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Mo

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0. Introduction

The Japanese postpositional particle **mo** has several distinct but obviously related uses. The present study is an attempt to characterize these uses of mo in a fairly uniform manner.

The three major uses of **mo** that we will be looking at are listed in (1).

(1) a. conjunctive: 'both ... and ...'
Neko **mo** inu **mo** nanika o tabeteiru
cat dog something ACC are eating
'The cat and the dog are eating something.'
b. additive: 'also, too'
Neko **mo** nanika o tabeteiru
cat something ACC is eating
'The cat too is eating something.'
c. quantificational: 'every, all'
Dono neko **mo** nanika o tabeteiru
wh cat something ACC is eating
'The cats are all eating something.'[1]

In the conjunctive use (1a), **mo** is attached to each of the NP or PP conjuncts. (In this and other uses, nominative and accusative case markers are deleted in the presence of **mo**. Other case markers are retained.[2]) In the additive use (1b), the phrase followed by **mo** is, intuitively speaking, an addition to an implicit list of items. In the quantificational use, **mo** is attached to a NP/PP which contains a **wh** word. **Mo** contributes the force of universal quantification.

There are several other uses of **mo** for which no extensive analysis will be attempted here. Those uses are listed in (2).

(2) a. 'not a single X'
Neko wa ippiki **mo** inakatta
cat TOP 1-CL was not
'Not a single cat was there.'
b. 'no matter what'
Kono neko wa dare ga kite **mo** suriyoru
this cat TOP who NOM come snuggles
'This cat snuggles up to whoever comes near.'

c. 'even if'
Kono neko wa hitori de mo heiki da
this cat TOP alone be fine is
'This cat will be fine even if it is left alone.'
d. conjunction of predicative categories
Kono neko wa kinoo kara tabe mo nomi mo sinai
this cat TOP yesterday from eat drink doesn't
'This cat hasn't eaten or drunk anything since yesterday.'

Unlike the examples in (1), those in (2) involve attachment of mo to syntactic categories other than NP and PP. In (2a), mo is attached to a "floated quantifier", that is, a numeral-classifier compound. In (2b), (c) and (d), mo is attached to sentential predicates, that is, verbs, adjectives and copula. [3]

In the following, I will first review Aone's (1987) study of the conjunctive use of mo, and point out the problems her analysis faces (Section 1). Mo in this use is then contrasted with other conjunctive postpositions (Section 2). After a new analysis for the additive use of mo is presented (Section 3), it will be extended to the conjunctive use (Section 4). I will then turn to the quantificational use of mo (Section 5), where I will argue against the unselective binding analysis of Nishigauchi (1986). The unselective binding analysis of mo is also shown to run into a problem when it interacts with adverbs of quantification (Section 6).

1. Conjunctive mo

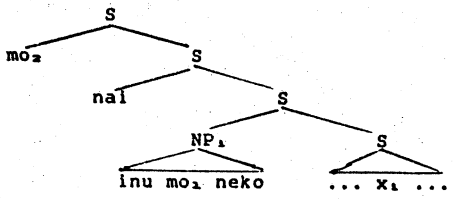
Aone (1988) proposes that a sentence with a conjunctive mo like (3) be analyzed as involving disjunction ('or') as in (4), rather than conjunction ('and').

(3) John wa inu mo_1 neko mo_2 kattei-nai
TOP dog cat have-not
'John neither has a dog nor a cat',

(4) $\forall x$ [[dog'(x) v cat'(x)] -> ~have'(j,x)]

According to Aone, the two occurrences of mo in (3) are given different translations at LF. The second instance of mo (mo_2) is a universal quantifier; it is the same kind of mo that we have seen in (1c). The first mo (mo_1) on the other hand, is a new type of mo, which is a disjunction. Inu mo neko, then, is given the translation $\lambda P[[dog'(x) \vee cat'(x)] \& P(x)]$, where x is a variable free in this phrase. The 'LF' of the sentence (3), then, looks like (5).

(5)



This 'LF' is translated as (6).[4]

(6) mo_2 ==> λøAø
nai ==> λø~ø
inu mo neko ==> λP[[dog'(x) v cat'(x)] & P{x}]
katteiru ==> have'
John ==> j

Ax ~ [λP[[dog'(x) v cat'(x)] & P{x}] (λx[have'(j,x)])]
= Ax ~ [[dog'(x) v cat'(x)] & have'(j,x)]
= Ax [~[dog'(x) v cat'(x)] v ~have'(j,x)]
= Ax [[dog'(x) v cat'(x)] -> ~have'(j,x)] (= (4))
(Aone's (28a'))

Aone notes that in (6), the universal quantifier (= mo_2) takes wide scope with respect to negation (= nai). This is highly suggestive in view of the fact that a quantificational mo always takes wide scope with respect to a clause-mate negation, as is shown in (7).

(7) Dare mo konakatta
who come-NEG-PAST
'Nobody came.'

Appealing as it is to give uniform analyses to conjunctive and quantificational mo sentences, Aone achieves the unification at the cost of translating the other occurrence of mo (= mo_1) in the conjunctive case as a disjunction, which is rather counter-intuitive. I give three fairly naive objections to this treatment of mo_1.

First, the syntactic representation in (5), especially the constituency of NP1, appears to be unwarranted. A NP mo NP sequence, if it is a constituent at all as Aone argues, has a very limited distribution. It is allowed only when it is followed (in the surface structure) by mo. No other postpositions in Japanese that participate in coordination are restricted in such a way.

The semantic status of mo$_1$ as disjunction is also dubious. To start with, mo$_1$ cannot be replaced by a more established disjunctive particle ka. Moreover, mo$_1$ can be used with a conjunctive adverb sosite ('as well'), but not with a disjunctive adverb matawa ('alternatively').

(8) a. inu mo sosite neko mo katteiru
dog as well cat have
'(He) has a dog, and a cat as well.'
b. inu to sosite neko o katteiru
c. *inu mo matawa neko mo katteiru
alternatively
d. inu ka matawa neko o katteiru
'(He) either has a dog or a cat.'

Finally, a very serious problem arises, when we try to formalize the reading of an affirmative sentence with the conjunctive mo.

(9) John wa inu mo neko mo katteiru
TOP dog cat has
'John both has a dog and a cat.'

The sentence (9) differs from (3) only in that the final verb is in the affirmative, rather than the negative. This sentence is perfectly grammatical. The conjunctive mo construction indeed is not a negative polarity expression. Aone's translation, however, would produce an entirely erroneous interpretation.

(10) Ax [[dog'(x) v cat'(x)] & have'(j,x)]

That is, Aone would have to claim (9) asserts that everything is either a dog or a cat and everything is in the possession of John, who presumably is also a dog or a cat. This is obviously not what the sentence means. The world need not consist of only dogs and cats, nor does John have to own everything.

Note that a much weaker (and much more sensible) translation like (11) is not appropriate either. (11) is equivalent to the formula that we would get for (9) in the unselective binding analysis mentioned in footnote 4.

(11) Ax [[dog'(x) v cat'(x)] --> have'(j,x)]

For the sentence (9) to be felicitously uttered, however, John need not be the owner of all the dogs and the cats in the world.

In fact, John's owning one dog and one cat is enough to make the sentence true. The sentence (9), then, should be given a translation like (12), where the claim is that John has a dog and a cat.

(12) Ex,y [dog'(x) & have'(j,x)] & [cat'(y) & have'(j,y)]]

I will come back to the proper translation of (9) in section 4, after an overview of NP (and PP) conjunctions in Japanese and a brief look at the additive use of mo.

2. NP Conjunctions

In addition to mo, there are at least three other post-positional particles that seemingly conjoins NPs; to, ni and ya. Each of these particles is used with different connotations. In this section, I will review Teramura's (1984) and Kuno's (1973) analyses of conjunctions. The formalization of the semantics of mo that will be given in sections 3 and 4 draws on these analyses. I will mostly confine myself to the discussion of to and mo, deferring the discussion of ni and ya to the appendix at the end of this section.

(13) a. Pinkerton mo Suzuki mo utatta sang
'Pinkerton and Suzuki sang.'
b. Pinkerton to Suzuki ga utatta
NOM
c. Pinkerton ya Suzuki ga utatta
d. ?Pinkerton ni Suzuki ga utatta

Teramura (1984) characterizes the semantics of to and mo as follows.

(14) To is used to enumerate the members of a set of interest at hand... (p.69)
mo is the form that connects (elements) when a certain set that can be defined by some attribute is understood either common sensically or between the speaker and the listner, and when the speaker asserts that all the members of such a set are there... (p.70)

As Teramura points out, mo is used most appropriately, for example, when a person is checking if he has packed all the necessary items in his suitcase before he leaves for vacation.

(15) Haburashi mo higesorimo shookazai mo ...
toothbrush shaver antacid
"(Now I've got) the toothbrush, the shaver, antacid, ..."

On the other hand, mo would be inappropriate in a context where it is unclear what the relevant attribute is.

Kuno (1973) points out that a conjunction with to is ambiguous between what he calls the phrasal conjunction and the sentential conjunction. He assumes that phrasal conjunctions are base-generated, while sentential conjunctions are derived via conjunction reduction. Kuno's phrasal conjunctions correspond to collective readings, and his sentential conjunctions to distributive readings.

NPs of the form NP to NP can be arguments of both collective predicates, as in (16), and non-collective predicates, as in (17). When the predicate is ambiguous, as in (18), NP to NP allows for both readings.

(16) John to Mary wa nite iru
TOP resemble
'John and Mary are alike.'

(17) John to Mary wa baka da
fool are
'John and Mary are fools.'
= 'John is a fool and Mary is a fool.'

(18) John to Mary ga kekkonsita
NOM married
'John and Mary got married.'
i) John and Mary exchanged the vow.
ii) John got married, and Mary got married.

Kuno does not discuss mo. It is clear from examples like (19) and (20) that a conjoined phrase with mo cannot be read collectively. (19) shows that NP that consists of singular NPs conjoined by mo is not allowed with a collective predicate. (20) shows that it is unambiguously distributive when it is used with an ambiguous predicate.

(19) *John mo Mary mo niteiru
resemble

(20) John mo Mary mo kekkonsita
married
'John got married and Mary got married.'

phonologically realized only optionally in Japanese, we never know whether we are dealing with a group-level argument or an individual-level argument.

Fortunately, there are predicates whose group-level argument is oblique. A comitative argument is not an option for such verbs. In (25), the PP headed by kara 'from' must take groups. To conjunction (a) is fine, but mo conjunction (b,c) is not.

(25) Schubert no Mikansei Kookyookyoku wa, ...
GEN Unfinished Symphony TOP
a. 'Allegro moderato' to 'Andante con moto' kara naru
from become
b. *'Allegro moderato' mo 'Andante con moto' mo kara naru
c. *'Allegro moderato' kara mo 'Andante con moto' kara mo naru
'Scubert's 'Unfinished' Symphony consists of ...'

We might be able to account for the ungrammaticality of the (b) sentence syntactically; generally, mo must follow, not precede, postpositions. But the ungrammaticality of (c) can be accounted for only semantically, namely in terms of the inherent distributivity of mo.

Appendix to Section 2

As we saw in (11), there are two other conjunctive particles that connect NPs: ni and ya. The purpose of this appendix is to make clear whether these particles can be used collectively or only distributively. Kuno claims they can only be interpreted ditributively. The only examples that Kuno gives in support of this conclusion, however, are sentences with the verb kekkonsuru 'to get married',

(18') a. John ni Mary ga kekkonsita
NOM married
b. John ya Mary ga kekkonsita

which are bad with the collective reading (but are good with the distributive reading). But this seems in part due to other aspects of the semantics of these two particles; ni is used for listing, and is often awkward if the list contains less than three items. Ya is used for giving examples, and is also awkward if all items are mentioned. Monogamist native speakers, who find these sentences funny, may be rejecting them for cultural reasons.

Phrases connected by ya or ni can be embedded in expressions denoting groups. They are occasionally felt to be not perfectly

I will follow Link (19??) and Landman (1988) among others and assume that we have two domains of individuals, namely, the domain of singular individuals (a, b, etc.) and their sums (written as a + b), and the domain of groups (= atomic plural individuals). Sums are mapped onto groups, by the operator !. The group that consists of individuals a and b is then !(a + b). Collective predicates like **kekkonsuru** 'to get married' take groups in their extensions, while non-collective predicates take individuals in their extensions. Many basically non-collective predicates can in fact take groups in their extensions as well; for example, if you are like me, carrying a piano upstairs must involve a collective effort of you and your friends. The collective readings of such predicates are enforced by adverbs like **issyoni** 'together', for example, though collective readings are usually also available without such adverbs.

A conjoined NP with **to** is ambiguous between the sum of elements, over which the predicated attribute is distributed (a + b) and the group that consists of elements conjoined !(a + b). The conjunctive **mo** gives us the equivalent of sums ('equivalent', because I will formulate **mo** using the generalized conjunction, rather than the summation operation), but never takes us to the groups.[5]

Observations using other syntactic frames consistantly show that **mo** cannot form a group. (21) through (24) show that **mo** is never grammatical, while **to** is, when embedded in an NP that makes an explicit mention of a group.

(21) a. [Pinkerton to M.B. to Suzuki] no uti de ...
GEN inside being
'Among Pinkerton, M.B. and Suzuki, ...'
b. *[Pinkerton mo M.B. mo Suzuki (mo)] no uti de ...

(22) a. [M.B. to Suzuki] tati wa Pinkerton o matteita
PLURAL TOP ACC were waiting
'M.B. and Suzuki were waiting for Pinkerton.'
b. *[M.B. mo Suzuki (mo)] tati wa Pinkerton o matte-ita

(23) a. ?[M.B. to Suzuki] nado no hito tati
etc. GEN person PLURAL
'people like M.B. and Suzuki'
b. *[M.B. mo Suzuki (mo)] nado no hito tati

(24) a. [Taroo to Hanako] no guruupu
GEN group
'the group that consists of Taro and Hanako'
b. *[Taroo mo Hanako (mo)] no guruupu

As for verbs that are collective, the situation is slightly more complicated, because many such verbs have an alternative subcategorization frame, taking individuals as arguments, plus an extra argument, usually comitative ('with'). Since arguments are

idiomatic, but are far better than phrases with mo, which are totally unacceptable.

(21) c. [Pinkerton ni M.B. ni Suzuki] no uti de ...
GEN inside being
d. [Pinkerton ya M.B. ya Suzuki] no uti de ...

(22) c. ?[M.B. ni Suzuki ni Trouble] tati wa Pinkerton o matta
waited
d. [M.B. ya Suzuki] tati wa Pinkerton o matte-ita

(23) c. [M.B. ni Suzuki ni Goro] nado no hito tati
etc.
d. [M.B. ya Suzuki] nado no hito tati

(24) c. [Taroo ni Hanako ni Yooko] no guruupu
GEN group
d. [Taroo ya Hanako] no guruupu

Ya and ni are also fine with predicates that take groups.

(25') a. Sooseki no sanbusaku wa 'Sansiroo' ni 'Sorekara' ni
GEN triolgy TOP
'Mon' kara natte iru
from become is
'Soseki Natsume's trilogy consists of ...'
b. Sooseki no sanbusaku wa 'Sansiroo' ya 'Sorekara' kara
natte iru

These facts seem to indicate that, contra Kuno, conjunctions with ya and ni can (at least sometimes) be interpreted as denoting groups.

3. Additive mo

We now turn to the additive use of mo. Examples of this use are provided in (26).

(26) a. Bertha wa neko mo katteiru
TOP cat has
'Bertha has a cat (as well as a dog).'
b. Bertha mo neko o katteiru
cat ACC has
'Bertha (as well as Zelda) has a cat.'
c. Neko mo honyuudoobutu da
cat mammal is
'Cats (as well as dogs) are mammals.'

Mo puts its NP sister into 'focus'. For mo to be appropriate, a set of implicit alternatives to the NP in focus must be presupposed.

Obviously this use is closely related to the conjunctive use discussed in the previous section. Kuroda (1965, p.79) considers, though he eventually does not adopt, the possibility of analyzing this use of mo as a subclass of the conjunctive use, more specifically, as conjunction with a phonologically unrealized "dummy" conjunct.

(27) Bertha wa neko mo D mo katteiru
TOP cat has
'Bertha has a cat (as well as a dog).' (= (26a))

The approach I will take is just as reductionist, but in the other direction; I will argue that the additive use of mo is basic, and this use will be extended for the conjunctive cases. In the rest of this section, I will give a brief sketch of the translation for the additive mo sentences.*

NPs are given the translations in (28). I will assume that a bare, determinerless NP is treated as the supremum of the property its common noun head denotes.

(28) Bertha => b
Zelda => z

neko => σx.cat(x), that is, c + a + t, where the CN neko denotes {c, a, t}
inu => σx.dog(x)

The verb katteiru is translated as have'. Its object argument (as well as its ga-marked subject) is in the scope of an existential quantifier. I will keep the interpretations of the bare NPs steady, as the suprema of properties, without respect to whether the NPs are in the scope of an existential quantifier or is in contexts of generic interpretations. I therefore build a mechanism that takes us from those maximum elements to smaller elements (either atomic individuals or sums) into the restriction on the quantifier. I am tacitly taking advantage of the fact that there is no number distinction in Japanese. Thus in (26a), Bertha may have one cat or two cats or three cats. (29) takes care of all those situations.

(29) neko o katteiru => λz[E, y ⊆ z, have'(y)](σx.cat(x))
= E, y ⊆ σx.cat(x), have'(y)

The 'meaning' of **mo** is formulated as in (30). This is intended to capture the spirit of Teramura's characterization quoted in the last section. **Mo** is a universal quantifier, whose domain of quantification is the elements of a contextually determined set C, of which the denotation of the NP argument of **mo** is a member.[7]

(30) mo => $\lambda x \lambda P[\forall y, C(y) \& C(x), P(y)]$

Thus, (26a) is given the translation in (31).

(31) neko mo => $\lambda x \lambda P[\forall y, C(y) \& C(x), P(y)](\sigma x.cat(x))$
$= \lambda P[\forall y, C(y) \& C(\sigma x.cat(x)), P(y)]$
Bertha wa x_o katteiru => $\exists E, z \subseteq x_o, have'(b,z)$
Bertha wa neko mo katteiru
$\Rightarrow \lambda P[\forall y, C(y) \& C(\sigma x.cat(x)), P(y)]$
$(\lambda x_o[\exists E, z \subseteq x_o, have'(b,z))$
$= \forall y, C(y) \& C(\sigma x.cat(x)), \lambda x_o[\exists E, z \subseteq x_o, have'(b,z)](y)$
$= \forall y, C(y) \& C(\sigma x.cat(x)), \exists E, z \subseteq y, have'(b,z)$

This means that Bertha has at least one individual-part of each of the elements of the contextually determined set C. If the previous discourse was about Bertha's ownership of a dog, the set C is likely to be the set of animal kinds represented by Bertha's pets.

4. Semantics of Conjunctive mo

Let us now return to the problem we left with at the end of Section 1. There we saw that when we apply Aone's (1987) analysis of conjunctive **mo** to affirmative contexts, incorrect readings arise. Thus if we follow Aone, (32) would be translated as (33), while the sentence can be uttered truthfully enough if a much weaker condition (34) is satisfied.

(32) Bertha wa inu mo neko mo katteru
TOP dog cat has
'Bertha both has a dog and a cat.'

(33) $\forall$ [dog'(x) v cat'(x)], [have'(b,x)]

(34) $\exists$ [dog'(x) & have'(b,x)] & $\exists$ [cat'(y) & have'(b,y)]

A translation equivalent to (34) can be given for (32) if we assume that the conjunctive **mo** is a generalized conjunction.

(35) inu mo neko mo => dog' ⌐ cat'
= λP[P(dog') ⌐ P(cat')]
Bertha wa ... katte-iru
=> λQ[E Q(x) & have'(z,x)]
Bertha wa inu mo neko mo katte-iru
=> λP[P(dog') ⌐ P(cat')]
(λQ[E Q(x) & have'(b,x)])
= λQ[E Q(x) & have'(b,x)](dog') ⌐ ...
= E dog'(x) & have'(b,x) ⌐ ...
= E dog'(x) & have'(b,x) & ... (= (34))

Though (35) fairly accurately represents the truth condition of a conjunctive mo sentence like (32), we may want to ask how we represent the difference between (32) and a to conjunction like (36).

(36) Bertha wa inu to neko o katteiru
TOP dog cat ACC has
'Bertha has a dog and a cat.'

As we saw in Section 2, the conjunctive use of mo presupposes a contextually defined set of which the denotations of the conjuncts are members. This can be done very easily by extending the analysis of the additive use of mo in the last section. I will aim at a representation like (37).

(37) Ax, C(x) & C(cats') ⌐ C(dogs'), E, y ⊑ x, have'(b,y)

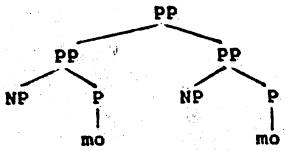
A negative sentence like (3), with which Aone's original proposal was successful, would also receive a natural translation shown in (38). Unlike Aone's, then, our analysis can give a uniform treatment for the conjunctive use of mo in both affirmative and negative contexts.

(3) Bertha wa inu mo neko mo katteinai
TOP dog cat have-not
'Bertha neither has a dog nor a cat',

(38) Ax, C(x) & C(cats') ⌐ C(dogs'), ~ E, y ⊑ x, have'(z,y)

I will assume that the conjunctive mo appears in a para-tactic structure like (39).

(39)



Independent of the conjunctive mo cases, we need parataxis of PPs for cases like (40) anyway.

(40) Tookyoo kara Oosaka made wa yaku sanbyaku mairu desu
Tokyo from Osaka to TOP about 300 miles is
"It's about 300 miles from Tokyo to Osaka."

Since not all PPs can be placed paratactically, Ps must be lexically specified as to whether they can participate in this construction.

Incidentally, parataxis is a fairly frequent phenomenon in Japanese; verbs and adjectives, and the phrases that they head, are conjoined not by separate conjunction words but by participating in parataxis. (Non-final conjuncts morphologically take either the "gerundive" or the "stem" forms, while the last conjunct appears with tense.)

(41) a. Nyuuingurando no huyu wa nagaku kibisii
New England GEN winter TOP long(STEM) hard
'The winter in New England is long and hard.'
b. Nyuuingurando no huyu wa nagakute kibisii
long(GERUND)

Parataxis syncategorematically introduces a "meet" generalized conjunction. Thus, with the conjunctive mo, we have:

(42) inu mo => λP[Ay, C(y) & C(σx.dog(x)), P(y)]
neko mo => λP[Ay, C(y) & C(σx.cat(x)), P(y)]

inu mo neko mo =>
λP[Ay, C(y) & C(σx.dog(x)), P(y)]
⌐ λP[Ay, C(y) & C(σx.cat(x)), P(y)]
= λP[Ay, C(y) & C(σx.dog(x)), P(y)
⌐ Ay, C(y) & C(σx.cat(x)), P(y)]
= \P[Ay, C(y) & C(σx.dog(x)), P(y)
& Ay, C(y) & C(σx.cat(x)), P(y)]

which is equivalent to:

(43) λP[∀y, C(y) & C(σx.dog(x)) & C(σx.cat(x)), P(y)].

This will then combine with (44) and produce the desired representation (37).

(44) Bertha wa x_a katteiru => λx[E, y ⊆ x, have'(z,y)]

There is an important advantage in analyzing the conjunctive mo in terms of the contextually determined set C. This formulation leaves open what the content of C is. In case of (37), for example, its denotation may either contain only cats and dogs, or cats and dogs along with some other sets, say, birds. Thus (32) can be uttered appropriately in either of the following two kinds of situations.

(45) a. Hanako: "I wonder if Bertha has a dog or a cat."
Taro: Bertha wa inu mo neko mo katteiru.
TOP dog cat have
"Bertha has both."
C = {cats, dogs}
b. Hanako: "Bertha has a parakeet, doesn't she?"
Taro: Bertha wa inu mo neko mo katteiru.
"Bertha has a dog and a cat, too."
C = {birds, cats, dogs}

An analysis of the conjunctive mo simply in terms of (generalized) conjunction presumably needs a separate device to account for this second reading. On our analysis, on the other hand, the two readings are considered to be derived by the same process.

We finally turn to the restriction placed on the NP argument of mo. It appears that only an e-type NP can occur with mo. To, on the other hand, does not have this restriction.* Proper nouns and definite descriptions, therefore, can occur with both mo and to with equal ease.

(46) a. Bertha mo Zelda mo neko o katteiru
cat ACC have
'Bertha and Zelda have a cat.'
b. Bertha to Zelda ga neko o katteiru
NOM cat ACC have
c. Bertha wa kono neko mo ano neko mo katteiru
TOP this cat that cat has
'Bertha owns this cat and that cat.'
d. Bertha wa kono neko to ano neko o katteiru
TOP this cat that cat has

Bare NPs, which I have claimed denote suprema of properties, are also fine with mo, indicating that they should be translated as

an e-type expression.

(47) Bertha wa inu mo neko mo katteiru
TOP dog cat has
'Bertha has both a dog and a cat.'

Nouns which are preceded by numerals cannot occur with mo though they are fine with to. This would be expected if we place the restriction on the semantic type of the argument of C, since there is no single individual that stand for a generalized quantifier like "two dogs" and "three cats". (If the context guarantees definite references, they will be okay with mo as well.)

(48) a. *Bertha ga sanbiki no inu mo nihiki no neko mo
NOM 3-CL GEN dog 2-CL GEN cat
katteiru
has
'Bertha has three dogs and two cats.'
b. Bertha ga sanbiki no inu to nihiki no neko o katteiru

Nouns with numerals, however, are fine if preceded by a definite determiner like kono 'this' and ano 'that'.

(49) Bertha ga kono sanbiki no inu mo ano nihikino neko mo
NOM this 3-CL GEN dog that 2-CL cat
katteiru
have
"Bertha owns these three dogs and those two cats."

All of the above judgments hold with the additive use of mo as well. Thus,

(50) a. Zelda wa neko o katteiru. Bertha mo neko o katteiru
TOP cat ACC have cat ACC have
'Zelda has a cat. Bertha has one too.'
b. Bertha wa inu o katteiru. Neko mo katteiru
"Bertha has a dog. She has a cat, too."
c. Bertha wa sanbiki no inu o katteiru.
TOP 3-CL GEN dog ACC have
*Nihiki no neko mo katteiru.
2-CL GEN cat have
"Bertha has three cats. She also has two cats."
d. Bertha wa kono sanbiki no inu o katteiru.
TOP this 3-CL GEN dog ACC has
Ano nihiki no neko mo katteiru.
that 2-CL GEN cat has
"Bertha owns these three dogs. She also owns those two

cats."

Judgments are less clear with modifiers defined in terms of proportions between the cardinalities of two sets. They are felt to be worse in conjunctive contexts (51a,d) than in additive contexts (b,e). They are perfect with to (c,f).

(51) a. ??nijuppaasento no dokusin dansei mo, hansuu izyoo no
20 percent GEN single male half over GEN
dokusin zyosee mo, nanika petto o katteiru
single female some pet ACC have
"Twenty percent of single males and over half of single females have some pets."

b. ?nijuppaasento no dokusin dansei mo nanika petto o katteiru
"Twenty percent of single males too have some pets."

c. nijuppaasento no dokusin dansei to, hansuu izyoo no
20 percent GEN single male half over GEN
dokusin zyosee ga, nanika petto o katteiru
single female NOM some pet ACC have
"Twenty percent of single males and over half of single females have some pets."

d. ??ooku no dokusin dansei mo, hotondo no dokusin zyosee
many GEN single male most GEN single female
mo nanika petto o katteiru
some pet ACC have
"Many single males and most single females have some pets."

e. ?hotondo no dokusin zyosee mo nanika petto o katteiru
"Most single females too have some pets."

f. ooku no dokusin dansei to, hotondo no dokusin zyosee
many GEN single male most GEN single female
ga nanika petto o katteiru
NOM some pet ACC have
"Many single males and most single females have some pets."

It appears that the more definite the sets become, the more acceptable these NPs are felt to be.

Apart from these obscure cases, judgments in the two contexts generally coincide, again rendering support for a uniform analysis of mo.[8]

5. Quantificational mo

The introduction of the contextually determined set C in the translations of the additive and the conjunctive mo sentences, in a sense, is mandated by the quantificational nature of mo. It may be plausible to assume that translation of surface forms to logical representations is executed in keeping with the condition

which prohibits vacuous quantification, and a variable is introduced if necessary and if the context permits.

When a surface form supplies a free variable, there is no need to actively introduce one in the process of translation. The third use of mo, the quantificational use of mo, is the case in point. In this use, variables are supplied in the form of "indeterminate pronouns", or wh words, in the phrase marked with mo. It would do no harm to give them rather simplistic representations as in (53), assuming that a wh NP is translated as an open sentence acting as the restriction clause for the quantifier translating mo.

(52) dono onnanoko mo sono araiguma o mita
which girl that raccoon ACC saw
"All the girls saw the raccoon."

(53) Ax, girl(x), saw(x,r)

A wh NP need not be adjacent to mo as in (52), as long as it is c-commanded by mo. Thus in (54), the wh NP is embedded in a complex NP. Exactly what such a sentence means will be discussed immediately. For the moment, (54) will be represented as (55).

(54) [[dono onnanoko] ga mita araiguma] mo kawaikatta
which girl NOM saw raccoon cute

(55) Ax, girl(x), the raccoon x saw was cute

One of the functions of mo is to mark the scope of quantification whose force it provides. Generally the scope of mo is the smallest clause that dominates it. In (54), mo is a matrix element, so the scope of mo is the entire sentence. In (56), where mo appears in a relative clause, its scope does not extend beyond it.[10]

(56) [[dono onnanoko] mo mita araiguma] ga kawaikatta
which girl saw raccoon NOM cute
"The raccoon that every girl saw was cute."

Sentences like (54) are potentially problematic for theories in which the "LF" representations like (55) are derived by movement, for such a derivation would involve extraction from inside a complex NP, violating the Subjacency condition on movement rules, if Subjacency also regulates movement after the s structure. Nishigauchi (1986) argues that movements in LF as well as syntactic movements are bounded. In his analysis, sentences like (54) circumvents a Subjacency violation because in Japanese a wh word can pied-pipe the entire NP that it is embedded in. The

pied-piped NP, as well as the embedded wh NP, is then interpreted as variable, through feature percolation. The particle mo is considered an unselective binder. Being unselective, it can both bind the original syntactic variable provided by the wh word and the variable correponding to the larger, pied-piped NP. The resultant LF, then, is not like (55), but involves binding of a pair of variables, as in (58). I switch to Nishigauchi's original examples.

(57) [[dare ga kaita] tegami] ni mo onazi koto ga
who NOM wrote letter LOC same thing NOM
kaite atta
written was

(58) For all x, y, (quantifier)
x a person, y a letter x wrote, (restriction clause)
the same thing was written in y. (core scope)
(Nishigauchi, 1986, p.179)

In (58), x is the original variable provided by the embedded wh NP dare, and y is the variable for the bigger NP, created by percolation of the wh feature.[11]

Nishigauchi's LF (58) for the sentence (57) appears to give more or less the correct condition the model must satisfy to make the sentence true. His approach, however, cannot account for the following sentences.

(59) a. Kono kaisya wa [[dono gakka] no sotugyoosei] mo
this firm TOP department GEN graduate
saiyoosuru
hire
"This firm will accept graduates of any major."
b. Kono mise de wa [[dono kuni] de syuppansareta hon] mo
this store in TOP country in was published book
utteiru
sell
"Books published in any country are sold in this store."

Nishigauchi would have to give translations like those in (60) to these sentences.

(60) a. Ax,y, department(x) & person(y) & belonged-to(y,x),
hire(f,y)
b. Ax,y, country(x) & book(y) & published-in(y,x),
sell(m,y)

The sentence (59a) as the stated policy of a company would be satisfied, however, even if not all applicants were hired.

Consider a situation in which there are two applicants each who have majored in philosophy, computer science and economics. The company hires one graduate of each major, and that would be enough to satisfy (59a). Similarly, the bookstore in (59b) need not be as well-stocked as to have every publication from every country. The store can put up a sign reading (59b) if each country is represented with at least one publication. In other words, in these sentences, the domain of elements the original variable x belongs to is universally quantified over, but the domain of elements the variable y is assigned to is not. The translations of the sentences in (59) should be (61).

(61) a. Ax, department(x), E, person(y) & belonged-to(y,x), hire(f,y)
b. Ax, country(x), E, book(y) & published-in(y,x), sell(m,y)

One can actually introduce another quantifier to quantify over the denotations of the larger NPs, something quite unexpected if they were universal quantifiers themselves. First observe that NPs without an overt determiner can cooccur with "floated" numerals, as in (62a). A mo-marked universal quantifier NP as in (62b), on the other hand, cannot occur with a "floated" quantifier. (62c) shows, however, that when the wh NP is properly embedded inside a mo-marked NP, the bigger NP can cooccur with a numeral. (62d) is the truth condition under which (62c) is true.

(62) a. ryuugakusei ga hutari kita
foreign student NOM two came
"Two foreign students came."
b. *dono ryuugakusei mo hutari kita
foreign student two came
c. dono kuni no ryuugakusei mo hutari kita
country GEN foreign student two came
"Two students from each country came."
d. Ax, country(x), E, student(y) & from(y,x), came(y) & |y| = 2

We can also observe that the bigger NP does not share the properties ascribed to universal quantifiers by Barwise and Cooper (1981). An inference from (63a) to (63b) goes through, while an inference in the other direction fails. Since male students are a subset of students, this means that the bigger NP is persistent and not anti-persistent.[12]

(63) a. Kono kaisya wa [[dono gakka] no otoko no
this firm TOP department GEN male GEN
sotugyoosei] mo saiyoosuru
graduate hire
"This firm will accept male graduates of any major."

b. Kono kaisya wa [[dono gakka] no sotugyoosei] mo
this firm TOP department GEN graduate
saiyoosuru
hire
"This firm will accept graduates of any major."
(= (59a))

To summarize, the mo-marked NPs that properly contain wh words are not themselves universal quantifiers. (They are basically given whatever appropriate interpretations bare NPs get in the same contexts.) If we decide that we need a separate level of syntactic representation called LF, which are derived from the s structure by movement rules, the LF movements must be allowed to violate the Subjacency.[13]

6. Proportion problem

Nishigauchi's unselective binding analysis also makes wrong predictions when it interacts with adverbs of quantification like **taitei** 'mostly' and **metttani** 'seldom' which seemingly modify the quantificational force.[14] Nishigauchi (1986, pp.182 ff.) was the first to observe that when the adverb of quantification **taitei** c-commands, and is c-commanded by, a mo-marked NP as in (64), the NP may either denote a (generalized) universal quantifier or a proportional quantifier 'most.'

(64) [[dono gakusei] ga kaita ronbun] **mo** taitei saiyoosareta
which student NOM wrote papuer mostly was accepted

When NP **mo** denotes a universal quantifier, there is in fact a further ambiguity, though Nishigauchi was not aware of it. On the first reading (65a), **taitei** is construed as a 'real' adverb of frequency, counting events and calculate their proportions. On the second reading (65b), **taitei** 'grabs' a bare NP and quantify over its denotation. In (64), we have a bare NP **ronbun** 'paper', so taitei may count papers. This is perhaps the most prominent reading.

(65) a. all x, student(x), E, paper(y) & wrote(x,y),
frequently-accepted(y)
b. all x, student(x), most, paper(y) & wrote(x,y),
accepted(y)

The reading on which the NP **mo** denotes a proportional quantifier 'most' may be represented as (65c).

(65) c. most x y, student(x) & paper(y) & wrote(x,y), accepted(y)

In (65c), we have quantification over a pair of variables. This is because the adverb of quantification taitei 'mostly', which Nishigauchi assumes to be an unselective binder, has grabbed whatever variables available, in this case, the variable corresponding to the embedded wh NP and the one that corresponds to the bigger NP.

I agree with Nishigauchi that there is a reading for (64) where we have a proportional quantifier, rather than a universal quantifier.[15] The translation in (65c), however, appears to be inadequate, in the face of rather extreme situations that give rise to the "proportion problem" discussed by Kadmon (1987).

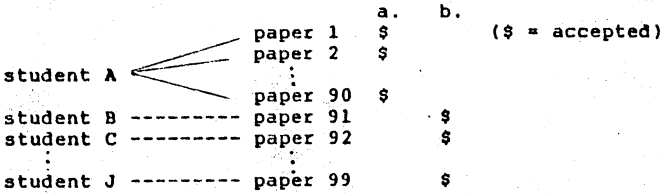
Kadmon notes that the truth of (66) depends on the proportion of dog-owning women who are happy to all the dog-owning women, not on the proportion of happy woman-dog pairs to all woman-dog pairs.

(66) Most women who own a dog are happy.

Consider, for example, a situation in which one happy woman owns fifty dogs and nine unhappy women own one dog each. There will be fifty (out of fifty nine) pairs in which the woman is happy. If we were counting pairs, this should suffice. The sentence, however, is not considered true in such a situation. What counts obviously is the number of women who are happy, since in another situation, where one unhappy woman owns fifty dogs and nine happy women own one dog each, (66) is considered true. What is crucial for the truth or falsity of sentences like (66), then, is the proportion of assignments to a single variable and not proportion of assignments to a pair of variables.

Returning to the sentence (64), consider a situation in which there are ten students and ninety nine papers. One of the students is the author of ninety papers, and the nine other students are the authors of the remaining nine papers, respectively. There are, then, 99 student-paper pairs in this model. Graphically, the situation looks like (67).

(67)



Furthermore, if the model is such that all the papers written by the student A were accepted, as in (67a), we have a

better than 90 percent overall acceptance rate. If we were counting the student-paper pairs at all, as Nishigauchi argues, this should be good enough to make (64) true. The sentence, however, is unanimously judged to be inappropriate in such a situation by native speakers I have talked to.

What do we count, then? Students. That is, assignments to the student variable. The sentence (64) is indeed appropriate in a model like (67b), where the majority of the students got their papers accepted, while the majority of papers were rejected. Thus a continuation like (68b) is felicitous. Note also that (68a), which would be appropriate if the sentence (64) were true in a model like (67a), is not a felicitous continuation of the sentence.[16]

(68) a. # ... but the students B through J didn't get their papers accepted.
b. ... but the student A didn't get a single paper accepted.

It should be reasonable, given these observations, that the sentence (64) be represented as (69), rather than (65c). In this reformulation, the wh NP dono gakusei is translated as variable bound by the adverb of quantification, but the determinerless NP which embeds it is treated as an individual.[17]

(69) Most x, student(x), *accepted(σy[paper(y) & wrote(x,y)])

We now turn to an apparent problem with this analysis. Consider a slight variation of the sentence (65).

(70) [[dono ronbun] o kaita gakusei] mo taitei saiyoosareta
which paper ACC wrote student mostly was accepted
cf. "Most paper's authors were accepted."

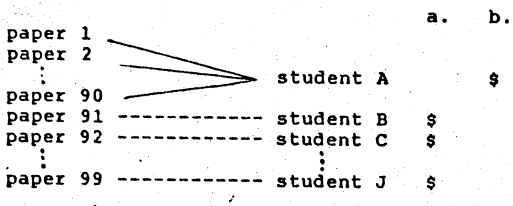
In (70), I have switched the 'students' and the 'papers'. We now have, with the quantificational force aside, 'students that wrote papers.' I will argue that its translation has exactly the same structure as (69) above, with 'students' and 'papers' trading places, and looks like (71).

(71) Most x, paper(x), *accepted(σy[student(y) & wrote(y,x)])

To determine whether this translation gives the right truth condition, let us consider what kind of situations this sentence will be true in. Again we do not want to count the assignments to the bigger NP, or the assignments to the pair of variables, because if we did so, (70) should be true in a situation like

(72a).

(72)



(70) is not appropriate in such a situation, simply because the majority of the papers are such that their authors were not accepted. Witness that a continuation like (73) is inappropriate here.

(73) # ... but the student A was not accepted, (while it was he that wrote most of the papers).

So we should count the assignments to the variable that translates the embedded NP dono ronbun. We expect that (70) would be true in a situation like (72b), where the one student who wrote most of the papers, and only that student, was accepted, since then for most of the papers, their author was accepted. Unfortunately, native speakers find the sentence (70) rather inappropriate given such a scenario. They in other words reject a continuation like (74).

(74) # ... specifically, the student A, but nobody else was accepted.

The intuition is very unclear in such extreme situations, since speakers usually assume that the mapping from the embedded NP (paper) to the bigger NP (student) is reasonably even when they use a sentence like (70). This assumption can be accounted for pragmatically in the following way. A relative clause is used in (70) to classify the students, by adding restrictions to their denotations. (That is, we can talk about 'the student who wrote the paper on Japanese reflexives', 'the student who wrote the paper on the stage-level/individual-level distinction', and so forth.) In a situation like (72), most assignments to the embedded variable will give you the same individual, namely, the student A. To utter (70) fully aware of such a mapping situation, then, would be highly uncooperative, and hence, pragmatically inappropriate.

If it is a pragmatic consideration that rules out (72b), there may well be a way to cancel it, and indeed there is one.

Consider the following scenario. One day in late April 1990, you walk into the department lounge and find application essays improperly disposed of in the waste basket. There are ninety-nine essays. Names on the title pages have been rubbed out. Already made suspicious by the rumor that an unusually small number of applicants (you don't know exactly how many) have been accepted this year (which unbeknownst to you was actually caused by another severe state budget cut), you are now convinced that there was some irregularity in the admission process. You head immediately to the Admissions Office, to which all the documents have already been sent. There you confront this uncooperative clerk, who grudgingly agrees to tell you, for each of the ninety-nine essays, whether its author has been accepted. She, however, is adamant about not revealing the identities of the applicants. So you read aloud a title, and the clerk tells you whether its author has been accepted. The two of you go through this routine ninety-nine times. The result of your investigation is rather surprising: For ninety out of the ninety-nine essays, the author has been accepted. you have not found out that there were exactly ten applicants, one of whom sent in ninety essays, while the others sent in only one essay each. Nor will you find out till September that only one applicant was accepted, the prolific one. The clerk announces that the office is closing, and you exit, mumbling (70) to yourself.

In order to properly judge the truth condition of a sentence like (70), then, a speaker must be "blindfolded" with respect to the proportions of the two variable assignments. In other words, (70) is considered truthful and appropriate in a situation like (72b), if the speaker is not aware of the unevenness of mapping between the domain of papers and that of students. Once this pragmatic condition is satisfied, there is no reason to reject (71) as the translation for (70), paralleling the translation (65c) given to (64).

It should be noted that the asymmetry we observe in (64) and (70) and the one Kadmon observed in (66) run in the opposite directions. In Kadmon's example, the quantification is over the denotations of the bigger NP which properly contains the other indefinite. In (64) and (70), on the other hand, the value of the bigger NP is dependent on the assignment to the smaller NP, and the quantification is over the denotation of this smaller NP.

7. Conclusion

In this paper, I have argued for a uniform treatment of the three major uses of the postposition **mo**. **Mo** is analyzed as primarily a universal quantifier. The domain of quantification is contextually determined in the additive and the conjunctive uses of the particle, while the variable to be bound is syntactically provided in the quantificational use. Further, **mo** is claimed to be a selective quantifier, giving rise to asymmetric readings.

Notes

[1] In the glosses, the following abbreviations are used: NOM(inative), ACC(usative), GEN(itive), TOP(ic) and CL(assifier).
In the formulas, A is a universal quantifier, E an existential quantifier and ~ a negation.

[2] Such deletion/retention of case markers is not specific to mo. See, for example, Kuno (1973).

[3] I am sure these cases too can be analyzed by extending the analysis presented below. (2d) obviously involves a straightforward extension of the conjunctive use. (2a) and (2c) can be done in terms of the contextually defined set C, introduced in section 3, though it is not obvious what semantic types the arguments of **mo** in these cases should be given. (2b) is closely related to the quantificational use of mo; Nishigauchi (1986) in fact claims (2b) is a subcase of it.

[4] While Aone gives the selection index x to the universal quantifier, she obviously is assuming that the quantifier is unselective.
A question arises, as Barbara Partee and Angelika Kratzer have point out to me, as to how we put the negation where it is in the first line of (6). There, the negation has scope over the restrictive clause and the core scope of the universal quantifier, but such a scope relation is impossible, because the universal quantifier must appear in a tripartite structure.
We might try, therefore, modifying Aone's analysis in the following manner. In 'LF', the disjunction (= NPi) takes scope over the negative (= nai). The representation is then translated as (i), which is equivalent to the last line of (6).

(i) A, [dog'(x) v cat'(x)], ~[have'(j,x)]

See also discussion around (10) and (11) below.

[5] I will not attempt an extensive analysis of distributivity in Japanese in this paper. Cf. also Kawasaki (1989).

[6] Many details are left open, which can be filled in only after a more thorough survey of NP interpretation in Japanese is attempted. In the following, I will ignore intensionality, and the question of how the existential quantifier is introduced. For this last question, see Kratzer (1988), Diesing (1988) and references cited therein.

[7] The formulation in (30) should be improved upon, to deal with examples where the focus is not the NP argument itself but a subpart of it, as in (i).

(i) Bertha no neko **mo** nezumi o tukamaeru
GEN cat mouse ACC catch
'Bertha's cat (as well as Zelda's) catches mice.'

[8] Restrictions to the type e might be too strong. A good alternative candidate is strong quantifiers in the sense of Barwise and Cooper (1981).

[9] The kind of NPs that can appear as argument of **mo** to a large degree corresponds to the kind of NPs that can appear in another context where semantic types are at issue, namely, in the context of thetic judgments with individual-level predicates. Ogihara (1987) observes that bare NPs with a cardinal modifier are not allowed in a ga-marked subject position of an individual-level predicate.

(i) a. *hutari no hito ga kitigai da (individual-level)
two GEN person NOM crazy are
"Two people are crazy."
b. hutari no hito ga okotte iru (stage-level)
angry are

[10] The sentence (56) in fact has another reading on which **mo** takes scope over the entire sentence, as Chisato Kitagawa has pointed out to me. This reading is available because the mo-marked NP can be construed as the topic of the whole sentence. The mo-marked NP on this reading is a constituent of the matrix clause, rather than the relative clause.

[11] I would not consider the fact that the variable x does not appear in the core scope in Nishigauchi's formulation problematic. At any rate, his intention is obvious. Cf. the formulation in (i) with unrestricted quantifiers.

(i) $\forall x \forall y [P(x) \& Q(y) \rightarrow R(y)]$
$= \forall y [\exists x P(x) \& Q(y) \rightarrow R(y)]$

[12] In Barwise and Cooper (1981), a determiner D is persistent if for all $M = \langle E, | \ | \rangle$, and all $A \subseteq B \subseteq E$, if $X \in |D|(A)$ then $X \in |D|(B)$.

I am grateful to Kazuhiko Fukushima for suggesting that I provide an argument from the theory of generalized quantifiers.

[13] The derivation of a LF representation may involve co-indexing, rather than movement. Cf. Pesetsky (1988). It is very likely that something like Pesetsky's D-linking of wh elements is relevant in the quantificational use of **mo**. Noriko Kawasaki (personal communication) recently reminded me that naze 'why', which usually resists D-linking, never appears in this construction. The same observation was made by Taisuke Nishigauchi in a personal communication as far back as 1985, if I remember correctly.

As for the embedding of wh elements in interrogative sentences, see Hasegawa (1987), which is an insightful critique of Nishigauchi (1984).

[14] **Mettani**, though translated as 'seldom' here, is a negative polarity item and must be in the scope of negation.

[15] This reading obviously is not available to all native speakers or for all sentences. The availability of such a reading seems to depend on the relative order between the mo-marked NP and the adverb, and the Aktionsarten of the predicate, among other things. One-time episodic sentences generally do not allow for such a reading.

[16] An argument in terms of possible continuations may not be conclusive, given the flexibility of discourse settings.

[17] The operators 'σ' and '*' are adopted from Link (1983) and Landman (1988). *P(α) is defined as Ax x α & atomic(x) -> P(x) and is here used primarily to indicate the distributivity of predicates.

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