

# Kennedy's Puzzle: What I'm Named or Who I Am?

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## 0. The big picture

This paper is a defense of two hypotheses against a challenge to both. The main hypothesis at issue is that of direct compositionality (e.g., Montague, 1973), which is that the syntax and semantics work in tandem. Thus the syntax “builds” (proves the well-formedness of) expressions and each expression is assigned a model-theoretic interpretation as it is “built” in the syntax. This view thus makes no use of mediating levels of representation such as LF, and as such requires no extra apparatus mapping surface structures into LFs (or vice-versa). The sub-hypothesis here is the hypothesis of variable-free semantics (see especially Jacobson, 1999, 2000), which is that the semantics makes no use of variables (and hence no use of assignment functions) and the syntax concomitantly makes no use of indices. A corollary of this view is that variable names are an artefact, and can never play a role in the statement of grammatical phenomena. Although these two hypotheses are logically independent, the two go rather naturally hand in hand: one reason for this is that dispensing with variables removes many of the apparent challenges to direct compositionality. Space precludes discussion of this here; see Jacobson (1999, 2000a) for a detailed exposition of the link between these two hypotheses.

Thus the goal of this paper is to examine one case where it looks like variable names are indeed crucial; this centers on an analysis of Heim (1997) of some facts from Kennedy (1994). I argue that Heim's basic insight is indeed correct - but that using the tools of variable names is the wrong way to implement the insight. I will then propose that recasting the insight in a variable-free semantics - using what we might call “healthy” model-theoretic objects (i.e., model-theoretic objects which make no use of assignment functions as part of their building blocks) - will account for the same cases, while avoiding some of the problems caused by the use of variable names.

## 1. Background

I will elucidate the problem using the “conventional” terms; thus my discussion here uses notions like variables and LF. For the moment, I will also assume that an elided VP requires there to be a linguistically overt expression which serves as its “antecedent” - that is, there is some overt expression which satisfies some identity condition either on form or meaning with the elided material. The story begins with Sag's dissertation (Sag, 1976), in which he made the following claim: Take an elided VP (hereafter,  $VP_{ELL}$ ) and take its antecedent VP (hereafter,  $VP_{ANT}$ ). Let the two be identical (for Sag, this meant identity of LF) and let them both contain variables which are unbound within them. Then, even if the two variables have identical names, the identity condition is not satisfied unless the two are ultimately bound by the same thing. (See Partee and Bach, 1981 for a discussion of the non-compositionality of this condition if it is recast into semantic terms.)

Almost under any view of identity (form, or meaning), Sag's condition would be an unpleasant surprise. But fortunately (for every theory), we now know that this condition is incorrect. Some of the facts that led to Sag's conclusion were simply wrong, others have independent explanations, and there are perfectly good

cases which would be incorrectly blocked by this condition. Thus Evans (1988) points out that (1) and (2) are impeccable, and Jacobson (1992) notes cases like (3):

- (1) Bagels, I like. Donuts, I also do. (Evans, 1988)
- (2) I know which rivers Bill likes to swim in, and I know which rivers/lakes Mary does. (Evans, 1988)
- (3) Mary<sub>i</sub> asked John to water her<sub>i</sub> plants, and Sue asked Bill to. (okay on sloppy reading; Jacobson, 1992)

And yet, there is one case for which it looks like Sag's condition might be right: this involves ACD and is discussed in Kennedy (1994). (The sentences in (4) are a modification of Kennedy's facts. Also, Kennedy considers additional facts which I do not have space to discuss):

- (4) a. John kissed every girl who Bill did. (*kiss*)
- b. \*John kissed every girl who knew a boy that Mary did. (*kiss*)
- c. \*John kissed every girl who knew a man who liked a woman that Bill did. (*kiss*)

## 2. Heim, 1997

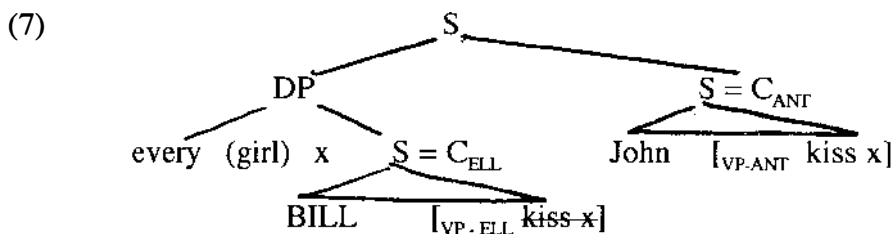
There is an intriguing analysis of these due to Heim (1997). First, Heim adopts Rooth's focus condition on ellipsis (Rooth, 1992) which can be stated as follows:

- (5) Consider a VP<sub>ELL</sub> and a VP<sub>ANT</sub>. Then VP<sub>ELL</sub> must be contained within some constituent C<sub>ELL</sub> and VP<sub>ANT</sub> must be contained within some constituent C<sub>ANT</sub> such that the meaning of C<sub>ANT</sub> - or something which follows from this meaning (where "follow from" need not be logical entailment, but can be a pragmatic inference) - is a member of the focus value of C<sub>ELL</sub>.

Put slightly differently, take "meanings" to be functions from assignment functions to something else. then, for all g, [[C<sub>ANT</sub>]]<sup>g</sup> (or something which follows from this) must be a member of [[C<sub>ELL</sub>]]<sup>FOC</sup><sup>g</sup>. We see in (6) a typical case of VP Ellipsis which very happily satisfies this condition:

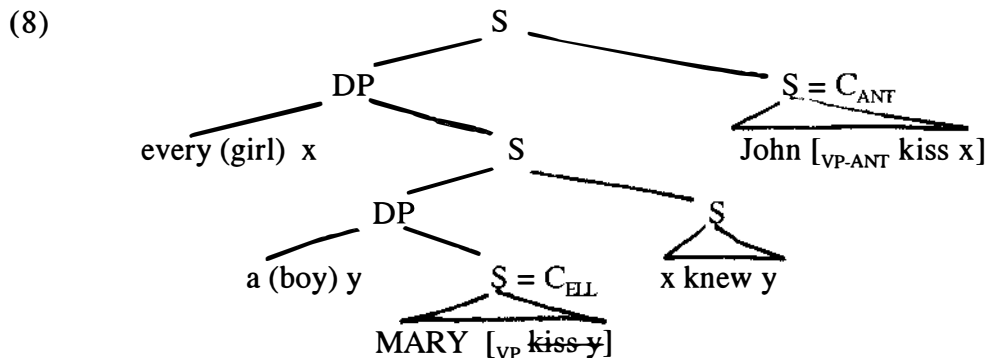
- (6) John left. BILL did too.

For the sake of exposition, let me temporarily oversimplify Heim's actual proposal. Her claim is that the good case of ACD is good because the elided VP and its antecedent have the same variable name in object position, as shown in (7):



In this case, for all g [[C<sub>ANT</sub>]]<sup>g</sup> is a member of the focus value (i.e., is an alternative to) [[C<sub>ELL</sub>]]<sup>g</sup>, and so Rooth's condition is met. But in a bad case such as (4b), the variable names are different, as shown in (8) (here, and throughout this section I

will ignore the contribution of the head noun as it is basically irrelevant; I assume that the relative clause combines with the head and then with the determiner, but will suppress the full details here):



Here Rooth's condition is not met, since there are assignment functions  $g$  such that  $[[C_{ANT}]]^g$  (which is the proposition that John kissed  $g(x)$ ) is not an alternative to the proposition Mary kiss  $g(y)$  (which is the attempted  $C_{ELL}$ ). Notice that putting it this way *assumes* that  $C_{ANT}$  and  $C_{ELL}$  would have to be as shown above; the interested reader can verify that there are no other two expressions that one could find to serve as  $C_{ANT}$  and  $C_{ELL}$ .

The appeal of this analysis is that the contrast between these and the Evans cases follows effortlessly. In the good Evans' cases,  $C_{ANT}$  and  $C_{ELL}$  can both be big enough so that the offending variable is bound within each, and so the contrast is possible. Thus consider again (1). In this case the representation for  $C_{ANT}$  is, roughly: [bagels,  $x$  [I like  $x$ ]] and the representation for  $C_{ELL}$  is [DONUTS,  $y$  [I like  $y$ ]]. Here the variables are bound within these; for any  $g$ , the focus value of  $C_{ELL}^g$  is a set of propositions: {I like bagels, I like muffins, I like croissants, ...} and  $C_{ANT}^g$  is a member of this set. Similar remarks hold for (2) and (3).

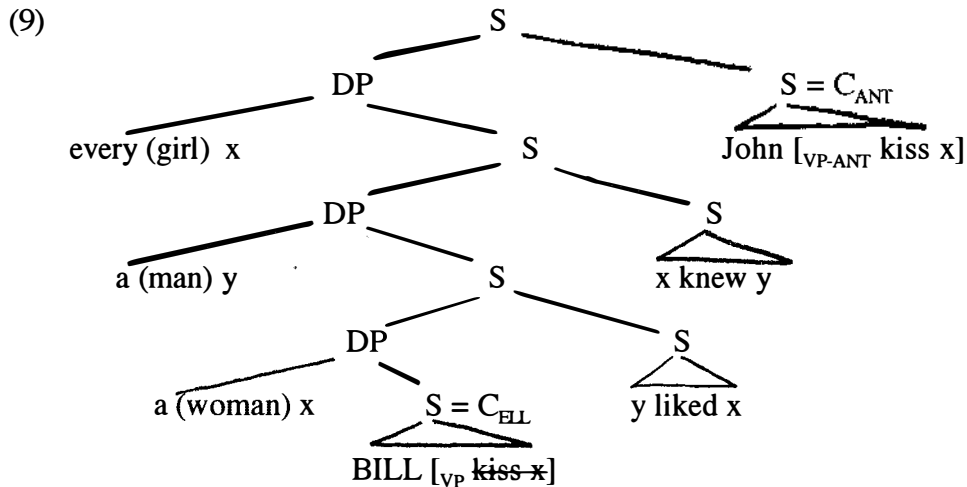
### 3. Advantages and Problems

It seems to me that there is something deeply right about part of this solution. By blaming the offending cases on an inability to get the focus considerations right, the contrast between the Kennedy cases and the Evans cases falls out immediately: in the ACD (Kennedy) cases we can't set up appropriate contrast domains (essentially because one is contained within the other), but in the Evans case we can. The use of variable names here is an attempt to "track" individuals; the insight is that in (4b) and (4c) the ellipsis is not good because the individuals serving as object of *kiss* in each case are - in some difficult to pin down sense - not the "same individuals". I will claim that this insight is exactly correct, but that variable names are not the right way to pin this notion down.

Notice that of course if Heim's full solution were right, it would present a serious challenge to the claims of variable-free semantics: which is that variable names are an artefact and should never play a role in the semantics. Moreover, the entire analysis poses major challenges to direct compositionality as it makes crucial use of the interpretation of LF expressions - expressions which do not correspond to anything in the obvious (surface) syntax.

In fact, though, there are problems with Heim's analysis which might make one suspicious of the particular tools used in this implementation. In the first place - a point noted by Heim herself - this requires a stipulation on the reuse of variable names (what she dubs the "No Meaningless Coindexation") condition. This

condition can be stated as: In any LF, if a variable  $x_i$  is bound by some binder  $\alpha$ , then all other occurrences of  $x_i$  must also be bound by  $\alpha$ . (Compare this, incidentally, to Sag's condition on the names of unbound variables within  $VP_{ANT}$  and  $VP_{ELL}$ : Sag's condition was on VP ellipsis whereas Heim's is more general, but it interacts with the focus condition on ellipsis to make the same predictions in these particular cases.) The necessity of this condition cannot really be shown by a case like (4b), because in that case if the two were "accidentally coindexed" we would simply get the wrong meaning. However, the crucial case is (4c), where without this condition nothing would block an LF like that in (9):

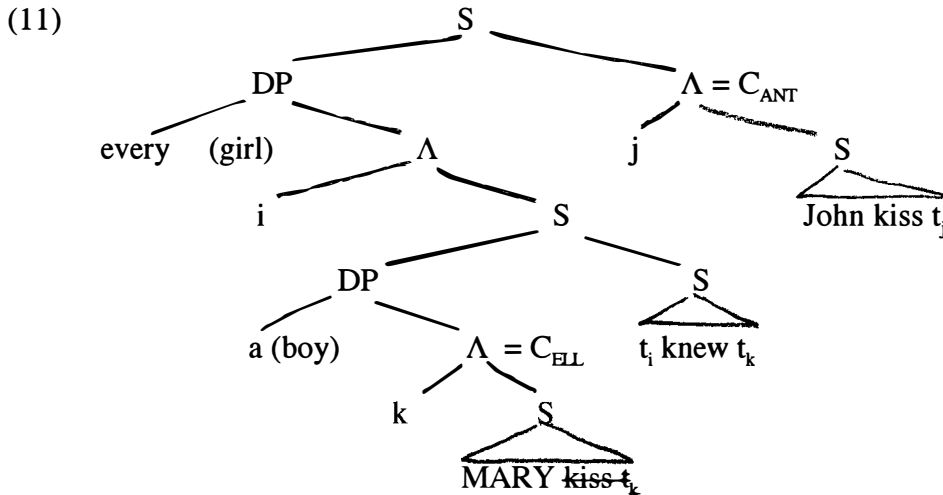


Here Rooth's focus condition would be met since the same variable occurs in the object of  $C_{ELL}$  and  $C_{ANT}$  and yet the sentence remains bad: this is because in some sense these are not the same individuals, they are made so only by "accidental" co-indexation. While the accidental co-indexation condition will indeed stop this, it is a complete stipulation once one uses variables and follows from nothing else in a system with variables. (In recent unpublished work, Kennedy (2003) attempts to derive part of Heim's condition from the hypothesis that assignment functions are partial; space precludes discussion of this here.)

That is the theoretical problem. There is an additional empirical problem, discussed in Jacobson (1998). This is that this does not allow for a case of contrasting DPs, as in (10), which is impeccable:

- (10) Every boy that the teacher praised envied every boy/GIRL that the PRINCIPAL did.

To demonstrate this, I need to return to an aspect of Heim's proposal which I oversimplified above - which is that Heim's analysis also requires that quantification is over assignment functions, not individuals. (Indeed, this is the main point of her paper, aptly titled "Predicates or Formulas?") The motivation for this conclusion is as follows. Take the standard view of quantification, where quantifiers are relations between two functions of type  $\langle e, t \rangle$ . Then consider again (4b). If we were to unpack the kind of shorthand notation for LFs used above, the LF for this would be as shown in (11). (Following the sort of notation used in Heim and Kratzer, 1998, think of  $i$  and  $j$  as variables over integers):



Let me stress that the particular syntactic details of the LF don't really matter: the point is that there would be some expression ( $C_{ELL}$ ) which is the meaning of *who MARY did kiss* and which is a function of type  $\langle e, t \rangle$ , and another expression ( $C_{ANT}$ ) which is also of type  $\langle e, t \rangle$  and which is the argument of the generalized quantifier which is raised from (or substituted onto) the object position. And since both of these are of type  $\langle e, t \rangle$  they form an appropriate contrast. Like the Evans' cases, the variable within each of these is bound (it has been  $\lambda$ -abstracted over) and so the difference in variable names should not matter. Thus for any assignment function  $g$ , the alternatives to  $C_{ELL}$  here are alternative properties: its focus value is a set like  $\{\lambda x[\text{Sue kissed } x], \lambda x[\text{Bill kissed } x], \dots\}$ .

Thus it is crucial in Heim's account that the semantic composition doesn't involve any expression of type  $\langle e, t \rangle$ ; this is accomplished by taking quantification to be over assignment functions. For example, let the LF for *Every man walks* to be as in (12), with the semantics of (13):

(12) every  $x$  [man,  $x$ ] [walks,  $x$ ]

(13)  $[[\text{every } x \quad [\Phi] \quad [\Psi]]^g = 1 \text{ iff } \forall g' \text{ just like } g \text{ except possibly for assignment to } x, [[\Phi]](g') \rightarrow [[\Psi]](g')$

Under this view, a DP like *every man* actually has no meaning (since the determiner takes both arguments simultaneously), but this can be easily remedied by Curry'ing its meaning. In that case, the LF for *Every man walks* would be as in (14) and the semantics is given in (15):

(14)  $[_{DP} \text{ every } x \quad [_S \text{ man}, x]] \quad [_S x \text{ walks}]$

(15) Let  $G$  be a variable of type  $\langle g, t \rangle$  (i.e., a set of assignment functions)

Let  $\Phi'$  be the semantic value of  $\Phi$  - hence  $\Phi'$  is of type  $\langle g, t \rangle$

Then: the meaning of  $\text{every}_x \Phi =$

$\lambda G[\lambda g[\forall g' \text{ exactly like } g \text{ except for the value assigned to } x, [\Phi'](g') \rightarrow G(g')]]]$

Notice that with this semantics, a DP of the form *every  $x$  [man,  $x$ ]* does not have the same meaning as *every  $y$  [man,  $y$ ]*. Although it may look like the variables in these are fully bound they are not: these are actually open expressions and are open on different variables. One can easily verify this by considering what happens when each of these combines with a sentence of the form  *$x$  loves  $y$* .

But now given this fact, consider again (10). The only expressions which could count as  $C_{AND}$  and  $C_{ELL}$ , would be the subject and object DPs; indeed our intuition is that these are what is being contrasted. And yet, under this semantics, there are assignment functions  $g$  such that the value of the subject DP under  $g$  is not a member of the focus value of the object under  $g$ . That is  $[[every\ x[student,\ x\ and\ the\ teacher\ praised\ x]]]^{fs}$  is not a member of  $[[every\ y,\ student\ y\ and\ the\ PRINCIPAL\ praised\ y]]^{FOC^g}$ . Again this is because each of these are “open” expressions - and are open on different variables.

#### 4. Copy Identity

Before turning to my account of the facts, let us consider an alternative proposal due to Sauerland (2004) (hereafter, S). S’s proposal does not make crucial use of variable names, but does make use of a variety of devices incompatible with (at least a strong version of) direct compositionality, and thus it too - if correct - would challenge to the general program here. But, I will argue, S’s proposal also has serious problems. The initial observation is that the effect is lessened (according to S, it disappears) if the heads are the same or have roughly the same meaning:

- (16) a. \*John kissed every woman who likes the boy that BILL did.  
 b. ?John kissed every woman who likes the woman that BILL did.  
 c. ?John kissed every woman who likes the one that BILL did.

(Judgments here are my own; S predicts (16b) and (16c) to be perfect.)

To vastly oversimplify S analysis (in ways which hopefully do no harm to the main points), S assumes the following (note that I use the category N wherever S uses the category NP, so keep in mind that by “N” I mean something which can be complex and consist of, for example, a relational noun and its complements). *A. The matching theory of relatives* - according to which a relative pronoun actually consists of a determiner and lexical material of category N, and where the lexical material is deleted under semantic identity with the head. *B. The copy theory of movement* - according to which moved material leaves a copy of the head (the N) portion in the position of the trace. Moreover, the interpretation of the head in the trace position constitutes a restriction on the individual variable in object position. Thus following work by Fox, the interpretation of the trace is as follows:

- (17) Let P be a predicate (i.e., linguistic material of category N). Then  $[[t_x - P]]^g = g(x)$  if  $P(g(x))$  and  $[[t_x - P]]^g$  is undefined otherwise.

These two assumptions combine to predict that lexical material which has the same meaning as the head will be present in the position of the trace, so that in (16a) for example, the object DP will be *every girl who Bill kissed*  $t_{x-girl}$ . The contrast between (16a) and (16b) now follows straightforwardly. Along with Heim, S adopts Rooth’s focus condition and - along with Heim - the analysis pins the problem on the fact that there is nothing which can serve as  $C_{ANT}$  and  $C_{ELL}$ . But here the problem is not because the obvious candidates have different variable names in object position, but rather variables restricted over different domains. Thus in (16a)  $C_{ANT}$  is trying to be *John kissed*  $t_{woman}$ , and  $C_{ELL}$  is trying to be *BILL kissed*  $t_{boy}$  (I ignore here the indices on the traces since they play no role), and the meaning of the first is not a member of the focus value of the second. (Note: here there is no need to adopt the view that quantification is over assignment functions. Take the standard

view, and “move up the tree” to where we have two properties. It will still be the case that the result holds.) In (16b) on the other hand, both  $C_{ANT}$  and  $C_{ELL}$  contain woman-traces in the object position, and so the focus condition is met.

This immediately raises an obvious question: how do we account for the contrast between the (bad) Kennedy cases and the (good) Evans cases? After all, in the Evans cases too we have a copy of the lexical head in the trace position, and so cases like these should be bad if the heads are different. But in fact they do not require head identity - as shown by (1) and by (18):

(18) I like the lake you visited, and I (also) like the RIVER that you did.

S's explanation for this is as follows. In the Kennedy cases, the trace position contains a copy of the lexical head of the *wh* pronoun, which in turn is identical (in meaning) to the lexical material in the head. In the Evans case, the idea is that there is no movement trace in the lower position. Rather, it is a silent *pro* over N type meanings (that is, meanings of type  $\langle e, t \rangle$ , which is a bound variable, bound by the head. (The precedent for this comes from an analysis of Schwarz (1999) of some cases of sloppy identity with deleted VPs Schwarz's account involves allowing VPs in some cases to be pronouns at LF which are interpreted as bound variables, and where the lexical material binding these is raised. Sauerland extends this proposal to the case of nouns: let these also be proforms interpreted as bound variables.) Thus (19) gives a rough rendering of S's proposed LF for *the lake you visited*, though note that (19) is adorned with some extra symbols to help show how the semantic composition works. (20) gives the interpretation of *the x [pro<sub>i</sub>]*:

(19) *the lake you visited* = lakes  $\lambda P_1 \langle e, t \rangle$  [the ( $t_1 \langle e, t \rangle \cap \lambda x$  [you visited the  $x$  [ $pro_1 \langle e, t \rangle$ ]])]

(20) [[the  $x$  [ $pro_1 \langle e, t \rangle$ ]]]<sup>g</sup> =  $\iota a$  [  $g(x) = a$  and  $g(pro_i)(a)$  ] (undefined if  $g(pro_i)(a)$  is false)

Note that in the end the interpretation of the LF in (19) is the same on all assignment functions since  $pro_1$  has been  $\lambda$ -abstracted over. As a consequence, on all  $g$ , [[*LAKE you visited*]] will be a member of the focus value of [[*RIVER you did visit*]]. (One can also set  $C_{ANT}$  and  $C_{ELL}$  as bigger expressions; for example the entire first conjunct is a member of the focus value of the entire second conjunct.) The key difference between this and the Kennedy case is that in the latter, the meaning of the head noun provides a restriction on the variable in object position, and  $C_{ANT}$  and  $C_{ELL}$  will have different restrictions. Here the only thing that restricts this variable is whatever set  $g$  assigns to  $pro_1$ , but if we move high enough up then  $g(pro_1)$  becomes irrelevant because we  $\lambda$ -abstract over  $pro_1$ .

Of course now we must ask: why not the same possibility in the (bad) Kennedy cases? The story - in a nutshell - is that Rooth's focus condition could not be satisfied in the Kennedy cases. Even if we were to raise the lexical content of the N and have it bind a pro-form, there could be no way to get contrasting domains and this in turn is due to the containment property. In the (good) Evans cases, on the other hand, each of the pro-Ns can be bound separately, and since the domains are distinct, the domains consisting of the binder (the lexical head) and the bindee can be in contrast. I refer the reader to S's actual paper for more detail.

But this proposal has some very suspicious aspects to it. First, it is a pure stipulation that “pro” itself has no lexical content identical to the head (or at least none which plays a role in the semantic interpretation). Notice that the account requires not only that traces have lexical content (which, one might argue, is simply

there as a remnant from movement), but that certain kinds of *overt pronouns* also do. In particular, the entire story told above crucially assumes that relative pronouns have lexical content: this is necessary because they need to leave copies of this in the trace position. So why should overt pronouns have lexical content but not the silent N-pro? Secondly, part of the “independent motivation” for the copy theory of movement - which is crucial to the above story - is the supposed fact that the head exhibits certain connectivity effects with the position of the trace. But once we allow heads to raise and bind N-pros, this explanation disappears (S does have discussion relevant to this point, to which I return momentarily). Since the connectivity effects with respect to relative clause heads are sometimes claimed to be a bit more complex, let me clarify with a question *wh*-movement case.

So, consider the folk (wisdom that (21) is bad (I use \* here as a report of the received judgments; I think that these merely require the right discourse conditions):

- (21) a. \*Which argument that John was wrong did he finally accept?  
b. \*Which uncle of John’s did he invite?

But what would stop (22) as a representation for (21b), where we have just a *pro* in the gap position?

- (22) uncle of John’s  $\lambda P_{1 \langle e, t \rangle}$  [which  $t_{1 \langle e, t \rangle}$  [ $\lambda x$  [he invite the  $x_{[pro-1 \langle e, t \rangle]}$ ]]]

One might entertain the following answer: perhaps raising of the head is possible only when the head is focussed. While plausible, this is of no help, as the effects persist with focus. (Thus the \* in (23) means that these are no worse than (21)):

- (23) a. \*I know which good argument that John was wrong he finally accepted, and I know which BAD argument that John was wrong he didn’t.  
b. \*I know which UNCLE of John’s he invited, and I know which AUNT of John’s he didn’t.

Note that (23) contrasts with (24):

- (24) I know which UNCLE of John’s Mary invited, and I know which AUNT of John’s she didn’t.

In fact, S already notes a related problem (centering on the interaction of Principle B and Schwarz’s analysis of VP-pro) and, following Schwarz suggests that VP “pro” actually behaves *syntactically* like a full copy of its binder. Hence, S points out to me that one can say the same about the N-pro here. But note that it is absolutely crucial to the entire story above that this pro not behave *semantically* like the a full copy of its binder. So it must be in the position of the gap for the purposes of syntactic constraints and yet the semantics must somehow know to “ignore” this material in computing the semantic composition. How this would actually work is unclear to me. The proposal is framed within a theory in which syntactic representations (of LFs) are constructed and “sent” to the semantics for model-theoretic interpretation; I do not know how the semantics can be smart enough to ignore the interpretation of certain material which is there in the syntax.

Moreover, this idea helps with the account of Principle C violations above only if we believe that Principle C is stated in purely syntactic terms. (It would thus have to be just a constraint on co-indexation.) And yet it is well-known that it cannot be stated this way: a constraint on co-indexation is not enough to block Principle C violations in which the offending pronoun is free and happens to pick

out the same referent as a full NP or name which it c-commands. One kind of solution would be to remove it from the grammar altogether and hope (with Kuno many others) that it is really a constraint on information packaging in discourse. But then there is no reason to believe that sentences like (23) give any evidence for copy movement, and so there becomes no independent motivation for one of the key pieces of the “copy identity” analysis of Kennedy’s facts. A second kind of solution is to take roughly the sort of view proposed originally in Reinhart (1983) - where the free reading of a pronoun in which it is “accidentally” coreferential with a c-commanded name is blocked in virtue of the fact that there is another representation/interpretation pair which gives the same reading. But in that case, the ultimate statement of the constraint which would block (23) is going to have to look at the interpretation of the LF with a copy of the head in the pro position, and so it is untenable to posit material which is there “in the syntax” and not “in the semantics”. (Notice that since Schwarz’s analysis of VP pro has similar problems it is subject to the same remarks.) The upshot of this is that it seems that the copy identity solution is unlikely to be correct.

### 5. Towards a solution: the necessary ingredients

The claim I would like to make here is that Heim’s basic insight is correct, but it should be translated into direct model-theoretic terms without the intermediate use of indices and without the concomitant conventions on the reuse of indices. Thus I agree with two main aspects of her analysis. One is that the key difference between the (good) Evans cases and the (bad) Kennedy cases lies in the ability to construct contrasting domains for the purposes of Rooth’s focus condition. (S’s analysis also shares this property.) Second, with Heim I agree that the good vs. bad cases of ACD have to do with the “open-ness” of the object position: the bad cases are in some sense “about” different individuals while the good cases are about the same individual. We will now attempt to reconstruct this intuition in variable-free terms.

First, let me clarify a point about ellipsis in general. I have been using the terminology of a deletion account where the “missing” material is actually linguistically present. An alternative is that the missing material is just like a “free variable” over VP meanings (and so - in terms of a variable-free semantics - this means that a constituent containing a VP ellipsis site has as its meaning a function from VP type meanings to propositions; see Jacobson, 2003 for full details). What is picked up, then, is a contextually salient meaning. I actually believe that this is the right way to think about it, but because this would complicate the exposition I will continue to use the terminology of the first way. Second, I embed the explanation in a Categorical Grammar syntax. We thus now turn to the ingredients.

*1. The Focus condition* First, we need to recast Rooth’s focus condition in direct compositional terms. I will actually not fully do this here, but let us begin with the following “semi-direct compositional” formulation, which has certain aspects in common with the formulation in Merchant (2000) (although phrased rather differently):

- (25) Let  $\alpha$  be an expression of the form  $\langle [\alpha], VP, [[\alpha]] \rangle$ . Then there is an expression  $\beta$  of the form  $\langle [\emptyset], VP, [[\alpha]] \rangle$ , > provided that:
- (1)  $[[\alpha]]$  is given in the context (= “identity condition”), and
  - (2)  $\alpha$  is contained within some larger expression (call it  $C_{ELL}$ ) such that there is another expression  $C_{ANT}$  whose meaning is or makes contextually salient a member of  $[[C_{ELL}]]^{FOC}$

Notice that (25) replaces Rooth's condition to the effect that  $C_{ANT}$  must mean *or imply (possibly pragmatically)* a member of  $[[C]]^{FOC}$  with the weaker condition that  $C_{ANT}$  must mean *or make contextually salient* a member of  $[[C]]^{FOC}$ . Because this modification will play a crucial role, it is imperative that the notion of "make contextually salient" ultimately be fleshed out better than is done here; I leave this as a large promissory note.

As mentioned above, (25) is not actually compatible with direct compositionality - in fact it is still quite uncompositional. In the first place, it is not a local property of some expression that its meaning is given in the context. In the second place, the focus condition requires us to look at the meaning of a larger expression which contains the "deleted" VP. However, these problems are actually artefacts of the some space-saving oversimplifications being adopted here and can be solved. For discussion, see Jacobson (2003a, 2003b).

2. *ACD as TVP Ellipsis.* The next crucial ingredient is the analysis of ACD as transitive verb phrase (TVP) ellipsis (Cormack, 1984, Evans, 1988, Jacobson, 1992). Thus first consider the semantic composition of an ordinary relative clause:

(26) John read every book that Mary will read.

In the "standard" view of the semantic composition, there is a variable in the semantics as object of *read* (and a trace in the syntax), and this is ultimately  $\lambda$ -abstracted over so that *that Mary will read* has a meaning of type  $\langle e, t \rangle$ . But there are a variety of approaches within Categorical Grammar and related theories in which there is no need to posit a variable here. Take, for example, the approach in Steedman (1989): here the meaning of *read* simply function composes with the meaning of *will* and the result in turn function composes with the (type-lifted) meaning of *Mary*. *Mary will read* thus denotes the property  $\lambda x[\text{read}'(x)(m)]$ . The ACD-as-TVP ellipsis analysis posits that the semantic composition of (27) is essentially the same:

(27) John read every book that Mary will.

That is, the missing or "deleted" material is only *read* (not *read x*) - we thus have just a "missing" meaning of type  $\langle e, \langle e, t \rangle \rangle$  rather than a missing VP-type meaning.

The same remarks hold for the cases in (1) - and indeed for any case in which the standard account posits that the deleted VP contains only a variable in object position. Again given the kinds of tools available in Categorical grammar (and related theories) in general and in a variable-free semantics in particular, all of these can be analysis as the ellipsis of just an expression whose meaning is of type  $\langle e, \langle e, t \rangle \rangle$ . See Evans (1988) and Jacobson (1992) for details. Incidentally, one might worry about the fact that in the standard view - where the missing material is *read x* - the existence of ACD and of Evans cases follows immediately from the existence of VP Ellipsis (once one discards Sag's unpleasant condition). After all, all of these cases are ordinary VP Ellipsis. It is thus reasonable to ask whether the same is true under the ACD as TVP Ellipsis analysis - do we get the TVP ellipsis cases for free? Fortunately, the answer is yes, see Jacobson (2003a).

3. *Focus in a variable-free semantics.* We now come to the key ingredient of the analysis, which centers on the interpretation of focus in a variable-free semantics. I am adopting Rooth's (1984) alternative semantics, but the following question arises: how does the computation of alternatives interact with the interpretation of pronouns? In other words, consider (28):

(28) Every man<sub>i</sub> said that he<sub>i</sub> RAN.

Under the system advocated in Jacobson (1999), *he RAN* is of category  $S^{NP}$ , and its ordinary meaning (leaving aside the semantic contribution made by the gender of the pronoun) is  $\lambda x [ [ran](x) ]$  (which is just  $[ran]$ ). But what is its focus value? There are two obvious possibilities. One is that it is a set of alternative functions from individuals to propositions, thus a set like:  $\{ \lambda x [x \text{ walked}], \lambda x [x \text{ danced}], \lambda x [x \text{ jumped}], \dots \}$ . But a second possibility is that its focus value is actually a function from individuals to a set of alternative propositions (about that individual): thus its focus value is  $\lambda x [ \{x \text{ walked}, x \text{ danced}, x \text{ jumped} \} ]$ . The key to my account of the Kennedy facts is the hypothesis that the second is correct - when we have an unbound pronoun within some constituent with focus somewhere, the focus value of that constituent is a function from individuals to a set of alternatives.

Some independent motivation for this view is provided by the interpretation of focussed pronouns themselves (and of material containing focussed pronouns). Take the plain focussed pronoun *HE*. Under the variable-free system adopted here, its ordinary value is the identity function on individuals - each individual is mapped to itself. Again we can ask: what is its focus value? Is it alternative functions of type  $\langle e, e \rangle$  - or is it a function from individuals to a set of alternative individuals? My own intuition is that the second answer is the natural one.

But, intuitions aside, one can probe this further by considering what happens when we embed a stressed pronoun in further material. Before continuing, let me point out that Jacobson (2000a) notes that there are actually two kinds of cases where a pronoun can be stressed. One is discussed originally in Sauerland (1998) and where one pronoun is (informally speaking) contrasted with another:

(29) Every third grade boy<sub>i</sub> loves his<sub>i</sub> mother and every FOURTH grade boy<sub>j</sub> loves HIS<sub>j</sub> mother.

Cases of this type are quite interesting, but will not figure into the discussion here. Note, though, that a pronoun can also receive contrastive stress when - informally speaking - is being contrasted with some other individual:

(30) Every third grade boy voted for Bill's mother, but every FOURTH grade boy<sub>i</sub> voted for HIS<sub>i</sub> mother <his - as opposed to Bill's>

In fact, I noted in Jacobson (2002) that with reflexives there is actually a difference in terms of which morpheme is stressed:

(31) a. Every third grade boy<sub>i</sub> voted for himself<sub>i</sub>, and every FOURTH grade boy<sub>j</sub> voted for HIMself<sub>j</sub>/\*himSELF<sub>i</sub>.  
b. Every third grade boy voted for Bill, and every FOURTH grade boy<sub>j</sub> voted for himSELF<sub>i</sub>/\*HIMself<sub>j</sub>.

The point of revisiting these facts here is that they make it fairly clear that the focus value of *HE* or of *himSELF* is not an alternative set of functions of type  $\langle e, e \rangle$  but rather a function from individuals to alternative individuals. Thus the focus value of *HE* is  $\lambda x [ \{Bill, Tom, Mary, \dots\} ]$ . If we generalize from the case where the pronoun itself is focussed to the case in (28) - where there is an unbound pronoun and something else is in focus - we arrive at the conclusion above:  $[[he RAN]]^{FOC}$  is a function mapping each individual to a set of alternative proposition.

The key intuition here is that the semantic effect of a pronoun which is "unbound" within some expression C is for it to have widest scope - including over

the focus value. (This is analogous to what one would say in the standard view - where the assignment function is always given “widest scope”.)

There is a second crucial point to note: the “widest scope” property is *not* true of argument slots in general. To clarify, consider the ordinary value of *RAN*. Its ordinary semantic value is exactly the same as the ordinary value of *he RAN*. Their syntactic categories are different (not surprisingly, since they have different syntactic distributions): the former is of category  $S/_R NP$  which simply means that it is something expecting to combine in the syntax with an NP (to its right), and the latter is of category  $S^{NP}$  which means that it is not expecting to combine with an NP, but rather that it contains an (unbound) pronoun within it. Both have meanings of type  $\langle e, t \rangle$ , and - ignoring the gender contribution in *he* - both just denote the set of runners. But I claim that the two have different focus values.  $[[RAN]]^{FOC}$  is in fact a set of alternatives of type  $\langle e, t \rangle$ , while  $[[he RAN]]^{FOC}$  is a function from individuals to a set of alternatives. Of course this raises an important question: just how does the computation of alternatives work so as to actually get this result? Part of the answer to this question will have to be left for future research, although the beginnings of the answer is sketched below in the appendix.

4. *Relative clause gaps (in a Categorical Grammar)*. Consider (32):

(32) every boy who) Mary kissed

Within the work in Categorical Grammar - and in related theories such as Generalized Phrase Structure Grammar (GPSG) and Head Driven Phrase Structure Grammar (HPSG) - there are two broad classes of ways to think about the syntax of a relative clause which contains a “gap”. In one view (see especially Steedman, 1987) *Mary kissed* is just an ordinary  $S/_R NP$ . That is, it is simply something expecting to find in the syntax an NP on its right, and relative pronouns subcategorize for such creatures. But others (e.g., Oehrle, 1990) have argued that gaps are actually encoded in the syntax with a special feature (see also the work in GPSG and HPSG all of which takes essentially this view. (Note that given the general variable-free program this means that gaps and pronouns are similar.) Incidentally, the information that there is an (unbound) “gap” within something would pass up only until we reach the point where the rule system is such that this material is explicitly “asked for” (we can thus call it “bound” at this point). What this means is that *boy (who) Mary kissed* is presumably just of category N (recall that N can be lexical or complex).

My analysis crucially relies on the premise that the second view above is correct: gaps within relative clauses are simply not the same as ordinary argument slots which expect to be filled in the syntax. But indeed there is considerable independent motivation for this view; see for example Oehrle (1990) and Jacobson (1999, fn. 19). We will notate an S with a gap in it as  $S \setminus NP$ . With this in mind, take the focus value of  $[[MARY kissed]]$  in an expression like *the boy who MARY kissed*. Just as in the case of pronouns, the semantic contribution of a “gap” has widest scope - and so the focus value here is not a set of alternative properties (i.e., it is not something like the set: {being kissed by Sue, being kissed by John, ...}. Rather, it is a function from individuals to alternative propositions about that individual - thus the focus value is  $\lambda x[\{Sue kiss x, John kiss x, \dots\}]$ . To complete the picture, we need to say something about the focus value of a bigger expression like *who Mary kissed*. As discussed in Jacobson (1998) there is good reason to treat relative pronouns as ordinary pronouns (as this allows for a simple, direct compositional account of the semantics of Pied-Piping). There are a number of ways to work out the full syntactic details of this pronoun and the full details of how this combines with an  $S \setminus NP$  like *Mary kissed*, and space precludes a discussion of

this here. Suffice it to say that under almost any reasonable way to look at this, the focus value of *who Mary kissed* will also be a function from individuals to alternative propositions. But, as noted above, the “gap” (and/or pronoun position) is presumably closed off in a fuller expression like *boy (who) MARY kissed* - so here the focus value will be a set of alternative sets.

Call an expression with a gap or a pronoun within it (which is unbound within that expression) one which is syntactically open. This includes expressions of category  $S^{NP}$  or  $S/NP$ . These denote functions from (in this case) individuals to (in this case) propositions. So does an expression of the form  $S/NP$  - that is, an ordinary VP. But the essential claim here is that the former - the syntactically “open” expressions - have focus values which are functions from individuals to sets of alternatives, while the syntactically “closed” expressions (e.g., a run of the mill VP) - has as its focus value just a set of alternatives of the same type.

Since the remarks above may strike a reader as rather theory-internal, let me try to clarify what is at stake. I am not interested in stipulating that any expression whose syntactic category is  $S^{NP}$  or  $S/NP$  (that is, any expression with an unbound pronoun or gap within it) will have as its focus value a function from individuals to sets of alternatives. The hope is that the combinatory rules - which allow expressions of these categories to combine with others and which at the same time combine both ordinary semantic values and focus values - can be stated in a way that this result naturally follows. (Again, see the appendix for a first pass at this.) Thus an anonymous SALT reviewer objected that under the analysis here, the kind of focus value that an expression will have is not predictable from the type of its ordinary semantic value. This is correct - but there is no reason why it should be. Focus values are derived from the combinatory rules (or ‘principles’), and this is where the action will have to be.

5. *Rooth's focus condition for open expressions.* To complete the analysis, we need to decide one more thing: what is the requirement for satisfying Rooth's focus condition when  $C_{ELL}$  is a syntactically open expression - and thus its focus value is not a simple set of alternatives but rather a function from individuals to sets? It seems reasonable to assume that in this case we need a larger expression  $C_{ELL}$  whose meaning is a function  $f$  from individuals to sets of alternatives, and an expression  $C_{ANT}$  whose meaning is such that for every relevant individual  $x$ , the meaning of  $C_{ANT}$  is or makes salient some member of  $f(x)$ . Notice that I am confining the requirement to the set of “relevant” individuals - and hence another promissory note is that this can ultimately be defined better than it is here, and given independent motivation. But the intuition is, I believe, fairly straightforward: the idea is that the focus value of *(who) MARY did kissed* is a function from individuals to alternative propositions about who kissed those individuals, and so if this is taken as  $C_{ELL}$ , the only relevant individuals to consider are those who were indeed kissed by Mary.

This final piece is the only piece for which I cannot cite independent motivation, and whether or not it is plausible ultimately depends on a better understanding of the focus condition in the first place. Surely (25) (or Rooth's version, or any other version) should follow from something else and should not simply be stipulated in the grammar, but until we know just what this “something else” is it is hard to know whether the extension of the focus condition proposed above is the right one for the case of “open” expressions. But the rest of the ingredients here are all independently motivated within the general program assumed here. For readers not familiar with this program it might seem like a lot of apparatus, so let me therefore try to restate a few of the points in more informal and more general terms. Fundamental to the entire discussion is the assumption that variable-free semantics is correct - and that expressions containing pronouns unbound within them are not functions from assignment functions to something

else but rather from individuals to something else. Once one is willing to buy into this, it seems not difficult to imagine that the focus value of an expression containing a pronoun is a function from individuals to sets of alternatives. Perhaps the most theory-internal part of the analysis will seem to be the apparatus developed in (4) which concerns the difference between syntactically open and syntactically closed expressions. But all this asks the reader to believe is that ordinary VPs (for example) which combine in the syntax with NPs have a different focus value from material with an unbound pronoun within it, and that this hopefully will fall out easily from the way the combinatory principles work.

## 6. Accounting for the Cases

We can now put this all together, and account for all of the cases considered above. We begin with a classic Kennedy violation, as in (4b) *\*John kissed every girl who knew a boy who MARY did kiss*. As in Heim's analysis, we begin by trying to take  $C_{ELL}$  as *(who) MARY did kiss*. Whether or not we include *who* in the expression, the focus value is a function from individuals to alternative propositions about that individual. Thus to satisfy the focus condition as amended in (5) above, it needs to be the case that there is an expression  $C_{ANT}$  such that for relevant individual - that is, for every individual that Mary kissed - the meaning of  $C_{ANT}$  makes salient some proposition about someone (else) kissing those individuals. But without further contextual support, this is not met. (Indeed with additional support this can be met and I return to this below.) Notice that the fact that the sentence is about who John kissed is of no help, since for each individual that Mary kissed there is nothing relevant about whether or not John kissed that individual. Note too that moving to a larger expression (that is, to one which is "syntactically closed") is of no help. Take, for example, *the boy who MARY did kiss*. This is "closed" - and we assume that the combinatorics is such that its focus value is just a set of alternative individuals {the boy who John kissed, the boy who Sue kissed, ...}. But there is no  $C_{ANT}$  whose meaning is or makes one of these individuals salient.

But wait - one should be saying - what allows for a good run-of-the-mill ACD case like (4a) *John kissed every girl who BILL did kiss*? Have we not just ruled out ACD in general? The key here centers on the fact that quantifiers denote relations between sets. Because of this  $C_{ANT}$  can be the entire matrix sentence. Again, let  $C_{ELL}$  be *(who) BILL did kiss*. The focus value is a function from individuals (and the relevant ones are just those that Bill did kiss) to alternatives about those individuals. Is there any  $C_{ANT}$  such that for each such individual, the meaning of  $C_{ANT}$  makes salient something about someone else kissing that individual? Indeed there is - the matrix does just this. And in fact because quantifiers denote relations among sets, this will be true regardless of what quantifier we find heading the object (One might think that a sentence like *John kissed no girl that BILL did kiss* would be a problem. But note that for each x that Bill kissed, we learn that John didn't kiss x. That this "counts" as a valid alternative to Bill's kissing x can be demonstrated by the fact that ellipsis is possible in *John didn't kiss Mary, but BILL did*.)

Thus I am claiming that Heim's basic idea is correct: normal ACD is good because in some sense the matrix and the relative clause are "about" the same individuals while this is not true of the Kennedy cases. But rather than attempting to track those individuals by use of the intermediary of variable names - which requires (among other problems) the No Meaningless Coindexation constraint - the strategy here is to track this in direct model-theoretic terms.

What about the contrast between Kennedy cases and Evans cases? Here I claim that Heim's story is exactly right, and carries over directly to the account here.

Consider (1) *Bagels I like. DONUTS, I also do.* Here the contrasting domains are the whole sentences. Notice that the interior portion of the second sentence (*I also do like*) has as its focus value a function from individuals to alternative propositions (in this case, the only proper alternative is the proposition that I do like that individual). But the “openness” of this focus value does not matter, for we can find a closed expression - *DONUTS, I also do* - whose focus value is just a set of alternative propositions {I like bagels, I like muffins, I like croissants, ...}.

But now take the case of contrasting DPs, as in (10) *Every girl that the teacher praised envied every girl/BOY that the PRINCIPAL did.* Recall that the problem for Heim’s analysis is that these are both “open” - and are “open” on different variables. In other words, there are assignment functions  $g$  such that the value of *every girl that the teacher praised* on  $g$  is not a member of the focus value of *every girl/BOY that the PRINCIPAL did praise* on  $g$ . But under the analysis here, these present no problem - the subject and object DPs can be in contrast exactly as we would expect should be the case. Thus the focus value of *every girl that the PRINCIPAL did praise* is a set of alternative generalized quantifiers: {every girl that the teacher praised, every girl that the scout leader praised, ...}. (Notice that if the heads are in contrast the story is the same - here the set of alternatives are those that vary both on the praisers and on the value of the head.)  $C_{ANT}$  is the subject, whose meaning is a member of this focus value.

Since my analysis is meant as a reconstruction of Heim’s analysis, why the difference? The difference has to do with the way the combinatorics works here - we have hypothesized that “fancy” focus values (functions from individuals to alternatives) arise only when we have expressions with pronouns and gaps within them. These are expressions which do not combine in the syntax with others in the “normal” way, and the combinatory rules combining them will also have the effect of yielding these fancy focus values. But generalized quantifiers are syntactically closed. Their ordinary semantic value is of type  $\langle\langle e, t \rangle, t \rangle$ , but their focus value is not a function from properties to alternative propositions about those properties. Rather, it is just a set of alternative functions of type  $\langle\langle e, t \rangle, t \rangle$ . The basic intuition here to keep in mind is that only pronouns and gaps contribute an argument position which has widest scope over the focus value.

Finally, let us turn to the “Sauerland effect” - the fact that Kennedy cases improve if the heads are identical. Thus consider (33):

(33) ?John visited every town which was near the town/the one that BILL did.

My tentative explanation for the improvement here is that in this case  $C_{ELL}$  is the larger expression *the town that Bill did visit* (or perhaps *town that BILL did visit*) where  $C_{ANT}$  is the entire S. To develop the explanation, let me oversimplify a bit and ignore the presupposition contributed by *the*, combined with the singular morphology in the object. That said, the focus value of *town that BILL did visit* is a set of alternatives {the town(s) that John visited; the town(s) that Mary visited, ...}. But now note that the entire matrix gives information about town(s) that John visited, and hence makes salient a member of the focus value of *the town that BILL did visit*.

Indeed, I believe that this corresponds with our intuition that the contrast is in fact between John’s towns and Bill’s towns. As such, these are best when the discourse context also supports conjuring up such a contrast. For example, these are happy in a context where it is assumed that each person did visit at least one town, and so it is easy to set up this kind of contrast. For this reason (34b) - which does not automatically lend itself to such a context - is worse than (34a) - which supports a context in which it is assumed that each person did some town-visiting:

- (34) a. ?John visited every town which was near the town/one of the towns that BILL did (**visit**)  
 b. ??John visited every town which was near a town that BILL did (**visit**).

As further support for this general line, consider a DP like *a/the river that DONALD TRUMP kayaks on*. One can imagine two different reasons for stress on *Donald Trump*. The first is what I will call the “wow, Donald Trump!” reading - of interest the opposition of Donald Trump to us ordinary mortals. The second reason would involve a scenario in which Donald Trump is a member of our kayaking club, and we know that each member of the club routinely kayaks on one river. In this case the contrastive stress differentiates rivers. Notice that we find a subtle but, I believe, real contrast with ellipsis in these two scenarios. (35) is set up to favor the “wow, Donald Trump!” reading. Because there is no background assumption that everyone kayaks on some river it is harder to interpret the entire object as C<sub>ELL</sub> and thus harder to take the information provided by the antecedent as a salient alternative. But (36) supports the reading where Bill’s river is a salient alternative to Donald Trump’s river:

- (35) ???Every day, Bill kayaks on a river that just happens to be right next a river/one that (wow! - of all people) DONALD TRUMP does.  
 (36) ?Bill (always) kayaks on a river that is right next to the river/the one that DONALD TRUMP does.

In other words, the extent to which we find the Sauerland amelioration depends on the extent to which we can stack the deck to get the entire object to be the domain for which we are looking for a relevant contrast (and the extent to which the subject matter of the matrix supplies this contrast). But in that case, one would expect that these should always be possible - even if the heads are different. In other words, we ought to be able to always ameliorate Kennedy’s effect with appropriate discourse conditions and appropriate contrast domains. And indeed, this is exactly what we find. Take, for example, a context in which last summer, each person in the kayak club kayaked on at least one lake and at least one river. Then in that context, (37) is fine

- (37) John kayaked on a lake that was in the same state as the RIVER that MARY did. (even better with stress on *John*)

Or, in a context in which each teacher nominated one girl and one boy for the awards ceremony; here (38) is quite good:

- (38) Mary nominated a girl who dates the BOY that BILL did. (even better with stress on *Mary*).

The conclusion, then, is that the Kennedy effect is actually highly discourse dependent; exactly as one would expect under a story were we are looking for “salient” alternatives.

## 7. Appendix

Here I lay out in preliminary fashion combinatorics for focus using the variable-free apparatus in Jacobson (1999), showing how an expression with focus such as *RAN* can combine with a pronoun (or an expression containing a pronoun) to give the desired result. We begin with the observation that *ran* is of category S/NP. It

gets to combine with a pronoun (or with something containing a pronoun) by undergoing the “Geach” rule; which maps it into a function of type  $\langle\langle e, e \rangle, \langle e, t \rangle\rangle$ . What we need to do is to fold focus into this picture.

Following Rooth (1984) assume that all expressions have both an ordinary value and a focus value (where an expression with no “focussed” constituent within it has as its focus value just its ordinary meaning). Thus for any expression  $\alpha$ , let  $[[[\alpha]]]$  be the pair  $\langle [[[\alpha]]], [[[\alpha]]]^{FOC} \rangle$ . Then the “Geach” rule (which allows an expression to shift into something which can take a pronoun in argument position) can be reformulated as follows:

- (39) For any expression  $\alpha$  which is a triple of the form  $\langle [\alpha], A/B, [[[\alpha]]] \rangle$  there is a corresponding expression  $\beta$  of the form  $\langle [\alpha], A^C/B^C, [[[\beta]]] \rangle$ , where  $[[[\beta]]]$  is the pair:  
 $\langle \lambda f_{\langle c, b \rangle} [\lambda x_c [ [[[\alpha]]](f(x)) ]], \lambda f_{\langle c, b \rangle} [\lambda x_c \{ \{ Z \mid \exists Y [ Y \varepsilon [[[\alpha]]]^{FOC} \text{ and } Z = Y(f(x)) \} \} ] ] \rangle$

(So, note that the first member of this pair is  $[[[\beta]]]$  and the second member is  $[[[\beta]]]^{FOC}$ . This will give the desired result.

## Endnotes

\* I'm dedicating this paper to the memory of Frederic Evans, who died of AIDS almost exactly 10 years ago (from the presentation date of this paper). Frederic's direct contribution to this domain is obvious in the above (I think that the importance of the “Evans examples” is huge) but there's also an indirect contribution: he was Chris Kennedy's first syntax professor in graduate school (at Yale). I would like to thank Chris Barker and Uli Sauerland for helpful discussion on this paper.

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