ABSTRACT
        The paper explores the significance of a contrast
between generalized phrase structure grammar (GPSG), a context-free
grammar with a well structured theory of features, and head-driven
phrase structure grammar (HPSG), a mechanism for increasing the power
of GPSG by introducing head-wrapping and lexical rules, using
examples from Mandarin Chinese. A study focusing on the discontinuous
idiom chunks of possessive object (POBJ) construction produced the
unexpected result that even though head-wrapping is a syntactic
operation introduced to account for discontinuous constituencies,
POBJ data cannot be accounted for with the Head-wrap mechanisms. The
adoption of Head-wrap operations as the only explanation of
discontinuous constituencies predicts that one of the disjoint
sub-strings must have the head of the entire constituent on its edge.
The validity of Head-wrap as the mechanism for accounting for the
discontinuity of syntax is challenged by the fact that the
frequency/duration adverbial splits the POBJ predicate non-adjacent
to the head. The failure of grammars with head-wrapping to produce a
straightforward syntactic solution to the POBJ data calls for a
closer examination of non-syntactic approaches. (MSE)

Is Head-Wrap Necessary?
Mandarin Possissive Objects in GPSG and HPSG

by

Chu-Ren Huang

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IS HEAD-WRAP NECESSARY?
MANDARIN POSSESSIVE OBJECTS IN GPSG AND HPSG*
Chu-Ren Huang
Academia Sinica and Tsing Hua University

Among recently developed unification-based grammati-
cal theories (Shieber 1986), there is a genetically re-
lated pair offering interesting contrasts. GPSG (Gener-
alized Phrase Structure Grammar, Gazdar et al. 1985) is a
context-free grammar with a well-strucutred and powerful
theory of features. HPSG (Head-driven Phrase Structure
Grammar, Pollard 1984, and Sag and Pollard 1987), while
maintaining the important characteristic of being recog-
nizable in deterministic polynominal time, increases the
power of GPSG by introducing head-wrapping and lexical
rules.1 The innovations allow the grammar to do without
metarules (Pollard 1985), and to account for discontinuous
constituencies in a more straightforward way.2 More
specifically, with head-wrapping, and the notion and
notation of Head as a grammatical primitive, a string can
be inserted within another string in HPSG.3 That is, in a
headed string (a string where the head is marked), head-
wrappping renders the positions immediately before and
after the head accessible to syntactic operations.4 Since
the constituency of the original string has not been
changed, the fact that two disjoint sub-strings form a
constituent can be accounted for without referring to any
contextual information other than what is encoded on the
headed string. As a consequence, an interesting contrast
occurs between HPSG and GPSG with regard to discontinuous
constituencies. The contrast is that HPSG has head-wrap
as one powerful and coherent mechanism to account for such
constructions, while GPSG needs some ad hoc measures.

In this paper, I try to explore the significance of
this contrast by studying a set of Mandarin Chinese data.
Mandarin grammatalizes very little dependencies and shows
even less of them with overt markings.5 In other words,
for discontinuous constituencies in this language, the
discontinuity is likely the only non-cannonical syntactic
fact to be accounted for. A reasonable speculation is
that they serve as ideal cases demonstrating the advantage
of head-wrap mechsanisms. This paper focuses on one such
case, the POBJ (Possessive Object) construction.

I) The Data and a GPSG Account

The POBJ construction (underlined in 1) is a set of
discontinuous idiom chunks. The construction is so-called
because it shares the same surface structure with the
possessive construction. Thus 2 is ambiguous with two
readings: the more readily available POBJ reading a and
the genuine possessive reading b.

(1) a. ta   sheng   le   Wangwu san   ge   zhongtou
        s/he give-brith   PERF Wangwu three MEASURE hour
         (de) qi
         DE   air
    b. ta   sheng   le   san ge   zhongtou Wangwu
        s/he give-brith   PERF three MEASURE hour   Wangwu
         (de) qi
         DE   air
        'S/he was mad at Wangwu for three hours.'

(2) Zhangsan chi Lisi de   cu
     Zhangsan eat Lisi DEnp vinegar
  a. Zhangsan is jealous of Lisi.
  b. Zhangsan uses Lisi's vinegar.

Like transitive verbs, a POBJ predicate takes two argu-
ments.   Unlike typical transitive verbs, its non-subject
argument, as well as duration/frequency adjuncts, can only
occupy positions between two parts of the discontinuous
constituent.
     Referring to the first noun phrase in the POBJ string
[verb NP (de) NP] as NP1 and the second as NP2, Huang's
(1987. ch.4) summary of the grammatical features of the
POBJ construction is repeated in 3. The features relavent
to the discussions on head-wrapping are the first two and
the distribution of frequency/duration adverbials des-
cribed in 1.

(3) a. The matrix verb forms a (discontinuous) idiom
        chunk with NP2.
    b. NP1 is the oblique object of the idiom chunk.6
    c. NP1 allows wh-questions and anaphora, but cannot
        be topicalized.
    d. NP2 allows neither wh-questions, nor anaphora, nor
        topicalization.
    e. A reflexive pronoun in the NP1 position can be
        coreferential with the matrix subject, while a
        non-reflexive pronoun cannot.

     The following GPSG account is proposed in Huang
(1987.258-265). His analyses make crucial uses of two
mechanisms of the theory: metarules and feature matrixes.
     Based on the observation that Mandarin Chinese allows
an adverbial phrase to occur between a verb and an object,
exemplified by 4, the ID/LP statements in 5 and 6 are
proposed.7

(4) a. ta   kanle   sange   zhongtou shu
        s/he read-PERF   three-MEASURE hour   book
        'S/He has been reading books for three hours.'
    b. *ta   kanle   shu sange   zhongtou
        s/he read-PERF   book three-MEASURE hour

(5) 8 ID Rule: VP --> H, XP[+ADV, +DUR/FRE], NP

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(6) LP Statements:
   a. H[+V, -N] < [BAR 2]
   b. [+ADV] < [-OBL]

     Since the adverbial phrase is a modifier of the verb phrase, Huang (1987) treats it as a sister of the verbal head in 5. The LP statement 6a postulates that the lexical head precede other phrasal sisters and 6b that an adverbial phrase precede a non-oblique noun phrase. He also notices that the oblique object (NP1) in a POBJ construction occurs either before or after the adverbial, and that the idiom chunk object (NP2) and object NPs in other constructions, such as the object in 4, must occur after the adverbial. Thus he assumes that the LP statement specifically refers to the feature [-OBL].

(7) VP[POBJ] --> W
$$\Downarrow$$
  VP[POBJ] --> W, NP[+OBL]

(8)a. Sanbai chi Yunniang de cu
     Sanbai eat Yunniang DE vinegar
     `Sanbai is jealous of Yunniang.'
   b. Sanbai chi cu
     Sanbai eat vinegar
     `Sanbai is jealous.'

     The metarule in 7 is the cornerstone of the proposed account. The input of the metarule is a ID statement independently motivated by 8b. It does not differ from other VP rules except that the head is marked by the feature [POBJ], which Huang (1987) assumes to be a subcategorization feature marking all POBJ idiom chunks. The metarule takes such ID rules and gives back ID rules with an extra argument: an oblique object, as exemplified by 9.

(9) VP[POBJ] --> H, NP, [+ADV, +FRE/DUR], NP+[OBL]

(10)9 [+OBL] < [-OBL]

The output ID rule 9 is governed by the LP statements in 6. 6a postulates that the lexical head in an ID rule precede all other phrasal categories. Thus in the POBJ construction the verb is the first element in the VP. The LP statement 6b requires a non-oblique NP to follow an adverbial, and the additional LP statement 10 requires it to follow the oblique object. Thus the fact that NP2 is the last element in a POBJ verb phrase is accounted for. The alternative order between the adverbial phrase and NP1 is predicted by the grammar because there is no LP statement governing the order between an oblique NP and an adverbial phrase.10
     The analysis just sketched has two problems. the first involves semantics and the second constituent struc-

tures. Both suggest inadequacy of this GPSG account.
First, the meanings of the idiom chunks are not composi-
tional. They are each instantiated on two segments: the
verb and NP2, but do not equal the logical sums of the
meanings of the (two) segments. One strategy is to give
each idiom chunk a lexical entry which specifies the
semantic meaning and the two segments involved. For such
a strategy to work, the two segments must either be re-
trieved as a unit directly from the lexicon or be linked
to the same piece of information in the lexicon, even
though they occur discontinuously without sharing a local
tree. The proposed rules for the POBJ construction admit
a tree where the verb and NP2 are not adjacent to each
other. Thus they cannot form a single lexical item.11
Since GPSG does not allow syntactic operations to reach
beyond the domain of a local tree, neither is it possible
to relate the two segments to one lexical entry. The
general translation schema in Gazdar et al. (1985) fails
to derive a correct semantic translation for 9.

Second, instead of forming a constituent, the nodes
in the string [NP1 de NP2] are analyzed as sisters of the
verbal head in this account, contradicting evidence cited
in Huang (1987. ch.4) showing that they form a constitu-
ent. A dilemma arises between conserving a direct mapping
from syntax to semantics and representing the configura-
tional information. The analysis assigns the flat struc-
ture 9, in which the adjunct is a sister of the head of
the predicate, such that it can be directly translated as
a function taking the predicate as an argument. Assigning
the structure [np NP1 de NP2] would include the duration/
frequency adverbial in the same noun phrase. The adjunct
would be a sister of both NP's but not the verb. Direct
mapping between syntax and semantics can only interprete
the adverbial as semantically interacting with either NP1
or NP2.12

II) An HPSG Analysis
        HPSG differs critically from GPSG in that it allows
non-adjacent surface segments to form a syntactic unit.
This is done by introducing head-wrap, in addition to the
familiar concatenation operations, as a mechanism to form
larger syntactic units.13 The reference to Head comes
from the fact that strings can only be segmented immedi-
ately before or after the head of that string. `Wrap'
refers to the fact that one argument, i.e. one of the
strings, `wrap' around the other argument. Various con-
catenation mechanisms are also included in the grammar.

(11) LL1(Left-left Head Wrap 1):
        `Wrap the left hand argument around the other argu-
        ment, placing the head of the former immediately to
        the left of the latter, and take the head of the
        first argument as the head of the resultant string.'

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(12) LL1<S,T> = s1 ....si t1 .. tj ... tm s(i+1) ... sn
                    * <--head
     where S = (s, i) = s1 ... si ...sn
                              *
     and   T = (t, j) = ti ...tj ... tm
                              *

     11 and 12 exemplify the Head-wrap rules. Other rules
can be constructed along the same line.   The rule, called
`left-left head wrap 1,' is described in 11 and formulated
in 12, following Pollard (1984).   In 12, again following
Pollard's (1984) convention, an asterisk marks the head of
a string. Capital letters S and T stand for strings, and
subscripted small letter si and ti stands for elements in
the string. The number i in the ordered pair (s, i)
designates the position of the head in the string. The
LL-1 rule in 12 places the second argument immediately to
the right of the head of the first argument which also
serves as the head of the new string.   It should not be
difficult to envisage the idiom chunk [verb ... NP2]
involved in a POBJ construction as the first string and
the wrapping element, and the oblique object the second
string, i.e. the wrapped argument.   LL-1 would give the
exact order needed for the combined string.

(13)   <VP[POBJ] --> LL1(VP[POBJ], NP); FA>
        where VP[[POBJ] --> H NP[POBJ]
                            *

     13 spells out the details of the LL-1 operation
applied on the idiom chunk rule and the oblique object NP
to generate the POBJ construction.   In this analysis, the
order between the verb, NP1,   and NP2 is correctly cap-
tured.   The fact that the verb and NP2 form a semantic
unit, a predicate, and that NP2 is an argument of that
predicate is also captured with the help of the head-wrap
mechanism.   FA stands for functional application.   Thus
the semantic translation of the POBJ construction is
simply applying the function represented by the wrapping
idiom chunk to the nominal argument represented by NP1.
The potential problem of semantic translation that arises
in the GPSG analysis is solved.

(14)a. Sanbai sheng-le   Yunniang bantian de   qi
       Sanbai give-birth-PERF Yunniang half-day DEnp air
    b. Sanbai sheng-le   bantian Yunniang de   qi
       Sanbai give-birth-PERF half-day Yunniang DEnp air
       'Sanbai is angry at Yunniang for a long time.'

     Rather unexpectedly, this head-wrapping account still
has problems with the placement of one of the adverbial
positions.   In 14, it is shown that duration/frequency
adverbials have two possible positions in a POBJ construc-
tion.   Since an adverbial phrase semantically takes the

7 5

whole predicate as its argument, i.e. it modifies the
whole predicate; syntactically, it and the whole POBJ
predicate, i.e., `he output string of 13, should be two
arguments of th= same operation. The problem is that
Head-wrap operations can only wrap an argument immediately
next to the head. This allows us to derive 14b but nut
14a. 15a is the right-left head wrap rule accounting for
14b. 15b gives the resultant headed-string.

(15)a. <VP --> RL2 ([+ADV, +FRE/DUR], VP[POBJ]; FA>
     b. VP --> H XP[+ADV, +FRE/DUR] NP[OBL] NP
              *

    Given the position of the adverbials in 14a, there is
simply no Head-wap rule available to generate the correct
string. Given the strictly order nature of the CON fea-
ture Pollard (1984) adopts, neither does it seem possible
to allow adjuncts to be combined with the predicate before
the oblique object to get the rightr order.14 Thus, the
idiosyncracy of this construction cannot be accounted for
with Head-wrap rules in the framework of Pollard (1984).15

III) Idioms as Partially Defined Functions: A Solution
    The failure of grammars with Head-wrapping to produce
a straightforward syntactic sulotion to the POBJ data
calls for a closer examination of non-sytactic approaches.
Although it does not seem possible for GPSG to account for
the discontinuous constituency of POBJ in syntax without
mechanisms to permutate elements within a constituent,
there is no reason to preclude a lexico-semantic account.
Wasow et al. (1983) propses a brilliant account for some
English idiom chunks. The basic idea is that elements in
idiom chunks should be treated as compositional. Tradi-
tionally, it has been taken for granted that idioms are
not compositional in the sense that the meaning of an
idiom cannot be derived compositionally from the literal
meanings of their components. But pieces in an idiom do
have identifiable meanings and often allow internal modif-
ication or show syntactic versatility. Thus they could be
treated compositionally by assigning special meanings to
them and by restricting the applicability of these mean-
ings. In general, these idiomatic meanings would be
treated as partially defined functions. For example, the
idiomatic intension of take (as in take advantage of)
would be a function which is defined only on the idiomatic
intension of advantage. Following their lead, I will
assume that the semantic meaning of the POBJ construction
is derived compositionally from the meanings of the verb
and NP2. For the idiom sheng..qi 'be mad at', the inten-
sion of sheng would be a function which is defined only on
the intension of qi. An assumption specific to this
Mandarin construction is that the nominal category (eg. qi
'air') of the idiom chunk syntactically encodes the subca-
tegorization information and is semantically translated as

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a function which takes two arguments. This assumption
fits in nicely with Chierchia's (1982, and 1984) IL*, the
semantic framework I am adopting here. On the other hand,
the verbal head (sheng) is translated as a partially de-
fined identity map, and the adjunct is marked with a
semantically potent feature which allows it to be inter-
preted at the correct level. Together with appropriate LP
statements, the rules 16-18 account for POBJ in GPSG.

(16)a. VP[POBJ] --> H, NP[POBJ];   <H' (NP')>
    b. NP[POBJ] -->NP, (ADV[D/F]), (de), N[POBJ];
                <lamda V'[(ADV'(V'[N'(NP')]))]>

(17) gi, N[POBJ],   lamday lamdax [BE-MAD-AT (x)] (y)

(18) sheng, V, <lamdaP P>,
         where P is a type <e,p> variable
     [type <<e,p>,<e,p>>, restricted identity map, defined
     only on the lexical item gi of 17]

This solution, suggested to me by Gennaro Chierchia
(p.c.), allows [NP1 (de. NP2] to form a constituent. Is
is not unlike the LFG account proposed in C. Huang (1987.
ch.4). In that account, POBJ constructions are treated as
double-headed constructions, and both the verb and NP2 are
partial instantiations of the predicate. In this account,
NP2 alone bears the subcategorization information, and the
verb preserves that information as an identity map.
Assuming the ID rules of 16, the lexical entries for the
two discontinuous parts of the idiom chunks would be given
as 17 and 18.

(19) cu, N[POBJ], lamy lamx [BE-JEALOUS-OF (x)] (y)

(20) chi, V, <lamP P>, where P is a type <e,p> variable,
              [type <<e,p>,<e,p>>, restricted identity map]

19 and 20 account for another discontinuous idiom chunk
chi...cu 'be jealous of' and illustrate an advantage of
the current analysis. 19 is the lexical entry for cu as
NP2. It is simply a two-place predicate. Since the GPSG
semantics is type-driven, 19 entails that NP2, cu in this
case, would take NP1 as an argument with straightforward
functional application. The limited space of this paper
does not allow detailed explication of the semantic ac-
count. Briefly, I simply assume that when an adverbial is
present, the translation relies on the feature system. A
semantically motivated feature will be employed to mark
that the adverbial is modifying the whole VP rather than
the POBJ NP. Recall that semantically potent features are
translated in semantics in GPSG. Similar to the treatment
I gave to the DEnp-construction with object gaps in chap-
ter 3 of Huang (1987), the translation of this feature
would allow the meaning of the adverbial to be introduced

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at the VP level. The verb would be assigned a translation
of a type <<e,p>, <e,p>> identity map. Such special
translations would be defined for those idiom chunks only.
That is, chi would be a partial function defined for the
few lexical items it co-occurs with as parts of idiom
chunks, like cu, bingqilin `ice cream' [chi bingqilin
`take advantage of']. This move is supported by limited
productivity of the idiom chunks.

(21)a. chi cu (vinegar)   'be jealous at'
     b. chi bingqilin (ice cream) 'take advantage of'
     c. chi fan (rice)   'be employed by'
     d. chi kuei (deficit)   'be taken advantage of'

     In 21, I show that the verb chi `eat' recurs in some
idioms. It would be desirable to anlyze all the occur-
rences of chi in these idioms as the same lexical item.
The partial function of identity map seems to be an
answer.   It implies that it is NP2 which dictates the
meaning of the idiom, as predicted by my lexico-semantic
analysis.

IV) Conclusion
     This paper studies the discontinuous idiom chunks of
the POBJ construction with a somewhat unexpected result.
Even though Head-wrapping is a syntactic operation intro-
duced primarily to account for discontinuous constituen-
cies, the POBJ data cannot be readily accounted for with
the Head-wrap mechanisms.   The adoption of Head-wrap
operations as the sole explanation of discontinuous cons-
tituencies predicts that one of the disjoint sub-strings
must have the head of the whole constituent on its edge.
The POBJ data, exemplified in 14a, offer an exception to
this prediction.   The frequency/duration adverbial splits
the POBJ predicate at a position non-adjacent to the head.
Such a fact casts doubts on the validity of Head-wrap as
the mechanism to account for discontinuity on syntax.   I
have also shown that a lexico-semantic analysis adopting
Wasow et al.'s (1983) idea accounts for the data. Head
gramamr, as formulated in Pollard (1984), however, cannot
adopt this solution easily.   The strict partial order
encoded in the feature values of the CON feature does not
allow the semantic manipulations required by this lexical
analysis.   There are two possible interpretations of the
current study.   One can take the POBJ data as evidence
showing that Head-wrap mechanisms simply do not correctly
characterize the set of discontinuous constituencies
allowed in natural languages. Alternatively, one can also
argue that the set of data discussed illustrate lexically-
controlled discontinuencies, while Head-wrap rules should
satisfactorily accounts for syntactic discontinuencies.
The choice of a correct interpretation awaits further
studies of discontinuous constintuencies in other natural
languages.

FOOTNOTES

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1 Strictly speaking, the grammar introduced in Pollard (1984) is called Head Grammar by him. HPSG refers to a later version developed at Hewett-Packard and partially documented in Pollard (1985) and Sag and Pollard (1987). One substantial difference is that HPSG has a much richer lexicon. Since this paper deals mainly with the Head-wrap operations shared by both grammars, I will not differentiate them.

2 The best known example of discontinuous constituency is the Dutch cross-serial dependencies discussed in Bresnan et al. (1982). It is argued that GPSG cannot assign the correct structure to this construction. Grammars with Head-wrapping, on the other hand, offers a relatively simple account (Pollard 1984, Sag et al. 1986).

3 See the definition of a head grammar in chapter 1 of Pollard (1984). See also the appendix there for mathematical properties of the grammar. The mathematical properties of HPSG are not yet fully understood. My discussions will be restricted to the features it shares with head grammars.

4 Similarly, one can perceive concatenation as marking the positions immediately after the last element of the string and before the first element of the string for another string.

5 The language has no morphological case, nor tense, nor agreement. It has topicalization as an instance of long distance dependency, but has no gapped wh-questions.

6 NP1 is an oblique object in the sense that it is a structurally marked argument (though not morphologically marked) which is the only argument other than the subject but does not behave like a typical object. Supporting evidence includes the facts that it does not occur in the Mandarin passive construction, and bei-construction. See Huang (1987, ch.4) for detailed discussion.

7 Both 5 and 6 are slightly revised . XP in 5 needs to be further restricted, maybe to [+N, -PRD].

8 A problematic case, pointed out to me by Louie Mangione (p.c.), is given in (i). In (i), the frequency of occurrence adverbial occurs after the object. This phenomenon is allowed with certain verbs only. For exam-

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ple, 3b with an identical structure is ungrammatical. I
do not have a straightforward account for (i) for the
moment. Another observation is that (i) is another coun-
terexample to J. Huang's (1982) Phrase Structure const-
raint. Adopting a strictly bi-branching phrase structure
schema, as J. Huang (1982) does, the VP would have to be
left-branching twice because both the NP complement and
the NP adverbial occur to the right of the verb.
(i) ta   qu-guo   meiguo sanci
     s/he go-EXPERIENCE America three-times
     `S/He has been to America three times.'
     9 A more general way to capture the effects of this
LP statement is (i). Since the idiomatic feature of NP2
has to be specified, (i) guarantees that NP2 is preceded
by all its phrasal sisters, including the adverbials. The
domain of this statement overlaps with 10. Further stu-
dies will determine between the overlapping rules.
(i) XP < NP[IDIOM]
     10 The occurrence of the optional DEnp is not dis-
cussed here and is assumed to be accounted for by the
general schema in chapter 2 of Huang(1987).
     11 The semantics of GPSG, as explained in Gazdar et
al. (1985.182-244), is a tree interpretation procedure.
The translation rules take trees as inputs and return
intensional logic translations as outputs. The verb and
NP2 are clearly not adjacent on the tree and are not even
on the same local tree. Thus they cannot be translated as
a unit.
     12 Another point worth noting is that explicit
reference to grammatical relation is made in the LP state-
ment in 6b. It is generally conceived unnecessary to
refer to grammatical relations in GPSG though the proposed
mechanisms do not preclude such a possibility. The data
show that it is crucial to differentiate NP1 from NP2 to
get the right order, and that NP2 has to pattern with
other object NPs in being ordered after the adverbial
phrase. The only grammatical feature distinguishing NP1
from other NPs is that it is an oblique object and the
others are not.
     13 It is worth bearing in mind that head-wrap cannot
scramble a string, such as transformations do. In addi-
tion to the positions before and after an category (a
headed-string in HPSG), it allows the other category to
occur in two positions within the stirng representing the
wrapping category, one immediatly before and one immedi-
ately after the head of that string.
     14 In Pollard (1984), the CON (mnemonic for control
types) feature, similar to the definition of categories in
Categorial Grammar, stipulates how arguments are combined
with argument-taking predicates both syntactically and
semantically. For instance, the familiar [CON TRN] (for
TRNsitive VP) category will take an NP argument syntacti-
cally, paired with the semantic operation of functional
application, to form a [CON INT] [for INTransitive VP]

category. Similarly, together with the semantic operation
of Equi adopted in GPSG, a [CON OEQ] (for Object EQui)
category will combine with an NP syntactically to form a
[CON TRN] category. There is a strict partial order
relation among these control types. As Pollard (1984)
himself observes, optional arguments cannot be easily
incorporated in this system. Head-wrapping would have
yielded the correct linear order for 14a 'f the optional
adverbial phrase were 'wrapped' before the oblique object
(i.e., a rule like 15 is applied before 13). But then the
semantic type and the CON feature of the adverbial phrase
cannot be uniquely determined in the grammar as defined in
Pollard (1984). He notices in a footnote that adjuncts
can be easily accounted for in his grammar if predicative
heads are translated as denoting relations among quan-
tifiers of situations. In this approach, the frequency/
duration adverbials, as adjuncts, could be combined with
the predicate before or after the oblique object without
affecting its semantic translation. This proposal, how-
ever, has not been fully formalized and cannot be justly
evaluated here.

15 Pollard (1984) does incorporate uses of linear
precedence statements to determine the ordering of comple-
ments in constructions such as the anomalous raising
constructions. Thus he introduces a third type of syn-
tactic operation AL (for anomalous linearization). The
definition is quoted here as (i), where Mi stands for
headed-strings and Xi stands for corresponding categories.
(i)   AL(<M0, X0>, <M1, X1>, <M2, ..2>)=
       (M0 Mj Mk: <j, k> is a permutation of <1, 2> such
       that <Xi, Xj> is consistent with the LP rules [in the
       grammar].)
Pollard (1984) calls Head Grammars with the AL mechanisms
Extended Head Grammars and argues that they have the same
weak generative capacity as Head Grammars. AL, however,
cannot be applied to account for the POBJ data in 14a.
Linearization can only take place among headed-strings
which are instantiations of syntactic complements (i.e.
required arguments in his terminology). The order rela-
tion needs to be captured here involves NP2, a non-head
segment of a headed-string and a non-argument.

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