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A NOTE ON THE INTERPRETATION OF ADJOINED RELATIVE CLAUSES

0. Introduction

In Bach and Cooper (1978) a semantics is proposed for adjoined relative clauses in Hittite and for the NP S analysis of English relatives within the general framework of Montague (1974). The aim of their analysis is to show that a potentially serious set of counterexamples to the compositionality thesis – the thesis that the interpretation of a construction is a function of the interpretations of its immediate subconstituents – can in fact be handled compositionally given certain plausible assumptions about the translations of NPs, and by means of the technical device of 'distinguished variables'. In this note I would like to propose an extension of Bach and Cooper's analysis to cover a class of interpretations arising in Warlpiri adjoined relative clauses reported in Hale (1976). The claim is that by translating tenses on analogy with NPs these additional, so-called '*T*-relative' interpretations, where the tense is modified rather than an NP, can be accommodated straightforwardly within the Bach and Cooper approach.

1. Warlpiri

In a very interesting paper on the adjoined relative clause in Australia Hale (1976) observes that relative clauses in Warlpiri are open to two distinct interpretations, which he terms 'NP-relative' and '*T*-relative', respectively. The former is simply the 'standard' restrictive relative clause interpretation, where the relative clause modifies an NP in the main clause. The latter is rather similar in meaning to a *when-* or *while*-clause in English, i.e., it specifies "the temporal setting of the events depicted in the main clause" (Hale, 1976, p. 79).[1] Thus in (1), the clause *kuja-npa pantu-rnu nyuntulu-rlu*, '(which) you speared', modifies the NP *wawiri*, 'the kangaroo'. On the other hand in (2), the clause *kuja-npa ya-nu-rnu nyuntu*, 'when you came up', modifies or specifies more fully the time of the main clause.

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(1) ngajulu-rlu kapu-rna wawiri purra-mi, kuja-npa pantu-rnu nyúntulu-rlu
(I-ERG AUX-lsg kangaroo cook-NONPAST, COMP/AUX-2sg spear-PAST you-ERG)
'I will cook the kangaroo you speared'.

(2) ngajulu-rlu lpa-rna karli jarntu-rnu, kuja-npa ya-nu-rnu nyuntu
(I-ERG AUX-lsg boomerang trim-PAST, COMP/AUX-2sg walk-PAST-HITHER you)
'I was trimming a boomerang when you came up'

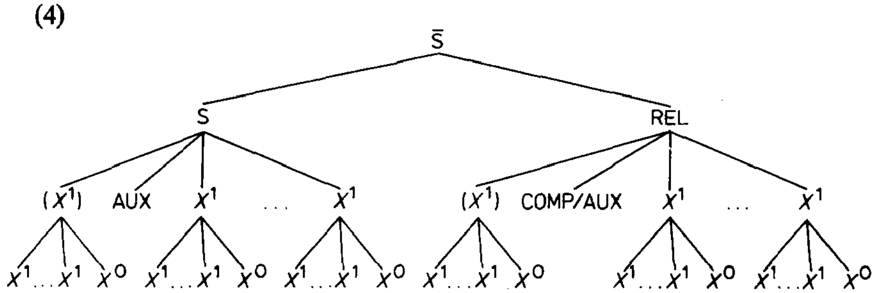
The important point to note here is that despite this difference in interpretation we are dealing with the same syntactic construction. Thus in both cases the relative complementizer /kuja-/ appears.

The syntax of Warlpiri has been the subject of a number of recent proposals, some diverging sharply from traditional views of phrase structure (cf. Hale, 1981; Lapointe, 1980; Nash, 1980), hence it is difficult at present to be confident as to what structure should be assigned to examples (1) and (2). For purposes of this note I shall adopt the view that (i) adjoined relative clauses in Warlpiri are underlyingly sentence-peripheral (i.e., I shall reject the 'extraction analysis', which sees these clauses as sisters of the NPs they modify in deep structure, with their surface position obtained by a movement rule), and (ii) free word order in Warlpiri is to be handled by the device of unspecified-category rules using the star '*' notation. These proposals are incorporated in the following (very tentative) PS rules for Warlpiri[2]:

(3)
$$\begin{aligned} \bar{S} &\rightarrow S\ \mathrm{REL} \\ S &\rightarrow (X^1)\ \mathrm{AUX}\ X^{1*} \\ \mathrm{REL} &\rightarrow (X^1)\ \mathrm{COMP/AUX}\ X^{1*} \\ X^1 &\rightarrow X^{1*}X^0 \end{aligned}$$

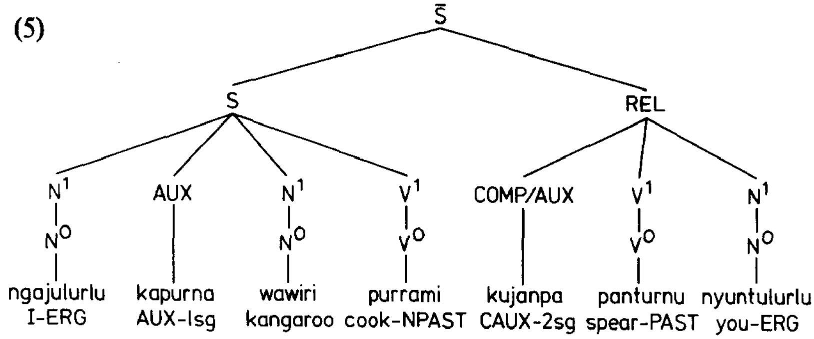
which produce trees of the general form:

(4)

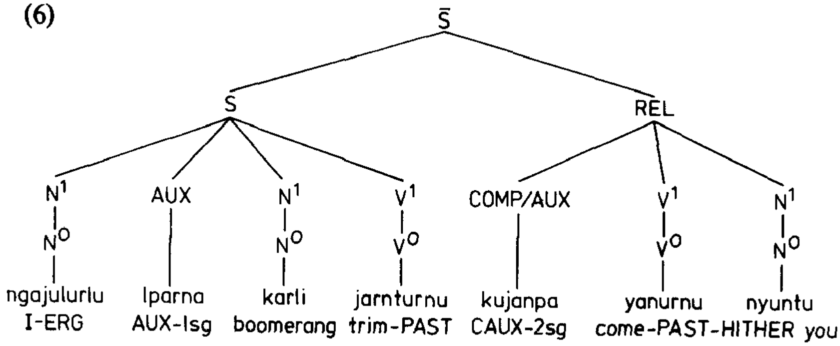


where 'X^{1*}' designates any iteration (possibly null) of X^1 categories. These rules yield structures (5) and (6) for (1) and (2), respectively, as well as the alternative orderings for these examples given in (7).

(5)



(6)



(7)(a) wawiri kapurna ngajulurlu purrami, kujanpa panturnu nyuntulurlu
purrami kapurna wawiri ngajulurlu, kujanpa panturnu nyuntulurlu

(b) . . . , panturnu kujanpa nyuntulurlu
. . . , nyuntulurlu kujanpa panturnu

(c) karli lparna ngajulurlu jarnturnu, kujanpa yanurnu nyuntu
jarnturnu lparna karli ngajulurlu, kujanpa yanurnu nyuntu

(d) . . . , yanurnu kujanpa nyuntu
. . . , nyuntu kujanpa yanurnu

Bach and Cooper adopt Montague's (1974) treatment of NPs as denoting sets of properties. The fundamental idea in their semantics for adjoined relative constructions is to translate the main clause NP modified by REL in such a way that it contains a free property variable,

R. Thus the NP *wawiri*, 'the kangaroo', in (5) would be translated approximately as

(8) $\lambda P \exists x \forall y[[[\text{kangaroo}(y) \wedge R(y)] \equiv y = x] \wedge P(x)]$

i.e., 'the set of properties possessed by the unique kangaroo x with property R'. Consequently, S in (5) is interpreted to be true just in case there is some future time t such that I cook the unique kangaroo x with property R at t. In informal logical notation

(9) $\exists t[\text{FUTURE}(t) \wedge \text{AT}(t, \text{COOK}(\text{I}, \lambda P$
$\exists x \forall y[[[\text{roo}(y) \wedge R(y)] \equiv y = x] \wedge P(x)])))]$

The translation of REL provides the missing property; so, continuing with (5), REL is interpreted as the property of being speared by you. Again in informal notation

(10) $\exists t[\text{PAST}(t) \wedge \text{AT}(t, \text{SPEAR}(\text{YOU}, z))]$.

The translation $\bar{\text{S}}'$ of $\bar{\text{S}}$ is then obtained by taking lambda abstraction over the free property variable R in the translation of S and applying this to the translation of REL, i.e., $\bar{\text{S}}' = \lambda R[\text{S}'](\hat{z}\text{REL}')$.[3] In the case of (5) then, we have (after lambda conversion)

(11) $\exists t[\text{FUTURE}(t)) \wedge \text{AT}(t, \text{COOK}(\text{I}, \lambda P$
$\exists x \forall y[[[\text{roo}(y) \wedge \exists t[\text{PAST}(t) \wedge$
$\text{AT}(t, \text{SPEAR}(\text{YOU}, y))] \equiv y = x] \wedge P(x)])))]$

i.e., 'there is a future time and a kangaroo which you speared at some past time such that I will cook the kangaroo at that future time', which is the desired result.

Accepting then that we can obtain the NP-relative interpretation of Warlpiri adjoined clauses using the methods outlined above, what shall we say about examples like (2)? What about the T-relative readings? What I propose here is that we analogize tenses to NPs in allowing at least some tenses to be translated as definite descriptions containing a free property variable. That is,

(12)(a) FUTURE may be translate as
(i) $\lambda T_1 \exists t_1 \forall t_2[[[T_2](t_2) \equiv t_2 = t_1] \wedge t^* < t_1 \wedge T_1(t_1)]$

(i.e., 'the unique time with property T which is later than now')

or

(ii) $\lambda T_1 \exists t_1[t^* < t_1 \wedge T_1(t_1)]$

(b) PRESENT may translate as

(i) $\lambda T_1 \exists t_1 \forall t_2[[[T_2](t_2) \equiv t_2 = t_1] \wedge t^* = t_1 \wedge T_1(t_1)]$

or

(ii) $\lambda T_1 \exists t_1[t^* = t_1 \wedge T_1(t_1)]$

(c) PAST may translate as

(i) $\lambda T_1 \exists t_1 \forall t_2[[[T_2](t_2) \equiv t_2 = t_1] \wedge t^* > t_1 \wedge T_1(t_1)]$

or

(ii) $\lambda T_1 \exists t_1[t^* > t_1 \wedge T_1(t_1)]$

where t_1, t_2 are variables over time points, T_1, T_2 are variables over properties of time points, and where t^* is a special constant which always picks out the moment of evaluation. Here T_2 is the free property variable. These translations are motivated independently of the facts concerning adjoined relative clauses.

Partee (1973) has remarked insightfully on the similarities in the semantic behaviour of tenses and pronouns, and recent work by Cooper (1979) and Hausser (1979) has demonstrated the utility of translating pronouns – at least in some of their occurrences – as definite descriptions containing a free property variable.[4] The present proposal can thus be viewed as a straightforward combination of these results, and allows us to proceed without further ado to a treatment of adjoined T-relatives such as (2). If we select (12c) (i) as the translation of the main clause past tense in (2), the translation of S can be given roughly as[5]:

(13) $\exists t_1 \forall t_2[[[T_2](t_2) \equiv t_2 = t_1] \wedge t^* > t_1 \wedge$

$\mathrm{AT}(t_1, \mathrm{TRIM}(\mathrm{I}, \lambda P \exists x[\mathrm{boomerang}(x) \wedge P(x)]))]$

i.e., 'the unique past time with property T_2 is such that I trim a boomerang at that time'. Now let us suppose that the translation of REL can be either a non-temporal or a temporal property. This can be done by allowing our distinguished variable over individuals, z, to appear either in the translation of an NP in REL (as in (10) above), or in the translation of the tense of REL, respectively. Thus, choosing the latter option for (2), REL will translate as the temporal property of being a past time at which you came up, i.e.,

(14) $t^* > z \wedge \mathrm{AT}(z, \mathrm{COME\ UP\ (YOU)})$.

To get the translation of $\bar{\bar{S}}$, we can use the same translation schema for the configuration $[[\ldots]_S[\ldots]_{REL}]_{\bar{\bar{S}}}$ that we used before, viz., $\lambda R[S']$

($\hat{z}$REL′), where R is any property variable. In the case of (2), we chose the property variable T_2, i.e., $\bar{S}$ translates as $\lambda T_2[S'](\hat{z}REL')$. This will produce (after lambda conversion)

(15) $$\exists t_1 \forall t_2[[[t^* > t_2 \wedge AT(t_2, \text{COME UP (YOU)})] \equiv t_2 = t_1] \wedge t^* > t_1 \wedge AT(t_1, \text{TRIM}(I, \lambda P \exists x[\text{boomerang}(x) \wedge P(x)]))]$$

i.e., 'there is a unique past time at which you came up and I was trimming a boomerang at that time', which is again the desired result. Note that since the translation of REL can yield either a temporal or a non-temporal property, and since the translation scheme for $\bar{S}$ allows abstraction over any property variable, we can account for the ambiguity in

(16) ngajulu-rlu-rna wawiri nyangu, kuja-npa pantu-rnu nyuntulu-rlu

(I-ERG-lsg kangaroo see-PAST, COMP/AUX-2sg spear-PAST you-ERG)

(i) 'I saw the kangaroo which you speared'

(ii) 'I saw the kangaroo when you speared it'

with no further elaboration. To obtain (16)(i), we translate REL as the property of being a z such that you speared z; and to obtain (16)(ii) on the normal reading where *kangaroo* and *it* are co-referential, we translate REL as the property of being a past time z such that you speared him_0 at z, and quantify-in *wawiri*, 'the kangaroo', subsequently.

2. Conclusion

By accepting the above proposals for translating tenses it appears possible to achieve a very general account of the interpretation of Warlpiri adjoined clauses. Moreover, if the analysis is correct it would provide an interesting example of natural language generalizing across tenses and NPs, since what we would have is a single syntactic construction whose interpretation varied according to whether an NP or a tense were translated with a distinguished variable. These results thus serve to pose once again the question of where precisely the common features of tenses and NPs reside. Recent work applying model-theoretic techniques to natural language semantics may well provide an answer. Thus in Dowty (1979) and Larson and Cooper (1980) NPs and tenses both denote the same sort of set-theoretic object, viz., sets of sets. Within generalized quantification theory this is just to say that both NPs and tenses denote quantifiers (cf. Barwise and Cooper, 1981, for much illuminating information on quantifiers and natural language). It may thus be possible to view the interpretation of Warlpiri adjoined clauses as a case of natural language generalizing across the semantic type of quantifiers.

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NOTES

[1] There are, apparently, additional interpretations which Hale prefers not to gloss as either NP- or *T*-relative. For example

(i) kuja-ka-lu yuwarli nganti-rni jurlpu panu-kari-rli kankarlu watiya-rla, marna-ngka ka-nyanu jinjiwarnu-rlu nganti-rni yujuku-pardu.
(COMP/AUX-3pl nest build-NONPAST bird many-other-ERG up tree-LOC, spinifex-LOC AUX-REFLEX jinjiwarnu-ERG build-NONPAST shelter-DIMINUTIVE).
'Whereas many other birds build a nest up in a tree, the jinjiwarnu (bird species) builds itself a small shelter in the spinifex grass'
(Hale, 1976, example (24))

(ii) nyampu kuja-ka-rna junma marda-rni ngajulu-rlu, ngula kapu-rna-ju ngajulu-rlu-lku paji-rni.
(this COMP/AUX-lsg knife have-NONPAST I-ERG, so AUX-lsg(Subj)-lsg(Obj) I-ERG-NOW/THEN cut-NONPAST).
'I have this knife, so I'm going to cut myself now'
(Hale, 1976, example (25))

It's interesting to note that the English temporal connective *while*, which may well be amenable to the same sort of interpretive treatment as Warlpiri *T*-relatives, shows a range of meanings which includes the usage illustrated in (i). That is, despite its status as a temporal connective sentences like (iii) are common with *while*:

(iii) While John is a Montague grammarian, Mary believes in the EST.

Here, as in (i), the tense linkage is secondary. This suggests that (i) and (ii) may ultimately be treatable as *T*-relatives with pragmatic factors determining the exact nature of the interclausal connection. Of course in the absence of an explicit pragmatics these remarks are merely a promissory note.

[2] The expansion rule for S represents a modification and minor correction of that appearing in Lapointe (1980) as $S \rightarrow X^0$ AUX $(Y^0)^*$. The parentheses are corrected to show that AUX can appear in either first or second position. I am assuming that a surface

filter on uni-syllable AUX bases in initial position will rule out such examples as

(i) *ka-rna ngaju ya-ni

(AUX-lsg I come-NONPAST)

'I am coming'

(cf. Hale (1973) on the positioning of Warlpiri auxiliaries). The X^1 categories are introduced to capture the fact that when in second position, AUX or COMP/AUX falls after the first constituent and not simply after the first word. Thus we have (ii) and (iii) as well as (iv)

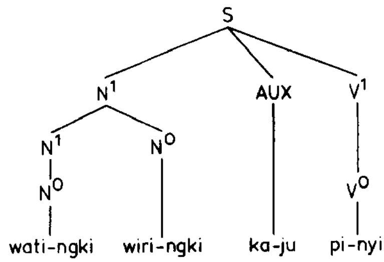
(ii) wati-ngki wiri-ngki ka-ju pi-nyi
(man-ERG big-ERG AUX-lsg hit-NONPAST)

(iii) wati wiri-ngki ka-ju pi-nyi
(man big-ERG AUX-lsg hit-NONPAST)

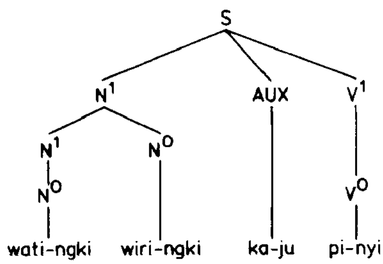
(iv) wati-ngki ka-ju wiri-ngki pi-nyi
(man-ERG AUX-lsg big-ERG hit-NONPAST)

where the three sentences are synonymous. These will get the structures (v), (vi) and (vii), respectively

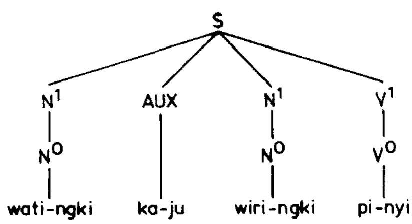
(v)



(vi)



(vii)



Since this is not a paper on Warlpiri surface syntax, and since the issues are quite complex, I shall wave my hands about the mechanisms which, for example, ensure that in (v) or (vi) either both of the initial N^0s receive ERG case marking or else only the rightmost does (i.e., the mechanisms which rule out **wati-ngki wiri kaju pinyi*). I will simply assume that some approach along the lines of Nash (1980) will work.

[3] The interpretation schema for the configuration $[[\ldots]_S[\ldots]_{REL}]_{\bar{S}}$, $\lambda R[S'](\hat{z}REL')$, is meant to be understood as allowing R to represent *any* property variable. Cases of vacuous abstraction, e.g., by choice of a property variable not appearing free in S′, are to be handled along the lines of Cooper (1975, 1979) where the semantics fails to assign a denotation if the incorrect variables are chosen.

[4] In considering the sentence

(ix) If Susan comes in, John will leave immediately.

Partee (1973) suggests the translation

(x) $(\exists t)\varphi(t) \supset \psi((\mathrm{Imm}(\mathrm{FUT}))(\iota t)\varphi(t)))$.

I believe that with the definite description treatment of tenses advanced here we may be able to go some distance in implementing this suggestion technically. For example, let

Susan comes in $\Rightarrow \lambda t_1[\mathrm{AT}(t_1, \mathrm{COME\ IN}(s))]$
John will leave immediately $\Rightarrow$
$\exists t_2 \forall t_3[[[T](t_3) \equiv t_3 = t_2] \wedge t^* < t_2 \wedge \mathrm{AT}(t_2, \mathrm{IMM\ (LEAVE}(j)))]$

and

$$\left\{\begin{matrix}\alpha \text{ if } \beta \\ \text{if } \beta, \alpha\end{matrix}\right\} \Rightarrow \lambda T \exists t_4[T(t_4)](\hat{\ }\beta') \supset \lambda T[\alpha'](\hat{\ }\beta')$$

Then

If Susan comes in, John will leave immediately
$\lambda T \exists t_4[T(t_4)](\hat{t}_1[\mathrm{AT}(t_1, \mathrm{COME\ IN}(s))]) \supset$
$\lambda T[\exists t_2 \forall t_3[[T](t_3) \equiv t_3 = t_2] \wedge t^* < t_2 \wedge \mathrm{AT}(t_2, \mathrm{IMM\ (LEAVE}(j)))]$
$(\hat{t}_1[\mathrm{AT}(t_1, \mathrm{COME\ IN}(s))]) \to \cdots \to$
$\exists t_4[\mathrm{AT}(t_4, \mathrm{COME\ IN}(s))] \supset \exists t_2 \forall t_3[[\mathrm{AT}(t_3, \mathrm{COME\ IN}(s)) \equiv t_3 = t_2]$
$\wedge\ t^* < t_2 \wedge \mathrm{AT}(t_2, \mathrm{IMM\ (LEAVE}(j)))]$.

Because of the definite description in the consequent of this formula we guarantee that t_2, t_3, and t_4 all denote the same time point if there is a t_4 satisfying the antecedent.

[5] For simplicity's sake progressive aspect has been ignored.

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