11 E-Type Anaphora

We have distinguished referential from bound-variable pronouns and have discussed the relevance of the distinction for the semantics of ellipsis and the interpretation of syntactic Binding Theory. We have argued, in particular, that "anaphoric" relations in the descriptive sense of the term are a mixed bag, and that some cases involve variable binding whereas others involve co-reference. In this chapter, we will show that there are even further kinds of anaphoric relations to be distinguished, and additional interpretations for pronouns as well.

We will begin with a review of predictions from the current theory, specifically its predictions about the distribution of pronouns which are anaphorically related to quantificational antecedents. We will find that the syntactic assumptions that gave rise to these predictions hold up well under scrutiny. Yet, they seem at first to exclude a whole bunch of perfectly grammatical examples. This problem will lead us to reexamine some assumptions: Is it possible, after all, to assign a referential interpretation to a pronoun whose antecedent is a quantifier? What does "antecedent" mean in this case? In the end, we will find conclusive evidence that some pronouns are neither referential nor bound variables. They have a third kind of interpretation, as so-called E-Type pronouns. We will spell out one concrete analysis of E-Type pronouns, on which they are definite descriptions with complex silent predicates, and will briefly mention applications to some famous examples.

11.1 Review of some predictions

QR is subject to some locality constraints. For instance, it is not grammatical to QR the "no" DP in the relative clause of (1) all the way to the matrix S.

(1) Every problem that no man could solve was contributed by Mary.

Such constraints on QR entail constraints on the distribution of bound-variable pronouns. If the predicate abstract created in the movement of **no man** cannot extend beyond the relative clause, then the binder index that heads this abstract

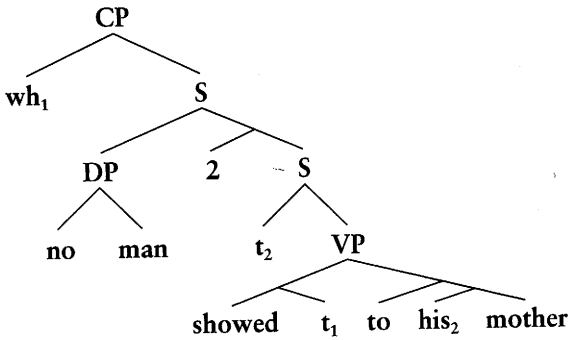
cannot bind pronouns outside the relative clause. In this particular example, there aren't any pronouns around in the first place. But look at (2) and (3).

(2) Every problem that no man showed to *his* mother was easy.

(3) Every problem that no man could solve kept *him* busy all day.

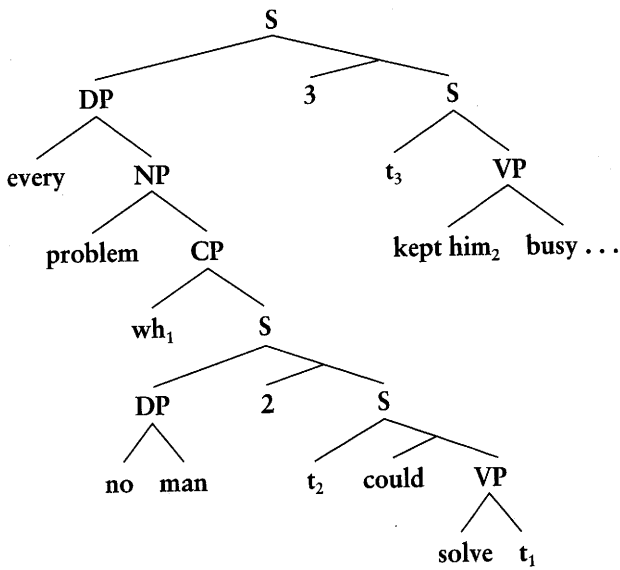
For the **his** in (2), an anaphoric reading where its antecedent is **no man** is entirely natural. This is predicted, since we can generate an LF in which the relative clause looks as follows:

(4)



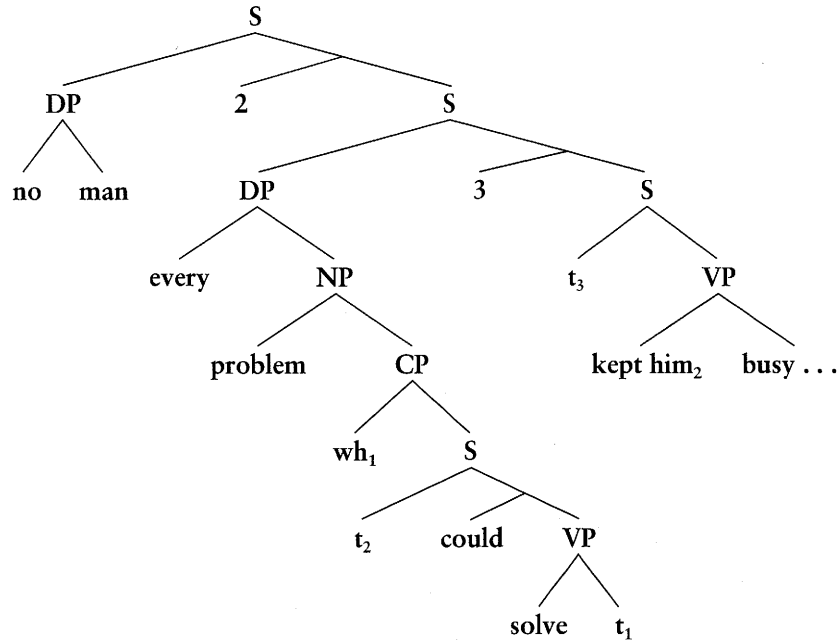
(3), on the other hand, is strange – unless, of course, we imagine a context in which the reference for **him** is somehow fixed independently of the information contributed by this sentence. This, too, is predicted. If we QR **no man** *within* the relative clause, the pronoun remains free (even if it happens to bear the same index):

(5)



This LF requires a context that assigns a referent to the index 2. If we wanted to get the pronoun bound, we would have to QR **no man** to the matrix S:

(6)*



(6) would mean that there is no man who was kept busy all day by every problem he could solve. No such reading is available for (3), and the prohibition against QR out of relative clauses correctly predicts this.

The binding of the pronoun in (6) would probably be ruled out even if the long-distance application of QR to **no man** were legitimate. The reason is that the trace of **no man** fails to c-command **him**, so the co-indexing in (6) also violates (at least some versions of) the Weak Crossover prohibition (for instance, our Binding Principle from chapter 10). LFs like (6) are thus ruled out redundantly. Still, we have independent evidence – namely, from judgments about the truth-conditions of sentences like (1) (where pronoun binding does not play a role at all!) – that one of the reasons why (6) is ruled out is a constraint on QR. (6) would be impossible even if Weak Crossover did not apply here.

Let us look at a couple more structures in which the scope of a quantifier phrase cannot be wide enough to allow the binding of a certain pronoun. (These cases, too, are redundantly excluded by Weak Crossover.)

The simplest case of this kind arises when the pronoun isn't even in the same sentence as the quantifier. The highest adjunction site that we could possibly choose when we QR a DP is the root node for the whole sentence. It follows from this that bound-variable anaphora is a sentence-internal relation. Indeed, it is impossible to construe **no boy** as the antecedent of **he** in the text in (7).

(7) No boy was invited. He complained.

A similar situation arises in coordinate structures. There is some evidence that QR obeys the Coordinate Structure Constraint,[1] so that a quantifying DP in one conjunct of **and**, for instance, cannot take scope over the whole conjunction. This implies that it is also impossible for **no boy** to bind the **he** in the following variant of (7).

(8) No boy was invited and he complained.

Compare (7) with (9).

(9) John was invited. He complained.

(7) doesn't have an anaphoric reading where **no boy** is the antecedent of **he**, but (9) is easily read with **he** anaphoric to **John**. This contrast is not mysterious from our present point of view. Due to the sentence-internal nature of QR, neither example permits a bound-variable construal for **he**. Hence both examples can only be read with **he** as a referring pronoun. In (9), **he** may refer to the same individual as **John**, in which case the two DPs co-refer. In (7), **he** cannot co-refer with **no boy** for the simple reason that **no boy** doesn't refer.

So far, so good. But as we look at a wider range of examples, this simple picture will come to look insufficient.

11.2 Referential pronouns with quantifier antecedents

Consider a variant of an example from Evans:[2]

(1) Only one congressman admires Kennedy. He is very junior.

Only one congressman is not a referring DP. If we wanted to treat it as referring to an individual, we would run into many of the familiar paradoxes afflicting such treatments (see chapter 6). Therefore, **only one congressman** and **he** could not possibly co-refer. Nor should it be possible for **he** to be a bound variable co-indexed with the QR trace of **only one congressman**. Since the two are in separate sentences, there is no possible landing site for the quantifier phrase that would be high enough to c-command the pronoun. Yet our intuitions tell us that **he** can be read as anaphorically related to the antecedent **only one congressman**. How can this be, if neither co-reference nor variable binding are possible?

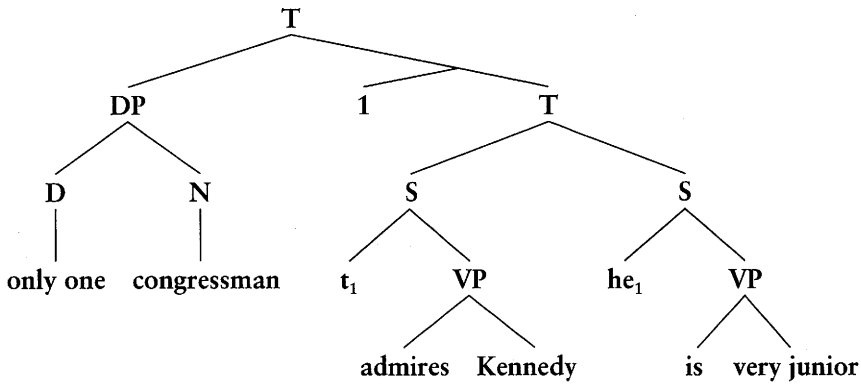
The first response to this dilemma that comes to mind is that QR is perhaps less constrained than we have thought, after all. Perhaps the constraints that we reviewed above for DPs with the determiner **no** do not pertain to DPs in general. Could it be that some DPs, among them **only one congressman**, *are* able to take scope over whole multisentential texts?

We could implement this possibility by introducing a constituent T (for "text") that dominates all the Ss in a text. A suitable semantic rule for such T constituents is easy to state:

(2) If $\phi^1, \ldots, \phi^n$ are Ss, and ψ is $[_T\ \phi^1, \ldots, \phi^n]$,
then $[\![\psi]\!] = 1$ iff for all i such that $1 \leq i \leq n$, $[\![\phi^i]\!] = 1$.

In other words, a text is interpreted as the conjunction of all its sentences. In (1), we could now apply QR in such a way that it adjoins **only one congressman** to T. And if Weak Crossover for some reason didn't apply here either, we could also co-index this DP with the pronoun **he**. The result would be an LF with the pronoun bound:

(3)



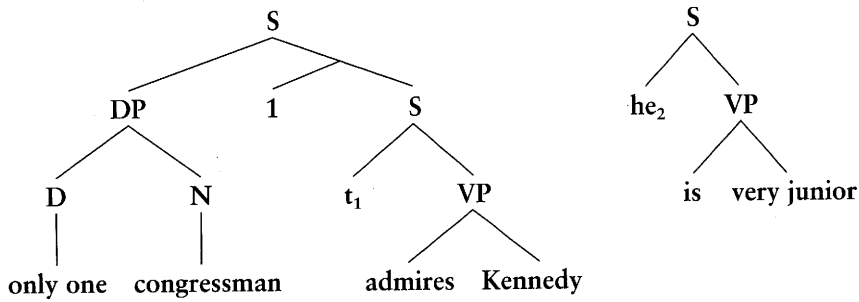
(3) is interpretable and receives the following truth-conditions: $[\![(3)]\!] = 1$ iff there is only one element of D that is a congressman and admires Kennedy and is very junior.

Does this solve our problem of accounting for the anaphoric reading in (1)? No. As Evans pointed out, the truth-conditions of (3) are not the intuitive truth-conditions of the English text (1). To see why not, imagine a situation in which two congressmen admire Kennedy, one of them very junior and the other one senior. The structure (3) is true in this state of affairs, since there is only one individual who is a congressman, admires Kennedy, and is very junior. Intuitively, however, someone who utters (1) under these circumstances has made a false assertion. (1) contains the assertion that only one congressman admires Kennedy; and this assertion is falsified by our scenario.

We conclude from this, with Evans, that our attempt to account for (1) by liberalizing syntactic constraints on QR and pronoun binding was misguided. Upon closer inspection, (1) actually *supports* these constraints. The fact that (1) cannot have the meaning of (3) confirms that DPs with the determiner **only one** are subject to these constraints as well, no less than DPs with **no**.

It's back, then, to our initial assumption that the scope of **only one congressman** is confined to the first sentence. We might as well forget again about T-nodes and the rule for their interpretation, and assume that the text in (4) is represented at LF as a sequence of Ss.

(4)



In (4), $\mathbf{he}_2$ is a free variable. (And it would be just as free if we had insisted on writing $\mathbf{he}_1$ instead.) So it must be a referential pronoun. Can we argue that this prediction is correct?

To do so, we have to answer three questions: (i) What does the pronoun refer to (on the intended reading)? (ii) Does this assignment of reference lead to intuitively correct truth-conditions for each sentence in the text? (iii) How does the referent in question become salient enough to be available when the pronoun is processed? Regarding the third question, a somewhat vague and sketchy answer will have to do for us here. But concrete and precise answers to the first two are definitely our responsibility as semanticists.

Here is a quick answer to question (i). The pronoun $\mathbf{he}_2$ in (4) refers to the congressman who admires Kennedy.

Here is a quick answer to question (ii). The first sentence in (4) is true iff only one congressman admires Kennedy. Given that $\mathbf{he}_2$ denotes the congressman who admires Kennedy, the second S in (4) is true iff the congressman who admires Kennedy is very junior. So for both sentences of (4) to be uttered truly, it must be the case that only one congressman admires Kennedy and that the congressman who admires Kennedy is very junior. This prediction accords with intuition.

And here is a quick answer to question (iii). The congressman who admires Kennedy is a salient referent for the pronoun $\mathbf{he}_2$, because a hearer who has just processed the first sentence of text (4) will naturally be thinking about this guy.

These are basically the answers we will stick by, although there are some details to be made more precise. We said that the pronoun refers to the congressman who admires Kennedy. But what if there isn't one? Or if there are two or more? Taking these possibilities into account, we give the following more precise answer to question (i): When the text (4) is uttered on the "anaphoric" reading that is under consideration here, then the pronoun **he**$_2$ refers to the congressman who admires Kennedy, if there is exactly one; otherwise it has no referent. In the latter case, the utterance context is not appropriate for (4) (in the technical sense of our Appropriateness Condition from chapter 9), and the second sentence in (4) gets no truth-value. A speaker might, of course, be using (4) in the false belief that there is exactly one congressman who admires Kennedy. But in that case, we are claiming, he acts just like a speaker who uses a pronoun demonstratively and points in a direction where he believes there is something to point at, when in fact there isn't.

So what we are saying about truth-conditions is, more precisely, the following. A speaker who uses (4) makes two consecutive utterances. The first one is true if only one congressman admires Kennedy, and false otherwise. The second one is neither true nor false if the first one was false. But if the first one was true, then the second one is true if the congressman who admires Kennedy is very junior, and false if he is not.

Let's also take a second look at question (iii). What causes the referent of **he**$_2$ (when it has one, and when this is the congressman who admires Kennedy) to be suitably salient? Clearly, the utterance of the sentence that precedes the pronoun (namely, **Only one congressman admires Kennedy**) plays a crucial role in this. We said that processing that sentence will make the listener think of this man. Why? Because the sentence **Only one congressman admires Kennedy** is in some sense "about" him. The appropriate notion of "aboutness" here cannot be defined very precisely. Crucially, we don't want to say that an utterance is only "about" an entity if that entity is the referent of one of its parts. There is no constituent in **Only one congressman admires Kennedy** which denotes the congressman who admires Kennedy. The "aboutness" relation is more indirect. The sentence, in effect, makes a claim about the cardinality of a certain set (namely, the intersection of congressmen and admirers of Kennedy). When the claim is true, the set is a singleton and uniquely determines its sole member. Whatever the psychological details, it seems reasonable to assume that a listener who has just interpreted this sentence and imagined it to be true is therefore in a state of mind in which he readily guesses that the intended referent of the subsequent **he**$_2$ may be the congressman who admires Kennedy.

In a certain sense, then, quantifiers can serve as "antecedents" for referential pronouns. It is no longer mysterious now that there are perfectly grammatical and interpretable anaphoric pronouns whose quantificational antecedents do not c-command them at SS or at LF. In fact, we may have to wonder at this

point why we were able to find any confirmation at all for our earlier expectation that quantifiers could only antecede pronouns they c-command. Why, for example, did the examples we saw in section 11.1 give us that impression?

(5) Every problem that no man could solve kept him busy all day.

(6) No boy was invited and he complained.

In (5) and (6), there is just no anaphoric reading at all. How come? How do these differ from example (1)?

There seems to be a significant difference between **no** and **only one**. We can see this in minimal pairs like (6) versus (7), or (1) versus (8).

(7) Only one boy was invited and he complained.

(8) No congressman admires Kennedy. He is very junior.

When we choose **no**, anaphoric readings become impossible. The reason for this is actually quite transparent, given the story we have told about (1). If (8) had a reading analogous to the one in (1), the pronoun **he** in (8) should also refer to the congressman who admires Kennedy. But in this case, it is not compatible with the truth of the first sentence that there *is* any such congressman. Whenever the first sentence of (8) is uttered truthfully, there is no congressman admiring Kennedy which the pronoun could possibly refer to. Nor is there any other person who is systematically brought to the attention of a listener who processes this negative claim (except, of course, Kennedy, who indeed is the only possible referent for "he", when (8) is presented out of context).

If this approach is right, it is not the presence of **no** *per se* that prevents an anaphoric construal, but the meaning of the antecedent discourse as a whole. If the speaker denies the existence of the relevant potential referent in any other way than by using a sentence with **no**, the effect should be the same. If, on the other hand, a **no** DP is embedded in an utterance that doesn't amount to a denial of existence, anaphoric pronouns should become okay again. There is some evidence that these predictions are on the right track:

(9) I seriously doubt that there is a congressman who admires Kennedy. He is very junior.

(10) I can't believe that I received no mail at all today. You stole it!

"He" in (9) cannot be taken to refer to the congressman who admires Kennedy, whereas "it" in (10) *can* refer to the mail I received today.

Let us look at a couple of other quantifiers besides "no" and "only one".

(11) Every woman was invited. She was pleased.

(12) A woman was invited. She was pleased.

(11) does not allow any anaphoric reading. Without a context that independently furnishes a referent, it simply sounds incoherent. Can we explain why? Apparently an utterance of "Every woman was invited" strongly conveys the message that there were several women invited. The semantic analysis of "every" that we have assumed in this book does not predict this as part of the truth-conditions, and so we currently don't have an explanation for this intuition.[3] But the intuition is clearly there, and this is all we need to know for the present purpose. Given that the first sentence in (11) evokes a scenario with multiple invited women, it is not suited to highlighting any individual woman as the intended referent. From the perspective of our approach to the previous examples, the use of "she" in (11) is infelicitous for essentially the same reason as when you utter "she" while pointing at a crowd. Indeed, this analogy is reinforced by the observation that (11) becomes a lot better when "She was pleased" is changed to "They were pleased".

Example (12) raises more delicate questions, which have been debated extensively.[4] The basic judgment is that an anaphoric reading in (12) is naturally available. Can we analyze this reading in the same way as we analyzed the anaphoric reading in (1) (with "only one")? That is, can we say that the pronoun either refers to the unique woman who was invited (provided there is one) or else gets no value? Many concrete uses of such sentences clearly fit this analysis. For example, suppose the topic of conversation is this year's party convention. Who will be the keynote speaker? In this context, if I utter (12),

(12) A woman was invited. She was pleased.

you will understand me as claiming, first, that a woman was invited (to give the keynote address), and second, that the woman who was invited was pleased. If you suspect that my first claim is false (perhaps because they invited a man, or perhaps because no invitation has been issued yet), then you will accordingly assume (just as the analysis predicts) that my use of "she" may not refer to anyone. The possibility that two or more women might have been invited probably doesn't even cross your mind, given the scenario we have specified. But it is not strictly inconceivable, of course, and we can examine our intuitions about this case as well.

If two women were invited, then my use of "she" did not refer to an individual who was the unique woman invited – that much is clear as a matter of

logic. But might it still have referred to somebody, perhaps to one of the two invited women? Under appropriate circumstances, this seems to be possible. Imagine, for instance, that you happen to find out not only that two women were invited, but also that one of the invitations occurred in my (the speaker of (12)'s) presence, whereas the other one was issued secretly behind my back. In that case, you will conclude that my use of "she" referred to the woman whose invitation I witnessed. (And accordingly, your judgment about the truth of my second utterance will depend on whether *this* woman was pleased.)

This kind of observation suggests that we should not commit ourselves to any simple-minded recipe for fixing the reference of pronouns which are, in some pre-theoretical sense, "anaphorically related" to quantificational antecedents. A large number of cases of this sort conform to a common pattern: the antecedent sentence is of the form "Det A B", and the pronoun refers to the unique A that is B, if there is one, or else denotes nothing and causes presupposition failure. But it doesn't *always* have to work in this way. Reference resolution is a complex cognitive task, and we have been aware all along that we could not provide rules for it, even when we were thinking only about run-of-the-mill deictic uses and cases of co-reference anaphora.

What we have learned in this section is that there are anaphoric relations which are neither variable binding nor co-reference. If the approach we have indicated here is right, then the ways in which previous discourse can furnish a referent for a pronoun have to be varied and sometimes rather indirect. The pronoun does not always simply co-refer with its so-called antecedent. Often, the antecedent contributes to the fact that a referent is made available in a much more roundabout way, in concert with the message conveyed by the surrounding sentence, and with miscellaneous information about the speaker's grounds for her assertions.

11.3 Pronouns that are neither bound variables nor referential

We have concluded that there are referential pronouns which have quantifiers as "antecedents", in a certain sense. Although we had not thought of this possibility when we first discussed the distinction between referential and bound-variable pronouns, its existence does not really challenge our theory. The Evans example ((1) in section 11.2) seemed at first to create a problem, but we were eventually able to argue that it could be accommodated without revising any of our syntactic or semantic assumptions. The examples we will look at next are

more recalcitrant. They contain pronouns which, for rather obvious reasons, cannot be considered referential and cannot be treated as bound variables.[5]

There is, in fact, a general recipe for constructing this problematic type of example. Take a sentence that exhibits the kind of anaphoric dependency we saw in Evans's congressman sentence:

(1) Only one congressman admires Kennedy, and he is very junior.

Introduce another pronoun into it. For instance, substitute a pronoun for the name "Kennedy":

(2) Only one congressman admires *him* and he is very junior.

Finally, embed the whole thing in a construction in which this new pronoun is bound. For example:

(3) Every president thought that only one congressman admired him and he was very junior.

We might have hoped that the analysis we developed for the "he" in the simpler original example would carry over to (3). But there is an obstacle. The "he" in (1), we argued, was a referential pronoun. Can the "he" in (3) be referential as well? What would be its referent? The congressman who admired Kennedy? The congressman who admired Johnson? The congressman who admired Reagan? No. None of these guys is the right choice. Whichever of them we take "he" to denote, the truth-conditions we then predict for (3) as a whole turn out different from the ones we intuitively understand. It seems that the denotation of "he" must be allowed to vary with the assignment somehow. But can "he" be a bound-variable pronoun? Then what would it be bound by? The quantifier "only one congressman"? But we have argued at length that such an analysis makes wrong predictions in sentence (1), and the argumentation carries over entirely to (3).

Here is another pair of examples which illustrates the problem. Take (4) first.

(4) John bought just one bottle of wine and served it with the dessert.

(4) is similar to (1) above and can be accounted for along the same lines: it refers to the bottle of wine John bought. This correctly accounts for the intuition that (4) implies that John served the unique bottle of wine he bought with the dessert, and is not equivalent to "there is just one bottle of wine which John bought and served with the dessert". The latter could be true if John bought, say, five bottles, four of which he served before the dessert and one of which he served with it. But (4) is judged false in this case.

But now look at (5).

(5) Every host bought just one bottle of wine and served it with the dessert.

Here the same account no longer works. The argument against a bound-variable analysis of **it** carries over from (4) to (5). (5) does not have the truth-conditions of "for every host, there is just one bottle that he bought and served with dessert". Otherwise it could be true if some of the hosts bought two or more bottles. The English sentence (5) is falsified by such circumstances. So (5) no more involves a bound-variable reading of the pronoun than does (4). But **it** in (5) cannot be referential either. What could its referent possibly be? The bottle of wine that host John bought? If that were its reference, (5) should mean that every host bought just one bottle of wine and then served the one that *John* bought for dessert. The actual truth-conditions of (5) are not of the form "every host bought just one bottle of wine and served x for dessert", for any $x \in D$.

So there are some pronouns that are neither free variables nor bound variables. Let's call them "E-Type pronouns".[6] Our current theory interprets all pronouns as (bound or free) variables, so it plainly denies their existence. We will have to make some substantive revision. So far, we only have a label and a negative characterization. What are E-Type pronouns? What is their syntactic representation and their semantic interpretation?

11.4 Paraphrases with definite descriptions

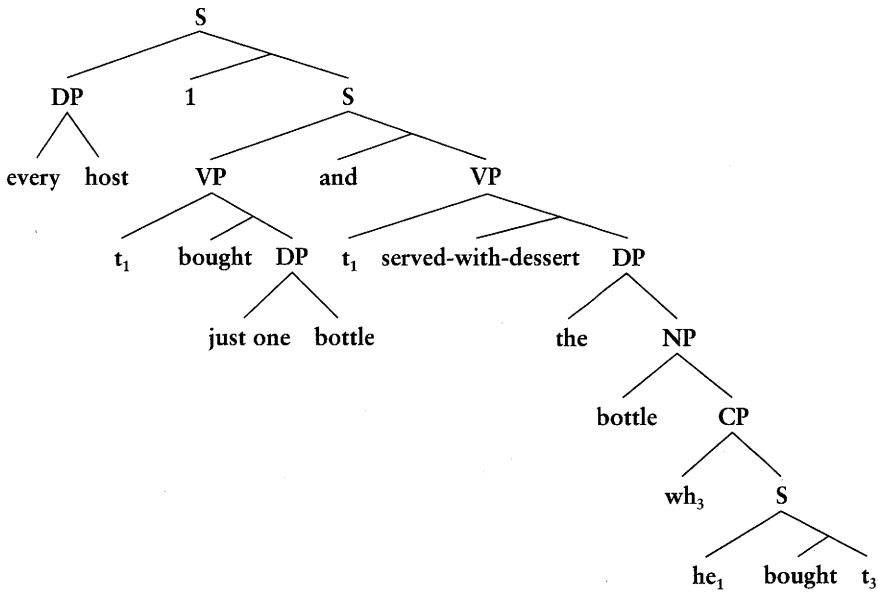
We begin with an observation: E-Type pronouns can always be paraphrased by certain definite descriptions. For instance, (5) in section 11.3 on the relevant reading is truth-conditionally equivalent to (1).

(1) Every host bought just one bottle of wine and served *the bottle of wine he had bought* with the dessert.

Of course, a paraphrase is not yet a semantic analysis. But it may help us find one. Let us first consider in detail how the paraphrase in (1) is interpreted, and return to the original sentence with the pronoun in the following section.

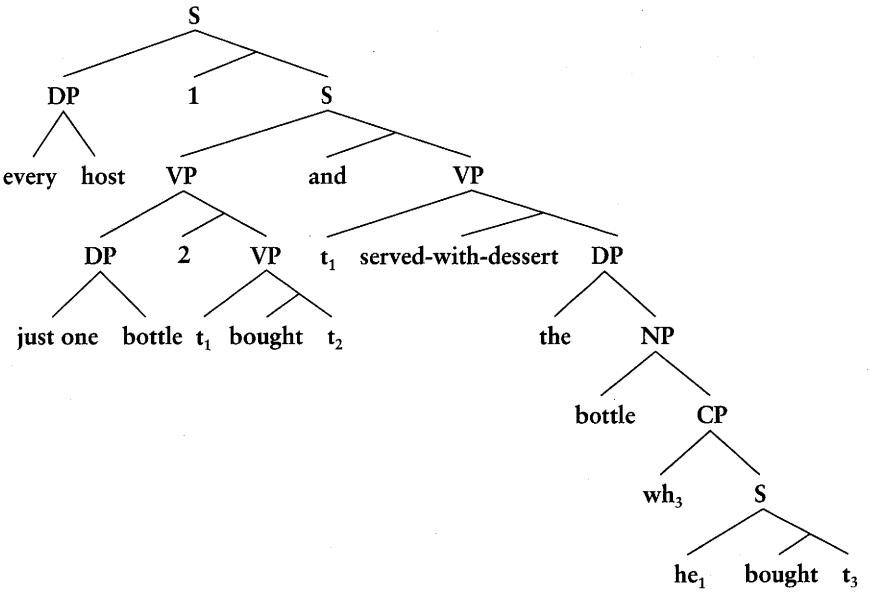
What is the LF of (1)? Evidently, **every host** has scope over everything else in the sentence and binds the pronoun **he**. We have also seen that **just one bottle of wine** does not take scope over the conjunction **and**. Since **and** here conjoins two VPs, and the scope of **just one bottle of wine** is confined to the left conjunct, there has to be an adjunction site for QR at or below the VP level. As discussed in chapter 8, we can solve this problem by assuming VP-internal subjects.[7] The SS of (1) is then something like (2) (making obvious abbreviations).

(2)



In deriving an interpretable LF from this, we need not move **every host** further (its index already binds the pronoun), but we must QR **just one bottle.** So the LF is (3) (omitting the internal stucture of the definite DP, which stays as in (2)).

(3)



We sketch the most important steps in the semantic interpretation of this structure:

$[\![(3)]\!] = 1$
iff
for every host x, $[\![[_{VP}[_{VP} \ldots\ldots] \textbf{ and } [_{VP} \ldots\ldots]]]\!]^{[1\to x]} = 1$
iff
for every host x,
$[\![\textbf{just one bottle } 2[\textbf{t}_1 \textbf{ bought } \textbf{t}_2]]\!]^{[1\to x]} = 1$
and $[\![\textbf{t}_1 \textbf{ served } \ldots \textbf{ the bottle he}_1 \textbf{ bought}]\!]^{[1\to x]} = 1$
iff
for every host x,
there is just one bottle y such that $[\![\textbf{t}_1 \textbf{ bought } \textbf{t}_2]\!]^{[1\to x,\ 2\to y]} = 1$
and x served ... $[\![\textbf{the bottle he}_1 \textbf{ bought}]\!]^{[1\to x]}$
iff
for every host x,
there is just one bottle y such that x bought y
and x served ... the bottle x bought.

11.5 Cooper's analysis of E-Type pronouns

We have considered the analysis of the definite description paraphrase and have seen an LF that correctly expresses its truth-conditions. Let us now return to our original example with the pronoun, (1).

(1) Every host bought just one bottle of wine and served it with the dessert.

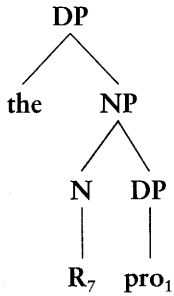
(1), we have noted, has the same truth-conditions we have just calculated. Can we devise an analysis for the E-Type pronoun which will yield this prediction?

One thing is clear. If the pronoun **it** in (1) is to have the same interpretation as the DP **the bottle he$_1$ bought**, then the LF representation of **it** has to contain an occurrence of the variable 1. Otherwise, the semantic value of the E-Type pronoun could not possibly vary with the value of that variable. It would not be able to denote different bottles of wine for different choices of host. It is also clear that the variable 1 cannot be the only meaningful constituent in the LF of **it**. The semantic values of **it** as a whole are not hosts, but bottles.

Here is an analysis due to Robin Cooper.[8] Cooper proposes, in effect, that the LF representation of an E-Type pronoun consists of a definite article and a predicate that is made up of two variables. The first variable is of type <e,<e,t>> and remains free in the sentence as a whole. The second variable is of type e, and typically gets bound in the sentence (in our example, that is the variable 1). We may think of these variables as unpronounced pro-forms. We will use the

notation $\mathbf{R}_i$ for the type <e,<e,t>> variable and $\mathbf{pro}_i$ for the type e variable (where i in each case is an index). The syntactic representation of an E-Type pronoun then looks like this:

(2)



We have little to say about the syntactic or morphological side of the analysis. Let us simply assume that DPs which consist of a definite article followed by nothing but unpronounced items will always be spelled out as pronouns. For instance, (2) may become **it**.[9]

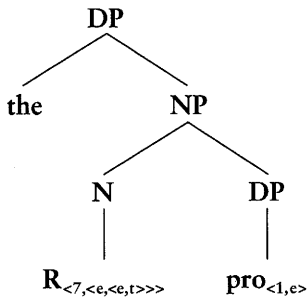
How are such structures interpreted? The basic idea is that the **R** variable receives a denotation from the context of utterance. In this respect, it is like a referential pronoun – except that it has a different semantic type, and therefore it requires that the context specify not a salient individual, but a salient 2-place relation. In the example at hand (sentence (1) under the intended reading), the **R** variable denotes the relation which holds between people and bottles they have bought. (More accurately, it denotes the function [$\lambda x \in D . \lambda y \in D .$ y is a bottle that x bought].[10]) This relation (function) will have been made salient to the hearer as a result of his or her processing the first conjunct of the VP in (1), the predicate **bought just one bottle**. It will therefore be a natural candidate for the value of the free **R** variable in the second conjunct. Given this choice of value for the node $\mathbf{R}_7$, the rest of the interpretation of structure (2) will be straightforward. By Functional Application and the entry for **the**, the denotation of (2) under an assignment g turns out to be the (unique) bottle bought by g(1). We will spell all this out more precisely right below.

To summarize Cooper's proposal, an E-Type pronoun is a definite description with an unpronounced predicate. The predicate is complex, and crucially contains a bound variable as well as a free variable. The free variable is essentially a relational noun (like "father"), except that its semantic value is not fixed lexically, but depends entirely on the utterance context. (It also is not restricted to semantic values which happen to be expressible by lexical items or constituents of the language. For instance, in our example the **R** variable is interpreted as "bottle-bought-by", but this is presumably not a well-formed constituent in English.) The bound variable serves as the free variable's argument, and it will typically be co-indexed with other bound variables in the larger structure. As a

result, the E-Type pronoun's value co-varies systematically with the values of other variables in the sentence. (In our example, the bottle assigned to **it** varies with the person assigned to the QR trace of **every host**.) The proposal explains why an E-Type pronoun can be paraphrased by an explicit definite description. The explicit description and the E-Type pronoun are interpreted alike, except that the E-Type pronoun relies on context where the explicit description relies on lexical meaning.

To implement this analysis in our semantic theory, we don't need to make any real changes. We just have to make sure that our formulation of certain rules and principles covers higher-type variables as well as those of type e. First, let's assume that an index is not merely a number, but a pair of a number and a semantic type.[11] So the tree we gave in (2) is really an abbreviation of (3) below.

(3)



(Of course, we will get away with the abbreviated versions for all practical purposes, since the types in interpretable structures are always predictable from the environment.) A variable assignment is then defined as follows:

(4) A partial function g from indices to denotations (of any type) is a (*variable*) *assignment* iff it fulfills the following condition:
For any number n and type τ such that $\langle n,\tau\rangle \in dom(g)$, $g(n,\tau) \in D_\tau$.

Now our so-called Pronouns and Traces Rule should really be called "Pro-forms and Traces Rule", and be formulated as follows:

(5) *Pro-forms and Traces*
If α is pro-form or trace, i is an index, and g is an assignment whose domain includes i, then $[\![\alpha_i]\!]^g = g(i)$.

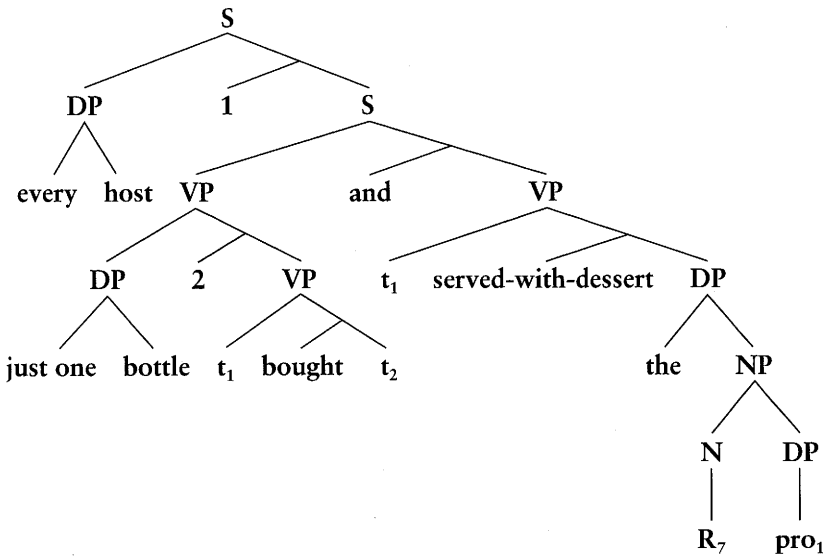
The Appropriateness Condition for utterances can stay as it is (cf. section 9.1.2):

(6) *Appropriateness Condition*
A context c is *appropriate* for an LF ϕ only if c determines a variable assignment g_c whose domain includes every index which has a free occurrence in ϕ.

This formulation automatically covers the indices of our free **R** variables and ensures that they receive values of the appropriate type from the context.

This is all we need for a precise analysis of our example. The LF we propose for (1) is (7) below.

(7)



The utterance context c in which (7) is uttered specifies the following assignment g_c:

(8) $g_c := [7 \rightarrow \lambda x \in D \,.\, \lambda y \in D \,.\, y$ is a bottle that x bought]

By appropriate calculations (for the most part parallel to those we sketched in section 11.4 above), we determine that the utterance of (7) in the context c is true iff every host bought just one bottle and served the bottle he bought with dessert.

11.6 Some applications

Given the existence of E-Type pronouns, our grammar now predicts a great deal of structural ambiguity for every surface sentence that contains one or more pronouns. Not only are there often multiple choices of well-formed and interpretable indexings, but each pronoun can in principle be either a simple variable or a complex structure. We have not placed any syntactic constraints on the

generation of E-Type pronouns, and thus there should be E-Type readings for pronouns all over the place. Is this a problem?

A little reflection shows that an E-Type interpretation of a given pronoun will generally be indistinguishable from a referential interpretation, unless the pronoun is in the scope of a quantifier. Consider an example which illustrates this point. Before we were persuaded that we needed E-Type pronouns, we looked at examples like (1).

(1) Only one congressman admires Kennedy. He is very junior.

The **he** in (1), we argued, could be represented as a simple free variable, to which the utterance context assigned the congressman who admires Kennedy. But nothing stops us now from generating another LF in which **he** is an E-Type pronoun with the structure **the** $[\mathbf{R}_i\ \mathbf{pro}_j]$. We even have good reason to believe that such an LF would be easy to interpret, since a context in which (1) as a whole is uttered will naturally furnish a salient referent for $\mathbf{pro}_j$ (namely, Kennedy) and a salient referent for $\mathbf{R}_i$ (namely, the relation between people and the congressmen that admire them). Given these choices of values, the structure **the** $[\mathbf{R}_i\ \mathbf{pro}_j]$ will denote the congressman who admires Kennedy. So the overall interpretation is the same as on our original analysis. In general, when all the variables contained in an E-Type pronoun happen to be free variables, the pronoun as a whole receives a fixed referent (if it is interpretable at all). In that case, we can always give an alternative analysis on which this referent is directly assigned to a simple free variable pronoun. It is not surprising, therefore, that we needed to turn to examples containing a higher quantifier in order to get evidence for the existence of E-Type pronouns in the first place.

We assume that the coexistence of multiple analyses for examples like (1) is harmless. Presumably, when listeners process utterances, they will first consider simpler parses and entertain more complex ones only when forced to. So if there is a highly salient suitable referent for a simple individual variable (as in paradigm examples of deictic uses or of co-reference anaphora), the listener will have no motivation to try out the E-Type analysis. With an example like (1), it is less evident that the single variable analysis is simpler than the E-Type analysis from a processing point of view. We leave this as an empirical question. Our main point here is that the free generation of E-Type pronouns in all sorts of environments does not appear to give rise to unattested readings.

There is even some direct empirical evidence that pronouns which are not in the scope of quantifiers can have E-Type analyses. Consider our earlier example with an elliptical continuation.

(2) John bought just one bottle of wine and served it with the dessert. Bill did too.

(2) allows (in fact, strongly favors) a sort of "sloppy" reading, on which the second sentence means that Bill bought just one bottle and served the bottle that he, Bill, bought with the dessert. Given our assumptions about ellipsis in chapter 9, this reading calls for an E-Type analysis of **it**. We leave it to the reader to spell out the argument, as well as to explore more systematically what the existence of E-Type pronouns implies for the emergence of strict and sloppy readings under ellipsis.[12]

Cooper's analysis of E-Type pronouns has been successfully applied to a variety of examples of great notoriety. We will conclude the chapter with a few brief illustrations.

The so-called donkey sentences were brought to the attention of modern linguists through the discussion of Geach.[13] The typical donkey sentence has an indefinite DP in an "if" clause or relative clause, and a pronoun anaphoric to it in the main clause. Geach's original examples are (3) and (4).

(3) If a man owns a donkey, he beats it.

(4) Every man who owns a donkey beats it.

(5) Nobody who owns just one computer keeps it at home.

Much of our discussion from the previous sections obviously carries over to these examples. It is easy to see, for instance, that the **it** in (5) cannot be a referential pronoun (there is no contextually given computer it refers to), and that it can also not be a bound-variable pronoun (the sentence does not have the truth-conditions that would result from giving **just one computer** wide enough scope to bind the pronoun). A definite description paraphrase ("it" = "the computer that he or she owns") captures the intended reading, and it makes transparent that the pronoun's value must vary with the value of the QR trace of the "no" DP. Cooper's analysis exploits the plausible assumption that the phrase "nobody who owns just one computer" is suited to make salient the relation between people and their computers. We leave it to the reader to spell out the LF and interpretation of (5) in more detail.

Another staple of the literature on pronouns are the "paycheck" sentences. Here is Jacobson's edition of Karttunen's classic example.[14]

(6) A woman who puts her paycheck in a federally insured bank is wiser than one who puts it in the Brown Employees' Credit Union.

The **it** cannot be referential, since it denotes no particular, contextually salient paycheck. It can also not be a bound variable, since there is no possible binder high enough in the structure. QR'ing the "antecedent" **her paycheck** all the way

out of its relative clause to a position c-commanding **it** is definitely not an option, since that would leave the **her** unbound. Cooper's E-Type analysis applies naturally. Let **it** be represented as **the** [$\mathbf{R}_i$ **pro**$_i$], where j is co-indexed with the relative pronoun (in the second relative clause), and i is mapped to the relation between people and their paychecks, which has plausibly been brought to salience with the earlier mention of paychecks.[15]

An interesting extension of Cooper's analysis of paycheck sentences was developed in Jacobson's study of the so-called Bach–Peters paradox.[16] An example is (7).

(7) Every boy who deserved it got the prize he wanted.

Bach and Peters had observed that there was no possible LF for this sentence in which both pronouns could be bound. Either **every boy who deserved it** c-commands **he**, or **the prize he wanted** c-commands **it**, but not both. Even if we disregard all syntactic constraints on movement and indexing, it is strictly impossible to derive from (7) an interpretable LF with no free variables. Jacobson argues that in every example of this kind, one of the pronouns is not a bound-variable pronoun, but an E-Type pronoun. In (7), for example, the **he** is bound by the **every** DP, but the **it** can be represented as **the** [$\mathbf{R}_i$ **pro**$_i$], where the **pro** is co-indexed with the trace of **who**, and the R variable refers to the relation "prize-wanted-by" (the relation between boys and the prizes they want). As Jacobson shows, this analysis makes sense of the distribution of possible determiners in these "paradoxical" sentences, as well as of syntactic constraints on the relations between pronouns and antecedents.

Cooper's E-Type analysis also throws light on many examples with pronouns whose antecedents are in the scope of modal verbs and adverbs and of propositional attitude verbs. These including the "fish" sentences discussed since the late 1960s[17] and the cases of so-called modal subordination.[18]

(8) John wants to catch a fish and eat it for dinner.

(9) A wolf might come in. It would eat you first.

Like the pronouns we have discussed in this chapter, the occurrences of "it" in (8) and (9) are not in suitable configurations to be bound by their "antecedents"; nor would such an analysis (even if permitted by syntax) represent their intuitive truth-conditions. And they also cannot be simply referential, for which fish or which wolf would be the referent? There may not even be any fish or wolves at all, yet (8) and (9) can be true. The solution, in a nutshell, exploits the fact that **want**, **might**, and **would** are quantifiers (namely, quantifiers over possible worlds). Once this is made explicit, the examples reveal a structure similar to

the ones we have analyzed here. For example, (8) means that every possible world w in which John gets what he wants is such that he catches a fish in w and eats *the fish he catches in w* for dinner in w. This is just a vague hint at an analysis, but we cannot do much more in the absence of a real analysis of sentence-embedding verbs and modals. Largely, that is beyond the scope of this book, though you will get a first taste in the next chapter.

Notes

1 For recent discussion of the applicability of the Coordinate Structure Constraint to QR, see E. Ruys, *The Scope of Indefinites* (Ph.D. dissertation, University of Utrecht, 1992; OTS Dissertation Series).

2 Evans's original example contains "few" and "they" instead of "only one" and "he". We have changed the example (and others below) in order to avoid complications related to plurality, a topic beyond the scope of this book. See G. Evans. "Pronouns," *Linguistic Inquiry*, 11/2 (1980), pp. 337–62. For a fuller elaboration of the most important points in that paper, see *idem*, "Quantifiers and Relative Clauses I," *Canadian Journal of Philosophy*, 7 (1977), pp. 467–536, repr. in G. Evans, *Collected Papers* (Oxford, Oxford University Press, 1985), pp. 76–152.

3 This holds regardless of whether we favor the "classical" analysis or the "presuppositional" analysis, at least if we stick to the official version of the latter, as it was presented in section 6.8. On that version, "Every woman was invited" presupposes that there is at least one woman, but not that there is more than one. Perhaps we should adopt a stronger version, on which every α β always presupposes that $[\![\alpha]\!]$ has at least two elements. This looks like a reasonable proposal, but we cannot take the space here to examine it seriously.

4 See Evans, "Quantifiers"; *idem*, "Pronouns"; N. Kadmon, "On Unique and Non-unique Reference and Asymmetric Quantification" (Ph.D. dissertation, University of Massachusetts, Amherst, 1987; distributed by GLSA); *idem*, "Uniqueness," *Linguistics and Philosophy*, 13/3 (1990), pp. 273–324; S. Neale, *Descriptions* (Cambridge, Mass., MIT Press, 1990); and others.

5 The existence of such examples has been known for a long time. Besides Evans, "Quantifiers"; *idem*, "Pronouns", see R. Cooper, "The Interpretation of Pronouns," in F. Heny and H. Schnelle (eds), *Syntax and Semantics*, vol. 10: *Selections from the Third Groningen Round Table* (New York, Academic Press, 1979), pp. 61–92. Many examples go back to earlier literature; an especially good source is B. Partee, "Opacity, Coreference, and Pronouns," *Synthese*, 21 (1970), pp. 359–85.

6 The term was coined by Evans, but its usage in the linguistic literature has broadened, and it is often now applied to pronouns which Evans explicitly distinguished from "E-Type" pronouns. We, too, are applying it indiscriminately to all pronouns which are not covered by the theory we had up to now. See Evans, "Quantifiers", and Neale, *Descriptions*, for discussion.

7 A flexible types approach would also be feasible at this point.

8 See Cooper, "Interpretation of Pronouns." For recent versions and some discussion of alternatives, see also I. Heim, "E-Type Pronouns and Donkey Anaphora,"

Linguistics and Philosophy, 13/2 (1990), pp. 137–78; G. Chierchia, "Anaphora and Dynamic Binding," *Linguistics and Philosophy*, 15/2 (1992), pp. 111–83; and Neale, *Descriptions*.

9 One detail that we gloss over here is how the pronoun receives the correct gender, number, and person features. Our presuppositional treatment of features from section 9.1.2 can be applied to E-Type pronouns as well. Suppose that the structure in (2) has features adjoined to it, which determine the shape of the spelled-out pronoun. Then the presuppositions generated by these features will, in effect, put constraints on the denotation of $\mathbf{R}_7$. You are invited to elaborate this remark and apply it to an example.

10 This is the Schönfinkelization of the 2-place relation just described.

11 See exercise in section 8.2.

12 See Fiengo and May, *Indices and Identity*, and S. Tomioka, "A Sloppy Identity Puzzle," *Natural Language Semantics*, 6 (forthcoming).

13 P. Geach, *Reference and Generality* (Ithaca, NY, Cornell University Press, 1962).

14 L. Karttunen, "Pronouns and Variables," in *Papers from the Fifth Regional Meeting of the Chicago Linguistics Society* (University of Chicago, 1969), pp. 108–15.

15 Evans calls the pronoun in the paycheck sentence a "pronoun of laziness", which he specifically distinguishes from an "E-Type pronoun". Following Geach's terminology, a pronoun of laziness is equivalent to an (exact) repetition of its antecedent. The paycheck pronoun fits this description, since (6) is indeed accurately paraphrased by substituting "her paycheck" for "it". Notice that our previous examples of E-Type pronouns do not have this property. Example (1) of section 11.5, for example, does not mean the same thing as "Every host bought just one bottle of wine and served *just one bottle of wine* with the dessert". As we have noted before, we do not adhere to Evans's terminology, but use "E-Type pronoun" in a broader sense. If the analysis we have adopted from Cooper is right, then the indiscriminate terminology is indeed theoretically justified. Be that as it may, it is common. The term "pronoun of laziness" is rarely used these days, but has also been employed in a very broad sense (e.g., in Partee, "Opacity").

16 E. Bach, "Problominalization," *Linguistic Inquiry*, 1 (1970), pp. 121–2; P. Jacobson, *The Syntax of Crossing Coreference Sentences* (Bloomington, Indiana Linguistics Club, 1979).

17 See, e.g., J. Dean, "Nonspecific Noun Phrases in English," Harvard Computational Laboratory Report no. NSF-20 (Cambridge, Mass., 1968); Partee, "Opacity"; R. Montague, "The Proper Treatment of Quantification in Ordinary English," in J. Hintikka, J. Moravcsik, and P. Suppes (eds), *Approaches to Natural Language* (Dordrecht, Reidel, 1972), pp. 221–42.

18 C. Roberts, "Modal Subordination and Pronominal Anaphora in Discourse," *Linguistics and Philosophy*, 12/6 (1989), pp. 683–721.