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A Logical Theory of Verb Phrase Deletion

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It's been known for some time that mere identity of terminal strings is insufficient to guarantee recoverability of deletion. Lees (1960), for instance, cited examples like (1) to show that in order for deletion to apply, the deletion target and the deletion trigger must have identical constituent structure. (Lees actually argued for the stronger condition of identity of derivational history).

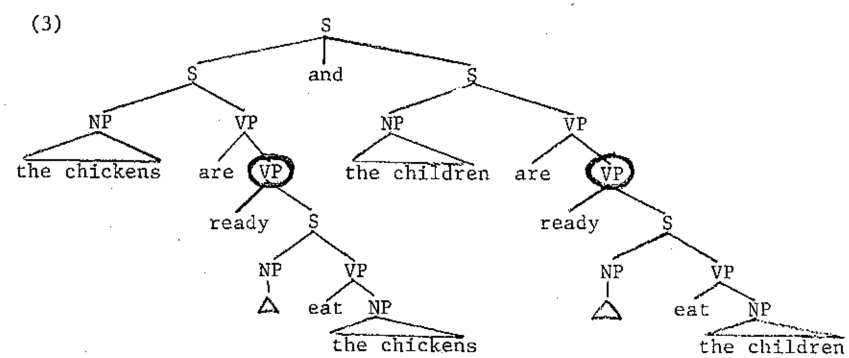
(1) *Drowning cats, which is against the law, are hard to rescue.

Similar arguments can be found scattered throughout the transformational literature of the last decade or so (see for instance Chomsky (1965, 1968), Ross (1967), Lakoff (1968), and Hankamer (1971)). Ross and Lakoff both speculate that the necessary condition on deletion is identity of underlying structure. The standard examples are those in (2) (all involving Verb Phrase Deletion (VPD))which are two, not four ways ambiguous.

(2)(a) John likes flying planes, and Bill does too.
(b) Betsy divulged when Bill promised to call me, and Sandy did, too.
(c) The chickens are ready to eat, and the children are too.

Now Lakoff discusses (2)(c) in some detail. He notes in fact that on the "ready to be eaten" reading, (2)(c) presents a problem for the theory of identity of underlying structure as a necessary condition for deletion. The problem, tout court, is that on the standard view of these sentences, the trigger and target VP's correspond to non-identical entities in underlying structure. In an Aspects-type theory, for instance (which Lakoff was working on at the time), the underlying structure of (2)(c) on this "object-deletion" reading, would be as in (3).

(3)



:ircled VP's are non-identical (in fact no VP's are identical). Lakoff suggested that "items that do not appear in the derived :ture are completely irrelevant to the question of linguistically ificant identity". This suggestion, though hardly explanatory, t conceivably handle the following cases as well.

(4)(a) Paul was hassled by the police, and Norma was too.
(b) Betsy seems to me to be unhappy, and Sandy does too.
(c) Peter is easy to talk to, and Betsy is too.

It's interesting to note, however, that Lakoff's suggestion fails :count for why these next examples are ungrammatical.

(5)(a) *The steak is ready to eat, and the chicken is ready to, also.
(b) *Peter is easy to talk to, and Betsy is easy to, also.

e have the same underlying structure and the same structure immed- ly prior to deletion (in all relevant respects) as (2)(c) and :), which are legitimate instances of VPD. Why should it be ible to delete the "higher" VP and not the embedded one, when the ssary identity holds between all the VP's in question. Note ıer that on the EQUI reading, similar sentences with <u>ready to</u> are ectly acceptable:

(6) Peter is ready to give up, and Betsy {(a) is / (b) is ready to} also.

ill return to this curious state of affairs in a moment, but some ıer remarks are in order first.
In Lakoff (1970), the claim is made that VP-Deletability is a test true ambiguity, rather than "vagueness" of meaning (see Sadock and ky (1973) for further discussion of this matter). Now for reasons I'll mention later, it's not completely clear that the level where appropriate identity for deletion is determined is the same level e such matters as logical consequence are determinable (Lakoff's n would appear to be tantamount to this). Nevertheless I would like rgue that there is a level of logical form (I mean level in the e of Chomsky (1955)) where the applicability of deletion rules is rmined. Moreover, I would like to suggest that logical forms are less "abstract" than is frequently claimed, especially, say, by onents of Generative Semantics.
By this I mean that the logical form of a sentence like "Betsy s Peter" should not be as in (7) (many details omitted), as many osophers and linguists (especially following McCawley (1970)) ne, but rather

(7) LOVE (BETSY, PETER)

ld express the <u>grammatical</u> relation of subject-predicate overtly. ıt work in the framework of Montague Grammar, it seems, to me,

(Montague (1974), Partee (1975), Thomason (1974)), has come much closer to positing the kind of logical forms that will allow us to give an adequate account of VPD (though I will not commit myself here to Montague's "proper treatment" of quantification).

The crucial device whose credibility I would like to establish (from the point of view of capturing linguistically significant generalizations) is the λ-calculus (Church (1941)). Suppose, essentially along with Montague, that every surface verb phrase corresponds to a λ-predicate in logical form. The logical form of "Betsy loves Peter" we will write as in (8)[1]

(8) Betsy, λx(love (x, Peter)) or simply
Betsy, λx(x love Peter)

Very roughly, this is to be thought of intuitively as predicating a property of Betsy, namely, the property of loving Peter.

Now the λ-calculus allows us to do many things (this is hardly one of its virtues). One very nice feature of the λ-calculus however, is that it allows us to assign to a quantifier what is essentially VP-scope. The preferred reading of "someone loves everyone," then, we will write as (9)

(9) (Ex)(x, λy((∀z)(y loves z)))

(intuitively, there exists some x, such that x has the property of loving everyone). Further speculations about the nature of logical forms will be offered in what follows.

One more notion that must be brought to the fore before proceeding is the standard notion of "alphabetic variance". Intuitively, two λ-expressions are alphabetic variants, if they differ only with regard to variable letters. The notion is not quite this simple, however. For two λ-expressions, λx(A) and λy(B), to be alphabetic variants, every occurrence of x in A must have a corresponding instance of y in B, and vice versa. Also, any Quantifier in A that binds variables in A must have a corresponding (identical) Quantifier in B that binds variables in all the corresponding positions in B. However, if there are any variables in A that are bound by some quantifier outside of λx(A), then the corresponding variable in λy(B) must be bound by the same operator in order for alphabetic variance to obtain (λx(...) and λy(...) are alphabetic variants in (∀z)([John, λx(x loves z)] & [Bill, λy(y loves z)]). Crucially, if λx(A) contains a variable bound outside of λx(A) (for instance, z in (∀z)(John, λx(x loves z))) and λy(B) contains a corresponding variable bound outside of λy(B) (even one bound by an analogous operator, for instance, w in (∀w)(John, λy(y loves w))) the two λ-expressions are not alphabetic variants (though here the universally quantified expressions, considered as a whole, would be).[2]

By way of illustration, the following pairs of λ-expressions are alphabetic variants.

(10)(a) λx(x is happy) = λy(y is happy)
(b) λw(w loves John) = λz(z loves John)
(c) λw((∀y)(w likes y)) = λz(∀q)(z likes q))
(d) λw((Ez)(w ate z)) = λq((Er)(q ate r))
(e) λx(x said(Mary, λy(y likes x)) = λz(z said(Mary, λw(w likes z)))
(f) λx(x loves y) = λz(z loves y) as in (∀y)([John, λx(x loves y)] & [Bill, λz(z loves y)])

rsely, the pairs of λ-expressions in (10) are not alphabetic nts.

(11)(a) λx(x is happy) ≠ λy(y is sad)
(b) λw(w loves John) ≠ λz(z loves Mary)
(c) λx(x likes y) ≠ λw(w likes z), as in (Ey)(John, λx(x likes y)) & (∀z)(Bill, λw(w likes z)), or in John, λy(y said(Mary, λx(x likes y))) & Bill, λz(z said(Mary, λw(w likes z)))

Now, assuming that logical forms bear a very close relation to the .ce syntax (i.e. given that there is at the very least a definable :spondence between surface verb phrases and λ-expressions), we have :ecessary apparatus to account for the intuition of McCawley (1967), rites...
The only way I know of stating this transformation [=VPD-I.A.S.] is to say that the deletion may take place only in a structure whose semantic representation is of the form $f(x_1)$ & $f(x_2)$"[3]
'er the following formulation of VPD.

(12) With respect to a sentence S, VPD can delete any VP in S[4] whose representation at the level of logical form is a λ-expression that is an alphabetic variant of another λ-expression present in the logical form of S or in the logical form of some other sentence S', which precedes S in discourse.

In many cases, this theory makes the same predictions as a purely ıctic theory. Sentences like the following one, for instance, 'e the possibility of deletion would be guaranteed by any purely ıctic theory) is a possible VPD environment because of its logical which is as indicated.

(13) Peter loves Betsy, and Sandy {loves Betsy / does ∅} too.

(13)' Peter, λx(x love Betsy) & Sandy, λy(y love Betsy)

.3)', λx(...) and λy(...) are alphabetic variants. This captures .y the intuition that (13) is "saying the same thing" about Peter ;andy, which is essentially McCawley's intuition.

Our theory makes some rather novel predictions also, many of which have escaped notice in the literature. The well known ambiguity of a sentence like "someone hit everyone" for instance, is accounted for by assigning it the two logical representations in (14)

(14)(a) (Ex)(x,λy((∀z)(y hit z)))
(b) (∀z)(Ex)(x,λw(w hit z))

Now a sentence like "Bill hit everyone" will be assigned only one logical form, that in (15), because there is no scopal variation possible when only one quantifier word is present.

(15) Bill, λq((∀p)(q hit p))

We therefore predict that in a sentence like the following one, the left conjunct is disambiguated.

(16) Someone hit everyone, and then Bill did.

That is, the left conjunct in (16) can be interpreted only as in (14)(a), where the existential quantifier has wide scope. λy(...) in (14)(a) is an alphabetic variant of λq(...) in (15). Deletion is impossible if the left conjunct of (16) is interpreted as in (14)(b) because the only λ-expression there (λw(...)) is not an alphabetic variant of λq(...) in (15). This prediction seems to be correct. (16) allows only the interpretation where the existential quantifier has wide scope in the left conjunct.

Consider now (17).

(17) Betsy greeted everyone when Sandy did.

(17) has two readings, one which would be true, say, if Betsy and Sandy walked into a room full of people and said "Hello everybody" in two-part harmony. (17) on this reading is derivable from (18) whose logical form is as indicated (details omitted, especially a precise treatment of <u>when</u>)

(18) Betsy greeted everyone when Sandy greeted everyone.

(18)' (a) [Betsy, λx((∀y)(x greet y))] when [Sandy, λw((∀z)(w greet z))]

or perhaps,

(b) Betsy, λr([r, λx((∀y)(x greet y)] when [Sandy, λw((∀z)(w greet z))])

In either formula, λx(...) and λw(...) are alphabetic variants.

Another reading of (17) is one it shares with (19).

(19) Betsy greeted everyone when Sandy greeted {them / % him}.

Notice that (18) does not have this reading, and further that in (19), no two VP's are syntactically identical. Our claim is that logical,

than syntactic identity is what determines deletability.
›re (17) can be derived from (19) because in its logical form,
(in either rendition), λy(...) and λw(...) are alphabetic variants.

.9)' (a) (∀x)([Betsy, λy(y greet x)] when [Sandy, λw(w greet x)])

or

(b) Betsy, λq((∀x)([q, λy(y greet x)] when [Sandy, λw(w greet x)]))

ır theory is able to account for the ambiguity of (17), which, in
ıctic identity theory, is derivable only from (18).
›w consider the following discourse.

!0)(a) Speaker A: What was Harry able to take a picture of?
(b) Speaker B: A Gnu.
(c) Speaker A: *What was Tom Ø?
[Ø = able to take a picture of].

;rammaticality of (20)(c) follows from our theory given the stan-
ısumption that wh-words in questions are to be treated on a par
ıantifiers, i.e. given the assumption that wh-words bind variables
:ž (1962), and many later references). That is, (20)(a) and (c)
ıve logical forms roughly as follows:

!0)(a)' (for what x)(John, λy(y was able to take a picture of x))
!0)(c)' (for what z)(Tom, λw(w was able to take a picture of z))

ı and λy(...) are not alphabetic variants, because they each contain
.es bound by different outside operators. (x and z are bound by
ınt wh operators--see the preceding discussion)
:milar behavior can be observed with pseudo-clefts, whose logical
/e might represent using Russell's iota operator (again we omit
ıtails, including a proper treatment of tense).

!1) *What Betsy saw was Topkapi, and what Peter did Ø was
South Pacific
[Ø = see]
!1)' ιx(Betsy, λy(y see x)) = Topkapi &
ιz(Peter, λw(w see z)) = South Pacific

ı and λy(...) are also not alphabetic variants because of the
ı binding of the variables x and z contained within them. The
ın in (21) is therfore predicted to be impossible by our theory.
›reover, this example should be compared with the following one,
leletion is in fact possible.

!2) What Betsy tried to see, but couldn't, is Topkapi.
!2)' ιx([Betsy, λy(y tried (y, λr(r see x)))] but ¬COULD
[Betsy, λz(z see x)]) = Topkapi

logical form of (22)', λz(...) and λr(...) are indeed alphabetic

variants, for they each contain a variable, i.e. x, bound by the same outside operator (ι). Crucially, the last three examples have all involved constraints on the deletion of syntactically identical VP's. Our theory seems to be able to sort out precisely which ones are deletable, and which are not, in a way that no purely syntactic theory is able to.

We are now ready to return to the ready sentences we observed at the outset. The standard view of the derivation of sentences like "the steak is ready to eat" is essentially Lakoff's (see also Hankamer (1971)). That view is that these sentences are derived by deletion under identity from structures like the one we saw earlier (cf. (3) above).

Now there is something wrong with this view. Consider a sentence like (23). The source for this sentence would be identical to the one

(23) The steak which Harry sold to Sue is ready to eat.

underlying (24), whose derivation differs from that of (23) only in

(24) The steak which was sold to Sue by Harry is ready to eat.

that optional cyclic rules have applied. But if that source contains an identical NP as the underlying object of eat, what is to prevent optional cyclic rules from applying to the second relative clause, but not to the first one, creating non-identity at the level when the deletion rule is to apply? The result will be ungrammatical sequences like the following:[5]

(25) *The steak which Harry sold to Sue is ready to eat the steak which was sold to Sue by Harry.

One solution to this dilemma might be to treat the target of such deletion rules as a pronominal element. We might further speculate that such pronominal elements are always to be treated as bound variables, a speculation which receives further support from the existence of sentences like this next one:

(26) Everything is ready to eat.

That is, we would not want to derive this sentence from an underlying structure with two everythings, for we would not be able to capture the fact that the object of eat is to be treated logically as a bound variable (the argument is analogous to the by now standard arguments regarding EQUI).

Now the fact that the object of eat in such sentences must be interpreted as a bound variable is certainly a property of the ready class of predicates. We might therefore require the λ of the ready predicate also to bind the position of the embedded object pronoun. ready for John to eat would then correspond to the following λ-predicate.

(27) λx(x is ready for [John, λy(y eat x)])

ıg Δ represent an unspecified subject, ready to eat would cor-
ıd to this λ-predicate:

(28) λx(x is ready for [Δ, λy(y eat x)])

Ve are now ready to explain the ready deletion facts we observed ›r. (29) would be assigned a logical form like that in (29)' ıe "object-deletion" reading).

(29) The steak is ready to eat, and the chicken is ready to eat also.

(29)' The steak, λx(x is ready for [Δ, λy(y eat x)]) & the chicken, λw(w is ready for [Δ, λz(z eat w)]).

›: ready to eat in the second conjunct of (29) corresponds to .) in (29)' , which is an alphabetic variant of λx(...). That therefore deletable. The embedded VP: eat, on the other hand, ›ponds to λz(...), which has no alphabetic variant in (29)' ..), the only reasonable candidate, has x where λz(...) has w). :ore only the higher VP is deletable in (29). This explains the ıst we noted above between (2)(c) and *(5)(b).[6]
Votice that since we have dispensed with a syntactic identity :ement on the rule of VPD, having relegated the recoverability .etion to our theory of logical form, we can write VPD simply as)). Arguments that AUX must be mentioned in the SD of the rule

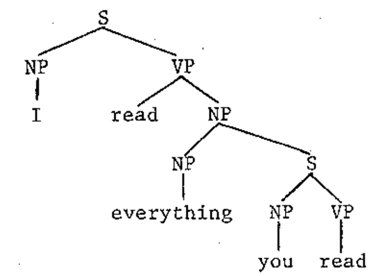
(30) X - AUX - VP - Y
⇓
∅

› found in Bresnan (1976a) and Sag (forthcoming). We might further ıesize that all deletion rules that can apply in discourse (see ıd Hankamer (1976) for a survey of these rules) are like (30) in ›ntioning the deletion trigger.
This formulation of the rule allows us to account for the extremely ›matic examples noted by Bouton (1970). Bouton observed that VPD ›ply in sentences like the following, where the target VP is con- l within the antecedent VP.

(31) I read everything you {read / did ∅}.

:oblem of course is that the standard formulation of VPD (whose .s something like: X - VP - Y - VP - Z) cannot apply to sentences :his, whose structure is something like that in (32) (after .vization).

(32)



Notice, however, that these sentences will have a logical form something like the following (where (∀y:you, λr(r read y)) represents a restricted quantifier. An alternative analysis is possible using conditionals):

(32)' I, λx((∀y:you, λr(r read y))[x, λz(z read y)])

Rule (30) can apply to (32). The deletion will be recoverable because in (32)', λz(...) and λr(...) are alphabetic variants.

Sentences like this have some futher interesting properties. Consider the ambiguity of (33) for instance.

(33) Betsy wants Peter to read everything Alan wants him to read.

This sentence has an opaque reading which is paraphrasable as: what Betsy wants is for Peter to read everything Alan wants him to read. The other, transparent reading of (33) might be paraphrased (rather crudely) as: everything that Alan wants Peter to read is also such that Betsy wants Peter to read it. Now we might represent this ambiguity as two different scopes of the universal quantifier. The opaque reading would be something like (34), and the transparent reading, as in (35).

(34) Betsy, λx(x want [(∀y:Alan, λz(z want [Peter, λw(w read y)]))
[Peter, λq(q read y)]])

(35) Betsy, λx((∀y:Alan, λz(z want [Peter, λw(w read y)]))
[x, λr(r want [Peter, λq(q read y)])])

The decision to represent this ambiguity scopally is the right one, I would claim, beacuse it accounts for the fact that (36), which is the result of applying VPD to the VP: wants him to read in (33), has only the transparent reading.[7]

(36) Betsy wants Peter to read everything that Alan does.

Why is this so? Because the deleted VP corresponds to λz(...) in both (34) and (35), but only in (35), the representation for the transparent reading, does λz(...) have an alphabetic variant (i.e. λr(...)).

There are numerous other facts to be accounted for in this domain. kample, only one of the following discourses is possible if the sentence has the transparent reading:

(37) Betsy wants Peter to read everything that Alan wants him to read.

(a) Yea, Sandy does Ø, also.
[Ø = want Peter to read everything...]

(b) *Yea, Sandy wants him to Ø, also.
[Ø = read everything that Alan...]

ılso follows from our theory. The logical forms for the two ıces in (37) is given in (38) ((38)(*ii*) is the logical form for the ıce underlying (37)(a) or (b) prior to deletion).

(38)(*i*) Betsy, $\lambda x((\forall y{:}Alan, \lambda z(z\ want\ [Peter, \lambda w(w\ read\ y)]))\ [x, \lambda r(r\ want\ [Peter, \lambda q(q\ read\ y)])])$

(*ii*) Sandy, $\lambda m((\forall o{:}Alan, \lambda n(n\ want\ [Peter, \lambda p(p\ read\ o)]))\ [m, \lambda s(s\ want\ [Peter, \lambda t(t\ read\ o)])])$

ıgher VP, which is the one deleted in (37)(a), corresponds to), which is an alphabetic variant of λx(...) in the logical form preceding sentence. The embedded VP, however, which is the one ıd in (37)(b), corresponds to λt(...), which would be an alphavariant of λq(...) in the logical form of the previous sentence for the diverse binding of the variables o and y. The facts ')(a) and *(37)(b) thus fall out of our theory nicely. Comparatives work the same way, which would point to the correct- of treating them scopally. The important facts in that area are like the following.

(39) Sam claimed he was taller than he was and Bill did too.

.s sentence, the two conjuncts can both have either the sensible parent) or the contradictory (opaque) reading (they must both the same interpretation, of course). That much is easy to explain. , however, that the following example, which is just like (39) only the embedded VP: taller than he was has been deleted, only the contradictory reading in both conjuncts.

(40) Sam claimed he was taller than he was, and Bill claimed he was, too.

planation is quite parallel to the one just given for the facts).

'e can also explain an observation of Edwin Williams's, namely, sentence like (41)

41) Mary's father told her to work harder than her boss did Ø.

cannot have the (opaque) reading which is paraphrasable by: what Mary's father told her was that she should work harder than her boss told her to work. The explanation for this fact is about the same as the one we gave for the missing reading of (36) above.

As for sloppy identity, our theory of logical form will allow us to do essentially everything that Keenan's (1971) analysis does, but without having to posit two separate deletion rules, as Keenan does. All we need to assume is that pronouns in the VP that bear the same referential index as the subject of the sentence are optionally represented in logical form by variables bound by the λ-operator. Thus (42) would have two logical forms, which are sketched in (43).

(42) $John_i$ scratched his_i arm.

(43)(a) $John_i$, λx(x scratched his_i arm)

(b) $John_i$, λx(x scratched x's arm)

I will not elaborate on this matter here (a detailed analysis is given in Sag (forthcoming)), except to point out that there are some surprising facts in this area too which have escaped notice in the literature and which follow from the proposed analysis. Thus consider (44), which is ambiguous depending on whom Peter said Betsy hit, himself (sloppy), or Alan (non-sloppy).

(44) $Alan_i$ said Betsy hit him_i, and Peter did Ø too.
[Ø = said Betsy hit him]

We account for the two readings of this deleted sentence by assigning its pre-deletion source the following two logical forms.

(44)' $Alan_i$, $\lambda x(x\ said\ [Betsy, \lambda y(y\ hit\ him_i)])$
& $Peter_j$, $\lambda w(w\ said\ [Betsy, \lambda z(z\ hit\ him_i)])$

(44)" $Alan_i$, $\lambda x(x\ said\ [Betsy, \lambda y(y\ hit\ x)])$
& $Peter_j$, $\lambda w(w\ said\ [Betsy, \lambda z(z\ hit\ w)])$

In either case, λx(...) and λw(...) are alphabetic variants predicting the possibility of the deletion in (44) on either reading.

(45), however, which differs from (44) only in that it was the embedded VP that got deleted, is unambiguously non-sloppy, i.e. it says that Peter said that Betsy hit Alan.

(45) $Alan_i$ said Betsy hit him_i, and Peter said she did, too.

The reason for this is the following: If this sentence has the sloppy reading, i.e. if it has the logical form in (44)", then the VP that was deleted in (45) corresponds to λz(...). But λz(...) contains the variable w (bound from outside) where λy(...) contains x (also bound from outside). No alphabetic variance obtains, and VPD is impossible.

In this paper I have proposed a theory of VPD and sketched an ne of a theory of logical form that I think should go with it. ve seen cases where a sentence loses one of its readings after as applied, and cases where deleted sentences seem to gain ngs that their sources (in a purely syntactic deletion theory) t have. The conclusion then at the very least is that overt ctic identity is neither a necessary nor a sufficient condition P-deletability. I have claimed that these deletion facts provide nce for a very surfacy and relatively compositional view of al form. This is not to say that an explanation for the facts in this paper could not be found in a more abstract theory of al form. I am only claiming that a coherent account of the facts e given in a theory of the sort that I have sketched and that not at all obvious what an alternative account could look in a more abstract framework.[8]

Let me conclude with two observations. First, if my hypothesis logical form is correct, and if the logical form of a sentence ken to be sufficient to determine its logical consequences, examples like the following (which was discovered with the aid off Nunberg) are rather troublesome.

(46) They caned a student severely when I was a child, but
not like Miss Grundy did ∅ yesterday.
[∅ = cane a student]

the first clause can be interpreted generically at the same time the deleted indefinite NP has a specific interpretation.[9] But istinction between generic and specific interpretations of sentences is clearly relevant for determining logical consequences. not at present know how to reconcile facts like this with the y I have presented except to say that indefinite NP's are not sented scopally at the level of logical form.

Finally, the commonly held position that transparent versus e understandings of sentences containing proper names and definite iptions should be treated as scope differences in logical form position is essentially due to Russell (1905)) would seem to be sistent with our theory. Assuming the correctness of that we would expect, on the transparent readings, only the deletions 7)(a) and (48)(b) (where the higher VP has been deleted) and not in (47)(b) and (48)(b) (where the embedded VP has been deleted).[10]

(47)(a) Alan wanted to talk to Betsy. Peter did also.
(b) Alan wanted to talk to Betsy. Peter wanted to also.

(48)(a) Alan wanted to talk to the tallest man in Chicago.
Betsy did also.
(b) Alan wanted to talk to the tallest man in Chicago.
Betsy wanted to also.

our examples, however, seem perfectly acceptable.

FOOTNOTES

*This paper is an attempt to summarize the main points made in Chapter Two of my forthcoming doctoral dissertation. All matters discussed here are treated in more detail there. My research has been supported in part by a grant from The National Institute of Mental Health (5 P01 MH13390-09) to M.I.T. I have had many helpful discussions with Barbara Abbott, Noam Chomsky, Ken Hale, Larry Horn, Hans Kamp, Susumu Kuno, Geoff Nunberg, and Haj Ross. I am also indebted to Barbara Partee, whose 1974 Linguistic Institute course in Montague Grammar is probably what provided the starting point for all my thinking on these matters. Many of the facts observed here, and some of the proposed explanations for them, have been discovered independently by Edwin Williams, who draws different conclusions from them.

1. Unlike standard λ-calculi, I write arguments before their λ-predicates. I think there are some good reasons for this, actually (see Sag (forthcoming)), but I will not develop those here.
Note further that since every surface VP corresponds to a λ-predicate, corresponding active and passive sentences will have different logical forms. These will be related either by logical equivalence (see for instance Bresnan (1976b)) or else by meaning postulate (as Thomason has suggested).

2. For a more formal discussion of this notion see van Fraassen (1971, pp. 102-104), Hughes and Cresswell (1968), and Kalish and Montague (1964). λ functions just like ∀ or E, with respect to alphabetic variance.

3. Keenan (1971) has a similar intuition.

4. Subject to the backwards anaphora constraint, of course. See the discussion in Sag and Hankamer (1976).

5. This type of argument was pointed out to me by Geoff Pullum, who attributes it to Michael Brame.

6. On the EQUI reading, of course, there is no bound variable in the object position of the embedded VP. Therefore either the higher VP or the lower VP is deletable.

7. (36) has another reading, which is unproblematic, namely, the one it shares with (*i*).

(*i*) Betsy wants Peter to read everything that Alan reads.

8. Notice for instance that lexical decomposition in general wreaks havoc with our theory:

(*i*) *John melted the copper, and the tin did ∅, too.
[∅ = melted]

9. Kuno (1974) observes similar cases with specific vs. non-specific indefinite NP's.

Ɩhis problem could be solved within a scopal theory only if we ed proper names and definite descriptions to have scope over than one sentence in discourse. (47), for instance, would be blematic if the logical form of the two sentences in discourse i).

(*i*) (Betsy-x)([John, λy(y want (y, λz(z talk to x)))].
[Peter, λw(w want (w, λs(s talk to x)))])

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