On Generic Noun Phrases*

Hiroto Ohnishi

1. INTRODUCTION

Ohnishi (1987, 1988) presented an analysis of two ambiguous readings of the bare plural, in which two morphologically null VP operators give rise to the ambiguity. I will generalize the theoretical intuition behind the analysis with the so called *parameter function* so as to treat unselective quantification and atemporal *when* clauses. Though this theory can be strictly formalized in an intensional logic framework like Montague's PTQ system, I will not pursue it here, but try to give an intuitive grasp instead. For a strictly formalized version, see Ohnishi (1990) (forthcoming).

2. THE OUTLINE OF THE SYSTEM IN OHNISHI (1988)

In this section, I roughly summarize the system proposed in Ohnishi (1988) and argue that though theoretically correct, we can not broaden the scope of data since it is still immature.

Basically the system was developed to explain the two ambiguous readings of the bare plural.

(1) Athletes ate with a knife.

(Schubert & Pelletier (1987))

The bare plural *athletes* is construed as universally quantified in one reading and existentially quantified in the other, which can be made more explicit with adverbials such as *back in those days* and *this morning* respectively. It is this ambiguity that Carlson (1980) mainly tries to explain. According to his analysis, the origin of the ambiguity is, roughly, the ambiguity of the levels of the predicate *ate with a knife.* That is, when the predicate is an individual-level predicate (in his terminology), which refers to the subject's characteristic (permanent) property, the universal reading arises. On the other hand, when the predicate is a stage-level one, which refers to the subject's temporary property, the existential reading arises. The point of his analysis is that the denotation of the bare plural is constant (i.e., a kind as an individual), and the readings of a predicate is responsible for the ambiguity. For a precise explication of his analysis and arguments against it, see Ohnishi (1988) and the references cited there.

My analysis proceeds in the opposite direction: it is not predicates but subjects (i.e., bare plurals) that are responsible for the ambiguity. Bare plurals themselves are construed as universally quantified in some cases and existentially quantified in others. The choice of these two types of quantification depends on the property of a predicate, as Carlson rightly pointed out. To maintain this semantic relationship between subjects and predicates, I assumed two VP operators, I (interval) and PT (point of time), which indicate that predicates in the scope of these operators refer to the properties in an interval (characteristic properties) and ones at a moment of time (temporary properties) respectively. In other words, the distinction between temporary properties and characteristic properties are reduced to the one between these VP operators. The sentence (1) has two different syntactic representations:

(2) a. [G athletes] I [ate with a knife]
 b. [G athletes] PT [ate with a knife]

where G is also a morphologically unrealized determiner whose semantic interpretation varies depending on the operator of the predicate: roughly,[(1),(2)]

(3) a. [$\forall$ athletes] I [ate with a knife]
 b. [$\exists$ athletes] PT [ate with a knife]

Notice that these operators are needed for sentences other than ones with bare plurals:

(4) John ran in the park.

The sentence (4) exhibits the same ambiguity as (1): John's temporary property and John's characteristic (habitual) property. The basic intuition behind this proposal is that bare plurals are, in essence, variables ranging over the set denoted by a noun which are ultimately bound by time. In other words time is the implicit quantifier of bare plurals. When the time referred to by a sentence is some point of time, the number of the individuals denoted by the bare plural is clearly limited (i.e., $\exists$) since they have to be individuals that exist at that time (and participate in the event). So some individuals are suffice for the sentence to be true. Similarly individuals that are admitted by an interval are those which exist in that interval, which is a set of points of time. Taking into consideration that an interval is not limited in its length without explicit markers such as tense operators and adverbials, individuals that exist in an interval include all individuals denoted by the noun.[(3)] This is the origin of the universal reading.

Though I introduced this intuition into a formal system as above, it can handle only two extremes: one point of time, and all points of time. There are many cases that we can not analyse with this simple system. For example, unselective quantification in Lewis (1975) falls out of the scope of this analysis:

(5) a. Quadratic equations never have more than two solutions.
    b. Quadratic equations never have two different solutions.[4]

The underlined adverbials are not, according to him, quantifiers over times. Rather they quantify over cases, which are 'tuples of participants, in (5a), ⟨x⟩ (x: quadratic equation). Hence unselective quantifiers *never* and *usually* bind x (i.e., no x..., most x...). Unselective quantifiers are so called because they can bind any free variables that occur in the sentences. If we have general devices which relate quantifiers over times to those over individuals, these adverbials also fall in the scope of this system. But as it stands, our system is very limited since we can relate only the universal quantifier and the existential quantifier over times (i.e., an interval and a point of time) to $\forall$ and $\exists$, respectively.

In the next section, I present a general procedure that relates quantification over times to that over individuals.

3. FROM TIMES TO INDIVIDUALS

In this section I present a model which enable us to capture the above mentioned relation between times and individuals. We here assume a PTQ-like system with some modifications. The point of modification is this: though in the PTQ system, there are three distinct non-empty sets corresponding to individuals (A), points of time (T) and possible worlds (W), which are mutually independent, we introduce the function of the following definition:

(6) PARAMETER FUNCTION P
P is a function that maps t ($t \in T$) into a non-empty subset of individuals:
$A = \cup \{P(t) \mid t \in T\}$

As defined, P maps each t ($t \in T$) into a set of individuals ($\subseteq A$). This means the domain A varies depending on the choice of t. Namely, at t1 $A=\{a, b, c, d, e\}$, at t2 $A=\{a, b\}$, at t3 $A=\{a, b, i, j\}$, and so on. We read the value P(t) as *individuals that exist at the point of time* t. We also introduce quantifiers over times as follows:

[always' ϕ]=1 iff at every point of time t, ϕ=1
[never' ϕ]=1 iff at every point of time t, ϕ=0
[sometimes' ϕ]=1 iff at *sometimes* t, ϕ=1
[often' ϕ]=1 iff at *often* t, ϕ=1

we also introduce complex quantifiers
[when ψ ϕ]=1 iff at any t ψ=1, ϕ=1
Further, when no overt quantifiers occur, we have
the two representations whose semantic
values are respectively as follows:
[PT' ϕ]=1 iff at some point of time t, ϕ=1
[INT' ϕ]=1 iff at every point of time t, ϕ=1

Now we can handle the ambiguity of bare plurals and Lewis' unselective quantifiers (i.e., temporal adverbials such as *never, often, sometimes, always*...). First of all, let us examine the former cases. Consider:

(7) Dogs barked.

Following Ohnishi (1988), I consider the following to be the representation of *dogs* in (7):

(8) [G Dogs]NP

where the empty determiner G is translated as follows:

(9) $\lambda Q \lambda P P\{Q\}$

Then the translation of the entire NP is obtained:

(10) $\lambda P P\{f(\hat{\ }dog')\}$

The formal definition of the function f is as follows:

(11) f
for all $\hat{\ }P \in ME\langle s, \langle e, t\rangle\rangle$, $f(\hat{\ }P) \in A$

As is clear from the definition above, this function takes the intension of a property (denotation of a noun, which is a set of individuals) and yield a newly-created individual in the domain A. Linguistically this function creats a *kind* in Carlson's terminology, since, as Chierchia (1982) argued, this formal construct satisfies the criterion for kinds: it includes all (possible) dogs. The translation (9) is a familiar one for Montague Grammarians: a function that yields the property set of an individual. In the PTQ system, λ PP{j} is a set of properties of the individual John.

Hence the translation in (10) is a set of properties of the newly-created individual dogs: the kind dog. I assume that bare plurals are always translated in this way.

The universal reading of (7) is rather straightforward. The resultant logical form for this reading is:(5)

(12) $(\forall t(t \in T))[bark'(f(^\wedge dog'))]$,
where the past tense operator is omitted

Recall that the domain of individuals A, hence the set of dogs, varies depending on the time t. Therefore this logical form means that at every point of time all dogs at that time had the property of barking. This means that the kind dogs had that property. Note that the notion of interval, which was the mark for a characteristic or habitual property in Ohnishi (1988), is recaptured as $\forall t(t \in T)$.

Similarly the logical form for the existential reading is as follows:

(13) $(\exists t(t \in T))[bark'(f(^\wedge dog))]$,

where the past tense operator is omitted

The logical form (13) reads that at least there is a point of time at which dogs that exist at that time had the property of barking. However this interpretation is not perfectly acceptable since this logical form tells us that all dogs (including imaginary ones) at that time had the property of barking, which is too hard a condition to satisfy and clearly not the truth condition of the reading in question. The reading requires *some* dogs that had the property of barking, but not *all* dogs that existed at that time. But this problem may be worked out if we have a proper pragmatic theory that restricts the domain of discourse to the one on the basis of which the speaker makes this assertion, which is out of the scope of this paper.

Now we move to the analysis of unselective quantifiers of Lewis. The logical forms for these are precisely the same as those in (12–13) except that in these cases quantifiers over times are explicit. As I mentioned in the preceding section, I assume that these adverbials are, in essence, quantifiers over times. See the following sentences and their logical forms:

(14) Dogs often bark.
$(ususlly\ t(t \in T))[dark'(f(^\wedge dog'))]$

(15) Dogs sometimes bark.
$(sometimes\ t(t \in T))[bark'(f(^\wedge dog'))]$

(16) Dogs never bark.
$((never\ (t \in T))[bark'(f)^\wedge dog'))]$

For example, the logical form in (16) tells us that at *never t*, dogs that exist at that point of time have the property of barking. Hence no dogs have the property of barking. Similarly for (14–15).

So far I have outlined the formalism in Ohnishi (1990) rather intuitively. The system in Ohnishi (1988) was extended along the basic intuition behind it. The heart of the analysis is that bare plurals are uniquely interpreted as a set of individuals denoted by the noun (which is ultimately converted into an individual) and they are bound by time by means of the parameter function, which changes the set itself.

4. ATEMPORAL *WHEN*

Atemporal (restrictive) *when* clauses are extensively discussed in Carlson (1979), Farkas and Sugioka (1983) and Schubert and Pelletier (1987). Examples of atemporal *when* clauses are the followings:

(17) a. Lizards are pleased when they are in the sun.
b. Bears are intelligent when they have blue eyes.
c. Canaries are popular when they are in the sun.

According to Farkas and Sugioka (1983) three major characteristics of them are: (i) we can substitute *if* for *when* with no significant change of meaning.

(18) Lizards are pleased if they are in the sun. (=17a)

(ii) they can not refer to a specific event and, hence, can not go with a specific time adverbial:

(19) Lizards are pleased when they are in the sun at 5.

(iii) they can be paraphrased by a restrictive relative clause. This point was originally made by Carlson (1979):

(20) Lizards that are in the sun are pleased.

With data (ii–iii) in mind, Carlson (1979) concluded that atemporal *when* clauses are syntactically adverbial clauses but semantically restrictive relative clauses. Thus he translated atemporal *when* clauses (e.g., (17a)) just like restrictive relative clauses (e.g., (20)). But two insurmountable problems immediately come up if we take his analysis seriously. One is that there are many instances of atemporal *when* that do not contain pronouns in their main clauses. That is, no suitable relative clause analysis can be proposed:

(21) Bears have thick fur when the climate is cold.

The other is that we have to admit a drastic discrepancy between two *whens*: atemporal *when* and ordinary *when* in the following sentence.

(22) When Tom entered the room, Mary was knitting.

The same counterargument also holds for Farkas & Sugioka's approach. Their "logical form" for (17b) is as follows:

(23) $G\,(\text{have-blue-eyes}\,(x^0) \subset \text{intelligent}\,(x^0))$
$(x^0:\ \lambda\ z^0(R\,(z^0,\ b^k)))$

where *G* (for *generally*) is an unselective quantifier that binds any variable in the formula, in this case, x^0. Hence this formula reads "generally x has blue eyes". The underlined part represents the range over which the variable x^0 moves, in the present case, the range is the set of objects (^{0}) that are the realization of (R) the kind (^{k}) bears. C is the analogue of implication, and this is what atemporal *when* denotes. Though ordinary *when* does refer to time (in my opinion, not theirs), atemporal *when* denotes implication! This result from their stress on teh data (i). Another problem is genuinely from a theoretical point of view, which was pointed out in Schubert & Pelletier (1987): the "logical form" of this analysis, which is a fine theoretical fusion of Carlson and Lewis, simply is not formalizable. In other words, it can not be given any model-theoretic semantics. This stems from the fact that they used Lewis' logical form, which itself is not strictly formal.

In my analysis the very natural assumption that *when* clauses as a whole specifies points of time suffices to solve these problems. In other words, *when* clauses are complex quantifiers over times. Similarly to the unselective quantification cases, we arrive at the following "logical form" for (17a):

(24) (when lizards are in the sun $t\,(t \in T)$)
[pleased'(f(^lizards')]

When lizards are in the sun above is a quantifier over times and f(^lizards') denotes all the lizards that exist at t as before. Intuitively this logical form reads "for *lizards are in the sun* t, all the lizards that exist at t is pleased". Note that this logical form quite satisfactorily explains the data (i–iii). For (i) since, from (24), all lizards are pleased at times when *lizards are in the sun* holds, if that situation occurs, lizards are pleased without fail. There are no cases where these sentences differ in their truth conditions. For (ii) since this is a data which served as a criterion to distinguish between atemporal *when* and ordinary point-of-time-referring *when*, our analysis is immune to the data. Simply because we do not make such unnatural a distinction, we can provide exactly the same analysis to sentences containing ordinary *when*:

(25) When Tom entered the room, Mary was knitting.
(when Tom enter the room t) ([PROG knit'(m)]

For (iii) semantically restrictive relative clauses as in (20) serve, in effect, as a function that maps the denotation of a head noun to its subset (i.e., *lizards* to its subset *lizards that are in the sun*). Our analysis guarantees the paraphrazability between atemporal *when* clauses and restrictive relative clauses. For what is at stake in (24) is not all lizards but its subset (i.e., *lizards* at times *when lizards are in the sun* holds).

As above, we can formulate the characteristics of atemporal *when* quite satisfactorily along the line discussed in section 3. As noted, we can also provide the unified analysis of *when* in this analysis. Apparently Carlson (1979), Lewis (1975), Farkas and Sugioka (1983) (and many others) take "schizoid" analyses of *when* that assume two *whens* (ordinary *when* and *when* that is translated into restrictive relative or implication). Such "schizoid" analyses are not limited to the analyses of *when*. They assume two different semantic representations for *always, sometimes, never* ..... for all basically temporal adverbials. The advantage of taking our analysis over the others should be clear.

5. CONCLUSION

This paper presented an extension of the analysis in Ohnishi (1988). The basic theoretical intuition there was grasped as the parameter function, which alows the domain of individuals to depend on the moment of time. This naturally extended the scope of our analysis to Lewis' unselective quantification and atemporal *when* clauses. For details, see Ohnishi (1990), where a rigorous formalization and possible extensions of the analysis is presented.

NOTES

* This paper presents an intuitive theory on generic noun phrases. For a rigorous formalization and details, see Ohnishi (1990).

(1) We restrict our attention only to subject NPs for simplicity.

(2) Precisely, the translations of G is as follows:

(i) $[G]^{I}$: $\lambda Q \lambda P P\{Q\}$

(ii) $[G]^{PT}$: $\lambda Q \lambda P \exists x[P\{x\} \ \& \ Q\{x\}]$

That is, the translations of the G co-indexed with the operators varies depending on which operator it is co-indexed with. When $[G]^I$ applies to a noun, say, *dog*, it yields a property set of the *kind* dog.

(3) I assume that the I operator takes the maximal set of points of time without such operators. Tense operators such as the past tense operator restrict the set to a certain subset (e.g., a set of points earlier than now). Further temporal adverbials are taken to be quantifiers over times.

(4) The original sentences in Lewis (1975) contain indefinite NPs instead of bare plurals. But the very same argument holds for bare plurals.

(5) Formally, the translation into the intensional logic is as follows:

(iii) I'[bark'(f(dogs'))]

And the truth-condition for (i) is that (i) is true iff for every point of time t, [bark'(r(dogs'))] is true. The "logical form" in (12) is only for the sake of perspicuity. This holds also for (13) and other logical forms below.

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