Identifying Anaphors

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Given a language L and an expression S of L, can we identify in terms of the *structure* of S, the possible locations of anaphors and their antecedents?

In a series of papers I have argued that we can, but only on a language by language basis. This is so even if, as here, we limit ourselves to *simple anaphora* -- one that (by definition) satisfies

    i. the anaphor and antecedent are co-arguments, and
    ii. the anaphor is a full NP reflexive anaphor.

(So we do not treat here of clitic or verbal affix anaphors, nor do we treat of reciprocals or other types of referential dependencies different from reflexives).

Thus I claim that even for simple anaphora there is no fixed identification procedure that works for all languages. Nominal morphology is a factor in some Ls (Korean); linear order is relevant in Samoan in a way in which it is not in Korean or English; C-command seems relevant in English in a way in which it is not in Korean or Samoan.

The purpose of this paper is to present another, less widely recognized, means of identifying simple anaphor-antecedent pairs, one I call *verb dependent*. Some languages which exhibit this pattern are Toba Batak (Sumatra), Malagasy (Madagascar), and Tagalog (Philippines). The pattern of simple anaphora in these Ls instantiates in the domain of anaphora a more general structure type they share, which I shall call *verbal case marking*. The defining trait of VCM languages is:

VCM Languages

The semantic role of a structurally identifiable argument
of a predicate P varies with the choice of affix on P

These affixes will be called *theta affixes*. In general they do not vary with the noun class (person, number, gender) of the NP whose theta role they assign. (For a language independent definition of *structurally identifiable* see Keenan, 1993a).

The characteristic property of verb dependent anaphora is that the distribution of anaphors and their antecedents is conditioned by the presence of theta affixes. Other phenomena, such as extraction, are also conditioned by these affixes.

Moreover the morphological conditioning is independent of syntactic hierarchy, and in consequence the distribution of anaphors in these Ls may (and does) violate the sorts of C-command relations expected on the basis of English. We will provide an explicit compositional interpretation for such Ss, one in which the interpretation of the verbal morphology yields the correct anaphor-antecedent relations even though anaphors asymmetrically C-command their antecedents.

This paper is organized as follows: **§1** reviews some of the variation in the expression of the anaphor-antecedent relation. **§2** exemplifies verb dependent anaphora. **§3** presents a compositional semantics for verb dependent anaphora.

§1 Anaphora Variation

In Korean (Keenan, 1993a; O'Grady, 1985; Park, 1986) we find that simple anaphors may more or less indifferently preceed or follow their antecedents (1a,b) - (3a,b) preverbally if they are suffixed with *-ul/-lul* ("accusative") and their antecedents are suffixed with *-i/-ka* ("nominative"). What cannot happen is that anaphors are nominatively marked and their antecedents are accusatively marked, regardless of their relative order (4a,b).

(1)   a. John-i   caki-casin-ul pinanhayssta
            John-nom self-   -acc criticized
            John criticized himself.

           b. caki-casin-ul   John-i   pinanhayssta
            self-   -acc   John-nom criticized
            John criticized himself

(2)   a. Nwukwunka(-ka)   caki-casin-ul pinanhayssta
            someone(-nom)   self-   -acc criticized
            Someone criticized himself

           b. Caki-casin-ul nwukwunka(-ka) pinanhayssta
            self-   -acc someone(-nom) criticized
            Someone criticized himself

(3)   a. Nwuka caki-casin-ul pinanhayss-ni
            Who   self-   -acc criticized-Q
            Who criticized himself?

           b. Caki-casin-ul nwuka   pinanhayss-ni
            self-   -acc who   criticized-Q
            Who criticized himself?

(4) a. * Caki-casin-i   John-ul   pinanhayssta
       self-   -nom   John-acc   criticized
       He-self criticized John

   b. * John-ul caki-casin-i   pinanhayssta
       John-acc   self- -nom   criticized
       John criticized he-self

These data suggest that in the minimal contexts in which anaphora arises, learners of Korean must attend to the NP case marking on anaphors but may ignore the linear order (and presumably C-command) relations between anaphors and antecedents. To produce grammatical and intelligible results it suffices to mark anaphors accusative and assign the other NPs independently allowable cases. Overt case marking is also a factor in Bengali and Hindi (Dayal, 1993) and likely in other NCM (nominal case marking) languages. But, due to its absence, overt affixing of NPs is not a conditioning factor on the distribution of anaphors and antecedents in Ls like Mandarin or English.

By contrast in Samoan, arguments of transitive verbs are distinctly case marked and their relative order after the verb is quite free (in the ergative/absolutive case marking paradigm), (5a,b). But (Keenan, 1992; Chapin, 1970; Cook, 1991) anaphors must follow their antecedents regardless of case (5c-f).

(5) a. E   vivi'i   e   le tama le teine
      asp   praise   erg   the boy the girl
      The boy praises the girl

   b. E   vivi'i le   teine e   le tama
      asp   praise the   girl   erg   the boy
      The boy praises the girl

   c. E   vivi'i   e   le tama 'o   ia lava
      asp   praise   erg   the boy abs   3s self
      The boy praises himself

   d. E   vivi'i   le tama e   ia lava
      asp   praise   the boy erg   3s self
      The boy praises himself

   e. * E   vivi'i   e   ia lava le tama
      asp   praise   erg   3s self the boy
      He-self$_i$ praises the boy$_i$

f. * E   vivi'i 'o   ia lava e le   tama
   asp   praise abs 3s self erg the boy
   The boy praises himself

Note also that (5d) is a case where the anaphor outranks its antecedent on the theta role hierarchy: AGENT > NON-AGENT. And this is so regardless of whether we regard *e* marked NPs as "subjects" in any deep sense; unequivocally such NPs are agents.

Samoan presents a second case marking paradigm in transitive Ss, usually it seems, with verbs that are not so clearly AGENT-PATIENT/THEME taking. (6) is illustrative.

(6)   E   alofa le   teine 'i   lona tina
       asp love the   girl loc   her mother
       The girl loves her mother

Here the '*i* marked ("locative") NP does not naturally preceed the unmarked NP.

However, a few verbs which take the case marking paradigm in (6) do take an AGENT argument, and it is the '*i* marked one:

(7)   a. Na   lavea   le teine 'i   le tama
          past hurt   the girl loc   the boy
          The boy hurt the girl

       b. Na   lavea   le tamaititi   iate ia   lava
          past hurt   the child   loc+3s   self
          He-self hurt the child

       c. * Na   lavea   'o   ia lava 'i   le tama
            past hurt   abs   3s self loc   the boy
            The boy hurt himself

Again, in (7b) the anaphor follows its antecedent and outranks it on the theta role hierarchy. (7c) shows that this order may not be reversed.

§2. Verb Dependent Anaphora

Our first example of a VCM language with verb dependent anaphora is Toba Batak (Austronesian; Sumatra; Schachter, 1984). Transitive Ss in Toba are verb initial and may be distinguished according to the prefix on the verb. The major prefixes are *mang-* and *di-*, as illustrated in (8):

(8) a.   Mang-ida   si Ria   si Torus
        asp-see   art Ria   art Torus
        Torus sees Ria

b. Di-ida   si Torus si Ria
   asp-see art Torus art Ria
   Torus saw Ria

As main clauses, Ss built from *mang-* verbs are interpreted imperfectively (including generically). Ones built from *di-* verbs are interpreted perfectively. This distinction is overidden in subordinate contexts. Interchanging the NPs in (8a) changes the meaning to "Ria sees Torus". Similarly interchanging the NPs in (8b) reverses theta role assignment. In these Ss then the choice of verbal affix *mang- / di-* correlates with the theta role of a certain NP. In more detail:

Schachter (1984) argues that in all Ss of the form [pref+V NP_1 NP_2], the prefixed V and NP_1 form a constituent to the exclusion of NP_2. Partial summary evidence: Only NP_2 extracts (= relativizes, forms *wh-* questions by movement), NP_1 cannot be moved away from its verb. Various adverbial particles may separate the two NPs, but cannot separate V from NP_1. NP_2 undergoes discourse deletion, but NP_1 is largely immune to such processes. Predicate phrases, whether verbal, adjectival or formed with PPs, present an intonation peak on their penultimate syllable. And when V is transitive it is the penultimate syllable of [V + NP_1] which gets the peak. So this assignment treats predicates built from adjectives and intransitive verbs and transitive verb plus following NP identically.

The evidence for V + NP_1 constituency does not distinguish Ss built from *mang-* and *di-* verbs. So the audible constituent structure (which might be derived and contain empty nodes) of both types of S is given by:

(9)   [[pref+V + NP_1] + NP_2].

Thus in *mang-* Ss the external NP, NP2, is assigned the highest theta role in the theta grid of the verb (See Sugamoto, 1984), whereas the prefix *di-* assigns that theta role to the internal NP, NP_1. In this (minimal) way we see that Toba is a VCM language.

Now, in *mang-* Ss, (10a,b), only the external NP can antecede the reflexive, *dirina*, whereas in *di-* Ss only the internal NP functions as antecedent, (11a,b).

(10) a. Mang-ida   dirina   si Torus
          -see   self   art Torus
      Torus sees himself

b. *Mang-ida si Torus dirina
         -see art Torus self
    He-self sees Torus

(11) a. Di-ida   si Torus dirina
          -see   art Torus self
      Torus saw himself

b. *Di-ida dirina si Torus
         -see self   art Torus
    He-self saw Torus

So in (11a) the anaphor asymmetrically C-commands its antecedent.

Observe that it is quite easy to describe the distribution of anaphors and antecedents in Toba in terms of its observable structure:

Batak Anaphora Constraint (BAC)

In simple Ss A may antecede B iff B forms a constituent with a
mang- prefixed verb or A forms a constituent with a *di-* prefixed verb

The **BAC** characterizes simple anaphora in terms of constituency and identity of theta affixes. If we only checked hierarchical structure we could not distinguish *mang-* from *di-* Ss as they are hierarchically identical. Of course the **BAC** as given is incomplete: more must be said concerning (i) ditransitive verbs and objects of prepositions, and (ii) a (very) few other verbal affixes, e.g. *ter-*. But even so, *mang-* and *di-* Ss are the most widespread type of transitive S and the **BAC** gives the correct characterization for this core case. In this way we see that the distribution of anaphors and antecedents is not independent of verbal morphology.

Philippine languages (Tagalog, Cebuano, ...) are a second, well known type of VCM language, ones which also present some surprising anaphora patterns. The number of theta role distinctions coded by theta affixes in Tagalog is much greater than in Toba Batak. Two common theta affixes are *-um-* and *-in-*, "actor focus" and "goal focus" respectively, as in (12a,b).

(12) a. s-um-ampal ng   lelake ang babae   TAGALOG
          AF-hit   acc man   woman
      The woman hit/slapped a man

      b. s-in-ampal ng   babae   ang   lelake
          GF-hit   gen   woman   man
      The/a woman hit/slapped the man

Here it is the *ang* marked NP whose theta role varies with the choice of affix. And, comparable to Toba, only the NP whose theta role is identified on the verb can extract (Schachter, 1976).

We note that in (12a) the relative order of NPs (with their "case markers" *ng* and *ang*) varies quite freely postverbally. The *ng* NP here cannot be replaced by a definite NP such as a demonstrative or proper noun, and it has no pronominal forms. In (12b) by contrast there is a preference for the *ng* NP to follow the verb immediately (Schachter, 1976); moreover it may receive a definite interpretation,

can be replaced by demonstratives and proper nouns, and has pronominal forms - - ones which independently function as possessors of N's. So Ss built from -in- forms present by far the widest range of NP arguments.

Tagalog presents an NP reflexive *sarili niya* '"self" + 3gen', but its distribution in these simple transitive S types is surprising. Neither NP in (12a) can be replaced by it preserving grammaticality. In (12b) only the *ang* NP can be reflexive:

(13) a. sinampal ng babae ang sarili niya
      hit   gen woman   self
      The woman hit herself

    b. * sinampal ng sarili niya ang babae

For this limited range of transitive S we may describe the distribution of simple reflexives by: Only *ang* NPs of *-in-* infixed verbs may be reflexive. The statement becomes somewhat more complex as a greater range of roots, theta affixes and case markers is considered. Still these examples show that the distribution of reflexives is not independent of the choice of theta affix.

Our last example of a VCM language is Malagasy. Like its cousins, Tagalog and Toba Batak, Malagasy builds verbs from roots and affixes. The two semantically most neutral theta affixes are *i-* and *aN-*, (14). They are *active* in the sense that the NP external to the major constituent break is assigned the highest ranking theta role in the theta grid of the verb. And, as with Tagalog and Toba, it is only this NP which relativizes, questions by movement, etc.

(14) a. [N+i+vidy   akanjo hoan'ny tena+ny]   ny   vehivavy   rehetra
       pst+act+buy clothes for'the self+their the   woman   all
       All the women bought clothes for themselves

    b. [M+aN+vono (mamono) tena hoan'ny zanaka] ny ray-aman-dreny
       pres+act+kill   self for'the child   the father-and-mother
       Parents kill themselves for (their) children (generic)

    c. [M+aN+petraka (mametraka) ny enta+ko ao anatin'ny vata] aho
       pres+act+place   the thing+my there in'the trunk I
       I am putting my things in the trunk

There are other active prefixes, most built by prefixing *i-* and *aN-* with semantically richer affixes having meanings like CAUSE and RECIPROCAL.

The natural "passive" (15) of (14c) is done by prefixing the root with *a-* rather than *aN-*. Typically the external NP in such Ss is assigned a THEME theta role (sometimes PATIENT). And in general in non-actives the "Agent Phrase" (the NP which receives the highest theta role in the theta grid of the verb) is bound to the verb in exactly the same, complicated, way in which possessors are bound to their noun heads and most objects of prepositions are bound to their preposition. Keenan (1933b) argues at length that these possessors form a syntactic constituent with their verbal head to the exclusion of other verbal complements.

(15)   [[A+petra+ko]   ao   anatin'ny   vata] ny   enta+ko
           pass+put+my   there in'the   trunk the   thing+my
           My things are put by me in the trunk

Similarly suffixing the root with *-ina* assigns PATIENT (and sometimes THEME, depending on the verbal root) to the external NP, the Agent Phrase being presented as a possessor as expected.

(16)   [[No+vidi+n'ny vehivavy rehetra] hoan'ny tena+ny] ny akanjo
           pst+buy+pass'the women all   for'the   self+their the clothes
           Clothes were bought by each woman for herself

The most interesting non-active affix here is the "circumstantial" suffix *-ana* which combines with a root to which an active prefix has already been added. The external NP can now be interpreted with any theta role carried by an oblique NP in an active. Thus (17) is cognitively synonymous with (14b), but it is now the external NP which is assigned the benefactive role.

(17)   [[Amonoan'ny   ray-aman-dreny$_i$]   tena$_{i,*j}$] ny zanaka$_j$
           act+kill+obl'the   father-and-mother self   the child
           same as (14b) -- not literally translatable

Consider now the anaphora pattern exemplified in these Ss. That in (14a,b) is comparable to English, and, as in English, we may not interchange anaphor and antecedent preserving grammaticality. But the pattern in (16) and (17) is more surprising. The external NP, which clearly C-commands the anaphor, is not a possible antecedent. Only the genitive Agent Phrase is a possible antecedent and on no account which accepts the gross constituent structure illustrated (allowing invisible structure) will the Agent Phrase C-command the anaphor. Indeed the natural structure (Keenan, 1993b) is one in which the anaphor asymmetrically C-commands the Agent Phrase. In any event, the **MAC** below is descriptively adequate for simple anaphora in Malagasy.

A may antecede B iff B is accusative or an object of a
preposition and A is the external argument of an active
predicate or the genitive complement of a non-active one.

(Recall that *active* and *non-active* are defined partially in terms of theta affixes).

It may seem implausible that possessors should be able to bind outside their
dominating NP, but this fact is compatible with many comparable ones in
Malagasy. Thus, external NPs of active predicates, possessors of non-active ones
and possessors of predicate nominals enjoy comparable control priviledges:
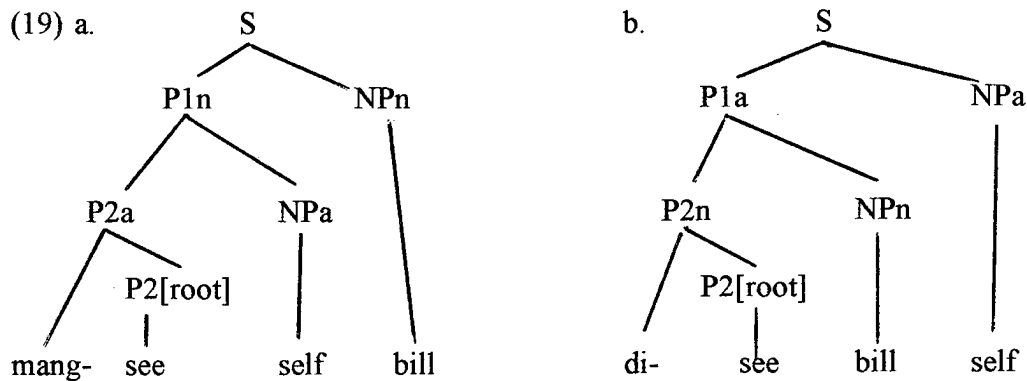
(18) a. Mikasa   ny   hamaky io boky io   ny mpianatra tsirairay
          act+intend the   fut+read that book that the student   each
          Each student intends to read that book

      b. Kasain'ny mpianatra   tsirairay ny   hamaky io   boky io
          intend+pass'the student each   the   fut+read that book that
          same as (18a). NOT 'It was intended by each student that that book be
          read (by someone)'

      c. Adidi + n +   i Doda   ny   manaiky   an'i   Dada+ny
          duty + gen + art Doda   the   pres+agree acc'art father+his
          Doda's duty is to obey his father

§3. Little Batak

We present here a simple formal language designed to exhibit the sort of verb
dependent anaphora we have illustrated above. Our purpose is to show that such
a language can be directly interpreted as a function of its structure yielding the
correct semantic results. Our purpose is to show that there is nothing logically
necessary about antecedents C-commanding their anaphors and thus no semantic
motivation for designing structures for the Ls studied in which such C-command
relations hold. Crucially of course we will assign a syntactic and a semantic role
to the verbal morphology. It is reasonable then that little Batak learners may
simply interpret what they hear along the lines proposed here.

Syntax

Using English morphemes for the content words in Batak, we provide a context
free grammar in which predicates "agree" in certain features with their arguments.
Our rules will yield derivations summarized by trees like (19).

(19) a.

```
                S
              /   \
           P1n     NPn
          /   \      \
        P2a    NPa    \
       /  \     |      \
      /  P2[root]|      \
     /     |     |       \
  mang-   see   self    bill
```

b.

```
                S
              /   \
           P1a     NPa
          /   \      |
        P2n    NPn    |
       /  \     |     |
      /  P2[root]|    |
     /     |     |    |
    di-   see   bill  self
```

So there are "nominative NPs", NPn's, and "accusative NPs", NPa's. Proper nouns belong to both categories but the reflexive *self* (in real Batak, *dirina*) only has category NPa, accusative NP.

Similarly there are two kinds of one place predicate: P1n's, which combine with nominative NPs to form Ss, and P1a's which combine with accusative NPs to form Ss. Thus P1's and the NP's they combine with "agree" in "case features". Similarly there are two kinds of two place predicates: P2n's, which combine with nominative NPs to yield P1a's, the kind of P1 which wants an accusative NP to make an S. And there are P2a's, which combine with NPa's to form P1n's, the kind of P1 that wants a nominative NP to make an S.

With this agreement mechanism then each nuclear S will have just one nominative NP and one accusative NP.

Now both kinds of P2's are formed from a lexical class of category P2[root]. *mang-* combines with such roots to form P2a's, and *di-* combines with such roots to form P2n's. More formally, here are our rules:

1. S → P1a + NPa   2. P1a → P2n + NPn
   S → P1n + NPn   P1n → P2a + NPa

3. P2a → mang-+ P2[root]
   P2n → di- + P2[root]

4. P2[root] → see, etc.   5. NPn → john, bill

   P1n → laughed   NPa → self, john, bill

Semantics

Given a non-empty universe E of (possibly abstract) objects about which we think of ourselves as speaking, a subset of E will be called a *property over* E. We write **P** for the set of properties over E. And we write **R** for the set of binary relations over E.

1. P1n's will denote properties over E.

2. Proper nouns denote functions which map properties into {**true,false**} and binary relations to properties.

Given an object b ∈ E, we will think of a proper noun like *bill* as denoting a function which maps a property q to **true** just in case b ∈ q, and it maps a binary relation R to the set of those objects which bear R to b.

More formally, proper nouns will denote elements of {I_b|b ∈ E}, where for each b ∈ E, each property q, and each binary relation R,

$$I_b(q) = \textbf{true} \text{ if and only if } b \in q \quad \text{and}$$

$$I_b(R) = \{a|b \in aR\} \quad (\text{where } aR =_{df} \{y| \, aRy\})$$

The elements of {I_b|b ∈ E} are called *individuals*.

3. Now, in interpreting a sentence, an expression of category NPn will be interpreted as a function which maps properties to truth values. As the only NPn's are proper nouns we have already said what sorts of functions they can denote. In a particular situation (model) we just must say which individual each proper noun denotes.

So in a model with universe E = {a,b,c, ...} where john denotes I_a and the P1n *laugh* is interpreted as a subset **LAUGH** of E, then the sentence *laughed john* will be interpreted as I_a(**LAUGH**), which is **true** iff a ∈ **LAUGH**. In general denotations of expressions in a given model are noted by the upper case expression.

4. Equally in interpreting a sentence an expression of category NPa will be interpreted by functions mapping binary relations to properties. Again we have already said what functions of this sort are denoted by proper nouns. The NPa *self* denotes that function **SELF** defined below:

$$\textbf{SELF (R)} = \{a| \, aRa\}$$

5. Expressions of category P2[root] are interpreted by binary relations.

6. Now we come to the crux of the semantics, the denotation of *mang-* and *di-*. Like *self* they are logical constants, we give their denotation explicitly.

mang- denotes that function **MANG** which maps each binary relation R to a function which maps possible NPa denotations to properties, as follows:

$$\textbf{MANG}(R)(G) = G(R)$$

Thus e.g. where *bill* denotes I_b, *mang-see bill* will denote $\textbf{MANG}(SEE)(I_b)$, which is just $I_b(SEE)$, namely the set of objects which stand in the SEE relation to bill. Similarly *mang-see self* denotes $\textbf{MANG}(SEE)(SELF)$, which is $SELF(SEE)$, the set of x's such that $(x,x) \in SEE$. Thus observe the truth conditions of (20), in a situation in which *bill* denotes I_b:

(20) [Mang-see self bill]   =   BILL(MANG(SEE)(SELF))
                        =   BILL(SELF(SEE))
                        =   **true** iff $(b,b) \in SEE$

Now consider *di-*. It combines with a relation denoting expression to yield something which combines with an NPn to yield something which combines with an NPa to yield a truth value. Its semantic interpretation follows this syntax directly. That is, *di-* will denote a function **DI** which maps binary relations R to functions mapping each NPn denotation H to a function mapping each NPa denotation G to a truth value, as follows:

$$\textbf{DI}(R)(H)(G) = H(G(R))$$

So e.g. **DI**(SEE)(JOHN)(BILL) = JOHN(BILL(SEE)). But notice that this is the same truth value as JOHN(**MANG**(SEE)(BILL)) = JOHN(BILL(SEE)). In other words the interpretation of (21a,b) are identical:

(21) a. Mang-see bill john   b. Di-see john bill

And finally course notice that the interpretation of (22) is given by:

(22) [Di-see bill self]   =   **DI**(SEE)(BILL)(SELF)
                   =   **BILL(SELF(SEE))**

and this latter is just the interpretation of (20). That is, in Little Batak (22a,b) have identical interpretations:

(22) a. Mang-see self bill   b. Di-see bill self

That is, *di-see bill self* "He-self saw bill" is true iff the object in the universe determined by *bill* stands in the SEE relation to himself. Thus the anaphor is correctly bound, and there is simply no logical problem in interpreting an expression in which an anaphor asymmetrically C-commands its antecedent. The key to doing that in this case was of course the assignment of a rich enough meaning to the particular morphemes *mang-* and *di-*.

Note the obvious here: English lacks the analogue of *mang-* and *di-*. Its transitive verbs are, in these respects, less structured than in Batak, and in consequence the compositional interpretation of minimal transitive Ss in English and Batak is not point for point the same. Their syntax differs and so does their semantics, though both manage to say "John saw Bill" and "John was seen by Bill", but each in their own way.

conclusion We have discussed one means languages may use to "code" the anaphor-antecedent (**AA**) relation. And we have touched upon others. But where does this leave us? Are there no language general properties concerning the **AA** relation?

This question is addressed in more detail in Keenan (1993a). We argue there that there is a very non-trivial general property. Namely, the **AA** relation is asymmetric in the sense that, informally, if A can antecede B then B cannot antecede A. More precisely (but see Keenan op cit for the notion "preserving structure"):

Anaphor-Antecedent Asymmetry

Anaphors and antecedents may not not be
interchanged preserving meaning and structure

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