 9-CL baseball team-ACC formed

'(A group of) nine boys formed a baseball team.'

These sentences are all grammatical and all are true of a situation in which a group of nine boys together formed a baseball team. Thus, whatever syntactic form it takes, the DNQ sentence always allows a collective reading.

Next, consider the sentences in (36), which all contain the predicate *aruku* 'walk'. Since walking can only be a property of individual objects, *aruku* lexically forces a distributive reading.

(36)a. [gakusei san-nin]-ga aruita.
student 3-CL-NOM walked

b. [gakusei-no san-nin]-ga aruita.
student-GEN 3-CL-NOM walked

c. [san-nin-no gakusei]-ga aruita.
3-CL-GEN student-NOM walked

d. [gakusei-ga san-nin] aruita.
student-NOM 3-CL walked

'Three students (each) walked.'

These sentences are all grammatical and all are true of a situation in which each of three students walked. Thus, each of the four DNQ constructions is compatible with a distributive reading.[66]

Finally, to check that each type of DNQ sentence may receive a cover reading let us consider whether each of the sentences in (38) can be true of the cover situation (37), repeated from (34) above:

(37) Musician A wrote some musicals on his own, and
musician B wrote some musicals on her own, and
musician A collaborated with musician C to write some more musicals, and
musician B collaborated with musician C to write yet more musicals.

(38)a. [sakkyokuka san-nin]-ga korera-no kageki-o sakkyokushita.
composer 3-CL-NOM these-GEN musical-ACC composed

b. [sakkyokuka-no san-nin]-ga korera-no kageki-o sakkyokushita.
composer-GEN 3-CL-NOM these-GEN musical-ACC composed

c. [san-nin-no sakkyokuka]-ga korera-no kageki-o sakkyokushita.
3-CL-GEN composer-NOM these-GEN musical-ACC composed

d. [sakkyokuka-ga san-nin] korera-no kageki-o sakkyokushita.
composer-NOM 3-CL these-GEN musical-ACC composed

'Three composers composed these musicals.'

Indeed, the sentences in (38) can all be true of a situation of type (37). Thus, all four types of DNQ constructions may receive a cover reading.

In sum, each of the different kinds of Japanese DNQ sentences behaves exactly like an English sentence containing a cardinal quantifier, or, for that matter, like simple sentences

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[66] Recall that a single-event verification of a distributive reading is not a collective reading under our definition of the term. Thus, the fact that the sentence in (36) would also be true if the three boys walked together does not show that they also have collective readings.

such as in (31) above which have no numeral quantifiers but simply contain plural terms. This, of course, contrasts sharply with the case of the syntactically distinct Japanese FNQ sentence. Before considering the FNQ, though, we must clarify our theoretical assumptions as to what causes the ambiguity as to distributive, collective, and cover readings in the case of the DNQ.

4.3. Deriving the Ambiguity of the DNQ

In this section, we discuss how the distributive, collective, and cover readings of the DNQ can be accounted for in terms of the general theory of plurality we are assuming

4.3.1. Distributive and Collective Readings

We start with a formalization of the distributive and collective readings in the theoretical framework of Link (1983, 1984), as revised in Landman (2000). Consider the following sentences, assuming that the denotation of *John and Bill* is the sum individual $j \sqcup b$:

(39)a. John and Bill carried an armchair upstairs.

b. John and Bill walked.

c. John and Bill met.

(39a) can be true if John and Bill each carried a different chair upstairs. To account for the availability here of a distributive reading, Link posits the existence of a covert distributivity operator 'D', which can optionally apply to the semantic value of *carry a chair upstairs*.[67]

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[67] Roberts (1986, 1989) and Heim, Lasnik and May (1991) suggest that English floated *each* may be a phonetic realization of this D-operator.

Defining 'D' as in (40a) by means of the atomic part-of relation $\bullet\Pi$, and abbreviating the lexically derived semantic value of *carry a chair upstairs* as CARRY, the distributive interpretation of this predicate may be represented as in (40b):

(40)a. $D = \lambda P \lambda y \forall x[x \bullet\Pi y \rightarrow P(x)]$

b. $^{D}\text{CARRY} = \lambda P \lambda y \forall x[x \bullet\Pi y \rightarrow P(x)](\text{CARRY})$
$= \lambda y \forall x[x \bullet\Pi y \rightarrow \text{CARRY}(x)]$

Thus, the distributive reading of (39a) is interpreted as (41a), which entails (41b):

(41)a. $j \sqcup b \in {}^{D}\text{CARRY}$

b. $j \in \text{CARRY} \wedge b \in \text{CARRY}$

As for (39b), the predicate *walk* is an inherently distributive predicate. If a group of people are walking, then necessarily each person in this group is completely realizing the action of walking without the necessary participation of anyone else. To account for such lexically specified distributivity, Link posits meaning postulates such as the following:

(42) $\text{WALK} = {}^{D}\text{WALK}$

Given (42), (39b) can only be interpreted as (43a), which entails (43b):

(43)a. $j \sqcup b \in {}^{D}\text{WALK}$

b. $j \in \text{WALK} \wedge b \in \text{WALK}$

Turning to (39c), here we find that a distributive reading is not available; a collective reading is obligatory. This is because a collective verb such as *meet* does not include singular individuals in its extension; it denotes a set that only contains sum individuals. The

D-operator cannot apply, neither in the syntax nor in the lexicon.[68] Thus, (39c) is true or false depending on whether or not (44) holds:

(44) $j \sqcup b \in$ MEET

Finally, note that (39a), which contains a so-called 'mixed predicate', can also have a collective reading. This is because the extension of a mixed predicate includes both singular and sum individuals. Thus, when the D-operator does not apply, (39a) will be true or false depending on whether or not (45) holds:

(45) $j \sqcup b \in$ CARRY

Assuming that a distributive reading comes from the presence of the D-operator applying to the predicate, Link can also account for sentences such as the following:

(46)a. VP-conjunction
John and Bill met in the park and carried the piano upstairs.

b. Relative Clause (non-restrictive)
John and Bill, who met in the park, carried the piano upstairs.

For both of these sentences, which contain the lexically collective predicate *met in the park*, the matrix predicate *carried the piano upstairs* can be assigned a distributive reading. In the case of (46a), this can be captured by the interpretation in (47a), which is equivalent to (47b):

(47)a. $j \sqcup b \in \{x \in D: x \in \text{MEET} \wedge x \in {}^{D}\text{CARRY}\}$

b. $j \sqcup b \in \text{MEET} \wedge j \in \text{CARRY} \wedge b \in \text{CARRY}$

As for (46b), it involves a non-restrictive relative clause. If we assume that non-restrictive relative clauses are additional predications on the modified NP, then the meaning of (46b)

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[68] If it were applied, it would make (39c) necessarily true, violating a general principle of semantic well-formedness.

can be captured by predicate conjunction. Thus, the following interpretation can be given for (46b):

(48) $j \sqcup b \in \text{MEET} \wedge j \sqcup b \in {}^{D}\text{CARRY}$

Thus, sentences with VP-conjunction or non-restrictive relative clauses pose no problem for the D-operator hypothesis.

A problem does arise, though, with restrictive relative clauses. A sentence such as (49a) cannot be interpreted as (49b):

(49)a. The boys who were sleeping soundly formed a circle around a campfire.

b. $\sigma\,(^*\text{BOY}) \in {}^{D}\text{SLEEP} \wedge \sigma\,(^*\text{BOY}) \in \text{FORM}$

(Here, the meaning postulate applies: $\text{SLEEP} = {}^{D}\text{SLEEP}$)

Syntactically, the restrictive relative clause is a predicate on the noun *boys*, not the DP *the boys*. On the other hand, the main predicate predicates a property of the whole DP *the boys who were sleeping soundly*. (49b) ignores these syntactic facts, and consequently (49b) entails the nonexistence of boys who were not sleeping soundly and the nonexistence of boys who did not form a circle around a campfire. Obviously, (49a) has neither of these entailments; it can still be true if some other boys besides those referred to by *the boys who were sleeping soundly* were not sleeping soundly and did not form a circle around a campfire. We will see how we may handle a sentence with a restrictive relative clause immediately below. First, though, let us consider another problem for the D-operator hypotheses.

On closer examination, the interpretation of the sum individual seems to call for a further refinement, as Landman demonstrates. Consider the following sentence:

(50) The cards below 7 and the cards from 7 up are separated. (from Landman 1989)

The most salient interpretation of (50) is that the cards below 7 are put together in one stack and the cards from 7 up are put together in another stack, and that these two stacks of cards are separated from each other. Given what we have assumed so far, the subject *the cards below 7 and the cards from 7 up* denotes the sum of *the cards below 7* and *the cards from 7 up*, namely, the following:

(51) $\sigma(^*\{x \in \text{CARD}: x<7\}) \sqcup \sigma(^*\{x \in \text{CARD}: x \geq 7\})$

Recall that $\sigma(^*P)$ denotes the supremum, the sum of all the singular individuals. Thus, $\sigma(^*\{x \in \text{CARD}: x<7\})$ denotes the sum of all the cards from Ace to 6 in the four suits. If we identify each card *c* by a pair of subscripts, namely 1 to 13 for the number, and D (diamond), H (heart), C (clover) and S (spade) for the suit, then $\sigma(^*\{x \in \text{CARD}: x<7\})$ denotes (52):

(52) $c_{1\text{-}D} \sqcup c_{1\text{-}H} \sqcup c_{1\text{-}C} \sqcup c_{1\text{-}S} \ldots\ldots\ldots \sqcup c_{6\text{-}S}$

Likewise, $\sigma(^*\{x \in \text{CARD}: x \geq 7\})$ denotes the sum of all the cards from 7 to King for the four suits:

(53) $c_{7\text{-}D} \sqcup c_{7\text{-}H} \sqcup c_{7\text{-}C} \sqcup c_{7\text{-}S} \ldots\ldots\ldots \sqcup c_{13\text{-}S}$

Since these two sums are conjoined with *and*, the result is the following:

(54) $(c_{1\text{-}D} \sqcup \ldots . \sqcup c_{6\text{-}S}) \sqcup (c_{7\text{-}D} \sqcup \ldots . \sqcup c_{13\text{-}S}) = c_{1\text{-}D} \sqcup \ldots . \sqcup c_{13\text{-}S}$

This is what is denoted by *the cards below 7 and the cards from 7 up*, the subject of the predicate *separated*. Thus, the sentence in (50) would be interpreted as follows:

(55) $c_{1\text{-}D} \sqcup \ldots . \sqcup c_{13\text{-}S} \in \text{SEPARATE}$

However, this describes a situation in which the sum of all the cards are separated in any manner. It does not capture the intended reading, according to which the separation takes place only between the cards from ace to six, on one hand, and the cards from seven to king, on the other.

Worse, as Landman points out, since (56a) and (56b) end up having the same interpretation, (57), repeated from (50), is incorrectly predicted to have the same meaning as (58) or any similar sentence:

(56)a. $\sigma(^*\{x \in \text{CARD}: x<7\}) \sqcup \sigma(^*\{x \in \text{CARD}: x \geq 7\})$

b. $\sigma(^*\{x \in \text{CARD}: x<10\}) \sqcup \sigma(^*\{x \in \text{CARD}: x \geq 10\})$

(57) The cards below 7 and the cards from 7 up are separated.

(58) The cards below 10 and the cards from 10 up are separated.

In order to obtain the correct meaning for (57), so as to distinguish it from (58), it is necessary to assume some mechanism which distinguishes the two relevant groups. In light of this problem, Link posits an implicit 'group operator', represented by the up arrow '↑', which turns an individual sum into a group atom in its own right. The two plural NPs in (57), then, are interpreted each with this group operator, as follows:

(59) $\uparrow\sigma(^*\{x \in \text{CARD}: x<7\}) \sqcup \uparrow\sigma(^*\{x \in \text{CARD}: x \geq 7\})$

With this interpretation of the plural NP, and assuming that collective and mixed predicates contain group atoms in their extensions, the sentence in (57) is interpreted as follows:[69]

(60) $\uparrow\sigma(^*\{x \in \text{CARD}: x<7\}) \sqcup \uparrow\sigma(^*\{x \in \text{CARD}: x \geq 7\}) \in \text{SEPARATE}$

Given this group interpretation, (49) does not entail (50) or any similar sentence with a different number.

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[69] That is, SEPARATE includes in its extension not only the sum individuals in (55) and (56), but also group atoms formed of these sum individuals.

Now, given the group operator, we have a way to handle restrictive relative clause sentences such as (61), repeated from (49a):

(61) The boys who were sleeping soundly formed a circle around a campfire.

The following interpretation can be given for this sentence:

(62) $\uparrow\sigma(\text{*BOY} \in {}^{D}\text{SLEEP}) \in \text{FORM}$

This representation respects the syntax of the sentence: The distributive predicate *were sleeping soundly* applies to the noun *boys*, and the matrix collective predicate *formed a circle around a campfire* applies to the whole subject DP. Thanks to the group operator, the denotation of the subject DP need not be a set of singular individuals; it an be a group atom and therefore can be a member of the extension of the collective matrix predicate. In this manner, then, the distributive restriction on the NP does not apply to the whole DP.

A group atom is distinct from a sum individual. As we discussed earlier, a sum and its parts are ordered and related by the individual part-of relation. For a group atom, this relation does not hold, since a group is itself an atom. Thus, a group of boys (taken as a group atom) is not compatible with a predicate which applies only to singular atoms, such as *walk*. Landman (2000) notes that the ambiguity between a sum and group reading of a plural NP is systematic. A group atom can be formed from every sum individual. That is, while a plural NP only denotes a set of sums, a group atom can always be derived from each sum. Therefore, the denotation of a plural NP does not need to include group atoms as a lexical property. In contrast, collective and mixed verbs are lexically specified to contain group atoms in their extensions.

In sum, under Link's system, we are equipped with the following operations: In the nominal domain we have pluralization ('*') and group formation ('$\uparrow$'), and in the verbal domain we have distributivization ('^{D}'). As Landman (2000) points out, there arises a certain redundancy here. Link first distinguishes a distributive reading from a collective reading by letting the predicate be modified by a D-operator. A plural term can receive a collective reading when the predicate is not modified by a D-operator. However, later Link introduces the group operator to derive a group atom out of a sum, which also yields a collective reading. Thus, under Link's system, a collective reading can arise in two ways, as illustrated in (63), where a, b, and c stand for the three boys in question:

(63)a. Three boys carried the piano upstairs.

b. $a \sqcup b \sqcup c \in$ CARRY

c. $\uparrow(a \sqcup b \sqcup c) \in$ CARRY

In (63b), the predicate applies directly to the sum of the three boys; in (63c), it applies to the group derived from this sum. The collective reading asserted by (63b) is true if the assignment function specifies that, lexically, the extension of CARRY includes the sum individual $a \sqcup b \sqcup c$. The collective reading asserted by (63c) is likewise true or false depending on whether or not CARRY is lexically specified to include the group atom $\uparrow(a \sqcup b \sqcup c)$.

Landman argues that there is no empirical motivation to have the two mechanisms to yield a collective reading, and since there is, in fact, only one collective reading as far as intuition is concerned, a better theory of plurality would represent this in just one way. Landman proposes, therefore, a revision of Link's theory whereby the collective reading is only represented by group atoms occurring in the denotation of DPs and predicates, as in (63c). On this view the sum operator more closely corresponds to the semantic value of a coordinator like *and*, which makes possible but does not force a collective reading. Moreover, the group operator is restricted to the nominal domain; it cannot apply to any sum individual contained in the extension of a predicate, creating group atoms in a predicate that lexically lacks a collective interpretation. In Landman's theory, all predicates are lexically specified to contain only atoms in their extensions. Distributive predicates contain only singular atoms and therefore can never have a collective reading.[70] Collective predicates contain only group atoms, and therefore can only have collective readings.[71] Finally, mixed predicates contain both singular and group atoms, allowing these to have both distributive and collective readings.

The distributive reading of a plural term, then, is attributed to semantic plurality in the verbal domain, which parallels plurality in the nominal domain. This eliminates the need for the D-operator. That is, a distributive predicate is defined in terms of the plural operator * as follows, where AT is the lexically specified set of atoms of the extension P of any predicate:

(64) $\quad {}^{D}P = {}^{*}\{a \in AT: a \in P\}$

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[70] This replaces the meaning postulates such as (42):
$\text{WALK} = {}^{D}\text{WALK}$

[71] More precisely, collective predicates contain only group atoms and amounts in their extensions, the presence of the latter making it possible for a collective predicate to be true of a substance, e.g. *Snow gathered in the courtyard.*

Just as the plural operator can freely apply in the nominal domain to yield a plural term, it can also freely apply in the verbal domain, mapping a set of atoms to a semilattice consisting of atoms and sum individuals. For example, while WINK would be a 'singular predicate' denotation consisting only of singular atoms, *WINK would be a 'plural predicate' denotation consisting of singular atoms and sum individuals formed of these atoms. These two kinds of predicates would apply to DPs as follows:

(65)a. John winked. (66)a. $j \in \text{WINK}$

b. John and Bill winked. b. $j \sqcup b \in {*}\text{WINK}$

c. John winked and Bill winked. c. $j \in \text{WINK} \wedge b \in \text{WINK}$

The sentence in (65a) asserts a relation between the singular term *John* and a singular predicate and is interpreted as shown in (66a). (65b) asserts a relation between the plural term *John and Bill* and a plural predicate and is interpreted as shown in (66b). Sentence (65b) in fact entails (65c). This is captured by the entailment of (66c) by (66b), which follows from the circumstance that *WINK derives from WINK just as $j \sqcup b$ derives from j and b. Note that (66b) does not represent a collective reading. The predicate *wink* can never have a collective reading because it contains no group atoms in its extension. For this reason, the formulas in (67) are ill-formed (uninterpretable or necessarily false):

(67)a. $\uparrow(j \sqcup b) \in \text{WINK}$ (ill-formed)

b. $\uparrow(j \sqcup b) \in {*}\text{WINK}$ (ill-formed)

Crucially, note also that the group operation $\uparrow$ cannot apply to the verbal domain, adding $\uparrow(j \sqcup b)$ to the extension of *WINK. If this were possible, *wink* would have a collective reading, contrary to fact (cf. **The couple winked.*)

Next, let us consider an inherently collective predicate such as *meet*, which only contains group atoms in its extension:

(68)a. *John meets. (69)a. $j \in$ MEET (ill-formed)

b. John and Bill meet. b. $\uparrow(j \sqcup b) \in$ MEET (well-formed)

b'. $j \sqcup b \in$ *MEET (ill-formed)

b''. $\uparrow(j \sqcup b) \in$ *MEET (well-formed)

c. *John meets and Bill meets. c. $j \in$ MEET $\wedge$ $b \in$ MEET (ill-formed)

The sentence in (68a) is ungrammatical. This is because the predicate *meet* does not have singular atoms in its extension, so a formula such as (69a) is uninterpretable. For the same reason, (68b) cannot entail ungrammatical (68c). This is because (68b) can only be interpreted as in (69b). The formula in (69b') is uninterpretable, and therefore so is its entailment in (69c). However, (69b'') is well-formed. The plural predicate *MEET can simply be derived from the singular MEET, forming the semilattice with the group atoms each of which has the property of meeting. This means that the group of John and Bill is an element of the set of groups that met.

An important empirical advantage of this analysis is that it can handle the case of distribution over groups compositionally:

(70)a. The boys and the girls meet.

b. $\uparrow(\sigma(\text{*BOY}) \wedge \sigma(\text{*GIRL})) \in$ MEET

c. $\uparrow(\sigma(\text{*BOY})) \wedge \uparrow(\sigma(\text{*GIRL})) \in$ *MEET

Under the interpretation in (70b), the sentence in (70a) yields the reading in which there is a single meeting of all the boys and the girls. Under the interpretation in (70c), it yields the reading in which there is a meeting of the boys and another meeting of the girls.

In view of its simplicity and superior empirical coverage, then, we will be assuming Landman's revision of Link's theory of plurality as the theoretical framework for our analysis of the semantics of the Japanese quantificational NQ. There are two significant aspects of this theory that will become extremely relevant in the next two chapters. First, the availability of a collective reading for the DNQ will follow simply from the general theory of plurality we are assuming by application of the group operator to the denotation of a DP containing a DNQ. Second, this same general theory of plurality rules out the collective reading of a predicate which only contains singular atoms in its extension. That is, there is no operation or combination of operations that can map a set of singular atoms in the extension of a predicate into a group atom. This aspect of Landman's Linkian theory will become relevant when considering the FNQ.

4.3.2. Cover Reading

Let us now complete the picture by considering briefly the cover reading. The essential characteristic of this reading is that it only requires that the total number of singular atoms in the denotation of a plural term participate in one way or another in the event or situation denoted by the predicate. In particular, it does not specify whether a given individual among this set of singular atoms acts alone or together with others. For example, under a cover reading, the sentence *three students wrote a paper* is interpreted in such a way that, either singly or as a group, three students in total wrote a paper. Landman's account of this reading calls for a shift to quantification over events along the lines of Parsons' (1990) neo-Davidsonian semantic theory. In chapter 6 we will offer an alternative object-based account of this reading. For now, though, let us simply observe that the cover reading is only available when a collective reading is also available. This can be demonstrated simply by considering the contrasts in (71):

(71)a. Three boys winked. (cover not available)

b. Three boys met. (cover available)

c. Three boys wrote a paper. (cover available)

While a cover reading is possible for (71b) and (71c), which have a collective and a mixed predicate, respectively, it is not found with (71a). Why is this? For the same reason that a collective reading is not available with (71a), a distributive predicate like *wink* contains no group atoms in its extension. In general, the cover reading requires the presence of group atoms in the denotation of the predicate. If this lacks group atoms, there is no way that it can be true that two or more of the singular atoms in the denotation of an argument DP participate as a group in the event or situation in question. Conversely, though we have not yet shown exactly how we capture it, whenever a predicate does include group atoms in its lexically specified denotation, both a collective and a cover reading will be available.

4.4. Summary

In this chapter, we have discussed our semantic assumptions regarding the lexical denotation of Japanese nouns and their plural interpretations. We have adopted Chierchia's proposal that, lexically, all Japanese nouns are like English mass nouns, with the ones that denote objects having a denotation analogous to that of English *furniture*. When such object-denoting terms co-occur with a classifier, they acquire a denotational structure equivalent to that of the union of an English singular and a plural count term. In the absence of a classifier, such a denotation structure remains undefined by the grammar but can be accommodated by the speaker/listener. The result is that a Japanese object-denoting term like *hon* 'book' or *hito* 'person' can always yield either a singular or a plural reading. We then showed that, adopting Landman (2000), the collective reading of the Japanese 'singular+plural' term can always be derived for a DP by application of the group operator. Thus, the fact that all four of the syntactically distinct types of Japanese DNQ sentences allow a collective reading with collective and mixed predicates can be accounted for simply in terms of application of this group operator. We also saw that all DNQs can occur with a cover reading, and this may be seen to follow from the fact that whenever a collective reading is available a cover reading is available as well. Finally, we noted that the group operator must be restricted to the nominal domain. As we will see, this will have relevance to the obligatory distributive reading of the FNQ.

CHAPTER 5

SEMANTICS OF THE QUANTIFICATIONAL FNQ

In this chapter, we examine the semantics of the Japanese floating NQ. As we mentioned in the introduction, the principal semantic questions are: i) what is the proper treatment of quantification in the case of the Japanese FNQ that has a numeral classifier and ii) how can one account for the general requirement the sentences containing such an FNQ receive a distributive interpretation. We will address the second question in close connection to the first. Given that the predominance of a distributive reading with the quantificational FNQ sentence is a systematic phenomenon, we believe the correct explanation of this distributivity phenomenon must follow from a proper analysis of Japanese FNQ quantification over individuals. Such an analysis should also be compatible with the syntactic and semantic assumptions we laid out in the last two chapters.

Chapter 5 proceeds as follows: In 5.1, we discuss some proposals in the relevant prior semantic literature on FQs in general and on Japanese FNQs in particular. In 5.2, we propose our semantic analysis of the Japanese quantificational FNQ within the generalized quantifier theoretical framework. We do this by first separately discussing the three basic components of quantification, namely, the quantifier, its first argument and its second argument. Here we also discuss the relationship between the FNQ and its host NP. In section 5.3, we show how the proposed analysis accounts for all the data showing the distributivity phenomenon that was presented in chapter 2. In section 5.4 our analysis is extended to cover the FNQ sentence with a special type of classifier that ranges over events, rather than objects, i.e. what we call the 'event classifier'.

5.1. Distributivity and the FQ Literature Review

In this section, we examine key hypotheses in the semantics literature relevant to an account of the meaning of the quantificational FNQ. First, we briefly review three basic analyses of distributivity, namely, predicate distributivity, determiner distributivity, and the scope account of distributivity. Then we turn to a few notable semantic accounts of the FQ to see whether they may apply to the Japanese quantificational FNQ. Specifically, we discuss an important early work of Dowty and Brodie (1984), who analyze the English FQ as a VP-quantifier, the D-operator analysis by Link (1987), and another VP-quantifier analysis proposed by Fukushima (1991), which is specifically for Japanese. Then we discuss Junker (1990), who analyzes the FQ as a D-operator quantifying over events, and another event quantificational analysis recently proposed by Nakanishi (2002a,b), which also specifically applies to Japanese.

5.1.1. Predicate and Determiner Distributivity and the Scope Account

We start our discussion with some earlier attempts to derive distributive readings purely from lexical properties or purely from quantifier scope interactions.

Bennett (1974) showed that certain distributive/collective interpretations are directly determined by the lexical semantics of predicates. As we illustrated in chapter 2, and, as we discussed in chapter 4, distributive predicates such as *walk*, *sleep*, and *eat* force a distributive reading; abstracting away from amount quantification, collective predicates such as *gather*, *form a circle*, and *sing in chorus* force a collective or a cover reading, and mixed predicates such as *make a boat*, *buy a book*, etc. allow any reading.[1] However, clearly this will not account for the distributive reading of the Japanese quantificational FNQ. Consider the following table which summarizes the ways in which NQ type (DNQ or FNQ) and predicate type interact, when NQ quantifies over individuals:

(1) Interaction of quantificational NQ type and predicate type

	NQ Type	**Predicate Type**	**Available Readings**
a.	DNQ	Distributive	Distributive
b.	DNQ	Collective	Collective/Cover
c.	DNQ	Mixed	Distributive/Collective/Cover
d.	FNQ	Distributive	Distributive
e.	FNQ	Collective	**Ill-formed**
f.	FNQ	Mixed	**Distributive**

[1] That a collective predicate can allow a cover reading is shown by the fact that a sentence such as *Fifty thousand demonstrators gathered in front of various government buildings last Saturday* can be true without all 50,000 demonstrators having gathered in front of each of the government buildings referred to.

Distributivity can also be attributed to lexical semantics in the case of certain determiners. Scha (1981) offers a classification of determiners in terms of distributive/collective interpretation. According to Scha, determiners such as *every* and *each* require a distributive interpretation, while numerals such as *two* and *three* allow distributive, collective and cover readings.[2] However, the situation in the case of the Japanese NQ is as follows:

(2) Effect of quantificational NQ type

	NQ Type	**Available Readings**
a.	DNQ	Distributive/Collective
b.	FNQ	**Distributive**

According to Scha, the numeral determiner is an ambiguous category. This correctly predicts the case of Japanese DNQs, as shown in (2a). But Scha's classification does not cover the FNQ, since syntactically it is not a determiner, and even if it were (as the syntactic movement approach maintains), the analysis would break down since the FNQ sentence is not ambiguous. One possible move at this point would be to posit that the Japanese numeral has two entries in the lexicon, a non-distributive one for the DNQ and an obligatorily distributive one for the FNQ. However , this would beg the question of why only the distributive one

[2] All English native speakers seem to agree with the judgements in (i), (ii) and (iv); however, some reportedly find (iii) grammatical, or at least acceptable, while others do not:
(i) *Every boy gathered in the yard.
(ii) *Each boy gathered in the yard.
(iii) ?Every boy I knew gathered in the yard.
(iv) *Each boy I knew gathered in the yard.

could occur with an FNQ. Thus, the distributive reading of the FNQ sentence cannot solely be attributed to the lexical characteristics of the NQ.

Next, let us consider whether the systematic distributive reading of the Japanese FNQ can be accounted for in terms of scope theory. In fact, we already know that this will not work since, as we discussed in chapter 3, the Japanese FNQ does not undergo QR but rather is always interpreted in situ. Furthermore, while the subject-oriented FNQ can take either wide scope or narrow scope relative to the object, the object-oriented FNQ always takes narrow scope relative to the subject, and yet both FNQs always yield a distributive reading. However, the futility of attempting to account for the distributivity phenomenon in terms of a scope mechanism does not only follow from these observation; even in English distributivity cannot possibly be explained by scope theory. Let us examine this matter a little more closely.

An English plural term such as *three boys* is ambiguous as to a collective or distributive reading, and this is determined by the presence or absence of the group operator, as we saw in chapter 4. Now, note that the presence or absence of the group operator has nothing to do with any scope mechanism such as QR. To see this, let us examine the possible scopal interactions of plural terms as described in Landman (1996). Landman argues for the existence of eight readings for a sentence such as *Three boys invited four girls*. These are shown in (3). The symbol label of each reading is the underlined heading in (i) through (viii). The box below each reading schematically illustrates the situation type which verifies it. Putting technical details aside, let us concentrate on the scope analysis here, which is described in abbreviated form after each reading label. 'Sum' entails a distributive reading, and 'group' entails a collective reading:

(3) Three boys invited four girls.

Terminology:

in the logical representations:

- x, y, a, b = object variables
- e = event variable
- $*$ = plurality marker
- $\uparrow$ = function from individual sum into group atom
- $Ag(e)$ = the agent of event e
- $Th(e)$ = the theme of event e
- $At(x)$ = atom of x

in the situation diagrams:

- $a, b, c, \ldots$ = boys
- $1, 2, 3, \ldots$ = girls
- $\alpha \rightarrow \beta$ = α invites β
- $\uparrow$ = function from individual sum into group atom
- $\sqcup$ = sum operator

(i) $\underline{D_S (C_O)}$ subject: sum & QR-ed
object: group & in-situ

$$\exists x \in *BOY{:}\ |x|=3 \ \wedge\ \forall a \in AT(x){:}$$
$$\exists e \in INVITE{:}\ Ag(e)=a \quad \wedge\ \exists y \in *GIRL{:}\ |y|=4 \ \wedge\ Th(e)= \uparrow(y)$$

$a \rightarrow \uparrow(1 \sqcup 2 \sqcup 3 \sqcup 4)$
$b \rightarrow \uparrow(5 \sqcup 6 \sqcup 7 \sqcup 8)$
$c \rightarrow \uparrow(9 \sqcup 10 \sqcup 11 \sqcup 12)$

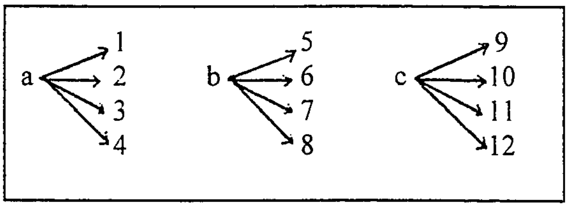
(ii) $\underline{D_O (C_S)}$ subject: group & in situ
object: sum & QR-ed

$$\exists y \in *GIRL{:}\ |y|=4 \ \wedge\ \forall b \in AT(y){:}$$
$$\exists e \in INVITE{:}\ \exists x \in *BOY{:}\ |x|=3 \ \wedge\ Ag(e)= \uparrow(x) \wedge\ Th(e)= b$$

$\uparrow(a \sqcup b \sqcup c) \rightarrow 1$
$\uparrow(d \sqcup e \sqcup f) \rightarrow 2$
$\uparrow(g \sqcup h \sqcup i) \rightarrow 3$
$\uparrow(j \sqcup k \sqcup l) \rightarrow 4$

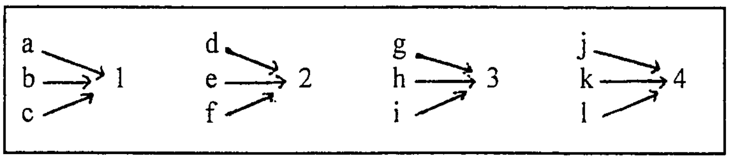
(iii) $\underline{D_S (D_O)}$ subject: sum & QR-ed
object: sum & in situ

$$\exists x \in {}^*\text{BOY}: |x|=3 \;\wedge\; \forall a \in \text{AT}(x): \exists y \in {}^*\text{GIRL}: |y|=4 \;\wedge\; \forall b \in \text{AT}(y): \\ \exists e \in \text{INVITE}: \text{Ag}(e)= a \;\wedge\; \text{Th}(e)= b$$



(iv) $\underline{D_O (D_S)}$ subject: sum & in situ
object: sum & QR-ed

$$\exists y \in {}^*\text{GIRL}: |y|=4 \;\wedge\; \forall b \in \text{AT}(y): \exists x \in {}^*\text{BOY}: |x|=3 \;\wedge\; \forall a \in \text{AT}(x): \\ \exists e \in \text{INVITE}: \text{Ag}(e)= a \;\wedge\; \text{Th}(e)= b$$



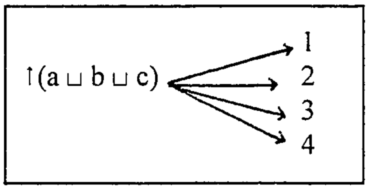
(v) $\underline{(C_S\, C_O)}$ subject: group & in situ
object: group & in-situ

$$\exists e \in \text{INVITE}: \exists x \in {}^*\text{BOY}: |x|=3 \;\wedge\; \text{Ag}(e)= \uparrow(x) \;\wedge \\ \exists y \in {}^*\text{GIRL}: |y|=4 \;\wedge\; \text{Th}(e)= \uparrow(y)$$

$$\boxed{\uparrow(a \sqcup b \sqcup c) \rightarrow \uparrow(1 \sqcup 2 \sqcup 3 \sqcup 4)}$$

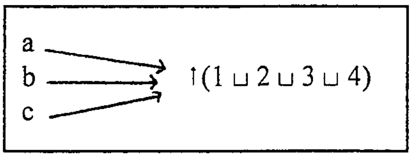
(vi) $\underline{(C_S\ D_O)}$ subject: group & in-situ
object: sum & in-situ

$$\exists x \in {}^*\text{BOY}: \ |x|=3 \ \wedge \ \exists y \in {}^*\text{GIRL}: |y|=4 \ \wedge \ \forall b \in \text{AT}(y): \\ \exists e \in \text{INVITE}: \ \text{Ag}(e)= \uparrow(x) \ \wedge \ \text{Th}(e)= b$$



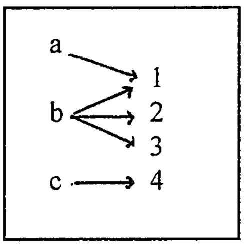
(vii) $\underline{(D_S\ C_O)}$ subject: sum & in-situ
object: group & in-situ

$$\exists x \in {}^*\text{BOY}: \ |x|=3 \ \wedge \ \exists y \in {}^*\text{GIRL}: |y|=4 \ \wedge \ \forall a \in \text{AT}(x): \\ \exists e \in \text{INVITE}: \text{Ag}(e)=a \ \wedge \ \text{Th}(e)= \uparrow(y)$$



(viii) $\underline{(D_S\ D_O)}$ subject: sum & in-situ
object: sum & in-situ

$$\exists e \in {}^*\text{INVITE}: \quad \exists x \in {}^*\text{BOY}: \ |x|=3 \ \wedge \ {}^*\text{Ag}(e)= x \ \wedge \\ \exists y \in {}^*\text{GIRL}: \ |y|=4 \ \wedge \ {}^*\text{Th}(e)= y$$



In English, in which the subject and the object NPs relatively easily take wide or narrow scope, the eight readings shown here do indeed seem to exist, as Landman claims, though the presence of some readings as distinct from others may be controversial.[3] [4]

In Landman's analysis, QR (equivalently quantify-in) is associated with wide scope taking. However, a distributive reading of an NP (being a sum) is not necessarily related to QR or wide scope taking: Although QR-ed elements take wide scope and these wide scope elements are interpreted distributively in (i)-(iv), in-situ elements that take narrow scope are interpreted distributively (being a sum) in (iii) and (iv) as well. Furthermore, as we see in (vi)-(viii), a distributive reading of an element exists in scopeless readings anyway. In the scopeless readings, neither NP takes wide or narrow scope relative to each other. Therefore,

[3] Landman notes that one might think that reading (vii) is a borderline case of reading (i), and that reading (vi) is a borderline case of reading (ii). In fact, the five readings that exclude (vii), (vi), and the cumulative reading in (viii), are what Lakoff (1970) had proposed as the possible readings of the sentence in (3). So, one might claim that Lakoff's scope theory is better in not generating 'redundant' readings. But Landman rejects the 'borderline reading' notion: Reading (ii) is an inverse reading, which is very difficult to get with sentence (3), while reading (vi) is very easy to get with the same sentence. Reducing reading (vi) to reading (ii) is to include an easy reading as a subcase of a very difficult reading. This seems peculiar. Thus, it is desirable for the two readings to be treated as independent. Furthermore, reading (vii) would be generated by the same general mechanism that generates (vi). For these reasons, Landman argues for the existence of these readings. We will simply adopt his analysis.

[4] Reading (viii) is what is commonly known as the 'cumulative' reading (cf. Scha 1981), which arises when two quantificational nominals are involved in a single sentence. Here, the three boys and the four girls are interpreted distributively, but it is underspecified exactly how many invitations each boy made, and how many invitations each girl received.

the distributive reading cannot always be accounted for in terms of wide or narrow scope, much less in terms of whether or not QR has applied.[5]

Having dispensed with purely lexical and scope-theoretical approaches, we now turn to some specific analyses of the FQ in the semantics literature. Perhaps one of these analyses will yield an explanation of the distributivity phenomenon.

5.1.2. Dowty and Brodie (1984)

Dowty and Brodie (1984) focus on English sentences with floated *all*. Adopting the basic tenet of generalized quantifier theory that the DP-denotation is a set of sets of individuals, Dowty and Brodie claim that the logical type of *all* in the floated position ('VP-quantifier' *all*) must be different from that of *all* in the determiner position (determiner *all*), since the determiner *all* maps CN (Common Noun)-denotations into DP-denotations, while the VP-quantifier *all* maps VP-denotations to VP-denotations.[6] According to Dowty and Brodie's system, then, the function application of a sentence with the determiner *all* and a sentence with the VP-quantifier (floated) *all* are represented as (4). The semantic tree of the two can be represented as in (5):[7]

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[5] A distributive reading attributed to QR is what Lakoff (1970) proposes. This is also refuted by Roberts (1986, 1989).

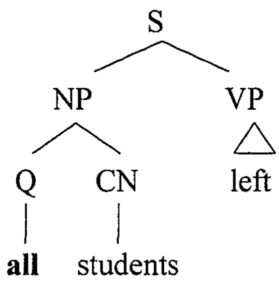
[6] In relation to this, they propose that, in order to treat VP-quantifiers with full generality with regard to negation and modality, the VP should be treated uniformly as a function from generalized quantifiers to truth values (the semantic type <<<e,t>,t>,t>), as suggested in Montague (1973) and Keenan and Faltz (1985), rather than as a function from entities to truth values (the semantic type <e,t>), which is more commonly assumed.

[7] Following Brodie (1983), Dowty and Brodie assume the following syntactic configuration within GPSG theory for the VP-quantifier *all*:

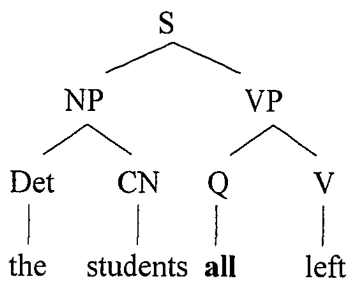
(4)a. Determiner *all*: VP' ([all' (CN')])

b. VP-quantifier *all*: [all' (VP')] (NP')

(5)a. Determiner *all*:



b. VP-quantifier *all*:

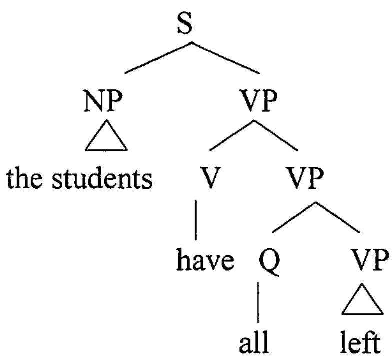


Now, as for what the VP-quantifier *all* actually does, Dowty and Brodie propose the following denotation of the VP associated with the floated *all*:

(6) $[\![\, [\text{all VP}]_{VP} \,]\!] = \{\wp \in D_{NP} \mid \cap\wp \subseteq \{y \mid y^{*} \in [\![\, \text{VP} \,]\!]\}\}$

"$\cap\wp$" : the intersection of all the sets in $\wp$;
"y^{*}": $\{ X \mid y \in X \}$ (i.e. the maximal filter generated by y);
"D_{NP}": the domain of NP denotations.

Dowty and Brodie informally describe this semantic value in the following way:



(7) "To understand intuitively what a VP-quantifier *all* must do, consider the NP denotation *the students* [shown below]. VP *all* must, so to speak, first examine this NP-denotation and extract its generator set -- i.e. the set of contextually relevant students. For NPs such as this one, this can be done simply by taking the intersection of all the sets in the NP-denotation. The resulting sentence must then assert that every individual that is a member of this intersection has the property denoted by the VP."

(Dowty and Brodie 1984; p76)

$[\![$ the students $]\!]$ = the family of all sets containing every contextually-relevant student

= $\{ X \mid ([\![\text{student}]\!] \cap \text{Rel}) \subseteq X \}$

(Dowty and Brodie, 1984; p76)

Concretely, given a sentence such as *The students all left*, we first examine the denotation of *the students*. Under generalized quantifier theory, this NP (i.e. DP in our terms) denotes a set of properties which are intersected, and the property $[\![$ student $]\!]$ is included in the intersection. The individuals in the intersection form a generator set; the contextually relevant student-individuals that *the students* refers to. Now, [all left] stipulates that all the elements in this generator set are included in the property [left]. Thus, the sentence is true if and only if the generator set of $[\![$the students$]\!]$ (e.g. John, Bill, and Tom, if these are all the students in the context) is included in the set of objects that have the property 'left'.

Extending Dowty and Brodie's analysis to Japanese FNQs, let us consider the following sentence:

(8) **gakusei**-ga **[san-nin** kaetta].
student-NOM 3-CL left

'Three students left.'

Instead of *all*, we have the numeral *three*. Along the lines of (6), we might try using a semantic value such as the following to accommodate the numeral:[8]

(9) $[\![[3\ \ \mathrm{VP}]_{\mathrm{VP}}]\!] = \{\, \wp \in D_{NP} \mid \ \ |(\cap\wp) \cap \{y \mid y^{*} \in [\![\mathrm{VP}]\!] \}| \geq 3 \,\}$

According to (9), the denotation of the sentence in (8) would be calculated as follows: First we have to examine the denotation of the DP *gakusei* 'student'. Although this is a bare noun in Japanese, it may be assumed that this noun functions here as a definite plural.[9] So *gakusei* can have the same denotation as English *the students*, presumably in association with a phonetically null determiner equivalent of English *the*. Then we extract the generator set, i.e. the contextually relevant students, say John, Bill, Tom, Mary, and Sue. Now, [3 left] denotes the function that yields truth if three individuals in the generator set have (are elements of) the property [left].

However, we need to make an additional modification, since the logical representation in (9) does not represent the function of the classifier. This must be taken into account, since the following two sentences with different classifiers have distinct meanings:

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[8] Strictly speaking, the semantic value in (9) approximates only the 'exactly three' reading of *san* 'three'. As previously noted, we abstract away from the systematic ambiguity (or rather vagueness) of numerals as regards the "at least n", "at most n" and "exactly n"-readings.

[9] Of course, the Japanese CN is underspecified for definiteness and plurality, as we discussed in chapter 4, so a bare noun such as *gakusei* 'student' could be (i) indefinite singular ('a student') (ii) indefinite plural ('some students') (iii) definite singular ('the student') or (iv) definite plural ('the students'). In addition, it could be interpreted as generic as well.

(10)a. **gakusei**-ga, **san-nin** peepaa-o happyooshita.
student-NOM 3-CL paper-ACC presented

'Three students presented a paper.'

b. **gakusei**-ga, **san-kumi** peepaa-o happyooshita.
student-NOM 3-CL paper-ACC presented

'Three groups of students presented a paper.'

The difference between the two sentences is the classifier, namely *nin* (person) vs. *kumi* (group). The intersection of the generator set and the VP-set (the set of individuals who presented a paper) must be three individual students in (10a) and three groups of students in (10b). So, incorporating the classifier, we might try the following:

(11) $[\![(\text{3-CL VP})]\!]$

$$= \{ \wp \in D_{NP} \mid |(\cap\wp) \cap \{y \mid y^{*} \in [\![VP]\!] \}| \geq 3 \wedge ((\cap\wp) \cap \{y \mid y^{*} \in [\![VP]\!] \}) \subseteq [\![CL]\!] \}$$

This formula says that the intersection of the generator set and the VP-set has three elements, and these elements are the kind specified by the classifier. So, in the case of (10a), the three elements are *nin*-objects and in the case of (10b), the three elements are *kumi*-objects. Of course, in order to make this work, the individuals in a set denoted by a noun must include elements that denote individual entities (*nin*-objects) and elements that denote group entities (*kumi*-objects), but overall (11) seems to be a promising approach.

Unfortunately, though, there are some severe empirical problems. First, consider the status of the host NP. In English, the subject of the FQ sentence is always a definite DP:

(12)a. The students all left.

b. ?*Students all left.

Under Dowty and Brodies' analysis, the FQ *all* is dependent on this definite DP in the sense that the quantifier *all* specifies that all of some specific set of objects have some property.[10]

Since this is the case, Dowty and Brodie argue that the semantic interpretation of the FQ *all* is essentially the same as that of the partitive quantifier *all* (i.e. *all* in *all-of-the*-N), and that the two are different only in the order in which they combine with their arguments. This is consistent with the independently well-known characteristic of the partitive, namely, the so-called 'partitive constraint', which requires a principal filter (a definite) for the whole-denoting DP (cf. Barwise and Cooper 1981, Ladusaw 1982). However, turning to Japanese, the definiteness of the host NP and the meaning equivalence between the FNQ sentence and the sentence with the partitive interpretation are not at all necessary, though in some cases they hold. To see this point, consider the following FNQ sentences:

(13)a. **kyoo gakushoku-de chuushoku-o tabeta gakusei-**ga,
today cafeteria-at lunch-ACC ate student-NOM

nijuu-nin shokuchuudoku-o okoshita.
20-CL food-poisoning-ACC suffered

'Twenty of the students who had lunch at the cafeteria today suffered from food-poisoning.'

b. **gakusei-**ga, **nijuu-nin** shokuchuudoku-o okoshita.
student-NOM 20-CL food-poisoning-ACC suffered

'Twenty students suffered from food-poisoning.'

---

[10] Note that, although the FQ is treated as a VP-quantifier in the sense that it directly applies to the VP, the restricted domain of quantification is not the VP-denotation. For example, given a sentence such as *The students all came*, it is not the case that all comers were such that they were students.

In (13a), the subject is a complex DP with a relative clause, and it is most naturally taken as a definite DP (cf. Fodor and Sag 1982, Heim 1982). Thus, the FNQ sentence (13a) can be naturally interpreted with a partitive reading. In sharp contrast, however, in (13b), in which the relative clause has been removed and the subject is a bare noun, it is not at all necessary to assign a partitive reading. Rather, (13b) is more naturally interpreted with an existential reading, as in the English gloss. The possibility of an existential reading is even clearer in the following FNQ sentences:

(14)a. **neko-no kodomo**-ga kyoo, **san-biki** umareta.
cat-GEN child-NOM today 3-CL was born

'Three kittens were born today.'

b. John-ga sono kami-ni **wa**-o yukkurito, **mit-tsu** kaita.
J-NOM the paper-on circle-ACC slowly 3-CL drew

'John drew three circles.'

It is certainly not the case that in order to interpret these sentences one must presuppose a contextually relevant set of cats or circles. Dowty and Brodie's analysis would require that the host NPs of (14a) *neko-no kodomo* 'kittens' and (14b) *wa* 'circle' be definite plurals, yielding the sentence meanings 'three of the kittens were such that they were born' and 'John drew three of the circles', respectively. In other words, to assign such meanings, (14a) would have to presuppose the existence of some cats, including those that were born and those that were not born, and (14b) the existence of some circles, including those that John drew and those that John didn't draw. Clearly, neither presupposition is readily available, much less required. On the contrary, under their most natural interpretation, the sentences merely assert the existence of three cats that were born and the existence of three circles that were drawn by John. Thus, the definiteness of the host NP and the mechanism of partitivity should not be embedded in the FQ mechanism, at least in not Japanese, contrary to Dowty and Brodie's proposal.[11] [12]

Second, we are not quite certain how to modify their analysis so that it is applicable to the object-oriented FNQ in Japanese: Since, as given, their analysis treats VP-quantifiers semantically as relations between a VP and its argument, the analysis predicts that the host NP is necessarily an argument of the VP, i.e. that it is precisely the subject. However, suppose that we were somehow able to make the necessary modifications to handle the object-oriented FNQ in the same manner as the subject-oriented FNQ. That is, putting aside the mapping problem, suppose (15a) could be interpreted as (15b):

(15)a. John-ga **gakusei-o**, **san-nin** tataita.
J-NOM student-ACC 3-CL hit

'John hit three students.'

b. $[\![(\text{3-CL} \ [\text{John hit}])]\!]$
$= \{ \wp \in D_{NP} \mid |(\cap\wp)\cap\{y \mid y^{\star} \in [\![\text{John hit}]\!]\}| \geq 3 \wedge ((\cap\wp)\cap\{y \mid y^{\star} \in [\![\text{John hit}]\!]\}) \subseteq [\![\text{CL}]\!] \}$

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[11] Hoeksema (1996) argues that this requirement does not necessarily hold even for the English FQ *all*. He offers, for instance, the following counter-example: *The plaintiff demonstrated a probability of 1 in 4,000 by computing the chance that 12 consecutive mistakes would all fall against him.*

[12] However, the partitive reading of the Japanese FNQ construction clearly emerges when the host NP itself contains an NQ; i.e. sentences which have both a DNQ and an FNQ. For example, observe the following example (modified from an example sentence in Kitagawa and Kuroda 1992):

(i) koko-ni atta **juu-dai**-no torakku-ga yuube-no uchini **ni-dai** nusumareta.
here-at were 10-CL-GEN truck-NOM last night-GEN during 2-CL stolen
'**Two of the ten trucks which were here** were stolen during last night.'

In this case, (15a) would be interpreted as asserting that the intersection of the set of the contextually relevant students and the set of things that John hit consisted of three elements and that the objects in this intersection had the *nin*-property. This would more or less capture the meaning of an FNQ sentence like (15a). However, the minute we turned to sentences with an event classifier sentence, such as (16a), the analysis would completely break down:

(16)a. John-ga **pisutoru**-o sokode, **ni-hatsu** hanatta.
J-NOM pistol-ACC there 2-CL released

'John released two shots of a pistol there.'

b. $[\![\text{(2-CL [John shot])}]\!]$
$= \{ \wp \in D_{NP} \mid |(\cap\wp) \cap \{y \mid y^{*} \in [\![\text{John shot}]\!] \}| \geq 2 \wedge ((\cap\wp) \cap \{y \mid y^{*} \in [\![\text{John shot}]\!]\}) \subseteq [\![\text{CL}]\!] \}$

Here, the host NP is *pisutoru* 'pistol'. This must be analyzed as a DP, i.e. 'the pistols'. Under the hypothetical analysis we are now considering, (16a) asserts that, among these pistols, two of them have the property denoted by the predicate, namely the property of being something that John shot. However, the event classifier *hatsu* refers to a shot or blast, which is a type of event, while *pisutoru* usually refers to a type of objects, namely pistols. Now, there is no entity that can be a shot/blast and a pistol at the same time. Thus, since the two sets in question do not intersect, the sentence in (16a) would be necessarily false. This is clearly a false prediction; (16a) is well-formed; it can in principle be true. Generally, a sentence with an event classifier seems to be a challenge for any analysis of the Japanese FNQ due to the fact that events and objects are distinct sorts of entities under any semantic analysis. In particular, the problem seems to arise when we take the first logical argument of the FNQ to be the host NP denotation. If we are to attain a unified analysis of the quantificational FNQ, wet must find a solution to this problem. In any case, if Dowty and Brodie's analysis is to be pursued, there must be a major modification regarding this matter.

5.1.3. Link (1987)

Now, let us re-consider the D-operator approach of Link (1983) in relation to the case of the Japanese FNQ sentence. As we discussed in the last chapter, Link (1983) uses a D-operator in the verbal domain to obtain a distributive reading.[13] Thus, in contrast to the ordinary VP-denotation in (17a), the denotation of the VP with the D-operator is as in (17b):

(17)a. VP :$\lambda x[VP(x)]$

b. $^{D}VP : \lambda x \forall y[y^{\bullet}\Pi x \rightarrow VP(y)]$

As noted in the last chapter, under this analysis an inherently distributive predicate such as *walk* is equipped with the D-operator by a meaning postulate (WALK = ^{D}WALK). A mixed predicate such as *carry a piano upstairs* has two meanings, one with the D-operator, and the other without it. In sum, distributivity is reduced to a mechanism that divides a sum into all its atomic parts and checks whether each one has the property denoted by the VP. The role of the D-operator is "to transform a VP into a ^{D}VP, thereby removing the

[13] Roberts (1986, 1989) offers a similar analysis of distributivity. Basically, Roberts considers the source of distributivity to be a D-operator associated with the VP (and derived predicates), and treats FQs as phonetically overt realizations of D-operators. We may thus consider Link's and Robert's analyses virtually equivalent with respect to the mechanism of distributivity.

collective/distributive ambiguity" (Link 1987, section 5). Thus, an FQ sentence such as (18a) would have the meaning represented in (18b):[14]

(18)a. **The children each** received 10 dollars.

b. $\forall y[y{}^{\bullet}\Pi\sigma[{}^{*}x\ \text{child}] \rightarrow \text{received }\$10'(y)]$[15]

(18b) says that every atomic i-part of the individual-sum of the children, i.e. every child, received 10 dollars.

Since a distributive reading is obtained by application of the D-operator, we might suppose that the Japanese FNQ contains an overt instance of it, as Roberts (1986) suggests

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[14] Link (1998) points out that the English FQ *all* differs from *each* and *both* in that it can accept a collective reading when it is forced do so by lexical properties of the predicate it modifies, as in (i). The adjective *common* turns *file a suit* into a collective predicate. In addition, a mass noun host NP can force *all* to have an amount quantificational reading as in (ii):

(i) **The tenants all** filed a common suit against their landlord.

(ii)**The water** was **all** gone.

In such cases, Link notes that the emphasis is on totality. However, as Link also notes, floated *all* in plural constructions seems to force distributivity when the predicate it modifies allows a distributive reading. Compare (iii) and (iv):

(iii)The children received 10 dollars. (ambiguous)

(iv)**The children all** received 10 dollars. (distributive)

In (iv), according to Link, the FQ *all* forces a distributive reading of the sentence since the predicate *received 10 dollars* can apply to the children individually. Note also how the FQ *all* saves (vi) from having the odd 'all in one dress' reading which reportedly is the only reading available for (v) (Thanks to William Philip for this observation):

(v) #The women were wearing a dress. (pragmatically ill-formed)

(vi) The women were all wearing a dress.

(vii) The women were wearing dresses.

Thus, although *all* appears to have some special lexical property that allows it to co-occur with collective predicates and have a substance-denoting host NP, it patterns with *each* and *both* in that it always gives rise to a distributive reading when the predicate allows this.

[15] The exact formula shown by Link is the following:

(i) $\forall y[y{}^{\bullet}\Pi\sigma{}^{*}x\ \text{child}'(x) \rightarrow \text{received }\$10'(y)]$

Here, *the children* is expressed as $\sigma{}^{*}x$ child'(x). Following Landman (2000), we abbreviate this as in the text, namely $\sigma[{}^{*}\text{child}]]$.

for the FQ in English. Consider first the following English sentence and the logical representation of its distributive reading which Link offers:

(19)a. Three men lifted a piano.

b. Three men all lifted a piano.

c. (**U** : the translation relation between natural language and logical representation)
Entries:
3 men **U** $\lambda P\exists x[(3men)'(x) \wedge P(x)]$
^{D}(lifted a piano)**U** $^{D}(\lambda y\exists z[piano'(z) \wedge lifted'(y,z)]$
$=\lambda x\forall y[y^{\bullet}\Pi x \rightarrow \exists z[piano'(z) \wedge lifted'(y,z)]$
Composition:
3 men lifted a piano **U** $\exists x[(3\ men)'(x) \wedge \forall y[y^{\bullet}\Pi x \rightarrow \exists z[piano'(z) \wedge lifted'(y,z)]]]$

In English, (19a) is in principle ambiguous, but when the VP is associated with the D-operator, the logical representation would be the same as that of the FQ sentence (19b), which is (19c). Similarly, then, the meaning of a Japanese FNQ sentence such as (20a) might be represented as (20b):

(20)a. **gakusei**-ga, **san-nin** hon-o katta.
student-NOM 3-CL book-ACC bought

'Three students bought a book.'

b. $\exists x[(3\ students)'(x) \wedge \forall y[y^{\bullet}\Pi x \rightarrow \exists z[book'(z) \wedge bought'(y,z)]]]$

This says that there is a sum entity of three students and that all the atomic i-parts of this entity have the property 'bought a book'. In other words, three students each bought a book.

However, as in the case of Dowty and Brodie's analysis, some modification must be made to incorporate the classifier denotation. The only possible place in the formula which we can modify to accommodate the classifier is the variable x, since the number of this element is what the NQ specifies. So, let us incorporate the classifier into the analysis as follows:

(21) $\exists x[(3\ \text{nin})'(x) \wedge \text{student}'(x) \wedge \forall y[y^{\bullet}\Pi x \rightarrow \exists z[\text{book}'(z) \wedge \text{bought}'(y,z)]]]$

This reads that there is a sum entity x of three *nin*-objects, which is also a member of the set denoted by 'student', and for all individuals y in x, there is a book z which y bought.

(21) will work for (20a). However, once again, the analysis faces an apparently insurmountable empirical problem with FNQ sentences that contain an event classifier. The sentence in (22a) will yield the logical representation (22b):

(22)a. John-ga **pisutoru**-o sokode, **ni-hatsu** hanatta.
J-NOM pistol-ACC there 2-CL released

'John released two shots of the pistol there.'

b. $\exists x[(2\ \text{hatsu})'(x) \wedge \text{pisutoru}'(x) \wedge \forall y[y^{\bullet}\Pi x \rightarrow [\text{hanatta}'(j,y)]]]$

The problem is exactly the same as what is described for Dowty and Brodie's analysis of such sentences. That is, there is no entity which has the property of *2 hatsu* and pisutoru at the same time. *Hatsu* refers to a shot/blast, which is a type of event, while *pisutoru* refers to a type of objects, i.e. pistols. Again, the paradox seems to follow from the assumption that the first logical argument of the quantifier must be the host NP. In order to cover the event classifier FNQ sentence in Japanese, at least the denotation of the NQ which contains the event classifier must be differentiated from the denotation of the NQ which contains the object classifier.

There is also another, more general, objection to a D-operator account of the Japanese FNQ. Unlike the case of English floated *each*, the Japanese FNQ could not possibly be simply identified as a phonetic realization of the D-operator. Clearly, the most that could be claimed is that the FNQ includes the D-operator as part of its lexical semantic content. But now, given that the D-operator is assumed to always be optionally present in any sentence with a plural term and a mixed predicate, why should it necessarily be included in the lexical content of the FNQ?

5.1.4. Fukushima (1991)

Fukushima (1991) offers a detailed semantic analysis of the Japanese FNQ, also within the framework of generalized quantifier theory.[16] Following Dowty and Brodie, Fukushima also treats the Japanese FNQ as a VP-quantifier, i.e. a linguistic element that functionally composes with the VP.

Fukushima's analysis of a subject-oriented and an object-oriented FNQ sentence are shown in (23) and (24), respectively:[17]

(23)a. **otoko**-ga, **go-nin** kita.
man-NOM 5-CL came

'Five men came.'

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[16] The framework of syntax Fukushima follows is JPSG (Japanese phrase structure grammar), a Japanese adaptation of Gazdar et al's (1985) GPSG proposed by Gunji (1987).

[17] Like Dowty and Brodie, Fukushima also treats the VP as a higher-order predicate of the semantic type $<<<e,t>,t>,t>$.

b. semantic tree

(go-nin' (kita')) (otoko')
5 CL came man

otoko' go-nin'(kita')

go-nin' kita'

c. interpretation derivation

go-nin: $\lambda W_{<<<e,t>,t>,t>} \lambda P_{<e,t>} [W(\lambda Q_{<e,t>} [|P \cap Q| \geq 5 \wedge P \subseteq nin'])]$
| kita: $\lambda T_{<<e,t>,t>} [T(\lambda x_e [kita'(x)])]$
|/
go-nin (kita): $\lambda P[|P \cap \lambda x[kita'(x)]| \geq 5 \wedge P \subseteq nin']$
|otoko:λy_e [otoko'(y)]
|/
(go-nin (kita))(otoko): $|\lambda y[otoko'(y)] \cap \lambda x[kita'(x)]| \geq 5 \wedge \lambda y[otoko'(y)] \subseteq nin'$
'man' 'came' 'man' CL_{human}

(24)a. Hanako-ga **hon**-o, **san-satsu** katta.
H-NOM book-ACC 3-CL bought

'Hanako bought three books.'

b. semantic tree

((san-satsu' (katta')) (hon')) (h')
3 CL bought book Hanako

h (san-satsu' (katta')) (hon')

hon' san-satsu' (katta')

san-satsu' katta'

c. interpretation derivation

katta: $\lambda U_{<<e,t>,t>} \lambda T_{<<e,t>,t>} [T(\lambda y_e [U (\lambda x_e [katta' (x)(y)])])]$
| san-satsu: $\lambda W_{<<<e,t>,t>,<<<e,t>,t>,t>>} \lambda P_{<e,t>}[W(\lambda Q_{<e,t>}[|P \cap Q| \geq 3 \wedge P \subseteq satsu'])]$
|/
san-satsu (katta):
$\lambda P[\lambda T[T(\lambda y [|P \cap \lambda x[katta'(x)(y)] | \geq 3 \wedge P \subseteq satsu'])]]$

| hon: λy_e [hon'(y)]

|/

(san-satsu(katta))(hon):

$\lambda T[T(\lambda y[|\lambda y[hon'(y)] \cap \lambda x[katta'(x)(y)]| \geq 3 \wedge \lambda y[hon'(y)] \subseteq satsu'])]$

| Hanako: $\lambda P_{<e,t>}$ [P(h)]

|/

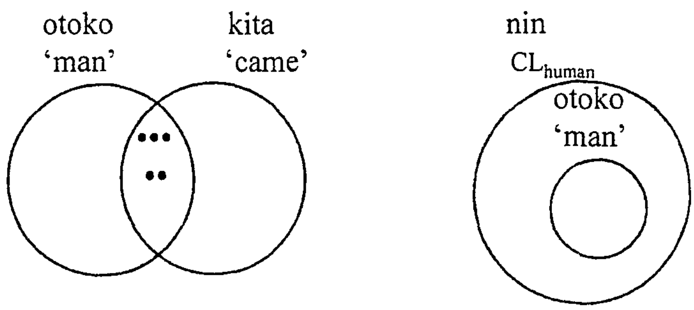
((san-satsu(katta))(hon))(Hanako):

$|\lambda y[hon'(y)] \cap \lambda x[katta'(x)(h)]| \geq 3 \wedge \lambda y[hon'(y)] \subseteq satsu'$

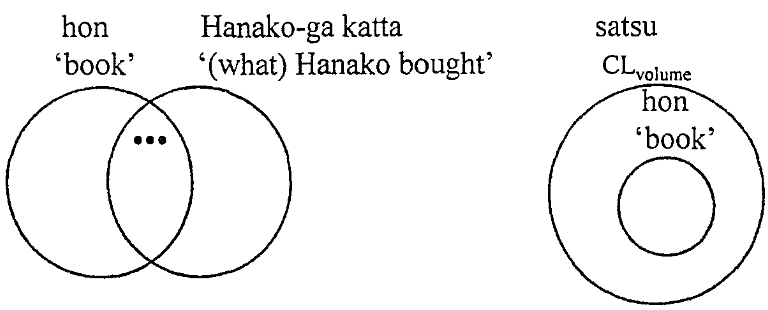
'book' 'bought' 'book' CL_{volume}

Note that the outcome of the interpretation derivation consists of two conjuncts. The first expresses the quantification (a cardinality constraint of the intersection of two sets) and the second expresses the relationship between the classifier the host NP. The two conjuncts are independent of each other, forming two independent propositions. The two propositions asserted in (23a) and (24a), then, can be illustrated as the combination of two diagrams as follows:

(25)a. Subject-oriented FNQ quantification



b. Object-oriented FNQ quantification



What the quantification proper asserts here is that the set of elements that are in the intersection of the host NP denotation and the predicate denotation has the cardinality expressed by the numeral. The relationship between the host NP and the classifier is such that the host NP denotation is a subset of the classifier denotation, both being a set of objects. As given, this analysis makes the role of the classifier quite explicit. Moreover, in this analysis the FNQ composes with the predicate, as other adverbs do, which we have argued is a syntactic prerequisite for any adequate semantic account of it.

Although we owe much to Fukushima for this analysis, there remain problems similar to those observed with Dowty and Brodie's approach. First, even though the FNQ is treated as an adverb and thus syntactically composes with the predicate, under Fukushima's analysis the FNQ is not the semantic type of $<<e,t>,<e,t>>$, which is the type of adverbs in general. Rather, as Fukushima explicitly points out, the FNQ is a 'semantic determiner', on a par with a DNQ, even though syntactically it does not behave like a determiner.

Second, the quantification of the FNQ is based on (the intersection is formed by) the host NP denotation and the predicate denotation. That is, the host NP is identified as the first logical argument, as in Dowty and Brodie's and Link's analyses. As a result, the interpretation of the FNQ sentence turns out to be exactly the same as that of the DNQ sentence. Precisely because he equates the truth conditions of the DNQ sentence with those of the FNQ sentence, Fukushima's analysis cannot capture the semantic difference between the DNQ and the FNQ. That is, under Fukushima's analysis, both the DNQ and the FNQ have only a distributive interpretation. Because they have the same underlying logical representation, though, one could not modify his analysis so that it captured the collective reading of the DNQ without incorrectly predicting a collective reading for FNQ as well. Clearly, this is a major empirical deficiency.

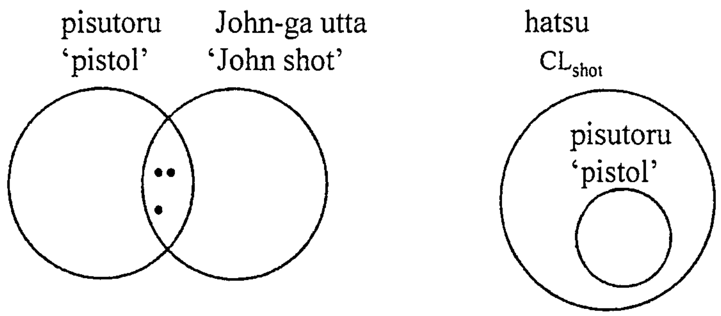
Third, because the host NP denotation is taken to be the first logical argument of the FNQ, Fukushima's analysis is also unable to account for the FNQ sentence that has an event classifier. According to Fukushima, the analysis of the sentence (26a) would be (26b), which can be illustrated as (26c):

(26)a. John-ga **pisutoru**-o, **san-patsu** utta.
J-NOM pistol-ACC 3-CL shot

'John shot three shots of a pistol.'

b. $|\lambda y[\text{pisutoru}'(y)] \cap \lambda x[\text{utta}'(x)(j)]| \geq 3 \wedge \lambda y[\text{pisutoru}'(y)] \subseteq \text{hatsu}'$
'pistol' 'shot' 'pistol' CL_{shot}

c.



This is triply problematic. First, due to the numeral 3 in the NQ, there are three elements in the intersection of the host NP denotation and the predicate denotation. This entails that there must be three pistols that John shot (with). However, the sentence in (26a) is, in fact, also true if John shot three times with a single pistol. Second, the classifier *hatsu* 'shot/blast' denotes a type of event. Thus, the set denoted by this classifier would not intersect with the set denoted by the host NP, which is a set of objects. Third, for the same reason the subset relation between the classifier denotation and the host NP denotation can never hold. A set of objects cannot be a subset of a set of events. Thus, the second proposition of the sentence meaning is necessarily false and, therefore, the whole sentence would also be necessarily false even if the first proposition were true. Thus, even if Fukushima's analysis could be maintained for a quantificational FNQ that has an object-denoting numeral classifier , the event classifier FNQ sentence would require a completely different analysis. Obviously, the object-denoting classifier and the event classifier are lexically distinct. Any adequate analysis of the FNQ must respect this distinction. However, since both types of classifier conform to the same syntactic construction, what is desired here, theoretically, is the same semantic analysis for both, particularly in terms of quantification. In any analysis in which the domain of quantification is the host NP denotation, the event classifier sentence such as above cannot be covered, thereby precluding a unified analysis.

Finally, another problem with Fukushima's analysis is that it is not compatible (without modification) with the general theory of plurality we are assuming. As we saw in chapter 4, this general theory provides us with an elegant account of the underspecification of plurality in Japanese nouns, so we wish to retain it. However, Fukushima's analysis assumes that the noun denotes a set consisting of only atoms, as in traditional Montague grammar and generalized quantifier theory. This is a necessary assumption for Fukushima since, if sum individuals are allowed in the model, the numeral no longer specifies the intended number of relevant objects. Consider, for example, the sentence *otoko-ga go-nin kita* 'five men came'. Allowing sums in the set denoted by the host NP *otoko* 'man', Fukushima's analysis would falsely predict that this sentence could be true if only three men came. This is because there would be nothing to prevent *go-nin* '5-CL' from counting the five individuals {a⊔b⊔c, a⊔b, b⊔c, a, b} rather than the five atomic individuals {a, b, c, d, e}.

In conclusion, despite its elegance, Fukushima's analysis proves inadequate for our purposes. Though we will draw from its insights, we must seek an alternative analysis.

5.1.5. Junker (1990)

Junker (1990) analyzes the FQ as a VP-quantifier as well, but specifically one that applies to the event denoted by the VP. In addition, Junker follows Link (1983) in that the FQ is treated as a distributivity operator.

Junker's event-quantificational analysis is based on her observation of French FQs' special relationship to distributivity. Consider the following contrast:

(27)a. **Chacun des enfants** prit l'autobus en même temps.
Each of the children took the bus at the same time.

b. ???**Les enfants prirent chacun** l'autobus en même temps.
???'The children each took the bus at the same time.'

In (27a), *chacun* 'each' is a determiner or predeterminer within a DP and is semantically compatible with the adverbial phrase *en même temps* 'at the same time', while in (27b), *chacun* 'each' is floated and is no longer compatible with this adverbial phrase. If we replace the adverbial phrase with *l'un aprés l'autre* 'one after the other', the judgements reverse:

(28)a. ???**Chacun des enfants** téléphona à sa mère l'un après l'autre.
???Each of the children called his mother one after the other.

b. **Les enfants** téléphonèrent **chacun** à leur mère l'un après l'autre.
The children each called their mother one after the other.

A similar contrast obtains with *tous* 'all':

(29)a. ??**Tous les gens** découvrirent la grotte l'un après l'autre.
??All the people discovered the cave one after the other.

b. **Les gens** découvrirent **tous** la grotte l'un après l'autre.
The people all discovered the cave one after the other.

The contrasts in (27)-(29) show that the French FQ construction is not quite compatible with adverbial phrases such as *en même temps* 'at the same time', while it is perfectly compatible with adverbial phrases such as *l'un après l'autre* 'one after the other'. This suggests, in Junker's view, that the FQ sentence is well-formed only when it refers to the situation type where a multiple number of the relevant events occur.[18]

Junker's observation also includes the following data with coordinated subjects:

(30)a. ***Chacune de la bicyclette, la trousse à outils et la cuisinière** se sont vendues pour $10.
*Each of the bicycle, the tool kit, and the oven sold for $10.

b. **La bicyclette, la trousse à outils et la cuisinière** se sont vendues **chacune** pour $10.
The bicycle, the tool kit, and the oven each sold for $10.
(taken from Roberts, 1986)

---

[18] The data in (28) and (29) suggest that expressions like *at the same time* and *one after the other* are sensitive to event semantic circumstances. Intuitively, both can only occur in a sentence in which at least two distinct events can be recognized, which includes the case in which these are subevents of the described event. The adverbial *at the same time* places no specific constraints on how these two events may differ:
(i)a. John left, and Mary left at the same time. (different participants, same type of event)
b. John laughed, and he cried at the same time. (same participants, different type of event)
c. ??John left and he left at the same time. (same participant, same type of event: nondistinct events)
In contrast, the adverbial *one after the other* can only occur in a sentence that describes an event consisting of a temporal sequence of subevents that differ in that each of a given set of objects participates in only one of them:
(ii)a. The boys winked one after the other. (different boy per subevent)
b. John smoked cigarettes one after the other. (different cigarette per subevent)
c. ??The boys simultaneously winked one after the other. (indistinguishable subevents)

(31)a. ***Tous de Robespierre, Marat et Charlotte Corday** participèrent activement à la révolution de 1789.
*All of Robespierre, Marat and Charlotte Corday took an active part in the French revolution of 1789.

b. **Robespierre, Marat et Charlotte Corday participèrent tous** activement à la révolution de 1789.
Robespierre, Marat and Charlotte Corday all took an active part in the French revolution of 1789.

This set of data shows that coordinated subjects are compatible only with FQs, and not with determiner Qs. According to Junker, this is because "the FQ forces the distribution of the event, and in a FQ construction, a series of different token events are mapped onto each individual denoted by the subject NP." That is, if there is reference to a distributive event, which is the case with coordinated subjects, then only the FQ construction is well-formed.

Having demonstrated that a distributive reading is associated with French FQs, Junker proposes (somewhat elliptically) the following analysis of FQs as distributivity operators:

(32) *Interpretive component of the grammar*:
D: Distributive Operator:
F_D: Distributive function,
F_D: domain (X) $\rightarrow$ range (Y)
F_D: $\forall x, x \in X, \exists y, y \in Y, F_D(x) = y$

(33) *Syntactic representation of distributivity*:
D: a distributive operator
X, Y: Two syntactic constituents
< >: an ordered relation
D<X,Y>
- where D is configurationally attached to X at S-structure
- where Y is given by predication

(34)a. *Non-floated quantifier*
[Each of [the children]][received a balloon]

Q<NP, VP>
Each <child, receiving event>

b. *Floated quantifier*
[The children][each [received a balloon]]

Q<VP, NP>
Each <receiving event, child>

The first logical argument and the second logical argument are reversed in the non-floated Q and floated Q sentences. In the case of the non-floated Q, the NP is the first argument, while the VP is the second argument. In the case of the floated Q, the VP is the first argument, while the NP is the second argument. Thus, Junker strictly adheres to the principle of compositionality by directly relating S-structure representation to semantic interpretation. The FQ is a distributive operator which takes the VP-denotation and distributes onto each individual of the NP-denotation. More concretely, the non-floated case (34a) might be interpreted as 'each child is related to a receiving-a-balloon event', while the floated case (34b) might be interpreted as 'each receiving-a-balloon event is related to a child.' Here, Junker assumes that the NP denotes a set of objects, and the VP denotes a set of events.

Applying this analysis to Japanese, we obtain the following schema:

(35)a. *Non-floated quantifier*
[**san-nin**-no [**kodomo**-ga]] [fuusen-o moratta].
3-CL-GEN child-NOM balloon-ACC received

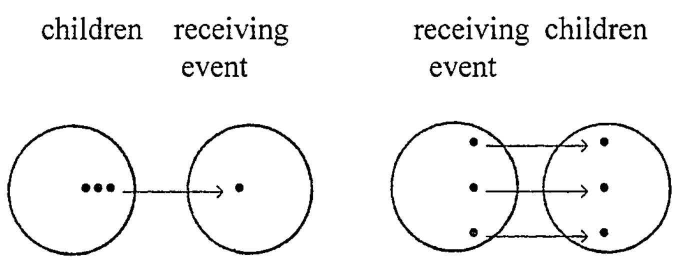
b. Q<NP, VP>
3-CL <child, receiving event>

(36)a. *Floated quantifier*
[kodomo-ga] [**san-nin** [fuusen-o moratta]].
child-NOM 3-CL balloon-ACC received

b. Q<VP, NP>
3-CL <receiving event, child>

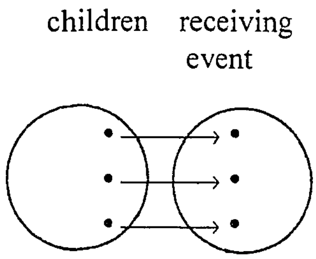
Thus, (35a) may be paraphrased as something like 'there are three children and the children are related to a balloon-receiving event. Meanwhile, (36a) may be paraphrased as something like 'there are three balloon-receiving events and the balloon-receiving events are related to a child. However, since Junker assumes that the FQ is a D-operator, the FNQ *san-nin* here would also be a D-operator. Then, (36a) is, more precisely, 'there are three balloon-receiving events and each of the balloon-receiving events is related to a child. We might try to illustrate Junker's analysis in the following fashion:

(37) a. Non-floated b. Floated



In (37), the 'predication relation' (cf. 33 above) between an event (of receiving a balloon) and a participating object (child) is represented by an arrow. In another sense, the arrow corresponds roughly to a theta-relation. In (37a), the correspondence between the three children and a receiving event is not specified to be a one-to-one relation, but in (37b), due to the presence of the FNQ, which functions as a D-operator, each receiving event corresponds to a child, forming a one-to-one relation. Of course, when the distributive determiner *each* is present in the non-floated case, the three children would distributively correspond to balloon-receiving events, as follows:

(38) Each child received a balloon. (Non-floated, but with *each* in the DP)



Under Junker's analysis, the distinction between DNQ and FNQ quantifications is clear. The non-floated Q takes the host NP denotation as the first argument, while the floated Q takes the VP denotation as the first argument. Thus, unlike the analyses by Dowty and Brodie (1984), Link (1987) and Fukushima (1991), the quantification of the FQ as a VP-quantifier is explicitly differentiated from the quantification of the DQ. In fact, under an event-quantificational analysis, the D-operator may not be necessary, since the specific number expressed by the FNQ entails the presence of that specific number of token events, which entails that individuals are distributed over these events in any case.

The analysis is not exactly clear about an important aspect of the hypothetical event quantification. Junker does not explain how different events of the same type may be identified so as to be counted. However, we may suppose that two events of a given type differ if each has different participant. For example, three distinct events of dancing can be perceived in the case of (39) simply by letting each one involve a different student.

(39) **gakusei**-ga, **san-nin** odotta.
student-NOM 3-CL danced

'Three students danced.'

Carlson (1998) argues that thematic roles can individuate events. For example, if there are three different agents, then there are three different events.[19] On the other hand, as Carlson also notes, two events of the same type occurring at different locations and/or at different times should also be regarded as distinct events. In this case, though, why couldn't (39) describe the situation represented in (40a)? Why can only (40b) describe such a situation?:

(40)a. e_1 = John danced yesterday at time t_1.
e_2 = John danced yesterday at time t_2.
e_3 = John danced yesterday at time t_3.

b. gakusei-ga kinoo, san-kai odotta.
student-NOM yesterday 3-CL danced

'A student danced three times yesterday.'

There certainly are three dancing events in the situation in (40a). The FNQ sentence in (39) should be true of this situation if we assume that the FNQ counts the number of events. In fact, though, (39) cannot be interpreted as a description of the situation in (40a). (39) asserts the existence of three students, while there is only one student, John, in situation (40a).[20]

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[19] In a collective reading of (i), there is a single agent, namely a group of five boys. Thus, it is a single event, not five events.
(i) Five boys carried a piano up the stairs.

[20] (39) would be true under an 'event-related reading' in the sense of Krifka (1990), who shows that a sentence such as *Four thousand ships passed through the lock* may be true of even a single ship provided there are four thousand events of it passing through the lock in question. The fact that this special reading is not available for (39) seems to be related to the fact that number in question is so small (cf. 4000 ships). That is, a licensing condition for Krifka's event-related reading appears to be reference to large numbers, perhaps because this makes it hard to actually verify the truth value of a sentence by counting.

Thus, if the numeral specified by the FNQ has to match the number of students and the number of dancing events at the same time, then it must be stipulated (contra Carlson) that an event can only be defined exclusively in terms of theta-relations. The numeral specified by the FNQ must count distinct theta-relations, not the number of distinct events in the more general sense of Carlson, for whom three distinct events do exist in (40a). Under this restricted definition of distinct event, the fact that (39) is not an appropriate description of the situation in (40a) can be accounted for. The theta-relations in e_1, e_2, and e_3 in (40a) are identical, not distinct; in all cases there is a single agent relation between John and dancing. Thus, the number of distinct events qua distinct theta-relations is not three, but one. However, if the FNQ counts events distinguished only on the basis of distinct theta-relations, then a severe empirical problem arises with (40b). This sentence clearly refers to three different events, each occurring at a different time.[21] Yet, if events can only be distinguished in terms of distinct theta-relation, (40b) should only refer to a single event. Thus, the stipulation needed to prevent (39) from being true of the situation in (40a) makes it impossible to capture the truth condition of (40b).

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[21] This is demonstrated by the fact that (40b) entails (i):
(i) Three dancings occurred yesterday.
It will not help to further stipulate that NQs like *san-kai* 'three times' quantify over time units rather than events since that will not explain away the entailment of (i) by (40b). Moreover, this further stipulation runs into problems of its own since (ii) can be true of three simultaneous events (Parsons 1990):
(ii) John was shot three times, once in the arm, once in the shoulder and once in the foot.

In sum, Junker's event quantificational approach fails to explain the basic fact about the meaning of the Japanese FNQ, namely that when an object-denoting numeral classifier is used there generally can only be quantification over objects.[22]

5.1.6. Nakanishi (2002a,b)

Nakanishi (2002a,b) sheds new light on the Japanese NQ by examining it from a completely different perspective. Treating the NQ uniformly as a measure function, she uncovers an interesting semantic distinction between the FNQ and the DNQ that had not previously been noticed.[23] [24] In particular, she makes the insightful observation that, when interpreted as amount terms, the DNQ and the FNQ are distinct in that for the DNQ a monotonicity constraint holds in the nominal domain while for the FNQ it holds in the verbal domain.

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[22] Japanese NQ sentences do also in principle allow the special event-quantificational reading proposed by Krifka (1990). Since this is a special interpretation we will not discuss it but rather simply refer the reader to Krifka (1990). However, precisely because Krifka's event quantificational reading is special, it is problematic to subsume under it ordinary cases of object quantification such as exemplified in (39).

[23] Classifiers such as *guramu* 'gram', *rittoru* 'liter' etc. in Japanese clearly do denote measure functions, turning an NQ into an amount term. In addition, as we briefly discussed in chapter 2 (section 2), classifiers such as *nin* and *mai* can in principle have a nonstandard measure function construal. However, Nakanishi's claim, which we dispute, is that all classifiers always denote measure functions as their basic meaning. On this view, there is no crucial semantic difference between numeral classifiers and measure classifiers, nor between quantification over individuals and amount quantification.

[24] Nakanishi (2002b) uses the terms 'split Q' and 'non-split Q' for our DNQ and FNQ, respectively. We will retain our own terminology in our discussion of her work.

Consider first the following grammaticality contrast, which is directly affected by the fact that *san-rittoru* 'three liters' in (42a) measures the substance denoted by the host noun *mizu* 'water', while *san-do* 'three degrees' in (42b) does not:

(42)a. [mizu **san-rittoru**]-ga tsukue-no ue-de koboreta. (DNQ)
water 3-CL-NOM desk-GEN on-at spilled

'Three liters of water spilled on the desk.'

b. *[mizu **san-do**]-ga tsukue-no ue-de koboreta. (DNQ)
water 3-CL-NOM desk-GEN up-at spilled

(intended) 'Some water whose temperature is three degrees spilled on the desk.'

This grammatical contrast is well-captured by the monotonicity constraints (in the nominal domain) proposed by Nakanishi, following Schwarzschild (2002):[25]

(43)a. Restriction on the Host Noun
The host noun must have a part-whole relation, i.e., the extension of the host noun must be a lattice of individuals.

b. Restriction on Measure Functions
The measure function μ must be monotonic relative to the given part-whole structure, or a lattice structure of individuals.

[25] Nakanishi's and Schwarzschild's use of the term 'monotonicity' and 'monotonic' are slightly different from the standard way these terms are employed in discussions of the semantics of quantifiers. Normally the terms are used to describe the entailment properties of a quantifier with respect to its first (left) and second (right) logical arguments. For example, the numeral quantifier *three* (in contrast to a complex numeral quantifier such as *at most three*) is described as being 'left and right monotone increasing' as verified by (i) and (ii):

(i) Three **boys** walked. → Three **children** walked.
(ii) Three boys **walked rapidly**. → Three boys **walked**.

In contrast *no* is 'left and right monotone decreasing', as seen by the valid entailment in (iii) and (iv):

(iii) No **children** walked. → No **boys** walked.
(iv) No boys **walked**. → No boys **walked rapidly**.

The monotonicity of a measure function (in the nominal domain) is defined by Schwarzschild (2002) as follows:

(44) A measure function μ is monotonic relative to the domain I iff:
For individuals x, y in I:
If x is a proper subpart of y, then μ(x) < μ(y).

Assuming that the measure function μ for 'three liters of water' is VOLUME, while that for 'three degree water' is TEMPERATURE, (42a) does, but (42b) does not, satisfy (43b), since the volume measure function is monotonic for *water*, while the temperature measure function is non-monotonic for *water*. To be concrete, in (42a), if three liters of water spilled on a desk, its volume is greater than a subpart of the water, say, two liters of water. In contrast, in (42b), if some water whose temperature is three degrees spilled on a desk, there is no entailment such that its temperature is greater than that of a subpart of the water.

Nakanishi then observes that, in contrast to the DNQ, the FNQ sentence is subject to the same monotonicity constraint applying in the verbal rather than the nominal domain. First observe the following:

(45)a. **mizu**-ga tsukue-no ue-de, **san-rittoru** koboreta. (FNQ)
water-NOM desk-GEN on-at 3-CL spilled

'Three liters of water spilled on the desk.'

b. ***mizu**-ga tsukue-no uede, **san-do** koboreta. (FNQ)
water-NOM desk-GEN on-at 3-CL(degree) spilled

(intended) 'Some water whose temperature is three degrees spilled on the desk.'

In (45a), *san-rittoru* '3 liters' denotes a measure function that is monotonic for the water spilling event. (45b) is ill-formed because the temperature measure function denoted by *san-do* '3 degrees' is not monotonic for a water spilling event. Thus, the FNQ sentence in (45) shows that the monotonicity constraint is satisfied in the verbal domain. One might object that in (45a) it is the subject *mizu* 'water' that respects the monotonicity constraint, not the predicate. However, the following contrast supports Nakanishi's claim that it is application of the monotonicity constraint to the verbal domain that is crucial:

(46)a. **yuki**-ga kinoo, **san-ton** John-no ie-no ue-ni tsumotta. (FNQ)
snow-NOM yesterday 3-CL J-GEN house-GEN on-at accumulated

'Three tons of snow accumulated on the top of John's house yesterday.'

b. ***yuki**-ga kinoo, **san-ton** John-no ie-o oshitsubushita. (FNQ)
snow-NOM yesterday 3-CL J-GEN house-ACC smashed

(intended) 'Three tons of snow smashed John's house yesterday.'

Since (46a) and (46b) both contain the same substance-denoting subject *yuki* 'snow', they both satisfy the monotonicity constraint in the nominal domain, yet (46b) is ill-formed. This is because the measure function denoted by *san-ton* '3-CL' is not monotonic for an event of snow smashing John's house, which has no subevents that are of the same logical type in the whole event.

Having shown how DNQs differ semantically from FNQs when they are interpreted as denoting a measure function, Nakanishi then attempts to extend her analysis to cover all DNQs and FNQs within an event-semantic framework. For example, Nakanishi claims that the FNQ sentence in (47a) is subject to the same monotonicity constraint applied to the predicate, given that the predicate extension is a semilattice of subevents of an event of a given type:

(47)a. **hako**-ga kinoo, **juk-ko** John-no tsukue-no ue-ni tsumiager-are-ta. (FNQ)
box-NOM yesterday 10-CL J-GEN desk-GEN up-on pile up-pass-past

'Ten boxes were piled up on John's desk yesterday.'

b. ***hako**-ga kinoo, **juk-ko** John-no tsukue-o oshithubushita. (FNQ)
box-NOM yesterday 10-CL J-GEN desk-ACC smashed

(intended) 'Ten boxes smashed John's desk yesterday.'

In (47a), the predicate *tsumiagerareta* '(was) piled up' describes a monotonic event since a subevent of boxes piling up on John's desk is still an event of boxes piling up on John's desk. In contrast, in the ungrammatical FNQ sentence in (47b), the predicate *John-no tsukue-o oshitsubushita* 'smashed John's desk' does not describe a monotonic event since a subevent of an event of smashing John's desk itself is not an event of smashing John's desk.

In order to formulate a precise account of how the FNQ is subject to the monotonicity constraint on the predicate, Nakanishi must be explicit about how a measure function can apply to a predicate. Here, she extends Krifka's (1989) analysis of durational temporal adverbials as expressing an indirect measurement of an event by a time period. Consider (48):

(48) He slept for three hours.

Krifka proposes that the meaning of (48) can be described in terms of a function h from an event lattice E to a lattice of 'event run times' T, where $h(x \cup_E y) = h(x) \cup_T h(y)$:

(49) $E \xrightarrow[h]{} T$

This is to say that *for three hours* indirectly measures the sleeping event by measuring a run time of the event. Adopting and extending this approach, Nakanishi points out that an event can also be indirectly measured out into subevents on the basis of objects participating in it a given way, i.e. on the basis of 'theta-role participants'. That is, one can posit a homomorphism h from a lattice of events E to a lattice of individuals I, where $h(e_1 \cup_E e_2) = h(e_1) \cup_I h(e_2)$:

(50) $E \xrightarrow[h]{\quad} I$

This is to say that an FNQ such as *juk-ko* in (47a) can indirectly measure out subevents of the piling-up event denoted by the predicate by identifying the individuals involved in each subevent, in this case boxes. The measure function μ for the event e applies to h(e), yielding μ(h(e)). This is an indirect measure function in contrast to the direct measure function found in the nominal domain in cases like (42a):

(51) The direct measure function

$$\begin{array}{ccc} I & & \text{measured amount} \\ x & \xrightarrow[\mu]{\qquad\qquad} & \mu(x) \end{array}$$

(52) The indirect measure function

$$\begin{array}{ccccc} E & & I & & \text{measured amount} \\ e & \xrightarrow[h]{\qquad} & h(e) & \xrightarrow[\mu]{\qquad} & \mu(h(e)) \end{array}$$

Given these assumptions, Nakanishi formulates the monotonicity of the indirect measure function (in the verbal domain) as follows:

(53) The indirect measure function μ is monotonic relative to the domain E iff:
For events e_1 and e_2 in E:
If $h(e_1)$ is a proper subpart of $h(e_2)$, then $\mu(h(e_1)) < \mu(h(e_2))$.
[PRECONDITIONS: There is a homomorphism h from E to I such that $h(e_1 \cup_E e_2) = h(e_1) \cup_I h(e_2)$, and h preserves a lattice structure form E to I, assuming, if $e_1 < e_2$, then $h(e_1) < h(e_2)$.]

Nakanishi notes that h could be the 'be an agent of' function. For example, h(e) = x could mean that 'x is an agent of e'. Presumably this is limited to the case of subject-oriented FNQ sentences. In consideration of the object-oriented FNQ sentence, we might generalize h as a 'be any thematic (θ-role) participant of' function. Furthermore, since μ in the case of 'three liters of water' is volume and that in the case of 'three degree water' is temperature, we might conjecture that μ in the case of the Japanese NQ such as *san-nin* '3-CL' would be NUMBER. Equipped with (53), Nakanishi revises the monotonicity constraints in the verbal domain as follows:

(54)a. Restriction on the Verbal Predicate
The verbal predicate must have a part-whole relation, i.e., the extension of the verbal predicate must be a lattice of individuals.

b. Restriction on Measure Functions
The measure function μ must be monotonic relative to the given part-whole structure, or a lattice structure of events.

Given this analysis of the FNQ, Nakanishi makes the following generalization:

(55) Both the DNQ and the FNQ are subject to monotonicity constraints.
a. The DNQ measures individuals denoted by the host noun.
→ Monotonicity constraints on the nominal domain.
b. The FNQ measures events denoted by the verbal predicate.
→ Monotonicity constraints on the verbal domain.

Equipped with this analysis, Nakanishi then also offers an account of the distributivity phenomenon. The argument seems to run as follows: Only under a distributive reading of an FNQ sentence may the indirect measure function denoted by the FNQ satisfy the monotonicity constraint because only under the distributive reading may individuals be mapped to single subevents in the event semilattice of the predicate. For example, consider the following sentence again:

(56) **gakusei**-ga kinoo, **san-nin** odotta.
student-NOM yesterday 3-CL danced

'Three students danced yesterday.'

Under the distributive reading there are three students, say John, Mary, and Paul, and each can be mapped to a different subevent of dancing yesterday. The dancing property holds as much for these subevents as it does for the whole event denoted by (56) and therefore the monotonicity constraint is satisfied.

As attractive as this analysis appears at first blush, it has some severe empirical and theory-internal problems. First, although the distributive reading does indeed conform to Nakanishi's account of how a monotonicity constraint applies to the verbal domain, this does not explain the distributivity phenomenon since we still do not know why the distributive reading is the only reading that can satisfy the monotonicity constraint in question. This takes us back to exactly the same empirical problem as in Junker's analysis as to why different times or different places cannot distinguish different subevents as well as different participants. Recall the situation such as follows in which John danced on three different occasions:

(57) e_1 = John danced yesterday at time t_1.
e_2 = John danced yesterday at time t_2.
e_3 = John danced yesterday at time t_3.

Such a construal of the event denoted by (56) would also satisfy Nakanishi's monotonicity constraint in the verbal domain. However, (56) cannot generally have this meaning. In short, Nakanishi must simply stipulate that only theta-roles count for the construal of an event semilattice, but then, just as for Junker, a severe problem arises with regard to an event classifier such as *kai* 'times' (see 40b above).

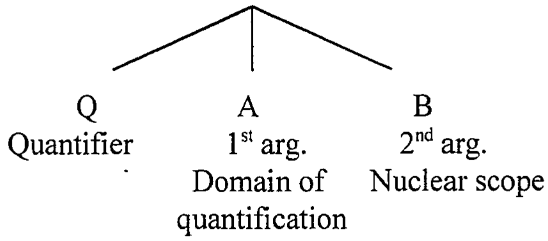
A second problem for Nakanishi's proposal is that it seems to rule out the possibility of a collective reading for the DNQ. If it is the application of a general semantic principle to the verbal domain that prevents the FNQ sentence from having a collective reading, then application of this same general principle to the nominal domain should also prevent the group operator from applying to a plural term. The problem here is worse because the paradox follows directly from the central hypothesis that it is the monotonicity constraint that forces the FNQ to have a distributive reading.

In sum, as a general account of the DNQ and the FNQ, Nakanishi's proposal is not satisfactory. It cannot capture the distributivity phenomenon. However, her account of the distinct semantic behavior of DNQs and FNQs does hold when these have an amount term reading, as we saw in the discussion of (42), (45) and (46) above. This, we think, is a very important contribution to research of the Japanese NQ because it provides a new kind of evidence of the fundamental syntactic difference between the DNQ and the FNQ. Evidently, the syntactic difference cuts across semantic function, causing a difference in the way the monotonicity constraints hold of amount term DNQs and amount term FNQs that parallels the difference in terms of distributivity between quantificational DNQs and quantificational FNQs.

5.2. Japanese Floating NQ Quantification

We have seen that each of the analyses reviewed in the previous section had difficulty accounting for the Japanese FNQ. In particular, as regards the domain of quantification, the first three analyses identify it as the denotation of the host NP (or the generator set extracted from the host NP), and the last two analyses took it to be the predicate denotation in terms of events. The former have difficulty capturing the event classifier sentence. The latter have difficulty capturing basic intuitions that numeral classifier refers to objects. Thus, it seems that our first major task is to correctly identify the domain of quantification. In what follows, we will take a closer look at the basic elements of the quantificational FNQ sentence, assuming the following general schema for quantification over objects:

(60)



We will develop an alternative analysis in which the domain of quantification is neither the host NP denotation nor events denoted by the predicate, but rather the classifier denotation.

5.2.1. The Quantifier

In a typical quantificational FNQ sentence such as the following;

(61) **gakusei**-ga, **san-nin** kaetta.
student-NOM 3-CL left

'Three students left.'

the sentence has a host noun, an NQ, and a verb. The first question is whether it is just the numeral (*san* '3') that is the quantifier, or rather the NQ including the classifier (*san-nin* '3-CL'). In English and many other languages, the numeral does not contain any overt sub-component and immediately precedes a noun, so the numeral itself is naturally considered to be the quantifier. In Japanese, on the other hand, the situation is not so clear.

The numeral in Japanese is generally morphologically associated with a classifier. Although some linguists have taken this to be purely a formal agreement phenomenon lacking semantic function, we have argued that this is an inaccurate analysis. We showed in chapter 3 (section 3.1) that the classifier is semantically significant in that each classifier has its own meaning. The meaning of each classifier itself does not express the quantity. We propose, then, that the quantifier is the numeral alone, and not the whole NQ.

According to our syntactic analysis of the FNQ construction, the numeral must first combine with the classifier to form an NQ and then this NQ must combine with the predicate to form the complex predicate [FNQ+VP]. Finally, this complex predicate composes with the host NP. Thus, we propose that the Japanese numeral quantifier that quantifies over individuals is a three place expression whose lexical content has the following logical structure:

(62) $\lambda C \lambda P \lambda H\ [\Phi]$

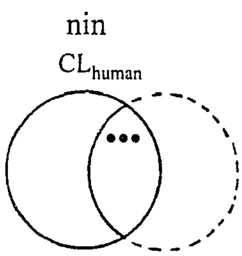
where C = classifier; P = predicate; H = host NP; Φ = semantic value.

We will consider exactly what the semantic value Φ is, which must include reference to a specific number, after we have examined the semantic contribution of the classifier and the predicate, and the semantics of the host NP.

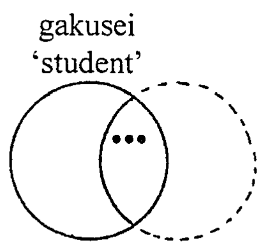
5.2.2. The Domain of Quantification

Given that the numeral itself is the quantifier, we propose that the classifier denotation is the domain of quantification. Thus, an NQ such as *san-nin* '3-CL' describes a (partial) situation such as (63a). It does not describe the (partial) situation such as (63b), as would be the case if the domain of quantification were the host NP, e.g. *gakusei* 'student':

(63)a.



b.



Given that it functions as the first logical argument of the numeral, the classifier should be assumed to denote a set of individuals. Now, recall our discussion in chapter 4 which showed how Link's semilattice plurality theory deftly captures the singular/plural underspecification of the Japanese common noun when it is assumed that the Japanese noun denotation contains both sums and singular individuals. Given this assumption, it is important to note that a common noun could never suffice as the first logical argument of a numeral quantifier because there would be nothing to prevent the quantifier from counting sum individuals rather than singular atoms, as we briefly discussed concerning Fukushima's analysis. This is a general problem for any theory of the FNQ that takes the host NP to be the first logical argument. Let us go over the problem in detail. Suppose *nin* denoted a set consisting of both sums and singular atoms, on a par with an ordinary object-denoting Japanese noun. In this case, its denotation would contain the elements of the semilattice structure formed from atoms, as represented in (64) for a context involving four *nin*-objects (i.e. human beings) as the domain of quantification:

(64) nin: CL_{human}

$$
\begin{array}{cccccc}
 & & a \sqcup b \sqcup c \sqcup d & & & \\
a \sqcup b \sqcup c & & a \sqcup b \sqcup d & a \sqcup c \sqcup d & & b \sqcup c \sqcup d \\
a \sqcup b & a \sqcup c & a \sqcup d & b \sqcup c & b \sqcup d & c \sqcup d \\
a & & b & c & & d
\end{array}
$$

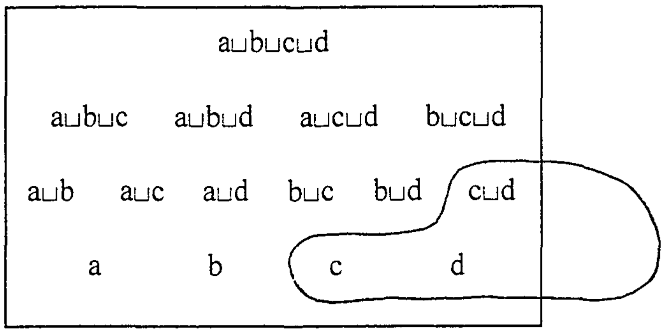
Now consider the sentence (65), repeated from (61):

(65) **gakusei**-ga, **san-nin** kaetta.
student-NOM 3-CL left

'Three students left.'

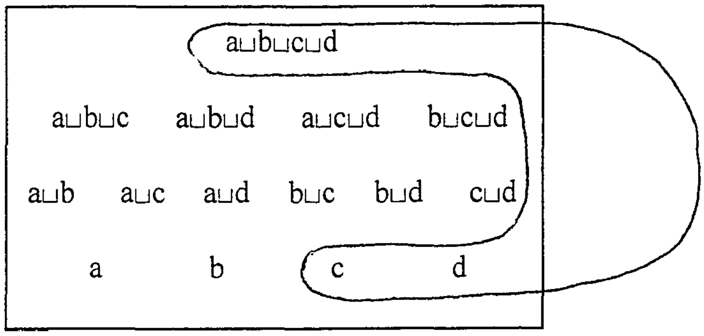
Since the numeral is *san* '3', a set of three elements must be selected from the domain of quantification (64). Suppose we select any three-member set to satisfy this truth conditions, say, {c⊔d, c, d} or {a⊔b⊔c⊔d, c, d}. Clearly, this will not work. In the former case, the number of distinct individuals is only two, namely c and d, and in the latter case, it is as many as four, namely a, b, c, and d, as shown below:

(66)a. nin:CL_{human}



number of quantified elements: 3
number of individuals: 2

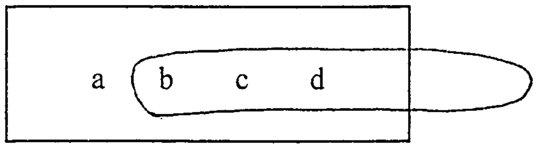
b. nin: CL_{human}



number of quantified elements: 3
number of individuals: 4

In fact, the sentence in (65) asserts that the number of students who left is three, so it should not be true in either situation. The numeral *san* '3' does not correspond to the number of individuals in these situations. This is precisely because we included sums in the domain of quantification. The correct truth conditions can be assigned to (65) only if the cardinality requirement of *san* '3' is satisfied by a three-member set such as {a, b, c}, {a, b, d}, etc. In order for the number expressed by the quantifier to be the cardinality of a set of singular individuals, the individuals in the domain of quantificaion must all be atoms, excluding sums, as shown below:

(67) nin: CL_{human}



number of quantified elements: 3
number of individuals: 3

In general, the domain of quantification of a numeral quantifier must only contain singular individuals (Kratzer 1989, Chierchia 1998a). Therefore, the elements denoted by the classifier must be all atomic. That is to say that the classifier does not form a semilattice structure at all. Rather, it is a singular term. We will call this the 'atomicity constraint' on classifier denotations. Thus, the crucial semantic property of the classifier is that it conforms to this constraint.

Obviously, though, atomicity is not the only semantic property of a classifier. As we know, each classifier has its own meaning. *Nin*, for example, is used only to count human beings. Thus, it also has the meaning 'human' as a lexical property. In general, the denotation of a numeral classifier consists of two lexical specifications; a qualitative component (e.g. 'human') and a restrictive component (atomicity). We find Link's 'atomic-individual-part-of' operator, i.e. $^{\bullet}\Pi$, useful here: Adopting this, we may define the lexical meaning of the numeral classifier as follows:[26]

---

[26] Note that the formulas in (68) are not intended to represent a productive syntactic process of deriving classifiers from all Japanese nouns. Such a situation does seem to arise in a classifier language like Thai, where any count-type noun may function as a classifier.

(68) nin (CL_{human}): $\lambda x_e \exists y_e[nin'(y) \wedge x {}^\bullet\Pi y]$

satsu (CL_{volume}): $\lambda x_e \exists y_e[satsu'(y) \wedge x {}^\bullet\Pi y]$

kumi (CL_{group}): $\lambda x_e \exists y_e[kumi'(y) \wedge x {}^\bullet\Pi y]$

etc. of type <e,t>

The first conjunct asserts that the elements in the extension of a classifier must have a certain property, such as the property of being human (*nin*), or of being a bound volume (*satsu*), or of forming a group (*kumi*). Note that what is denoted here is equivalent to the denotation of a very general common noun like English *thing*, or *-body* in *somebody*, or Japanese *mono* 'thing'. Thus, the qualitative component picks out both sums and atoms. However, the second conjunct asserts that these elements must be atomic members of the set denoted by the first conjunct. For example, if there are three individuals a, b, and c which have the property of being a human in a given context, then the denotation of the qualitative component of *nin* is {a⊔b⊔c, a⊔b, a⊔c, b⊔c, a, b, c}, but the restrictive component selects only the atomic elements within this set. Thus, the denotation of *nin* as a numeral classifier is only {a, b, c}. Note, in this regard, the special nature of the classifier *kumi*. The quality component of *kumi* refers to groups of objects. This obscures the fact that *kumi* can only denote a set of atoms. What the denotation of *kumi* may not include is any sum of the groups. But sums, recall, are not groups under the theory of plurality we are assuming. Thus, the classifier *kumi* denotes a set of objects each of which has the property of being a group, though each remains an atom. In other words, *kumi* denotes a set of group atoms.

Now that we have isolated the meaning components of the numeral classifier, we can distinguish more easily the observation that the classifier must agree semantically with its host NP from the function of the classifier as an 'atom definer' for a mass term. The semantic agreement phenomenon is agreement between the host NP and the qualitative component of the classifier. The restrictive component, on the other hand, is what gives a precise definition to the vague 'potential' atoms of the host NP.[27] Note also that neither of these semantic relationships between the numeral classifier and the host NP require any special syntactic relation; they are established indirectly when the host NP composes semantically with the [FNQ+predicate] constituent.

In sum, there is a significant difference between a common noun such as *otoko* 'man' and a classifier such as *nin*. The extension of *otoko* is a set of individuals which includes both atoms and sums. In contrast, the classifier only denotes a set of atoms and as such satisfies a universal semantic (or logical) requirement for functioning as the domain of quantification of a cardinal quantifier.

Finally, note that identifying the classifier as the domain of quantification is a crucial step for formulating a unified account of object-quantificational FNQ sentences such as (65) and event-quantificational FNQs such as (69):

(69) John-ga **kono pisutoru**-o, **ni-hatsu** utta.
J-NOM this pistol-ACC 2-CL shot

'John shot two shots of this pistol.'

In (69), the NP *kono pisutoru* 'this pistol' is obviously not what the numeral quantifies over. Rather, what the numeral *ni* 'two' counts here is a number of *hatsu* 'blasts/shots'. In

[27] Recall from our discussion in chapter 4 that, following Chierchia (1998a, b), we take the lexical denotation of an object-denoting noun to be like that of English *furniture*. In the absence of a classifier, its atomic individuals are vague (undefined) 'potential' atoms.

harmony with this, the quality specification of the classifier *hatsu* 'blast/shot' restricts the domain of quantification to a set of (atomic) shooting/blasting events: (69) asserts that there are two shots that John shot with 'this pistol'. We will have more to say about such 'pistol sentences' or 'event classifier sentences' in section 5.4 below. For the moment, though, let us simply observe that the classifier functions as the domain of quantification in both the case of the object-denoting classifier and in the case of the event classifier.

5.2.3. The Nuclear Scope

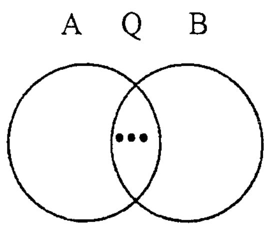
Now we turn to the nuclear scope of FNQ quantification. For the sentence in (70), repeated from (65), we have argued that the NQ consists of the quantifier and its domain of quantification.

(70) **gakusei**-ga, **san-nin** kaetta.
student-NOM 3-CL left

'Three students left.'

To identify the nuclear scope, consider the general mechanism of quantification again illustrated as follows:

(71)



Generally, the nuclear scope, represented by B here, is a property that holds for the quantified objects in the domain of quantification. Thus, the elements in the intersection of A and B have, by definition, the property of A and B, respecting the principle of conservativity. In (70) the property shared by the three atomic *nin*-objects should be represented by the nuclear scope of the quantifier *san* 'three'. Now, what is this property? The property of being a leaver (*kaetta* 'left'), or the property of being a student (*gakusei* 'student') or the property of being a student who left? Another look at a DNQ-FNQ sentence such as (72) can shed some light on the question:

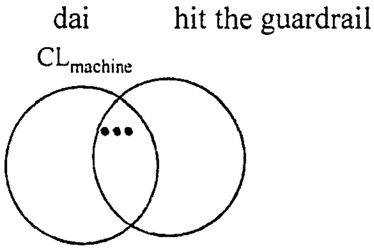
(72) **narande hashitteita** **suu-dai**-no **torakku**-ga,
in a row running some-CL-GEN truck-NOM

san-dai gaadoreeru-ni butsukatta.
3-CL guardrail-to hit

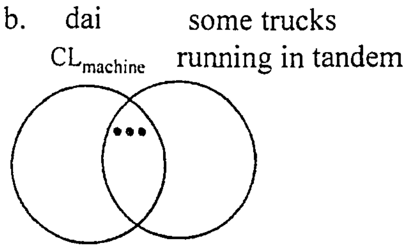
'Three of the several trucks that were driving in tandem hit the guardrail.'

In chapter 3, we noted that the numeral of the FNQ '3' in this sentence indicates the number of *dai*-objects (machinery; trucks here) which hit the guardrail. That is, the property of hitting the guardrail, which is denoted by the predicate, is shared by the three elements that are *dai*-objects. This reveals clearly that the predicate is the nuclear scope. On the other hand, the property denoted by the host NP 'some trucks that were running in tandem' cannot be the nuclear scope, since this cannot be the property of the three elements that are *dai*-objects. Compare the following two situation diagrams which represent these two quantification relations. (73a) represents the quantification in which the nuclear scope is the predicate, and (73b) represents the quantification in which the nuclear scope is the host NP:

(73)a.



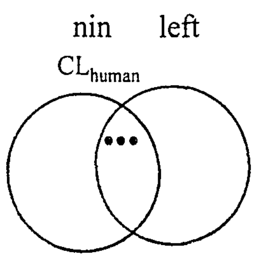
b.



The three elements in the classifier denotation each must have the property denoted by the nuclear scope. (73a) correctly describes a situation in which each of the three *dai*-objects has the property of hitting the guardrail, while (73b) describes a situation in which each of the three *dai*-objects has the property of 'some trucks running in tandem'. Obviously, (73b) is a wrong analysis, since no individual *dai*-object can have the property of being some trucks running in tandem. That is an impossible state of affairs. Thus, we conclude that the nuclear scope is the predicate.

Going back to (70), then, what the predicate denotes, namely, the set of leavers, corresponds to the nuclear scope. Thus, to interpret the sentence in (70), we count the *nin*-objects in terms of the leaving property. This can be illustrated as follows:

(74)



(74) describes a situation in which the set of *nin*-objects and the set of leavers intersect, and there are three elements in the intersection. Thus, if (70) is true, the situation is that there are three *nin*-objects that left.

Next, let us consider a sentence with an object-oriented FNQ, such as the following:

(75) John-ga **hon**-o, **san-satsu** katta.
J-NOM book-ACC 3-CL bought

'John bought three books.'

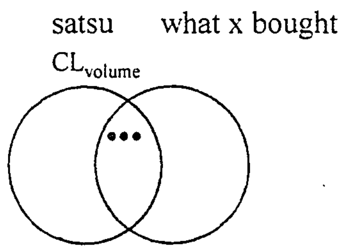
Here, the FNQ *san-satsu* determines that the three *satsu*-objects (bound volumes) are recognized to hold a certain property denoted by the nuclear scope. Since the host NP was not identified as part of the nuclear scope in the case of subject-oriented FNQ, we might expect the same to hold in the case of an object-oriented FNQ. Again, consideration of a DNQ-FNQ sentence confirms this:

(76) Hanako-wa **sokoni aru san-mai-no kaado**-o, **ichi-mai** mekutta.
H-TOP there exist 3-CL-GEN card-ACC 1-CL flipped

'Hanako flipped one of the three cards there.'

In (76), the numeral '1' of the FNQ counts the number of *mai*-objects (sheet-like objects) that were flipped. That is, the predicate *mekutta* 'flipped' is the property of the one *mai*-object. Again, the host NP, i.e.'three cards that exist' cannot be the property of just one *mai*-object. It is semantically incoherent for one card to be three cards. Thus, the host NP cannot be the nuclear scope of *ichi-mai* '1-CL'. The numeral of the FNQ indicates precisely the number of objects that have the property specified by its classifier and the property denoted by the predicate. Going back to (75), then, the property of the three *satsu*-objects can be identified as the predicate *katta* 'bought'. However, the complete interpretation of a transitive verb requires a value for its subject argument and so, given that some value will eventually be given to *x*, we derive the property of 'being bought by *x*' as the nuclear scope. Thus, the nuclear scope of *san* '3' can be illustrated as follows:

(77)



(77) describes a situation in which the set of *satsu*-objects and the set of things that *x* bought intersect, and there are three elements in their intersection. The specific value of *x* is given later by the subject *John*. Thus, (75) is true when there are three *satsu*-objects that are bought by John.

Although we cannot yet discuss it in detail here, let us also note that the predicate is the nuclear scope for the event classifier FNQ sentence as well. Again, consider the infamous pistol sentence:

(78) John-ga **pisutoru**-o, **ni-hatsu** utta.
J-NOM pistol-ACC 2-CL shot

'John shot a pistol twice.'

We mentioned above that the classifier provides the domain of quantification for *ni* '2' in this sentence. 'Two shots' must have the property denoted by the nuclear scope and the verb here is 'shot'. Thus, in accordance with our derivation of the nuclear scope for an object-oriented FNQ sentence such as (75), we may derive the nuclear scope for *ni* '2' in (78) from the predicate, taken as a closed formula with respect to its nominal arguments. As we will see, the nuclear scope in this case is a set of events that have the property of being events of John shooting a pistol. However, let us postpone discussion of this. For the moment, the only point we wish to make is that the nuclear scope for such FNQs is also the predicate.

In sum, we propose that the nuclear scope is the predicate denotation.[28] The subject-oriented FNQ and the object-oriented FNQ compose with the intransitive verb phrase and the transitive verb phrase, respectively. The denotation of these two types of predicate can be exemplified as follows:

(79)a. intransitive verb phrase for a subject-oriented FNQ, e.g. kaetta 'left'

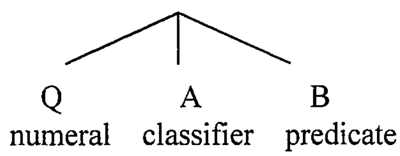
λx_e [kaetta'(x)]

b. transitive verb phrase for an object-oriented FNQ, e.g. katta 'bought'

$\lambda T_{<<<e,t>,t>} \lambda x_e [T(\lambda y_e[\text{katta}'(y)(x)])]$

At this point, we have identified the three basic components of FNQ quantification, namely, quantifier (Q), its domain of quantification (A) and its nuclear scope (B), as follows:

(80)



Letting n be the quantity specified by the numeral, if there are n elements in the intersection, the sentence is true because these n elements have the properties that the classifier and the predicate denote. Note that this analysis conforms to the principle of conservativity, which may be represented as follows:

(81) Conservativity:

If $A, B \subseteq E$, then $Q_E AB \leftrightarrow Q_E A(A \cap B)$

---

[28] To be precise, in the computation of the FNQ sentence with an object-denoting classifier, it suffices to assume that the predicate denotation is a set of objects, and in the computation of the FNQ sentence with an event classifier, it has to be assumed to be a set of events. These will be clarified in the precise computations below.

(81) says that a quantified sentence Q_EAB is true if and only if a quantified sentence $Q_EA(A\cap B)$ is also true. More concretely, from the pool of entities in the domain of quantification A, Q picks out only those that also have the property B. For example, given an English sentence such as *Some girls smoke*, where the quantifier is *some*, A is *girls*, and B is *smoke*, then we can see that this sentence is true if and only if the sentence *Some girls are girls that smoke* is also true. In the following we show how the Japanese FNQ sentence with the analysis (80) passes the same conservativity test:

(82)a. subject-oriented FNQ

gakusei-ga, **san-nin** peepaa-o kaita.	3	nin	peepaa-o kaita
student-NOM 3-CL paper-ACC wrote		CL	wrote a paper

'Three students wrote a paper.' → Three nin are nin that wrote a paper.

b. object-oriented FNQ

John-ga **piza**-o, **ni-mai** tabeta.	2	mai	John-ga tabeta
J-NOM pizza-ACC 2-CL ate		CL	John ate

'John ate two slices of pizza.' → Two mai are mai that John ate.

c. event classifier (object-oriented)

John-ga **pisutoru**-o, **ni-hatsu** utta.	2	hatsu	John-ga utta
J-NOM pistol-ACC 2-CL shot		CL	John shot

'John shot two shots of a pistol.' → Two hatsu are hatsu that John shot.

The quantificational analysis of each FNQ sentence above is shown on the right. Each FNQ sentence entails a proposition of the form $Q_EA(A\cap B)$. Thus, our quantificational analysis is consistent with the principle of conservativity, a UG constraint on natural language quantification.

5.2.4. The Host NP

Given the analysis we have developed so far, it seems that the quantification computation is over. Quantification requires just three components, i.e. the quantifier, its first argument, and its second argument, which we have identified to be the numeral, the classifier, and the predicate, respectively. This seems strange because we have not yet even mentioned the host NP. Japanese linguists have always assumed a significant role for the host NP in the interpretation of an FNQ. This relationship seems crucial in other languages such as English and French. What, then, is the host NP doing in Japanese FNQ sentences? What precisely is the relationship between the FNQ and its host NP, this relationship which has attracted so much attention in the syntactic literature? If we are correct in the steps of our analysis thus far, then we are forced to conclude that the role of the host NP falls outside of the quantification proper. In fact, this is indeed empirically plausible considering the fact that the Japanese FNQ sentence with an event classifier cannot allow the host NP to be involved in the quantification proper.[29] However, in many cases an FNQ sentence also does contain

[29] It is also possible for an FNQ that quantifies over objects to occur in a sentence that apparently has no host NP at all:
(i) Daiana-no osooshiki-ni nan-nin kita-no?
Diana-GEN funeral-to what-CL came-Q
'How many people came to Princess Diana's funeral?'
However, given that Japanese freely allows null arguments, it could be argued that (i) does have a host NP, only an inaudible one.

a host NP. Now it is time to examine the exact function of this element in the ordinary FNQ sentence. Consider again the following:

(83)a. **gakusei**-ga, **san-nin** hon-o katta.
student-NOM 3-CL book-ACC bought

'Three students bought a book.'

b. John-ga **hon**-o, **san-satsu** katta.
J-NOM book-ACC 3-CL bought

'John bought three books.'

As we can see in (83), the host NP occupies an the argument position. Under the generalized quantifier theory which we are assuming, arguments such as subject and object are DPs. This is to say that the host NP, which is a common noun (e.g. *gakusei* 'student' and *hon* 'book' in 83), is actually associated with some determiner. In a Japanese sentence, no obligatory overt determiner is required. However, the claim that a subject or an object is associated with a phonetically null determiner can be supported by the fact that the following simple sentences are interpreted with different readings which are realized by different determiners in languages such as English that have obligatory overt determiners:[30]

(84)a. gakusei-ga kita.
student-NOM came

'A student/some students came.' or
'The student(s) came.'

---

[30] (84) was presented in chapter 4 to make the point that a bare noun in Japanese can be interpreted as singular or plural. The same set of data is presented here to make the point that a bare noun in Japanese can be interpreted as definite or indefinite.

b. John-ga hon-o katta.
J-NOM book-ACC bought

'John bought a book/some books.' or
'John bought the book(s).'

The interpretation of bare nouns such as *gakusei* 'student' and *hon* 'book' in an argument position can vary as shown. However, they must be assigned either a definite or indefinite reading. A simple way of accounting for this is to assume that there actually is a determiner in (84), only it is phonetically null. Assuming the presence of an inaudible determiner, then, a bare noun would have the semantic value of a property. Thus, the meaning of the host NP would be as follows:

(85) gakusei 'student': λx_e [gakusei'(x)]

ringo 'apple': λx_e [ringo'(x)]

Such a noun would always be associated with a determiner to form a DP, just as in English. Thus, when the inaudible D is indefinite, this can be represented as follows:[31]

(86) (*a*): $\lambda X_{<e,t>}\lambda Y_{<e,t>}\exists y[X(y) \wedge Y(y)]$

The composition of the host NP with such a determiner, then, will yield the following:

(87)a. DP containing a host NP *gakusei* 'student'

$\lambda Y\exists y[\text{gakusei}'(y) \wedge Y(y)]$

b. DP containing a host NP *ringo* 'apple'

$\lambda Y\exists y[\text{ringo}'(y) \wedge Y(y)]$

---

[31] There are, of course, other ways of representing the existential reading of an indefinite (e.g. Heim, 1982). Since this goes beyond our concern, for simplicity we represent the indefinite reading of a Japanese DP by positing that one of the Japanese inaudible determiner is an existential quantifier. In addition we abstract away from the specific/non-specific distinction.

Given such a meaning, the DP would compose with a predicate in the ordinary way. According to our analysis, the FNQ is an adverb. As such, it composes with a given predicate and forms another (complex) predicate of the form [FNQ+Pred], providing a further restriction on the range of the predicate, just as other adverbs do. This, then, is what the DP containing the host NP composes with: In the case of a subject-oriented FNQ sentence, [FNQ VP] composes with $[..NP..]_{DP}$ which is the subject, and in the case of an object-oriented FNQ sentence, [FNQ Verb] composes with $[..NP..]_{DP}$ which is the direct object, forming [DP [FNQ Verb]], and further composes with the subject DP. Therefore, the relationship between the complex predicate [FNQ+Pred] and the DP which contains the host NP is, syntactically, just the relationship between a predicate and its argument. Consequently, the relationship between the FNQ inside the complex predicate [FNQ+Pred] and the host NP inside the DP is not direct. It can be likened to the relationship between *John* and *deliberately* in the sentence *John deliberately broke the window* or between *petals* and *gently* in the sentence *Mary gently picked the petals.* Furthermore, the relationship between the classifier inside the FNQ and the host NP is even more indirect. There is no direct interaction. Rather, the relationship between the classifier and the host NP is one of semantic and pragmatic coherence, as we discussed in chapter 3 and earlier in this chapter in section 5.2.2. That is, the semantic agreement of the host NP with the quality component of the classifier is simply the familiar relationship of selectional restriction. In the case of a subject-oriented FNQ, the classifier compositionally adds to the predicate a selectional restriction on its subject; in the case of an object-oriented FNQ, the classifier compositionally adds to the predicate a selectional restriction on its object. In (83a), for example, the classifier *nin* adds the requirement that the subject of *san-nin katta* '3-CL bought' denote human beings. In (83b), the classifier *satsu* adds the requirement that the object of *san-satsu katta* '3-CL bought' denote book-like things. (In addition, of course, the numeral places restrictions on the cardinality of the specific argument.) In other words, what we find in general in classifier systems such as that of Japanese is the overt morphological realization of predicate selectional restriction.

Of course, the classifier and the host NP are indirectly related in a sentential context as two elements which are parts of an overall interpretation. Concretely, the complex predicate containing the FNQ is composed with a DP such as shown in (87), in which an existential quantifier is introduced by the inaudible determiner, as shown in (86). Thus, although the numeral is a three-place expression, it is the inaudible determiner whose maximal projection contains the host NP that 'glues the subject and predicate together' in the case of a subject-oriented FNQ sentence. Likewise, in an object-oriented FNQ sentence, it is predication, not the FNQ, that holds the sentence together. For this reason our account of the semantics of the FNQ captures the entailment of (88b) by (88a) in exactly the same way that a standard analysis of the English NQ captures the entailment of (89b) by (89a):

(88)a. gakusei-ga san-nin hashitta.
student-NOM 3-CL ran

'Three students ran.'

b. gakusei-ga hashitta.
student-NOM ran

'A student wrote a paper.'

(89)a. Three boys left.

b. A boy left.

When the semantic contribution of *three* is removed from (89a), the result is (89b). Likewise, when the semantic contribution of *san-nin* '3-CL' is removed from (88a), the result is (88b).

5.2.5. The Semantic Value of the Numeral

At this point, let us return to the quantifier, i.e. the numeral, and specify precisely what its semantic value must be. What the numeral has to do is compose with the classifier and then the predicate, forming the complex predicate [FNQ+Pred]. The outcome value then composes with the DP containing the host NP. What we propose, then, as the semantic value of the numeral is the following:

(90) $[\![n]\!] = \lambda C \lambda P \lambda x \exists K\, [\, K \subseteq (C \cap P) \wedge |K| \geq n \wedge \sqcup K = x \,]$

where C=classifier denotation and P=predicate denotation

The semantic effect of (90) can be described informally as follows:

(91)a. A numeral n is a semantic object that seeks a classifier denotation and a predicate denotation, and when they are saturated the outcome becomes a property of objects.

b. n asserts the existence of a set of objects K, which is contained in the intersection of the classifier denotation and the predicate denotation.

c. K contains n-many elements.

d. The supremum generated by the elements in K is identified as the property of objects in question.

(91a) describes the semantic type of the numeral. (91b) and (91c) together describe the computation of numeral quantification. (91d) describes the relation to the DP. Let us now see exactly how this all works for a simple sentence such as *gakusei-ga san-nin hashitta* 'Three students ran'. The classifier *nin* selects human beings, so it denotes the set of all human atoms. The predicate, *hashitta* 'ran' denotes the set of runners. Thus, the intersection of these two sets is the set of atomic human runners. Note that this intersection contains all individual human runners. Now, the numeral is 3, so the intersection of the predicate and the classifier must include a subset of at least three elements. The numeral asserts that this subset exists; the 'cardinality set' K is bound by an existential quantifier. Now, the three atomic human runners are *gakusei* 'student' in this sentence. *Gakusei* 'student' is independently bound by another existential quantifier, associated with a null determiner equivalent to English *a*. This inaudible indefinite determiner asserts the existence of an element x in the denotation of *gakusei* which has the property K. The only way to relate an element x to K is to form a supremum of K and identify x with K. This is what is expressed in the last conjunct. This is possible because the elements in the set denoted by *gakusei* 'student' can be either atoms or sums. Thus, one of the sums can be identified as the sum of three atomic human runners.

It should be seen now where the distributivity phenomenon comes from. According to our analysis above, the distributivity phenomenon is directly determined by the atomicity condition of the classifier compositionally applying in the syntactic context of the FNQ. That is, the classifier denotation is intersected with the predicate denotation. In the next section we will see exactly how this works.

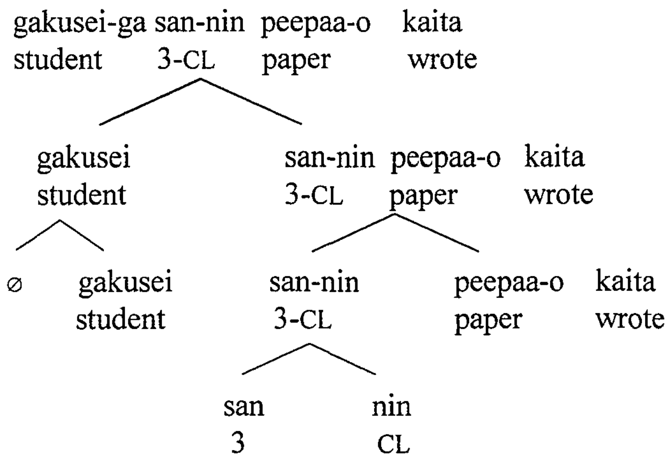
5.2.6. Interpretation Derivation of the Core Cases

Here we present the derivation of two simple sentences with an FNQ, i.e. the core cases of the FNQ construction. One is a sentence with a subject-oriented FNQ and the other is a sentence with an object-oriented FNQ. Because the syntax is so basic here, we use a GPSG-like representation to show how meaning is assigned compositionally in an FNQ sentence. Thus, the semantic interpretation of the FNQ sentence in (92a) can be represented by the semantic tree in (92b) and by the interpretation derivation in (92c). For simplicity, we treat *peepaa-o kaita* 'wrote a paper' as an intransitive verb phrase.

(92)a. **gakusei**-ga, **san-nin** peepaa-o kaita.
student-NOM 3-CL paper-ACC wrote

'Three students wrote a paper.'

b. semantic tree



c. derivation

$3{:}\lambda C_{<e,t>}\lambda P_{<e,t>}\lambda x_e \exists K[K \subseteq (C \cap P) \wedge |K| \geq 3 \wedge \sqcup K = x]$
| nin: 'nin(CL)': $\lambda u_e \exists v_e[\text{nin}'(v) \wedge u^{\bullet}\Pi v]$
|/
3 (nin): $\lambda P \lambda x \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u^{\bullet}\Pi v] \cap P) \wedge |K| \geq 3 \wedge \sqcup K = x])]$
| peepaa-o kaita 'wrote a paper': $\lambda x_e[\text{peepaa-o kaita}'(x)] =_{abbr.}$ peepaa-o kaita'

|/
(3(nin))(peepaa-o kaita):
$\lambda x \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap peepaa\text{-}o\ kaita') \wedge |K| \geq 3 \wedge \sqcup K = x\ ]$
| gakusei 'student': $\lambda x[gakusei'(x)]$
| | ⌀ 'a': $\lambda X_{<e,t>} \lambda Y_{<e,t>} \exists y[X(y) \wedge Y(y)]$
| |/
| ⌀ (gakusei): $\lambda Y \exists y[gakusei'(y) \wedge Y(y)]$
|/
(⌀gakusei)((3(nin))(peepaa-o kaita)):
$\exists y[gakusei'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap peepaa\text{-}o\ kaita') \wedge |K| \geq 3\ \wedge \sqcup K = y\ ]]$
'student' 'nin' 'wrote a paper'

The final line of (92c) asserts that there is a set of objects K which is a subset of the intersection of the set of atomic *nin*-objects and the set of objects whose property is *peepaa-o kaita* 'wrote a paper', that the number of the elements in this set K is at least three, and that the supremum of K is y which has the property of being student.

Here, note that the predicate *peepaa-o kaita* 'wrote a paper' is a mixed predicate. Thus, its extension might include both individual atoms and group atoms. According to what we assumed in chapter 4, a plural predicate denotation can be derived from a singular predicate denotation freely applying the plural operator *. Thus, a plural predicate *peepaa-o kaita* 'wrote a paper' denotes a set containing individual atoms and group atoms, and all the sums formed of these atoms. To be concrete, suppose a model in which there are six paper-writers d, e, f, g, h, and $\uparrow(i \sqcup j)$, among which d, e, f, i, and j are students, g is a professor, and h is a panda. Then, *peepaa-o kaita* 'wrote a paper' in this model denotes a set containing these six atomic elements and all the sums generated by these atoms. The classifier *nin* denotes the set of human singular atoms. Thus, the intersection of these two sets contains human singular atoms which wrote a paper, namely the intersection is the set: {d, e, f, g}. That is, all the sums and the group atom $\uparrow(i \sqcup j)$ are excluded since they are not singular atoms, and the element h is excluded since it is not human. Now, K is a subset of the intersection and its cardinality is ≥ 3. For the sentence to be true, there must be such a K whose supremum is an element of the set denoted by *gakusei* 'student'. Indeed there is such a K, namely {d, e, f}, since these three elements are students, and thus $d \sqcup e \sqcup f$ is an element of the set denoted by the plural term *gakusei*. Therefore, the sentence (92a) is true of this model. Note that the intersection of the classifier denotation and the predicate denotation guarantees the distributivity, since it excludes all sums and group atoms.

If the predicate were of the distributive type, e.g. *hashitta* 'ran', it would denote a set containing singular atoms and sums generated by them. In this case, the classifier's atomicity constraint would exclude the sums. On the other hand, if the predicate were of the collective type, e.g. *gasshooshita* 'sang in chorus', it would denote a set containing only group atoms and sums generated by them. In this case, the classifier's atomicity constraint would exclude all of these elements. Therefore, the intersection would be the null set. In other words, there would be no cardinality set K in such a case. Hence the sentence would be semantically ill-formed (always false). This is why the collective predicate is generally incompatible with an FNQ quantifying over individuals.

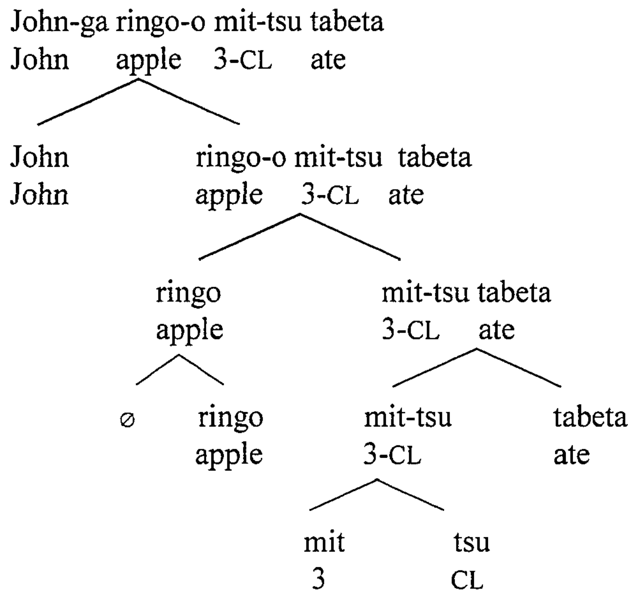
Furthermore, recall that we argued that a common noun such as *gakusei* 'student' in Japanese denotes a set containing both sums and atoms. The supremum generated by K, then, is an element in the set denoted by *gakusei*, namely a sum individual.

Next, let us consider the case of an object-oriented FNQ such as (93a). Its semantic tree can be represented as in (93b), and its interpretation derivation as (93c):

(93)a. John-ga **ringo**-o, **mit-tsu** tabeta.
J-NOM apple-ACC 3-CL ate

'John ate three apples.'

b. semantic tree



c. interpretation derivation

3: $\lambda C_{<e,t>}\lambda P_{<<<e,t>t,>,<e,t>>}\lambda D_{<<e,t>,t>}\lambda x_e$
$D[\lambda y_e[\exists K[K\subseteq(C\cap\lambda z_e[P(\lambda N N(z))(x)])\wedge|K|\geq 3\wedge\sqcup K=y]]]$
| tsu 'tsu (CL)': $\lambda u_e\exists v_e[\mathrm{tsu}'(v)\wedge u^{\bullet}\Pi v]$
|/
3(tsu):
$\lambda P\lambda D\lambda x D[\lambda y[\exists K[K\subseteq(\lambda u\exists v[\mathrm{tsu}'(v)\wedge u^{\bullet}\Pi v]\cap\lambda z[P(\lambda N N(z))(x)])\wedge|K|\geq 3\wedge\sqcup K=y]]]$
| tabeta 'ate': $\lambda T_{<<e,t>,t>}\lambda s_e[T(\lambda w_e[\mathrm{tabeta}'(w)(s)])]$
|/
(3(tsu))(tabeta):
$\lambda D\lambda x D[\lambda y[\exists K[K\subseteq(\lambda u\exists v[\mathrm{tsu}'(v)\wedge u^{\bullet}\Pi v]\cap\lambda z[\mathrm{tabeta}'(z)(x)])\wedge|K|\geq 3\wedge\sqcup K=y]]]$
| ringo 'apple': $\lambda x[\mathrm{ringo}'(x)]$
| | ⌀ 'a': $\lambda X_{<e,t>}\lambda Y_{<e,t>}\exists y[X(y)\wedge Y(y)]$
| |/
| ⌀ (ringo): $\lambda Y\exists y[\mathrm{ringo}'(y)\wedge Y(y)]$
|/
((3(tsu))(tabeta))(⌀ (ringo)):
$\lambda x[\exists y[\mathrm{ringo}'(y)\wedge\exists K[K\subseteq(\lambda u\exists v[\mathrm{tsu}'(v)\wedge u^{\bullet}\Pi v]\cap\lambda z[\mathrm{tabeta}'(z)(x)])\wedge|K|\geq 3\wedge\sqcup K=y]]]$
| John: $\lambda S_{<e,t>}S(j)$

|/
(John)(((3(tsu))(tabeta))(ringo)):
$\exists y[\text{ringo}'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[\text{tsu}'(v) \wedge u^{\bullet}\Pi v] \cap \lambda z[\text{tabeta}'(z)(j)]) \wedge |K| \geq 3 \wedge \sqcup K = y]]]$
'apple' 'tsu' 'ate'

The final line of (93c) asserts that there is a set of objects K which is a subset of the intersection of the set of atomic *tsu*-objects and the set of objects whose property is *John-ga tabeta* 'John ate', that the number of the elements of K is at least three, and that the supremum of K is y, which is an element of the set of apples.

Again, a distributive reading obligatorily arises here. The predicate denotation, namely $\lambda z[\text{tabeta}'(z)(j)]$, denotes a set of things that John ate. This set is on a par with a common noun such as *gakusei* 'student', which denotes a set of things that have the property of being student, or a predicate such as *hashitta* 'ran', which denotes a set of things that ran. That is, this set contains both sums and atoms. However, just as in the previous case, due to the atomicity constraint of the classifier, the intersection of the classifier denotation and the predicate denotation contains only (singular) atoms. This yields the obligatory distributive reading. Again, since the common noun *ringo* 'apple' is a plural term, it denotes a set which contains both sums and atoms. Therefore, the supremum generated by K is an element in the set denoted by *ringo*, namely a sum individual.

Note that we differentiate the semantic type of the subject-oriented FNQ from that of the object-oriented FNQ, just as Fukushima does. The type of the numeral differs in the two cases depending on the type of the predicate each takes. Consider the two cases:

(94)a. the numeral '3' of the subject-oriented FNQ

$$\lambda C_{<e,t>}\lambda P_{<e,t>}\lambda x_e \exists K[K \subseteq (C \cap P) \wedge |K| \geq 3 \wedge \sqcup K = x\ ]$$

b. the numeral '3' of the object-oriented FNQ

$$\lambda C_{<e,t>}\lambda P_{<<<e,t>t,>,<e,t>>}\lambda D_{<<e,t>,t>}\lambda x_e \\ D[\lambda y_e[\exists K[K \subseteq (C \cap \lambda z_e[P(\lambda N N(z))(x)]) \wedge |K| \geq 3 \wedge \sqcup K = y]]]$$

For (94a), the type of the predicate is that of the intransitive verb <e,t>, while for (94b), the type of the predicate is that of the transitive verb <<<e,t>t,>, <e,t>>. We take this difference in logical types to be empirically motivated. As we saw in chapter 3, the two NQs differ as regards the types of constituents they may compose with.[32]

Finally, for the sake of completeness, let us note that the entailment relationship in (95), repeated from (88), obtains without any additional assumptions, as does the one in (96):

(95)a. **gakusei**-ga, **san-nin** hashitta. → b. gakusei-ga hashitta.
student-NOM 3-CL ran → student-NOM ran

'Three students ran.' 'A student ran.'

---

[32] In this regard, the Japanese FNQ exhibits a property that is commonly observed in natural language. Type-flexibility is found in several kinds of expressions, e.g. English *and*, *only*, *even* etc. (e.g. Rooth 1985). It is even found with a great many verbs. Consider *eat*, which is of type <e,t> when it is intransitive, but of type <<<e,t>,t>,<e,t>> when it is transitive. In general, when a lexical entry that has more than one logical type, whichever one fits the context is used. There is no need for the FNQ to 'know' what type of predicate it is modifying. If only the logical type for a subject-oriented FNQ fits the predicate, only a subject-oriented FNQ reading is available. The same holds for the logical type of an object-oriented FNQ. If both logical types fit the predicate, the sentence will be ambiguous between a subject- and an object-oriented FNQ reading:
(i) sensei-ga san-nin gakusei-o mita.
teacher-NOM 3-CL student-ACC saw
'Three teachers saw a student.' or
'A teacher saw three students.'

(96)a. John-ga **ringo**-o, **mit-tsu** tabeta. → b. John-ga ringo-o tabeta.
J-NOM apple-ACC 3-CL ate — J-NOM apple-ACC ate

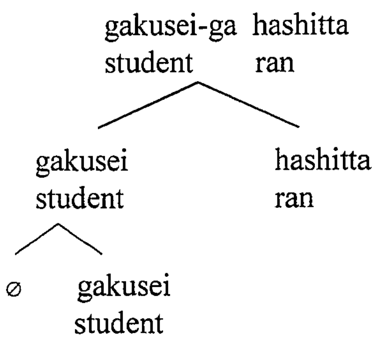
'John ate three apples.' — 'John ate an apple.'

The sentences in (95b) and (96b) are minimally different from (95a) and (96a) in that the latter do not have the FNQ. Thus, (95b) and (96b) are computed by the same syntactic and semantic operations as (95a) and (96a), minus those associated with the FNQ:

(97)a. gakusei-ga hashitta.
student-NOM ran

'A student ran.'

b. semantic tree



c. interpretation derivation

gakusei 'student': $\lambda x[gakusei'(x)]$
| ∅ 'a': $\lambda X_{<e,t>}\lambda Y_{<e,t>}\exists y[X(y) \wedge Y(y)]$
|/
∅ (gakusei): $\lambda Y\exists y[gakusei'(y) \wedge Y(y)]$
| hashitta 'ran': $\lambda x_e[hashitta'(x)]$
|/
(∅ (gakusei))(hashitta): $\exists y[gakusei'(y) \wedge hashitta'(y)]$
'student' 'ran'

(98)a. John-ga **ringo**-o tabeta.
J-NOM apple-ACC ate

'John ate an apple.'

b. semantic tree

John-ga ringo-o tabeta
John apple ate

John
John

ringo-o tabeta
apple ate

ringo
apple

tabeta
ate

∅
ringo
apple

c. interpretation derivation

ringo 'apple': $\lambda x[\text{ringo}'(x)]$
| ∅ 'a': $\lambda X_{<e,t>}\lambda Y_{<e,t>}\exists y[X(y) \wedge Y(y)]$
|/
∅ (ringo): $\lambda Y\exists y[\text{ringo}'(y) \wedge Y(y)]$
| tabeta 'ate': $\lambda T_{<<e,t>,t>}\lambda s_e[T(\lambda w_e[\text{tabeta}'(w)(s)])]$
|/
(tabeta)(∅ (ringo)):$\lambda s[\exists y[\text{ringo}'(y) \wedge \text{tabeta}'(y)(s)]$
| John: $\lambda S_{<e,t>}S(j)$
|/
(John)((tabeta)(∅(ringo))): $\exists y[\text{ringo}'(y) \wedge \text{tabeta}'(y)(j)]$
'apple' 'ate'

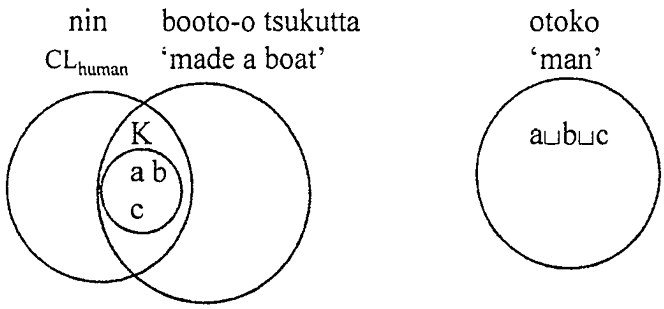
5.3. Accounting for the Distributivity Phenomenon

Having presented the basics of our analysis of Japanese FNQ quantification, it is now time to account for the distributivity phenomenon explicitly. Consider (99a). Under our analysis, (99b) depicts the state of affairs that must hold in the model for this sentence to be true:

(99)a. **otoko**-ga, **san-nin** booto-o tsukutta.
man-NOM 3-CL boat-ACC made

'Three men made a boat.'

b.



The crucial factor that yields the distributive reading here is the atomic nature of the elements in the set denoted by the classifier. We have argued that these elements are necessarily atoms. Since the classifier denotation is intersected with the predicate denotation, each element in the intersection of *nin* and *booto-o tsukutta* 'made a boat' must be atomic as well. This entails that each of these atoms has the property that he made a boat. The sentence in (99a) is true if and only if three men each made a boat. In short, the distributivity phenomenon is simply a consequence of the atomicity of the entities in the set denoted by the classifier. This is the crux of our account of obligatory distributive reading of the FNQ. Let us now look at the actual sentences that we have seen in chapter 2. We discussed six types of sentences, namely, (i) the sentence with a once-only predicate, (ii) the sentence with a collective predicate, (iii) the sentence with NQ-*de*, (iv) the sentence with a predicate denoting a homogeneous event, (v) the sentence that entailed individual responsibility, and (vi) the sentence with a non-argument host NP. We will now examine each of these cases.

The first case is the sentence with a once-only predicate. An FNQ is pragmatically ill-formed with such a predicate, as the following example shows:

(100) #**kodomo**-ga kinoo, **san-nin** sono inu-o koroshita.
child-NOM yesterday 3-CL the dog-ACC killed

'Three children killed the dog.'

Under our analysis, the numeral indicates the number of elements in the set K, which is in the intersection of the two sets denoted by the classifier and the predicate. Thus, (100) asserts that there is a set of three atomic *nin*-individuals. each of whom killed a particular dog, and that the supremum of these three individuals is an element in the set of children. This could only be true, however, if the dog in question were killed three different times, once by each child. This is not a plausible state of affair; thus, the sentence is pragmatically ill-formed.

The second case is a sentence with a collective predicate. As we discussed in chapter 2, such a sentence can only be well-formed under a shift to a non-quantificational amount term reading of the NQ. Setting this aside as a special interpretive possibility, we address here the fact that under a quantificational reading an FNQ causes a sentence containing a collective predicate to be semantically ill-formed, as the following illustrates:

(101) #**kodomo**-ga, **sanjuu-nin** gasshooshita.
child-NOM 30-CL sang in chorus

'Thirty children sang in chorus.'

Under our analysis, this sentence asserts that there are thirty individuals which have the property of being atomic *nin*-objects, each of which has the property of singing in chorus, and that the supremum of these thirty individuals is a member of the set of children. Since there are no atomic individuals who, all alone, have the property of singing in chorus, the sentence again results in ill-formedness.

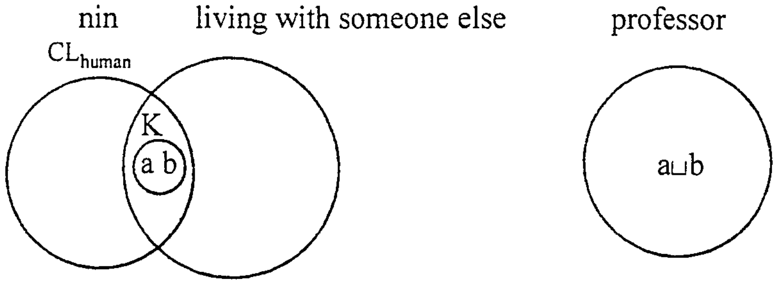
The third case is the sentence with NQ-*de*, as shown below:

(102) **kyooju**-ga, **futa-ri** futa-ri-de sundeiru.
prof-NOM 2-CL 2-CL-by live

'Two professors live in a group of two.'

The predicate *fu-tari-de sundeiru* here denotes a set of individuals who have the property of living with another individual. Therefore, the FNQ sentence asserts that there are two elements in the intersection of the set of *nin*-objects and the set of individuals who live with someone else, as follows:

(103)



Each element in the intersection necessarily has the property of living with someone else. Thus, the two professors each must live with someone else for the sentence to be true.

The fourth case is the sentence with a homogeneous event predicate. Here, a contrast in acceptability is observed between sentences in which the FNQ modifies a homogeneous event predicate, as in (104a), and sentences in which it modifies a predicate denoting a non-homogeneous event, as in (104b):

(104)a. ?**Harvard-no gakusei**-o Taro-ga, **san-nin** matta.
H-GEN student-ACC T-NOM 3-CL waited

'Taro waited for three Harvard students.

b.**gengogaku-no** **hon**-o Taro-ga, **san-satsu** yonda.
linguistic-GEN book-ACC T-NOM 3-CL read

'Taro read three linguistics books.'

In chapter 2, we showed that (104a) was really well-formed and appropriate as a true description of a situation in which Taro waited for three students individually. The ill-formedness arises only if the speaker's intention is to assert that Taro waited for three students collectively. This can be seen, recall, by comparing (104a) with (105), which can more readily be taken to describe a waiting event that consists of seven waiting subevents, one for each train:

(105) (Taroo-wa 2-ji choodo-ni roku-ban-no hoomu-ni tsuita.)
T-TOP 2-o'clock exactly-at six-#-GEN platform-to arrived

nana-dai, kare-wa sorekara **densha**-o matta.
7-CL he-TOP then train-ACC waited

'(Taro arrived at the platform of 6 exactly at 2.) He then waited for (each of) seven trains.'

The two situation perceptions corresponding to the ill-formed and well-formed readings of (104a) can be schematically illustrated as follows. The line in the center represents temporal progression from left to right. Individuals a, b and c are perceived as arriving at the points indicated:

(106)a. Taro waits for three students at the same time. (Ill-formed reading of 104a.)

a arrives b arrives c arrives
↓ ↓ ↓

A B C
Taro waits for: (a, b, c) (b, c) (c)

b. Taro waits for three students individually. (Well-formed reading of 104a.)

a arrives b arrives c arrives

$\underbrace{\_\_\_\_\_\_\_\_}_{A}\downarrow\_ \ldots\ldots\ldots\ \underbrace{\_\_\_\_\_\_\_\_}_{B}\downarrow\_ \ldots\ldots\ldots\ \underbrace{\_\_\_\_\_\_\_}_{C}\downarrow$

Taro waits for: (a) (b) (c)

First consider the situation (106a), in which Taro waits for three students collectively, and these arrive one at a time. In this situation, time period A is the time during which Taro waits for the three students collectively. Then, a arrives. At that point, Taro stops waiting for a, so time period B is the time during which Taro waits for the other two students collectively. Then, b arrives. Now Taro stops waiting for b, so time period C is the time during which Taro only waits for the last student c. Next consider the situation in (106b), in which Taro waits for three students individually, i.e. Taro's waiting is always restricted to a single student. In this situation, A, B and C are time periods during each of which a complete and distinct waiting event occurs.

With this distinction in mind, now consider the properties of the individuals. According to our analysis, the sentence in (104a) is true if there are three atomic *nin*-objects each of which has the property that Taro waited for him or her. In situation (106a), an atomic *nin*-object Taro waits for is only c, in time period C. That is, there is only one such individual , not three. Note that the collection of a, b and c has the property of being waited for by Taro (in time period A) and the collection of b and c has this property (in time period B). Thus, these two sets of individuals are not elements in the set denoted by the classifier *nin*, since they are non-atomic. Because its truth conditions are not met, sentence (104a) is ill-formed as a description of situation (106a). On the other hand, in situation (104b), Taro is perceived as waiting for a, b and c separately in time periods A, B and C, respectively. Thus, each of the three individuals has the property of being waited for in its own right, unlike the above case. Thus, sentence (104a) is well-formed when taken as a description of a situation such as (106b).

The latter type of situation is clear in sentence (105) given the nature of trains, i.e. that they arrive and leave individually. Thus, a distributive reading can be easily established, since there are seven *dai*-objects and the property of being waited for by Taro applies to each of them. Similarly, for the verb *yomu* 'read' in sentence (104b), it is easy to verify a distributive reading since books are always read one at a time.[33] Thus, there are three *satsu*-objects for each of which the property of being read by Taro holds. In sum, our object quantificational analysis can readily handle the seemingly event-oriented data that Sasaki Alam cites. There is no need for a switch to event quantification.

The fifth case is the sentence expressing individual responsibility. Recall the following example:

(107) **juumin**-ga shichoo-ni, **go-nin** koogibun-o okutta.[34]
resident-NOM mayor-to 5-CL written protest-ACC sent

'Five residents sent a written protest to the mayor.'

According to our analysis, this sentence asserts that there are five elements in the intersection

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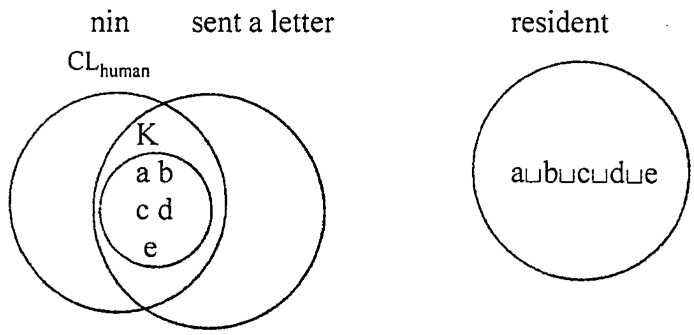
[33] Even when one simultaneously reads portions of several different books over a extended time period, alternating from one to another, there is never any event of reading in which a sentence from two different books is simultaneously read.

[34] In the original sentence in chapter 2, the numeral is 74. To simplify matters, we have changed it to five here.

of the set of *nin*-individuals and the set of letter senders, as shown below:

(108)



Since each element has the property of sending a letter, and one letter is involved in each sending, it is entailed that five letters were sent to the mayor, one from each resident. This captures individual responsibility reading.

Finally, the last case is the sentence with a host NP that is not a subject or a direct object. The NP that is construed with the FQ is marked with *ni*, *de*, *kara*, etc. We argue here, following the work by Inoue (1978), that these NPs are what Inoue calls 'quasi-objects'. Generalizing, we shall call them 'quasi-arguments'.[35] Let us consider the relevant sentences again:

(109)a. Hanako-wa **ryokan**-ni, **ni-ken** atatta.
H-TOP inn-at 2-CL inquired

'Hanako inquired at two inns.'

b. Machiko-wa **kaisha-no** **hito**-to, **san-nin** tsukiatta.
M-TOP office-GEN person-with 3-CL dated

'Machiko dated with three people from her office.'

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[35] We do not wish to suggest that quasi-arguments are syntactically realized.

c. keisatsu-wa **jiken-no** **mokugekisha**-kara, **san-nin** jijoochooshu shita.
police-TOP incident-GEN witness-from 3-CL hearing did

'The police collected testimony from three witnesses of the incident.'

d.Madonna-wa **nihon-no** **konsaato** **kaijoo**-de, **san-kasho** kooenshita.
M-TOP Japan-GEN concert location-at 3-CL performed

'Madonna performed at three concert locations in Japan.'

In these sentences, the lexical arity requirements of the verb require the presence of the NP that is construed with the FNQ. This can be seen from the ill-formedness the results from not including the quasi-argument NP:[36]

(110)a. *Hanako-wa atatta.
H-TOP inquired

'Hanako inquired.'

b.*Machiko-wa tsukiatta.
M-TOP dated

'Machiko dated.'

c. ?keisatsu-wa jijoochooshushita.
police-TOP collected testimony

'The police collected testimony.'

d.?Madonna-wa kooenshita.
M-TOP performed

'Madonna performed.'

The verb *ataru* means 'inquire' in (107a). However, another, more basic, meaning of this

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[36] Some of the examples in (110) can become acceptable when a null argument is licensed. This may be because in these cases, there is a real argument that is null, rather than a quasi-argument. If the context offers sufficient information, accommodation can supply the content of this null argument.

verb is 'hit', as shown by the following sentence:

(111) booru-ga mado-ni atatta.
ball-NOM window-at hit

'The ball hit the window.'

Whenever one object 'hits', necessarily there is another object that is 'hit', e.g. the window in (111). We assume that *ataru* in (109a) asserts the same necessary relationship between a theme and a target entity, although the target is not an affected object. Since the target is a necessary part of the relationship in question, we conclude that, grammatically, the NP that refers to the target is an argument of this verb. The verb *tsukiau* is glossed as 'date', but this verb is in fact a complex verb of the form V-*au*, in which the verb *au* 'meet' functions as a reciprocal verbal suffix. Thus, a single individual cannot be the sole agent of this action. In other words, it requires the object, the individual who Machiko had a date with. The verb *jijoochooshusuru* 'conduct a hearing' can possibly be used without an overt source NP, since it is a complex verb with an incorporated direct object. This verb can be analyzed as *jijoo-o chooshu suru* 'obtain the report of the circumstance'. But the presence of the source of the report is presupposed by the eventuality of the verb *chooshusuru* 'hear'. Thus, the source, namely 'witnesses', can be considered a significant part of the hearing event. For this reason, we take it to be a quasi-argument. Finally, the verb *kooensuru* 'performed' is a verb that refers to a set of actions that together constitute a whole event. This event may have a theme, e.g. the show or song that was performed, or it may not (cf. *John gave a performance at Lincoln Center.*) In the latter case, though, the time and the place of the performance becomes a salient aspect of the whole event. It acquires the status of a necessarily mentioned aspect of the event. Therefore, an NP that refers to the time or place of the performance becomes a kind of quasi-argument. Thus, in each case in (109) the NP that is construed with the FQ functions as a quasi-argument, even though it is not case marked by nominative *ga* or accusative *o*. If that is the case, then such quasi-argument NPs would enter into the semantic interpretation in the same fashion as an ordinary argument host NP. In other words, although they are PPs syntactically, quasi-arguments are semantically interpreted as NP, with the semantic value of the P-head included in the semantic value of the predicate.[37]

5.4. The FNQ with an Event Classifier

In this section, we will discuss what we call the event classifier, e.g. a classifier such as *hatsu* 'shot/blast'. The semantic analysis we proposed above was based on classifiers that are construed with objects, such as *nin* (people) and *dai* (machinery), etc. We assumed, naturally, that the denotation for such a classifier was a set of objects:

(112) nin: $\lambda u_e \exists v_e[\text{nin}'(v) \wedge u^{\bullet}\Pi v]$ (a set of atomic objects of nin-category)

dai: $\lambda u_e \exists v_e[\text{dai}'(v) \wedge u^{\bullet}\Pi v]$ (a set of atomic objects of dai-category)

However, we cannot have the same definition for the classifier which is event-oriented, as:

(113) hatsu 'shot': $\lambda u_e \exists v_e[\text{hatsu}'(v) \wedge u^{\bullet}\Pi v]$.

This would denote 'a set of atomic objects of the *hatsu*-category'. An analysis such as (113) must be immediately rejected since there is no <u>object</u> of any sort that we can refer to as a *hatsu* 'shot/blast'. *Hatsu* can only refer to a type of event, namely an event of shooting or

[37] There are a variety of ways this could be handled syntactically, e.g. P-incorporation at LF. Since the syntax of the quasi-argument is not directly relevant to our investigation of the FNQ, we will not examine it in this thesis.

blasting. We hypothesize, then, that the denotation of an event classifier is a set of single events, where a single event is taken to be an atomic event individual. This means that the domain of quantification is a set of event individuals. Enriching our model with a universe of discourse, that includes both event individuals and object individuals, and semilattices of both sorts of entity as well, we define classifiers like *hatsu* and *maki* as singular terms of the semantic type <s,t>, where *s* stands for event or situation.[38] [39] Thus, *hatsu* denotes a set of atomic *hatsu*-events (shooting/blasting/exploding), and *maki* denotes a set of *maki*-events (rolling), as shown below:[40]

(114) hatsu: $\lambda e_{1s} \exists e_{2s}[\text{hatsu}'(e_2) \wedge e_1 {}^{\bullet}\Pi e_2]$ (a set of atomic events of *hatsu*-category)

maki: $\lambda e_{1s} \exists e_{2s}[\text{maki}'(e_2) \wedge e_1 {}^{\bullet}\Pi e_2]$ (a set of atomic events of *maki*-category)

We assume the atomicity condition also holds for the event classifier as a general lexical characteristic of all classifiers. This is what forces the events denoted by an event classifier to be singular events. In addition, we specify that the numeral can alternatively quantify over

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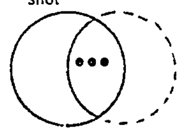
[38] Just as objects can be combined into sums, events of a given type can form a join-semilattice consisting of atomic (minimal) events and complex events that are sums in the sense that they have subevents that are atomic events. For example, an event of John shooting a pistol twice can be analyzed as a sum event individual whose subevents are two atomic events of John shooting a pistol once. Note also that we use the term 'event' here in general sense that includes events that lack agentive participants (cf. 'situations', 'eventualities')

[39] Recall that object-quantificational classifiers such as *nin* are of the semantic type <e,t>. The type *s* is traditionally used for intension in the literature, but here it means event or situation.

[40] Here, e_1 and e_2 are event variables of type *s*, as opposed to *x* and *y* which are object variables of type *e*.

events rather than objects.[41] Thus, for example *san-patsu* '3-CL' counts three individuals in the set of events denoted by the classifier, as shown below:

(115) hatsu
CL_{shot}



Three event atoms which are shots are counted and segregated from the rest of the event individuals in the set. According to our analysis, these quantified elements share a certain property that is denoted by the nuclear scope. Let us now examine this. Consider again the pistol-sentence. For ease of exposition we use a subject-oriented FNQ version of it here:

(116) **pisutoru**-ga, **san-patsu** utareta.
pistol-NOM 3-CL were-shot

'Three shots of a pistol were shot.'

According to our analysis, the nuclear scope of an FNQ is always the predicate. In the case of an FNQ with an object-denoting numeral classifier, the nuclear scope is a predicate taken as a property. For example, for *san-nin kaetta* '3-CL left', the predicate *kaetta* 'left' has the following denotation:

(117) kaetta 'left': $\lambda x[\text{kaetta}'(x)]$

Here the nuclear scope denotes a set of objects, namely, the set of leavers. Clearly, this

---

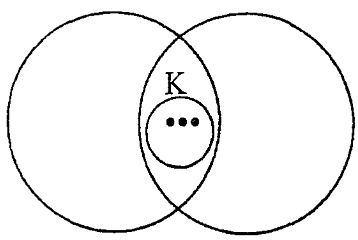
[41] This is a plausible assumption, considering English expressions such as *five shots*, *five sneezes*, *five visits*, etc. The ability to quantify over events or situations, rather than objects, is evidently a universal property of numeral quantifiers. In fact, in view of expressions like *both shots*, *most shots*, *each shot*, etc., the potential to quantify over events as well as objects appears to be a general property of all forms of quantification. We also assume, though, that in the default case event quantification cannot occur unless it is forced by lexical semantic properties, as in the case of an event classifier.

cannot be the way the predicate is interpreted in (116). If (118) were the nuclear scope for *san-patsu* '3-CL (three shots)', (116) could not be interpreted:

(118) utareta: λx_e[utareta'(x)]

Rather, the nuclear scope derived from the predicate *utareta* 'was shot' must consist of the set of events of being shot in the case of (116). Now, entirely independently of the Japanese event classifier FNQs, it is generally assumed that all predicates also lexically contain an event or situation variable (Davidson 1967, Higginbotham 1985, Kratzer 1989, Parsons 1990, and many others). Up until now we have abstracted away from this because the event variable, which normally only participates in the determination of tense or other global aspects of sentence meaning, is irrelevant (in our view) to the object quantifiation found with ordinary FNQs such as *san-nin* 'three people'. Now, though, we must add this event variable into the equation since the event-oriented FNQ interacts with it. In this event semantic framework, then, the intransitive verb phrase is more precisely analyzed as of the type <e,<s,t>>, rather than <e,t>. We obtain, then, the following situation model:

(119) hatsu utareta (= 'being shot' events)
CL_{shot}



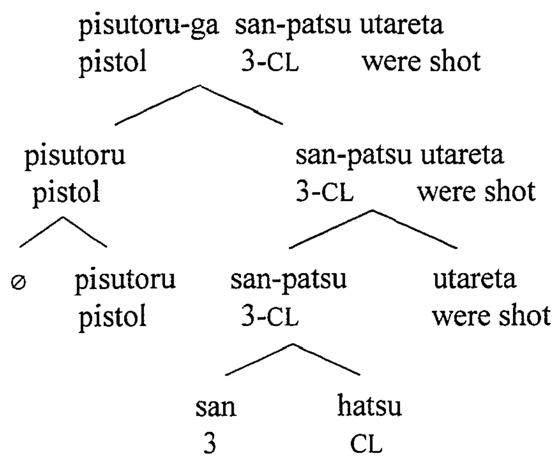
Note that the intransitive verb phrase *utareta* 'was shot' is of type <e, <s,t>>. That is, it has a variable *e* for the object that is being shot. In the case of (116), this is a pistol. Thus, this variable is given a value that has the 'pistol' property when [FNQ+Pred] composes with the subject.

According to our discussion so far, the exact semantic analysis will be as in (120). Assuming, for the sake of concreteness, that Tense introduces an existential quantifier which binds the event variable, and abstracting away from this, the sentence is of the type <s,t>. Also, maintaining the type of the DP as <<e,t>,t>, the type of the intransitive predicate is represented here as <<<e,t>,t>,<s,t>>, rather than <e,<s,t>>.[42]

(120)a. **pisutoru**-ga, **san-patsu** utareta.
pistol-NOM 3-CL were shot

'Three shots of a pistol were shot.'

b. semantic tree



c. interpretation derivation

hatsu 'hatsu (CL)': $\lambda e_{1s}\exists e_{2s}[\text{hatsu}'(e_2)\wedge e_1{}^{\bullet}\Pi e_2]$
| $3{:}\lambda C_{<s,t>}\lambda P_{<<<e,t>,t>,<s,t>>}\lambda D_{<<e,t>,t>}\lambda e_{3s}\exists K[K\subseteq(C\cap P(D))\wedge|K|\geq 3\wedge\sqcup K=e_3]$

---

[42] This is only a technical matter. In an attempt to achieve type-logical uniformity, one could alternatively assume that the type of the intransitive verb phrase under object quantification is <<<e,t>,t>,t>, or even <<<e,t>,t>,<s,t>>, rather than <e,t>. However, our main concern is the semantic value of the formulas rather than type-logical uniformity. Thus, we will not bother to revise our analysis of object quantification.

|/
3 (hatsu): $\lambda P\lambda D\lambda e_3\exists K[K\subseteq(\lambda e_1\exists e_2[hatsu'(e_2)\wedge e_1{}^\bullet\Pi e_2]\cap P(D))\wedge|K|\geq 3 \wedge\sqcup K=e_3]$
| utareru 'was shot': $\lambda T_{<<e,t>,t>}\ \lambda e_{4s}T(\lambda x_e[utareta'(x)(e)])$
|/
(3(hatsu)) (utareta):
$\lambda D\lambda e_3\exists K$
$[K\subseteq(\lambda e_1\exists e_2[hatsu'(e_2)\wedge e_1{}^\bullet\Pi e_2]\cap \lambda e_4D(\lambda x[utareta'(x)(e_4)])\wedge|K|\geq 3 \wedge\sqcup K=e_3]$
| pisutoru 'pistol': $\lambda x_e[pisutoru'(x)]$
| | ∅ 'a': $\lambda X\lambda Y\exists y[X(y)\wedge Y(y)]$
| |/
| ∅ (pistol): $\lambda Y\exists y[pisutoru'(y)\wedge Y(y)$
|/
((3(hatsu))(utareta))(∅(pisutoru)):
$\lambda e_3\exists K[K\subseteq(\lambda e_1\exists e_2[hatsu'(e_2)\wedge e_1{}^\bullet\Pi e_2]\ \cap$
'hatsu'
$\lambda e_4\exists y[pisutoru'(y)\wedge utareta'(y)(e_4)])\wedge|K|\geq 3\wedge\sqcup K=e_3]$
'pistol' 'were shot'

The final line of the derivation asserts that there is a set of events K, which is a subset of the set of atomic *hatsu*-events and the set of shooting events of a pistol, and that the number of the events is at least three, and that the supremum of these atomic events is the property of the event in question. Assuming that the event variable e_3 will be bound by an existential quantifier introduced by Tense, the final interpretation would be that the supremum of the three atomic events is asserted to exist as an individual event. This is a correct description of the proposition asserted by the sentence (120a).

At this point, let us compare the above analysis of the event classifier FNQ sentence with that of the object classifier FNQ sentence we proposed earlier:

(121) Event classifier FNQ sentence

a. pisutoru-ga san-patsu utareta. 'Three shots of a pistol were shot.'
pistol-NOM 3-CL were shot

b. $\lambda e_3 \exists K[K \subseteq (\lambda e_1 \exists e_2[\text{hatsu}'(e_2) \wedge e_1 {}^{\bullet}\Pi e_2] \cap \lambda e_4 \exists y[\text{pisutoru}'(y) \wedge \text{utareta}'(y)(e_4)]) \wedge |K| \geq 3 \wedge \sqcup K = e_3]$
'hatsu' 'pistol' 'were shot'

(122) Object classifier FNQ sentence

a. gakusei-ga san-nin hashitta. 'Three students ran.'
student-NOM 3-CL ran

b. $\exists y[\text{gakusei}'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u {}^{\bullet}\Pi v] \cap \text{hashitta}') \wedge |K| \geq 3 \wedge \sqcup K = y]]$
'student' 'nin' 'ran'

In the case of the event classifier FNQ sentence (121), the quantification is computed on the basis of events. Thus, the denotation of the 'host NP', *pisutoru* 'pistol', is related to the cardinality set of events K only in the way that it is a participant in these events. Quantification here has nothing to do with the quantity of pistols as objects, nor the definiteness/indefiniteness of a pistol or pistols. Thus, *pisutoru* can also be definite, referring to a single specific pistol. For example, the sentence (121a) can minimally be changed to *kono pisutoru-ga san-patsu utareta* by simply adding the demonstrative *kono* 'this' to the noun *pisutoru*. In this case, the quantification is over events of shooting of a particular pistol rather than over events of shooting some pistol or other. Thus, the anaphora in (123) is perfectly well-formed:

(123) John-ga **omocha-no pisutoru**-o, **san-patsu** utta.
J-NOM toy-GEN pistol-ACC 3-CL shot

'John shot three shots of a/his toy pistol.'

Mary-wa isoide sore-o toriageta.
M-TOP quickly it-ACC took away

'Mary quickly took it away.'

The pronoun *sore* 'it' in the second sentence in (123) can readily take *omocha-no pisutoru* 'toy-pistol' in the first sentence as its antecedent, whether this has a nonspecific indefinite reading, i.e. 'a pistol', or a specific or definite reading 'the pistol'. Either way, it refers to objects or an object and thus can be an antecedent for the pronoun in the second sentence.

The host NP in an object quantificational FNQ sentence can also freely have either a definite/specific reading or a nonspecific indefinite reading. However, in this case varying the semantic value of the inaudible determiner whose maximal projection contains the host NP has an effect on the presuppositional information of numeral quantification. That is, if the inaudible determiner of the host NP is definite, then the quantified objects are identified as what the definite NP refers to. For example, with a definite reading of its host NP, (122a) would mean '(all) three of the students ran', presupposing the existence of a set of three students.[43]

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[43] Under such a reading there also seems to be a tendency for a presupposition failure to occur if the presupposed set has exactly the cardinality specified by the FNQ. To be concrete, consider a kind of the DNQ-FNQ sentence such as follows, in which the host NP is clearly definite and exiplicit that the number of the students is exactly the same as the number specified by the FNQ:

(i) korerano **san-nin**-no **gakusei**-ga **san-nin** hashitta
these 3-CL-GEN student-NOM 3-CL ran
'Three of these three students ran.'

This sentence is awkward precisely because the number specified by the DNQ and by the

Finally, let us also note that some definites can be property denoting. Consider the following:

(124) John-wa **kono pisutoru**-o, **san-choo** katta.
J-TOP this pistol-ACC 3-CL bought

'John bought three of this pistol.'

In this FNQ sentence, the object host NP, *kono pisutoru* 'this pistol' is unequivocally definite. However, it is property denoting. In (124), *kono pisutoru* can only refer to a particular model of pistol, rather than a particular object that is a pistol.

5.5. Summary

In this chapter, we first reviewed the relevant semantic literature. We found that the main problem for prior analyses of the Japanese quantificational FNQ was that the wrong semantic object was identified as the domain of quantification. Thus, we focused our attention on identifying the correct elements of each of the three components of Japanese numeral quantification. We proposed as an alternative the following analysis of FNQ quantification

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FNQ is identical. A DNQ-FNQ sentence is usually quite well-formed when the number specified by the DNQ is greater than the number specified by the FNQ, yielding a partitive reading, as we have seen earlier in the example of Inoue (1978), repeated here:

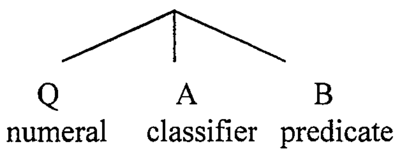
(ii) narande hashitteita **suu-dai**-no **torakku**-ga
in tandem running some-CL-GEN truck-NOM
san-dai gaadoreeru-ni butsukatta
3-CL guardrail-to hit
'Three of the several tucks that were running in tandem hit the guardrail.'

While the sentence (i) is not ungrammatical, the awkwardness of the sentence (i) disappears completely if a morpheme *tomo* 'all' is added, as in (iii):

(i) korerano **san-nin**-no **gakusei**-ga, **san-nin**-tomo hashitta.
these 3-CL-GEN student-NOM 3-CL-all ran
'All of these three students ran.'

proper:

(125) FNQ quantification



The quantifier is the numeral itself, its domain of quantification is the classifier denotation, and its nuclear scope is the predicate denotation. A significant way in which our analysis differs from previous analyses is that the classifier is treated as an independent semantic entity, providing the domain of quantification for the numeral in the FNQ. We then examined the exact function of the host NP and argued that it does not play an essential role in the quantification itself, though the quantified objects are identified as an element of what the host NP denotes.

The classifier denotation was analyzed, crucially, as a set of atomic objects, in conformity with an atomicity condition applying in the lexicon. Given that classifiers are lexically specified to denote only sets of atoms, the distributivity phenomenon is a necessary consequence of the syntactic circumstance that the FNQ combines with the predicate. Thus, under this analysis, the distributivity phenomenon does not require any additional mechanism. We showed how the data we presented in chapter 2 are all accounted for.

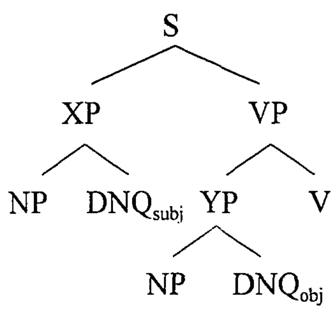
By identifying the classifier denotation as the domain of quantification, we made a significant step forward towards a unified account of FNQ sentences with either object or event classifiers. This is because, under our analysis, the numeral of the NQ systematically indicates the number of what the classifier denotes, not the number of objects the host NP denotes. Thus, in a sentence with an object classifier such as *John-ga pisutoru-o ni-choo* *katta* 'John bought two pistols', the numeral 'two' does not quantify over the denotation of the host NP *pisutoru*, but rather over that of the classifier *choo*, i.e. a classifier for weapons. Likewise, in the sentence *John-ga pisutoru-o ni-hatsu utta* 'John shot a pistol twice', the numeral 'two' does not quantify over the denotation of the host NP *pisutoru*, but rather over that of the classifier *hatsu* i.e. a classifier for shots/blasts. In this way FNQs with object-denoting classifiers and FNQs with event classifiers do not have to be accounted for by means of two completely different quantificational analyses. The only difference is the kind of quantification, i.e. object quantification or event quantification.

CHAPTER 6

SEMANTICS OF THE QUANTIFICATIONAL DNQ

In chapter 3, we showed that the syntax of the DNQ constructions is fundamentally distinct from that of the FNQ constructions and may be represented schematically as follows (abstracting away from the freely alternating precedence relation between the host NP and the DNQ):

(1) DNQ construction



Just as our semantic analysis of the quantificational FNQ was closely tied to its syntax, our analysis of the quantificational DNQ will be closely tied to the syntactic analysis in (1). In the semantic analysis proposed for FNQ quantification in chapter 5, the obligatory distributive reading resulted as a consequence of the atomicity condition imposed by the classifier. However, obviously, the classifier does not only occur in FNQ constructions. It is a systematic characteristic of all numerals in Japanese, including the quantificational DNQ.[44] Thus, aside from showing how the quantificational reading is compositionally derived from the DNQ, our principal task in this chapter is accounting for the availability of collective and cover readings with DNQ sentences.

The chapter is organized as follows. Based on our syntactic assumption summarized in (1), in 6.1 we discuss DNQ quantification. Here, it is shown that DNQ quantification is crucially different from that of FNQ quantification in the order of function composition. In 6.2 we discuss the ambiguity of the DNQ sentence. The discussion here crucially hinges on matters discussed in chapter 4, where we laid out our basic semantic assumptions.

6.1. Japanese DNQ Quantification

Given the syntactic structure of the DNQ construction in (1), an obvious fact is that the DNQ and the host NP form a constituent. Thus, we propose that, in the interpretation of the DNQ sentence, function composition occurs as follows: (i) Num+CL = NQ, (ii) NQ+NP = NP, (iii) Det+NP = DP, and (iv) DP+VP=S (in the case of the subject-oriented FNQ). That is, the numeral composes with the classifier, its first logical argument. The resulting NQ then composes with the NP-denotation, which is the numeral's second logical argument. At this point, the outcome is another, complex, NP. Thus, in contrast to the case of the FNQ which is an adverb, the DNQ is treated as if it were an adjective. This complex NP, containing the

[44] Just as the FNQ can quantify over individuals or amounts, the DNQ can be quantificational or give rise to an amount term reading, depending, in the unmarked case, on whether a numeral classifier or a measure classifier is used. In this chapter we will completely ignore the latter possibility and focus exclusively on the quantificational DNQ.

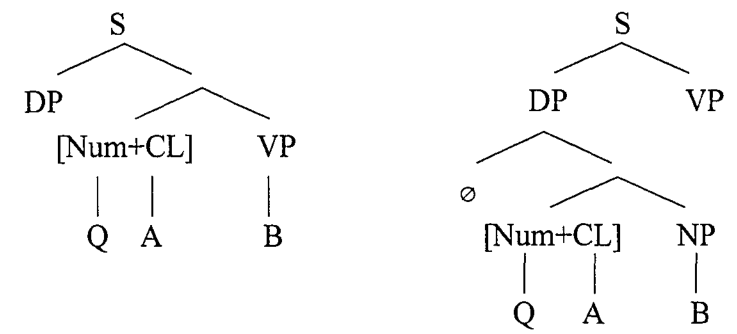
DNQ and the host NP, in turn composes with a phonetically null determiner equivalent to English *a*, whose presence we assumed in the FNQ construction as well, forming a DP.[45] Finally, this DP composes with the VP. Given the FNQ and the DNQ sentences in (2), whose basic syntactic structures are as in (3), (4) represents the distinct structures corresponding to the FNQ and the DNQ:

(2)a. **gakusei**-ga, [**san-nin** hashitta]. (FNQ)
student-NOM 3-CL ran

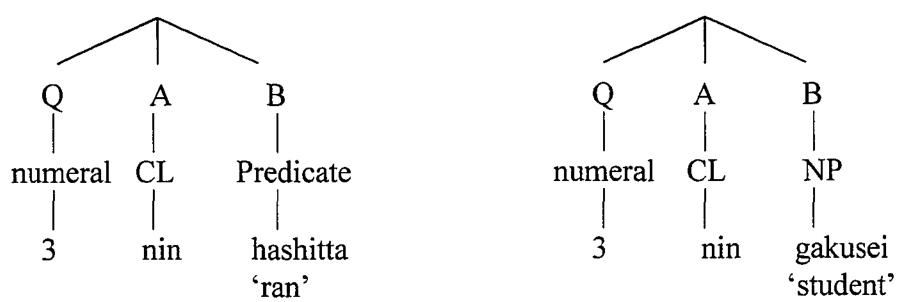
b. [**san-nin**-no **gakusei**]-ga hashitta. (DNQ)
3-CL-GEN student-NOM ran

'Three students ran.'

(3)a. FNQ b. DNQ



(4)a. FNQ b. DNQ



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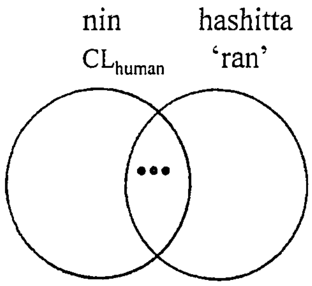
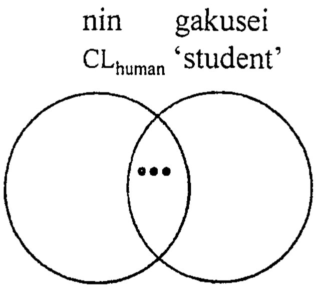
[45] As we saw in the last chapter, the inaudible determiner could alternatively be definite, in which case a partitive reading would result.

The second logical argument (B), namely the nuclear scope, is different in the two cases. For the FNQ, it is the predicate; for the DNQ, it is the host NP. Thus, in FNQ quantification the classifier denotation and the predicate denotation intersect, while in DNQ quantification the classifier denotation and the host NP denotation intersect. Verification of the FNQ and the DNQ can thus be contrasted as in (5):

(5)a. FNQ



b. DNQ



The interpretation of the DNQ sentence (2b), illustrated in (5b), represents a situation in which there are three individuals that have the property of being a *nin*-object and the property of being a student. Although the student-set denoted by the host NP includes sums, since the classifier denotation is a set of atomic objects, the elements in this intersection must also be atoms as well. This differs from the case of the FNQ in (5a), in which the second argument is the predicate denotation. In (5a) the classifier's atomicity condition screened out sums in the predicate denotation. However, in the case of the DNQ in (5b), the classifier's atomicity condition is imposed on the elements holding the property denoted by the NP. Thus, the distributive reading realizes itself over the NP in the case of a DNQ. That is, the three elements in the intersection must each be a student individual. The complete semantic analysis of (2b), then, is as follows:

(6)a. **san-nin**-no **gakusei**-ga hashitta.
3-CL-GEN student-NOM ran

'Three students ran.'

b. semantic tree

san-nin-no gakusei-ga hashitta
3-CL student ran

san-nin-no gakusei
3-CL student

hashitta
ran

∅

san-nin-no gakusei
3-CL student

san-nin
3-CL

gakusei
student

san
3

nin
CL

c. derivation

nin 'nin (CL)': $\lambda u_e\, \exists v_e\, [nin'(v) \wedge u^{\bullet}\Pi v]$

| 3: $\lambda C_{<e,t>}\, \lambda P_{<e,t>}\, \lambda x_e\, \exists K[K \subseteq (C \cap P) \wedge |K| \geq 3 \wedge \sqcup K{=}x]$

|/

3(nin): $\lambda P \lambda x \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap P) \wedge |K| \geq 3 \wedge \sqcup K{=}x]$

| gakusei 'student': $\lambda x_e\, [gakusei'(x)] =_{abbr.} gakusei'$

|/

(3(nin))(gakusei): $\lambda x \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap gakusei') \wedge |K| \geq 3 \wedge \sqcup K{=}x]$

| ∅ 'a': $\lambda X_{<e,t>}\, \lambda Y_{<e,t>}\, \exists y_e\, [X(y) \wedge Y(y)]$

|/

∅((3(nin))(gakusei)):

$\lambda Y \exists y[\exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap gakusei') \wedge |K| \geq 3 \wedge \sqcup K{=}y] \wedge Y(y)]$

| hashitta 'ran': $\lambda x_e\, [hashitta'(x)]$

|/

(∅((3(nin))(gakusei)))(hashitta):

$\exists y \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap gakusei') \wedge |K| \geq 3 \wedge \sqcup K{=}y] \wedge hashitta'(y)]$

'nin' 'student' 'ran'

The final line of the interpretation derivation asserts that there is a set K which is a subset of the intersection of the set of atomic *nin*-objects and the set of students, that the number of the elements in K is at least three, and the supremum generated by K is an element of the set denoted by *hashitta.*

Since a common noun such as *gakusei* 'student' is a plural term, it contains sums and atoms. Due to the atomicity constraint of the classifier, then, the intersection of the classifier denotation and the host NP denotation contains only atoms, namely human atoms which are students. In this case, the set K has three elements, which we might represent a, b, and c. Thus, the sum of these elements, namely $a \sqcup b \sqcup c$, is asserted to be a member of the denotation of *hashitta* 'ran'. Informally, (6a) asserts that there are three students who ran, just like what is asserted by an English sentence *Three students ran.*

The analysis of an object-oriented DNQ sentence such as (7a) is as shown in (7b-c):

(7)a.	John-ga	**mit-tsu**-no	**ringo**-o	tabeta.
	J-NOM	3-CL-GEN	apple-ACC	ate

'John ate three apples.'

b. semantic tree

John-ga mit-tsu-no ringo-o tabeta
J 3-CL apple ate

John
J

mit-tsu-no ringo-o tabeta
3-CL apple ate

mit-tsu-no ringo
3-CL apple

tabeta
ate

∅

mit-tsu-no ringo
3-CL apple

mit-tsu
3-CL

ringo
apple

mi
3

tsu
CL

c. derivation

tsu 'tsu (CL)': $\lambda u_e \exists v_e [tsu'(v) \wedge u^{\bullet}\Pi v]$
| 3: $\lambda C_{<e,t>} \lambda P_{<e,t>} \lambda x_e \exists K[K \subseteq (C \cap P) \wedge |K| \geq 3 \wedge \sqcup K = x]$
|/
3(tsu): $\lambda P \lambda x \exists K[K \subseteq (\lambda u \exists v[tsu'(v) \wedge u^{\bullet}\Pi v] \cap P) \wedge |K| \geq 3 \wedge \sqcup K = x]$
| ringo 'apple': $\lambda x_e [ringo'(x)] =_{abbr.}$ gakusei'
|/
(3(tsu))(ringo):$\lambda x \exists K[K \subseteq (\lambda u \exists v[tsu'(v) \wedge u^{\bullet}\Pi v] \cap ringo') \wedge |K| \geq 3 \wedge \sqcup K = x]$
| ∅ 'a': $\lambda X_{<e,t>} \lambda Y_{<e,t>} \exists y_e [X(y) \wedge Y(y)]$
|/
∅((3(tsu))(ringo)):
$\lambda Y \exists y[\exists K[K \subseteq (\lambda u \exists v[tsu'(v) \wedge u^{\bullet}\Pi v] \cap ringo') \wedge |K| \geq 3 \wedge \sqcup K = y] \wedge Y(y)]$
| tabeta 'ate': $\lambda T_{<<e,t>,t>} \lambda s_e [T(\lambda w_e[tabeta'(w)(s)]$
|/
(∅((3(tsu))(ringo)))(tabeta):
$\lambda s[\lambda Y \exists y[\exists K[K \subseteq (\lambda u \exists v[tsu'(v) \wedge u^{\bullet}\Pi v] \cap ringo') \wedge |K| \geq 3 \wedge \sqcup K = y] \wedge tabeta'(y)(s)]$
| John: $\lambda S_{<e,t>} S(j)$

$|/$
$\exists y[\exists K[K \subseteq (\lambda u \exists v[tsu'(v) \wedge u^{\bullet}\Pi v] \cap ringo') \wedge |K| \geq 3 \wedge \sqcup K{=}y] \wedge tabeta'(y)(j)]$
'tsu' 'apple' 'ate'

Here it is asserted that there is a sum which is the supremum of three atomic *tsu*-objects; these are apples, and John ate them.

6.2. The Ambiguity of the DNQ Sentence

As we observed in chapter 2 and 4, the DNQ sentence is in principle ambiguous, allowing a distributive, collective, or cover reading. Needless to say, the ambiguity is constrained by the type of predicate. If the predicate is of the distributive type, the sentence must receive a distributive reading and if the predicate is of the collective type, the sentence must receive a collective reading. Complete ambiguity arises, though, when the predicate is of the mixed type. The possibilities are summarized in (8). The ambiguity of (8c) is represented with diagrams in (9):

(8)a. distributive predicate → distributive reading

san-nin-no **gakusei**-ga hashitta.
3-CL-GEN student-NOM ran

'Three students ran.'

b. collective predicate → collective reading

san-nin-no **gakusei**-ga hito-tsu-no wa-o tsukutta.
3-CL-GEN student-NOM 1-CL-GEN circle-ACC formed

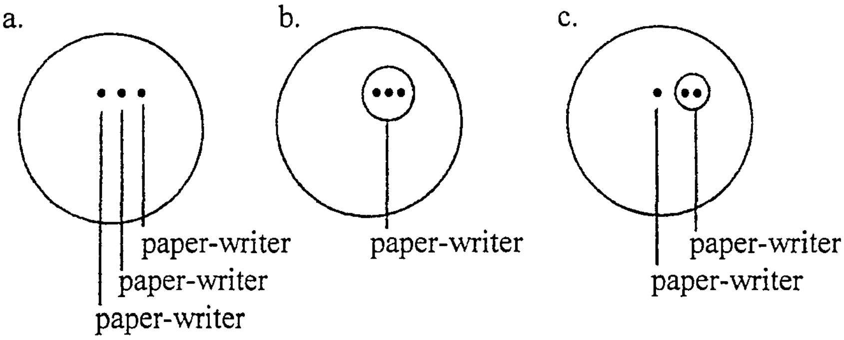
'Three students formed a single circle.'

c. mixed predicate →distributive/collective/cover

san-nin-no **gakusei**-ga peepaa-o kaita.
3-CL-GEN student-NOM paper-ACC wrote

'Three students wrote a paper.'

(9) a. b. c.



(distributive) (collective) (cover)

The question is how this ambiguity can be captured within our analysis. What we will now show is that the potential ambiguity of the Japanese DNQ sentence follows from our analysis of NQ quantification simply as another instance of the universal ambiguity of the plural term. As we described in chapter 4, plural terms are systematically ambiguous as to the distributive, collective and cover reading. The assumptions needed to capture this systematic ambiguity also accounts for the potential ambiguity of the Japanese DNQ sentence. Let us see, then, how each reading can be derived from what we obtain as the interpretation of a DNQ sentence. Consider the following meaning contrast of the following DNQ and FNQ sentences with the mixed predicate *peepaa-o kaita* 'wrote a paper':

(10) FNQ_{subj} sentence

a. **gakusei**-ga, **san-nin** peepaa-o kaita.
student-NOM 3-CL paper-ACC wrote

'Three students wrote a paper.'

b. $\exists y[\text{gakusei}'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u^{\bullet}\Pi v] \cap \text{peepaa-o-kaita}') \wedge |K| \geq 3 \wedge \sqcup K = y]]$
'student' 'nin' 'wrote a paper'

(11) DNQ_{subj} sentence

a. **san-nin**-no **gakusei**-ga peepaa-o kaita.
3-CL-GEN student-NOM paper-ACC wrote

'Three students wrote a paper.'

b. $\exists y \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u^{\bullet}\Pi v] \cap \text{gakusei}') \wedge |K| \geq 3 \wedge \sqcup K = y] \wedge \text{peepaa-o-kaita}'(y)]$
'nin' 'student' 'wrote a paper'

To simplify the discussion, we treat the meaning of *peepaa-o kaita* 'wrote a paper' as an intransitive verb phrase, i.e. as referring to a set of paper-writers. In the case of the FNQ sentence, since the classifier's atomicity condition is directly imposed on the predicate denotation, a distributive reading obligatorily results. Now consider the interpretation of the DNQ sentence (11b). Here, the classifier denotation intersects with the host NP denotation. Thus, the atomicity condition is imposed on the host NP denotation, forcing a distributive reading within this nominal domain. But distributivity is restricted to this domain, because the predicate denotation is related to the cardinality set K by means of a sum. The cardinality set K is mapped to a sum and this sum is identified as an element of the set denoted by the predicate *peepaa-o kaita* 'wrote a paper'. Specifically, since the numeral is 3, if we name the three elements a, b, and c, then K={a, b, c}. These elements are atomic *nin*-objects which are students in a situation which (11a) is true of. The sum of these elements, namely

$\sqcup K$, is then $a \sqcup b \sqcup c$. The sentence asserts that this sum is an element of the set denoted by the predicate *peepaa-o kaita* 'wrote a paper'. Now, if there are four paper writers, a, b, c, and d, then *peepaa-o-kaita* denotes the set $\{a, b, c, d, a \sqcup b, a \sqcup c, a \sqcup d, b \sqcup c, b \sqcup d, c \sqcup d, a \sqcup b \sqcup c, a \sqcup b \sqcup d, b \sqcup c \sqcup d, a \sqcup b \sqcup c \sqcup d\}$. Therefore, $\sqcup K$ can be identified as a member of this set. At this point, we obtain the following:

(12) $a \sqcup b \sqcup c \in$ *WROTE-A-PAPER

This entails the following:

(13) $a \in$ WROTE-A-PAPER $\wedge$ $b \in$ WROTE-A-PAPER $\wedge$ $c \in$ WROTE-A-PAPER

This is how (11a) can have a distributive reading.

Next, let us consider the collective reading of (11a). First recall our basic assumption, discussed in chapter 4, that the collective reading is the result of applying a group operator $\uparrow$ to a sum. Thus, for the sentence (14a), we assumed a logical representation such as (14b), which can be more formally represented as (14c):

(14)a. Three boys bought books.

b. $\uparrow(a \sqcup b \sqcup c) \in$ BOUGHT-BOOKS, where a, b and c are atomic boy individuals.

c. $\exists x\, [(\text{*BOY})(x) \wedge |x|{=}3]$: $\uparrow x \in$ BOUGHT-BOOKS, where x is a sum entity.

In the case of the Japanese DNQ, then, one can also readily obtain a collective reading simply by applying the group operator to the supremum of the set K that is the output value of the quantification, as shown in (15):

(15) $\exists y \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u{}^{\bullet}\Pi v] \cap \text{gakusei}') \wedge |K| \geq 3 \wedge \uparrow(\sqcup K){=}y] \wedge \text{peepaa-o-kaita}'(y)]$
'nin' 'student' 'wrote a paper'

That is, the output value of DNQ quantification is a set K of singular atoms of a given cardinality. Under the distributive reading the sum of set K is asserted to be an element of the predicate denotation. Under the collective reading the sum of the set K is mapped to a group atom $\uparrow(\sqcup K)$. Thus, under a collective reading, the truth conditions of the sentence are evaluated on the basis of whether this group atom is a member of the denotation of *paper-o-kaita* or not.

There are two things that are important to note about this analysis of the collective reading of the DNQ. First, each step of the derivation makes use of independently motivated operations posited under the general theory of plurality we have adopted. Thus, there is no need to modify the semantic value of the DNQ to obtain the collective reading. Second, we cannot apply the same operation to an FNQ to derive for it a comparable collective reading because $\sqcup K$ applies to the host NP, not the predicate. Consider what happens when we try to do this. Suppose that (16a) were interpreted as (16c) rather than as (16b) (repeated from 10b):

(16)a. **gakusei**-ga, **san-nin** peepaa-o kaita.
student-NOM 3-CL paper-ACC wrote

'Three students wrote a paper.'

b. $\exists y[gakusei'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap peepaa\text{-}o\text{-}kaita') \wedge |K| \geq 3 \wedge \sqcup K = y]]$
'student' 'nin' 'wrote a paper'

c. $\exists y[gakusei'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[nin'(v) \wedge u^{\bullet}\Pi v] \cap peepaa\text{-}o\text{-}kaita') \wedge |K| \geq 3 \wedge \uparrow(\sqcup K) = y]]$
'student' 'nin' 'wrote a paper'

In (16c), it is asserted that there are three atomic individual paper-writers. Although a set of paper-writers in principle could be a group atom, due to the classifier *nin*, this set of paper-writers can only consist of singular atoms. Restricted by the classifier, *peepaa-o kaita* 'wrote a paper' is just as obligatorily distributive as an inherently distributive predicate such as *walk*; it does not have any group atoms in its extension. Thus, even though the output value of the quantification may be 'collectivized' and asserted to be a subset of a group atom denoting host NP, this modification of the relation to the host NP cannot eliminate the distributive reading, which is indelibly fixed by (and within) the quantification proper. Thus, (16c) is just as much a distributive reading as (16b). The only difference between (16b) and (16c) is that in the latter it is asserted that the three students in question can be taken as a group when considered in isolation from the event in which they each write a paper. Thus, the set of three students could form a group, each writing a paper, but doing so simultaneously and at the same location. This is what we called the 'single-event verification' of a collective reading at the outset of chapter 2. Recall that with sentences such as *Three students walked together* and *John bought three books at once*, the adverbial phrases such as *together* and *at once* imply that the walking and book-buying are single events. We may now see how this can be formally represented as involving an application of the group operator to the sum of the individuals (K). Finally, note that we could not derive a collective reading for the FNQ by applying the same set of operations to the classifier denotation to yield $\uparrow(\sqcup CL')$. This is impossible for the same reason that $\uparrow$*WALK is ill-formed; it would violate the lexically specified atomicity condition.

Let us now turn to the cover reading, which is also available with a DNQ. Landman (2000) proposes an event semantic analysis of the cover reading according to which (17a) may be interpreted as (17b):

(17)a. Three students wrote a paper.

b. $\exists e \in$ *WROTE: $\exists x \in$ *STUDENT: $|x|=3 \wedge {}^{C}Ag(e)=\uparrow(x)$

Here, the definition of the cover role based on a thematic role *R* of an event *e* is:

(18) $\quad {}^{C}R(e)=a$ iff $a \in \text{ATOM} \wedge \sqcup(\{\downarrow(d) \in \text{SUM}: d \in \text{AT}(*R(e))\})=\downarrow(a)$

where $\downarrow$ is an operator which reduces a group atom into a sum.

However, since our analysis of the quantificational NQ is object-based, we capture the cover reading of the DNQ by proposing that the third conjunct of (11b) can alternatively have the interpretation shown in (19), which also makes use of Landman's group-to-sum operator $\downarrow$ and where P is the predicate denotation:[46]

(19) $\quad \forall x[Kx \rightarrow x=y \vee x \,{}^{\bullet}\Pi\, (\downarrow y)]$

This asserts that all members of the cardinality set K are either y or an atomic individual part of the sum generated by a group atom y. Here, y is an element in the denotation of the predicate. Integrating this into the overall interpretation of the DNQ sentence (20a), we obtain (20b):

(20) $\quad \text{DNQ}_{\text{subj}}$ sentence with a cover reading

a. **san-nin**-no **gakusei**-ga peepaa-o kaita.
3-CL-GEN student-NOM paper-ACC wrote

'Three students wrote a paper.'

b. $\exists y \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u\,{}^{\bullet}\Pi v] \cap \text{gakusei}') \wedge |K| \geq 3 \wedge$
'nin' 'student'
$\forall x[Kx \rightarrow x=y \vee x \,{}^{\bullet}\Pi\, (\downarrow y)]] \wedge \text{peepaa-o-kaita}'(y)]$
'wrote a paper'

---

[46] See Chierchia (1998b) for another possible object-based formulation for a cover reading.

(20b) asserts that there is a set K consisting of three atomic *nin*-objects which are students, and each of the elements in K is either an element of the set of paper writers, or else an atomic individual part of the sum generated by an element of the set of paper writers. Suppose that the denotation of *peepaa-o-kaita* in a given model is a set $\{a, \uparrow(b \sqcup c), d\}$. That is, person a wrote a paper, the group consisting of b and c wrote a paper, and person d wrote a paper. In addition, suppose K is the set $\{a, b, c\}$. Then, the verification procedure must check if all the elements in K, namely a, b, and c, have the property of being a member of the predicate denotation or of being an atomic individual part of the sum generated by a member of the predicate denotation which is a group atom. In this case truth results, since the predicate denotation is $\{a, \uparrow(b \sqcup c), d\}$: First, person a is a member of $\{a, \uparrow(b \sqcup c), d\}$. Second, person b is an atomic individual part of a sum mapped from a member of this set, i.e. $\uparrow(b \sqcup c) \in \{a, \uparrow(b \sqcup c), d\}$ and $b \in \downarrow(\uparrow(b \sqcup c))$. Note here that $\uparrow(b \sqcup c)$ is a group atom, and the group-to-sum operator $\downarrow$ forms a sum out of this group. That is, $\downarrow(\uparrow(b \sqcup c)) = b \sqcup c$. Finally, person c is also an atomic individual part of a sum mapped from a member of the predicate denotation, i.e. $\uparrow(b \sqcup c) \in \{a, \uparrow(b \sqcup c), d\}$ and $c \in \downarrow(\uparrow(b \sqcup c))$.

Moreover, we can simplify the calculus slightly. Technically, the sum derived from a single-membered group atom by $\downarrow$ is this single member itself. That is, $\downarrow x = x$, when x is an atom. Thus, also for person a, we can check whether it is an atomic individual part of a sum mapped from the predicate denotation by the operator $\downarrow$, i.e. $a \in \{a, \uparrow(b \sqcup c), d\}$ and $a \in \downarrow(\uparrow a)$, which is true. Therefore, the disjunct $x=y$ in (19) can be eliminated. The cover interpretation of (17b), then, can be uniformly represented as follows:

(21) $\exists y \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u {}^{\bullet}\Pi v] \cap \text{gakusei}') \wedge |K| \geq 3 \wedge$
'nin' 'student'
$\forall x[Kx \rightarrow x {}^{\bullet}\Pi (\downarrow y)]] \wedge \text{peepaa-o-kaita}'(y)]$
'wrote a paper'

Again, note that we make use of independently motivated and assumed operations so the lexical meaning of the DNQ remains unchanged. That is, we assume that (21) is derived from the distributive interpretation (11b) by semantic operations; it is not lexically encoded as an alternative meaning of the NQ. In addition, note that, as in the case of our analysis of the collective reading of the DNQ, applying the same semantic transformations to an FNQ will not derive for it a cover reading. Consider (22a) interpreted as (22b):

(22)a. **gakusei**-ga, **san-nin** peepaa-o kaita.
student-NOM 3-CL paper-ACC wrote

'Three students wrote a paper.'

b. cover reading

$\exists y[\text{gakusei}'(y) \wedge \exists K[K \subseteq (\lambda u \exists v[\text{nin}'(v) \wedge u {}^{\bullet}\Pi v] \cap \text{peepaa-o-kaita}') \wedge |K| \geq 3 \wedge$
'student' 'nin' 'wrote a paper'
$\forall x[Kx \rightarrow x {}^{\bullet}\Pi (\downarrow y)]]$

This yields a cover reading for the host NP, as a kind of after-thought. It is like the single-event verification of an FNQ sentence. Concretely, it asserts that there is a set K of three atomic *nin*-objects which are paper writers, and these elements are atomic individual parts of a sum mapped from a member of the set denoted by *gakusei* 'student' by means of the operator $\downarrow$. To see how such an interpretation can be true, we can imagine a model in which a group atom is formed by one of the sums in the set denoted by *gakusei* 'student'. However, again, this cannot neutralize the distributivity within the quantification itself. That is, the atomicity constraint on the quantified objects in K remains untouched.

In sum, the three way ambiguity of the DNQ sentence in (23a) is derived as shown in (23b-d). (23b) is a distributive reading which the DNQ sentence receives in the default case, (23c) is a collective reading which is derived from (23b) by applying the group operator, and (23d) is a cover reading which is derived from (23b) by applying the cover mechanism

(23)a. DNQ_{subj} sentence

san-nin-no **gakusei**-ga peepaa-o kaita.
3-CL-GEN student-NOM paper-ACC wrote

'Three students wrote a paper.'

b. Distributive reading

$$\exists y \exists K[K \subseteq (\underbrace{\lambda u \exists v[nin'(v) \wedge u {}^{\bullet}\Pi v]}_{\text{'nin'}} \cap \underbrace{gakusei'}_{\text{'student'}}) \wedge |K| \geq 3 \wedge \sqcup K = y] \wedge \underbrace{peepaa\text{-}o\text{-}kaita'(y)}_{\text{'wrote a paper'}}]$$

c. Collective reading

$$\exists y \exists K[K \subseteq (\underbrace{\lambda u \exists v[nin'(v) \wedge u {}^{\bullet}\Pi v]}_{\text{'nin'}} \cap \underbrace{gakusei'}_{\text{'student'}}) \wedge |K| \geq 3 \wedge \uparrow(\sqcup K) = y] \wedge \underbrace{peepaa\text{-}o\text{-}kaita'(y)}_{\text{'wrote a paper'}}]$$

d. Cover reading

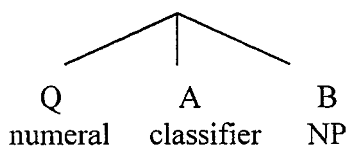
$$\exists y \exists K[K \subseteq (\underbrace{\lambda u \exists v[nin'(v) \wedge u {}^{\bullet}\Pi v]}_{\text{'nin'}} \cap \underbrace{gakusei'}_{\text{'student'}}) \wedge |K| \geq 3 \wedge$$
$$\forall x[Kx \rightarrow x {}^{\bullet}\Pi (\downarrow y)]] \wedge \underbrace{peepaa\text{-}o\text{-}kaita'(y)}_{\text{'wrote a paper'}}]$$

Let us summarize the discussion so far. The basic, lexically derived, meaning of the quantificational DNQ gives rise to distributive quantification over the individuals denoted by the host NP. Thus, the distributive reading is the default interpretation of a DNQ as well. However, semantic operations freely can apply to the DNQ yielding a collective or a cover reading. This can be considered an instance of a much more general phenomenon found in the ambiguous interpretation of any plural term in any language. Nor is this phenomenon tied to quantification since even a plural pronoun such as *they* can have collective or cover reading. To account for this general phenomenon some special mechanisms must be assumed in any case. For concreteness, we have adopted Landman's theory, modifying this in the case of the cover reading, to show how the Japanese DNQ also instantiates the general phenomenon. At the same time, we have shown how our analysis of Japanese NQ quantification makes it impossible to derive a collective or cover reading with the FNQ by applying the semantic operations that derive a collective and cover reading for the DNQ.

6.3. Summary

In this chapter, we discussed Japanese DNQ quantification. Syntactically, the DNQ is directly combined with the host NP, not the predicate. On the basis of this syntactic fact, we argued that the second logical argument of the numeral in the case of the DNQ is the host NP, as follows:

(24) DNQ quantification



Thus, in DNQ quantification, the nominal constituent containing the NQ and the host NP asserts the quantification. This combines with the null determiner, and further with the predicate, as assumed generally.

Due to the atomicity condition of the classifier denotation, the analysis initially seems to predict that the DNQ sentence will only have a distributive reading, contrary to fact.

However, the availability of collective and cover readings with the DNQ was accounted for as instances of very general phenomena concerning the interpretation of plural terms.

CHAPTER 7

CONCLUSION

In this chapter we conclude with a summary of the thesis and a speculative discussion of how our analysis of the Japanese NQ may be generalized and extended to cover NQs in other languages, and in particular, NQs in English. Here we will offer an account of why only certain quantifiers float in English and why English NQs do not float.

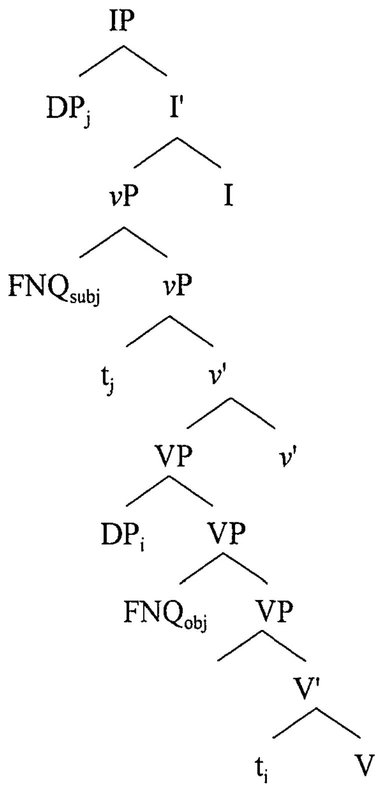
7.1. Summary of the Thesis and Further Questions

We have investigated the syntax and the semantics of the Japanese NQ within the framework of generative grammar and generalized quantifier theory. The empirical issue which we concentrated on was the Japanese FNQ's distributivity phenomenon, i.e. the observation that the Japanese FNQ sentence obligatorily has a distributive reading when quantificationally interpreted. To account for this, we have been led to a new analysis of quantification in the Japanese NQ that has two central hypotheses. The first is that the classifier functions as the first logical argument of the NQ, lexically restricting the domain of quantification to a set of atomic individuals. The second central hypothesis is that there is a fundamental syntactic difference between floated and non-floated Japanese NQs and that this is what accounts for the different semantic properties of these two types of NQ.

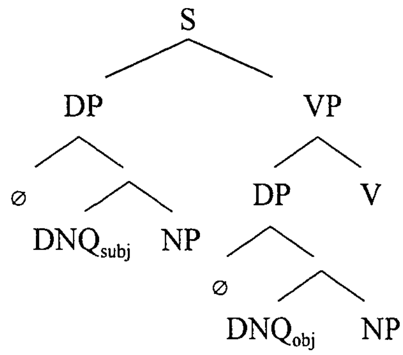
We started our investigation with a close examination of the purely syntactic properties of the DNQ and the FNQ. This guiding assumption here was that the syntactic difference directly affects the semantic difference, fully respecting the principle of compositionality. On the basis of distributional properties and other empirical arguments, we determined that the FNQ is syntactically an adverb while the DNQ forms a constituent with an NP, where it essentially has the syntactic properties of a modifying adjective. The basic syntax of the Japanese FNQ, which we came to analyze is as shown in (1a), can be contrasted with the basic syntax of Japanese DNQ, which is roughly represented in (1b):[1]

[1] The syntactic analysis for the DNQ construction in (1b) abstracts away from some irrelevant details (e.g. S stands for IP). The element represented by the symbol ⌀ is a phonetically null determiner usually equivalent in meaning to English *a*.

(1)a. FNQ

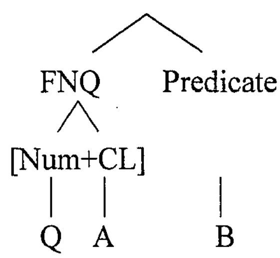


b. DNQ

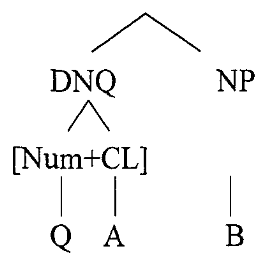


Given these syntactic structures, the syntactic difference between the DNQ and the FNQ maps to the difference in quantificational structure shown in (2):

(2)a. FNQ



b. DNQ



Thus, our account of Japanese NQ quantification can be summarized as follows:

(3) The Summary of the Numeral Quantificational Analysis

	DNQ	FNQ
Quantifier	Numeral	Numeral
Domain of Quantification	Classifier	Classifier
Nuclear Scope	NP	Predicate

Under this analysis, the host NP does not participate in the quantification proper. Rather, the FNQ is related to the host NP in the same way that an adverb is related to an argument of the predicate it modifies, and the DNQ is related to the host NP simply by the modification relation. With ordinary object-denoting numeral classifiers, but not with event classifiers, the classifier inside the NQ and the host NP must agree. However, this agreement is semantic in nature; it is not syntactic agreement.

Our semantic analysis provided a unified account of subject- and object-oriented FNQs, such that the two types of FNQ sentences were seen to differ only with respect to the type of predicate they composed with. We also noted a distinction between object-denoting and event-denoting classifiers. Again, we offered a unified account of this. FNQs with an object-denoting numeral classifier and FNQs with an event classifier were seen to differ only as regards the type of entity, objects or events, a difference determined by the lexical properties of the classifier. A crucial aspect of this unified analysis is that the classifier necessarily denotes a set of atoms, i.e. it is a singular term. This is simply because only atoms are discrete enough to be counted; the truth conditions of a cardinally quantified sentence break down if sums are in the domain of quantification. Given this lexical 'atomicity restriction' on classifier denotations, the generally obligatory distributive reading of an FNQ sentence was seen to follow trivially from the principles of set theory: The elements in the intersection of the classifier denotation and the predicate denotation must be atomic, given that the classifier is a singular term. We then showed how the effects of the lexical atomicity restriction are neutralized in the case of the DNQ by general, independently motivated, operations that give rise to the collective and cover readings. These general operations can only apply in the nominal domain, however, and that is why the quantificational FNQ cannot also have collective or cover readings.

The proposed analysis is limited to the quantificational NQ, as opposed to the amount term NQ. The amount term NQ can show up as either a DNQ or an FNQ, but the amount term has a distinct semantics. In contrast to the classifier of a quantificational reading, which denotes a set of individuals, the classifier of the amount term reading denotes a measure function, or a scale. However, as we noted earlier, and has been discussed by Lønning (1987), under special conditions measure denoting classifiers can in principle be construed as individual denoting classifiers, and vice versa. We accounted for the compatibility of some FNQ sentences with a collective predicate in terms of this phenomenon, which quite easily obfuscates judgements about FNQ sentences.

The analysis we have proposed leaves a number of further questions unanswered. For example, one remaining question is exactly how the DNQ-FNQ sentence, which we discussed quite frequently, should be analyzed:

(4)a. narande hashitteita **suu-dai**-no **torakku**-ga gaadoreeru-ni,
in a row running some-CL-GEN truck-NOM guardrail-to

san-dai butsukatta. (Inoue 1978)
3-CL hit

'Three of the several trucks that were driving in tandem hit the guardrail.'

b. Hanako-ga soko-ni aru **san-mai**-no **kaado**-o, **ichi-mai** mekuru-to
H-NOM there-at be 3-CL-GEN card-ACC 1-CL flip-when

sore-wa baba-dat-ta. (cf. Fukushima 1991)
it-TOP joker-COP-PAST

'When Hanako flipped one of the three cards, that was a joker.'

For some reason, the DNQ-FNQ sentence necessarily yields a partitive reading. Why should this be and what is the relationship of the DNQ-FNQ sentence to the canonical Japanese partitive construction? Second, the FQ phenomenon in Japanese is obviously not limited to the numerals; many other quantificational expressions undergo Q-float as well, as we briefly showed in chapter 1. Why do so many quantifiers float in Japanese and what is the relationship between FNQs and Japanese FQs? If our proposal is on the right track, then it is reasonable to hypothesize that Japanese FQs such as *subete* 'all', *sorezore* 'each', and etc. may contain a phonetically null or lexically incorporated classifier. Such an extension of our analysis would be a generalized modification of Doetjes' (1997) proposal. This topic will be briefly examined below for English.

7.2. On the English FQ

In this section, we offer a speculative extension of our analysis of the Japanese NQ by outlining an account along the same lines of quantification in the English FQ and NQ. In connection with this, we will address the question of why only English *all*, *each* and *both* may be FQs and why the English NQ does not float.

7.2.1. The Domain of Quantification for the English Numeral

A central claim of the semantic analysis proposed in this thesis is that in Japanese the classifier provides the restricted domain of quantification of the numeral quantifier. Another central claim is that the classifier denotes a set of atoms only. Suppose that this is not a historical accident for Japanese but rather, as we have suggested, follows from a deeper logical constraint on numeral quantification, and, for that matter, on the quantification in distributive universal quantifiers such as *each*, *every*, and *both*. That is, suppose such quantification is only possible if the atomicity condition holds on the domain of quantification. In this case, at least for an English numeral quantifier such as *three*, the domain of quantification must also be a set of atoms, whether the primitives are objects or events. Consider, then, an ordinary English sentence such as the following:

(5) Three boys left.

Under standard assumptions, the quantifier is the numeral *three*, its domain of quantification the NP *boys*, and its nuclear scope the predicate *left*. That is, (5) is interpreted as asserting that there are three individuals who are boys who left. Let us focus on the domain of quantification, the plural term *boys*. In chapter 4, we discussed the denotation of plural terms in English and concluded that an English plural term such as *boys* denotes a set that contains just sums. Therefore, if we assume that *boys* in (5) denotes such a set, then we will not obtain a proper domain of quantification for the numeral *three*. For a numeral quantifier, the domain of quantification must only denote a set of atoms, or the truth conditions will break down as we demonstrated in chapter 5.

There are two ways we could resolve this problem. One is to assume that *boys* in (5) is actually semantically a singular term, its surface form being plural for some purely syntactic reason. As we discussed in chapter 4, an English singular term such as *boy* only denotes a set of atoms, so if *boys* in (5) were actually semantically interpreted as the singular term *boy*, then numeral quantification could be computed successfully. Note that the hypothesis that a noun which is syntactically plural may be semantically singular is not completely implausible.[2] In fact, we consider this a necessary assumption for some assignments of meaning. Krifka (1990) notes that the singular/plural distinction is a purely syntactic agreement phenomenon, observing that there are cases in which the numeral quantifier denotes the number 1 and nevertheless the noun must be in plural form, as in *1.0 ships* (vs. **1.0 ship*). Moreover, consider, the following sentence, which contains the English classifier *flock*:

(6) Three flocks of birds landed in the pumpkin field.

In this sentence, the classifier *flocks* is plural on the surface. However, if it were also semantically plural, *flocks* would only denote a set of sums. Consequently, what the NQ *three flocks* refers to would systematically be a set of more than three flocks, since none of the elements in the set denoted by the plural term *flocks* is a singular atom. To be precise, even if each sum in the model happens to contain the smallest number of atoms that is

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[2] The implausibility comes, of course, from consideration of the fact that the same form *boys* in *all the boys* and *the boys* would seem to have to be a plural term, not a singular term, at least under the standard assumptions reviewed in chapter 4.

greater than 1, i.e. 2, there would always have to be as many as six flocks for (6) to be true. This clearly is not the case.[3] For (6) to be true, there must be something which the speaker can identify that is three in number. This 'something' is precisely a set of three flocks. Only under this circumstance can *three flocks* refer to three flocks. Therefore, the classifier *flocks* must denote a set of atomic flocks. That is, it is actually semantically singular. This is precisely what it should be under the assumption that *flocks* functions as a classifier. Thus, the fact that *flocks* must be in the plural form appears to follow purely from a language-specific requirement of English syntax, presumably arising from some parametric setting for the type of grammar to which English belongs. This syntactic parameter forces the English nominal element to be realized phonetically in the plural form when the numeral quantifier composes with it is anything other than natural integer 1, or when there is an indefinite singular determiner (again consider **three cup*, **three liter*, **1.0 ship*, etc). Thus, the presence of the plural suffix *-s* on *boy* in (5) can arguably be taken to be nothing more than syntactic agreement.[4]

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[3] Note that this problem does not arise when English classifiers apply to mass terms, e.g. *three bottles of beer*, because the object functioning as a unit of measure can contain a single amount of the substance in question. A flock of birds, in contrast, must consist of more than one bird.

[4] Den Dikken points out to me that there are some languages that have a morphological singular/plural distinction in nouns in which, in the use of a numeral, the modified noun must be the singular form. Observe the data below:

(i)	ha'z	(ii)	ha'z-ak	(iii)	ha'rom ha'z(*-ak)
	house-SG		house-PL		three house-SG(*-PL)
	'a house'		'houses'		'three houses'

This shows that, with respect to the syntactic parameter setting for plural marking, Hungarian belongs to a distinct group of languages from the one English belongs to.

On the other hand, an alternative approach is to assume (i) that, contrary to one of our assumptions for English in chapter 4, English plural count terms have the same denotational structure as mass terms (and Japanese terms in general) in that they do include atomic individuals and (ii) that there is an inaudible classifier immediately following the numeral, as follows:[5]

(7) Three *e* boys left.

Under this speculative hypothesis, the inaudible element *e* is a 'generalized classifier' that is found in non-classifier languages like English. It is the "other side of the coin" of Chierchia's (1998b) mass/count semantic parameter . Just as the Japanese setting of this parameter yields overt classifiers and null determiners, the English setting yields overt determiners and null classifiers. In order to do its job, the hypothesized English null classifier must denote only a set of atoms; it must be a singular term. Lexically, it would mean something like 'individual', 'piece', 'body' or 'thing'.[6] Now, since English does have singular terms, and since in some classifier languages the classifier is an overt copy of the noun in the host NP, what we might additionally suggest is that the hypothesized inaudible English classifier in (7) is simply a singular term derived from the overt plural term in

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[5] On this view, we adopt the analysis in which the extension of the English plural term includes atoms as well as sums, rather than the analysis in which it has only sums. Of course, we still retain the mass/count distinction for English; the English plural term lexically defines its atoms while the mass term does not.

[6] Interestingly enough, *body* and *thing* actually appear in some English quantificational expressions, e.g. *everybody* and *everything* (den Dikken, p.c.).

construction with it.[7] In the case of (7), this would be the singular term *boy*. That is, in (7), the empty category would be assigned the value *boy*, as follows:

(8) Three (boy) boys left.

If we assume such an underlying form for sentence like (5), then, the English NQ sentence can be analyzed just like a Japanese DNQ sentence, as illustrated in (9). In (9b), the numeral is the quantifier *three*; the inaudible singular term *child* is its first argument, and the plural term *children* is its second argument:

(9)a. **san-nin**-no **kodomo**-ga hashitta.
3-CL-GEN child-NOM ran

'Three children ran.'

b. Three (child) children ran.

---

[7] Note that there appears to be at least one classifier language, namely Thai, which productively generates its classifier this way, as the following examples illustrate (from Singhapreecha 2000):

(i) k^hăa săam k^hăa	(ii) mátĩ săam mátĩ
leg 3 CL	resolution 3 CL
'three legs'	'three resolutions'

However, we are not certain exactly how syntax and semantics are related in Thai NQs, since, in Thai the host NP and the numeral seem to form a syntactic constituent, rather than the numeral and the classifier, as in Japanese and English (cf. Singhapreecha 2000, den Dikken and Singhapreecha 2002).

From a different perspective, den Dikken and Singhapreecha (2002) argue for the presence of the generalized Classifier Phrase in many languages in which a predicate inversion is associated with a linker, a semantically meaningless morpheme, such as French *de*, Thai *thii*, Mandarin *de*, Japanese *no*, etc. Their claim is that this linker occupies the CL-head position. Thai seems to have multiple CLPs, and one of the CL-heads can be occupied by the linker *thii*. The hypothesized CL as a potential host of a linker, however, is distinct from the hypothesized CL which hosts the singular term *boy* in (8). Our speculation about the presence of an inaudible generalized classifier in English is based purely on the semantic considerations.

The Japanese sentence in (9a) and the English sentence in (9b) have the following parallel quantificational structure. That is, given a numeral as the quantifier, the first argument a singular term, and the second argument a plural term:

(10)a. Japanese

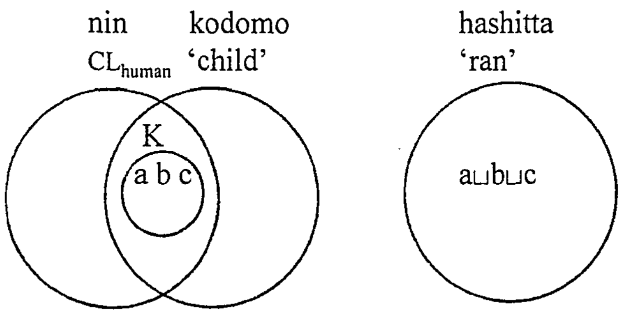
Q	A	B
san	nin	kodomo
3	CL	'children'

b. English

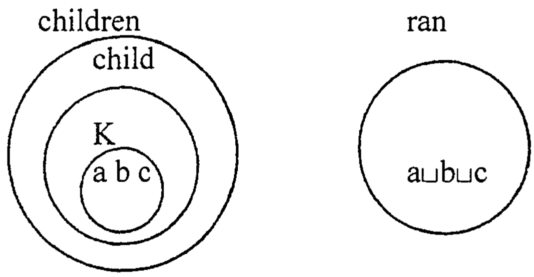
Q	A	B
three	child	children

The denotations of the domain of quantification and the nuclear scope are both sets of objects that intersect. The numeral indicates the number of elements in this intersection. These elements form a set which is further computed as a subset of the denotation of the predicate, as follows:

(11)a. Japanese



b. English



In English, the denotation of a singular term is always a subset of its corresponding plural term. Thus, the intersection is identical with the set denoted by the singular term. However, aside from this difference, the semantic computation of the sentence is exactly the same in English and Japanese. Thus, this analysis of the English NQ sentence is superior to the first approach we considered above because it makes no reference to hypothesized special cases of syntactic agreement peculiar to English but rather provides a general analysis that can apply to all languages.[8]

7.2.2. Why Only *All*, *Each* and *Both* Float

With this analysis in mind, let us consider the fact that the English FQ construction is limited to *all*, *each*, and *both*. First, we must note that these quantifiers are strong quantifiers rather than weak quantifiers. However, this cannot be the reason why they may float since the

[8] Alternatively, we could hypothesize that the inaudible generalized classifier does not derive from the overt plural term but is simply drawn from the lexicon, where it is lexically defined as denoting only atoms, on a par with a Japanese numeral classifier. However, perhaps the reason why it is inaudible is because it is derived. Pursuing this line of reasoning, it might be further conjectured that the English generalized classifier is derived at LF by number feature movement, where number is the grammatical feature that makes a count noun count and that enforces the atomicity condition in a Japanese classifier.

strong quantifier *every* cannot float. Moreover, the Japanese FNQ is a weak quantifier. A more significant common property of the English FQs, it seems to us, is that they all allow or require a distributive reading. This requires counting, a property shared with NQs. But this cannot be sufficient either, since, again, *every* does not float and no English NQs float:

(12)a. The boys all/each/both took a card.

b. *The boys every took a card.

The crucial factor licensing Q-float must be some property that *all*, *each* and *both* have which *every* lacks. What is this property? Here, Doetjes' (1997) claim that the FQ is associated with a nominal element suggests itself as a plausible answer. Specifically, let us assume that the floatable quantifiers in English are actually those that contain a hidden nominal element that is part of their lexical content. Observe that this hypothesis correctly predicts the grammaticality of the sentences in (13a-c) and, given the supposition that *every* lacks this nominal component, the ungrammaticality of (13d):

(13)a. All took a card.

b. Each took a card.

c. Both took a card.

d. *Every took a card.

In (13a-c), each quantifier can by itself function as an argument because it lexically contains a nominal element. Suppose, alternatively, that these quantifiers were simple determiners composed with a syntactically realized empty category:

(14)a. All *e* took a card.

b. Each *e* took a card.

c. Both *e* took a card.

This would not work because now there would be no way to rule out (15):

(15) *Every *e* took a card.

Thus, if we are to attribute Q-float potential to the presence of a nominal element, we must also hypothesize that this component of the quantifier is presyntactically encoded in its lexical content. With this proviso, we can make the following first attempt at a descriptive generalization:

(16) If an English quantifier lexically contains a nominal element, then it can float.

At this point, though, we are immediately faced with an empirical problem: English also has quantifiers that contain an overt nominal component, such as *everybody*, and these precisely cannot float, e.g. **The boys will everybody take a card.* So, we must make the further stipulation that the hidden nominal element must be phonetically null. This suggests us the following descriptive generalization:

(17) If an English quantifier lexically has a phonetically null nominal component, then it can float.

Why should it be necessary for the hypothesized nominal element to be phonetically null? We do not have an answer for this question, and, since this is not a dissertation about English NQs, we will not attempt to give one but rather leave the matter to future research. However, we speculate that the answer may lie in the language-specific properties of the English case-checking system. That is, perhaps in English phonetically realized referring expressions must be case-checked and this prevents a quantifier like *everybody* from floating.

Now, suppose (17) is more or less correct. Then, exactly what is this phonetically null nominal element that is presyntactically encoded in the lexical content of these quantifiers? Doetjes suggests that it is a pronoun, at least in the case of French FQ *tous*. As in chapter 3, we will call this the 'pronoun hypothesis'. English *all*, *each*, and *both* also seem to require a contextually provided antecedent. This is compatible with the pronoun hypothesis given that a pronoun is referentially dependent on an antecedent. However, this is not particularly compelling evidence in support of the pronoun hypothesis since the fact that *all*, *each*, and *both* are semantically dependent on a referential nominal in the discourse does not entail that they are anaphoric in the same way that a pronoun is. Definite DPs are also anaphoric and the strong quantifiers *all*, *each*, and *both* have the property, precisely, that they presuppose an additional contextual restriction on their domain of quantification over and above the lexical one provided by their host NP.[9] Thus, the semantic well-formedness of sentences like (13a-c) can be accounted for without the pronoun hypothesis. It is sufficient to assume the presence of a hidden nominal; it is not additionally necessary to assume that this nominal be pronominal. Moreover, the hypothesized hidden pronominal element of the pronoun hypothesis is shrouded in mystery. If this element is to function as a restriction on the domain of quantification, it must denote a property, i.e. it must be of type <e,t>. Now, how can a pronoun do this? Can a set of objects have the property of 'being an it'?[10] Pronouns

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[9] If neither the sentence nor the discourse containing the strong quantifier contains a prior referring expression that can provide this additional restriction, accommodation will make use of bridging to obtain it.

[10] In sentences like *It's a she*, the pronoun *she* is not really a pronoun; it requires no antecedent. Rather, it is used to mean something like 'has the property of being female'.

are of type e. Thus, for the pronoun hypothesis to be workable, it must stipulate that the hidden pronoun in the quantifiers in (12a) and (13) is obligatorily type-shifted to <e,t>, or, alternatively, that it is lexically specified as such. However, in this case, is it really a pronoun?[11] Finally, consider the fact that alongside (13a-c) the following sentences are also perfectly grammatical:

(18)a. All of them took a card.

b. Both of them took a card.

c. Each of them took a card.

Here, *of them* is a PP. The quantifiers *all*, *both*, and *each* cannot be determiners since a determiner cannot compose with a PP (**the of them*). Thus, we must assume that the quantifiers in (18) are associated with our hypothetical nominal element, thereby syntactically licensing composition with a PP. Now, if this nominal element is a pronoun, exactly what is the relationship between it and the overt pronoun which appears inside the PP? Perhaps future research will be able to answer such questions and vindicate Doetjes' pronoun hypothesis, but note that the questions only arise under the pronoun hypothesis. There is no mystery to solve if the hidden nominal element is not pronominal, but rather a very general noun like *thing*, or *body*, i.e. an inaudible analog of *thing* and *body* in *everybody*

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[11] Of course, UG does allow for the existence of pronoun-like nouns, which are of type <e,t>. According to Noguchi (1995), most Japanese pronouns are 'N-pronouns' of this type, heading an NP. Even English has one, namely *one* (which, interestingly enough, derives from a numeral). However, arguably these anaphoric elements are not really pronouns since Principle B does not seem to constrain their distribution (thanks to William Philip, p.c., for pointing this out). Consider the following contrasts:
(i) Looking in the mirror, the big one_1 saw the big one_1 and the small one_2 saw the small one_2.
(ii)*Looking in the mirror, he_1 saw him_1 and she_2 saw her_2.

and *everything*. In conclusion, then, let us reject the pronoun hypothesis for English just as we rejected it for Japanese. The hidden nominal in the quantifiers in (12a), (13a-c) and (18) is simply [+N].[12]

Going back to our hypothesis (17) which accounts for why English *all*, *each* and *both* float, let us now consider why ordinary NQs such as *three* do not:

(19) *The boys three took a card.

Here we can account for the absence of Q-float along the same lines as our account of why *every* does not float. Though we have hypothesized that the English NQ construction contains a hidden nominal element functioning as a generalized classifier, as shown in (8) above, crucially this element is not a part of the numeral itself but rather occupies a syntactic position of its own between the numeral and the host NP plural term. Thus, the situation is comparable to the case of *every*. Just like *every*, the English numeral cannot float because it does not lexically contain a hidden nominal. In other words, the hypothetical generalization in (17) applies as much to the English numeral as it does to English *every*. On the other hand, because the numeral does have a syntactically realized null nominal unlike *every*, it can have an anaphoric function, as illustrated in (20):

(20)a. The three took a card.

b. Three took a card.

To sum up our discussion so far, the quantifiers *all*, *each* and *both* are lexically associated with a phonetically null nominal element, and thus they float. Quantifiers such

[12] We might identify this phonologically null nominal to be the 'empty noun' recently discussed by Panagiotidis (2003a, b).

as *every* and English numerals are not lexically associated with a nominal element, and thus they cannot float. The numerals, however, are associated with a phonetically null nominal element that is syntactically realized as an empty category, so, though they cannot float, they can occupy an argument position without an overt nominal being present.

7.2.3. The English Classifier NQ

English does have a class of phonetically realized morphemes that are classifiers. These include words like *flock*, in *flock of birds*, *school* in *school of fish*, *set* in *set of objects*, *glass* in *glass of water*, etc. Obviously, the English classifier is morphologically and syntactically distinct from the Japanese classifier. It is a word, not a bound morpheme, and it usually combines with a numeral to form an NQ in a pseudopartitive construction. Let us call this the 'English classifier NQ'. Now, the question is: why doesn't the English classifier NQ float? Consider the following contrasts:

(21)a. Three flocks of birds landed in the pumpkin field.

b. *Birds landed [three flocks]$_{Adv}$ in the pumpkin field.

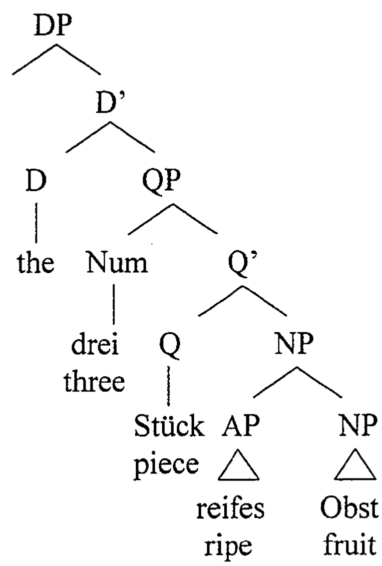
(22)a. John drank three glasses of beer.

b. *John drank beer [three glasses]$_{Adv}$.

Descriptively, the classifier NQs *three flocks* and *three glasses* cannot occur within a VP as an adverb as shown in (21b) and (22b) and must rather be in construction with a host NP, i.e. they can only exist as DNQs, as shown in (21a) and (22a). Note that there is nothing semantically wrong with sentences of the syntactic form in (21b) and (22b). In some other languages, in particular Japanese, such sentences are abundant. Thus, the source of the ill-formedness here seems to be in its syntax. Let us consider more closely, then, the syntactic structure of the English classifier NQ construction.

According to Löbel (1989), in a language like German a classifier takes a Q-head position and selects an NP. Consider Löbel's syntactic analysis of the pseudopartitive construction:

(23)



We should note that there is a difference between German and English as regards the surface form of the pseudopartitive construction. In standard English, a pseudopartitive nominal constituent such as *three cups of sugar* requires the presence of the preposition *of*. This is not the case in other Germanic languages such as German or Dutch, nor in Japanese *gakusei san-nin* 'student 3-CL' (see Appendix B), so we assume that its required presence in standard English is a peripheral syntactic property specific to English and we will ignore it.[13] [14] Thus,

[13] *Three cups sugar* seems to be well-formed in colloquial speech for some English native speakers.

[14] Krifka (1990) also notes that *of* is inserted at the surface (cf. Akmajian and Lehrer 1977). It might also be possible to analyze this instance of *of* as a 'linker' in the sense of den

following Löbel, we propose that the classifier in the English classifier NQ construction occupies Q-head position and requires the presence of a nominal complement, namely an NP. Given this analysis, we can account for the absence of Q-float for *three flocks* and *three glasses* in (21b) and (22b) by positing that it is syntactically impossible to extract the head and specifier of QP in a pseudopartitive structure such as (21b) and (22b) without bringing along the complement NP.[15]

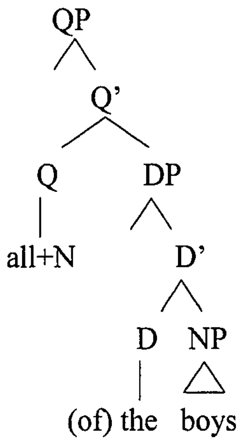
Of course, the general principles blocking extraction of an English classifier NQ would seem to also predict that a floated quantifier such as *all* cannot be syntactically derived from a DP, as the stranding theory claims. This would be no problem for those who reject the stranding theory. However, it should be noted that our account of why the English classifier NQ cannot 'float by extraction' is not necessarily inconsistent with a stranding-theoretical account of the English FQ. This is because floatable quantifiers such as *all* arguably have a DP-complement when they occur as DQs (Giusti 1991, Shlonsky 1991):

Dikken and Singhapreecha (2002).

[15] Note, in this regard, the stark contrast between the partitive and pseudopartitive construction. With a partitive construction which contains two NQs, extraction of the whole-denoting element is syntactically possible:

(i) Three of the six boys left.
(ii) Of the six boys, three left.
(iii) Of the six boys, John said that he saw three.

(24)



Indeed, the floatable quantifier *all* must occupy a syntactic position quite distinct from that of the numeral since it can co-occur with a numeral, as in *all the three boys* and *all of the three boys*. (Recall that we take *of* here to be 'syntactic decoration'.) *Both* and *each* can also be taken to occur in the structure in (24), as seen by *both of the two boys*, *both the boys* and *each of the three boys*.[16] Thus, the nominal domain in English can be considered to have a maximal projection higher than DP, which hosts a lexical element such as *all*, and another maximal projection lower than DP, which hosts a numeral and a classifier. Following Giusti and Shlonsky, we call the former QP, and we relabel Löbel's QP an NQP. We also assume Löbel's 'Num' should more precisely be NumP (Number Phrase), since this is a position for a maximal projection. The modified structure would be as shown in (25a), which turns out to be hierarchically parallel to the structure of the Japanese nominal phrase proposed by Kawashima (1994), modified under our analysis of the NQP as shown in (25b):[17]

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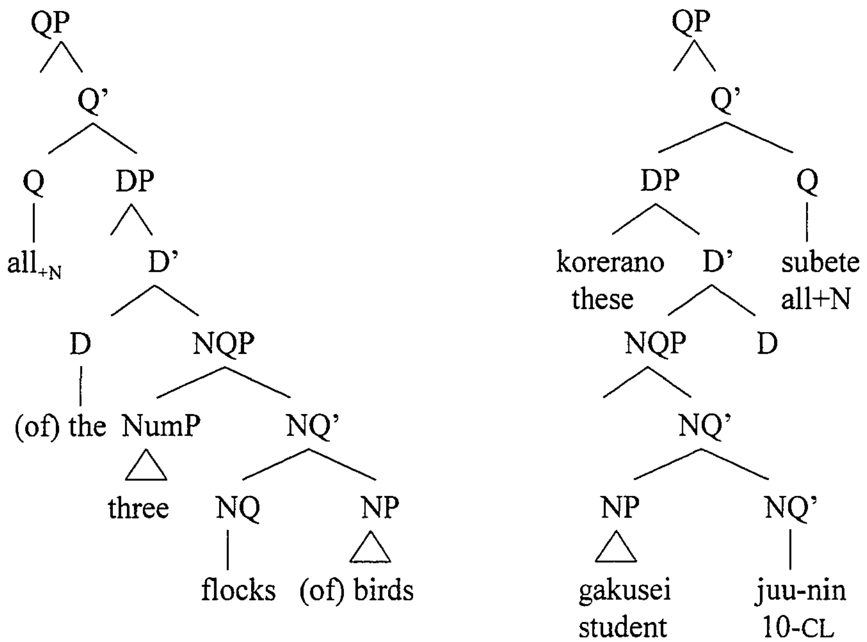
[16] On the other hand, *each* presents a little problem here: **each the boy*, **each the boys*.

[17] We also follow Murasugi (1991) and Koike (1999), assuming the demonstrative to occupy the spec DP position.

(25)a. English b. Japanese



In sum, whether we adopt a stranding-theoretical account of the English FQ, or a base-generated account analogous to our account of the Japanese NQ, the English classifier NQ is unable to float because (i) if it has been generated as part of a pseudopartitive construction it cannot be separated from its NP complement by a syntactic operation, and (ii) if it is generated without an overt NP complement, it still cannot occur in adverb position because of the general restriction imposed by (17), i.e. because it lacks a lexically specified hidden nominal element.

7.3. Concluding Remarks

In the previous section, we outlined how our account of the Japanese NQ might be extended and developed into a general theory of numeral quantification that applies to other languages and moreover how it might be extended to a general theory of Q-float along the lines of

Doetjes (1997). We used English to illustrate this. Although further research is needed to confirm the validity of the approach, its general merit, if workable, should be clear: It offers a unified account of NQs and FQs, explaining why some quantifiers can float and others cannot. Of course, it may turn out that such a unified analysis is not factually supported. For example, it may simply be the case that UG allows two distinct ways of generating an FQ, via base-generation as an adverb (Japanese FNQs) or via extraction from a DP (the stranding theoretical analysis of English FQs). However, it is always preferable, on general methodological grounds, to strive for a unified account.

APPENDIX A

DNQ CONSTITUENCY TESTS

Here we demonstrate the alleged constituency of the lexical strings [NP NQ], [NP-*no* NQ] and [NQ-*no* NP], using the following standard constituency tests: (i) pseudo-clefting, (ii) coordination and (iii) adverb insertion.

(1) [NP NQ]

a. Pseudo-clefting

konshuu-no korokiamu-ni kita-no-wa [gakusei juu-nin]-da.
this week-GEN colloquium-to came-that-TOP student 10-CL-COP

'The ones who came to the colloquium are ten students.'

b. Coordination

[[gakusei juu-nin]-to [Yoshida sensei]]-ga korokiamu-ni kita.
student 10-CL-and Y prof.-NOM colloquium-to came

'Ten students and Prof. Yoshida came to the colloquium.'

c. Adverb insertion

*[gakusei kinoo juu-nin]-ga korokiamu-ni kita.
student yesterday 10-CL-NOM colloquium-to came

(2) [NP-no NQ]

a. Pseudo-clefting

konshuu-no korokiamu-ni kita-no-wa [gakusei-no juu-nin]-da.
this week-GEN colloquium-to came-that-TOP student-GEN 10-CL-COP

'The ones who came to the colloquium are ten students.'

b. Coordination
[[gakusei-no juu-nin]-to [Yoshida sensei]]-ga korokiamu-ni kita.
student-GEN 10-CL-and Y prof.-NOM colloquium-to came

'Ten of the students and Prof. Yoshida came to the colloquium.'

c. Adverb insertion

*[gakusei-no kinoo juu-nin]-ga korokiamu-ni kita.
student-GEN yesterday 10-CL-NOM colloquium-to came

(3) [NQ-no NP]

a. Pseudo-clefting

konshuu-no korokiamu-ni kita-no-wa [juu-nin-no gakusei]-da.
this week-GEN colloquium-to came-that-TOP 10-CL-GEN student-COP

'The ones who came to the colloquium are ten students.'

b. Coordination

[[juu-nin-no gakusei]-to [Yoshida sensei]]-ga korokiamu-ni kita.
10-CL-GEN student-and Y prof.-NOM colloquium-to came

'Ten students and eight professors came to the colloquium.'

c. Adverb insertion

*[juu-nin-no kinoo gakusei]-ga korokiamu-ni kita.
10-CL-GEN yesterday student-NOM colloquium-to came

The three NQ constructions show the same pattern for the three tests. The fact that [NP NQ], [NP-no NQ] and [NQ-no NP] each allow pseudo-clefting is evidence that they each are a single constituent (assuming a movement analysis of pseudo-clefting). The fact that each of these three NQ constructions allows coordination with an NP shows not only that they are constituents but also that they are, in fact, nominal constituents. Finally, the fact that insertion of the sentential adverb *kinoo* 'yesterday' between the NQ and the host NP is impossible in each case is further evidence that these three types of NQ are DP-internal.

APPENDIX B

SYNTAX OF THE JAPANESE PSEUDOPARTITIVE CONSTRUCTION

In this appendix, we discuss the internal syntax of the nominal constituent [NP NQ] here, e.g. *gakusei san-nin* 'student 3-CL'. First, let us consider the hypothesis that [NP NQ], or at least [N NQ], is a morphological compound (Fukushima 1991, Fujita 1994). This compound hypothesis is based on the observation that no adjective may intervene between NP (N) and NQ in the string [NP NQ]:

(1)a. [nigiyakana gakusei san-nin] Adj-N-NQ
cheerful student 3-CL

'three cheerful students'

b. [nigiyakana san-nin] Adj-NQ
cheerful 3-CL

'three cheerful (people)'

c. *[gakusei nigiyakana san-nin] *N-Adj-NQ
student cheerful 3-CL

An adjective can precede N, as in (1a), and can modify NQ, as in (1b), but cannot intervene between NP (N) and NQ, as shown by (1c).[18]

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[18] This description holds even if the N is turned into an NP with a modifier:

(i) [nigiyakana [joshidai-no gakusei]$_{NP}$ san-nin] Adj-NP-NQ
cheerful female college-GEN student 3-CL
'three cheerful students of a female college'

(ii) *[[joshidai-no gakusei]$_{NP}$ nigiyakana san-nin] *NP-Adj-NQ
female college-GEN student cheerful 3-CL

Another piece of data that at least shows a tight relation between the NP and the NQ in [NP NQ] is the fact that the NP lacks a postpositional connector/genitive case marker *no*. Normally, a nominal element that modifies another nominal within a syntactic phrase requires the presence of this grammatical morpheme, as shown in (2):

(2)a. John-no sensei
J-GEN teacher

'John's teacher'

b. piano-no renshuu
piano-GEN practice

'Piano practice'

c. nihon-no ongaku
Japan-GEN music

'Japanese music'

d. gakusei-no san-nin
student-GEN 3-CL

'three students'[19]

The NPs (2a-c) require the presence of *no* when they have the strictly compositional meanings indicated by the English glosses. Removing *no* gives rise to ungrammaticality in (2a) and makes (2b) only marginally acceptable. Removing *no* does not give rise to ungrammaticality in (2c) but it eliminates compositional meaning: While (2c) refers to all music that has the property of being Japanese, *nihon-ongaku* 'Japan music' seems to mean only a particular genre of music, namely, traditional Japanese music. In particular, [NP NQ] in comparison to (2d), which has exactly the same two elements NP and NQ yet with *no* on the NP, shows a tighter relation between the two elements than syntactic modification.

These are the data that might be cited in support of the compound hypothesis regarding [N NQ]. We find this insufficient and reject the compound hypothesis for the following reasons. First, note that there is a class of adverbial elements, such as *yaku*

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[19] This particular phrase could also mean 'three of the students' (partitive) and 'the three, who are students' (non-restrictive relative clause-like use of the NP).

'approximately' that can intervene between NP and NQ in [NP NQ], e.g. *gakusei* ***yaku*** *gosen-nin* 'approximately 5000 students'. Second, note that while removal of *no* generally gives rise to non-compositional meaning with a true compound, an [NP NQ] string such as (2d) is just as transparently compositional as any other NQ construction. Third, there is strong phonological evidence that [NP NQ] cannot be a compound word: (i) The rendaku (sequential voicing) phenomenon found in Japanese compounds is not observed in [NP NQ], and (ii) the distinctive prosodic pattern found in Japanese compounds is not observed in [NP NQ].[20] Let us look at these phonological phenomena more carefully.

The Japanese rendaku phenomenon is the voicing of an initial voiceless obstruent of the second member of a compound. While this is generally observed in compounds, evidently it does not occur in the lexical string [NP NQ]:

(3)a. nobori + saka ⇒ /nobori**z**aka/
up slope 'uphill'

b. yuruyakana + saka ⇒ /yuruyakana saka/
mild slope 'slow hill'

c. otoko + san-nin ⇒ */otoko **z**an-nin/ but /otoko san-nin/
man 3-CL 'three men'

In the compound in (3a), the first voiceless obstruent of the second word becomes voiced, i.e. /s/ becomes voiced /z/. This process does not occur in the second member of a two-word string which does not form a compound such as [Adj N], as illustrated in (3b); /s/ remains unvoiced. Now, it is the latter pattern that is found in the [NP NQ] in (3c). This suggests rather strongly that it is not a compound.

[20] See Vance (1987) for thorough discussions of the Japanese phonology in general.

The other piece of phonological evidence concerns the characteristic pitch pattern of Japanese compounds. Generally, the Japanese compound exhibits an L-H-L pitch pattern: It begins with a single low tone, continues with one or more high tones, and ends with one or more low tones.[21] [22] Consider the following set of data:

(4)a. ha ri
H L
'needle'

b. se n bo n
HL L L
'1000-CL'

c. ha ri se n bo n
L H H L L L
(the name of a blow fish)

d. ha ri se n bo n
H L H L L L
'one thousand needles'

The noun *hari* 'needle' and the NQ *senbon* '1000-CL' are lexically specified to have the particular pitch patterns shown in (4a) and (4b), respectively.[23] In (4c), which is clearly a compound in view of its non-compositional meaning (name of a kind of blowfish), we see the tell-tale L-H-L pitch pattern. In contrast, in (4d), which is a DP of the form [NP NQ], meaning 'one thousand needles', the lexical pitch pattern of the two words remains intact.

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[21] For a detailed and thorough discussion of the prosody of compound formation in Japanese, see Kubozono (1993).

[22] An analogous phenomenon occurs in English Adj-N compounds, although it is a characteristic stress pattern rather than as a characteristic pitch pattern, e.g.

[Whíte House]$_N$ vs. [whíte]$_{adj}$ [hóuse]$_N$.

[23] There are a great many dialects in Japanese and the pitch patterns of words can significantly differ depending on the particular dialect. Here we show the pitch patterns of standard Japanese. The pitch patterns of standard Japanese can be usually found along with the entry of words in a Japanese dictionary.

Thus, the fact that (4c) does not have the L-H-L pitch pattern argues that it is not a compound.[24]

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[24] To see that our observation in (4) is not an isolated case of lexical idiosyncrasy, observe the compounds in (i), which all show to the L-H-L compound pitch pattern:

(i)a. ka mo + ryo o ri ('duck' + 'dish') → ka mo ryo o ri ('duck dish')
H L HLL L H H LL

b. te re bi + ka i sha ('TV' + 'company') →te re bi ga i sha ('TV company')
H L L LH H L H H HL L

c. se k ke n + ka i sha ('soap' + 'company') → se k ke n ga i sha ('soap company')
LH H H L H H LH H H HL L

d. ta ma go + do n bu ri ('egg' + 'bowl') → ta ma go do n bu ri ('egg bowl dish')
L H L L H H H L H H H L L L

In (ii) we see more examples of the [NP NQ] strings that do not show the L-H-L compound pitch pattern:

(ii)a. ka mo + sa n ba ('duck' + '3-CL') → ka mo sa n ba ('three ducks')
H L H L L H L H L L (*LHHLL)

b. te re bi + go da i ('TV' + '5-CL') → te re bi go da i ('five TV-sets')
H L L L H H H L L L H H (*LHHHLL)

c. se k ke n + fu ta tsu ('soap' + '2-CL') → se k ke n fu ta tsu ('two bars of soap')
L H H H L H H LH H H L H H (*LHHHHLL)

d. ta ma go + fu ta tsu ('egg' + '2-CL') → ta ma go fu ta tsu ('two eggs')
L H L L H H L H L L H H (*LHHHLL)

Moreover, there are a few cases of compounds formed of numerals, in which case we do observe the characteristic L-H-L pitch pattern. In (iii) we see some examples where the second elements starts with a numeral:

(iii)a. i chi ka + ha chi ka ('1-Q' + '8-Q') →i chi ka ba chi ka ('a big bet')
L H L L H L L H H H L L

b. ze i ta ku + sa n ma i ('luxury' + '3-dark') → ze i ta ku za n ma i ('extravagant')
LHHL LH HH LHHH H L L L

c. a o + ni sa i ('blue' + '2-year') → a o ni sa i ('green')
HL H LL L HH LL

The L-H-L pitch pattern can also be seen in a few compounds in which the first element is an NQ:

(iv)a. hitori + tabi ('1-CL' + 'trip') → hitoritabi ('solitary trip')
LHL LH LHHLL

b. (tabisugata) go ni n + o to ko ('5-CL' + 'men') → go ni n o to ko ('five traveling men')
L H H L H H L H H H L L

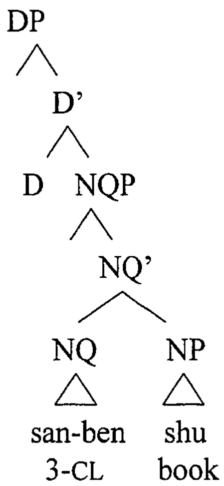
c. sa n ba + ka ra su ('3-CL' + 'crow') → sa n ba ga ra su ('three noisy people')
HL L H L L L H H H L L

d. ni ma i + shi ta (2-CL' + 'tongue') → ni ma i ji ta ('double standard')
H L L L H L HH L L

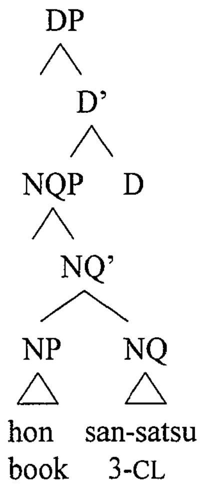
In sum, on the basis of a convergence of counter-evidence, we conclude that neither [N NQ] nor [NP NQ] is a compound. This leads us to analyze it as a syntactic constituent. The question now is what sort of phrase this might be. The answer to this question will have to explain syntactically why an adjectival modifier cannot intervene between NP and NQ, as seen in (1) and why the NP does not have to occur with the postpositional grammatical morpheme *no*, as seen in (2).

Some scholars of classifier languages argue for the presence of a maximal projection for the classifier element (e.g. Tang1990, Kawashima 1994, Kitahara 1992a, McClure 1999, Singhapreecha 2000, among others). For example, Tang (1990) proposes a DP-NQP (Numeral Quantifier Phrase)-NP hierarchy within the Chinese DP, as shown in (5). This is exactly the same hierarchy that Kitahara (1992a) independently suggests for Japanese, as shown in (6):[25]

(5)



(6)



[25] We use the term NQP. Tang labels this maximal projection 'KP'; Klassifier Phrase, and Kitahara labels it 'NCP'; Numeral Classifier Phrase. We stick to 'NQP' since it is a maximal projection headed by what we call 'NQ' throughout this thesis.

Let us suppose for the moment that (6) is indeed the phrase structure of a DP of the form [NP NQ]. This can be identified as an instance of the 'pseudopartitive construction' (e.g. Selkirk 1977, Akmajian and Lehrer 1976, Jackendoff 1977, Kubo 1996). The term 'pseudopartitive construction' refers to phrases such as *a cup of sugar* and *two bottles of wine* in English, which are similar to, but distinct from, true partitive constructions such as *three of the students* and *the best of these photos*: The true partitive construction generally contains a definite NP as the object of the preposition *of* and always expresses a part-whole relation.[26]

A key issue in the literature on pseudopartitives is determining which element is the head of such a phrase. For example, which is the head of *two cups of rice*, *cups* or *rice*? On the basis of the following empirical observation, Löbel (1989) claims, contra Selkirk (1977) and Abney (1987), that the classifier (*cups*) is the head:[27]

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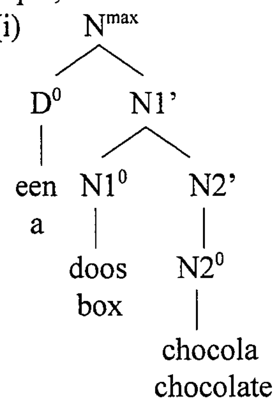
[26] Vos (1999) proposes a unique analysis of pseudopartitive and partitive constructions with a more liberal phrase structural analysis which she calls the 'macro-N-projection analysis'. This analysis is based on a criterion of well-formed feature projection. For example, *een doos chocola* 'a box of chocolate' in Dutch is analyzed as follows:

(i)



Here, N1' and N2' represent non-maximally projected nominal nodes. We will maintain more traditional X-bar theoretical assumptions, however, and will not attempt to adapt Vos's proposal to Japanese.

[27] The data in (7) are from Selkirk (1977).

(7)a. A cup of sugar was strewn on the floor.

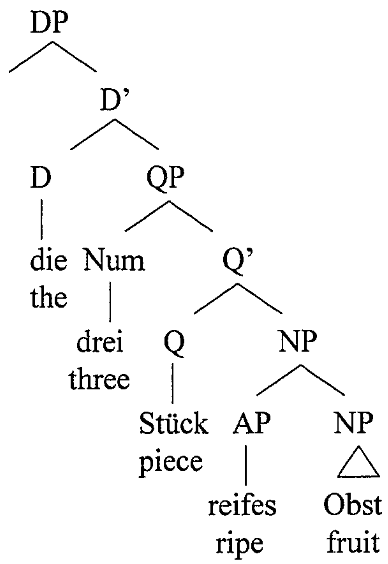
b. A cup of sugar was smashed on the floor.

(8)a. Two cups of sugar were strewn on the floor.

b. Two cups of sugar were smashed on the floor.

Selkirk observes that the predicate in (7a) makes the sentence a statement about sugar, while the predicate in (7b) makes the sentence a statement about a cup, and claims that *sugar* is the head in (7a), while *cup* is in (7b). However, Löbel points out that the distinction in her observation is semantic in nature and argues that *cup* is the head in both cases, on the basis of the syntactic agreement facts: In (8a-b), the plural verb form *were* must be used despite the predicate difference, which shows that, syntactically, *two cups of sugar* must be plural. *Cups*, in turn, must be the head of this phrase. In (7a-b), the singular verb form *was* must be used since *a cup of sugar* is singular. Löbel then proposes the following general structure for the pseudopartitive construction, using German as an example:

(9)



Under this analysis, a classifier such as *Stück* 'piece' is the head of QP that takes an NP as a complement and a numeral as its specifier. This has been criticized because the numeral occupies the spec position, a position usually reserved for maximal projections. It has been suggested that the numeral behaves more like a head than a maximal projection (e.g. Bhatt 1990). Putting aside this particular objection for the moment, let us note that Löbel's analysis cannot be directly adopted to Japanese for a language-specific reason. If we turned the structure (9) into a head-final structure for Japanese, the numeral and the classifier would be separated by the NP. This is not descriptively adequate (since the numeral and the classifier together constitute a word).[28] Thus, let us modify (9) letting the numeral be the Q-head, together with the classifier. Furthermore, if we simply change the label QP to NQP for Japanese, we actually arrive at Kitahara's structure as follows:

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[28] Closely following Löbel's analysis and modifying it only to account for the head-finalness of Japanese yields the following ungrammatical structure:

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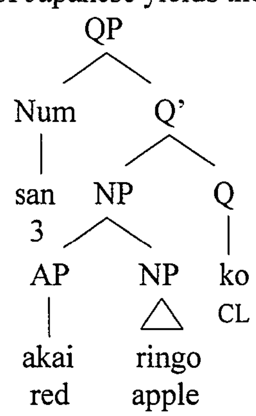
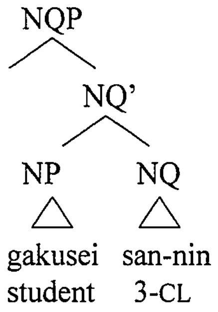


A grammatical form with these lexical element would be *akai ringo san-ko* 'red apple 3-CL'.

(10)



However, we depart from Kitahara in one significant aspect. Kitahara argues that the agreement between the classifier in the NQ and its host NP is an instance of syntactic agreement. Thus, following Chomsky (1993), Kitahara proposes that the NP must move up to the spec NQP so that the classifier agreement can occur in the syntactic checking domain of the spec-head relation. Since we saw, in chapter 3 (section 3.1), that this agreement is not syntactic but rather semantic or pragmatic but not syntactic, we do not assume movement of the host NP to the spec NQP.

As regards the spec NQP position, following Cinque (1993), we assume that all spec positions in the nominal domain are designated for adjectival elements and, in particular, we assume that the spec NQP is reserved for a lexical element that modifies the NQ, such as an adjective *soozooshii* 'loud'.[29] By adopting Cinque's generalization, we can account for the two different meanings of a nominal constituent such as *soozooshii gakusei san-nin* 'loud

[29] There are several different theories about the syntactic position of adjectives. They are analyzed as specifiers (e.g. Cinque 1993), as adjuncts (e.g. Bernstein 1993), as heads selecting an NP (Abney 1987), and as heads with an NP-specifier (e.g. Delsing 1993). Among these, Cinque's analysis, which incorporates head-movement within DP, has certain advantages: It explains the rigid word order among adjectives and accounts for the occurrence of adjectives on the right hand side of a head noun in some Romance languages. (cf. Kester 1996 for a review of these theories.) See also Sproat and Shih (1989) for an approach to the adjective based on Chinese. Sproat and Shih argue that the position of an adjective is determined by its scope and thus can occur in various different positions.

student 3-CL' in terms of a structural ambiguity as shown in (11a-b). The pitch contour in (11a) and (11b) is seen to be distinct as well:

(11)a. [[so ozooshi i gakusei] sa nni n]
loud student 3-CL

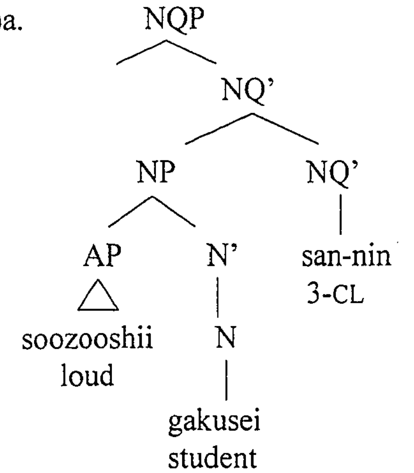
'three loud students'

b. [so ozooshi i [ga kusei sa nni n]]
loud student 3-CL

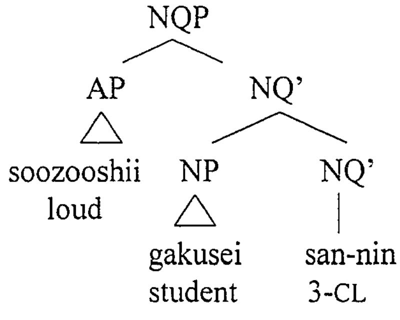
'a loud set of three students'

The difference between (11a) and (11b) concerns the scope of modification by the adjective *soozooshii* 'loud': *Soozooshii* modifies only *gakusei* 'student' in (11a), but it modifies [*gakusei san-nin*] 'three students' in (11b), as indicated by the English glosses. In the former case, the description 'loud' applies to each student, at least in principle, while in the latter case, it applies to the three students as a group. (If they were separated from each other, they might become very quiet.) These scope differences for the adjective can be represented as follows:

(12)a.



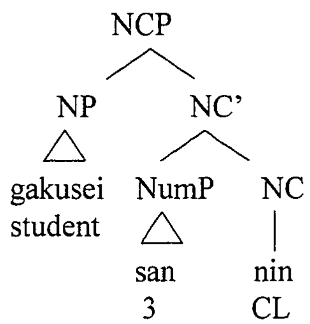
b.



In (12a), the adjective occupies spec NP, having scope over just the noun, while in (12b), it occupied spec NQP, having scope over the whole NQP.[30]

There is a possible alternative analysis for (10), however, suggested by McClure (1999) as in (13), in which NCP stands for Numeral Classifier Phrase:

(13)



Putting aside consideration of the position of the NP *gakusei* 'student', the significance of this analysis is that the numeral itself is projected as the maximal projection NumP, independent of the classifier, while the classifier is considered the head of the maximal projection NCP. This analysis receives some support from the fact that, apparently, the

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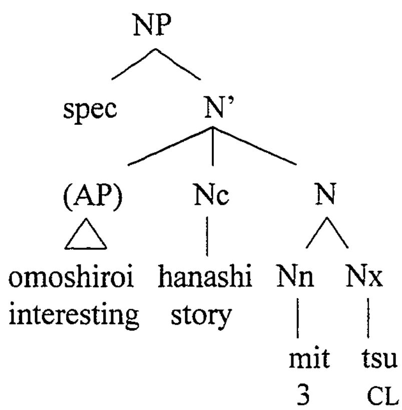
[30] Kubo (1996) proposes a different structure for the Japanese pseudopartitive construction adopting a partially tripartite structure as shown below: (Nc=an "open class" noun, Nn stands for a numeral and Nx stands for a classifier:

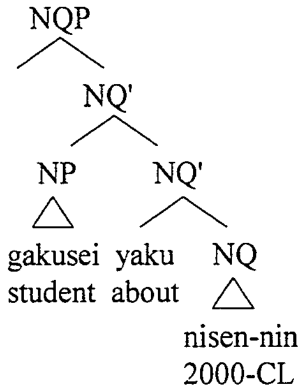
(i)



However, her configuration cannot capture the structural difference shown between (11a) and (11b).

numeral itself can be modified by a certain class of adverbs. For example, in an expression such as *almost ten students* in English, it seems plausible to argue that *almost* modifies the numeral *ten* itself, rather than *ten students*. In Japanese, as we mentioned above, an NQ can be modified by a lexical element such as *yaku* 'approximately', e.g. *gakusei yaku 2000-nin* 'approximately two thousand students', which presumably modifies only the numeral. In addition, a numeral expression such as *nisen naishi sanzen-nin* '2000 to 3000-CL' shows that the numeral can be complex independent of the classifier. However, as we mentioned in chapter 3 (section 3.1), we consider an NQ to be a single word. We argued for this on the basis of the rendaku (voicing) phenomenon (see chapter 3, FN3). If we adopted the analysis in (13), we would have to assume that rendaku may apply at the intermediate projection (NC'). That is to assume that rendaku can occur at a phrasal level, between a head and its complement. This raises basic questions about the independence of the morphology and syntax modules and their relationship to the phonological module. Though further research may justify an analysis such as (13), we will pursue a more conservative approach and stick to the hypothesis that the NQ is a single word occupying the NQ-head position.

The question, then, is how to analyze complex NQs, such as *yaku nisen-nin* 'about 2000-CL' and *nisen naishi sanzen-nin* '2000 to 3000-CL'. We suggest that a lexical element such as *yaku* 'about' occupies a position under the intermediate projection NQ' as follows:

(14)


Under this analysis, an adverb like *yaku* composes with an NQ to yield an NQ.[31]

Let us consider, then, whether our analysis in (10) can be maintained with respect to other phenomena with the nominal constituent. Giusti (1991) and Shlonsky (1991) suggest the presence of Quantifier Phrase ('QP') above DP in the nominal domain. This accounts for the word order of an English noun phrase such as *all the three boys*, assuming that *all* is

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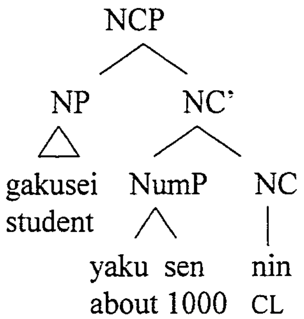
[31] Under the analysis in (13) *yaku* 'about' would compose with numeral to yield a complex numeral as shown below:
(i)


The scope of *yaku* 'about' is arguably limited to the numeral, as one might argue that the English *about* takes scope over just the numeral. Nevertheless, we suggest that its scope includes the classifier, according to the single-word hypothesis of the NQ [Num+CL].

Lexical elements such as *yaku/oyoso/daitai* 'about, approximately' are considered to be adverbs, according to a common Japanese dictionary (e.g. *Koojien*, *Kadokawa New Japanese Dictionary*). We assume that the NQ is a nominal element (Murasugi 1991) and presumably the numeral itself is also a nominal element (Jackendoff 1977, Corver, 2001). Then, such an adverbial element is modifying a nominal element. It is not exactly clear at this point what is going on here under the general assumption that adjectives modify nominal elements and adverbs modify predicates.

of category Q. Adopting the QP hypothesis, Kawashima (1994) proposes that the articulated structure of the Japanese nominal constituent includes a QP as the topmost maximal projection of the nominal domain. Adopting the QP hypothesis into Japanese successfully accounts for the Japanese data (15): (These data are taken, in a slightly modified form, from Kawashima.)[32]

(15)a. [gakusei sanjuu-nin subete]-ga kita. NP-NQ-Q
student 30-CL all-NOM came

'All the thirty students came.'

b. *[gakusei subete sanjuu-nin]-ga kita. *NP-Q-NQ
student all 30-CL-NOM came

The data in (15) can be analyzed as follows:

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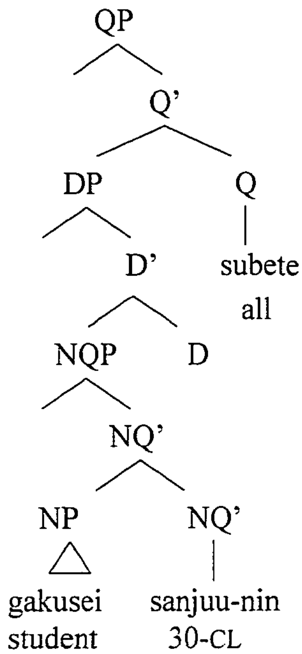
[32] The original data Kawashima offers is the following:
(i) [gakusei-ga sanjuu-nin subete] kita.
student-NOM 30-CL all came
'All the thirty students came.'
(ii) *[gakusei-ga subete sanjuu-nin] kita.
student-NOM all 30-CL came
Kawashima assumes that the bracketed part in each sentence here forms a nominal constituent. Under this assumption, the ordering constraint holds. However, we do not find this to be an ordinary nominal constituent so we believe that such data should be discussed separately. We make some comments on this in chapter 3. In any case, the modified examples here show the accuracy of Kawashima's observation more directly than her original data (i) and (ii).

(16)



Furthermore, if we now also assume, following e.g. Murasugi (1991) and Koike (1999), that Japanese demonstratives such as *kono* 'this' and *korerano* 'these' occupy the spec DP position, the word order of a Japanese nominal constituent containing a demonstrative can also be accounted for as in (17):

(17) [[korerano [gakusei san-nin]] subete]
these student 3-CL all

'all (of) these three students'

The scope of the demonstrative includes *gakusei san-nin*, but excludes *subete*. This is exactly what is predicted under the structural assumption in (16). Thus, (16) is descriptively adequate, and our hypothesis of the NumP in (10) is seen to be compatible with the QP hypothesis and consistent with demonstrative placement in Japanese.

Now, if (16) is indeed an accurate analysis of structure of the nominal constituent in Japanese, then it does not seem that we can maintain Tateishi's (1991) suggestion that the

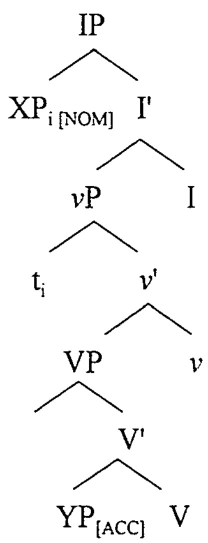
Case marker is generated in the D-head position. This is because the Case marker can be postpositioned to the Q-element in (17):

(18) [korerano gakusei san-nin subete]-**ga** sono iken-ni hantaishita.
these student 3-CL all-NOM the opinion-to disagreed

'All of these three students disagreed with the opinion.'

Such data raise the question of how the Case marker is syntactically realized. What we speculate here is that the nominative Case marker *ga* and the accusative Case marker *o* are structurally assigned, like English, without an independent syntactic position for the Case marker itself. Adopting the *v*P hypotheses (Chomsky 1995), which we assumed in chapter 3, we speculate that the subject base-generated in spec *v*P is raised to the spec of IP, where nominative Case is checked, while the direct object is base-generated in the complement of V-head and stays there since accusative Case is checked in this very position, as follows:

(19)



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