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Generalized floating quantifiers

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The University of Arizona, 1991

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GENERALIZED FLOATING QUANTIFIERS

by
Kazuhiko Fukushima

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A Dissertation Submitted to the Faculty of the
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1991
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Kazuhiko Fukushima entitled Generalized Floating Quantifiers and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

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SIGNED: [Signature]

[Signature]
To My Parents and Noi
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Abstract

A syntactic and semantic treatment of Japanese floating quantifiers is provided from a perspective of unification based grammatical theories and model theoretic semantics. The inventory of floating quantifiers under consideration includes not only familiar cardinals but also other quantificational elements such as universals. Syntactically, floating quantifiers are taken to be adverbial endocentric modifiers for some V-projections. Scrambling phenomena involving multiple floating quantifiers will also be accounted for without employing movement rules of any sort. Floating quantifiers function as semantic (but not syntactic) determiners (seen in the Generalized Quantifier theory) which establish a proper relationship between two sets (corresponding to a common noun and a one-place predicate) one of which functions as a domain of quantification.

In addition to presenting the specifics of the syntactic and semantic accounts for the phenomena in question, this thesis considers consequences of the proposed account and offers a new perspective on a universal theory of quantification. A typological classification of language is proposed which establishes the opposition between 'floating quantifier oriented' vs. 'determiner oriented' languages. From this perspective, a comparison between Japanese and English is carried out and some typological differences between the two are shown to follow from the envisaged opposition.
Chapter 1

Introduction

1.1 Unification Based Approach

This thesis provides a new approach to an old problem that has been discussed in the literature of Japanese linguistics under the rubric of 'floating quantifiers'. The new approach not only provides syntactic and semantic accounts for the phenomena in question but also reveals their significance for a universal theory of quantification. Relevant phenomena are partially exemplified in (1a-d) and (2a-d). (Hereafter, the gloss for a classifier is not given unless it is important for the exposition.)

(1) a. San-nin gakusei-ga hon-o sensei-ni okut-ta
   three-cl(person) student-nom book-acc teacher-dat send-past
   'Three student sent a book to a teacher'

b. Gakusei-ga san-nin hon-o sensei-ni okut-ta

c. *Gakusei-ga hon-o san-nin sensei-ni okut-ta

d. *Gakusei-ga hon-o sensei-ni san-nin okut-ta

e. \[NP \text{San-nin-no gakusei]-ga hon-o sensei-ni okut-ta}\]

(2) a. San-satu gakusei-ga hon-o sensei-ni okut-ta
   three-cl(bound volume) student-nom book-acc teacher-dat send-past
   'A student sent three books to a teacher'

b. Gakusei-ga san-satu hon-o sensei-ni okut-ta

c. Gakusei-ga hon-o san-satu sensei-ni okut-ta
d. Gakusei-ga hon-o sensei-ni san-satu okut-ta

e. Gakusei-ga [NP san-satu-no hon]-o sensei-ni okut-ta

What we see in (1a-d) and (2a-d) are distinct construal patterns between the floating quantifiers and their construees, namely san-nin ‘three’ and gakusei-ga ‘students’ in (1a-d) on the one hand and san-satu ‘three’ and hon-o ‘books’ in (2a-d) on the other. In (2a-d) san-satu is able to ‘float around’ to any pre-verbal position unlike its counterpart san-nin in (1a-d). We refer to this sub-class of floating quantifiers more accurately as ‘floating numeral classifiers’ which are quantificational (numeral) as well as classificational. Numeral classifiers can also occur NP-internally as (1e) and (2e) exemplify.

The floating numeral classifiers above are not the only floating quantifiers in the language. Also being accounted for are floating universal quantifiers like zen-in ‘all’ exemplified in sentence (3a) which can be interpreted in three different ways as indicated. (This, however, does not exhaust the possible range of interpretations. See Chapter 4.) Zen-in in (3a) shows distinct syntactic and semantic properties from the numeral classifiers seen (1a-d) and (2a-d) above. For example, one of the differences is that even when it goes together with the subject gakusei-ga it can be construed back to it crossing over both direct and indirect objects sensei-o ‘teacher’ and tomodati-ni ‘to a friend’. Moreover, as indicated by the parenthesis, the two different types of floating quantifiers can indeed cooccur within a single sentence and interact with each other.

(3) a. Gakusei-ga sensei-o tomodati-ni (san-nin) zen-in syookaisi-ta

      student-nom teacher-acc friend-dat (three) all-cl([human]-member) introduce-past

b. ‘All (three) students introduced a teacher to a friend’

c. ‘A student introduced all (three) teachers to a friend’

d. ‘A student introduced a teacher to all (three) friends’

Although there have been numerous studies of floating numeral classifiers found in (1a-d) and (2a-d), almost all past studies focused on the issue of word order and how to obtain correct ‘surface forms’ with/without employing transformational rules. This work has been productive, uncovering many intriguing pieces of data. At the same time, however, it has failed to investigate and provide an account for relevant semantic properties of numeral classifiers. In addition, as far as floating universal quantifiers are concerned, to my knowledge, there has not been any account proposed for their syntactic or semantic properties, particularly with respect to the interactive effects which the universals and the cardinals together can create.

Furthermore, it is virtually impossible to find past studies that have examined the implications of floating quantifier phenomena for a universal theory of quantification, such as the Generalized
Quantifier (GQ) theory of Barwise and Cooper (B&C) (1981). This thesis is written with the conviction that an investigation into the semantic properties of floating quantifiers is an indispensable part of an adequate research program concerning the grammar of floating quantifiers: they offer novel insights concerning what floating quantifiers really are, what sort of syntactic and semantic treatments are optimal for characterizing their properties, and what implications and consequences floating quantifiers have for a universal theory of quantification.

It is shown in Chapter 2 that floating numeral classifier phenomena are plausibly explained by a non-floating account. The chapter proposes a rigorous and explicit approach to these phenomena, which serves as the foundation for the further extension in the later chapters. The syntactic theory outlined in the chapter designates floating numeral classifiers as adverbial endocentric modifiers for some V-projections and is based on unification-based grammatical theories, represented by Generalized Phrase Structure Grammar (GPSG) (Gazdar, Klein Pullum, and Sag (GKPS) 1985), Head Driven Phrase Structure Grammar (HPSG) (Pollard and Sag (P&S) 1987), Japanese Phrase Structure Grammar (JPSG) (Gunji 1987), and Unification Categorial Grammar (Zeevat 1988). Particularly, Gunji's JPSG framework is closely followed. Given the non-trivial ordering possibilities among the non-verbal elements seen in (1a-d) and (2a-d), it is of theoretical interest, hence one of the interesting issues pursued by the present study, that a unification-based grammar which assumes no transformations is indeed capable of accounting for the long distance dependency involving floating numeral classifiers for which, traditionally, a transformational account was considered to be the only possibility. We will also see the interaction between so called scrambling and floating numeral classifier phenomena. Along with the syntactic account a semantic treatment of floating numeral classifiers is proposed from a model theoretic point of view (Montague 1974; Dowty, Wall, and Peters 1981); in particular they will be given interpretations utilizing the GQ schema of B&C.

Chapter 3 defends the adverbial analysis given to floating numeral classifiers in Chapter 2, which treats them as adverbial quantificational elements which do not participate in a direct modificational relationship with their common noun 'construees' (intuitively speaking). Evidence will be alluded to which strongly favors the view that floating numeral classifiers establish a proper relationship between (or unite) a common noun and a predicate. And, through this process, they indirectly quantify their common noun construees. Generally, the chapter witnesses a dependency of floating numeral classifiers not directly on their common noun construees but on the predicates which they modify. The semantic approach outlined in Chapter 2 is extended and the additional data introduced to motivate the adverbial analysis will be given appropriate treatments. In addition an account of quantifier scope phenomena involving floating numeral classifiers will also be provided. This account

1For an introduction to the fundamentals of unification-based grammars, the reader is referred to Shieber (1986).
is significant in two ways: 1) Given the semantic analysis outlined in Chapter 2 and the Quantification Calculus of Hendriks (1987), the present semantic approach avoids the problem attributed to the fact that a floating numeral classifier and its common noun construee are not in a direct modificational relationship and do not even form a syntactic constituent. 2) The analysis of scope ambiguity motivates two interesting semantic conjectures which seem to be incompatible with each other (as pointed out by Hendriks), namely Type Driven Translation (Klein and Sag 1985) and type ambiguity (Partee and Rooth 1983; Partee 1987).

The coverage of the syntactic and semantic analyses is broadened in Chapter 4 and the phenomena involving universal floating quantifiers like the one seen in (3a) above are accounted for. It is shown that the syntactic and semantic accounts given in Chapter 2 extend to the additional data without difficulty. Moreover, mixed and complex cases with both a floating numeral classifier and a floating universal quantifier within a single sentence are also dealt with. The distributional properties and interpretations of these complex cases are shown to follow from the interaction of syntactic and semantic definitions given to floating numeral classifiers and floating universal quantifiers independently. Finally, the scrambling phenomena touched upon in Chapter 2 are revisited. Despite the high degree of complexity arising from the interaction between scrambling, floating numeral classifiers, and floating universal quantifiers, the present account is shown to be able to handle these complex cases.

Chapter 5 ties together all the specifics of the syntactic and semantic accounts developed in the earlier chapters and discusses some theoretical implications of the phenomena and the accounts proposed for them. Floating quantifiers are given a proper position to occupy within a universal theory of quantification. First, it is motivated that floating quantifiers can naturally be treated with the GQ schema by examining the applicability of the GQ properties found mostly in B&C. Second, given that floating quantifiers are amenable to the GQ schema which has originally been devised for non-floating quantifiers, a semantic typological classification of languages is suggested which divides languages into two classes: 'floating-quantifier oriented' vs. 'determiner oriented' languages. The nature of the opposition is such that in the former, NP-external floating quantifiers are considered to be the basic elements which enable the GQ interpretation. For this sort of languages, the existence of NP-internal instances of quantificational elements is immaterial. In contrast, in the latter, NP-internal syntactic determiners are considered to be the basic quantificational elements rather than the floating quantifier counterparts, which assume a secondary status. This orientational opposition is to provide not only quantificational typological classifications of natural language but also explanations for other typological differences between the two types of languages. In a preliminary fashion, a comparison between Japanese and English is made to demonstrate this last point.
1.2 Theoretical Controversy

Before getting started with the present proposal, let us examine what has been suggested in the literature for the treatment of floating numeral classifiers. The theoretical controversy surrounding Japanese floating numeral classifiers can be divided into two general types. The first controversy concerns the proper syntactic treatment of word order phenomena and is represented by the opposition between a ‘launching’ analysis and a ‘non-launching’ analysis. According to the former, floating numeral classifiers like those seen in (1a-d) and (2a-d) are ‘launched’ from within NPs in (1e) and (2e) which contain them (Okutsu 1969, Kamio 1977, Haig 1980, etc.). On the other hand, the latter ‘base-generates’ the floating numeral classifiers in their ‘surface’ positions (Inoue 1978, Takano 1984, Ueda 1986, Miyagawa 1989, Yatabe 1990, etc.). The second controversy is independent of the first and is about a factor which dictates a proper construal relationship between a floating numeral classifier and its construee. As pointed out by Miyagawa (1989), we can abstract away from the launching vs. non-launching opposition, and view this controversy as being about a proper relationship that has to hold between a floating numeral classifier and its construee as they appear in the surface forms. We will examine these two in turn.

1.2.1 Launching vs. Non-launching Analyses

As far as I know, all launching analyses are formulated in the classical transformational framework. They have been criticized most notably by Inoue (1978) and Takano (1984, 1986) on empirical grounds, and by Ueda (1988) on theoretical grounds. Since the empirical implausibility of the launching analysis is one of the main contentions of Chapter 3, the introduction of the host of relevant evidence against it is postponed till that chapter.

From a theoretical point of view, Ueda argues against the launching analysis. He bases his argument on the assumptions from the recent development in the transformational syntax, the Government and Binding (GB) theory (Chomsky 1981, 1986), and points out that a syntactic rule which moves numeral classifiers deviates from the allowable range of movement rules (either ‘substitution’ or ‘adjunction’) within the framework, hence the impossibility of the launching analysis. Though this argument is theory internal and only valid if the launching analysis is to be formulated according to the same theoretical framework, it may help to show that word order possibilities involving floating numeral classifiers are not the kind which is readily amenable to a treatment which assumes movement of some sort.2

An account along the lines of Sportiche (1988) may be an alternative which a movement-based theory could offer. In explaining French floating quantifiers, he proposes the movement of the construee (from the subject position of VP to SPEC of IP) instead of the movement of the quantifier. However, it is not clear if this sort of account can indeed
It seems to be the case that the evidence provided against the launching analysis is compelling, especially on empirical grounds, as will be shown in Chapter 3. The absence of counter arguments against the non-launching analysis also indicates that this alternative analysis is more plausible and preferable to the launching analysis.

1.2.2 Constraints on Construal Relationship

Let us examine the second controversy, namely the nature of the set of constraints on a proper construal relationship between a floating numeral classifier and its construee. Ignoring the applicability of movement, we find numerous proposals with respect to this subject matter but each of them seems to fall into one of the following six core proposals: 1) the ‘grammatical relation’ condition (Okutsu 1968, Kuno 1978, Haig 1980, etc.), 2) the ‘surface case’ condition (Shibatani 1977), 3) the grammatical relation condition with the ‘quasi-direct-object’ provision (Inoue 1978), 4) the ‘predication’ condition (Ueda 1986 and Miyagawa 1989), 5) the ‘θ-hierarchy’ condition (Yatabe 1990), and 6) the ‘pragmatic’ condition (Hamano 1989). Each of these is reviewed below.

1.2.2.1 The Grammatical Relation Condition

The grammatical relation condition proposes that floating numeral classifiers can be construed only with a subject and a direct object. This explains the acceptability of (1a,b) and (2a-d) (repeated as (4) and (5)) and unacceptability of (6). (Note that, though they are identical strings, the intended construal relationships between the numeral classifier and its construee are different between (4d) and (6a) below. In the former san-nin is taken to be subject oriented and in the latter indirect object oriented as the intended interpretations indicate.) In (6a) the numeral classifier is intended to be construed with the dative object and in (6b) with the adjunct.

(4) a. San-nin gakusei-ga hon-o sensei-ni okut-ta
   three-cl(person) student-nom book-acc teacher-dat send-past
   'Three students sent a book to a teacher'

b. Gakusei-ga san-nin hon-o sensei-ni okut-ta

c. *Gakusei-ga hon-o san-nin sensei-ni okut-ta

d. *Gakusei-ga hon-o sensei-ni san-nin okut-ta

e. [NP San-nin-no gakusei]-ga hon-o sensei-ni okut-ta

explain floating quantifier phenomena in Japanese where (as we shall see in the chapters to follow) the distribution of these elements is less restricted than in French and English.
It is obvious that the condition alone does not predict the range of data correctly as (4c,d) demonstrate. To obtain a more adequate account, Haig (1980) states a set of restrictions on the application of movement rules he proposes ('quantifier float' and 'scrambling') which appear to be a mere collection of descriptive statements. In addition, this sort of account forces us to take grammatical relations as primitives. There is nothing wrong in doing so but deciding which element in an actual sentence corresponds to which grammatical relation is not a trivial task. Case markers will not be much help in this respect. As pointed out by Shibatani (1977), in Japanese, it is erroneous to associate a given grammatical relation with a particular case marker, since the correspondence is not always straightforward.

1.2.2.2 The Surface Case Condition

Upon recognizing that grammatical relations do not offer a satisfactory constraint on the floating numeral classifier-construee relation, Shibatani (1977) proposes that the surface cases realized by case markers (e.g. -ga, -o, -ni, etc.) are the crucial factors for deciding a proper construal relation. He claims that floating numeral classifiers can be construed to only ga or o-marked NPs. His account seems to be adequate given the data in (4a,b), (5), and (6). This can also explain the contrast between (7a) and (7b).

(7) a. *Sensei-ni san-nin eego-ga hanas-e-ru
   teacher-dat three English-nom speak-poss-pres
   '(INT.) Three teachers can speak English'
b. Sensei-ga san-nin eego-ga hanas-e-ru
   teacher-nom three English-nom speak-poss-pres
   'Three teachers can speak English'

Shibatani argues that, according to the grammatical relation condition, (7a,b) are expected to be well-formed due to the fact that both sensei-ni and sensei-ga are the subjects. He justifies this claim by the applicability of 'reflexivization' and 'honorification' which are considered to be sensitive to subjecthood.

Just as was the case with the grammatical relation condition above, this account has to be augmented with some additional constraint(s) to prevent examples like (4c,d). Moreover, as pointed out by Inoue (1978), there seems to be no explanation in Shibatani’s account as to why sentences like (8a) are possible. Or, though the nature of the example is a bit different, (8b) will not be dealt with properly, either.

(8) a. Hanako -ga kokuugaisya-ni huta-tu atat-te-mi-ta
    -nom airline company-adj two check-try-out-past
    'Hanako tried out checking with two airline companies'

b. Hanako -ga depaato-ni huta-tu it-te-mi-ta
    -nom department store-to two go-try-out-past
    'Hanako tried out going to two department stores'

1.2.2.3 The Quasi-direct-object Provision

Extending the grammatical relation approach, Inoue (1978) suggests, with examples like (8a) above, that a crucial factor is not so much the surface cases as what counts as a ‘direct object’. She notes that not only accusative o-marked NPs but also dative ni-marked NPs can be in some sense a direct object of a verb (hence, ‘quasi-direct-object’). Under such a circumstance, even a dative NP can be a construee of a floating numeral classifier. Though the situation is not exactly parallel, a sentence like (8b) also shows a similar point. The difference between the two is that in (8a) kokuugaisya-ni seems to be an obligatory complement to begin with, while in (8b) depaato-ni seems to be an adjunct which has acquired a complement status.

This quasi-direct-object provision is an interesting observation. But Inoue does not offer any plausible criterion according to which we can decide just when a dative NP is a direct object and when it is not. It also inherits the same problems associated with the grammatical relation approach pointed out above. Finally, the data seen in (4c,d) are still left unaccounted for.
1.2.2.4 The Predicational Condition

Building upon Inoue's observation, Miyagawa (1989) proposes the predicational condition on the numeral classifier-construee relation. He conjectures that the relationship between a numeral classifier and its construee is that of predication in the sense of Williams (1980). It requires a floating numeral classifier to occupy a structural position where 'mutual C-command' holds between the construer and construee. Further, he assumes that the nominative, accusative, and (sometimes) dative case markers (-ga, -o and -ni) on the one hand and postpositions (-kara, -de, -ni, etc.) on the other are distinct in that the former only cliticize onto an NP and do not project a phrasal projection, enabling mutual C-command to obtain. For the latter mutual C-command fails to obtain. This condition enables him to account for (4a-d), (5b-d), and (6). The example (5a) is to be derived by scrambling the numeral classifiers to the sentence initial position. (In this sense his account is not a pure base-generation account.)

Miyagawa's mutual C-command requirement is interesting in that it captures the locality effect seen in the contrast (4a,b) vs. (4c,d). A similar effect is rendered by the present syntactic account proposed in Chapter 2 based on the Obliqueness Hierarchy of Pollard and Sag (1987). With respect to the locality effect, Miyagawa's predicational account and the account proposed in this thesis have a lot in common. For this reason, in Chapter 2, a more detailed review of his analysis will be carried out and a comparison between the two will be made to show that distinct predictions indeed obtain, especially in terms of long distance dependency between a floating numeral classifier and its construee. I will not dwell on the predicational condition any further here.

1.2.2.5 The θ-hierarchy Condition

Yatabe (1990) proposes a novel account for the phenomena under consideration based on the θ-hierarchy in (9) due originally to Jackendoff (1972). (A item on this list is said to be thematically 'higher' than any item listed to its right.)

(9) agent < recipient < instrument < location < theme (predicate)

Following Gunji (1987), he assumes that, in Japanese, verbs come with an unordered argument list and the association of each argument as well as a numeral classifiers to the corresponding slot on the

2Ueda (1986) independently proposes an account which is almost identical to Miyagawa's. We examine Miyagawa's proposal since his coverage of the data is broader than that of Ueda.

4As we see below, to exclude some cases of fronting of numeral classifiers, Miyagawa appeals to ergativity/unaccusativity. See Terada (1987) for a similar approach. However, we note that Tateishi (1990) expresses some doubts about the Miyagawa-Terada approach. He suggests that ergativity/unaccusativity is not called for explaining floating numeral classifier phenomena in the language.
argument list can take place in any order. No movement rule of any sort is involved in explaining the word order variation. The well-formedness of the floating numeral classifier–construee relationship is determined in the following way: only the thematically lowest slot [which has not been discharged yet (K.F.)] in the argument list of a verb with which a floating numeral classifier combines can be the construee of the numeral classifier. This explains (4b-d), (5c,d), and (6a,b).

To save (4a) and (5a,b) which will be banned by his account, Yatabe has to bring in an unmotivated (possibly untestable) assumption that phrase structures of Japanese "are not necessarily flat or binary branching." This move enables the association of a floating numeral classifier and a desired argument slot in (4a) and (5a,b) due to the fact that the numeral classifier and the argument can be attached at the same node as shown, for example, in the semi-flat structures A and B of Figure 1.1 for (4a) and (5a).

There appear to be some theoretical and empirical shortcomings with Yatabe's account. First, the assumption that Japanese phrase structures are not necessarily flat or binary branching seems to be rather dubious. There is no principled or motivated way to choose a given structure from the set of all possible structures made available by the system. For example, why is the structure A in Figure 1.1 analyzed as such, why can’t it be given the structure seen in B instead, which will render the sentence ungrammatical?

Second, how do we know what \( \theta \)-role is assumed by which element in a given sentence? Are the items given in (9) constitute the complete list of such roles? This is a serious problem for any
theory assuming $\theta$-roles for explanatory purpose. Dowty (1988) and Ladusaw and Dowty (1989) raises objections to the traditional thematic roles. They caution against the argument that some grammatical phenomenon necessitates the assumption that $\theta$-roles enjoy an independent status in linguistic theory.

Third, as also mentioned by Yatabe as an apparent problem, a sentence like (10) is an actual counterexample for his account. This is so because, when san-nin combines with katta, regardless of the phrase structural properties of the sentence, the available lowest argument slot of the verb is theme. Thus the sentence can only have a reading which construes the numeral classifier and the direct object. This of course is not accurate.

(10) Hon-o gakusei-ga kinoo san-nin kat-ta
    book-acc student-nom yesterday three buy-past
    ‘Three students bought a book yesterday’

1.2.2.6 The Pragmatic Condition

Finally, let us examine the pragmatic condition due of Hamano (1989). This account proposes the availability of a contextually salient set as the crucial factor for the floating numeral classifier—construee relation. According to her, a floating numeral classifier requires that its construee refers to a subset of the contextually salient set. She elaborates on the nature of the contextual set and states that this set “must be transparent to the language users on the basis of semantic or contextual information”. However, it seems to be unclear what she means by ‘semantic or contextual information’ which is supposed to help us pick the contextually salient set, since these concepts are not defined by her at all, making it hard to verify such a claim.

Empirically speaking, the evidence employed to support her claim appear to be biased to force her conclusion about the proposed pragmatic condition. For example, all of her crucial example sentences are in the past tense, making it easy to render a contextually salient set. Moreover, contrary to what is claimed, a floating numeral classifier can legitimately be used in a sentence where its construee refers to no subset of a contextually salient set. Consider (11) which is a generic sentence and the subject sensyu-ga need not refer to any subset of a contextually salient set.

(11) Yakyuu-no tiimu-ni-wa sensyu-ga zyuu-nin hituyoo-da
    baseball-gen team-for-top player-nom ten need-cop-pres
    ‘To organize a baseball team, ten players are needed’

This concludes the review of the past proposals.
1.3 Summary

As the diversity of and the disagreement among the past proposals for floating numeral classifier phenomena indicates, the complexity of the subject matter is extensive. One can focus on one of many relevant aspects of the whole issue and easily come up with some interesting and even plausible conclusion in that sub-domain which may or may not be fruitful in the larger domain as a whole. In the remainder of this thesis, the effort is made to present a coherent theory which goes beyond the observations about the phenomena and the technicality of the account proposed for them and achieves a generalization concerning a general theory of quantification.
Chapter 2

Floating Numeral Classifiers

2.1 Introduction

We start the investigation into floating quantifier phenomena in Japanese with floating numeral classifiers. With data of a manageable size, the syntax and semantics of floating numeral classifiers are introduced in this chapter. The account given here provides the basic building blocks upon which further extensions and improvements are made in the later chapters. Section 2 describes the relevant phenomena and establishes the basic range of data. Based on the distributional patterns introduced in Section 2, Section 3 outlines the present syntactic treatment of floating numeral classifiers. The distinct lexical entries which reflect appropriate syntactic and semantic properties are established for different classes of floating numeral classifiers. Also entertained there is a non-transformational solution for the problem of dislocated numeral classifiers as well as a complication that arises from the co-existence of dislocated numeral classifiers and scrambling phenomena. The solution employs a GPSG apparatus, namely a SLASH feature, motivated for long distance dependency phenomena in general (GKPS 1985) and widely adopted by frameworks with affinities to GPSG.

From a Model Theoretic point of view (Montague 1974; Dowty, Wall, and Peters 1981), Section 4 focuses on the semantics of floating numeral classifiers and gives an explicit form to an informal but important assumption introduced in Section 3: the distribution of floating numeral classifiers is to be accounted for not just by syntactic conditions but rather by the interaction of syntactic and semantic conditions. This assumption takes the form of a 'next common noun argument' condition imposed on possible construees of floating numeral classifiers. Specifically, this section suggests that the quantifier under discussion is syntactically not a determiner (in the sense of Barwise and Cooper (B&C) 1981) that is directly construed with a common noun but rather a (quantificational)
adverbial functor that relates V-projection denotations to common noun denotations in a fashion similar to the proposal of Dowty and Brodie (1984).

After the presentation of the new approach, Section 5 reviews the recent GB treatment of floating numeral classifiers proposed by Miyagawa (1989) and compares it to the present account.

2.2 Distribution of Floating Numeral Classifiers

In this section we survey the distribution of numeral classifiers. The set of data given here is familiar in the literature on Japanese floating numeral classifiers mentioned above. For ease of exposition, I will divide up the distribution patterns into four different classes based on their construal possibilities with subjects, direct objects, indirect objects, and other optional adjuncts in the sense of Pollard and Sag (P&S) (1987). Also I ignore the word order variation in the language for the moment, but will come back to this in Section 3 below.

Generally, the following three patterns emerge through the examination of the data below. First the construal of a floating classifier to a subject is possible provided the construal does not cross over an indirect object or a direct object when the subject precedes these two. Second, a direct object is accessible by a floating numeral classifier from any pre-verbal position in a given sentence. Third, the construal of a floating numeral classifier to an indirect object or an adjunct is not possible from any position outside of the indirect object phrase or the adjunct phrase.

2.2.1 Construal to Subject

Let us begin with cases involving the subject and floating numeral classifiers. Except for a few cases, construal of numeral classifiers to subject constituents is relatively free from various positions in a given sentence. Consider the sentences in (1). In these examples  

\[ \text{hikoozyoo-kara} \text{ and } \text{Tookyoo-e} \text{ are adjuncts.} \]

(1) a. Hikooki yon-ki-ga hikoozyoo-kara Tookyoo-e tobitat-ta
    airplane four-nom airport-from Tokyo-to take off-past
    Four airplanes took off from an airport for Tokyo
b. Yon-ki hikooki-ga hikoozyoo-kara Tookyoo-e tobitat-ta

c. Hikooki-ga yon-ki hikoozyoo-kara Tookyoo-e tobitat-ta

d. Hikooki-ga hikoozyoo-kara yon-ki Tookyoo-e tobitat-ta

There is no theoretical significance given to terms such as 'subject', 'direct object', 'goal', etc. which are used for descriptive convenience only.
Although I do consider a bare numeral classifier such as *yon-ki* in (1b-e) on the one hand and a numeral classifier with a postposition such as *yon-ki-ga* in (1a) on the other to be syntactically distinct, for now I call them collectively as numeral classifiers for ease of exposition (see the syntactic analysis in Section 3 below). The sentences in (1) contain adjuncts and what we see is free interweaving of the classifier *yon-ki*, the subject *hikooki-ga*, the source adjunct *hikoozyoo-kara*, and the goal adjunct *Tookyoo-e*. The same construal patterns obtain with any other adjuncts present in the sentence.

But when we have SUBCATegorized complements (i.e. subjects, direct and indirect objects, see P&S 1987) such as the direct object *tegami-o* and the indirect object *sensei-ni* in (2), the construal pattern is more restricted: the numeral classifier *yon-ken* cannot be construed back to the subject *syuppansya-ga* when it crosses over either the direct object or the indirect object.

(2) a. Syuppansya-yon-sya-ga tegami-o sensei-ni okutt-ta
  publisher four-nom letter-acc teacher-dat send-past
  'Four publishers sent a letter to a teacher'

b. Yon-sya-syuppansya-ga tegami-o sensei-ni okutt-ta

c. Syuppansya-ga-yon-sya tegami-o sensei-ni okutt-ta

d. *Syuppansya-ga tegami-o yon-sya sensei-ni okutt-ta

e. *Syuppansya-ga tegami-o sensei-ni yon-sya okutt-ta

2.2.2 Construal to Direct Object

The cases with direct objects show a different distributional pattern of numeral classifiers from those with subjects. The data in (3) form a sharp contrast with those in (2).

(3) a. Syuppansya-ga tegami go-tuu-o sensei-ni okutt-ta
  publisher-nom letter five-acc teacher-to send-past
  'A publisher sent five letters to a teacher'

b. Go-tuu syuppansya-ga tegami-o sensei-ni okutt-ta

c. Syuppansya-ga go-tuu tegami-o sensei-ni okutt-ta

d. Syuppansya-ga tegami-o go-tuu sensei-ni okutt-ta

e. Syuppansya-ga tegami-o sensei-ni go-tuu okutt-ta
This illustrates that, from any pre-verbal position in the sentence, the construal of the numeral classifier *go-tuu* to the direct object *tegami-o* is possible. Introducing an optional locative adjunct does not change the construal pattern between a direct object and a numeral classifier at all.

(4) a. Gakusei-ga honya-de hon san-satu-o kat-ta
    student-nom bookstore-at book three-acc buy-past
    ‘A student bought three books at a book store’

b. San-satu gakusei-ga honya-de hon-o kat-ta

c. Gakusei-ga san-satu honya-de hon-o kat-ta

d. Gakusei-ga honya-de san-satu hon-o kat-ta

e. Gakusei-ga honya-de hon-o san-satu kat-ta

In (4) there is an adjunct *honya-de* in between the subject *gakusei-ga* and the direct object *hon-o* but this does not affect the free construal pattern between the numeral classifier *san-satu* and the direct object.

2.2.3 Construal to Indirect Object

When we turn our attention to the cases with indirect objects, what we obtain is the pattern exemplified in (5).

(5) a. Syuppansya-ga tegami-o erai sensei huta-ri-ni okut-ta
    publisher-nom letter-acc prominent teacher two-dat send-past
    ‘A publisher sent a letter to two prominent teachers’

b. *Huta-ri syuppansya-ga tegami-o erai sensei-ni okut-ta

c. *Syuppansya-ga huta-ri tegami-o erai sensei-ni okut-ta

d. *Syuppansya-ga tegami-o huta-ri erai sensei-ni okut-ta

e. *Syuppansya-ga tegami-o erai sensei-ni huta-ri okut-ta

The numeral classifier *huta-ri* is not able to be construed to the indirect object *sensei-ni* except in (5a). To obtain the numeral classifier construal to indirect objects, a numeral classifier has to be NP internal. The presence of other optional adjuncts in (5) does not change the construal pattern at all.
With respect to dative marked complements (but not necessarily indirect objects), Inoue (1978) points out an interesting example like in (6a) in which a dative marked element can be a construee of a floating numeral classifier.

(6) a. Hanako -ga kokuugaisya-ni huta-tu atat-te-mi-ta
    -nom airline company-dat two check-try-out-past
    ‘Hanako tried out checking with two airline companies’

b. Hanako -ga depaato-ni huta-tu it-te-mi-ta
    -nom department store-to two go-try-out-past
    ‘Hanako tried out going to two department stores’

She notes that not only accusative o-marked NPs but also dative ni-marked NPs can be in some sense a direct object of a verb, i.e. a ‘quasi-direct-object’. Under such a circumstance, even a dative NP can be a construee of a floating numeral classifier. Though the situation is not exactly parallel, a sentence like (6b) also shows a similar point. The difference between the two is that in (6a) kokuugaisya-ni seems to be an obligatory complement to begin with, while in (6b) depaato-ni seems to be an adjunct which has acquired a complement status. We will also examine her examples in the next section when we consider further predictions of the syntactic account.

2.2.4 Construal to Adjunct

The construal pattern of numeral classifiers to adjuncts is straightforward in that it behaves just like the indirect objects of (5). The examples (7) and (8) below employ both intransitive and transitive verbs and show that numeral classifiers have to be inside of NPs to function as adjuncts, obtaining the intended construal.\(^2\)

(7) a. Hikooki-ga [NP ookii hikoozyoo san-kasyo] -kara Tookyoo -e tobitat-ta
    airplane-nom large airport three -from -for take-off-past
    ‘Airplanes took off from three large airports for Tokyo’

b. *San-kasyo hikooki-ga ookii hikoozyoo-kara Tookyoo-e tobitat-ta

c. *Hikooki-ga san-kasyo ookii hikoozyo-kara Tookyoo-e tobitat-ta

d. *Hikooki-ga ookii hikoozyoo-kara san-kasyo Tookyoo-e tobitat-ta

e. *Hikooki-ga ookii hikoozyo-kara Tookyoo-e san-kasyo tobitat-ta

\(^2\)For the reason that the bracketed parts of (7a) and (8a) count as constituents, see the syntactic account given below.
In (7) the numeral classifier *san-ken* can only be construed to the locative adjunct *hikoozyoo-kara* when it occurs in between the noun and the postposition. Other construals are impossible. Exactly the same pattern obtains in (8) in that the construal between the numeral classifier *san-ken* and the locative adjunct *nomiya-ni* is possible only when the numeral classifier is internal to the NP. Again, as with the datives above, some cases, like the one introduced in Chapter 1, where an adjunct seems to acquire complement status and serves as the construee of a floating numeral classifier, are ignored for the moment but will be discussed in the next section.

This concludes the introduction of the data.

2.3 Syntax

Based on the fundamental distributional patterns established in the preceding section, this section offers a syntactic treatment of numeral classifiers which, together with the semantic translation schema developed in Section 4, covers the range of numeral classifier construal introduced in the previous section. The objective is accomplished in the following fashion. First, the group of numeral classifiers that appear internal to NPs (i.e. non-floating ones) are distinguished from another group of floating numeral classifiers that occur outside of NPs (i.e. floating ones). The fact that these two are distinct can be seen in the contrast between (9a) and (9b).

(9) a. Taroo -ga [onna-yo-nin katu otoko-go-nin]-o mi-ta
    -nom woman-four-cl and man-five-cl-acc see-past
    ‘Taroo saw four women and five men’

b. *Taroo -ga [yo-nin onna katu go-nin otoko]-o mi-ta
    -nom four-cl woman and five-cl man-acc see-past
    ‘(INT.) = (a)’
The two noun–numeral classifier ‘units’ in (9a) are (as proposed below) nominal compounds that can be coordinated with たつ ‘and’ and the whole is further taken by the postposition -ga. The two numeral classifier–noun ‘sequences’ in (9b) are not nominals (and not even constituents!). If they are nominal constituents which enjoy the same status as the nominal units in (9a), we would expect the coordination to succeed. Yoshida (to appear) recognizes this fact also. Takano (1984) provides a different test with cleft sentences which seems to reinforce the point made here.

(10) a. Taroo -ga at-ta-no-wa [onna-yo-nin]-da
   -nom see-past-nominalizer-top woman-four-cl-cop-pres
   ‘Who Taroo saw is four women’

b. *Taroo -ga at-ta-no-wa [yo-nin onna]-da
   -nom see-past-nominalizer-top four-cl-woman-cop-pres
   ‘(INT.) Who Taroo saw is four women’

Second, the floating type is further divided into two different classes of floating numeral classifiers with separate and explicit lexical entries. Specifically, both types of floating numeral classifiers are treated as adjuncts (i.e. adverbs) that function as endocentric modifiers for V-projections.

Third, the relationship between a dislocated numeral classifier and its ‘gap’ is mediated by means of the SLASH mechanism. In this way a numeral classifier can be interpreted properly even when it is disconnected from its construee.

2.3.1 Two General Types of Numeral Classifiers

2.3.1.1 NP Internal Numeral Classifiers

NP internal numeral classifiers are best taken to be nominals.3 Though I do not have a definite proposal for this type, I suggest a plausible direction to take. The numeral classifiers of this type have been introduced in the (a)-sentences of the examples (1) through (8) (except for (6) in Section 2. Typical examples of this type are as in (11).

(11) a. [NP gakusei-san-nin]-ga
   student-three-cl-nom
   ‘three students’

3The data like (i) below with the genitive (-no) marked NP-internal numeral classifier exemplify the third type:

(i) [NP San-nin-no gakusei] ‘three students’. We ignore this type in this chapter, since they are not ‘floated’. See Chapter 3 for a treatment of such data.
b. \([NP\ tegami-go-tuu\]-o
\letter-five-cl-acc
\five letters

I propose that these nominal numeral classifiers are combined with other nominals and form a nominal compound. So in (11a,b) *gakusei-san-nin* and *tegami-go-tuu* are complex nominals. It is plausible to think this way for the following reasons: 1) as seen in (11), the nominal-nominal unit can be combined with postpositions such as *-ga, -o* and many others that are normally combined with nominals, 2) the nominal-nominal unit is never interrupted by other items (such as adjectives) but can be modified by the same items if they precede the unit in question as seen in (12) and (13):

(12) a. *[NP\ gakusei-kanemotina\ -san-nin\]-ga
\student-rich \three-cl-nom
\three rich students

b. *[NP\ hon\ -ookii\ -go-satu\]-o
\book\ -big \five-cl-acc
\five big books

(13) a. [NP\ kanemotina\ gakusei-san-nin\]-ga
\rich \student\-three-cl-nom
\three rich students

b. [NP\ ookii\ hon-go-satu\]-o
\big \book\-five-cl-acc
\five big books

I do not have a specific suggestion concerning how these complex units are formed but simply assume the existence of a general morphological process that is also responsible for forming many other very productive compound nominals in Japanese. I do not have anything more to say about these NP-internal numeral classifiers of this type in the rest of the chapter. Indirect objects and adjuncts are able to be construed with numeral classifiers only through the NP-internal methods like the process just discussed.

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4Here are some (regular) nominal compounds which show analogous behavior: (i) *gakusei-kaikan-ga* 'student union (building)' (ii) *hon-dana-o* 'bookshelf'. These nominal compounds cannot be interrupted by adjectives either: (iii) *gakusei-ookii-kaikan-ga* '(INT.) big student union (building)' (iv) *hon-seinen-dana-o* '(INT.) useful bookshelf'. If the adjectives precedes these two are OK.
2.3.1.2 NP-external Floating Numeral Classifiers

The second type of numeral classifiers are the central focus of this chapter. This class is further divided into two sub-classes: 1) Subject Oriented (numeral) Classifiers (SOC), 2) Direct object Oriented (numeral) Classifiers (DOC). Each of these is lexically associated with a general syntactic and semantic definition as seen in (14). The semantic specifications given in (14) are only abbreviations but they serve the present purpose.

(14) a. Lexical Entry for Subject Oriented Classifier (SOC)

SOC: \{POS ADV; SUBCAT<+>; ADJUNCT IVP; SEM IVP'' \}

(where POS: part of speech, SEM: semantics)

b. Lexical Entry for Direct Object Oriented Classifier (DOC)

DOC: \{POS ADV; SUBCAT<+>; ADJUNCT TVP; SEM TVP''\}

We see that both (14a) and (14b) say that numeral classifiers of these types are adverbs that SUBCAT for nothing. They function as endocentric modifiers (i.e. adjuncts) to Intransitive Verb Phrases (IVP) and Transitive Verb Phrases (TVP), respectively. Semantically, (14a) says that this type of numeral classifier takes an IVP meaning and returns a new IVP (i.e. IVP'') meaning which is distinct from the original in such a way that this new meaning is the result of the numeral classifier taking the original IVP as an argument. Similarly, (14b) has the semantic definitions that takes a TVP meaning and returns a new meaning, TVP''. In addition, I am assuming that the very next argument that combines with the V-projection which has already been taken by a floating numeral classifier is the semantic construee of the numeral classifier (see Section 4, which outlines the semantic system, for the explicit form given to this assumption). This accomplishes the locality effect on the floating numeral classifier–construee relationship.

A word of caution is due concerning the names of the two classes of floating numeral classifiers which are labeled subject or direct object orientated. This does not mean that concepts such as 'subject' and 'direct object' are taken to be primitives or assumed by the present account. Rather these and other similar concepts are defined utilizing the order of the corresponding elements on the Head's SUBCAT list. This situation can be viewed as representing the order of argument positions in Montagovian semantic translations. Such an ordering is called the Obliqueness Hierarchy (P&S

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5Though the phonologically identical numeral classifiers are duplicated in the two separate classes, this move is for expository ease. We can in fact take one class of numeral classifiers to be basic and obtain the other class by some lexical redundancy rule.

6The adverbal nature of floating numeral classifiers is defended with rigor in Chapter 3.

7IVP, TVP and DTVP can be defined in the following way: IVP: V[SUBCAT<PP>]; TVP: V[SUBCAT<PP,PP>]; DTVP: V[SUBCAT<PP,PP,PP>].
2.3.2 Modification of Verbal Head

By itself, the lexical specification given above does not get us anywhere. It is when those floating numeral classifiers modify V-projections that we obtain a significant result. A lexical entry for a typical transitive verb will look like that in (15), with kaw 'buy.'

(15) Lexical Entry of kaw 'buy'

kaw: \{POS V; SUBCAT<PPga,PPo>; SEM kaw\}

(15) specifies that the verb kaw, subcategorizes for a subject PP and an object PP. Let us see the way a floating numeral classifier is incorporated into a local tree in simple cases.

(16) Onna-ga san-nin hon-o kat-ta
    woman-nom three book-acc buy-past
    'Three women bought a book'

(17) Hanako -ga hon-o san-satu kat-ta
    -nom book-acc three buy-past
    'Hanako bought three books yesterday'

Note in the trees A (for (16)) and B (for (17)) in Figure 2.1 the SUBCAT items specified on the Head are unified (Shieber 1986) with the complements fully one by one and cancelled out from the SUBCAT (SC) list (hence V[SC<>] = S). The unification of the complements and the floating numeral classifier is accomplished by the SUBCAT Feature Principle and the Adjunct Feature Principle of Gunji (1987), respectively.

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8Postpositional Phrase consists of the Head postpositions (e.g. -ga, -o, -ni, -kara, etc.) which SUBCAT for an NP.

9The syntactic trees are generated by a single phrase structure rule schema: M[other] → D[augher] H[ead] which stipulates that H is final in Japanese. It should be noted that there are different possibilities for the actual instantiation of D, i.e. either complements or adjuncts. For other JPSG conventions, see Gunji (1987).

10For the unification of complements, we need the SUBCAT Feature Principle (SFP) and to unify adjuncts (e.g. floating numeral classifiers), the Adjunct Feature Principle (AFP) is employed:

SFP: In complementation (i.e. M → C H), the value of the SUBCAT feature of H unifies with the value of the SUBCAT feature of M except for the category that unifies with C.

AFP: In adjunction (i.e. M → A H), the value of ADJUNCT of A unifies with H.
Figure 2.1: Trees for (16) and (17)
The explicit definition given in (14a), which imposes a strict locality condition on the floating numeral classifier-construee relation, prevents over-generation of an illicit construal like (18), which assumes a construal between onna-ga and san-nin.

(18) *Onna-ga hon-o san-nin kat-ta
woman-nom book-acc three buy-past
'(INT.) Three women bought a book

This is due to the syntactic and semantic definitions assigned to the SOC san-nin: it can only take IVP and not TVP as in (18).

However, this leads to the counterfactual prediction that the sentence in (19a) is unambiguous.

(19) a. Otoko-ga san-nin onna-o but-ta
    man-nom three woman-acc hit-past

b. 'Three men hit a woman'

c. 'A man hit three woman'

(19a) is indeed ambiguous as indicated in (19b,c). And what I have said so far will account only for the reading in (19b), i.e. with the numeral classifier being subject oriented. Figure 2.2 is the only syntactic analysis of (19a) which is predicted by my account at the moment.\(^{11}\) In this structure the numeral classifier san-nin has to be subject oriented and can never be direct object oriented. The reason is simple. The syntactic and semantic types of the numeral classifier requires an IVP with an

\(^{11}\)For typographical convenience the following simplified notation will be used in tree diagrams hereafter: $V[SC<>] = S$; $V[SC<PP>] = IVP$; $V[SC<PP,PP>] = TVP$; $V[SC<PP,PP,PP>] = DTVP$; $ADVP[AD] = ADVP_I$ (i.e. an adverbial phrase functioning as an IVP adjunct); $ADVP[AD TVP] = ADVP_T$.  

Figure 2.2: Tree for (19a)
IVP meaning. Thus the sentence in (19a) will never produce the reading in (19c). To see how (19c)
is indeed possible, we have to turn to the analysis of the cases with dislocated numeral classifiers.

2.3.3 Dislocated Numeral Classifiers

Consider first an unambiguous case involving dislocation of the numeral classifier:

(20) a. Hanako -ga hon-o san-satu kat-ta
    -nom book-acc three buy-past
    'Hanako bought three books'

b. Hanako-ga san-satu hon-o kat-ta

c. San-satu Hanako-ga hon-o kat-ta

In (20b,c) the numeral classifier san-satu is dislocated in the sense that it is not at a position which is required by its lexical specification. Nevertheless, these sentences are good with the numeral classifier construed with the direct object hon-o. How can this fact be accounted for? The way out of this is to employ a SLASH Feature which is independently motivated for other long distance dependency phenomena, e.g. WH-gap relationship and topicalization in English (GKPS 1985), scrambling in Japanese (Gunji 1987), etc. With the introduction of a SLASH feature, hence the introduction of a null string (a gap) which is given a lexical status in Gunji (1987) as in (21), the structures of (20b,c) will be as in Figures 3 and 4, respectively.\(^{12}\)

(21) Lexical DOC Gap

e: \{POS ADVP; SUBCAT <>; SLASH{ADVP; SEM TVP:/TVP'}; SEM...

In Figure 2.3 the DOC gap is introduced in the position which is in accord with the lexical definition given to the DOC. The dislocated numeral classifier meets the IVP with SLASH whose value unifies with it. Figure 2.4 is almost identical to Figure 2.3 except for the position where unification of the SLASHed ADVP and the numeral classifier san-nin occurs. SLASH is a Foot Feature (GKPS 1985) which is rather freely transmitted between daughters and mothers. Here I assume a version of the Foot Feature Principle due to Gunji (1987) which allows unification of the Foot value of the Head daughter and the dislocated item, cancelling the SLASHed item from the Head.\(^{13}\) Thus the long distance relationship between a floating numeral classifier and its gap is established.

\(^{12}\)Gunji (1987) introduces both subject and object gaps as lexical elements which can be freely generated. This means that we do not employ a gap introduction mechanism such as SLASH Termination Metarules (GKPS) for Japanese.

\(^{13}\)Foot Feature Principle (FFP) is defined as:

a. In complementation (i.e. M \(\rightarrow\) C H), the value of a Foot feature of the Mother unifies with the union of those of her Daughters.
Figure 2.3: Tree for (21b)

Figure 2.4: Tree for (21c)
Coming back to sentence (19a), we can see that the ambiguity is explained easily. The ambiguity is due to the possibility of the numeral classifier san-nin being either subject oriented or direct object oriented in this particular structure. The reading (19b) is to be analyzed as done in Figure 2.2 above with an SOC. In contrast, the reading (19c) will be analyzed in a similar fashion as in Figure 2.3 above with a DOC. The latter employs a SLASH feature that mediates the dependency between the numeral classifier and its gap. (22a) is also ambiguous in that this case is a dislocated instance in two ways, thus both subject and direct object oriented numeral classifiers have to be related to the gaps by the SLASH feature. I do not give the analysis trees but they are rather obvious.

(22) a. San-nin otoko-ga onna-o nagut-ta
-three man-nom woman-acc hit-past
b. ‘Three man hit a woman’ (SOC reading)
c. ‘A man hit three women’ (DOC reading)

Finally, as was also mentioned above, an important point to notice is that the construal of a given floating numeral classifier to a common noun contained in a given PP is possible when the PP in question is the very next argument (regardless of the possibility that it may be dislocated as well) to the IVP or TVP with which the numeral classifier has already combined (see Section 4).

2.3.4 Ditransitive S’s

What has been said so far is in fact a partial account for the data set given in Section 2. There is another type of construction (23), involving ditransitive verbs, that needs to be considered. The DOC in (14b)) is to be employed in ditransitive constructions as well. Only analysis trees corresponding to (23a,b) are given in Figures 5 and 6. An analysis tree for (23c) is not given here but similar to that for (23b) in that the point where unification of the dislocated numeral classifier occurs is lower in the tree. The system as it stands now does not permit (23d) to be generated. This case is an instance of scrambling which is going to be considered in detail in the next subsection with respect to its interaction with dislocated numeral classifiers.

(23) a. Taroo -ga hon-o san-satu sensei-ni okut-ta
-nom book-acc three teacher-to send-past
‘Taroo sent three books to a teacher’

b. In adjunction (i.e. M → A H), the value of a Foot feature of the Mother unifies with the union of those of her Daughters, with the possible exception that one of the categories in the Foot feature of the Daughter unifies with (modulo PFORM) the adjunct and is not passed to the Mother.
In Figure 2.5 we do not see any dislocation of the constituents. The DOC san-satu is taking the TVP in accord with the lexical requirement seen in (14b). The next argument to the modified TVP is the common noun hon-o which becomes the construee of the numeral classifier as expected. (23b), in which we see a dislocated instance of a numeral classifier, is analyzed as in Figure 2.6. The information concerning the missing numeral classifier is transmitted via a SLASH feature to the point where the unification of this missing element and the numeral classifier can take place.

One thing we should note here is that the present analysis accounts for the fact that it is not possible to construe a numeral classifier from the position following a direct object (in (23) above it will be any position following hon-o) to a subject. The reason turns out to be simple. Assuming that scrambling is not involved, due to the mismatch between the modifier and modifiee, an SOC cannot appear in the immediate local domain of the TVP Head (i.e. V(SC<PPga,PPo>). This, however, does not rule out the possibility of a DOC to occur in the same position.

2.3.5 Scrambling

Finally, the time has come to discuss the cumbersome but important subject matter of the discussion of floating numeral classifiers in sentences with word order variation (alias scrambling). The range of scrambling phenomena considered here is restricted to that involving a single clause. Scrambled structures provide counter examples to the analysis of floating numeral classifiers outlined above, if
one of Gunji's (1987) two analyses for scrambling called the 'SUBCAT approach' (as opposed to the 'SLASH approach') is to be maintained. This is because the approach in question takes advantage of an unordered SUBCAT value list and unification of the complements takes place in any order, accounting for the fact that within a minimal clause the order of complements is free. (see Gunji 1987 for the discussion).

As far as the present analysis is concerned, scrambling is handled using only the SLASH approach which is simultaneously introduced as an alternative by Gunji. Following P&S (1987), I assume that the SUBCAT value list is indeed ordered, hence the notation ' < ... > ' for the SUBCAT list which signifies a hierarchical complement order of 'obliqueness' (see also Pollard 1985). In this

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14 The employment of SLASH for scrambling cases entails that the phenomena are treated as basically unbounded. This is justified by the fact that scrambling can move elements across a clause boundary as seen in:

(i) a. Hanako-ga [Taroo-ga esa-o inu-ni yat-ta]-to omotte-iru
   'Hanako thinks that [Taroo gave some food to a dog]'
   b. Esa-o1 inu-ni1 Hanako-ga [Taroo-ga e2 yat-ta]-to omotte-iru '=(ia)'
   c. Inu-ni2 esa-o1 Hanako-ga [Taroo-ga e2 yat-ta]-to omotte-iru '=(ia)'.

But there are cases where crossing of a clause boundary is not allowed. C.f.:

(ii) a. Hanako-ga Ziroo-ni [Taroo-ga sensei-ni hon-o okut-ta]-to osie-ta
   'Hanako told Ziroo that Taroo sent a book to a teacher'
   b. "Sensei-ni1 Hanako-ga Ziroo-ni [Taroo-ga e1 hon-o okut-ta]-to osie-ta '(INT.) =(ii1a)'.

This shows that scrambling is basically unbounded but with some restrictions. The account presented in this chapter will have to be modified to accommodate scrambling cases crossing a clause boundary.

15 This may be desirable on independent grounds because it motivates the hierarchy in general. In HPSG this concept plays a central role and is motivated by a variety of independent evidence. For Japanese it is motivated not
chapter the elements to the left of the SUBCAT list are less oblique. (Actually, we have been tacitly assuming this all along.) Let us see how the interaction between scrambling and dislocated numeral classifiers is accounted for by the present analysis.

(24) a. Hon-o sensei-ni Taroo -ga san-satu okut-ta
    book-acc teacher-to -nom three send-past
    ‘Taroo sent three books to a teacher’

b. San-satu Taroo-ga sensei-ni hon-o okut-ta

In (24a,b) are two scrambled versions of (23a). And Figures 7 and 8 are the syntactic analyses of (24a) and (24b), respectively. In (25) and (26) are the direct and indirect object gaps and the gaps for the SOC and DOC.

(25) Lexical Direct and Indirect Direct Object Gaps
    a. e: {POS PP; SUBCAT<>; SLASH{PPo; SEM CN’}; SEM CN’/CN’}
    b. e: {POS PP; SUBCAT<>; SLASH{PPn; SEM CN’}; SEM CN’/CN’}

(26) Lexical SOC and DOC Gaps
    a. e: {POS ADVP; SUBCAT<>; SLASH{ADVP; SEM IVP);$’/IVP’}; SEM ...}
    b. e: {POS ADVP; SUBCAT<>; SLASH{ADVP; SEM TVP);$’/TVP’}; SEM ...}

In Figure 2.7 we see a case with only PP-scrambling in which PPni and PPo are dislocated and are related to their gaps via SLASH feature. As the direct object hon-o is still the next common noun argument that is to be taken by the TVP, the numeral classifier san-satu will be construed with this PP without any problem. What is seen in Figure 2.8 is different in that we see that both the numeral classifier san-satu and the indirect object sensei-ni are dislocated. But here again via SLASH the direct object is still the next argument to the TVP, making the construal possible.

The scrambling examples above are by no means exhaustive. If there is no restriction on the null string introduction, the system as it stands at the moment will allow massive over-generation as exemplified in (27).

(27) *Otoko-ga hon-o san-nin kat-ta
    man-nom book-acc three buy-past
    ‘(INT.) Three men bought a book’
Figure 2.7: Tree for (24a)

Figure 2.8: Tree for (24b)
Figure 2.9: Tree for (27)

The tree in Figure 2.9 is one logically possible syntactic analysis of a (vacuously) scrambled structure for (27) which the present analysis counter-factually predicts to be well-formed. To remedy unfavorable results like this, the Feature Co-occurrence Restriction (FCR) (28) is stipulated for Japanese. This FCR amounts to a prohibition on the introduction of gaps for PPs with the postposition ga (i.e. any ga-marked PP, not just the subject). Unlike in English, the convention seems to be necessary to achieve a proper application of the SLASH feature for languages like Japanese where multiple gaps of different kinds are allowed and rather flexible unification between gaps and fillers seem to be needed.

(28) Feature Co-occurrence Restriction (FCR)

\[
<\text{SLASH}> \rightarrow <\text{PFORM}\{\text{ga}, o, ni, ...\} > - \{\text{ga}\} >
\]

(PFORM: postpositional form—a multi-valued feature)

The FCR (28) states that the feature SLASH can co-occur with an attribute PFORM whose value can be any postposition except for ga. Given (28), the tree in Figure 2.9 is no longer a possible analysis for (27) because the introduction of the subject gap is not possible. Let us see one more case.

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Footnote (14) on this point the present analysis is distinct from Saito's (1985) account for scrambling. His analysis excludes cases involving movement from the structurally defined subject position which is not assigned a structural case by a given verb. But there are ungrammatical scrambling cases involving non-subject arguments (e.g. Footnote (14)) and it is not clear how his system can handle those cases.

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example (29) in which the numeral classifier, san-nin, is intended to be subject oriented.

(29) *Otoko-ga hon-o san-nin sensei-ni okut-ta
    man-nom book-acc three teacher-dat send-past
    ‘(INT.) Three men sent a book to a teacher’

The example (29) whose structure is given in Figure 2.10 will not be generated simply because the subject gap is not allowed by (28). (In Figure 2.10 ‘[~]’ indicates that a given category is undefined.)

This FCR can also be motivated on independent grounds. First, it rules out ill-formed scrambled cases like (30b) and (31b). The ga-marked objects in the stative sentences in (30a) and (31a) cannot be scrambled at all. Note that, generally in Japanese, scrambling is totally free within a single sentence as long as the main verb remains final.

(30) a. Taroo-ga sakana-ga suki-da
    -nom fish-nom fond-of-pres
    ‘Taroo likes fish’

b. *Sakana-ga Taroo-ga suki-da (wrong reading)

(31) a. Hanako-ga hon-ga hosi-i
    -nom book-nom want-pres
    ‘Hanako wants a book’

b. *Hon-ga Hanako-ga hosi-i (wrong reading)
Second, another consequence of the FCR is that it will force a 'gap-less' analysis for a relative clause which might be considered to contain a subject gap. In such an analysis a relative clause with a subject gap is taken to be a 'relative IVP' that is to be controlled by the head noun. This analysis has a desirable consequence in that the contrast between the structures in (32a,c) on the one hand and (32b) on the other is explained due to the category mismatch. In (32a) two IVPs are coordinated; in (32b) an IVP and an S/PP; in (32c) two S/PPs. Only (32b) is ungrammatical.\(^{17}\)

(32) a. \([NP \quad [IVP \quad [IVP \quad ie-ni \quad kaeri] \quad katu \quad [IVP \quad nai-ta]] \quad otoko] \quad\)
house-to return and cry-past man

'\(\text{the man who [went home and cried]}\)'

b. \(*[NP \quad [?? \quad [IVP \quad ie-ni \quad kaeri] \quad katu \quad [S/PP \quad Taroo -ga \quad e \quad at-ta]] \quad otoko] \quad\)
house-to return and nom meet-past man

'\(\text{*the man who [went home and Taroo met]}\)'

c. \([NP \quad [S/NP \quad [s/PP \quad Taroo -ga \quad e \quad sonkeisi]] \quad katu \quad [S/PP \quad Hanako -ga \quad hon-o \quad e \quad okutta]] \quad sensei] \quad\)
nom respect and nom book-acc send-past teacher

'the teacher who [Taroo respects and Mary sent a book to]'

Moreover, so called topicalization out of coordinated structures follows the same pattern of grammaticality. Provided with the FCR (28), the additional facts in (33) can be explained in an analogous manner.

(33) a. \(\text{Ano otoko-wa} \quad [IVP \quad [IVP \quad ie-ni \quad kaeri] \quad katu \quad [IVP \quad nai-ta]]\)
that man-top house-to return and cry-past

'\(\text{As for that man, he [went home and cried]}\)'

b. \(*\text{Ano otoko-wa} \quad [?? \quad [IVP \quad ie-ni \quad kaeri] \quad katu \quad [S/PP \quad Taroo -ga \quad e \quad at-ta]]\)
that man house-to return and nom meet-past

'\(\text{*As for that man, he [went home and Taroo met]}\)'

c. \(\text{Ano sensei-wa} \quad [S/NP \quad [S/PP \quad Taroo -ga \quad e \quad sonkeisi]] \quad katu \quad [S/PP \quad Hanako -ga \quad hon-o \quad e \quad okutta]]\)
that teacher nom respect and nom book-acc send-past

'\(\text{As for that teacher, [Taroo respects him and Mary sent a book to him]}\)'

Third, another set of facts concerning relative clauses offers an additional motivation for the FCR. The (a)-sentences in (34) and (35) allow two PPs with a postposition -\(\text{ga}\). However, only certain relative clauses formed from the (a)-sentences are acceptable. The (b)-NPs in (34) and (35)

\(^{17}\) Similar facts are noted in Saiki (1985). Also analogous English facts are seen in GKPS (1985).
show that when the missing element is the first ga-marked PP the whole NP are well-formed. In contrast, the (c)-NPs with the gaps of the second ga-marked PPs are unacceptable.\footnote{The order of the two ga-marked PPs in (34) and (35) has to be the way given in the (a)-sentences. C.f., *Me-ga Amerikazin-ga ao-i and *Dansei-ga sensinkoku-ga tanmei-da.} If we insist that both (34b/35b) and (34c/35c) involve a relative clause (i.e. S/PP) then we are left without any systematic explanation for the contrast. Given the FCR (28) that disallows a gap of a ga-marked PP, we are able to exclude (34c/35c) and retain (34b/35b).

\begin{enumerate}
\item [(34)]
\begin{enumerate}
\item a. Amerikazin-ga me-ga ao-i
\begin{flushleft}
Americans-nom eye-nom blue-pres
\end{flushleft}
\begin{flushright}
‘Americans are blued eyed’
\end{flushright}
\item b. \([NP [i\nu P \text{ me-ga ao-i} \text{ Amerikazin}] \]
\begin{flushleft}
‘Americans who are blued eyed’
\end{flushright}
\item c. *[\(NP [s/PP \text{ Amerikazin-ga e ao-i} \text{ me}] \]
\end{enumerate}
\item [(35)]
\begin{enumerate}
\item a. Sensinkoku-ga dansei-ga tanmei-da
\begin{flushleft}
developed-nation-nom man-nom short-life-cop-pres
\end{flushleft}
\begin{flushright}
‘In the developed nations, men are short-lived’
\end{flushright}
\item b. \([NP [i\nu P \text{ dansei-ga tanmei-na} \text{ sensinkoku}] \]
\begin{flushleft}
‘the developed nations where men are short-lived’
\end{flushleft}
\item c. *[\(NP [s/PP \text{ sensinkoku-ga e tanmei-na} \text{ dansei}] \]
\end{enumerate}
\end{enumerate}

\text{In addition to the interaction between scrambling and floating numeral classifier distribution, the FCR provides explanations for these unrelated problems as well. Hence the stipulation is well-motivated.}

\subsection{2.3.6 Further Syntactic Predictions}

Let us look at further syntactic predictions made by the system proposed above. We first look at additional consequences of utilizing the obliqueness hierarchy with respect to Inoue’s observation on quasi-direct-object mentioned in Section 2 and then we examine some problematic cases.

\textbf{Quasi-direct-objects as Complements}

For a syntactic system employing the obliqueness hierarchy, what is crucial is whether some element is included in the SUBCAT list or not (i.e. SUBCATegorized complements vs. non-SUBCATegorized complements).
adjuncts) and which position of the list that element occupies. The definitions of the SOC and DOC in (14) are given with respect to this distinction and not in terms of the grammatical relations or the surface cases.

For the present account, quasi-direct-objects do not pose any difficulty. They are treated as complements and included in the SUBCAT list as the second element. So a sentence like (6a) (repeated in (36a)) introduced in Section 2 is predicted to be well-formed. (36b) shows that the absence of the dative marked complement makes the sentence unacceptable.\(^{19}\) (About the suffix -te-mi-ta 'tried out', see the discussion immediately below.)

\[(36)\]
\begin{enumerate}
\item a. Hanako -ga kokuugaisya-ni huta-tu atat-te-mi-ta
\hspace{1cm} nom airline company-dat two check with-try-out-past
\hspace{1cm} 'Hanako tried out checking with two airline companies'
\item b. *Hanako -ga atatte-mi-ta
\hspace{1cm} nom check-see-past
\hspace{1cm} '(INT.) Hanako tried out checking with (something)'
\end{enumerate}

According to the present syntactic system, the presence of adjuncts between a floating numeral classifier and its construee does not disrupt their relationship, predicting (37a) to be well-formed. It is also the case that construal of a floating numeral classifier to an adjunct is not possible, rendering (37b) ill-formed.

\[(37)\]
\begin{enumerate}
\item a. Gakusei-ga honya-ni (kinoo) san-nin it-ta
\hspace{1cm} student-nom bookstore-to (yesterday) three go-past
\hspace{1cm} 'Three students went to a book store (yesterday)'
\item b. *Gakusei-ga honya-ni (kinoo) mit-tu it-ta
\hspace{1cm} student-nom bookstore-to (yesterday) three go-past
\hspace{1cm} '(INT.) A student went to three book stores (yesterday)'
\end{enumerate}

What is interesting is that the adjunct honya-ni seems to behave like a direct object under another circumstance as exemplified by the sentences in (38) which are structurally identical with those in (37) except for the suffixation of the morphem -temita. The flip flop of in grammaticality between (37) and (38) is noteworthy.

\[(38)\]
\begin{enumerate}
\item a. *Gakusei-ga honya-ni (kinoo) san-nin it-te-mi-ta
\hspace{1cm} student-nom bookstore-to (yesterday) three go-try-out-past
\hspace{1cm} '(INT.) Three students tried out going to a book store (yesterday)'
\end{enumerate}

\(^{19}\)The examples below which are labeled ungrammatical due to the lack of a complement will be acceptable when uttered in a discourse with rich contextual information about implicit elements.
b. Gakusei-ga  honya-ni  (kinoo) mit-tu it-te-mi-ta
    student-nom  bookstore-to  (yesterday) three  go-try-out-past
    ‘A student tried out going to three book stores (yesterday)’

Would (38) constitute counter examples for the syntactic system? The answer depends on whether honya-ni is an adjunct or a complement. There is good evidence that honya-ni in (38) (as opposed to that in (37)) is a complement. I suggest that the morpheme -te-mi, when lexically suffixed to a verb like ik (but not to a verb like afar in (36) which already is transitive), has the property of adding one more argument to the original SUBCAT list of the verb. We note that the verb ik in (37) without the morpheme in question behaves like an intransitive verb. However, once the morpheme is suffixed, it suddenly behaves like a transitive verb. Observe the contrast between (39a-c).

(39) a. Gakusei-ga san-nin it-ta
    student-nom three  go-past
    ‘Three students went’

b. *Gakusei-ga san-nin it-te-mi-ta
    student-nom three  go-try-out-past
    ‘(INT.) Three students tried out going’

c. Gakusei-ga san-nin honya-ni  it-te-mi-ta
    student-nom three  book store-to  go-try-out-past
    ‘Three students tried out going to a book store’

In fact this is not an idiosyncratic process applicable only to this particular verb but appears to be a more general process covering the group of verbs (and possibly more) listed in (40) which cooccur with either ni or kara-marked adjuncts. (41a-c) and (41d-f) show an analogous contrast seen in (39).20

(40) Other ik-type Verbs

   f. modor ‘return’, g. sotugyoosu ‘graduate’, h. syuppatusu ‘depart’, i. suwar ‘sit down’,
   j. dokuritusu ‘become independent’, k. kikokus ‘return to one’s country’

20We note that this process is not applicable for all verbs in the language. For example, it does not apply to a transitive verb with an obligatory direct object. Also there is an interesting analogy between this sort of morpheme and other argument adding morphemes like the causative suffix -ase.
(41) a. Gakusei-ga san-nin aisatusi-ta
    student-nom three greet-past
    'Three students greeted (with someone)'

b. *Gakusei-ga san-nin aisatusi-te-mi-ta
    student-nom three greet-try-out-past
    '(INT.) Three students tried out greeting (with someone)'

c. Gakusei-ga san-nin Hanako-ni asisatusi-te-mi-ta
    student-nom three -to greet-try-out-past
    'Three students tried out greeting with Hanako'

d. Gakusei-ga san-nin sotugyoosi-ta
    student-nom three graduate-past
    'Three students graduated'

e. *Gakusei-ga san-nin sotugyoosi-te-mi-ta
    student-nom three graduate-try-out-past
    '(INT.) Three students tried out graduating'

f. Gakusei-ga san-nin daigaku-kara sotugyoosi-te-mi-ta
    student-nom three university-from graduate-try-out-past
    'Three students tried out graduating from a university'

Now given this lexical 'add-one-more-complement' process, the contrast seen above is exactly what the present syntactic system predicts. The contrast, for example, between (37) and (38) is attributed to distinct SUBCAT lists for *ita and ittemita, the former of which contains only one argument (a subject) and the latter two arguments (a subject and an direct object). The fact that these two verbs have distinct SUBCAT lists is plausible, due to the fact that they also have distinct meanings because of the lexical process just described. Finally, as expected, we note that the verbs in (41) show the flip flop of grammaticality like the one seen between (37a) and (38a) above.

(42) a. Gakusei-ga Hanako-ni san-nin aisatusi-ta
    student-nom dat three greet-past
    'Three students greeted with Hanako'

b. *Gakusei-ga Hanako-ni san-nin aisatusi-te-mi-ta
    student-nom dat three greet-try-out-past
    '(INT.) Three students tried out greeting with Hanako'
c. Gakusei-ga daigaku-kara san-nin sotugyoosi-ta  
student-nom university-from three graduate-past  
‘Three students graduated from a university’

d. *Gakusei-ga daigaku-kara san-nin sotugyoosi-te-mi-ta  
student-nom university-from three graduate-try-out-past  
‘(INT.) Three students tried out graduating from a university’

Problematic Cases

In general, the syntactic treatment outlined seems to cover the floating numeral classifier distribution patterns adequately. However, there are some facts left unanswered by the present approach. Some of these cases are found in Miyagawa (1989) and are given in (43)–(45) as the (a)-sentences with Miyagawa’s judgments. (The comma in the sentences indicates a pause). In (43a) the numeral classifier huta-ri is dislocated from the position between gakusei-ga and omiyage-o. In (44a) the adjunct kompuutaa-de occurs between the subject gakusei-ga and the numeral classifier huta-ri. (45a) is the case where both san-satu and hon-o have been scrambled to the position before gakusei-ga. And (43b,c), (44b,c), and (45b,c) are the grammatical counterparts of the (a)-sentences which seem to possess the same structural properties.

(43) a. Hutari, Tanaka-san-ni gakusei-ga omiyage-o age-ta  
two -Mr.-dat student-nom souvenir-acc give-past  
‘Two students gave souvenirs to Mr. Tanaka’

b. Hutari, mina-o daihyoosi-te, Tanaka-san-ni sorera-no gakusei-ga omiyage-o age-ta  
two all representing -Mr.-dat those-gen student-nom souvenir-acc give-past  
‘On behalf of everyone present, those two students gave souvenirs to Mr. Tanaka’

c. Hutari, sensei-ni sorezore gakusei-ga hon-o age-ta  
two teacher-dat respectively student-nom book-acc give-past  
‘Two students gave books to the teacher, respectively’

(44) a. *Gakusei-ga kompuutaa-de hutari keisansi-ta  
student-nom computer-by two calculate-past  
‘Two students calculated with a computer’

b. Gakusei-ga naifu-de koremadeni hutari te-o kegasi-ta  
student-nom knife-with so far two hand-acc injure-past  
‘So far two students injured their hands with the knife’
I concede that the (a)-sentences in (43)–(45) are not that good. However, it is not at all clear that these are ruled out, as Miyagawa claims, by syntactic factors per se. First of all, the allegedly ill-formed (a)-cases can be substantially improved by making the pauses after the numeral classifiers longer and placing a heavy stress on the numeral classifiers and their construees. Second, it should be expected that the structurally identical (b) and (c)-sentences are also ungrammatical, contrary to the judgement (of mine and other Japanese native speakers) reported here. The present system accepts all the cases found in (43)–(45). For example, (43a) is analyzed as in Figure 2.11.

What is important here is the fact that the (b) and (c)-sentences are indeed grammatical. Thus there should be some extra factor involved which makes the (a)-sentences rather bad. 21

21 To accommodate a wider range of facts inclusive of those seen here, the account proposed in this chapter have to take into account not only purely mechanical apparatuses such as syntactic structures and rigid semantic translations but also more dynamic aspects of meaning and language use. Takao Gunji (personal communication) mentioned to me the following additional factors which increase the acceptability of floating numeral classifier constructions: 1) specificity of the term between a numeral classifier and its construee, 2) the fact that individuation (with respect to the numeral classifier) of the relation denoted by the predicate is possible, and 3) explicit contrastive use of the numeral classifier. For example, the contrast between (44a) vs. (44b) can be explained by 3) above in that the former fails to use the numeral classifier in a contrastive way. The latter, due to the presence of the adverbial koremadeni ‘so far’, a temporal contrast is implemented: two so far vs. an unknown number from now on. However, what is noteworthy is his disturbing observation that the subject–object asymmetry in terms of numerals classifier distribution is only apparent and the factors such as the ones given above are responsible for the asymmetry. He points out an example like: Gakusei-ga konna nomimono-o san-nin tsunyonai-ta ‘Three students ordered a strange drink’ which strikes me as well as other native speakers I consulted as grammatical. If his observation can be withheld, most theories for floating numeral classifiers found in the literature will have to be modified.
2.3.7 Summary

In this section we have seen the present syntactic treatment of floating numeral classifiers. It has been shown that by separating these numeral classifiers into two main classes, namely the SOC and the DOC, and giving appropriate syntactic as well as semantic definitions to each, we can account for their distributional patterns without assuming any transformation. Also demonstrated was the treatment of dislocated numeral classifiers and the cases involving scrambling which utilizes a SLASH feature.

2.4 Semantics

Next I show how the semantic interpretation of floating numeral classifiers is carried out. The important point is that the syntax and semantics of floating numeral classifiers are to accompany each other side by side. This point was partially demonstrated above when the difference between SOCs and DOCs was discussed in that the syntactic and semantic type mismatch prohibits an SOC being construed to a direct object and vice versa. The notion of type mismatch is made more explicit in this section. Further semantic conditions on the numeral classifier interpretation are introduced in the form of semantic translations which not only restrict the floating numeral classifier–construee relationship as a subset relationship but also impose a cardinality restriction, namely an intersective condition similar to the treatment of cardinals due to B&C (1981). In this
respect the present approach contrasts with those in the literature which treat quantifier movement as a purely syntactic phenomena and in which all efforts have been directed toward obtaining correct surface forms only.

The basic idea is this: semantically speaking, a floating numeral classifier relates (T)VP-denotations to common noun denotations. That is to say that a floating numeral classifier takes a denotation of an IVP or TVP and returns a denotation of a special IVP or TVP (i.e. IVP' C and TVP' C above), that in turn will take a denotation of a common noun. The semantic rules of numeral classifiers formulated below will ensure the proper relationship.

2.4.1 Semantic Translation Schema

Following a model theoretic approach to semantics, we employ semantic types that are associated with individual participant constituents to discuss the compositional semantics of numeral classifiers. We adopt the function TYP from GKPS (1985) that, given a category X, returns the semantic type of X. The range of this function is based on two primitive types, e (the type for individuals) and t (the type for truth values) and is closed under ordered pairing, i.e. whenever A and B are types, so is the ordered pair <A, B>. Ignoring intensionality, we shall assume the following assignment (46) and the corresponding Japanese basic vocabulary (47).

(46) Semantic Type Assignment

\begin{align*}
\text{a. } \text{TYP}(S) &= \langle e, t \rangle \quad (S') \\
\text{b. } \text{TYP}(IVP) &= \langle \langle e, t \rangle, t \rangle \quad (IVP') \\
\text{c. } \text{TYP}(TVP) &= \langle \langle e, t \rangle, t \rangle, \langle \langle e, t \rangle, t \rangle \quad (TVP') \\
\text{d. } \text{TYP}(DTVP) &= \langle \langle e, t \rangle, t \rangle, \langle \langle e, t \rangle, t \rangle, \langle \langle e, t \rangle, t \rangle \quad (DTVP') \\
\text{e. } \text{TYP}(DET) &= \langle \langle CN', e, t \rangle, t \rangle \quad (DET') \\
\text{f. } \text{TYP}(CN) &= \langle e, t \rangle \quad (CN') \\
\text{g. } \text{TYP}(NP) &= \langle e, t \rangle \quad (NP') \\
\text{h. } \text{TYP}(P) &= \langle \alpha, \alpha \rangle \quad (P') \\
\text{i. } \text{TYP}(SOC) &= \langle \langle IVP_C', e, t \rangle, t \rangle \quad (SOC') \\
\text{j. } \text{TYP}(DOC) &= \langle \langle TVP_C', e, t \rangle, \langle \langle e, t \rangle, t \rangle, t \rangle \quad (DOC') \\
\end{align*}

\footnote{This was suggested to me by Richard Oehrle. C.f. Dowty and Broady (1984) for a similar approach to English floating quantifiers all and each.}

\footnote{When common nouns are used alone in an appropriate context, I assume that the type shifting rule 'THE' of Partee (1986) changes the type of the CN \langle e, t \rangle to that of a quantifier \langle e, t, t \rangle.}
(47) Basic Vocabulary

a. ø
b. ku, sin, etc. come die
c. kaw, but, etc. buy hit
d. okur, age, etc. send give
e. aru, arayuru, subeteno, sono, etc. some every every that (the)
f. onna, otoko, hon, sensei, etc. woman man book teacher
g. Taroo, Hanako, Tookyoo, etc.
h. ga, o, ni
i. go-nin, san-satu, rop-pon, etc. five three six
j. go-nin, san-satu, rop-pon, etc. five three six

Provided with the semantic types in (46), we can do a simple case for a demonstration. (48) is an example of an intransitive sentence containing the SOC go-nin.

(48) Otoko-ga go-nin ki-ta

man-nom five come-past

'Five men came'

The interpretation schema is that of Type Driven Translation (Klein and Sag 1985; also GKPS 1985). In the semantic tree in Figure 2.12 the meaning of the larger unit is recursively built up from smaller units in a strictly compositional manner, taking advantage of the syntactic structure which has already been made available. Any mismatch of the semantic types will result in an uninterpretable structure. However, this does not quite give a complete interpretation yet. We want to guarantee that the very first common noun argument which is taken by the quantified V-projection is indeed the constituent with which the numeral classifier agrees. This is accomplished by the semantic translation for the SOC go-nin ‘five’ in (49) for (48).24

24The formulation of the semantic translation incorporates a suggestion made by a reviewer for Linguistics and Philosophy who pointed out a defect in an earlier formulation.
Figure 2.12: Semantic Tree for (48)

(49) Translation for SOC go-nin
\[ \lambda W \lambda P. W(\lambda Q. | P \cap Q | \geq 5 & P \subseteq \text{nin'}) \]
\[ (\text{TYP}(W) = \text{TYP}(\text{IVP'}), \text{TYP}(P) = \text{TYP}(\text{CN'}), \text{TYP}(Q) = \epsilon, t >) \]
What is expressed in (49) with respect to the example in (47) is: First, the SOC go-nin is a functor that takes an IVP meaning (W, a type raised IVP, i.e. a set of 'comers') and a common noun meaning (P, a set of individuals, namely men). Second, the cardinality of the intersection of these two sets P and Q (i.e. after the type raised IVP is lowered) is greater than or equal to five. Third, P is to be a subset of nin' (i.e. a set of individuals which can be meaningfully counted by the classifier). The semantic translation employing (49) is given in (51) along with the semantic translations of other constituents in (50). (Only a few intermediate steps are included.)

(50) Translations of constituents of (48)
\[ \text{otoko: } \lambda y. \text{otoko'}(y) \]
\[ \text{kita: } \lambda T. T(\lambda z. \text{kita'}(z)) \]
\[ (\text{TYP}(T) = \text{TYP}(\text{NP'})) \]

(51) a. go-nin ki-ta (\epsilon, t >):
\[ \lambda P. | P \cap \lambda z. \text{kita'}(z) | \& P \subseteq \text{nin'} \]
b. otoko-ga go-nin ki-ta (t):
\[ | \lambda y. \text{otoko'}(y) \cap \lambda z. \text{kita'}(z) | \geq 5 & \lambda y. \text{otoko'}(y) \subseteq \text{nin'} \]
Let us take one more example (52) with the DOC san-satu 'three' whose translation is given in (53). In Figure 2.13 is the semantic tree for (52). (53) lists the semantic translations of the constituents and Type Translation gives (54).

(52) Hanako -ga hon-o san-satu kat-ta
\[ -\text{nom book-acc three buy-past} \]
'Hanako bought three books'
The translation schema outlined naturally accounts for some basic facts surrounding floating numeral classifiers. First, the relationship between a given numeral classifier and the objects that are counted by it are restricted by the subset relation seen in the definition above. So the forms which exhibit incompatibility of the common nouns and the numeral classifiers as in (55) are not acceptable. (Note the intended construal and the gloss of the classifier.)

(55) a. *Otoko-ga san-biki ki-ta
    man-nom three-cl(animal) come-past
    ‘(INT.) Three men came’
b. *Taroo -ga hon-o san-nin kat-ta
   -nom book-acc three-cl(person) buy-past
   ('INT.) Taroo bought three books'

In addition to this, it follows from the present conjecture that if a given common noun is already quantified by an NP-internal quantifier or if an intended construee is already a quantifier (of \(< < e, t >, t >\)), then it is no longer possible to quantify that same common noun using a floating numeral classifier. This is shown in (56b-d).

(56) a. Otoko-ga san-nin ki-ta
   man-nom three come-past
   'Three men came'

b. *[NP Zenbu-no otoko]-ga san-nin ki-ta
   all-gen man-nom three come-past

c. *[NP Sono otoko]-ga san-nin ki-ta
   that(the) man-nom three come-past

d. *Taroo -ga san-nin ki-ta
   -nom three come-past

(56b) is the case with multiple quantification on a single common noun *otoko. (57c,d) are the cases with quantification on quantifiers *sono otoko ‘the man’ and *Taroo both of which are of type \(< < e, t >, t >\) which cannot be properly taken by the quantified V-projection due to the type mismatch. (56d) is possible only if there are three persons who are named Taroo. But this is not the reading with the proper name as a quantifier.

We have seen how the semantic translation schema works in simple sentences. But this is not all to the translation schema in that we still have to take care of the cases with dislocated numeral classifiers as in (58a) whose translation is demonstrated in (58b). In (57) are the translations of constituents of (58a) along with the semantic translation for an SOC gap.

(57) Translations for Constituents of (58a)

\begin{align*}
\text{go-nin:} & \quad \lambda W \lambda P . W(\lambda Q . |P \cap Q| \geq 5 \& P \subseteq \text{nin}') \\
\text{otoko:} & \quad \lambda y. \text{otoko}'(y) \\
\text{kita:} & \quad \lambda T . T(\lambda z . \text{kita}'(z)) \\
\text{e (SOC gap):} & \quad \lambda W \lambda P \lambda C . (C(W)) P \\
& \quad (\text{where } \text{TYP}(C) = \text{TYP}(\text{SOC}'), \text{TYP}(W) = \text{TYP}(\text{IVP}'))
\end{align*}
Translation with SLASH

a. Go-ni otoko-ga ki-ta
   five man-nom come-past
   'Five men came'

b. $e_{SOC}$ kita (IVP$_C$):
   \[ \lambda P\lambda C.(C(\lambda T.\lambda z.kita'(z))))P \]
   otoko-ga $e_{SOC}$ kita ($<SOC',t>$):
   \[ \lambda C.(\lambda T.\lambda z.kita'(z)(\lambda y.otoko'(y))) \]
   go-ni otoko-ga kita (t):
   \[ \mid \lambda y.otoko'(y) \cap \lambda z.kita'(z) \mid \geq 5 \land \lambda y.otoko'(y) \subseteq \text{nin'} \]

We see one more example below with a direct object PP Hanako-o scrambled.

(59) a. Hanako-o otoko-ga go-nin but-ta
    -acc man-nom five hit-past
    'Five men hit Hanako'

b. \[ \mid \lambda z.otoko'(z) \cap \lambda y.butta(h)(y) \mid \geq 5 \land \lambda z.otoko(z) \subseteq \text{nin'} \]

c. Translations for Constituents of (a)

\begin{align*}
\text{Hanako:} & \quad \lambda P.P(h) \\
\text{otoko:} & \quad \lambda z.otoko'(z) \\
\text{gonin:} & \quad \lambda W\lambda P.W(\lambda Q. \mid P \cap Q \mid \geq 5 \land P \subseteq \text{nin'}) \\
\text{butta:} & \quad \lambda T\lambda U.T(\lambda z.U(\lambda y.butta'(z)(y))) \\
\text{e (DO gap):} & \quad \lambda V.V \\
\text{(TYP(T) = TYP(U) = TYP(V) = TYP(NP'))} &
\end{align*}

(59b) is the translation for (59a). (All the intermediate steps are skipped.) Crucially, when the SOC go-nin and the IVP/PP butta combine forming IVP$_C$, a semantic change occurs. That is: 1) the type of the original subject NP meaning (the argument of the original IVP) is changed to a common noun and 2) this common noun is the next immediate argument of the IVP$_C$. This point is important in preventing an impossible sentence like (60a) in which the gap is construed to be that of the direct object Hanako-o. (60b) shows an incomplete translation for the sentence. In the last line of (60b) the dislocated object Hanako-o cannot be the argument of the quantified V-projection due to type $m^* \cdot m$-match, hence no further reduction is possible. Together with the FCR (28) above which prohibits the gap of PP-ga, the present system does not generate sentences like (60a).
(60) a. *Otoko-ga Hanako-o go-nin but-ta:
    man-nom -acc five hit-past
    (INT.)'Five men hit Hanako'

b. e_NP butta:
   \( \lambda U.\lambda V.\lambda z.\lambda y.\text{butta'}(x)(y)\(\))
   go-nin e_NP butta:
   \( \lambda P.\lambda V.\lambda z.\lvert P \cap \lambda y.\text{butta'}(x)(y)\rvert \geq 5 & P \subseteq \text{nin'}\)
   Hanako-o go-nin e_NP butta:
   \( \lambda P.\lambda V.\lambda z.\lvert P \cap \lambda y.\text{butta'}(x)(y)\rvert \geq 5 & P \subseteq \text{nin'}(\lambda P.P(h))\)
   (where TYP\(P) = \text{TYP(CN')}\)

   This concludes the semantics of numeral classifiers.

2.5 Miyagawa's GB Analysis

In the preceding two sections I have outlined the non-floating analysis of the floating numeral classifier distribution. The predictions of the present account are precise due to the explicit formalism. Let us examine Miyagawa's (1989) proposal in detail and compare it to the present one.

2.5.1 Miyagawa’s Core Assumptions and General Predictions

Some important assumptions of Miyagawa can be summarized in the following manner:

(61) Miyagawa's Core Assumptions

a. Numerical Classifiers are predicates (in the sense of Williams 1980) of the nouns they modify.

b. The necessary structural relationship between the numeral classifiers and nouns they modify is that of 'mutual C-command.'

c. Postpositions such as -ga and -o (and possibly dative -ni) do not project a maximal node and are only 'cliticized' onto NPs (this is crucial for the mutual C-command condition) but other postpositions do project a maximal node. This depends on whether the postpositions have the ability to assign a \(\theta\)-role to NPs or not. The former set of postpositions are taken to be non-\(\theta\)-role assigners.
d. A position (called a ‘virtual Argument position’) at which numeral classifiers can leave their traces is ‘licensed’ by the verb if the numeral classifier modifies an ‘affected theme’ NP and the NP and the numeral classifier are governed by the verb that assigns this \( \theta \)-role to the NP.

e. A numeral classifier can leave a trace only in a virtual A-position.

f. There are Japanese verbs that belong to the ‘ergative’ class. These verbs have their ‘surface’ subject within their VP in DS and assign theme role to it. Later, the VP internal ‘subject’ is preposed to the surface subject position. This enables the verbs to govern the subject as well as the numeral classifier (if there is one), hence making the numeral classifier position a virtual A-position. Also the subject and the numeral classifier C-command each other in DS.

Given these assumptions, Miyagawa predicts the following possible and impossible distributional patterns of numeral classifiers, represented schematically as in Figures 14 and 15, respectively. A dislocated numeral classifier can modify only an object of a transitive verb or a subject of an ergative verb. So in Tree A of Figure 2.14 the numeral classifier can be moved from the VP internal position to the S initial position. Tree B shows the movement of both the numeral classifier and the ‘deep’ subject of an ergative verb from the VP internal position. In both cases the modified NP and the numeral classifier occur within the VP in D-structure and are governed by the verb as well as mutually C-commanding each other either directly or via traces. In contrast, subjects of transitive and non-ergative verbs as in Figure 2.15 cannot be modified by a dislocated numeral classifier because the trace of the numeral classifier is not within the VP, i.e. it is not in a virtual A-position and the numeral classifier trace is not licensed properly. These predictions appear to be true when we

\[ \text{Figure 2.14: Tree A for Transitive Object and Tree B for Ergative Subject} \]

\[ \text{A} \]
\[ \text{S} \]
\[ \text{CL_i} \]
\[ \text{S} \]
\[ \text{VP} \]
\[ \text{NP} \]
\[ t_i \]
\[ V \]

\[ \text{B} \]
\[ \text{S} \]
\[ \text{CL_i} \]
\[ \text{S} \]
\[ \text{NP}_j \]
\[ \text{VP} \]
\[ t_j \]
\[ t_i \]
\[ V_{erg} \]

---

25 With respect to ergative verbs, it is noted that the judgement on floating numeral classifier constructions involving them is not clear cut, suggesting that ergativity may not be a significant factor after all. Tateishi (1990), for example, expresses strong skepticism about the relevance of the concept for the subject matter.
Figure 2.15: Tree C for Transitive Subject and Tree D for Non-ergative Subject

consider only the examples provided by him but there are cases (some seen above in (43b,c), (44b,c), and (45b,c) above and more given below) that contradict his claim.

2.5.2 Predictions by Miyagawa's System

In addition to the empirical uncertainty of his system pointed out above, there is at least one more crucial difficulty for Miyagawa's suggestion on empirical and conceptual grounds. The assumption (61d) (repeated) seems to be implausible due to the unclear status of the θ-role, 'affected theme' (Martin 1975: discussed below), and the unreliability of what Miyagawa calls an 'independent test for themehood' that is to distinguish the class of verbs which assign this θ-role and those which do not. We review this point carefully.

(62) Assumption on Affected Theme

The position (called a virtual Argument position) at which numeral classifiers can leave their traces is 'licensed' by the verb if the numeral classifier modifies an 'affected theme' NP and the NP and the numeral classifier are governed by the verb that assigns this θ-role to the NP.

This assumption together with (61e) is employed for 'predicate licensing', Miyagawa's main proposal. According to this licensing system, if a verb does not assign the (affected) theme role to an NP then there will be no virtual A-position at which a numeral classifier can legitimately leave its trace when it floats away. This conjecture is to explain the contrast in (63). (The grammaticality judgment in

\[ \text{Another unfavorable consequence for him is that the ill-formed NP in (i) is expected to be OK according to his system: (i) } ^* [NP [NP gakusei-n] san-nin seikou] \text{ 'INT} \text{. A success of three students'. C.f. (ii) } [s [NP Gakusei-ga] san-nin seikou-ta] \text{ 'Three students succeeded'. This is due to the condition imposed on the construal between an NP and a numeral classifier requiring only mutual C-command. This holds both in (i) and (ii). According to Miyagawa's system both g a and no-marked elements are NPs (e.g. (22), p.91 of Miyagawa (1989)). We also note that in both cases the noun seikou and the verb seikou-ta should assign the same θ-role to the NPs in question. Thus both are expected to be acceptable.} \]
(63b) is his. (63b) seems to be fine for the present author and other native speakers with whom the author consulted.)

(63) a. *Huta-tui, Taroo -ga [vu mado-o t; ake-ta]
   two nom window open-past
   'Taroo opened two windows'

   b. *Huta-rii, Taroo -ga [vu kodomo-o t; donat-ta]
   two nom child-acc yell at-past
   'Taroo yelled at two children'

He explains that in (63a) the verb *ake assigns a theme role to the object NP, *mado, thus the trace left in VP by the numeral classifier is in virtual A-position (due to (61)). This is not the case with (63b) whose verb donar does not assign a theme role to the object NP *kodomo making the trace position a non-virtual A-position. It is important for him to motivate the differences between verbs that assign the (affected) theme role and those that do not. He does so by appealing to the following two things: 1) the classification of (affected) themes by Martin (1975) and 2) the syntactic test utilizing 'intransitivizing resultative' -te aru constructions (again Martin 1975). For brevity, let us assume the adequacy of the first and examine only the second point.27

Martin's list of eight (affected) theme roles (which is actually called by Martin "a wide variety of semantic relationships", suggesting it may not be a coherent class after all) in Japanese is given in (64) (together with verbs that assign such a role) of which only four are chosen by Miyagawa as independent criteria for the theme role in question.

(64) Verbs with Affected Theme Roles

   a. that which is moved: okur 'send', das 'put out', tor 'take (away)', etc.

   b. that which is exchanged: (tori-)kae 'exchange', etc.

   c. that which is created: tukur 'make', tate 'build', iw 'say', hanas 'speak', etc.

   d. that which is converted: naos 'repair', su 'make someone something'

   e. that which is extinguished, consumed, destroyed, or gotten rid of: kes 'extinguish', tabe 'eat', kowas 'break', wasure 'forget', etc.

   f. that which is to be put on to be worn or which is worn: ki 'wear', hak 'wear', kabur 'wear', etc.

27But this is not to say that the notion of O-roles (inclusive of affected theme) is problem free. We recall Dowty's (1988) and Ladusaw and Dowty's (1989) argument against a linguistic theory which incorporates such notions.
g. that which is perceived: mi ‘see’, kik ‘hear’, kanzi ‘feel’, etc.

h. that to which attention is paid for the purpose of direct or indirect perception: mi ‘look at’, kik ‘listen’, kag ‘smell’, etc.

Given the list (64) we can examine the adequacy of Miyagawa’s syntactic test for the theme-role-assigning verbs utilizing intransitivizing resultative constructions of which (65a) is one example. It seems to be the case that the syntactic test is very shaky at best. He claims that sentences which pass this test contain a verb that assigns a theme role to its deep object (the surface subject after movement). Thus the contrast in (65).

(65) a. Mado-ga; \([v_P \ t; \ akete-ar-u]\)
    window-nom open-exist-pres
    ‘Windows have been left open’

b. *Hanako -ga; \([v_P \ t; \ aisite-ar-u]\)
    -nom love-exist-pres
    ‘(INT.) Hanako has been loved’

In (65a) is the verb aké which passes this test. He simply states that in (65b) Hanako does not receive a theme role because it fails the test. (If not a theme, what would it be?) So ais is not a theme role assigner. But it should follow from this that any item that appears in list (64) should both pass this test (as (65a) does) and allow a dislocated numeral classifier modifying an object that is to be floated from the virtual A-position within the VP where mutual C-command condition holds between the numeral classifier trace and the object. This has to be so because the verbs in (64) are all theme-role-assigning verbs which should behave in a consistent manner with respect to the syntactic test which he claims valid. This, however, turns out to be false.

(66) a. *Monogatari-ga hanasite-ar-u
    fairy tale-nom speak-exist-pres
    ‘(INT.) The fairy tales have been told’

b. Huta-tu Taroo -ga kodomo-ni monogatari-o hanasi-ta
    two -nom child-to fairy tale-acc speak-past
    ‘Taroo told two fairy tales to the child’

(67) a. *Yakusoku-ga wasurete-ar-u
    promise-nom forget-exist-pres
    ‘(INT.) The promise has been forgotten’
b. Mit-tu Taroo -ga yakusoku-o wasure-ta
   three -nom promise-acc forget-past
   'Taroo forgot three promises'

(68) a. *Tomedonai ikari-ga kanzite-aru
   unsuppressable fury-nom feel-exist-pres
   '(INT.) An unsuppressable fury has been felt'

b. Hito-tu Taroo -ga tomedonai ikari-o kanzi-ta
   one -nom unsuppressable fury feel-past
   'Taroo felt an unsuppressable fury'

(69) a. *Nioi-ga kaide-ar-u
   smell-nom sniff-exist-pres
   'The smell has been sniffed'

b. Hito-tu Taroo -ga henna nioi-o kai-da
   one -nom strange smell-acc sniff-past
   'Taroo sniffed one strange smell'

In (66)–(69) we see that the four verbs hanas, wasure, kanzi, and kag that belong to the list (64) actually fail to pass the theme-verb-test as seen in the (a)-sentences but nevertheless allow dislocated numeral classifiers to be construed to the object as in the (b)-sentences. This of course is not expected on Miyagawa’s account. Moreover, there are numerous verbs that do not belong to appear in the list which also fail the test but allow the same pattern of floating numeral classifier construal as the (b)-sentences above, e.g. hakkensu ‘discover’, kizuk ‘notice’, oboe ‘remember’, hazime ‘begin’, nakus ‘lose’, etc. What this shows is that his system which crucially relies on the notion of virtual A-position (which in turn depends on the theme role assignment by a given verb) for the licensing of a floating numeral classifier trace does not systematically and consistently predict what is possible and what is not.28

2.5.3 Comparison and Summary

The theory I proposed in Sections 3 and 4 and that of Miyagawa are in contrast in the following two respects. First, the present account allows all the grammatical structures of numeral classifier

28 An additional doubt about Miyagawa’s claim based on intransitive resultative -te aru constructions is found in Matsumoto (1990) in which possible/impossible -te aru constructions are explained based on pragmatic factors not on syntactic factors.
construal so far mentioned as well as some unclear ('bad') cases in (43–45) above. His system rules out 'bad' ones in (43–45) but incorrectly rules out grammatical sentences which have the identical structural properties of the 'bad' ones. Second, the present account, due to its explicit assumptions and definitions, is able to make precise predictions with respect to what should be and should not be possible concerning the distribution of dislocated numeral classifiers but his theory does not seem to do so because of some inexplicit and unreliable assumptions and syntactic tests involved in the system, some of which have been reviewed above.

2.6 Summary

What has been shown in this Chapter is a new solution for an old problem, i.e. a treatment of floating numeral classifiers. It was demonstrated that reanalyzing them as non-floating adverbial V-projection endocentric modifiers offers an adequate and principled account of the phenomena in question. The definition of a proper lexical entry, which includes syntactic and semantic types, for each class of floating numeral classifiers (either subject oriented or direct object oriented) makes this possible. It should be emphasized that, as shown in Section 3 and 4, it is not just syntactic conditions alone that regulate the distribution of floating numeral classifiers: rather, the interaction of the syntactic and semantic definitions given to them plays a crucial role in obtaining syntactically well-formed as well as semantically interpretable sentences. This point separates the present approach from others that are merely concerned with obtaining correct surface orders of constituents.
Chapter 3

The Adverbial Nature of Floating Numeral Classifiers

3.1 Introduction

The current chapter demonstrates the adverbial nature of floating numeral classifiers. In doing so, it also examines and offers an account for some additional semantic properties of floating numeral classifiers seen in the previous chapter. It is emphasized that an investigation into the semantic properties of floating numeral classifiers is an indispensable part of an adequate research program concerning the grammar of floating quantifiers in general.

The model theoretic semantic approach which accompanies the unification based syntactic analysis seen in the previous chapter provides a basic semantic framework to explore further data introduced here. In this chapter a more detailed examination of the semantic properties of numeral classifiers is our main concern. Based on a closer examination of an extended range of data presented below, the following three main points are to be demonstrated. First, the adverbial nature of floating numeral classifiers is defended in Section 2. Also an argument against the adverbial analysis due to Ueda (1986) is examined in Section 4. It will be shown that his argument is premature in that the range of facts concerning Japanese adverbs considered is very restricted. Second, Section 3 suggests that the semantic approach introduced above can be extended to capture the adverbial nature of floating numeral classifiers. Unfortunately, not all the new data seen in this chapter will be given proper accounts, due to the complexity of some data which require devices beyond what is available at the moment. Third, an account of quantifier scope ambiguity involving floating numeral classifiers is given in Section 5 by augmenting the semantic system proposed above with the Quantification

Apart from presenting specific accounts for the phenomena under consideration, Sections 3 and 4 also collectively offer motivation for two interesting semantic conjectures developed in the 80s, namely Type Driven Translation (Klein and Sag 1985; also GKPS 1985) and type ambiguity (Partee and Rooth 1983, Partee 1987). The semantic properties of floating numeral classifiers examined in this chapter (and of floating quantifiers in general) have interesting consequences for a universal theory of quantification, such as the Generalized Quantifier theory of Barwise and Cooper (B&C) (1981). This last point is the subject matter we will come back to in Chapter 5 after we examine universal floating quantifiers in Chapter 4.

Before getting started with the subject matter, it may be helpful to refresh our memory about the specifics of the semantic account given in the previous chapter. We recall that the semantic translation for, say, the Subject Oriented (numeral) Classifier go-nin ‘five’ are as in (1).

\[(1) \text{Translation for SOC } \text{go-nin}\]
\[
\lambda W \lambda P. W(\lambda Q. | P \cap Q | \geq 5 & P \subseteq \text{nin'})
\]
\[(TYP(W) = TYP(IVP'), TYP(P) = TYP(CN'), TYP(Q) = <e,t>)\]

What is expressed in (1) is: First, the SOC go-nin is a functor that takes an IVP meaning and a common noun meaning. Second, the cardinality of the intersection of these two sets \(P\) and \(Q\) (i.e. after the type raised IVP is lowered) is greater than or equal to five. Third, \(P\) is to be a subset of \(\text{nin'}\) (i.e. a set of individuals which can be meaningfully counted by the classifier).

In (2) is an example sentence with the SOC go-nin and (3) lists the translations of the constituents of (2). Type Driven Translation builds the meaning of the larger unit recursively as shown in (4).

\[(2) \text{Otoka-ga go-nin ki-ta}\]
\[\text{man-nom five come-past}\]
\[\text{‘Five men came’}\]

With the semantic translation for the SOC go-nin in (1), (2) receives a translation seen in (4).

\[(3) \text{Translations of Constituents of (2)}\]
\[\text{otoko}: \lambda y. \text{otoko}'(y)\]
\[\text{go-nin}: \text{same as in (1)}\]
\[\text{kita}: \lambda T.T(\lambda z. \text{kita}'(z))\]
\[(TYP(T) = TYP(NP'))\]

\[(4) \text{a. go-nin ki-ta } (<<e,t>,t>):\]
\[\lambda P. | P \cap \lambda z. \text{kita}'(z) | & P \subseteq \text{nin'}\]
b. otoko-ga go-nin ki-ta (t):
| $\lambda y.\text{otoko}'(y) \cap \lambda x.\text{kiita}'(x) \mid \geq 5 \& \lambda y.\text{otoko}'(y) \subseteq \text{nin}'$ 

Since it has not been pointed out so far, we should note the following two features of the semantic treatment. First, as opposed to the cases with NP-internal numeral classifiers (exemplified in $[NP \text{san-satu-no hon}]$ 'three books' which will also be discussed below) the exact cardinality of the common noun construee of a floating numeral classifier is not directly relevant in interpreting a sentence. Thus in (2) we are not directly committed to the existence of five men per se but rather the existence of five men via their action of coming. This is important for the consideration of the data given in Section 2 below. Second, the system as it stands now only produces a single scope order for two-place predicates. As promised, it will be shown in Section 4 that there is a natural extension of the semantic treatment which enables us to obtain both narrow and wide scope interpretations.

3.2 Motivation for Adverbial Analysis

Nearly all of the past studies on floating numeral classifiers seem to tacitly assume that numeral classifiers are quantificational elements that are more or less in a direct modificational relationship with their 'host' nouns. Such a conjecture is obvious in Haig's (1980) treatment in which all occurrences of floating numeral classifiers seen in (Sb-d) are derived from a single underlying source like (5a) (in which the numeral classifier with a genitive suffix $\text{san-satu-no}$ occupies a prenominal NP-internal position) via quantifier movement and scrambling.

(5) a. Hanako -ga $[NP \text{san-satu-no hon}-o$ kat-ta
               -nom three-gen book-acc buy-past
          'Hanako bought three books'

            b. San-satu Hanako -ga hon-o kat-ta
                  three -nom book-acc buy-past
          'Hanako bought three books'

            c. Hanako-ga san-satu hon-o kat-ta

            d. Hanako-ga hon-o san-satu kat-ta

As we have seen in the previous chapter, Miyagawa (1989) takes a weaker position with respect to the applicability of a movement rule. According to his account (5a) on the one hand and (5b-d) on the other are not syntactically related at all. Further, he base-generates (5c,d) and scrambles the numeral classifier $\text{san-satu}$ to the sentence initial position in (5b). But, as we recall, even according
to this account, floating numeral classifiers are treated as ‘predicates’ (in the sense of Williams 1980) that ‘modify’ their host directly as long as the numeral classifier and its host are in a mutual C-command relationship.¹ Let us call an account like that of Haig or Miyagawa a ‘direct modificational’ approach. This section will establish that the direct modificational approach to the phenomena faces significant difficulties and that the relationship between a floating numeral classifier and its common noun construee is best understood to be indirect, requiring a construal mediator—namely, a verb.

The evidence introduced below is chosen to show non-uniform syntactic and semantic behaviors of prenominal NP-internal and floating instances of numeral classifiers. This is expected if these two are considered to be of different sorts as in the present adverbial analysis but is rather unexpected according to the direct modificational approach. The reader's attention should be drawn to the unique and intimate semantic dependency exhibited by adverbial numeral classifiers and varieties of cooccurring predicates. In Section 3 we shall examine the semantic treatment of numeral classifiers introduced above in light of the data given here.

3.2.1 Coordination 1

It is possible to coordinate floating numeral classifiers and other (regular) adverbs and use the coordinated unit to modify a predicate. This is shown in (6). (Note that the English equivalences below do not reflect the coordination.)

witness-nom yesterday three and certainly that accident-acc witness-past
‘Three witnesses certainly witnessed the accident yesterday’

b. Terorisuto-ga kinoo [ zyuu-nin katu kotogotoku] taihos-are-ta
terrorist-nom yesterday ten and completely arrest-pass-past
‘Ten terrorists were arrested completely yesterday’

c. Taroo -ga kabin- o kinoo [ hito-tu katu konagonani] hakaisi-ta
-nom vase-acc yesterday one and to-pieces destroy-past
‘Taroo destroyed one vase into pieces yesterday’

What is shown here is that functionally (but not necessarily categorially, c.f. the adverbial use of yesterday in English) numeral classifiers are on the same status as other adverbs that modify predicates. This is rather awkward for the direct modificational approach in that the adverbial

¹As far as I know Mikami (1953), Inoue (1978), and Yatake (to appear) are the only authors who do not assume this direct construal view.
elements in (7), *tasikani, *kotogotoku, and *konagonani do not modify nouns at all. Suffixing the genitive marker -no does not help either.

(7) a. *tasikani(-no) syoonin
   ‘(INT.) a certain witness’

   b. *kotogotoku(-no) terorisuto
   ‘(INT.) a complete terrorist’

   c. *konagonani(-no) kabin
   ‘(INT.) a vase broken to pieces’

3.2.2 Coordination 2

Consider another set of facts from coordination. If floating numeral classifiers are endocentric modifiers for (T)VPs then we would expect that two (T)VPs which are modified by numeral classifiers can be coordinated with each other. This is exactly what we find. In (8a) two sub-VPs each of which has been combined with an numeral classifier are coordinated, forming a larger VP that later combines with the adjunct and the subject. The larger TVP in (8b) is constructed with two sub-TVPs each of which, again, is modified by an numeral classifier. The present adverbial analysis seems to be just right to capture these facts.²

(8) a. Heisi-ga seebusensen-de [[νP [hyaku-nin] katu [νP [yonhaku-nin husyoosi-ta]]] soldier-nom western front-at 100 die and 400 wound-past
   ‘100 soldiers died and 400 soldiers were wounded at the western front’

   b. Taroo -ga hon-o kinoo [[TVP san-satu kai] katu [TVP go-satu ut-ta]]
   -nom book-acc yesterday three buy and five sell-past
   ‘Taroo bought three books and sold five books yesterday’

3.2.3 Mismatches

As Inoue (1978) notes, under certain circumstances, some numeral classifiers are able to occur only in floating positions. In (9a) the numeral classifier hito-maki ‘one-rolled object’, which is normally used for rolled objects as shown in (9d), is used to indicate the number of hairbends. But as is obvious

²The data in (8) as well as (6) are problematic for an analysis assuming mutual C-command between numeral classifiers and their hosts. We note that, for cases like (8), a transformation such as Conjunction Reduction would not help the direct modificational account. This is because the following two sentences are not synonymous at all:
   (i) Dareka-ga husyoosi katu sin-da ‘Someone got injured and died’ vs. (ii) Dareka-ga husyoosi katu dareka-ga sin-da ‘Someone got injured and someone died.’
from (9b), this is not a proper numeral classifier for hairbands as opposed to ip-pon ‘one-long object’ in (9c) which is indeed proper.

(9) a. Taroo -ga hatimaki-o hito-maki yuukkuri mai-ta
    -nom hairband-acc one-rolled object slowly roll on-past
    ‘Taroo rolled on one hairband slowly’

b. *hito-maki-no hatimaki
    one-rolled object-gen hairband
    ‘(INT.) one hairband’

c. ip-pon-no hatimaki
    one-long object-gen hairband
    ‘one hairband’

d. hito-maki-no makimono
    one-rolled object-gen scroll
    ‘one scroll’

The example in (10a) shows a similar point in that the numeral classifier ip-patu ‘one-blast,’ which is used for counting weapon projectiles (10d), is employed to indicate the frequency of shooting performed by Taroo. Note, however, this example is different from the one in (9a) in that it is not the number of objects that is at issue but it is the number of events that matters. This numeral classifier cannot be used with weapons, such as a pistol. C.f. (10b) vs. (10c).

(10) a. Taroo -ga pisutoru-o ip-patu kinoo ut-ta
    -nom pistol-acc one-blast yesterday shoot-past
    ‘Taroo shot a pistol once yesterday’

b. *ip-patu-no pisutoru
    one-blast-gen pistol
    ‘(INT.) one pistol’

c. it-tyoo-no pisutoru
    one-weapon-gen pistol
    ‘one pistol’

d. ip-patu-no dangan
    one-blast-gen bullet
    ‘one bullet’
Again these examples are funny if floating numeral classifiers are uniformly treated as nominal modifiers as assumed by the direct modificational approach. Under such an assumption we would expect to find the numeral classifier in (9a) *hito-maki ‘one’ to be compatible with *hatimaki ‘hairband’ and should be able to appear in the NP-internal prenominal position. Even more intriguing is (10a) in which what clearly appears to be an numeral classifier (*ip-patu) is used in an adverbial fashion indicating the number of shooting events.

3.2.4 Predicate Dependency

The following examples further indicate that it is plausible to suppose intimate dependency between adverbial numeral classifiers and predicates rather than between them and their common noun construees. In (11) we see that the non-negative predicate *tariru ‘are sufficient’ cannot be used with a floating numeral classifier. It is interesting to note that the ill-formed (11b) can be made well-formed by simply changing the predicate from affirmative to negative as done in (11d). It is also noted that (11c) with an NP-internal numeral classifier and (11d) with a floating classifier do not share the same interpretation. (More on this point in the next subsection.) In contrast, both floating and non-floating numeral classifiers are compatible with the predicate *yooisi-ta ‘reserved’ seen in (12). This seems to be good evidence for the intimate dependency of floating numeral classifiers on predicates and not on their common noun construee per se.

(11) a. \([NP \text{San-ko-no ringo}-wa (koroera-no kodomotati-o tabesasu-no-ni) tari-ru]\\three-gen apple-top (these children-acc feeding-for) sufficient-cop-pres\\ ‘Three apples are sufficient (for feeding these children)’

b. *\([NP \text{Ringo-wa (korera-no kodomotati-o tabesasu-no-ni) san-ko tari-ru}]\\apple-top (these children-acc feeding-for) three sufficient-cop-pres\\

c. [NP \text{San-ko-no ringo}-wa (koroera-no kodomotati-o tabesasu-no-ni) tari-nai\\three-gen apple-top (these children-acc feeding-for) sufficient-cop-neg-pres\\ ‘Three apples are not sufficient (for feeding these children)’

d. \([NP \text{Ringo-wa (korera-no kodomotati-o tabesasu-no-ni) san-ko tari-nai}]\\apple-top (these children-acc feeding-for) three sufficient-neg-pres\\ ‘(Someumber of) apples are short by three (for feeding these children)’

(12) a. \([NP \text{Taroo -ga san-ko-no ringo}-o (koroera-no kodomotati-o tabesasu-no-ni) yooisi-ta}]\\-nom three-gen apple-acc (these children-acc feeding-for) reserve-past\\ ‘Taroo reserved three apples (for feeding these children)’
b. Taroo -ga ringo-o (korera-no kodomati-o tabeasu-no-ni) san-ko yooisi-ta
   -nom apple (these-gen children-acc feeding-for) three reserve-past
   ‘Taroo reserved three apples (for feeding these children)’

The following examples show even more systematic patterns of predicate dependency of floating
numeral classifiers. The example sentences all contain a stative predicate. The contrast between
(13) and (14) on the one hand and (15) and (16) on the other can be characterized if we focus
on subcategories of these predicates—namely ‘stage-level’ vs. ‘individual-level’ predicates (Carlson
1977). The former pair of sentences involve byooiki-da ‘are sick’ and yotte-iru ‘are drunk’ which are
stage-level predicates, indicating a temporary state of affairs. In the latter, however, the predicates
katawa-da ‘are crippled’ and kitigai-da ‘are crazy’ are of individual-level, signifying more or less a
permanent state of affairs. As is evident, floating numeral classifiers are compatible only with stage
level predicates. This pattern seems to be quite robust.3

(13) a. [NP San-nin-no gakusei]-ga byooiki-da
   three-gen student-nom sick-cop-pres
   ‘Three students are sick’

b. Gakusei-ga san-nin byooiki-da
   ‘Three students are sick’

(14) a. [NP San-nin-no gakusei]-ga yotte-iru
   three-gen student-nom drunk-pres
   ‘Three students are drunk’

b. Gakusei-ga san-nin yotte-iru
   ‘Three students are drunk’

(15) a. [NP San-nin-no gakusei]-ga katawa-da
   three-gen student-nom cripple-cop-pres
   ‘Three students are crippled’

b. *Gakusei-ga san-nin katawa-da
   (INT.) ‘Three students are crippled’

3The examples here contain only numeral classifiers which are weak determiners. Another weak determiner takusan
‘many’ (also a floating quantifier) shows the same pattern: (i) Gakusei-ga takusan byooiki-da ‘Many students are sick’
vs. (ii) *Gakusei-ga takusan katawa-da ‘(INT.) Many students are crippled’. However, this contrast disappear
when we have the following strong determiners (again floating quantifiers): (iii) Gakusei-ga zen-in/hotondo byooiki-da
‘All/Most students are sick’ vs. (iv) Gakusei-ga zen-in/hotondo katawa-da ‘All/Most students are crippled’. See
Chapter 5 for the GQ properties (e.g. the weak/strong distinction) of floating quantifiers.
If the direct modificational approach is right, the question we can ask is: why is it the case that there is a contrast between the NP-internal and NP-external cases of numeral classifiers with respect to the level distinction of the predicates involved? This of course is a very natural outcome for an adverbial account.  

3.2.5 No Direct Quantity Restriction

The following examples show another property of numeral classifiers. In these examples numeral classifiers can appear either in the NP-internal position (17a) and (18a) or in the floating position (17b) and (18b). But what is interesting here is that the (a)-sentences are not necessarily synonymous with the (b)-sentences. Examples similar to (17) are found in Inoue (1978). For example, in (14a) the number of the books which were bought and the number of books which were stolen has to be identical—namely three. This can be true for (17b) but not necessarily so and in fact the reading with more than three books is strongly preferred. Likewise (18a) commits us to that fact that there was one cell which increased (and became two) by cell division. In contrast, (18b) does not necessarily mean that there was only one cell but rather that the originally indeterminate number of

4 Data involving an amount numeral classifier like san-ritoru 'three liters' also demonstrate the dependency of floating numeral classifiers on the cooccurring predicates. Observe the contrast between (i) and (ii): (i) [NP San-ritoru-no mizu ga kire-ta 'Three liters of water depleted' (ii) *Mizu-ga san-ritoru kire-ta '(INT.) Three liters of water depleted'. The contrast is explained by appealing to lexical semantics of the predicate involved. The unacceptability of (ii) should be attributed to the incompatibility of the adverbial numeral classifier san-ritoru 'three-liters' with the predicate kireta 'depleted.' As mentioned in the next subsection, one of the notable semantic properties of floating numeral classifiers (as opposed to NP-internal ones like san-ritoru-no in (ii)) is that there is no quantity restriction imposed on their construees. But for the sentence (ii) to be felicitous the amount of water has to be zero after its depletion. In (i) this is achieved by specifying the original amount of water which is three liters by the NP-internal numeral classifier. This is, however, not guaranteed for (ii) because there is no way to know the original amount of water, retaining the possibility that there is still some water left. But the possibility of some water remaining is not compatible with the predicate kireta which demands that the water has to be eliminated completely. To treat amount numeral classifiers such as san-ritoru formally, we have to have not only a mechanism to deal with amount expressions (more generally with mass nouns) but also a plausible approach to opaque verbs such as kireta, kuresa 'increased', kuresa 'decreased', etc. Since intensionality is ignored in this thesis, the amount numeral classifiers are not given a formal account.
cells has been increased by one. (18) will not be given an analysis since the present semantic system is extensional and ill-equipped to treat predicates like *huta* ‘increased’.

(17) a. \[NP \text{San-satu-no Hanako-ga kinoo katta hon-ga nusum-are-ta} \]
    three-gen -nom yesterday buy book-nom steal-pass-past

    Three books that Hanako bought yesterday were stolen

b. \[NP \text{Hanako-ga kinoo katta hon-ga san-satu nusum-are-ta} \]
    -nom yesterday buy book-nom three-gen steal-pass-past

    Three books were stolen from the books that Hanako bought yesterday

(18) a. \[NP \text{Hito-tu-no saiboo-ga hue-ta (sosite huta-tu-ni nat-ta)} \]
    one-gen cell-nom increase-past (and-then two become-past)

    ‘One cell increased (and then became two)’

b. \[NP \text{Saiboo-ga hito-tu hue-ta} \]
    cell-nom one increase-past

    ‘Cells increased by one’

These facts are quite perplexing from the point of view of the direct modificational approach.

3.2.6 Doubling

Our final piece of evidence seen in (19) is related to the previous one in which we show that the quantity of the construee of a floating numeral classifier is not directly restricted. This means that we should be able to have a floating numeral classifier being construed to a common noun construee which is modified by a NP-internal numeral classifier. And indeed this is what we find.

(19) a. \[NP \text{Hanako-ga [NP san-mai-no kaado-o iti-mai mekuru-u-to, sore-wa baba-da-ta} \]
    -nom three-gen card-acc one turn-when it-top joker-cop-past

    ‘When Hanako turned one card out of three, it was a joker

b. \[NP \text{Taroo-ga [NP go-ko-no ringo-o ni-ko tabe-ru-to, nokori-wa san-ko-da} \]
    -nom five-gen apple-acc two eat-pres-if remainder-top three-cop-pres

    ‘If Taroo eats two apples out of five, the remainder is three’

3.2.7 Summary

The six pieces of evidence introduced above are: 1) coordination of numeral classifiers with other adverbs, 2) coordination of (T)VPs modified by numeral classifiers, 3) a mismatch between floating
numeral classifiers and their common noun construees, 4) the impossibility of using some prenominal NP-internal numeral classifiers in floating positions, 5) the fact that a floating numeral classifier imposes no direct quantity restriction on its common noun construees, and 6) cooccurrence of two numeral classifiers being construed to a single common noun in a single sentence. They seem to demonstrate quite plausibly the non-uniform syntactic/semantic behaviors of NP-internal and floating instances of numeral classifiers. This discrepancy between the two instances of numeral classifiers is exactly what is expected according to the present adverbial analysis.

3.3 Extended Semantic Analysis

Let us see if the semantic account introduced in Section 2 is of any use faced with the additional data seen in the previous section. It turns out that some of the facts are readily dealt with and others are a bit harder. However, it is demonstrated that the original account is on the right track and can be the point of departure for further exploration. The extension of the original account (both in this and Section 4) is accomplished in a principled way in that it appeals to assumptions and techniques that have been independently developed and motivated in the literature and are readily available.

3.3.1 Coordination

The first coordination data seen above seem to be hard to provide an account for. This is because the cases of coordination (6) above involve items belonging to distinct semantic types, namely (20) vs. (21) the former of which are the types for regular adverbs and the latter for numeral classifiers. Recall that, according to the semantic types of the SOC and DOC, when these two take IVP' or TVP' as their arguments, the type of the first argument of the original IVP' or TVP' is altered from that of a quantifier <<< e, t >, t > to that of a common noun < e, t >. This means that (20a) and (21a) on the one hand and (20b) and (21b) on the other cannot be coordinated. (ADV_I and ADV_T are adverbs that take IVP and TVP, respectively.)

(20) Semantic Types of Regular Adverbs

\[
\begin{align*}
\text{a. } &\text{TYP(ADV}_I\text{)} = <\text{IVP}', <<< e, t >, t >, t >> \tag{ADV}_I' \\
\text{b. } &\text{TYP(ADV}_T\text{)} = <\text{TVP}', <<< e, t >, t >, <<< e, t >, t >, t >> >, t >> > > \tag{ADV}_T'
\end{align*}
\]

(21) Semantic Types of DOC and SOC

\[
\begin{align*}
\text{a. } &\text{TYP(SOC)} = <\text{IVP}', <<< e, t >, t >> \tag{SOC}' \\
\text{b. } &\text{TYP(DOC)} = <\text{TVP}', <<< e, t >, <<< e, t >, t >, t >> >, t >> > > \tag{DOC}'
\end{align*}
\]
A simple solution is available. We can utilize a type shifting rule which we call 'DET': \(<e,t><e,t>,t>,t>\), producing a quantifier type from a common noun type (this is equivalent to 'THE' of Partee (1987)), and two other semantically valid rules Curry and Composition in the fashion indicated in (22) and (23).\(^5\) In (22), for example, by applying Curry to the regular ADV\(_T\), composing it with DET, and applying Curry again, we obtain the desired type.

\(^5\)This was suggested to me by Dick Oehrle. Also the applicability of type shifting rules for Japanese has been motivated by Ogihara (1986).

(22) Curry and Composition for SOC-ADV\(_T\) Coordination

\(<\text{IVP}',<<e,t>,t>,t>\rangle \quad \text{Curry} \quad <<e,t>,t>,\text{IVP}',t>\rangle

\Rightarrow \quad <<e,t>,<<e,t>,t>,\text{IVP}',t>\rangle

\Rightarrow \quad \text{Composition} \quad <<e,t>,<<e,t>,t>,\text{IVP}',t>\rangle

\Rightarrow \quad Curry \quad <\text{IVP}',<<e,t>,t>,t>\rangle

(23) Curry and Composition for DOC-ADV\(_T\) Coordination

\(<\text{TVP}',<<e,t>,t>,<<e,t>,t>,t>\rangle \quad \text{Curry} \quad <<<e,t>,t>,<\text{TVP}',<e,t>,t>,t>>\rangle

\Rightarrow \quad <e,t> \rightarrow <<e,t>,t>,<<<e,t>,t>,<\text{TVP}',<<e,t>,t>,t>>,t>\rangle

\Rightarrow \quad \text{Composition} \quad <<<e,t>,<<e,t>,t>,<\text{TVP}',<<e,t>,t>,t>>,t>\rangle

\Rightarrow \quad Curry \quad <<e,t>,<\text{TVP}',<<e,t>,t>,t>>,t>\rangle

\(<\text{TVP}',<<e,t>,t>,t>\rangle\>

Now that the types of (regular) adverbs have been made identical to those of numeral classifiers, we can go ahead and coordinate the numeral classifiers and the adverbs with no problem.

The second set of coordination data (8) are just instances involving two identical semantic types and straightforward. No extra device is needed.

3.3.2 Quantity Restriction

It was noted that, with a floating numeral classifier, there is no direct quantity restriction imposed on the common noun construee of that numeral classifier, e.g. the contrast (17) (repeated).

\(^{24}\) a. \([NP\ \text{San-satu-no \ Hanako-ga \ kinoo \ katt\ a\ hon]-ga\ \text{nusum-are-ta}\]

\[\text{three-gen} \quad -\text{nom yesterday buy book-nom steal-pass-past}\]

Three books that Hanako bought yesterday were stolen.
b. [NP Hanako-ga kinoo katta hon]-ga san-satu nusum-are-ta
   nom yesterday buy book-nom three-gen steal-pass-past

Three books were stolen from the books that Hanako bought yesterday.

As was mentioned briefly in Section 2, this is a consequence of the way the semantic translations of the SOC and DOC are set up. Let us see how (24b) will be translated. In (25) are the translation of the SOC san-satu ‘three’ and of other constituents in (24b) as well as the result of a Type Driven Translation. (The optional adverb is left out of the translation. H.K.hon’ stands for Hanako-ga_katta_hon’.)

(25) Translations for (24b)
\[
\lambda y. H.K.hon'(y) \cap \lambda x. nusumareta'(x) \mid \lambda y. H.K.hon'(y) \subseteq\text{san-satu'}
\]

Translators for Constituents of (25b)

san-satu: \[
\lambda W. \lambda P. W(\lambda Q. P \cap Q \mid \lambda y. H.K.hon'(y))
\]

Hanako-ga katta hon: \[
\lambda y. H.K.hon'(y)
\]

nusumareta: \[
\lambda T. T(\lambda x. nusumareta'(x))
\]

The floating numeral classifier san-satu does not require a specific number of books purchased by Hanako per se leaving it undetermined. But it clearly indicates that the cardinality of the intersection of the two sets, the set of books which Hanako bought and the set of individuals that were stolen has to be greater than or equal to one.

Let us consider how the difference between (24a) and (24b) can be accounted for. In (24a) the classifier san-satu ‘three’ is used NP-internally and what this sentence commits us to is that the cardinality of the books purchased by Hanako is three. Two assumptions are needed. First, we assume (after Link 1987; also Hoeksema 1983) that a prenominal NP-internal numeral classifier is an adjectival modifier not a determiner (as in B&cC), i.e. of type \(< e, t >\), < e, t >. Thus san-satu-no in (24a) modifies the common noun Hanako-ga katta hon ‘books Hanako bought’ and produces the set of all ‘i-sums’ of books each member of which contains exactly three atomic part. But crucially this set is not a GQ yet but is still a common noun (i.e. what is called a ‘numerically specified nominal’ by Link). Second, we assume that a mechanism similar to ‘existential closure’ of Heim (1982) introduces a semantic existential zero determiner ‘03’ when the numerically specified nominal is used in an appropriate context. (There is no corresponding syntactic zero determiner.)

\footnote{The modificational nature of NP-internal numeral classifiers is motivated in Chapter 5.}
Thus the translation of the GQ san-satu-no Hanako-ga katta hon ‘three books Hanako bought’ will be as in (26a) to which the translation of the predicate nusumareta ‘were stolen’ is applied, yielding the complete translation. We notice that the translation given to (24b) above and this translation indeed indicate two different things.

(26) Translation for (24a)

a. $\emptyset_3$ san-satu-no Hanako-ga katta hon:
$$\lambda P \exists x (3-H.K.hon(x) \& 3-H.K.hon(x) \subseteq satu \& P(x))$$

b. $\exists x (3-H.K.hon(x) \& \lambda y.3-H.K.hon(y) \subseteq satu \& nusumareta(y))$

The point noted above concerning the possibility of having two numeral classifiers within a sentence also follows from the translation of numeral classifiers and is readily treated. This can be done if we follow the same strategy taken above for (24a) and take a NP-internal numeral classifier to be an adjectival modifier. But this time it is not necessary to evoke the existential zero determiner. In a sentence like (19) (only (19a) repeated), the numeral classifier san-mai-no 'three' is again taken to be an adjectival modifier. Thus the result of combining this with the common noun kaado ‘card’ will produce another common noun which is considered to be the set of all i-sums of cards each member of which contains exactly three atomic parts. But since we cannot take the intersection between an individual and a set corresponding to a one-place predicate, we add a semantic rule which creates a set corresponding to a non-atomic individual. We call this rule ‘MEMBER’ which is defined in (27b). The translation corresponding to the conditional clause of (27a) is given in (27c).

(27) a. Hanako-ga [NP san-mai-no kaado]-o iti-mai mekuru-u-to, sore-wa baba-da-ta
   
   'When Hanako turned one card out of three, it was a joker'

b. MEMBER:
   $$\exists x, \forall y, \text{if } y \leq_1 x \text{ and } \text{Atom}(y) \text{ then } y \in \text{MEMBER}(x)$$

c. $\exists x (3-\text{kaado'}(x) \& \lambda y.3-\text{kaado'}(y) \subseteq \text{ma'i} \& | \text{MEMBER}(x) \cap \lambda y.\text{mekur}(y)(h) | \geq 1 \& \text{MEMBER}(x) \subseteq \text{ma'i})$

3.3.3 Classifier Constreuee Mismatch

It has been noted that a mismatch between floating numeral classifiers and their common noun construees is allowed. Thus in (9a) (repeated below) the numeral classifier hito-maki 'one' can be used to indicate the cardinality of hatimaki 'hairband' involved. But it was the case that this is not a proper numeral classifier for hairbands (e.g. (28b)) as opposed to the proper usage in (28c).
(28) a. Taroo -ga hatimaki-o hit-maki-yukkuri mai-ta
   -nom hairband-acc one-cl(rolled object) slowly roll on-past
   'Taroo rolled on one hairband slowly'

b. *hito-maki-no hatimaki
   one-cl(rolled object)-gen hairband
   '(INT.) one hairband'

c. ip-pon-no hatimaki
   one-cl(long object)-gen hairband
   'one hairband'

If we proceed with the translation schema the result in (29) obtains, which turns out to be false
since the second part of the truth condition is violated by the mismatch between the classifier maki
'roll' and the common noun hatimaki 'hairband.' But under the assumption that Taroo did put on
a hairband slowly, (28a) should count as true.

(29) Translation for (28a)
   \[ \lambda y.\text{hatimaki}'(y) \cap \lambda z.\text{maita}'(x)(t) \geq 1 \& \lambda y.\text{hatimaki}'(y) \subseteq \text{maki}' \]

What we could say is the following. For some floating numeral classifiers, the collocational restriction
on the relationship between a given numeral classifier and its construee is relaxed when the numeral
classifier is not in a direct modificational relationship. But this can only happen when a given
numeral classifier is used in the floating positions as an adverbial. The use of the numeral classifier
hito-maki being construed to hatimaki in (28a) is allowed due to the non-local and indirect nature
of their relationship, easing the strict membership restriction. The lexical semantics of the verb
maita 'rolled' which mediates the construal relationship between the two also contributes to the
relaxation of the membership restriction. It is not difficult to see the semantic relatedness between
the verb and the numeral classifier maki. In contrast, in the absence of such a construal mediator,
the NP-internal modificational relationship between the numeral classifier and it construee seen in
(28b) is not possible due to the local and direct nature of the relationship where the collocational
restriction has to be observed more strictly.

\(^7\)Dick Oehrle notes English examples like: (i) *What he wants is that everyone be here on time and (ii) *?He wants that everyone be here one time. What these show is that a tenseless that-clause which cannot be a complement of a verb like want can cooccur with the same verb under a different collocational condition.
3.3.4 Dependency on Predicates

The contrast (11) vs. (12) above (repeated below) was employed to demonstrate the dependency between adverbial numeral classifiers and predicates rather than between floating numeral classifiers and their common noun construees.

(30)

a. \([\text{NP } \text{San-ko-no ringo]-wa (korera-no kodomotati-o tabesasu-no-ni) tari-ru}\]
   
   three-gen apple-top (these children-acc feeding-for) sufficient-cop-pres
   
   'Three apples are sufficient (for feeding these children)'

b. \(\text{*Ringo-wa (korera-no kodomotati-o tabesasu-no-ni) san-ko tari-ru}\)
   
   apple-top (these children-acc feeding-for) three sufficient-cop-pres

c. \([\text{NP } \text{San-ko-no ringo]-wa (korera-no kodomotati-o tabesasu-no-ni) tari-nai}\]
   
   three-gen apple-top (these children-acc feeding-for) sufficient-cop-neg-pres
   
   'Three apples are not sufficient (for feeding these children)'

d. \(\text{Ringo-wa (korera-no kodomotati-o tabesasu-no-ni) san-ko tari-nai}\)
   
   apple-top (these children-acc feeding-for) three sufficient-neg-pres
   
   '(Some number of) apples are short by three (for feeding these children)'

(31)

a. \(\text{Taroo -ga [NP san-ko-no ringo]-o (korera-no kodomotati-o tabesasu-no-ni) yooisi-ta}\)
   
   -nom three-gen apple-acc (these children-acc feeding-for) reserve-past
   
   'Taroo reserved three apples (for feeding these children)'

b. \(\text{Taroo -ga ringo-o (korera-no kodomotati-o tabesasu-no-ni) san-ko yooisi-ta}\)
   
   -nom apple (these-gen children-acc feeding-for) three reserve-past
   
   'Taroo reserved three apples (for feeding these children)'

This contrast is explained with the help of lexical semantics of the predicates involved (as was done similarly in Note 4). The unacceptability of (30b) seems to be due to the incompatibility of the adverbial numeral classifier \text{san-ko} 'three' with the predicate \text{tari} 'are sufficient.' The exact nature of this incompatibility will be explicated below.

We begin with (30). We recall that NP-internal numeral classifiers impose a direct quantity restriction on their construee. A predicate like \text{tari} presupposes a contextually determined criterial quantity with which a given quantity of some object(s) is compared. The criterion serves as the standard of comparison. In (30a) it is simply compared against the quantity specified by the NP-internal numeral classifier \text{san-ko-no} which is three. If this quantity is larger than the criterion, the sentence is true. The following translation of (30a) demonstrates this formally. Here 'NC' indicates
the contextually supplied criterion. The treatment of NP-internal numeral classifiers seen above is employed again and the function MEMBER is used to obtain a set of atoms that belong to a non-atomic i-sum. (The translation leaves out the parenthesized items.)

(32) a. Translation for the constituents of (30a)

\[
\text{tariru}_a : \lambda T : T (\lambda z . | \text{MEMBER}(z) | \geq N_C)
\]

\[
\text{san-ko-no ringo} : \lambda P \exists z (3 \text{-} \text{ringo}'(z) \& \lambda y. 3 \text{-} \text{ringo}'(y) \subseteq k_0' \& \mathcal{P}(z))
\]

b. The result of type driven translation

\[
\exists z (3 \text{-} \text{ringo}'(z) \& \lambda y. (3 \text{-} \text{ringo}'(y) \subseteq k_0' \& | \text{MEMBER}(z) | \geq N_C)
\]

The matters are not simple in (30b) with a floating numeral classifier, where (as we recall) there is no direct quantity restriction on the construee. This means that a simple comparison like the one in (30a) between a specified quantity and the criterion is not available. Then in (30b), which indicates the extra number of apples with the floating numeral classifier san-ko, an attempt is made to establish such a quantity beyond the criterial point. The fact that this attempt is not possible can be demonstrated by the following example where we are not able to form a question asking about the extra number of apples, using a floating \(WH\)-classifier with the predicate \text{tariru}.

(33) *Ringo-wa (korera-no kodomotati-o tabesasu-no-ni) nan-ko tari-ru-ka

apple-top (these children-ace feeding-for) how many sufficient-cop-pres-Q

'((INT.) By what number are the apples sufficient (for feeding these children)?)'

The translation for (34b) below reflects this inability to access the information about the quantity specified by the numeral classifier. The translation of the predicate \text{tariru} is different from the one seen in (32a). This means that the predicate in question is associated with two different semantic specifications one of which requires a subcategorized numerical expression that supplies the quantity information. (For now we assume that \(N\) and \(n\) range over natural numbers.)

(34) a. Translation for the constituents of (30b)

\[
\text{tariru}_b : \lambda N \lambda T. T (\lambda z . \exists n (| \text{MEMBER}(z) | - N_C = n) \& \text{ABS}(n) = N)
\]

\[
\text{san-ko} : \lambda W.W(3)
\]

(where TYP\((W) = \text{TYP}(\text{tariru}_b)\))

\[
\emptyset_3 \text{ ringo} : \lambda P \exists z (y = \sigma z. \text{ringo}'(z) \& \mathcal{P}(y))
\]

b. The result of type driven translation
\[ \exists x (y = \sigma x.\text{ringo'}x & -\exists n (| \text{MEMBER}(y) | - N_c = n) & \text{ABS}(n) = 3) \]

Some remarks about (34a,b) is in order here. As seen in Link's (1983) approach to plurals, ‘\(\sigma x.\text{ringo'}x\)’ is the ‘supremum’ formed from the set of apples. ‘ABS’ is a function that returns the absolute value of a given input number. The final translation in (34b) says that there exists an individual which is the supremum of the set of apples and there is no number \(n\) identical to the difference between the cardinality of the subject and the contextually supplied criterial value. In addition the absolute value of \(n\) is equal to the number indicated by the floating numeral classifier.

In (34a) we note that the second occurrence of the variable \(n\) is outside of the scope of the existential quantifier (as well as the negation). This means that (34b) cannot be interpreted according to a standard predicate logic. We follow Groenendijk and Stokhof's (G&S) (1991) Dynamic Predicate Logic and attempt to provide an interpretation for (34b). The most notable feature of G&S's approach is that they can account for a cross-sentential anaphoric relation, for example, between an existential quantifier in the first conjunct and an instance of a free variable in the second (i.e. the syntactic form: \(\exists x P(x) \& Q(x)\) which cannot be interpreted in a traditional predicate logic).

It turns out that, regardless of what happens for the first conjunct, the occurrence of the variable \(n\) in the second conjunct cannot be bound by the existential quantifier due to the 'static' nature of negation which fails to pass on the information concerning variable binding to the second conjunct. This leaves the second occurrences of \(n\) unbound and, consequently, the identification between the numerical value obtained from the subtraction in the first conjunct and the value supplied by the numeral classifier is impossible. (I do not provide the definition of the static negation here. See G&S.)

It is noted that, in the negative context seen in (30c,d), either NP-internal (i.e. non-floating) or NP-external (i.e. floating) numeral classifiers can be used with the predicate \(\text{tari-nai} 'are not sufficient'\). For (30c), a comparison described above for (30a) is carried out between the specified quantity of the construee (i.e. three) and the contextually determined criterion. If the first is smaller than the second, the sentence counts as true. In (30d), just as in (30b), the quantity of the apples is unknown, making it necessary to determine such a quantity for the comparison's sake. However, the difference between (30b) and (30d) is that the latter is about the quantity of apples needed to reach (not exceeding) the criterion. This downward search is indeed possible with the predicate \(\text{tari-nai} as demonstrated by (35). This means that, with this predicate the information concerning the insufficient quantity is accessible, utilizing the floating numeral classifier. 8

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8The applicability of the dynamic system for this case was pointed out to me by Dick Oehrle.

9 It is interesting to note that, with a predicate like \(\text{yokaida} 'were excessive', the patterns we see with the \text{tariu}/\text{tari-nai} opposition are systematically reversed; the negative counterpart of this predicate cannot cooccur with
(35) Ringo-wa korera-no kodomotati-o tabesasu-no-ni nan-ko tari-nai-ka
   apple-top these children-acc feeding-for how many sufficient-neg-pres-Q
   'How many more apples are lacking for feeding these children?'

Formally, the translation of (30d) is similar to that of (34b) above. The crucial difference is
the presence of the extra negation which cancels the effect of the original negation. In (36a) is the
translation of tarinai. (The translations of other constituents are identical with those in (34a) and
are not repeated.)

(36) a. Translation for tarinai
   tarinai: $\lambda x. (x < n) \land \forall y. (y < n) \land \exists z. (z < n)
   \land (x < y) \land (y < z) \land (z < n)

b. The result of type driven translation
   $\exists x. (x = n) \land \forall y. (y = n) \land \exists z. (z = n) \land (x < y) \land (y < z) \land (z < n)$

The same remark about the binding of the second occurrence of n is applicable here as well. It is not
in the scope of the existential quantifier. The translation cannot be interpreted within a traditional
predicate logic. Again we appeal to Dynamic Predicate Logic but this time, due to the 'dynamic'
nature of the existential quantifier with respect to its ability to pass on the information about the
a floating numeral classifier.

(i) $\{NP San-ko-no ringo]-wa yokei-da
   'Three apples are excessive

(ii) Ringo-wa san-ko yokei-da
    The apples are excessive by three

(iii) $\{NP San-ko-no ringo]-wa yokei-de-nai
     'Three apples are not excessive

(iv) *Ringo-wa san-ko yokei-de-nai

Similar to tariru in (30), this predicate presupposes that there is a criterial point (again furnished by the context
beyond which the quantity of apples becomes excessive. For (i) and (iii), similar comparisons seen in (30a,c) will be
made between the specified quantities and the criterial point. And for (ii) and (iv), the information provided by the
floating numeral classifier san-ko will be used to identify unknown quantities of apples. But this time it is the negative
context where the access to the quantity information supplied by the numeral classifier is not allowed as we can see
from the contrast below.

(v) Ringo-wa nan-ko yokei-ka
   'How many apples are excessive?'

(vi) *Ringo-wa nan-ko yokei-de-nai-ka
variable binding, the second occurrence of \( n \) will properly be bound by the existential quantifier. (Again I do not give the definition of the dynamic existential quantification here. See G&S.)

What happens in (31) is entirely a different story. This is due to the fact that, for a sentence with the predicate \( yooisita \), there is no need to carry out a similar comparison between two quantities as done in (30) above. Nothing complicated is involved and the standard interpretation outlined in the previous sections will apply in a straightforward manner.

3.3.5 Unsolved Problems

In the five sub-sections above it was demonstrated that the original semantics of floating numeral classifiers, with some extension, produces correct results for a wider range of data previously unaccounted for. However, as pointed out below, there are some problems left unsolved. The phenomena mentioned here have to be dealt with by further research.

First, (10a) (repeated) exemplifies flexibility of floating numeral classifiers with respect to the collocational restriction on its construee but in a more complex way. In (37a) in which the numeral classifier \( ip-patu \) 'one', which is used for counting weapon projectiles not weapons per se (see (37b)), is employed to indicate the frequency of shooting performed by Taroo. However this is not simply a matter of relaxation of the membership restriction in that it is not the cardinality of some objects that is at issue here. The numeral classifier seems to perform quantification over events. The present system is not able to offer any satisfactory account for quantification over events and a possible extension is not immediately obvious at the moment.

(37) a. Taroo -ga pisutoru-o ip-patu kinoo ut-ta
   -nom pistol-acc one yesterday shoot-past
   'Taroo shot a pistol once yesterday'

b. *ip-patu-no pisutoru
   '(INT.) one pistol'

c. it-tyoo-no pisutoru
   'one pistol'

Second, another unsolved problem resides in one of the virtues of the present account. There is no quantity restriction imposed on the common noun construee, making it possible to have two numeral classifiers within a single sentence if one is in the NP-internal prenominal position and the other is in the floating position, e.g. (17) above. (Only (17a) is repeated).
When Hanako turned one card out of three, it was a joker. However, this pattern does not obtain all the time. For example, it is possible to have a floating numeral classifier in (39a) which indicates a cardinality but it is not possible to do so in (39b) which is expected to be OK due to the existence of data like (19). This fact is left without any explanation.

Finally, the highly systematic compatibility/incompatibility of a floating numeral classifier and stage-level and individual-level predicates seen in the examples (13-16) above suggests there has to be detailed research into the relationship between the two kinds of predicates and quantification. This is beyond the scope of this thesis. (See Fukushima (in preparation)).

### 3.4 Alleged Evidence Against Adverbial Analysis

Let us now briefly turn to an argument against an adverbial analysis found in the literature. We examine Ueda's (1986) opposition against an analysis like the one presented in this and previous chapters which takes floating numeral classifiers to be adverbial modifiers. It is shown that his argument is rather ill-conceived and does not invalidate an adverbial analysis, due to the fact that the range of facts about Japanese adverbs on which he bases his argument is quite limited.

Ueda's argument rests on the thematic orientational and distributional properties of adverbs. First, he argues that if floating numeral classifiers are adverbs then they should show the identical 'thematic orientational' pattern exhibited by other adverbs. He observes that floating numeral classifiers and other adverbs show the same thematic orientation in (40). Here both san-nin and nessin-ni 'earnestly' are 'agent oriented' according to Ueda's terminology.

(40) a. Gakusei-ga san-nin Taroo-o settokusi-ta
    student-nom three acc persuade-past
    'Three students persuaded Taroo'
b. Gakusei-ga nessin-ni Taroo -o settokus-are-ta
    student-nom earnestly -acc persuade-pass-past
    ‘A student persuaded Taroo earnestly’

But when these sentences are passivised, the uniform agent orientation seen in (40) is disrupted and it is only the regular adverb in (41b) that retains the original orientation.

(41) a. *Taroo -ga gakusei-ni san-nin settokus-are-ta
        student-dat three persuade-pass-past
    ‘(INT.) Taroo was persuaded by three students’

b. Taroo -ga gakusei-ni nessin-ni settokus-are-ta
    student-nom students-dat earnestly persuade-pass-past
    ‘Taroo was persuaded by a student earnestly’

Second, he shows that a derived ‘adverbial’ counterpart of a floating numeral classifier does not have the same distribution as its source. In (42a) san-nin cannot be agent oriented in the position it appears but san-nin-de ‘in three’ in (42b) can be. He goes farther and suggests that the mere existence of the adverbial counterpart san-nin-de indicates that san-nin is not adverbial. Though he fails to mention it, we note that (42b) has only the collective interpretation as indicated in the gloss and is not equivalent to a sentence with a simple floating numeral classifier, such as san-nin.

(42) a. *Gakusei-ga Taroo -o san-nin but-ta
        student-nom -acc three hit-past
    ‘(INT.) Three students hit Taroo’

b. Gakusei-ga Taroo -o san-nin-de but-ta
    student-nom -acc three-in hit-past
    ‘Three students hit Taroo together’

He claims that the evidence based on the orientational as well as distributional properties seen in (41) and (42) indicates that numeral classifiers and other adverbs are not the same kind of objects. Hence it is implausible to treat both of them under a uniform adverbial analysis.

We note the following two points with respect to Ueda’s claim. First, his argument goes through if thematic orientations of adverbs with respect to the active/passive opposition is shown to be an crucial attribute which separates all adverbs from floating numeral classifiers in the language. Second, it is the case that, if a new adverb is derived from a given derivational source (i.e. another adverb), it shares the same distributional properties as its source.
The first point is demonstrated to be false. Let us observe that adverbs in Japanese do not form a single natural class in terms of thematical orientational properties suggested by Ueda. Take an example like (43a) which includes the agent oriented adverb *kasikokumo* 'cleverly' which only goes with the grammatical subject *Taroo-ga*. When this sentence is passivised as in (43b), the thematic orientation of the adverb is distinct from the one in (43a) in that the adverb does not go with the original agent *Taroo-ni* anymore but instead goes with the grammatical subject *Hanako-ga*. (The position of the adverb does not affect the interpretation of (43).)

(43) a. *Taroo-ga* kasikokumo Hanako-o engoisi-ta
   -nom cleverly -acc support-past
   'Cleverly Taroo supported Hanako' (Only Taroo is clever)

   b. Hanako-ga kasikokumo Taroo-ni engoare-ta
   -nom cleverly -dat support-past
   'Cleverly Hanako was supported by Taroo' (Only Hanako is clever)

In light of these examples, the contrast between (41a) and (40a) on the one hand and (41b) and (40b) on the other does not come as a surprise at all. Contrary to what is claimed by him, not all adverbs retain the same thematic orientation when the sentence in which they appear is passivised.

Moving on to the second point, we immediately see that there is no reason to suppose that one form of an adverb and its derivational adverbial counterpart share the same distributional properties. This means that a floating numeral classifier *san-nin* in (42a) and its derivational counterpart *san­nin-de* in (42b) do not have to share the same distribution for both of them to qualify as adverbs. This is plausible since the two are morphologically distinct and do not share the identical meaning as noted above. But if his claim is true then all derived forms of adverbs and their derivational sources have to show the identical distribution. The falsity of this claim is demonstrated with the example in (44). It is observed that the distribution of the two adverbs in question *issyuukan* 'one week' and *issyuukan-de* 'in one week' is regulated by the compatibility with the cooccurring predicates *gamansi-ta* 'endured' and *hutot-ta* 'became fat', respectively.

(44) a. *Taroo-ga* itami-o issyuukan gamansi-ta
   -nom tomorrow one week endure-past
   'Taroo endured a pain for one week'

   b. *Taroo-ga* itami-o issyuukan-de gamansi-ta
   -nom tomorrow one week endure-past
   '*(INT.)* Taroo endured a pain in one week'
It may be objected that the situation in (44) is not quite parallel to the distributional discrepancy in (41) between floating numeral classifiers and their adverbial counterparts elaborated here as (45) vs. (46). One might point out that it is only the placement of the two in the post object position that makes a difference.

(45) a. San-nin gakusei-ga Taroo-o but-ta
    three student-nom -acc hit-past
    ‘Three students hit Taroo’

   b. Gakusei-ga san-nin Taroo-o but-ta

   c. *Gakusei-ga Taroo-o san-nin but-ta

(46) a. San-nin-de gakusei-ga Taroo-o but-ta
    three-in student-nom -acc hit-past
    ‘Three students hit Taroo together’

   b. Gakusei-ga san-nin-de Taroo-o but-ta

   c. Gakusei-ga Taroo-o san-nin-de but-ta

However, it is instructive to see that two related adverbial forms do indeed show an analogous distributional contrast seen in (46) vs. (46). The examples appear in (47) and (48). In these examples the two adverbs are both agent oriented. Similar facts are found in Hasegawa (1980).10

(47) a. Izimasii-koto-ni Hanako -ga wairo-o yookyuusi-ta
    greedily -nom bribe-acc demand-past
    ‘Hanako demanded a bribe greedily’

   b. Hanako-ga izimasii-koto-ni wairo-o yookyuusi-ta

   c. *?Hanako-ga wairo-o izimasii-koto-ni yookyuusi-ta

10It is noted that izimasii-koto-ni in (47) not only describes how Hanako demanded a bribe but also represents the speaker’s (negative) value judgement about what she did. Izimasii-ka in (48) does not have the second function.
(48) a. Izimasii-ku Hanako-ga waivo-o yookyuusi-ta
greedily -nom bribe-acc demand-past
'Hanako demanded a bribe greedily'
b. Hanako-ga izimasii-ku wairo-o yookyuusi-ta
c. Hanako-ga wairo-o izimasii-ku yookyuusi-ta

It has been shown that Ueda's argument against an adverbial analysis for floating numeral classifiers does not extend consistently to a wider range of facts about Japanese adverbs. Together with the evidence presented in Section 2 above, this strengthens the position taken in this thesis which maintains the adverbial nature of floating numeral classifiers.

3.5 Quantifier Scope

3.5.1 Scope Ambiguity

A floating numeral classifier and other cooccurring quantifiers make a sentence ambiguous. This is demonstrated in (49) and (50) with a universal quantifier in the subject and the object positions, respectively. (Caveat: here and below we only consider the interpretation of sentences where the combination of a numeral classifier and its construee common noun is taken to be collective and not distributive. The present system does not account for the distributive interpretation.) Note that the numeral classifier san-nin in (49) and (50) does not have to be in the position shown in the examples to get the indicated two interpretations.

(49) a. Kono kurasu-no dono otoko-mo onna-o san-nin kusugut-ta
   this class-gen which man-and woman-acc three tickle-past
   b. 'For each man in this class there is a group of three women such that he tickled them'
c. 'There is one group of three women the members of which were tickled by every man in this class'

(50) a. Onna-ga san-nin kono kurasu-no dono otoko-mo karakat-ta
   woman-nom three this class-gen which man-and tease-past
   b. 'For each man in this class there is a group of three women such that they teased him'
c. 'There is one group of three women the members of which teased every man in this class'
At first blush, these examples seem to be difficult to accommodate due to the fact that the numeral classifier san-nin ‘three’ and its common noun construee onna-o/-ga ‘women’ do not form a constituent as is also obvious from the examples given above. This makes floating numeral classifiers not readily amenable to familiar strategies of quantifier scope in the literature, e.g. quantifying-in (Montague 1974), Cooper store (Cooper 1983)\(^1\), or quantifier raising in LF (May 1977). For example, it is not clear how we can employ the quantifying-in approach for the analysis of scope ambiguity involving floating numeral classifiers. It is a quantifier of type \(<< e, t >, t >\) that is quantified in. But floating numeral classifiers have been shown to be adverbial modifiers and not quantifiers, making it necessary to formulate a separate rule to quantify in an adverb. This may not be impossible to do but the status of such a rule is unclear. In any event we will end up adding an arbitrary new rule to the system.

Alternatively, we may resort to quantifier raising in LF. According to this approach a floating numeral classifier will be raised to some position leaving a variable in its trace. This on the one hand unambiguously represents the scopal relationship between the numeral classifier and other quantificational elements in a given sentence but on the other hand has nothing to say about the semantic relationship between the numeral classifier (or other quantifiers for that matter) and the numeral classifier’s construee. Thus the validity of such an approach depends on a plausible theory of the semantic relationship between an numeral classifier and its construee.\(^2\)

In contrast the account proposed in this section not only avoids employing unnecessary devices/rules but also overcomes the empirical difficulty mentioned above. The account utilizes the Quantification Calculus (QC) developed by Hendriks (1987) which is strongly motivated on the ground that it makes possible the synthesis between two seemingly incompatible semantic approaches: Type Driven Translation (Klein and Sag 1985) and type ambiguity (Partee and Rooth 1983; Partee 1987).\(^3\) The semantic system presented in Chapter 2 above serves as a base into which Hendriks’s system can be incorporated naturally.

\(^1\)See Hendriks (1987) for criticisms of these two approaches.
\(^2\)Miyagawa (1989) proposes another LF account for similar facts which seems to extend to the other floating numeral classifiers. He assumes that \(WH\)-numeral classifiers like san-nin ‘how many’ in Otoko-ga san-nin tui-ta-ka ‘How many men arrived?’ is raised to COMP in LF together with the subject otoko-ga ‘men’. Such a proposal seems to be hard to implement due to the difficulty mentioned in the text. There can be an arbitrary number of elements in between the numeral classifier and its construee as seen in: Otoko-ga miti-ni mezoi-tate kinsu koko-ni yatte-no omoide san-nin tui-ta-ka ‘How many men arrived here yesterday, wondering, and with a lot of effort’.
\(^3\)See Hendriks (1987) for discussion on ‘Flexible Montague Grammar’. The reader will benefit from consulting Oehrle’s (1990) concise introduction to this approach with respect to quantifier scope. Also Moortgat (1990) recasts Hendriks’ system in a cut-free system to maintain decidability, which is absent in the original.
3.5.2 Quantification Calculus

The QC is an axiom base for semantic type transitions with the following three axioms and a rule.
('ii' below indicates that we can have zero or more a's.):

(51) Quantification Calculus

axioms:

I. value raising

\[(\bar{a}, b) : \lambda \bar{x} \bar{z} \cdot x(a, b) (\bar{z}) \implies (\bar{a}, ((b, c), c)) : \lambda \bar{x} \bar{y} \cdot y(z(a, b) (\bar{z})) \]

II. argument raising

\[(\bar{a}, (b, (\bar{c}, t))) : \lambda \bar{x} \bar{y} \cdot \lambda \bar{z} \cdot w(x(a, (\bar{c}, t))) (\bar{y})(\bar{z})(\bar{y}) \implies (\bar{a}, (((b, t), t), (\bar{c}, t))) : \lambda \bar{x} \bar{y} \cdot \lambda \bar{z} \cdot w(x(a, (\bar{c}, t))) (\bar{y})(\bar{z})(\bar{y}) \]

III. argument lowering

\[(\bar{a}, (((b, t), t), d)) : \lambda \bar{x} \bar{y} \cdot \lambda \bar{z} \cdot z(x((b, t), t), d) (\bar{y})(\bar{z})(\bar{y}) \implies (\bar{x}, (b, d)) : \lambda \bar{x} \bar{y} \cdot \lambda \bar{z} \cdot z(x((b, t), t), d) (\bar{y})(\bar{z})(\bar{y}) \]

rule:

IV. if \(a \implies b : \tau_b < x_a >\), and \(b \implies c : \tau_c < y_b >\),
then \(a \implies c : \tau_a [x_b : = \tau_b] \)

The QC enables us to postulate a basic type system with only first order types. However, as needs arise for higher type elements, these elements are made available from the first order sources via type transition. The quantifier scope account presented below makes heavy use of the axiom II, argument raising.

3.5.3 The Quantification Calculus and Quantifier Scope

Let us first witness the account of quantifier scope employing the QC with actual examples which do not involve floating numeral classifiers. This sub-section also serves to work out a transition from the original semantic system introduced in Chapter 2 to a new semantic system with the QC. We start out with the basic type system in (52) (a revision of (46) in Chapter 2) and the basic vocabulary (corresponding to (52b-j)) given in (53) with translations. (Note: \(X\) is a variable over either \(e\) or \(< e, t >, t >\); \(\alpha\) ranges over either \(e, < e, t >, \) or \(< e, t >, t >\).)
(52) Basic Semantic Types

a. \( \text{TYP}_B(S) = t \quad (S') \)
b. \( \text{TYP}_B(IVP) = <e,t> \quad (IVP') \)
c. \( \text{TYP}_B(TVP) = <e,<e,t>> \quad (TVP') \)
d. \( \text{TYP}_B(CN) = <e,t> \quad (CN') \)
e. \( \text{TYP}_B(NP) = e \quad (NP') \)
f. \( \text{TYP}_B(P) = <\alpha,\alpha> \quad (P') \)
g. \( \text{TYP}_B(SOC) = <<<X,t>,<<e,t>>,t>> \quad (SOC') \)
h. \( \text{TYP}_B(DOC) = <<<X,<<X,t>>,<<e,t>>,<<X,t>>> \quad (DOC') \)
i. \( \text{TYP}_B(WH-MO) = <<<e,t>>,<<e,t>>,t>> \quad (WH-MO') \)
j. \( \text{TYP}_B(WH-KA) = <<<e,t>>,<<e,t>>,t>> \quad (WH-KA') \)

(53) Basic Vocabulary

a. \( \emptyset \)
b. ku 'come' \( \lambda x. ku'(x) \)
c. ukar 'pass' \( \lambda x y. ukar'(x)(y) \)
kusugur 'tickle' \( \lambda x y. kusugur'(x)(y) \)
d. gakusei 'student' \( \lambda x. gakusei'(x) \)
onna 'woman' \( \lambda x. onna'(x) \)
e. Hanako \( h \)
f. ga, o, ni \( \lambda \alpha. \alpha \) (i.e. an identity function)
g. san-nin 'three' \( \lambda W. \lambda P. W(\lambda Q. | P \cap Q | \geq 3 & P \subset \text{nin}') \)
(\( \text{TYP}(W) = <X,t> \))
h. go-nin 'five' \( \lambda W. \lambda P. W(\lambda Q. | P \cap Q | \geq 5 & P \subset \text{nin}') \)
(\( \text{TYP}(W) = <X,<<X,t>>,t>> \))
i. dono-CN-mo 'wh-CN-and' \( \lambda P. Q \forall z(P(z) \rightarrow Q(z)) \)
j. dono-CN-ka 'wh-CN-or' \( \lambda P. Q \exists z(P(z) & Q(z)) \)

In (54a) is an ambiguous sentence with two readings (54b,c).

(54) a. Dono-gakusei-mo dono-siken-ni ukat-ta
    which-student-and which-exam-or-dat pass-past
    'Every student passed some exam'
b. \( \forall z(\text{gakusei}'(z) \rightarrow \exists y(\text{siken}'(y) & \text{ukatta}'(y)(z))) \)
c. \( \exists y(\text{siken}'(y) & \forall z(\text{gakusei}'(z) \rightarrow \text{ukatta}'(y)(z))) \)
The two readings are made available by the applications of argument raising, which provides exactly two non-equivalent ways to raise the two arguments of the predicate *ukatta* 'passed' in (54a). The processes are demonstrated in (55a,b) which correspond to (54b,c), respectively. (Note: 'T' in the examples below is a type for a type raised NP, such as $\lambda P.P(a)$.)

(55) Application of Argument Raising

a. $< e, < e, t > \implies < T, < e, t >$: $\lambda T_1 \lambda z. T_1(\lambda y. ukatta'(y)(z))$
   
   $\lambda T_1 \lambda T_2. T_2(\lambda z. T_1(\lambda y. ukatta'(y)(z)))$

b. $< e, < e, t > \implies < e, < T, t >$: $\lambda y \lambda T_2. T_2(\lambda z. ukatta'(y)(z))$
   
   $\lambda T_1 \lambda T_2. T_1(\lambda y. T_2(\lambda z. ukatta'(y)(z)))$

Now if we apply the second lines in (55a,b) to *dono-siken-ka* and *dono-gakusei-mo* we obtain the desired readings in (54b,c).

We now move onto the account of scope ambiguity involving floating numeral classifiers as promised above. Our first example sentence is (49a) (repeated). To make the presentation simple, I leave out the parenthesized items from the translation for the sake of ease of exposition. We are to obtain the readings in (57a,b).

(56) (Kono kurasu-no) dono otoko-mo onna-o san-nin kusugut-ta
   
   (this class-gen) which man-and woman-acc three tickle-past
   
   'Every man (in this class) tickled three woman'

(57) Two readings for (49a)

a. $\forall z(otoko'(z) \rightarrow \lambda z. onna'(z) \cap \lambda y. kusugutta'(y)(z)) \geq 3 \& \lambda z. onna'(z) \subseteq \text{nin}'$

b. $\lambda z. onna'(z) \cap \lambda y. \forall z(otoko'(z) \rightarrow kusugutta'(y)(z)) \geq 3 \& \lambda z. onna'(z) \subseteq \text{nin}'$

To obtain (57b), we begin with the application of argument raising to the first argument of the two-place predicate *kusugutta* 'tickled' whose semantic translation is: $\lambda y \lambda z. kusugutta'(y)(z)$. This will give us (58).

(58) First Argument Raising

$<< e, < e, t >> \implies < T, < e, t >>: \lambda T_1 \lambda z. T_1(\lambda y. kusugutta'(y)(z))$

To (58) we apply argument raising again but this time to the second argument:

(59) Second Argument Raising
The argument raised predicate in (59) will be taken by the numeral classifier (DOC) san-nin. Successive functional application and reduction obtains (60h).

(60) Complete Translation of (49b)

a. san-nin kusugut-ta:
   \[ \lambda W. \lambda P. W(\lambda Q. | P \cap Q | \geq 3 & P \subseteq \text{nin'})(\lambda T_1 \lambda T_2. T_2(\lambda x. T_1(\lambda y. kusugutta'(y)(x)))) \]

b. conversion:
   \[ \lambda P. \lambda T_1 \lambda T_2. T_2(\lambda x. T_1(\lambda y. kusugutta'(y)(x)))(\lambda Q. | P \cap Q | \geq 3 & P \subseteq \text{nin'}) \]

c. conversion:
   \[ \lambda P. \lambda T_2. T_2(\lambda x. | P \cap \lambda y. kusugutta'(y)(x) | \geq 3 & P \subseteq \text{nin'}) \]

d. conversion \((TVP_c')\):
   \[ \lambda P. \lambda T_2. T_2(\lambda x. | \lambda y. kusugutta'(y)(x)(z) | \geq 3 & P \subseteq \text{nin'}) \]

e. onna-o san-nin kusugu-ta:
   \[ \lambda P. \lambda T_2. T_2(\lambda x. | P \cap \lambda y. kusugutta'(y)(z) | \geq 3 & P \subseteq \text{nin'})(\lambda z. \text{onna'}(z)) \]

f. conversion \((IVP')\):
   \[ \lambda T_2. T_2(\lambda x. | \lambda z. \text{onna'}(z) \cap \lambda y. kusugutta'(y)(z) | \geq 3 & P \subseteq \text{nin'}) \]

g. dono otoko-mo onna-o san-nin kusugu-ta:
   \[ \lambda Q \forall z(otoko'(z) \rightarrow Q(z))(\lambda x. | \lambda z. \text{onna'}(z) \cap \lambda y. kusugutta'(y)(z) | \geq 3 & \lambda z. \text{onna'}(z) \subseteq \text{nin'}) \]

h. conversion \((t)\):
   \[ \forall z(otoko'(z) \rightarrow | \lambda z. \text{onna'}(z) \cap \lambda y. kusugutta'(y)(z) | \geq 3 & \lambda z. \text{onna'}(z) \subseteq \text{nin'}) \]

The reading in (49c) is gotten similarly but this time the application of argument raising starts with the second argument of the predicate as in (61).

(61) Second Argument Raising

\[ < c, e, t > > \implies < c, < T, t > >: \lambda y \lambda T_2. T_2(\lambda x. kusugutta'(y)(x)) \]

Then it raises the first argument, yielding (62).

(62) First Argument Raising
\[ <e, <T, t >> \implies <T, <T, t >> \lambda T_1 \lambda T_2 T_1(\lambda y.T_2(\lambda z.\text{kusugutta}'(y)(x))) \]

(62) will be applied to the numeral classifier (DOC) san-nin and successive reduction will produce (63).

(63) Translation for (49c)
\[ | \lambda z.\text{onna}'(z) \cap \lambda y.\forall z (\text{otoko}'(z) \rightarrow \text{kusugutta}'(y)(x)) | \geq 3 \& \lambda z.\text{onna}'(z) \subseteq \text{nin}' \]

(50a) above which is also ambiguous will get translated similarly, yielding two distinct scopal interpretations. The reader is invited to verify this.

### 3.6 Summary

In this chapter we have seen the plausibility of taking floating numeral classifiers to be adverbs of quantification (though not the unselective binders of Lewis 1975) which semantically relate a common noun meaning and a (T)VP meaning by syntactically combining with the (T)VP first. Also provided were the specifics of the extended semantic account covering the wider range of data which motivated the adverbial analysis. A principled extension of the semantic account given in Chapter 2 has been shown to be possible and the semantic facts hitherto unaccounted for has been given appropriate treatments. The range of the semantic facts encompasses quantifier scope ambiguity involving floating numeral classifiers as well.
Chapter 4

Floating Universal Quantifiers

4.1 Introduction

Extending the coverage of the proposed system further, in this chapter we investigate and provide an account for the syntactic and semantic properties of floating universal quantifiers such as zen-in 'all' and zen-bu 'all'. Though it is not in accord with Barwise and Cooper's (B&C) (1981) terminology, we refer to these universal quantificational elements as '(floating) universal quantifiers' in this chapter. To avoid confusions, when reference is made to a Generalized Quantifier (GQ), it will be clearly indicated.

What is demonstrated is the following. Sections 2 and 3 describe the distribution of the universal quantifier zen-in by dividing the cases into two: basic cases where the universal quantifier occurs alone in a given sentence and mixed cases where the universal quantifier cooccurs with a floating numeral classifier and both are construed to a single common noun. It will be shown that universal floating quantifiers, unlike floating numeral classifiers, have less restricted ordering possibilities. Syntactic and semantic solutions for the additional range of data is provided in Sections 4 and 5. The account given extends the syntactic and semantic approach devised independently for floating numeral classifiers in the previous chapters. After examining some predictions and consequences of the extended account, the issue of scrambling is going to be entertained again in Section 6. The fact that we are mixing regular scrambling and the distribution of both floating numeral classifiers and floating universal quantifier makes the magnitude of the problem immense. Nevertheless, it will be shown that the present system can handle these complex cases in a principled way.
4.1.1 Floating Universal Quantifiers

Universal quantification in Japanese can be achieved with floating universal quantifiers which consist of an element with a universal quantificational force zen 'all' and a classifier. For example, (1) shows two instances of floating universal quantifiers, the former of which is accompanied by a classifier -in '['human']member' and the latter by -bu 'part'.

(1) a. zen -in
   all -[human]member
   'all'

b. zen -bu
   all -part
   'all'

It is interesting to note that the class of classifiers which combine with regular numerals and the class of classifiers which go with a universal quantifier seem to be mutually exclusive. So classifiers for numerals (e.g. san 'three' and roku 'six') seen in the previous two chapters do not combine to form a universal quantifier, as seen in the contrast between (2a) and (2b). Also as can be seen in (2c) the regular numerals do not go together with the classifiers for the universal quantifiers either.

(2) a. san -nin/ -mai
    three -person/-flat object
    'three'

b. *zen -nin/ -mai
   all -person/-flat-object
   '(INT.) all'

c. *san -in/ -bu
    three -member/-part
    '(INT.) three'

d. zen -in/ -bu (=1a,b))
   all -member/-part
   'all'
4.2 Basic Cases

Since zen-in and zen-bu show the same distribution, we take the former and examine its properties. The distribution pattern displayed by floating universal quantifiers is different from that of floating numeral classifiers in that, generally, the distribution of the former is more flexible than that of the latter. The distinction can be summarized as below. First, a common noun functioning as an indirect object in a given sentence can be a construee of the universal quantifiers while this is not at all the case with the numeral classifiers. Second, the universal quantifiers do not show the asymmetric ordering restriction observed with the numeral classifiers regardless of whether they are construed to a subject or a direct object or an indirect object for that matter. However, despite these differences, it should also be noted that even for the universal quantifier, construal to adjuncts is not possible just as with the numeral classifiers.

The exposition in this section proceeds by dividing cases into three main categories: subject construal, direct and indirect object construal, and adjunct construal. For the data set in this section as well as in the next we ignore word order variation (scrambling phenomena) except for the order of the quantificational elements. (See Section 6 below for the discussion on what is predicted about scrambling involving floating universal quantifiers.)

4.2.1 Subject Construal

4.2.1.1 Intransitive S's

In intransitive sentences like (3) the floating universal quantifier zen-in 'all' can be placed at any preverbal position and be construed to the subject gakusei-ga 'students'. As was also the case with floating numeral classifiers, there are other possibilities concerning the use of the universal quantifier, namely, as a prenominal modifier (3c) and a part of a morphological nominal compound (3d). In these instances the universal quantifiers are NP internal. Cases like (3c,d) are not going to be discussed here any further.

(3) a. Zen-in gakusei-ga ki-ta
   all student-no come-past
   'All students came'

b. Gakusei-ga zen-in ki-ta

c. \[ NP \text{ Zen-in-no gakusei}-ga \] ki-ta

d. \[ NP \text{ Gakusei-zen-in}-ga \] ki-ta
4.2.1.2 (Di)transitive S's

As noted above, the construal pattern involving universal quantifiers differs from the cases with numeral classifiers. Thus it is possible for the subject gakusei-ga to be the construee of zen-in in any preverbal position.

(4) a. Zen-in gakusei-ga hon-o ka-ta
   all student-nom book-acc buy-past
   'All students bought a book'

b. Gakusei-ga zen-in hon-o ka-ta

c. Gakusei-ga hon-o zen-in ka-ta

It is interesting to compare the pattern in (4) with the one in (5) which is already a familiar one from Chapter 2. The crucial case is (5c) in which the numeral classifier san-nin 'three' cannot be subject oriented.

(5) a. San-nin gakusei-ga hon-o ka-ta
   three student-nom book-acc buy-past
   'Three students bought a book'

b. Gakusei-ga san-nin hon-o ka-ta

c. *Gakusei-ga hon-o san-nin ka-ta

The free ordering pattern of a subject oriented universal quantifier can further be illustrated with the following data with a ditransitive sentence.

(6) a. Zen-in gakusei-ga hon-o Hanako-ni okut-ta
   all student-nom book-acc -dat send-past
   'All students sent a book to Hanako'

b. Gakusei-ga zen-in hon-o Hanako-ni okut-ta

c. Gakusei-ga hon-o zen-in Hanako-ni okut-ta

d. Gakusei-ga hon-o Hanako-ni zen-in okut-ta

What is observed is that, again, a free construal pattern between the subject gakusei-ga and the universal quantifier zen-in. In contrast, numeral classifiers occurring in the same positions as in (7c,d) are not able to have the subject as their construees.
(7) a. Go-nin gakusei-ga hon-o Hanako-ni okut-ta
   five student-nom book-acc -dat send-past
   ‘Five students sent a book to Hanako’

b. Gakusei-ga go-nin hon-o Hanako-ni okut-ta

c. *Gakusei-ga hon-o go-nin Hanako-ni okut-ta

d. *Gakusei-ga hon-o Hanako-ni go-nin okut-ta

In summary, the universal quantifier zen-in can go together with the subject regardless of the positions in which it appears.

4.2.2 Object Construal in (Di)transitive S’s

The universal quantifier zen-in can be direct object oriented in (8). With respect to the direct object construal, numeral classifiers and universal quantifiers display identical patterns.¹

(8) a. Zen-in Taroo-ga sensei-o but-ta
   all -nom teacher-acc hit-past
   ‘Taroo hit all teachers’

b. Taroo-ga zen-in sensei-o but-ta

c. Taroo-ga sensei-o zen-in but-ta

The sharp contrast between floating universal quantifiers and floating numeral classifiers can be witnessed in sentences with ditransitive verbs. One such example is (9) where the universal quantifier zen-in can be indirect object oriented being construed to the indirect object sensei-ni ‘to teachers’ from any preverbal position. ((9b) needs indicated pauses and a strong stress on both zen-in and sensei-ni.)

(9) a. Zen-in, Taroo-ga hon-o sensei-ni okut-ta
   all -nom book-acc teacher-dat send-past
   ‘Taroo sent a book to all teachers’

b. ?Taroo-ga, zen-in, hon-o sensei-ni okut-ta

c. Taroo-ga hon-o zen-in sensei-ni okut-ta

¹In some examples that follow it is difficult to get a desired reading without appropriate pauses. This is partially due to the fact that the universal quantifier zen-in (or numeral classifiers) tends to go together with the closest possible common noun construee when there are multiple potential construees in a given sentence.
d. Taroo-ga hon-o sensei-ni zen-in okut-ta

As we recall, a numeral classifier in a floating position in the sentence is not able to be construed to an indirect object. E.g. (10).

(10) a. *Roku-nin, Taroo-ga hon-o sensei-ni okut-ta
    six -nom book-acc teacher-dat send-past
    'Taroo sent a book to six teachers'
b. *Taroo-ga, roku-nin, hon-o sensei-ni okut-ta
c. *Taroo-ga hon-o roku-nin sensei-ni okut-ta
d. *Taroo-ga hon-o sensei-ni roku-nin okut-ta

In this subsection it has been shown that the universal quantifier zen-in can be object oriented as well as indirect object oriented regardless of the positions it appears in the sentence. Adding the subject construal cases above, we could speculate that a potential construee of the universal quantifier zen-in is a complement. This claim turns out to be true when we consider sentences containing adjuncts.

4.2.3 Adjunct Construal

With NP-external (thus floating) numeral classifiers seen in the previous chapters, we do not obtain construal with adjuncts at all. This impossibility of adjunct construal found with floating numeral classifiers simply extends to the cases involving floating universal quantifiers. In (11) and (12) the NP-external universal quantifier zen-in can never be adjunct oriented and construed to onna-kara 'from women' and heisi-de 'with soldiers'.

(11) a. *Zen-in, Taroo-ga onna-kara nige-ta
    all -nom woman-from escape-past
    '(INT.) Taroo run away from all women'
b. *Taroo-ga zen-in onna-kara nige-ta
c. *Taroo-ga onna-kara zen-in nige-ta
d. Taroo-ga [NP zen-in-no onna]-kara nige-ta

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FOLLOWING THE ANALYSIS GIVEN IN CHAPTER 2, WE COULD SAY THAT THE ELEMENT ON THE SUBCAT LIST ARE POTENTIAL CONSTRUEES.
For adjunct orientations to be possible, for example, these quantifiers have to be internal to adjunct phrases and be accompanied by the genitive marker -no as (11d) and (12d) demonstrate. In accord with what is claimed in Dowty and Brodie (1984), it seems to be the case that floating quantifier phenomena in Japanese are also sensitive to the distinction between complements and adjuncts. With respect to Japanese floating quantifiers in general, a major division (in terms of the construal possibility) appears between complements and adjuncts. With respect to floating numeral classifiers (a subcategory of floating quantifiers), a finer division occurs between subjects and direct objects on the one hand and indirect objects on the other.

4.3 Mixed Cases

In the previous section we have noted some distributional dissimilarities between floating universal quantifiers and floating numeral classifiers. This section investigates what happens when both types are placed in a single sentence and used to quantify a single common noun. It is expected that the distributional pattern will be determined as a function of distinct syntactic and semantic properties of interacting universal quantifiers and numeral classifiers. This expectation is shown to be generally well-founded. However, there are two distinct distributional patterns that are to be observed. First, in some instances the universal quantifier-numeral classifier combination seems to form some sort of a coherent unit or constituent. When this happens, the unit shows the identical syntactic properties of the universal quantifier already introduced above. Second, in other instances when the two quantificational elements are separate, they show two distinct syntactic properties associated with each of them. Let us see some examples.
4.3.1 Subject Construal

4.3.1.1 Intransitive S's

With intransitive sentences in (13) the universal quantifier zen-in and the numeral classifier san-nin can be used in a single sentence as subject oriented floating quantifiers. It should be noted that they do not have to be adjacent to each other as the appearance of the optional adverbial element kinoo 'yesterday' between the two attests. This seems to exclude the possibility of forming a complex compound quantificational element morphologically, say, in the lexicon.

(13) a. Gakusei-ga san-nin kinoo zen-in ki-ta
     student-nom three yesterday all come-past
     'All three students came yesterday'
b. San-nin kinoo zen-in gakusei-ga ki-ta
c. San-nin gakusei-ga kinoo zen-in ki-ta
d. Gakusei-ga kinoo san-nin zen-in ki-ta

Note that in (13) it is the case that the numeral classifier san-nin always precedes the universal quantifier zen-in. What is unexpected is the fact that when the universal quantifier precedes the numeral classifier, the sentences are not good at all as can be seen in (14).

(14) a. *Gakusei-ga zen-in kinoo san-nin ki-ta
     b. *Zen-in kinoo san-nin gakusei-ga ki-ta
     c. *Zen-in gakusei-ga kinoo san-nin ki-ta
     d. *Gakusei-ga kinoo zen-in san-nin ki-ta

This is quite surprising in light of examples we have already seen in the previous section, namely, the cases with zen-in occurring alone at various positions in a sentence inclusive of the initial position. Since this ordering restriction holds for the subject construal cases in (di)transitive sentences as well, the data showing the same restriction will not be given for the rest of the subject construal cases.

4.3.1.2 (Di)transitive S's

In a transitive sentence like (15) the 'quantifier sequence' san-nin kinoo zen-in can be placed at the sentence initial, the post subject, and the post direct object positions, respectively. (The adverbial kinoo is optional in (15).) In all these cases it is possible to get subject construal of the quantifier
sequence. In (15a) it is surprising to see that the numeral classifier *san-nin* can be construed back to the subject *gakusei-ga* crossing over the direct object *Hanako-o*. This construal pattern is one of the impossible ones for numeral classifiers.

(15) a. *Gakusei-ga Hanako -o san-nin kinoo zen-in but-ta*
   student-nom -acc three yesterday all hit-past
   'All three students hit Hanako yesterday'

b. *San-nin kinoo zen-in gakusei-ga Hanako-o but-ta*

c. *Gakusei-ga san-nin kinoo zen-in Hanako-o but-ta*

It is also possible to separate the two quantificational elements (provided that we observe the restriction on the placement of the universal quantifier seen above) and place them at various positions as done in (16).

(16) a. *San-nin gakusei-ga zen-in Hanako-o kinoo but-ta*

b. *San-nin gakusei-ga Hanako-o zen-in kinoo but-ta*

c. *San-nin gakusei-ga Hanako-o kinoo zen-in but-ta*

d. *Gakusei-ga san-nin Hanako-o zen-in kinoo but-ta*

e. *Gakusei-ga san-nin Hanako-o kinoo zen-in but-ta*

f. *Gakusei-ga Hanako-o kinoo san-nin zen-in but-ta*

However, we have to bring in examples with ditransitive sentences to show the full effect of mixing the two quantificational elements in a single sentence. In (17) and (18) are two sets of data which show the interactive effect better. As was the case with the transitive sentences above, the quantifier sequence can be interspersed between the subject, direct, and indirect objects in (17). Again when we consider the restriction on the distribution of subject oriented numeral classifiers, the data in (17a,d) will come as surprise, since from the post direct object and indirect object positions a floating numeral classifier could not be construed back to subject crossing over either of them.

(17) a. *Gakusei-ga hon-o Hanako -ni san-nin kinoo zen-in okut-ta*
   student-nom book-acc -dat three yesterday all send-past
   'All three students sent a book to Hanako yesterday'

b. *San-nin kinoo zen-in gakusei-ga hon-o Hanako-ni okut-ta*
c. Gakusei-ga san-nin kinoo zen-in hon-o Hanako-ni okut-ta

d. Gakusei-ga hon-o san-nin kinoo zen-in Hanako-ni okut-ta

In (18), we witness that the separation of the two quantificational elements allows the distinctive properties associated with each of them to emerge. (Hereafter, the optional adverbial kinoo is not included in the data to make the exposition simpler.) For example, in (18f) where the numeral classifier san-nin occurs alone between the direct object hon-o and the indirect object Hanako-ni, the construal between san-nin and gakusei-ga is not possible as expected.

(18) a. San-nin gakusei-ga zen-in hon-o Hanako-ni okut-ta

b. San-nin gakusei-ga hon-o zen-in Hanako-ni okut-ta

c. San-nin gakusei-ga hon-o Hanako-ni zen-in okut-ta

d. Gakusei-ga san-nin hon-o zen-in Hanako-ni okut-ta

e. Gakusei-ga san-nin hon-o Hanako-ni zen-in okut-ta

f. *Gakusei-ga hon-o san-nin Hanako-ni zen-in okut-ta

In summary, mixing a numeral classifier and a universal quantifier within a single sentence creates a curious non-uniformity with respect to the word order. When the quantifier sequence is preserved, it is possible to place them at any preverbal position in the sentence just as it is possible to do when zen-in appears alone. But when the sequence is broken up, the ordering restriction associated with a floating numeral classifier has to be obeyed (in addition to the prohibition on zen-in preceding a numeral classifier).

4.3.2 Object Construal

In this subsection we examine cases involving transitive and ditransitive sentences with respect to object construal. The two contrasting patterns observed above (i.e. the quantifier sequence vs. the separated occurrences) will be found with object construal cases as well.

4.3.2.1 Transitive S's

The quantifier sequence san-nin zen-in can occur at any preverbal position in (19a-c). (19d-e) show that san-nin can be separated away from zen-in and the ordering we see here is what is expected if we take the syntactic property of a direct object oriented numeral classifier into account.
(19) a. Taroo-ga sensei-o san-nin zen-in but-ta
   -nom teacher-acc three all hit-past
   'Taroo hit all three teachers'
b. San-nin zen-in, Taroo-ga sensei-o but-ta
c. Taroo-ga san-nin zen-in sensei-o but-ta
d. San-nin Taroo-ga sensei-o zen-in but-ta
e. Taroo-ga san-nin sensei-o zen-in but-ta

Even with the direct object construal the peculiar ordering restriction excludes all the cases when zen-in precedes san-nin regardless of whether they are adjacent or not. (20) demonstrates this fact.

(20) a. *Zen-in san-nin, Taroo-ga sensei-o but-ta
   b. *Zen-in, Taroo-ga san-nin sensei-o but-ta
   c. *Zen-in, Taroo-ga sensei-o san-nin but-ta
d. *Taroo-ga zen-in san-nin sensei-o but-ta
e. *Taroo-ga zen-in sensei-o san-nin but-ta
f. *Taroo-ga sensei-o zen-in san-nin but-ta

4.3.2.2 Ditransitive S's

Sentences in (21) contain the quantifier sequence san-nin zen-in appearing at all preverbal positions. In all these instances, the sequence can be indirect object oriented. (In (21c) san-nin zen-in and sensei-ni have to be stressed to get the intended construal.)

(21) a. Taroo-ga hon-o sensei-ni san-nin zen-in okut-a
   -nom book-acc teacher-dat three all send-past
   'Taroo sent a book to all teachers'
b. San-nin zen-in, Taroo-ga hon-o sensei-ni okut-ta
c. Taroo-ga, san-nin zen-in, hon-o sensei-ni okut-ta
d. Taroo-ga hon-o san-nin zen-in sensei-ni okut-ta
When the sequence is broken up, the numeral classifier *san-nin cannot be indirect object oriented, regardless of its position. (22a-f) indicate that even when *san-nin precedes *zen-in the intended construal is impossible. The partial data in (22g-i) show (not surprisingly) that *zen-in cannot precede *san-nin.

(22) a. *San-nin Taroo-ga *zen-in hon-o sensei-ni okut-ta
b. *San-nin Taroo-ga hon-o *zen-in sensei-ni okut-ta
c. *San-nin Taroo-ga hon-o sensei-ni *zen-in okut-ta
d. *Taroo-ga san-nin hon-o *zen-in sensei-ni okut-ta
e. *Taroo-ga san-nin hon-o sensei-ni *zen-in okut-ta
f. *Taroo-ga hon-o san-nin sensei-ni *zen-in okut-ta
g. *Zen-in, Taroo-ga hon-o sensei-ni san-nin okut-ta
h. *Taroo-ga *zen-in hon-o sensei-ni san-nin okut-ta
i. *Taroo-ga hon-o *zen-in sensei-ni san-nin okut-ta

4.3.3 Summary

With respect to the mixed cases, a crucial factor which determines if a given orientation of a numeral classifier is possible or not is the ways it participates in a sentence. There are two possibilities: 1) a floating universal quantifier and a floating numeral classifier forming a quantifier sequence in which numeral classifiers occur as a part of the whole sequence and 2) the separate occurrences where numeral classifiers are separated and independent from a universal quantifier. In the former case the distribution pattern seen is the identical to that of the floating universal quantifier used alone. In the latter case orientation of a numeral classifier is decided based on its independent syntactic properties.

4.4 Solutions for Basic Cases

The syntax and semantics for the universal quantification under discussion are offered in this section. The account extends the one given to floating numeral classifiers in Chapter 2 to the new set of data. We lay out the necessary syntactic and semantic devices by defining them explicitly. Some demonstrations utilizing these devices follow immediately after the definitions. In this section we
start with simple cases where the universal quantifier *zen-in* appears alone in a sentence. Then in the next section we move onto the cases involving the mixed occurrences of the two kinds of quantificational elements.

### 4.4.1 Syntax

Syntax of a universal floating quantifier follows that of floating numeral classifiers closely and we will define the following general lexical schema for it.

(23) Lexical Specification for *zen-in*

\[
\text{zen-in: \{POS ADV; SUBCAT<>, ADJUNCT V[SUBCAT<PP+>]; SEM ... \}}
\]

That is to say that *zen-in* is an adverb which SUBCATEGorizes for nothing and functions as an adjunct for some projection of a category V with the restriction that the V-projection has to SUBCAT for at least one complement. (‘PP+’ indicates that there is one or more PPs.) The semantics of this lexical entry is not specified in (23) but will be defined in the subsection immediately below. This definition allows *zen-in* to combine with an IVP, TVP, or DTVP. Thus the definition, augmented with the SLASH mechanism employed for dislocated numeral classifiers in Chapter 2, enables us to capture the fact that the order of *zen-in* is free regardless of its orientation.\(^3\) Syntactic analysis trees are not given but they are very similar to those we have seen in Chapter 2.

### 4.4.2 Semantics

Type Driven Translation as well as type assignments analogous to those found in the previous chapters are going to be assumed. The type assignments will not be given in this chapter. We employ only semantic translations to demonstrate the semantics of floating universal quantifiers. As was the case in the previous chapters, intensionality is ignored in this chapter as well. We also simplify the matter a little and assume that the type of subcategorized arguments of verbs are already raised to a quantifier type by the rule of Argument Raising introduced in the previous chapter.

In (24) the first item is the semantic translation for *zen-in* which tells us that it combines with a verb whose arity is unspecified but with a minimal requirement of one. Additionally, we need a semantic rule (the second item) given in (24) Domain Permutation that changes the order according to which each argument is taken by a given predicate. To prevent the loss of information concerning grammatical relations which may occur with the application of the semantic rule, the

\(^3\)Unfortunately, this conjecture with SLASH also over-generates in that the mixed ill-formed cases with a floating universal quantifier preceding a floating numeral classifiers. This problem is to be entertained in Subsection 5.5 below.
individual variables appearing in the translations of n-place predicates are specified with specific types. This information about grammatical relations is indicated by subscripting relevant variables, e.g. \( \text{x}_{ga} \) in \( \lambda \text{x}_{ga}.P(\text{x}_{ga}). \)

A note on the notation is in order here. Lower case letters \( x, y, z \), etc. are used for individual variables. The capital letters \( T, U, \) and \( V \) stand for type raised NPs. \( P \) and \( Q \) are used for one-place predicates. The capital letter \( W \) stands for a translation of some verbal projection. The capital letters \( X, Y, \) and \( Z \) indicate variables over unspecified categories. The notation \('X'\) indicates zero or more \( X \)'s.

(24) Semantic Translation for \textit{zen-in} and Domain Permutation

\[
\text{zen-in: } \lambda W \lambda P.W(\lambda Q.\forall v(P(v) \rightarrow Q(v))) \& P \subseteq \text{in'}
\]

where \( \text{TYP}(W) = \text{TYP}(\lambda T'\lambda U\lambda V.\lambda W.\lambda Z.\lambda v.\lambda y.\lambda Z.P(\text{Z})(y)(\text{Z}))))) \)

Rule: Domain Permutation

\[
\lambda X'\lambda Y'\lambda Z'.\varphi[X', Y', Z'] \Rightarrow \lambda Y'\lambda X'\lambda Z'.\varphi[X', Y', Z']
\]

4.4.3 Demonstrations for Basic Cases

Let us examine how the semantic devices defined above work.

4.4.3.1 Basic Indirect Object Construal

The first basic case is (25) in which \textit{zen-in} is indirect object oriented. Semantic translations for the constituents of (25) are also given below. The sentence is built up by combining compatible elements by Type Driven Translation in a step by step manner.

(25) Hanako -ga Naomi -o sensei-ni zen-in syookaisi-ta

- nom - acc teacher-dat all introduce-past

\('Hanako introduced Naomi to all teachers'\)

Hanako: \( \lambda P.P(h) \)
Naomi: \( \lambda P.P(n) \)
Sensei: \( \lambda w.\text{sensei}'(w) \)
Syookaisita: \( \lambda T_{ni}\lambda U_{o}\lambda V_{ga}.T_{ni}(\lambda x_{ni}.U_{o}(\lambda y_{o}.V_{ga}(\lambda x_{ga}.\text{syookaisita}'(x_{ni})(y_{o})(x_{ga})))) \)

Since \textit{zen-in} is a functor that takes a V-projection, the following application is possible. (The symbol \('\Rightarrow'\) indicates a transition.)

\[ This was suggested to me by Dick Oehrle. \]
The indirect object common noun sensei-ni is added to the previous line producing:

\[(27)\] sensei-ni zen-in syookaisita (TVP'):
\[
\lambda P.\lambda U_o.\lambda V_{ga}.\forall v(P(v) \rightarrow Q(v)) \land P \subseteq \text{in}'(\lambda x_{ni}.U_o(\lambda y_o.\lambda z_{ga}.\text{syookaisita}'(v)(y_o)(z_{ga})))
\]
\[
\Rightarrow
\]
\[
\lambda P.\lambda U_o.\lambda V_{ga}.\forall (P(v) \rightarrow U_o(\lambda y_o.\lambda z_{ga}.\text{syookaisita}'(v)(y_o)(z_{ga}))) \land P \subseteq \text{in}'(\lambda w.\text{sensei}'(w))
\]

The addition of the direct object Naomi-o yields:

\[(28)\] Naomi-o sensei-ni zen-in syookaisita (IVP'):
\[
\lambda U_o.\lambda V_{ga}.\forall (\text{sensei}'(v) \rightarrow U_o(\lambda y_o.\lambda z_{ga}.\text{syookaisita}'(v)(y_o)(z_{ga}))) \land \lambda w.\text{sensei}'(w) \subseteq \text{in}'(\lambda P.P(n))
\]
\[
\Rightarrow
\]
\[
\lambda V_{ga}.\forall (\text{sensei}'(v) \rightarrow V_{ga}(\lambda z_{ga}.\text{syookaisita}'(v)(n)(z_{ga}))) \land \lambda w.\text{sensei}'(w) \subseteq \text{in}'
\]

Finally the previous line combines with the subject Hanako-ga resulting in the completed interpretation of (28).

\[(29)\] Hanako-ga Naomi-o sensei-ni zen-in syookaisita (S'):
\[
\forall v(\text{sensei}'(v) \rightarrow \text{syookaisita}'(v)(n)(h)) \land \lambda w.\text{sensei}'(w) \subseteq \text{in}'
\]
4.4.3.2 Basic Direct Object Construal

In (30) is an instance where we find direct object construal of zen-in. The translations given for the lexical items in (29) are used without any modification. What is different from the previous case is that achieving a desired interpretation requires that the semantic rule Domain Permutation in (24) be employed twice to get a quantifier NP Naomi-ni to combine with the V-projection which has already been taken by zen-in.

(30) Hanako -ga sensei-o Naomi-ni zen-in syookaisi-ta
    -nom teacher-acc -dat all introduce-past

'Hanako introduced all teachers to Naomi'

We start with the lexical item syookaisita 'introduced' and apply the Domain Permutation to it, matching the abstracted variable \( U_o \) of the lexical item and the variable \( Y \) in the semantic rule (24). This rule is used again before the V-projection zen-in syookaisita combines with the indirect object Naomi-ni. The rest is taken care of by simple applications.

(31) syookaisita (DTVP'):
\[
\lambda T_ni \lambda U_o \lambda V_{ga}. T_{ni}(\lambda x_{ni}. U_o(\lambda y_{o}. V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(y_{o})(z_{ga}))))
\]

Domain Permutation (with \( U_o \) matching \( Y \)):
\[
\lambda U_o \lambda T_{ni} \lambda V_{ga}. T_{ni}(\lambda x_{ni}. U_o(\lambda y_{o}. V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(y_{o})(z_{ga}))))
\]

zen-in syookaisita (DTVP'):
\[
\lambda P. \lambda U_o \lambda T_{ni} \lambda V_{ga}. T_{ni}(\lambda x_{ni}. U_o(\lambda y_{o}. V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(y_{o})(z_{ga}))))
\]

\((\lambda Q. \forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}')
\]

\[\Rightarrow\]
\[
\lambda P. \lambda T_{ni} \lambda V_{ga}. T_{ni}(\lambda x_{ni}. \lambda Q. \forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}'(\lambda y_{o}. V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(y_{o})(z_{ga}))))
\]

\[\Rightarrow\]
\[
\lambda P. \lambda T_{ni} \lambda V_{ga}. T_{ni}(\lambda x_{ni}. \forall v(P(v) \rightarrow V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(v)(z_{ga}))) \& P \subseteq \text{in}')
\]

Domain Permutation (with \( T_{ni} \) matching \( Y \)):
\[
\lambda T_{ni} \lambda P. \lambda V_{ga}. T_{ni}(\lambda x_{ni}. \forall v(P(v) \rightarrow V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(v)(z_{ga}))) \& P \subseteq \text{in}')
\]

Naomi-ni zen-in syookaisita (TVP'):
\[
\lambda T_{ni} \lambda P. \lambda V_{ga}. T_{ni}(\lambda x_{ni}. \forall v(P(v) \rightarrow V_{ga}(\lambda z_{ga}. syookaisita'(x_{ni})(v)(z_{ga}))) \& P \subseteq \text{in}'(\lambda P. P(n))
\]

\[\Rightarrow\]
sensei-o Naomi-ni zen-in syookaisita (IVP'):
\[ \lambda P. \lambda V_g. \forall u (P(v) \rightarrow V_g(\lambda x_g. syookaisita'(n)(v)(x_g))) & P \subseteq \text{in'} \]

\[ \lambda P. \lambda V_g. \forall u (P(v) \rightarrow V_g(\lambda x_g. syookaisita'(n)(v)(x_g))) & P \subseteq \text{in'}(\lambda w. \text{sensei}'(w)) \]
\[ \Rightarrow \]
\[ \lambda V_g. \forall u (\text{sensei}'(v) \rightarrow V_g(\lambda x_g. syookaisita'(n)(v)(x_g))) & \lambda w. \text{sensei}'(w) \subseteq \text{in'} \]

Hanako-ga sensei-o Naomi-ni zen-in syookaisita (S'):
\[ \lambda V_g. \forall u (\text{sensei}'(v) \rightarrow V_g(\lambda x_g. syookaisita'(n)(v)(x_g))) & \lambda w. \text{sensei}'(w) \subseteq \text{in'}(\lambda P. P(h)) \]
\[ \Rightarrow \]
\[ \forall u (\text{sensei}'(v) \rightarrow syookaisita'(n)(v)(h)) & \lambda w. \text{sensei}'(w) \subseteq \text{in'} \]

### 4.4.3.3 Basic Subject Construal

Next we entertain the third type of the universal quantifier construal, namely to the subject, exemplified in (32). In this Type Driven Translation the rule of Domain Permutation is involved three times making it possible for the common noun subject sensei-ga to combine with the IVP Hanako-o Naomi-ni zen-in syookaisita-{} which has been built up from a DTVP syookaisita with two complements Naomi-ni and Hanako-o and the universal quantifier zen-in already combined in.

(32) Sensei-ga Hanako-o Naomi-ni zen-in syookaisita-{}

'the teachers introduced Hanako to Naomi'

(33) syookaisita (DTVP'):
\[ \lambda T_n. \lambda U_0. \lambda V_g. \lambda T_n. (\lambda x_n. U_n(\lambda y_0. V_g(\lambda x_g. syookaisita'(x_n)(y_0)(x_g)))) \]

Domain Permutation (with \( V_g \) matching \( Y \)):
\[ \lambda V_g. \lambda T_n. \lambda U_0. T_n(\lambda x_n. U_0(\lambda y_0. V_g(\lambda x_g. syookaisita'(x_n)(y_0)(x_g)))) \]

zen-in syookaisita (DTVP'):
\[ \lambda P. \lambda V_g. \lambda T_n. \lambda U_0. \lambda T_n(\lambda x_n. U_0(\lambda y_0. \lambda Q. \forall u (P(v) \rightarrow Q(v))) & P \subseteq \text{in'}) \]
\[ \Rightarrow \]
\[ \lambda P. \lambda T_n. \lambda U_0. T_n(\lambda x_n. U_0(\lambda y_0. \lambda Q. \forall u (P(v) \rightarrow Q(v))) & P \subseteq \text{in'}(\lambda x_g. syookaisita'(x_n)(y_0)(x_g))) \]
4.5 Solutions for Mixed Cases

Let us move onto more complex cases with the two quantificational elements (e.g. zen-in and san­nin) occurring together and being construed to a single common noun within a single sentence. As done in the previous section, we first formulate necessary syntactic and semantic devices for the new cases and then employ them to demonstrate how these complex cases are accounted for.

4.5.1 Syntax

It is easy to explain the intuition behind the syntactic account for the additional set of data with the help of some schematic tree diagrams found in Figures 4.1 through 4.3. We make the three syntactic structures seen in Trees A, B, and C available. Tree A in Figure 4.1 is the structure for the separated mixed cases with both quantificational elements assuming subject orientation. It is important to note that the numeral classifier ‘three’ in Tree A is syntactically identical (i.e. an IVP
Figure 4.1: Tree A for Intransitive Cases

modifier) to the Subject Oriented Classifier (SOC) defined in Chapter 2. Of course the semantics of it will be modified to accommodate the new circumstance. Tree B in Figure 4.2 is for those instances with two separated direct object oriented quantificational elements. Again the numeral classifier 'three' in this case is the Direct Object Oriented Classifiers (DOC) given in Chapter 2 (i.e a TVP modifier). Finally, Tree C in Figure 4.3 is the constituent structure associated with the cases where the two quantificational elements form a quantifier sequence and seem to behave as a single coherent unit.

The fact that we are using the syntactic properties associated with the SOC and DOC which have been defined in Chapter 2 already leaves us only with the task of defining the lexical entry for the numeral functioning as a modifier for another adverb. This is done in (34a). In (34b) we repeat the definitions given to the SOC and DOC in Chapter 2 as well. Again SEM is not specified in (34) but will be given below when we consider the subject matter.

(34) a. Lexical Entry for Numeral Classifier as ADVP Modifier

san-nin: {POS ADV; SUBCAT<>; ADJUNCT ADVP[...]; SEM ...}

b. Subject Oriented and Direct Object Oriented Classifiers

SOC: {POS ADV; SUBCAT<>; ADJUNCT V[SUBCAT<PPga>]; SEM ...}

DOC: {POS ADV; SUBCAT<>; ADJUNCT V[SUBCAT<PPga,PPo>]; SEM ...}

Motivation for this sort of analysis is the following. First, the analysis utilizes the definitions already given to the SOC and DOC and automatically excludes the ditransitive cases with indirect object construal when a floating universal quantifier and a floating numeral classifier are separated. There is simply no way to generate ill-formed structures seen in (35). In all these sentences san-nin
Figure 4.2: Tree B for Transitive Cases

Figure 4.3: Tree C for All Three Cases
is intended to be indirect object oriented.

(35) a. *San-nin Taro-ga zen-in hon-o sensei-ni okut-ta
     b. *San-nin Taro-ga hon-o zen-in sensei-ni okut-ta
     c. *San-nin Taro-ga hon-o sensei-ni zen-in okut-ta
     d. *Taro-ga san-nin hon-o zen-in sensei-ni okut-ta
     e. *Taro-ga san-nin hon-o sensei-ni zen-in okut-ta
     f. *Taro-ga hon-o san-nin sensei-ni zen-in okut-ta

Second, since we are appealing to the independent syntactic properties of each quantificational element, this conjecture also bans a structure like (18f). It is not possible for the numeral classifier to be subject oriented for it does not appear in the position which is required by its lexical definition.

(36) *Gakusei-ga hon-o san-nin Hanako-ni zen-in okut-ta

Third, the following coordination instances are indeed possible. In (37a) is a case with the coordination of two disjuncts each of which is a subject oriented quantifier sequence. (37b,c) demonstrate a point with the coordination of two direct object oriented quantifier sequences, on the one hand, and two indirect object oriented quantifier sequences, on the other.

(37) a. Gakusei-ga [[san-nin kinoo zen-in] matawa [go-nin kyoo zen-in]] ki-ta-hazuda
     student-nom three yesterday all or five yesterday all come-past-MOD
     ‘All three or all five students must have come yesterday’

     b. Taro-ga gakusei-to sensei-o soresore [[san-nin kinoo zen-in] sorekara [go-nin kyoo zen-in]] but-ta
     -nom student-and teacher-acc respectively three yesterday all and five today all hit-past
     ‘Taro hit all three students yesterday and all five teachers today, respectively’

     -nom book-acc teacher-dat three yesterday all and five today all send-past
     ‘Taro sent a book to all three teachers yesterday and all five teachers today’

4.5.2 Semantics

The semantics of the mixed cases is provided by modifying the semantic translation given to zen-in in (24) above. What seems to be needed is that we associate two different translations with the universal quantifier. The one in (24) is basic and the one given below is the additional translation. The new translation allows for the universal quantifier to combine with a natural number which is
the additional cardinality information supplied by the numeral classifier coming into the structure later.

This move forces us to set up two other translations for the numeral classifier *san-nin* as well. The reason for this is the following. First, the previous translation (either as an SOC or DOC) does not allow it to combine with a V-projection which has already combined with another floating quantificational element such as *zen-in* which also takes a V-projection. Second, as far as the non-separate mixed cases are concerned, the numeral classifier is taken to be an adverbial modifier which modifies the universal quantifier. The simple alternative translation for the former case is given immediately below.

Thus floating quantifiers like *san-nin* are associated with multiple syntactic categories and semantic translations. This syntactic and semantic polymorphism seems to be widespread and necessary on general grounds.⁵

(38) Translations and Rule

zen-in: \( \lambda W \lambda N \lambda P . W (\lambda Q . \forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in'} \& | P \cap Q |= N) \)

where \( \text{TYP}(W) = \text{TYP}(\lambda \bar{X} \lambda U \lambda \bar{Y} \bar{T} (\lambda \bar{X} . U (\lambda y. \bar{Y} (\lambda \bar{x} . P (\bar{x})(x)))) \)

san-nin: \( \lambda X . X(3) \)

where \( \text{TYP}(X) = \text{TYP}(\lambda N \lambda P . W (\lambda Q . \forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in'} \& | P \cap Q |= N) \)

Rule: Domain Permutation

\( \lambda \bar{X} \lambda Y \lambda \bar{Z} . \varphi [\bar{X}, Y, \bar{Z}] \Rightarrow \lambda Y \lambda X \lambda \bar{Z} . \varphi [\bar{X}, Y, \bar{Z}] \)

Now that we have all necessary devices ready, we can proceed with some examples.

4.5.3 Demonstrations for Mixed Cases

According to the analysis we are following the sentence in (39) is structurally ambiguous between the separate and non-separate representations, respectively.

(39) Gakusei-ga san-nin zen-in ki-ta

student-nom three all come-past

'All three students came'

⁵There are instances in English where we witness similar behaviors of adverbs. For example (due to Terry Langendoen), adverbs like *absurdly* and *carefully* can be used separately as modifiers for a predicate: *Mary absurdly spoke* and *Mary carefully spoke* *absurdly*. But when they are adjacent in a particular order *absurdly carefully* as in *Mary spoke absurdly carefully* they are ambiguous in two ways: 1) they can modify the predicate as in the two sentences above or 2) *absurdly* can be understood to be the modifier for *carefully*. For these data to be given an account it is necessary to follow a similar practice as done for floating quantificational elements.
In this subsection we will look at the semantics of the separate cases as well as the non-separate cases each of which is further subdivided into different construal patterns.

4.5.3.1 Separate Intransitive Cases

In the separate intransitive case the following translations are involved. As we did above, we build up larger constituents step by step by Type Driven Translation. This process is straightforward.

(40) Translation for Separate Intransitive Case

\begin{align*}
\text{gakusei:} & & \lambda w. \text{gakusei}'(w) \\
\text{san-nin:} & & \lambda X.X(3) \\
& & (\text{TYP}(X) = \text{TYP}(\lambda N \lambda P. W(\lambda Q. \forall v(P(v) \rightarrow Q(v)) & \& P \subseteq \text{in'} & | P \cap Q | = N)) \\
\text{zen-in:} & & \lambda W \lambda N \lambda P. W(\lambda Q. \forall v(P(v) \rightarrow Q(v)) & \& P \subseteq \text{in'} & | P \cap Q | = N)) \\
\text{ki-ta:} & & \lambda T_{ga}. T_{ga}(\lambda x_{ga}. \text{kita}'(x_{ga}))
\end{align*}

(41) zen-in kita (IVP'):

\begin{align*}
\lambda W \lambda N \lambda P. W(\lambda Q. \forall v(P(v) \rightarrow Q(v)) & \& P \subseteq \text{in'} & | P \cap Q | = N) \& & \lambda T_{ga}. T_{ga}(\lambda x_{ga}. \text{kita}'(x_{ga})) \\
\Rightarrow & & \lambda N \lambda P. \lambda Q. \forall v(P(v) \rightarrow Q(v)) & \& P \subseteq \text{in'} & | P \cap Q | = N(\lambda x_{ga}. \text{kita}'(x_{ga})) \\
\Rightarrow & & \lambda N \lambda P. \lambda Q. \forall v(P(v) \rightarrow \text{kita}'(v)) & \& P \subseteq \text{in'} & | P \cap \lambda x_{ga}. \text{kita}'(x_{ga}) | = N \\
\text{san-nin zen-in kita (IVP')}: & & \lambda X.X(3)(\lambda N \lambda P. \forall v(P(v) \rightarrow \text{kita}'(v)) & \& P \subseteq \text{in'} & | P \cap \lambda x_{ga}. \text{kita}'(x_{ga}) | = N) \\
\Rightarrow & & \lambda P. \forall v(P(v) \rightarrow \text{kita}'(v)) & \& P \subseteq \text{in'} & | P \cap \lambda x_{ga}. \text{kita}'(x_{ga}) | = 3 \\
\text{gakusei-ga san-nin zen-in ki-ta (S')}: & & \lambda P. \forall v(P(v) \rightarrow \text{kita}'(v)) & \& P \subseteq \text{in'} & | P \cap \lambda x_{ga}. \text{kita}'(x_{ga}) | = 3(\lambda w. \text{gakusei}'(w)) \\
\Rightarrow & & \forall v(\text{gakusei}'(v) \rightarrow \text{kita}'(v)) & \& \lambda w. \text{gakusei}'(w) \subseteq \text{in'} & | \lambda w. \text{gakusei}'(w) \cap \lambda x_{ga}. \text{kita}'(x_{ga}) | = 3
\end{align*}
4.5.3.2 Non-separate Intransitive Cases

Type Driven Translation for the non-separate intransitive cases starts out with the modification of *zen-in* by *san-in*. Then the rest is successive simple applications just as in other intransitive cases.

(42) Translation for Non-separate Intransitive Case

\[ \text{gakusei: } \lambda w. \text{gakusei}'(w) \]
\[ \text{san-nin: } \lambda X.X(3) \]
\[ (\text{TYP}(X) = \text{TYP}(\lambda N \lambda W \lambda P.W(\lambda Q.\forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& \mid P \cap Q \mid = N)) \]
\[ \text{zen-in: } \lambda N \lambda W \lambda P.W(\lambda Q.\forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& \mid P \cap Q \mid = N) \]
\[ \text{ki-ta: } \lambda T_{x_2}.T_{x_2}(\lambda x_{x_2}.\text{ki-ta}'(x_{x_2})) \]

(43) san-nin zen-in (ADVP'):
\[ \lambda X.X(3)(\lambda N \lambda W \lambda P.W(\lambda Q.\forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& \mid P \cap Q \mid = 3) \]
\[ \Rightarrow \lambda W \lambda P.W(\lambda Q.\forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& \mid P \cap Q \mid = 3) \]
\[ \text{san-nin zen-in kita (IVP')}: \]
\[ \lambda W \lambda P.W(\lambda Q.\forall v(P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& \mid P \cap Q \mid = 3)(\lambda T_{x_2}.T_{x_2}(\lambda x_{x_2}.\text{ki-ta}'(x_{x_2}))) \]
\[ \Rightarrow \lambda P.\forall v(P(v) \rightarrow \text{ki-ta}'(v)) \& P \subseteq \text{in}' \& \mid P \cap \lambda x_{x_2}.\text{ki-ta}'(x_{x_2}) \mid = 3 \]
\[ \text{gakusei-ga san-nin zen-in kita (S')}: \]
\[ \lambda P.\forall v(P(v) \rightarrow \text{ki-ta}'(v)) \& P \subseteq \text{in}' \& \mid P \cap \lambda x_{x_2}.\text{ki-ta}'(x_{x_2}) \mid = 3 (\lambda w.\text{gakusei}'(w)) \]
\[ \Rightarrow \forall v(\text{gakusei}'(v) \rightarrow \text{ki-ta}'(v)) \& \lambda w.\text{gakusei}'(x_{x_2}) \subseteq \text{in}' \& \mid \lambda w.\text{gakusei}'(w) \cap \lambda x_{x_2}.\text{ki-ta}'(x_{x_2}) \mid = 3 \]

4.5.3.3 Separate and Non-separate Transitive Cases with Direct Object Orientation

These two situations arise within a sentence like (44). Again our analysis postulates two possible syntactic structures for this sentence: 1) with *san-nin zen-in* being a quantifier sequence and 2) with *san-nin* and *zen-in* being separate and independent of each other.

(44) Hanako -ga sensei-o san-nin zen-in but-ta
\[ \text{-nom teacher-acc three all hit-past} \]
\[ '\text{Hanako hit all three teachers}' \]
The first situation is analogous to the Separate Intransitive Cases above. The second situation is analogous to the Non-separate Intransitive Cases above. Since the expositions of these are rather redundant, I do not provide semantic analyses here.

4.5.3.4 Separate Transitive Cases with Subject Orientation

Matters are not the same when two quantificational elements are separated and assume subject orientation. For example, in (45) we notice that san-nin and zen-in are separated from each other by the intervening direct object but gakusei-ga is a legitimate construee of the both.

(45) Gakusei-ga san-nin Hanako-o zen-in but-ta
    student-nom three -acc all hit-past
    'All three students hit Hanako'

The translation of the sentence is carried out just as before with a successive application of functors to their compatible arguments both of which are listed immediately below. The translation process follows the list of lexical items.

(46) Translation for Separate Transitive Case

Hanako: \lambda P.P(h)
gakusei: \lambda w.gakusei'(w)
san-nin: \lambda X.X(3)

(\text{where } TYP(X) = TYP(\lambda N \lambda P (\forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& |P \cap Q| = N))

zen-in: \lambda W \lambda N \lambda P.W (\lambda Q. \forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& |P \cap Q| = N)

but-ta: \lambda T_0 U_ga.T_0 (\lambda x_o.U_ga(butta'(x_o)(y_ga)))

(47) but-ta (TVP'):

\lambda T_0 \lambda U_ga.T_0 (\lambda x_o.U_ga(butta'(x_o)(y_ga)))

\text{Domain Permutation (with } U \text{ matching } Y):
\lambda U_ga \lambda T_0.T_0 (\lambda x_o.U_ga(butta'(x_o)(y_ga)))

zen-in but-ta (TVP'):

\lambda W \lambda N \lambda P.W (\lambda Q. \forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& |P \cap Q| = N)

(\lambda U_ga \lambda T_0.T_0 (\lambda x_o.U_ga(butta'(x_o)(y_ga))))

\Rightarrow

\lambda \lambda N \lambda P. \lambda U_ga \lambda T_0.T_0 (\lambda x_o.U_ga(butta'(x_o)(y_ga))) (\lambda Q. \forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in}' \& |P \cap Q| = N)
4.5.4 Summary of the Proposed Account

Let us summarize the account and predictions made by the proposed system. This subsection is divided into two parts concerning syntactic and semantic predictions, respectively.

4.5.4.1 Syntactic Predictions

We start with syntactic predictions by utilizing a ditransitive sentence containing three common nouns all of which are potential construes of the two quantificational elements under discussion. We momentarily ignore scrambling of other elements except for floating quantifiers. We should note that the ill-formed mixed cases in which zen-in precedes san-nin have not been accounted for. This fact will be given an explanation in the next subsection. For now we assume some constraint which uniformly excludes all the cases where this situation obtains.

Our first sentence is (48). This sentence can have interpretations given in (48b-d) but not (48e-h). Given the assumption that the san-nin and zen-in can be a quantifier sequence as conjectured...
above and the fact that there is no numeral classifier that can appear in this position (neither the SOC nor DOC will do), this is exactly what is expected.6

(48) a. Gakusei-ga sensei-o tomodati-ni san-nin zen-in syookaisi-ta
    student-nom teacher-acc friend-dat three all introduce-past
    b. ‘All three students introduced a teacher to a friend’
    c. ‘A student introduced all three teachers to a friend’
    d. ‘A student introduced a teacher to all three friends’
    e. ≠ ‘Three students introduced all teachers to a friend’
    f. ≠ ‘Three students introduced a teacher to all friends’
    g. ≠ ‘All students introduced three teachers to a friend’
    h. ≠ ‘A student introduced three teachers to all friends’
    i. ≠ ‘All students introduced a teacher to three friends’
    j. ≠ ‘A student introduced all teachers to three friends’

Next we consider a slightly modified version of (48) in which san-nin is placed between sensei-o and tomodati-ni. This change produces distinct construal possibilities from the ones seen above in that direct object construal of the numeral classifier is possible.

(49) a. Gakusei-ga sensei-o san-nin tomodati-ni zen-in syookaisi-ta
    student-nom teacher-acc three friend-dat all introduce-past
    b. ≠ ‘All three students introduced a teacher to a friend’
    c. ‘A student introduced all three teachers to a friend’
    d. ≠ ‘A student introduced a teacher to all three friends’
    e. ≠ ‘Three students introduced all teachers to a friend’
    f. ≠ ‘Three students introduced a teacher to all friends’
    g. ‘All students introduced three teachers to a friend’

6This claim breaks down when we consider general scrambling cases for which a generous application of the SLASH feature has been advocated. As will be shown (48e,f,i,j) will still be prevented but (48g,h) are predicted to be good. We will come back to this and show an independent reason that (48g,h) do not obtain.
h. ‘A student introduced three teachers to all friends’

i. ≠ ‘All students introduced a teacher to three friends’

j. ≠ ‘A student introduced all teachers to three friends’

Now that the quantifier sequence has been broken up, the two quantificational elements are expected to show their own syntactic properties. In this respect the fact that san-nin shows only direct object orientation is not surprising at all. But zen-in can still show the three distinct orientations. We note that there is simply no way to construe the numeral classifier to the subject because of the lexical restriction placed on the SOC.

We can further advance the position of the numeral classifier and get a sentence like (50). Doing this changes the construal possibilities again. This time in addition to direct object construal, subject construal is possible. But even in this example it is not possible to obtain indirect object construal. It is not surprising that we obtain subject orientation of san-nin since it is in the legitimate position for the SOC.

(50) a. Gakusei-ga san-nin sensei-o tomodati-ni zen-in syookaisi-ta syookaisi-ta
    student-nom three teacher-acc friend-dat all introduce-past

b. ‘All three students introduced a teacher to a friend’

c. ‘A student introduced all three teachers to a friend’

d. ≠ ‘A student introduced a teacher to all three friends’

e. ‘Three students introduced all teachers to a friend’

f. ‘Three students introduced a teacher to all friends’

g. ‘All students introduced three teachers to a friend’

h. ‘A student introduced three teachers to all friends’

i. ≠ ‘All students introduced a teacher to three friends’

j. ≠ ‘A student introduced all teachers to three friends’

It is also possible to place san-nin at the sentence initial position as in (51) but this will produce the same range of interpretations as in (50). (We need a pause after san-nin to obtain the direct object construal of it.)

(51) San-nin gakusei-ga sensei-o tomodati-ni zen-in syookaisi-ta
As long as we do not place zen-in in the position preceding san-nin, the possible position for the former can also be advanced towards the sentence initial position. E.g. (52a,b)

(52) a. San-nin gakusei-ga sensei-o zen-in tomodati-ni syookaisi-ta

b. San-nin gakusei-ga zen-in sensei-o tomodati-ni syookaisi-ta

The range of interpretations we get from these sentences is the same as for (50) and (51) above. (However, as was noted before, it is important to have appropriate pauses and/or stress on certain constituents to obtain a desired reading. For example, with (52b) if we wish to have indirect object construal of the universal quantifier zen-in, we need to place a pause after gakusei-ga and a heavy stress on both zen-in and tomodati-ni.)

4.5.4.2 Semantic Predictions

The present analysis makes interesting predictions concerning the semantics of the floating universal quantifiers. We mention two of them here. First, it is instructive to compare the SEM of the SOC or DOC with that of the universal quantifiers. In (53) is the SEM of an SOC repeated from Chapter 2. (The choice between a DOC and an SOC is immaterial to the discussion at hand.)

(53) SEM of SOC

\[ \text{san-nin: } \lambda W \lambda P.W(\lambda Q. | P(v) \cap Q(v) | \geq 3 \& P \subseteq \text{ko'}) \]

\[ \text{where } \text{TYP}(W) = \text{TYP}(\lambda T. T(\lambda z.P(z))) \]

This definition allows for the cases like (53) in which the cardinality of set indicated by the common noun construee otoko of the floating numeral classifier san-nin does not have to be three. Thus it leaves open the possibility of adding an extra NP internal numeral classifier roku-nin-no to the common noun. Though it is true that at least three men go home, this sentence does not require those the only men.

(54) \[NP \text{Roku-nin-no otoko]-ga san-nin kae-ru-to, nokori-wa san-nin-da} \]

\[
\text{six-gen man-nom three go home-pres-if remainder-top three-cop}
\]

'If three men out of six go home, the remainder is three'

Let us compare this with the mixed cases we have been discussing. We repeat below the SEM of zen-in that can combine with a cardinal number supplied by a numeral classifier which interacts with it in a single sentence.

7 There is a third prediction. Given the analysis devised for quantifier scope ambiguity in Chapter 3, the floating universal quantifier is expected to show the same range of ambiguity. This is true in that Gakusei-ga zen-in sensei-o hito-ri but-ta 'Every student hit a teacher' is ambiguous with respect to quantifier scope. We do not examine how this is done here but it is not difficult to see how the Quantification Calculus of Hendriks introduced in Chapter 2 can handle a case like this.
(55) SEM of Floating Universal Quantifier

\[ \text{zen-in: } \forall W \forall \lambda P. W(\lambda Q. \forall v (P(v) \rightarrow Q(v)) \& P \subseteq \text{in} \& |P \cap Q| = N) \]

The definition involves two distinct relations involving two sets: 1) a subset relation and 2) an intersection of the two. The crucial point here is the subset part. Since the set which corresponds to the construee of the universal quantifier has to be a subset of whichever the set which corresponds to the predicate, all individuals belonging to the common noun which is the construee of the universal quantifier have to be included in the set of individuals represented by the predicate. This means that, quite unlike with the case involving floating numeral classifiers seen in (55), the definition should exclude the possibility of adding an extra NP internal numeral classifier. This turns out to be true as the sentences below attest.

(56) a. *?200-nin -no heisi-ga 100-nin zeni sensisi-ta
   -gen soldier-nom all die-in-service-past
   ‘(INT.) All 100 soldiers out of 200 died in service’

b. *?Taroo -ga 200-ko -no ringo-o 100-ko zeni bu tabe-ta
   -nom -gen apple-ace all eat-past
   ‘(INT.) Taroo ate all 100 apples out of 200’

The intersection part of the definition mentioned above leads us to another prediction about semantics of the universal floating quantifier. The construee of it should receive a definite interpretation. The simple universal determiners like all and every defined by Barwise and Cooper does not bring about this due to the possibility of the domain of quantification being empty. For example, if there is no man, a Generalized Quantifier formed with every and man will still be defined but fail to be a sieve.6 We note that this situation does not obtain with the floating universal quantifiers which participate in the mixed cases due to the additional cardinality restriction expressed by the intersection part of the definition. This means that, if a GQ is defined as the semantic combination between the universal quantifier and the numeral classifier on the one hand and the common noun construee on the other, it will always be a sieve \( \{X \subseteq E \mid B \subseteq X\} \) with \( B \) the set corresponding to the common noun whose cardinality is specified by the numeral classifier. This will satisfy the condition for being a definite determiner.

Now is it true that the sentences with the mixed instances seen above are interpreted with definiteness with respect to a relevant common noun construee? Unfortunately, this turns out to

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6 A DET is definite if for every model \( M = <E, ||> \) and every \( A \) for which \( || \text{DET} || (A) \) is defined, there is a non-empty set \( B \), so that \( || \text{DET} || (A) \) is the sieve \( \{X \subseteq E \mid B \subseteq X\} \). Sievehood of a GQ obtains when it is defined and neither of the following two situation obtains: 1) the GQ lets every set through (i.e. \( \text{GQ} = \{X \mid X \subseteq E\}\)), 2) the GQ lets no set through (i.e. \( \text{GQ} = \emptyset\)).
be false with respect to the Japanese data. It is interesting to compare the Japanese examples with similar examples in English where two quantificational elements appear in a single sentence being construed to a single common noun.\(^9\)

(57)  
a. All three students came  
b. The three students all came  
c. Gakusei-ga san-nin zen-in ki-ta  
   student-nom three all come-past  
   'All three students came'

The sentence (57a) is judged by native speakers to have a definite interpretation with respect to students (c.f. (57b)) but this is not necessarily the case with (57c) in that gakusei-ga can be indefinite (and actually this is preferred). We leave this problem unanswered here.\(^{10}\)

4.5.5 Complication

We have seen some syntactic and semantic predictions offered by the analysis in the previous subsection. There is an additional prediction which has not been offered any explanation so far. This has to do with the sentences seen above in which the floating universal quantifier zen-in precedes a floating numeral classifier such as san-nin. E.g. (58) and (59).

(58)  
a. *Gakusei-ga zen-in kinoo san-nin ki-ta  
b. *Zen-in kinoo san-nin gakusei-ga ki-ta  
c. *Zen-in gakusei-ga kinoo san-nin ki-ta  
d. *Gakusei-ga kinoo zen-in san-nin ki-ta

(59)  
a. *Zen-in san-nin, Taroo-ga sensei-o but-ta  
b. *Zen-in, Taroo-ga san-nin sensei-o but-ta  
c. *Zen-in, Taroo-ga sensei-o san-nin but-ta  
d. *Taroo-ga zen-in san-nin sensei-o but-ta

\(^9\)Unlike English, it is not possible to have the two quantificational elements within a single NP in Japanese, e.g. zen-in-no gakusei 'all students' and san-nin-no gakusei 'three students' but *san-nin-no zen-in-no gakusei or *zen-in-no san-nin-no gakusei (INT.) all three students'.

\(^{10}\)In Chapter 5 we will come back to the detailed discussion on the GQ properties of floating quantifiers.
These sentences are generated by the syntactic and semantic apparatuses devised above and are expected to be well-formed. However (58) and (59) are uniformly bad.

A clue for this puzzle is to be found not in the account proposed so far but in a more general theory of adverbial modification. I do not pretend that I offer a definitive formulation of such a theory but simply speculate on the effect of it. We note that in this thesis the floating quantifiers are taken to be adverbs of quantification which function as V-projection modifiers. (We recall the arguments presented in Chapter 3 defending this position.) It is, then, well expected that floating quantifiers also show distributional patterns which are shared by other adverbial modifiers of various kinds.

In Japanese it is generally true that order of adverbial modifiers is rather free. However in some instances the order of adverbials is not always free. For example, in (60) are two adverbials tuini ‘finally’ and takumasiku ‘strongly’ both of which can be used independently in separate sentences as modifiers for the one-place predicate seityoosita ‘grew up’ as in (60a,b). It is also possible for the two adverbials to occupy the sentence initial positions, e.g. (60c,d). Further, as (60e) indicates, it is possible for these two to modify a single predicate together. A crucial thing to be noticed here is that, for this joint modification to be possible, the relative order of the two adverbials has to be the way seen in (60e), namely tuini has to precede takumasiku (but they do not necessarily have to be adjacent). If this restriction is observed tuini can be placed at the sentence initial position as in (60f). But the violation of this restriction seen in (60g,h) results in unacceptable sentences. Exactly the same point is demonstrated in (61).

(60) a. Taroo -ga tuini seityoosi-ta
    -nom finally grow-past
    ‘Taroo finally grew up’

    b. Taroo -ga takumasiku seityoosi-ta
    -nom strongly grow-past
    ‘Taroo grew up strongly’

    c. Tuini Taroo-ga seityoosi-ta

    d. Takumasiku Taroo-ga seityoosi-ta

    e. Taroo-ga tuini takumasiku seityoosi-ta
    ‘Taroo finally grew up strongly’
(61) a. Me-ga yatto mie-ru
    eye-nom finally able to see-pres
    'My eyes can see finally'

b. Me-ga hakkiri mie-ru
    eye-nom clearly able to see-pres
    'My eyes can see clearly'

c. Yatto me-ga mie-ru

d. Hakkiri me-ga mie-ru

e. Me-ga yatto hakkiri mie-ru
    'My eyes can see clearly finally'

f. Yatto me-ga hakkiri mie-ru

g. *?Me-ga hakkiri yatto mie-ru

h. *?Hakkiri me-ga yatto mie-ru

The data above can serve to show that there is a certain ordering restriction among adverbs in general. But this is not enough to motivate the ordering restriction between zen-in and san-nin because the two adverbials in (60) and (61) are of distinct types. The two floating quantifiers used in the mixed cases seem to be adverbial of the same type. What we would like to see is that there is indeed a similar ordering restriction among adverbs of the same type. Let us observe some manner adverbs which validate this claim. In (62) through (66) are sentences with two manner adverbs which show the same sort of ordering restriction. I have given only two ordering variations for each but the same pattern seen in (60) and (61) obtains. As long as the relative ordering of the adverbs found in the (a)-sentences is retained as in the (b)-sentences, the sentences are good. If not the sentences are not good. (For ease of identification, adverbs consisting of more than a single word are bracketed.)

(62) a. Gakusei-ga gayagaya urusaku sawag-u
    student-nom clamorously noisily make commotion-pres
    'The students make commotion in a clamorous and noisy manner'
b. Gayagaya gakusei-ga urusaku sawag-u

c. *?Gakusei-ga urusaku gayagaya sawag-u (wrong reading)
d. *?Urusaku gakusei-ga gayagaya sawag-u (wrong reading)

(63) a. Naomi -ga mesomeso mizimeni nak-u
   -nom weepingly miserably cry-pres
   'Naomi cries in a weeping and miserable manner'

b. *?Naomi-ga mizimeni mesomeso nak-u (wrong reading)
d. *?Mizimeni Naomi-ga mesomeso nak-u (wrong reading)

(64) a. Taroo -ga [ me-o sara-noyooni] isyookenmei matigai-o sagasi-ta
   -nom eye-acc plate-as if with all effort mistake-acc look for-past
   'Taroo looked for mistakes with very attentive eyes and with all his effort'

b. [Me-o sara-noyooni] Taroo-ga isyookenmei matigai-o sagasi-ta

c. *?Taroo-ga isyookenmei [me-o sara-noyooni] matigai-o sagasi-ta (wrong reading)
d. *?Isyookenmei Taroo-ga [me-o sara-noyooni] matigai-o sagasi-ta (wrong reading)

(65) a. Hanako -ga [ asi-o boo-noyooni] isyookenmei sigoto-o sagasi-ta
   -nom foot-acc stick-as if with all effort job-acc look for-past
   'Hanako looked for a job making her legs stiff and with all her effort'

b. [Asi-o boo-noyooni] Hanako-ga isyookenmei sigoto-o sagasi-ta

c. *?Hanako-ga isyookenmei [asi-o boo-noyooni] sigoto-o sagasi-ta (wrong reading)
d. *?Isyookenmei Hanako-ga [asi-oboo-noyooni] sigoto-o sagasi-ta (wrong reading)

(66) a. Naomi -ga [ akai kutu-o akiramekire -zu-ni] [ usirogami-o hikareru-yooni] tatisat-ta
   -nom red shoe-acc give up -neg back hair-acc pull-pass-as if leave-past
   'Naomi left without being able to give up a pair of red shoes and as if leaving her mind behind'


c. *?Naomi-ga [usirogami-o hikareru-yooni] [akai kutu-o akiramekire-zu-ni] tatisat-ta

d. *?[Usirogami-o hikareru-yooni] Naomi-ga [akai kutu-o akiramekire-zu-ni] tatisat-ta
The (a) and (b)-sentences are fine with the two adverbs providing an intersective modificational effect for each predicate. The (c) and (d)-sentences are labeled bad with this same interpretations in mind. Under certain circumstances they can be meaningful but the modificational property is not intersective as before. In the (c) and (d)-sentences the first adverb could be understood to be modifying the second if that is ever felicitous. (Such an option is not available for (66c,d) at all.) That is, for example, (64c,d) means that Taroo spent all his effort in making his eyes attentive.

Another point to be noticed is the fact that each adverb pair displays some sort of an ‘elaboration’ relationship in such a way that the first of the two adverbs is suitable for describing, in more details, the circumstance which the second adverb describes in a more general way. This situation can be understood as the first adverb providing additional information to the second. For example, in (62a) gayagaya elaborates in more detail the circumstance described by urusaku and likewise for the others.

Coming back to (58) and (59), we notice that a similar situation obtains between floating numeral classifiers like san-nin and floating universal quantifiers like zen-in. We can consider that the numeral classifier adds more information concerning exactly how many was intended by saying ‘all’. It does not seem that unreasonable to speculate that the ordering relation found among the two kinds of floating quantificational elements is just like the one we have seen among other adverbs like in (62)–(66). This order restriction seems be influenced by the lexical semantics of the particular adverbs involved and the violation of it may cause some sort of interpretive difficulty, not necessarily syntactic ill-formedness.

One may object in the following way. How do we know the adverbs seen in (62)–(66) and the floating quantificational elements are the same sort of things? My answer to this question is that coordination is possible between the adverbs in question and the quantificational elements (assuming that coordination of incompatible elements is impossible). The gloss given to each sentence does not reflect the coordination at all.

(67) a. Gakusei-ga gayagaya katu san-nin sawai-da

student-nom clamorously and three make commotion-past

‘Three students made commotions in a clamorous manner’

b. Gakusei-ga zen-in sikamo isyookenmei hon-o sagasi-ta

student-nom all and with all effort book-acc look for-past

‘All students looked for a book with all [their] effort’

In summary what I wanted to achieve is to show that the cases in (58) and (59) are not excluded due to the syntactic and semantic apparatus provided above but rather due to some other indepen-
dent conditions governing the interpretation of adverbial modification in general. The formulation of such a condition requires further research and the condition is left unstated.

4.6 Scrambling Revisited

Introducing general scrambling phenomena into the distribution of floating universal quantifiers and numeral classifiers will increase the magnitude of the complexity of the subject matter. In this section we examine how the general account of the floating quantificational elements outlined above fares in handling general scrambling which in effect intersperses all preverbal elements among one another.

We have seen the account given to the interaction of scrambling and floating numeral classifiers in Chapter 2. A method that utilizes the SLASH mechanism was advocated together with the Feature Cooccurrence Restriction (FCR) which disallows the introduction of ga-gap. We therefore merge the account offered in Chapter 2 and the account given to the mixed cases in the previous sections. As before, the scrambling phenomena are restricted to the instances that occur within a single clause boundary.

We will take ditransitive sentences with six words each as our test cases. The six words are a subject, a direct object, an indirect object, a floating numeral classifier, a floating universal quantifier, and a ditransitive verb. Since the verb always has to be final, all permutations involving the five other elements are theoretically possible. In addition, due to the restriction discussed immediately above that disallows cases with zen-in preceding san-nin, 60 out of 120 possible cases are automatically excluded. The exposition in this section is not going to be exhaustive and we only examine crucial cases as well as potential problematic cases. This section is divided into two subsections each of which examines different type of problems.

4.6.1 Vacuous Scrambling

The account given in the Sections 4 and 5 of this chapter augmented with the account for scrambling phenomena in Chapter 2 will vacuously generate the following sentence (68) which was designated to be impossible above with the indicated intended interpretation. Nevertheless, the structure in Figure 4.4 shows that (68) should be possible with the intended interpretation.

(68) Taroo -ga sensei-o tomodati-ni san-nin zen-in syookaisi-ta
- nom teacher-acc friend-dat three all introduce-past
≠ 'Taroo introduced three teachers to all friends'
However, it is not clear if a sentence like (68) is impossible due to syntactic reasons. If an analysis like Figure 4.4 is impossible then so are those in Figures 4.5 and 4.6 corresponding to well-formed sentences in (69) and (70), respectively. This is because Figure 4.4 is the union of the latter two.

(69) Taroo -ga sensei-o tomodati-ni san-nin syookaisi-ta
    -nom teacher-acc friend-dat three introduce-past
    ‘Taroo introduced three teachers to a friend’

(70) Taroo -ga sensei-o tomodati-ni zen-in syookaisi-ta
    -nom teacher-acc friend-dat all introduce-past
    ‘Taroo introduced a teacher to all friends’

In Figure 4.5 the numeral classifier san-nin is a DOC and the position it appears is legitimate according to its lexical definition in that it functions as an TVP modifier. (69) is well-formed as expected. In the structure depicted in Figure 4.6 the universal quantifier zen-in is in the position where it can be a DTVP modifier and indirect object oriented. Thus (70) is also well-formed without any problem. This means that the structure seen in Figure 4.4 can be generated by the syntactic system with no problem but will be excluded due to independent reasons. One such reason is a prohibition on crossed dependency when both quantificational elements are compatible with the same type of construee just as in (67) where the construees of the quantificational elements are
Figure 4.5: Tree for (69)

Figure 4.6: Tree for (70)
both humans. It follows then if we modify (67) in such a way that there is no competing crossed
dependency, the sentence should be good. This is indeed true. (In the rest of this section examples
involving this sort of crossed dependency are avoided.)

(71) Taroo-ga hon-o tomodati-ni san-satu, zen-in, okut-ta
    -nom teacher-acc friend-dat three all send-past

    ‘Taroo sent three books to all friends’

It should also be noted that the present system will never generate impossible vacuous scrambling
instances as in Figure 4.7 which is an alleged structure for (72) that
can not be interpreted as
indicated.

(72) Gakusei-ga sensei-o tomodati-ni san-nin zen-in syookaisi-ta
    student-nom teacher-acc friend-dat three all introduce-past

    ≠ ‘Three students introduced a teacher to all friends’

The attempt to construe san-nin with the subject gakusei-ga is not possible at all. This is a con-
sequence of the FCR not allowing a ga-marked gap.

4.6.2 Non-vacuous Scrambling

We start with a sentence in (73) which can have only two interpretations indicated in (73b-c).
(73) a. Gakusei-ga sensei-ni hon-o san-nin zen-in oku-ta
   student-nom teacher-dat book-acc three all send-past
b. 'All three students sent a book to a teacher'
c. 'A student sent a book to all three teachers'
d. ≠ 'Three students sent a book to all teachers'
e. ≠ 'All students sent a book to three teachers'

(73b,c) are the possible cases when we take san-nin zen-in to be a quantifier sequence. (73d) can be given a syntactic analysis as in Figure 4.8 in which san-nin should be able to assume subject orientation. However, this is not allowed (as mentioned above) due to the semantic requirement (the next-common-noun condition) that the very next common noun argument of a given V-projection which has been taken by a floating numeral classifier has to be the construee of the classifier. This does not obtain in Figure 4.8. We note that direct object orientation of san-nin is not possible due to the mismatch between the classifier -nin ‘person’ and the common noun hon ‘book’.

The following sentence can also be legitimately generated in which we see two numeral classifiers are placed at the sentence initial position.
Figure 4.9: Tree for (74)

(74) Roku-nin, san-satu, gakusei-ga hon-o sensei-ni zen-in okut-ta
       six    three  student-nom book-acc teacher-dat all send-past
    ‘All six students sent three books to a teacher’
   ‘Six students sent three books to all teachers’

The position of zen-in can be advanced (as long as it does not precede san-nin) retaining the same interpretations. A syntactic analysis tree for (74) will be as in Figure 4.9. This tree obeys all the constraints placed on tree well-formedness. Thus the sentence whose structure is described by this tree is acceptable.

A more complex instance of scrambling can be seen in (75a) which offers the possible readings (75b,c). (For (75b) we need to place a pause after zen-in and stress gakusei-ga.) Syntactic structures for these cases are very similar to the one in Figure 4.9.

(75) a. San-satu zen-in sensei-ni hon-o gakusei-ga okut-ta
        three  all    teacher-dat book student-nom send-past
   b. ‘All students sent three books to a teacher’
   c. ‘A student sent three books to all teachers’
4.6.3 Summary of Scrambling

In this section we have examined the interaction between scrambling on the one hand and the two kinds of quantificational elements on the other. The data introduced were not exhaustive but other possible/impossible scrambling cases are variations of the instances introduced under the two major categories (vacuous and non-vacuous) of scrambling. Some of the possible sentences may never be uttered due to stylistic reasons and need extra prosodic help to be interpreted properly. We also noted that the sentences with the crossed dependency between two (or possibly more) compatible construer–construee pairs are not interpreted according to the way the syntactic system predicts independently.

4.7 Summary

The universal quantifier zen-in was shown to share basically the similar syntactic and semantic properties with floating numeral classifiers. That is to say they are also adverbial endocentric modifiers for V-projections and are interpreted with a GQ schema. Similar data seen in Chapter 3 involving floating numeral classifiers can be appealed to to defend this point. This allowed us to extend the basic approach outline for them in Chapter 2 to the cases involving universal quantifiers. The demonstration of the separate mixed cases shows this point well in that the syntactic properties associated with floating numeral classifiers (SOCs and DOCs) were utilized in accounting for the mixed distributions. It was also shown that complex scrambling facts can be handled by the present approach.
Chapter 5

Generalized Floating Quantifiers

5.1 Introduction

In the preceding chapters we have seen the plausibility of taking floating quantifiers to be adverbial endocentric modifiers for some V-projections which semantically relate a common noun meaning and a V-projection meaning by syntactically combining with the V-projection first. Also provided were the specifics of the syntactic and semantic account for floating quantifier phenomena in Japanese involving cardinals and universals. In this concluding chapter we consider some theoretical implications of the phenomena and the account proposed for them with respect to a universal theory of quantification, namely the Generalized Quantifier (GQ) theory of Barwise and Cooper (B&C) (1981). With respect to the way quantification is accomplished, a comparison between Japanese and English is carried out to reveal the fact that, despite the diversity of syntactic mechanisms, the uniform GQ interpretation is indeed the common denominator between the two. This comparison also supports typological characterizations of languages: the opposition between ‘floating quantifier oriented’ languages and ‘(syntactic) determiner oriented’ languages. Overall this chapter is a witness to the plausibility of the relational approach to the GQ schema seen in Zwarts (1983), van Benthem (1986), and Westerståhl (1989).

5.2 GQ Properties of Japanese Floating Quantifiers

It is clear that the semantic analyses given to cardinals and universal quantifiers in the preceding chapters are rooted in the GQ theory. This is witnessed from the semantic definitions given to the quantificational elements in the previous chapters. For example, the cardinals are given an
intersective condition and the universals a subset condition, respectively. In this section, before we get into the discussion of the theoretical implications, let us examine the applicability of the GQ properties (following mostly B&C) ascribed to DETs to floating quantifiers. (For the sake of expository ease, let us use ‘Det’ for syntactic determiners and ‘DEl’ for semantic determiners.) The properties we appeal to are: 1) conservativity, 2) the strong/weak distinction, 3) monotonicity, 4) intersectiveness, and 5) symmetry.

Since we have seen only two kinds of floating quantifiers so far, we add several more items (some in this section and others in the sections to come) to the inventory of floating quantifiers to make the discussion well-balanced with respect to different types of quantifiers. The following two are a part of the additional floating quantifiers introduced in this chapter: takusan ‘many’ and hotondo ‘most’. The former shows the identical distributional property as floating numeral classifiers and the distribution of the latter is identical with that of floating universal quantifiers. The inventory now represents weak cardinals, weak non-cardinals, strong cardinals, and strong non-cardinals. We ignore negative DETs for the moment but will come back to the subject matter later.

5.2.1 Conservativity

Floating quantifiers under discussion are conservative which can be shown utilizing the definition given in (1).

(1) Conservativity (alias ‘live on’ property):

With a non-empty set $E$ (a domain of individuals), a $DET$ (a function from sets to sets of sets) is conservative iff for any sets $X$ and $A$ in $E$, $X \in DET(A)$ \iff $(X \cap A) \in DET(A)$.

It is easy to see that this holds for floating quantifiers as the equivalences between (a)-sentences and (b)-sentences given in (2)–(5) attest. Note that, for example, the bracketed part in (2b) corresponds to $X \cap A$ in (1).

(2) a. Otoko-ga go-nin ki-ta
    man-nom five come-past
    ‘Five men came’

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1\footnote{I do not give explicit syntactic and semantic definitions for these additional quantificational elements as I have done in the chapters. As far as the general distributional properties of floating quantifiers are concerned, a preliminary observation suggests that weak floating quantifiers have identical syntactic distributional properties and likewise the strong ones.}
b. Otoko-ga go-nin [ki sikamo otoko-dat-ta]  
   man-nom five come and man-cop-past  
   'Five men were men who came'  

(3) a. Otoko-ga takusan ki-ta  
   man-nom many come-past  
   'Many men came'  

b. Otoko-ga takusan [ki sikamo otoko-dat-ta]  
   man-nom many come and man-cop-past  
   'Many men were men who came'  

(4) a. Otoko-ga hotondo ki-ta  
   man-nom most come-past  
   'Most men came'  

b. Otoko-ga hotondo [ki sikamo otoko-dat-ta]  
   man-nom most come and man-cop-past  
   'Most men were men who came'  

(5) a. Otoko-ga zen-in ki-ta  
   man-nom all come-past  
   'All men came'  

b. Otoko-ga zen-in [ki sikamo otoko-dat-ta]  
   man-nom all come and man-cop-past  
   'All men were men who came'  

5.2.2 Strong vs. Weak Distinction  

Strongness is defined as in (6).  

(6) Strongness:  

A DET is positive strong (or negative strong) if for every model with the domain of individuals E and every A ⊆ E, if the GQ DET(A) is defined then A ∈ DET(A) (or A ∉ DET(A)). If a DET is not strong then it is weak.
According to (6), the floating quantifiers found in (2a) and (3a) above are clearly weak since the validity of the sentences in (7) is contingent on an interpretation in a given model in that they are true in models with more than five corners or many corners, respectively. (The sentences in (7) and (8) may sound a little odd but this is because the messages they convey are too obvious to be told.)

(7)  a. Otoko-ga go-nin otoko-da
    man-nom five    man-cop-pres
    'Three men are men'

    b. Otoko-ga takusan otoko-da
    man-nom many    man-cop-pres
    'Many men are men'

In contrast, (4a) and (5a) above contain floating quantifiers that are positive strong. The sentences in (8) are judged to be automatically valid.

(8)  a. Otoko-ga hotondo otoko-da
    man-nom most    man-cop-pres
    'Most men are men'

    b. Otoko-ga zen-in otoko-da
    man-nom all     man-cop-pres
    'All men are men'

5.2.3 Monotonicity

The next property with which we examine floating quantifiers is monotonicity and its definition is given in (9). Here we employ a more detailed definition of the concept (found in Partee, ter Meulen, and Wall 1990) which classifies DETs as either 'left' increasing (or decreasing) or 'right' increasing (or decreasing). We note that left increasing DETs are 'persistent' and this fact makes it unnecessary to define this concept independently.

(9) Monotonicity:

A DET is left monotone increasing if \( X \in DET(A) \) and \( A \subseteq B \subseteq E \) implies \( X \in DET(B) \).

A DET is right monotone increasing if \( X \in DET(A) \) and \( X \subseteq Y \subseteq E \) implies \( Y \in DET(A) \).
A $\text{DET}$ is left monotone decreasing if $X \in \text{DET}(A)$ and $B \subseteq A \subseteq E$ implies $X \in \text{DET}(B)$.

A $\text{DET}$ is right monotone decreasing if $X \in \text{DET}(A)$ and $Y \subseteq X \subseteq E$ implies $Y \in \text{DET}(A)$.

According to the definition, go-nin and takusan are both left and right increasing, while zen-in and hotondo are left decreasing but right increasing. This is shown in (10)–(13). (10b,c) and (11b,c) imply (10a) and (11a), respectively. We notice that, for example, in (10b,c) the subject senotakai gakusei and the predicate hasi-te-kita are subsets of gakusei and ki-ta in (10a), respectively. Likewise for (11).

(10) a. Gakusei-ga go-nin ki-ta
   student-nom five come-past
   'Five students came'

   b. Senotakai gakusei-ga go-nin ki-ta
tall
   'Five tall students came'

   c. Gakusei-ga go-nin hasi-te ki-ta
      running
   'Five students came running'

(11) a. Gakusei-ga takusan ki-ta
    student-nom many come-past
    'Many students came'

   b. Senotakai gakusei-ga takusan ki-ta
tall
   'Many tall students came'

   c. Gakusei-ga takusan hasi-te ki-ta
      running
   'Many students came running'

With similar data in (12) and (13) we can be assured that the claim made about the strong $\text{DETs}$ above is true. This time (12a) and (13a) do imply (12b) and (13b), hence they are left decreasing. But (12c) and (13c) indeed imply (12a) and (13a), hence they are right increasing.
(12) a. Gakusei-ga hotondo ki-ta
   student-nom most come-past
   'Most students came'

b. Senotakai gakusei-ga hotondo ki-ta
tall
'Most tall students came'

c. Gakusei-ga hotondo hasi-te ki-ta
   running
   'Most students came running'

(13) a. Gakusei-ga zen-in ki-ta
   student-nom all come-past
   'All students came'

b. Senotakai gakusei-ga zen-in ki-ta
tall
'All tall students came'

c. Gakusei-ga zen-in hasi-te ki-ta
   running
   'All students came running'

5.2.4 Intersectiveness

We have seen above that go-nin and takusan are weak DETs. If they are weak then they are expected to satisfy the intersective condition defined below.

(14) Intersective Condition:

A DET is intersective if for all models with the domain of individuals E and for all 
X, A ⊆ E, X ∈ DET(A) iff X ∈ DET(A ∩ X).

The fact that the two weak floating quantifiers in question meet this criterion can be demonstrated by the equivalence of (15a,b) on the one hand and (16a,b) on the other. In (15b) and (16b) the predicate otokode sikamo ki-ta is nominalized with a help of the nominalizer -mono so that it can be used as a subject.
(15) a. Otoko-ga go-nin ki-ta
    man-nom five come-past
    ‘Five men came’

    b. [Otoko-de sikamo ki-ta-mono] -ga go-nin ki-ta
    man-ocp and comers -nom five come-past
    ‘Five men who are comers came’

(16) a. Otoko-ga takusan ki-ta
    man-nom many come-past
    ‘Many men came’

    b. [Otoko-de sikamo ki-ta-mono] -ga takusan ki-ta
    man-ocp and comers -nom many come-past
    ‘Many men who are comers came’

In (15a) otoko and ki-ta correspond to A and X and the bracketed portion in ex-1b) otoko-de sikamo ki-ta-mono corresponds to \((A \cap X)\) in the definition (14). Similarly for (16).

The sentences in (17) and (18) show that hotondo and zen-in are not intersective. That is (b)-sentences do not necessarily imply (a)-sentences.

(17) a. Otoko-ga hotondo ki-ta
    man-nom most come-past
    ‘Most men came’

    b. [Otoko-de sikamo ki-ta-mono] -ga hotondo ki-ta
    man-ocp and comers -nom most come-past
    ‘Most men who are comers came’

(18) a. Otoko-ga zen-in ki-ta
    man-nom all come-past
    ‘All men came’

    b. [Otoko-de sikamo ki-ta-mono] -ga zen-in ki-ta
    man-ocp and comers -nom all come-past
    ‘All men who are comers came’
5.2.5 Symmetry

Our final property is symmetry. A Det that satisfies intersective condition is to satisfy symmetry as well (a proof in B&C).

(19) Symmetry:

If a DET satisfies the intersective condition then for any A, B \( \subseteq E \), B \( \in \text{DET}(A) \) iff 
\( A \in \text{DET}(B) \).

The fact that go-nin and takusan are symmetric can be shown by the mutual implication between (20a,b) and (21a,b).

(20) a. Otoko-ga go-nin ki-ta
    man-nom five come-past
    ‘Five men came’

   b. Kita-mono-ga go-nin otoko-da-ta
    comer-nom five man-cop-pres
    ‘Five comers were men’

(21) a. Otoko-ga takusan ki-ta
    man-nom many come-past
    ‘Many men came’

   b. Kita-mono-ga takusan otoko-da-ta
    comer-nom many man-cop-pres
    ‘Many comers were men’

From the fact that the DETs hotondo and zen-in do not satisfy the intersective condition above, it is well expected symmetry does not hold for these two. (22b) and (23b) do not necessarily imply (22a) and (23a).

(22) a. Otoko-ga hotondo ki-ta
    man-nom most come-past
    ‘Most men came’

   b. Kita-mono-ga hotondo otoko-da-ta
    comer-nom most man-cop-pres
    ‘Most comers were men’
(23) a. Otoko-ga zen-in ki-ta
    man-nom all come-past
    ‘All men came’

b. Kita-mono-ga zen-in otoko-da-ta
    comer-nom all man-cop-pres
    ‘All comers were men’

5.2.6 Summary on the GQ Properties

The excursion in the five preceding subsections establishes that all floating quantifiers under consideration are conservative. Go-nin and takusan are weak, left and right monotone increasing, intersective and symmetric. In contrast, zen-in and hotondo are positive strong, left monotone decreasing but right monotone increasing, not intersective, and not symmetric. The examination of these properties is enough to show that, though they are not syntactically equivalent to English Dets, floating quantifiers can indeed be considered semantically equivalent to determiners (i.e. DETs) of B&C.

5.3 Floating Quantifier Language vs. Determiner Language

5.3.1 Relational Perspective on Floating Quantifiers

One of the universals suggested in B&C is the following:

(24) NP-Quantifier Universal:

   Every natural language has syntactic constituents (called noun-phrases) whose function is to express generalized quantifiers over the domain of discourse.

(24) has been controversial but for Japanese this turns out to be true in that we find N-projections (which we call NPs for convenience) that exhibit universal and existential forces, e.g. (25) and (26).²

(25) a. arayuru otoko
    every man
    ‘every man’

²But there is even an opinion like Imani’s (1989) which claims that NPs in Japanese are not GQs at all. According to such a view, however, it is not clear how the NPs seen in (25) and (26) which appear to be clearly GQs are to be treated. Also Jelinek (1990) describes quantification in Straits Salish which exhibits no opposition between nominal and verbal categories. Sentences are constructed combining predicates together, hence there is no possibility to form an NP functioning as a GQ.
b. aru onna
   some woman
   'some woman'

(26) a. dare-mo
   who-and
   'everyone'

b. dono gakusei-mo
   which student-and
   'every student'

c. dare-ka
   who-or
   'someone'

d. dono sensei-ka
   which teacher-or
   'some teacher'

However, what we would like to focus on here is not the mere existence of the quantificational NPs per se but rather the way they are constructed. Thus another B&C universal (27) becomes relevant.

(27) Determiner Universal:

Every natural language contains basic expressions, (called determiners [i.e. DETs, K.F.]) whose semantic function is to assign common noun denotations (i.e. sets) A a quantifier that lives on A.

Given the NP Universal (24) and the DET Universal (27), Japanese seems to be a language which instantiates B&C's conjecture. For example, in (25) above if arayuru and aru can be classified as DETs and arayuru otoko and aru onna are NP's, then quantification is achieved exactly as B&C describe. Likewise, in (26) if WH-mo and WH-ka are considered to be 'split DETs' and dono gakusei-mo and dono sensei-ka are NPs, then the same goes through. (This still leaves the status of (26a,c) uncertain.)

\footnote{Fukushima (1990) outlines an explicit interpretation schema for WH-quantifiers seen in (26) from a Situation Semantic point of view.}
It seems to be the case, however, that the NP Universal (24) is conceived of based on the
consideration of languages like English which employs a syntactic category of Det, an obligatory
element of NPs. In such languages a semantic DET and a syntactic Det coincide and can be
semantically considered to be a function schematically represented as in (28). We let ‘2’ stand for
the set of truth values \{0,1\}.

\[(28)\]

\[DET: \text{CN}_{<e,t>} \leftrightarrow \text{[P}^{<e,t>} \leftrightarrow 2]\]

The schema (28) corresponds well to the order of syntactic combination of the constituents in a
sentence of English according to which, first, an NP is built with a Det and a common noun, and
then the GQ will take a set corresponding to a VP meaning to a truth value. However, we notice
that the NP Universal (24) and the DET Universal (27) are independent of each other and the
schema (28) is semantically equivalent to (29a) and can even more generally be expressed as (29b)
in accord with the relational perspective on GQs seen in Zwarts (1983), van Benthem (1986), and

\[(29)\]

**Alternative Definitions for DET**

a. \(DET: P_{<e,t>} \leftrightarrow \text{[CN}_{<e,t> \leftrightarrow 2}\]

b. \(DET: A_{<e,t>} \times B_{<e,t>} \leftrightarrow 2\]

We would, then, expect that for a GQ interpretation to be possible in a given language, all we
need is two sets (regardless of whether they are one place predicates or common nouns) and some
quantificational element DET which establishes a proper relationship between the two sets.

It is interesting to note that such a conjecture is implicit in the GQ analysis of adverbs of
quantification in English, such as *always* and *sometimes* seen in (30), due to Schwarzschild (1989).

\[(30)\]

a. Always, if a child feeds a dog, it bites him.

b. Sometimes, if a child feeds a dog, its bites him.

According to Schwarzschild's account, for example, in (30a) the combination of the adverb *always*
and the restrictive if-clause will produce a GQ, i.e. a set of sets of n-tuples each member of which
is a set of n-tuples whose first member is a child and the second member is a dog that the child
feeds. Another set of n-tuples is obtained from the main clause each of whose member contains a
child as the first member and a dog as the second member such that the dog bites the child. If the
former set of n-tuples is a subset of the latter set of n-tuples then the sentence counts as true. Here
Table 5.1: Summary of the Orientational Opposition

<table>
<thead>
<tr>
<th></th>
<th>FQ Oriented Languages</th>
<th>Det Oriented Languages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floating Qs</td>
<td>basic</td>
<td>derived</td>
</tr>
<tr>
<td>NP-internal Qs</td>
<td>derived</td>
<td>basic</td>
</tr>
<tr>
<td>Syntactic Dets</td>
<td>absent</td>
<td>present</td>
</tr>
</tbody>
</table>

again what seems to matter is the availability of two sets which are to be in a certain relationship prescribed by a given quantificational element—namely, an adverb of quantification.

5.3.2 Japanese as a Floating Quantifier Language

As we witnessed in the previous chapters, employing NP-internal quantificational elements (though it is uncertain what category these elements belong to) is not the only possible way to express quantification in Japanese. Moreover, employing them is not even a predominant method of quantification in the language. With respect to the way quantification is accomplished, I propose that Japanese is a ‘floating quantifier (FQ) oriented’ language as opposed to a ‘Det oriented language’ like English. The distinction between the two can be summarized as in Table 5.1. In extreme cases, a FQ oriented language may have only a set of FQs as available semantic entities which achieve quantification (i.e. DETs). In contrast, a Det oriented language may exclusively designate a set of syntactic Dets as DETs. But in less extreme cases, where languages have both FQs and NP-internal quantificational elements (inclusive of Dets), either FQs or NP-internal quantificational elements can be considered to be more basic than the others. Japanese and English exemplify the less extreme cases in an interesting way.

It is claimed that, in Japanese, a set of floating quantifiers is the primary source of DETs which are necessary for GQ interpretations. Japanese, however, does not exclude the availability of NP-internal quantificational elements that combine directly with a common noun to form a GQ. But I suggest that such NP-internal quantificational elements are derivatives (through a lexical process) of floating quantifiers and their availability depends on the existence of floating quantifiers. Consequently, the inventory of such NP-internal quantificational elements in Japanese can be more restricted than that of floating quantifiers. In English, quantification is mainly achieved by employing syntactic Dets (which coincide with semantic DETs) that are capable of forming a GQ and they are the primary source of quantificational elements. Again it is not the case that, in English, there

4 With respect to the derivational nature of NP-internal quantificational elements, a similar idea is expressed by Mikami (1953) who takes floating numeral classifiers to be adverbial predicate modifiers and more basic.
cannot be any extra NP-external quantificational elements except for Dets nor quantification can be done only with Dets. Rather it suggests that other non-Det NP-external quantificational elements are secondary to Dets (again some of these elements can be derived from Dets through some lexical process).

Viewing Japanese and English from this sort of perspective is interesting in that the distinction correlates with other typological differences between the two. Below we examine these differences with the distinction between FQ orientation and Det orientation in mind.

Derivation of Additional DETs

In Japanese floating quantifiers are of two types. The first type is represented by the cardinals (e.g. go-nin 'five') and the universal quantifiers (e.g. zen-in 'all') both of which are constructed by combining a numeral or a universal quantification indicator with a classifier as we have seen in the previous chapters. The second type is exemplified by the newly introduced simplex adverbial floating quantifiers (takusan 'many' and hotondo 'most') seen in Section 2 of this chapter. What is interesting is the way these floating quantifiers appear within an NP. For them to be able to do so they have to be accompanied by the genitive marker -no as seen in (31).\(^5\)

(31) a. go-nin-no otoko
    five-gen man
    ‘five men’

b. *go-nin otoko
    five man
    ‘(INT.) five men’

c. zen-in-no otoko
    all-gen man
    ‘all men’

d. *zen-in otoko
    all man
    ‘(INT.) all men’

\(^5\)The sequences of words in (31b,d,f,h) do occur as a part of grammatical sentences. However, this does not mean that they are well-formed NPs. For example, the NPs in (31a,c,e,g) can legitimately be used as a short answer to a question like: Who came? but not those in (31b,d,f,h).
We note that the genitive marker is capable of deriving not only possessive elements but also modificational elements in general. Thus in (32) we see instances of pure possessive, pseudo possessive, and pure modificational uses of the genitive marker.

(32) a. Taroo-no sensei
    -gen teacher
    'Taroo's teacher'

b. kyoo-no tenki
    today-gen weather
    'today's weather'

c. genki-no hito
    health-gen person
    'healthy person'

d. sensei-no sono otoko
    teacher-gen that(the) man
    'the man who is a teacher'

Since the floating quantifiers are simpler than those acceptable pre-nominal counterparts in (32) and the genitive marker is capable of deriving modifiers for nouns in general, it would be reasonable to say that the prenominal versions seen in (32a,c,e,g) are derived from the original floating quantifier
source by affixation of the genitive marker in the lexicon. This derivational process for the pre-nominal forms seems to be in favor of taking floating quantifiers to be basic quantificational elements in Japanese.

Due to the lack of a morphological evidence, we cannot extend this conjecture to English cases (33) immediately. However, it is possible that English floating quantifiers *all, each, and both* are also derived (but in an opposite direction as done in the Japanese cases) from the Det counterparts by some lexical redundancy rule. Williams (1982) suggests that the English floating quantifiers are adverbials which are “a part of the verbal system” and not “a part of the nominal system”.

(33) a. All students came toady
    b. The students all came today
    c. Both students came today
    d. The students both came today
    e. Each student came today
    f. The students each came today

The Lack of Some Potential Derived Forms

The discussion above concerning the derivation of one set of quantificational elements from the other basic set leads to another interesting differences between Japanese and English. In Japanese, though it is true that most of the floating quantifiers can be made into a pre-nominal modifiers by affixing the genitive marker *-no* as described above, it is indeed the case that some floating quantifiers cannot be turned into a pre-nominal forms. The crucial cases are the following: simplex floating quantifiers like *dossari* 'many' in (34a) and *nokorazu* 'all' in (34c) and the ‘discontinuous’ negative floating quantifiers such as *zenzen ... nai* and *mattaku ... nai* as exemplified in (34e,g). The latter two quantificational elements can only be used in a negative sentence if they are to retain the quantificational force. (*Mattaku* can be used as an intensifier in a non-negative environment but this is not a quantificational use at all.)

(34) a. Hon-ga dossari ar-u
    book-nom many exist-pres
    ‘There are many books’

---

\(^6\)We note that, for English, the movement account of Sportiche (1988) mentioned in Chapter 1 is an alternative to this.
b. *Dossari-no hon-ga aru

c. Hon-ga nokorazu nakunat-ta
   book-nom all disappear-past
   ‘All books disappeared’

d. *Nokorazu-no hon-ga nakunatta

e. Otoko-ga zenzen ko-nakat-ta
   man-nom at all come-neg-past
   ‘No man came’

f. *Zenzen-no otoko-ga ko-nakat-ta

g. Otoko-ga mattaku ko-nakat-ta
   man-nom at all come-neg-past
   ‘No man came’

h. *Mattaku-no otoko-ga ko-nakat-ta

There are no pre-nominal counterparts corresponding to the floating quantifiers in (34a,c,e,g). One may object that zenzen and mattaku are not quantificational. For such skeptical people, an examination of the following data is recommended. The sentences in (35) and (36) are to show the applicability of two of the GQ properties, namely conservativity and monotonicity, introduced above to these negative floating quantifiers. (Though other properties can be shown to hold, we employ only the two here. Also the examples in (35) are structurally different from those data used in Section 2, due to the discontinuous nature of the negative floating quantifiers.)

(35) Conservativity

a. Otoko-ga zenzen ko-nakat-ta
   man-nom at all come-neg-past
   ‘No men came’

b. Otoko-ga zenzen [otoko-de sikamo kita-mono-de]-wa-nakat-ta
   man-nom at all man-cop and come cop-top-neg-past
   ‘No men were men who came’

b. Otoko-ga mattaku ko-nakat-ta
   man-nom at all come-neg-past
   ‘No men came’
Again the bracketed part of (35b,d) corresponds to \((X \cap A)\) of the definition (1) above. In (35a) and (35b) on the one hand and (35c) and (35d) on the other are equivalent to each other, hence \(zenzen\) and \(mattaku\) satisfy conservativity.

\[(36)\] Monotonicity

a. Gakusei-ga \(zenzen\) ko-nakt-ta
   \(student\-nom\ at\ all\ come\-neg\-past\)
   'No students came'

b. Senotakai gakusei-ga \(zenzen\) ko-nakt-ta
   \(tall\)
   'No tall students came'

c. Gakusei-ga \(zenzen\) hasi-te ko-nakt-ta
   \(running\)
   'No students came running'

d. Gakusei-ga \(mattaku\) ko-nakt-ta
   \(student\-nom\ at\ all\ come\-neg\-past\)
   'No students came'

e. Senotakai gakusei-ga \(mattaku\) ko-nakt-ta
   \(tall\)
   'No tall students came'

f. Gakusei-ga \(mattaku\) hasi-te ko-nakt-ta
   \(running\)
   'No students came running'

The fact that \(zenzen\) and \(mattaku\) are both left and right decreasing can be demonstrated by the valid implications from (36a) to (36b,c) and (36d) to (36e,f), respectively. Thus it is plausibly concluded that these floating quantifiers are lacking from the set of pre-nominal counterparts.

In English it is interesting to observe that not all Dets can be used as floating quantifiers. A partial examples to show this point are given in (37).
(37)  a. Three students came today
    b. *(The) students three came today
    c. Many students came today
    d. *(The) students many came today
    e. Every student came today
    f. *Student every came today
    g. Most students came today
    h. *(The) students most came today

There are only three floating quantifier counterparts among the entire inventory of Dets. I do not see an immediate explanation for this fact but this can be taken to be good evidence for the claim which take English NP internal Dets to be the basic source of _DETs_ from which other sorts (like floating ones) of _DETs_ can be derived in the manner speculated above.

Absence vs. Presence of Syntactic Dets

In his Ph.D. thesis Fukui (1986) argued that Japanese lacks the syntactic category of obligatory Det. Fukui defends this claim with empirical and theoretical motivation (c.f. Determiner Phrase (DP) Hypothesis). If this is correct, one possible reason is that, in a floating quantifier oriented language, quantification does not depend on the existence of Dets in an NP but can easily be achieved with adverbal floating quantifiers which is outside of an NP. But the situation is drastically different for English, a Det oriented language, whose Dets are undisputably obligatory in NPs.

It was suggested in Chapter 3 that NP-internal numeral classifiers are nominal modifiers not _DETs_ in the sense of B&C. The modificational nature has been motivated in the previous subsections. Given this conjecture and the suggestion by Fukui, the contrast between (38) and (39) can be explained. In (38) are Japanese NPs involving prenominal modificational quantifiers as well as (regular) adjectival modifiers. It is possible to change the order of the two in (38). Though there may be some differences in meaning, the important point is that order is not fixed. This is not surprising at all since the two are modificational and are on the same status.

(38)  a. san-nin-no utukusii onna
       three-gen beautiful woman
       ‘three beautiful women’
b. utukusii san-nin-no onna
   'three beautiful women'

c. zen-in-no wakai gakusei
   all-gen young student
   'all young students'

d. wakai zen-in-no gakusei
   'all students who are young'

In contrast, the order of Dets and adjectival modifiers cannot be altered in English. Again this is expected if a Det enjoys a special status distinct from that of an adjectival modifier.

(39) a. three beautiful women
   b. *beautiful three women
   c. all young students
   d. *young all students

5.4 Conclusion

Chapters 2 and 4 laid out the specifics of the syntactic and semantic treatment for the two kinds of floating quantifiers, namely floating numeral classifiers and floating universal quantifiers. Chapter 3 demonstrated that the adverbial analysis for Japanese floating quantifiers is not only possible but also empirically well-motivated. This was done by comparing the present adverbial analysis with the direct modificational account in light of the host of data introduced above. Moreover, in this chapter, it has been pointed out that adopting such an adverbial analysis for the phenomena under consideration is theoretically interesting in that doing so renders an interesting typological hypothesis within a research program of a universal theory of quantification. The hypothesis characterizes languages into: 1) floating quantifier oriented and 2) Det oriented languages. To substantiate this typological opposition, the comparison was made between Japanese and English and some typological (syntactic) differences between the two have been shown to follow from the orientational opposition. Obviously, more research is needed to examine the plausibility of such a typological claim.
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