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The Absorption Principle and E-Type Anaphora

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The Absorption Principle and E-Type Anaphora

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Abstract: The Absorption Principle is a principle of situation theory which restricts the kinds of parametric information which is available. In particular it rules out abstraction over variable occurrences in paramtetric restrictions (unless the parameter itself is included). In *Anaphora and Quantifiaction in Situation Semantics,* Gawron and Peters showed that the Absorption Principle has intuitively correct consequences in applications to quantificational and anaphoric semantics, but Sem, Saebo, Verne and Vestre (1990) point out cases of incorrect consequences. The present paper provides an analysis of the problematic cases in which the Absorption Principle is maintained. A key part of the analysis is the postulation that anaphors may have quantified NPs as antecedents, a position which has been vigorously advocated by Evans (1980). As a consequence, anaphors of this type are called 'E-Type'. We argue that the pronoun 'it' in the following discourse must be analyzed as E-Type`:

Tom has exactly one car. It is red.

We provide an analysis of E-Type anaphora with the following properties: (i) the type of the anaphor is derived from the conservative scope of its antecedent; (ii) its semantics is provided by a choice function; and (iii) there is a pragmatic condition that the choice function not be controlled either by speaker or hearer in the discourse. We demonstrate how this accounts for a wide range of facts, including apparently varying quantificational force.

Keywords: Semantics of natural language, anaphora, quantification, situation semantics.

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1 Introduction

In Gawron and Peters (1990a), henceforth G&P, we discussed a generalization we called the Absorption Principle (AP), which constrains scope-relations between NP's.

The Absorption Principle is a principle of situation theory which rules out certain kinds of parametric contents. If a parameter x occurs in a restriction on a parameter y, we say y depends on x. The Absorption Principle says that in such cases, any type formed by abstracting on x must also abstract on y. That is parametric types of the following form do not exist:

(1) $[\, x \mid \langle\!\langle \ldots y_{\langle\langle \ldots x \ldots \rangle\rangle} \ldots \rangle\!\rangle \,]$

However there are types of both the following forms:

(2) $[\, x, y \mid \langle\!\langle \ldots y_{\langle\langle \ldots x \ldots \rangle\rangle} \ldots \rangle\!\rangle \,]$
$[\, x \mid \exists y \langle\!\langle \ldots y_{\langle\langle \ldots x \ldots \rangle\rangle} \ldots \rangle\!\rangle \,]$

Thus, y can be absorbed anywhere within the scope of the type, but it cannot be a parameter of the type as a whole. The situation-theoretic motivations for the Absorption Principle need not concern us here. Suffice it to say that the restrictions on the existence of the forbidden types appear necessary for any theory countenancing restricted parameters.

Among its many effects, the AP prevents a pronoun utterance from being anaphorically related to the NP *his car* in any utterance of the following sentence in which *his* is anaphorically linked to *Every boy*:

*This paper owes a great deal to conversations with Makoto Kanazawa in its early formative stages. The authors would also like to thank Christa Hauenschild, Jean-Yves Lerner, Manfred Pinkal, and Barbara Zimmermann for discussions of this paper. As usual, the authors are responsible for its content.

(3) *Every boy* washed *his* car. #I inspected it.

Roughly, this is because the pronoun parameter x, which occurs in a restriction on the parameter y belonging to the NP *his car*, is abstracted on by either the content of the VP *washed his car* or the quantifier's scope:

(4) $[\, x \mid \exists y \langle\langle \text{WASH}, x, y_{\langle\langle \text{CAR},y\rangle\rangle \wedge \langle\langle \text{POSS},x,y\rangle\rangle} \rangle\rangle \,]$

In such cases, the Absorption Principle requires that the resulting type not be parametric in y. Since the VP content can have no parameter for y, no anaphoric relation to the NP *his car* was possible in the system of G&P.

In some contexts where the Absorption Principle would appear to apply, however, anaphoric uses of the pronoun do appear possible. In Sem, Sæbø, Verne, and Vestre (1990), Norwegian sentences of the following sort are raised as evidence against the Absorption Principle:

(5) John kysset sin kone og det gjorde Bill også.
John kissed his wife and Bill did too.

Here the only reading possible for the sentence with the elliptical VP is the sloppy reading, on which Bill kisses his own wife. But this means the content of the first clause must be roughly:

(6) $\langle\langle [\, x \mid \exists y \langle\langle \text{KISS}, x, y_{\langle\langle \text{WIFE},y\rangle\rangle \wedge \langle\langle \text{POSS},x,y\rangle\rangle} \rangle\rangle \,], z_{\langle\langle \text{NAMED},z,\text{“John”}\rangle\rangle} \rangle\rangle$

That is, John has the property of being an own-wife kisser:

(7) $[\, x \mid \exists y \langle\langle \text{KISS}, x, y_{\langle\langle \text{WIFE},y\rangle\rangle \wedge \langle\langle \text{POSS},x,y\rangle\rangle} \rangle\rangle$

Crucially, the property John has cannot be a property parametric in y: that would be just the sort of property which the Absorption Principle says does not exist. Since the parameter y has x in its restriction, when x is absorbed, y cannot be a parameter of the resulting type. But if y is not a parameter of the content of any utterance of (5), then one would expect that no pronoun could enter into an anaphoric relation with the NP *sin kone*.

Yet Sem, Sæbø, Verne, and Vestre discuss numerous examples in which an anaphoric relation is possble with an NP containing *sin*:[1]

(8) John vasket bilen sin. Den skinnende ren nå.
John washed his car. It is spanking clean now.

[1]The Norwegian constructions appear to be a kind of event (or event-type) anaphora, more closely analogous to the English "do it" construction than to VP ellipsis. But whether or not the ellipsis analysis should not be applied here, the issues raised are significant.

Before commenting on (8),[2] we turn to some other examples which pose related problems for the Absorption Principle. Consider the ambiguous discourse:

(9) Only John washed his car. It got spanking clean.

Here the first sentence can be interpreted to mean either that John was the only one to wash his *own* car, or that he was the only one to wash John's car. On the first of these readings, the VP content will be analogous to (7); again the point is that this VP content cannot have y, the parameter associated with *his car*, as a parameter. Yet an anaphoric relation with *it* still seems possible, even on this reading. This is in marked contrast to (3), where no such anaphoric relation is possible. Intuitively, the difference between these examples is clear. In (9), on the relevant reading, there is a salient car for the pronoun to exploit. In (3), there is no such car. The issue before us now is whether capturing this difference will entail weakening or abandoning the Absorption Principle.

We summarize the problem as follows: in G&P, we followed a basic strategy of trying to account for all anaphora by means of parameter-sharing, either directly by a pronoun and its antecedent, or by a pronoun and a role to which the antecedent was linked. This meant that if a pronoun's parameter fell outside the scope in which its antecedent's parameter was absorbed, there was no way for the two to be anaphorically related. Our problems concerning the action of the Absorption Principle and the anaphoric relations exhibited above can be viewed as a special consequence of this property of the system in G& P. In all cases, a pronoun falls outside the scope of its antecedent.

A somewhat different case of the same general problem involves a phenomenon first discussed in Grinder and Postal (1971), known as Missing Antecedents. The Missing Antecedents Phenomenon can be illustrated with contrasting discourses like the following:

---

[2] Analogous problems may arise in conjunction with constructions using the pronoun modifier *own* in English:

(i) John washed his own car. It got spanking clean.

In (i), it seems perfectly acceptable to understand the pronoun as anaphoric to the NP *his own car*. Many speakers find that *own* forces sloppy readings, so that a sentence like *The baby washed his own face before his mother could* is odd on the most pragmatically natural intepretation: the baby washed his face before the mother could wash it. Other speakers, however, accept these examples. Sentences with *own* only present a problem for the Absorption Principle if in fact they force a sloppy reading. The analogous data in Norwegian appears to be clear.

(10) John has never ridden a camel. # And it stank.

(11) John has never ridden a camel. But Bill has. And it stank.

In the first discourse, the pronoun cannot be understood as anaphoric to the NP *a camel*; in the second, it can.

The data suggest that the antecedent of the pronoun in (11) is not the overt NP in the first VP, but the "missing NP" that would have occurred if the VP of the second clause weren't elliptical. One might try to account for such examples by resorting to a parametric content for the minimal VP *ridden a camel*. If this VP content has a parameter for the camel, then even though that parameter is absorbed in the first clause as a whole, the parameter is re-used when the VP content is reused in ellipsis, this time without being absorbed, and is thus able to license further anaphora. This sort of account crucially relies on always being able to produce a VP content which is parametric in Missing Antecedent cases. However, the Absorption Principle can sometimes make it impossible to produce such a parametric VP content. Consider:

(12) John has never read a Russian novel he disliked. But Bill has. It was *War and Peace*.

We are concerned here with the sloppy reading of the VP-ellipsis, the reading on which what is at issue is John's reading novels John dislikes and Bill's reading novels Bill dislikes. On this reading, the content of the VP *read a Russian novel he disliked* must be

(13) $[\,x \mid \exists y\langle\!\langle \text{READ}, x, y_{\langle\!\langle \text{RUSSIAN-NOVEL},y\rangle\!\rangle \wedge \langle\!\langle \text{DISLIKE},x,y\rangle\!\rangle}\rangle\!\rangle\,]$

Note, that, in order to get the desired sloppy reading, the parameter y must depend on x. But in that case, the Absorption Principle requires that the scope of y can be no greater than x. There is thus no way to obtain a VP content which has absorbed x but is still parametric in y.

Worse yet for the complexity of missing antecedents' analysis, Nerbonne, Iida and Ladusaw (1990) (henceforth NI&L) demonstrate that missing antecedent cases interact directly with standard cases of donkey anaphora, demonstrating that "missing antecedent" mechanisms must in principle be available in donkey anaphora as well.

(14) No [farmers who own several donkeys$_j$]$_i$ beat them$_j$. Few $\emptyset_i$ even scold them$_j$.

This is an example of an $\bar{N}$ anaphor (*few* $\emptyset_i$) which contains an example of a "missing antecedent", i.e., a case in which the pronoun *them* could NOT have been licensed by the explicit NP *several donkeys*, but could only be licensed by material "missing" in the anaphor *few* $\emptyset_i$. The pronoun *them*$_j$, could not be licensed by the explicit NP *several donkeys* because it necessarily falls outside its scope, closed by the "trapping" quantifier *No*. So *several donkeys* is an unavailable Q-Type antecedent. One might try to avoid the conclusion that this is a missing antecedent, for example by noting that the plural anaphor *they* does not obey scope restrictions as strictly as its singular counterparts, *she*, *he* and *it*. For example, the following is certainly felicitous:

> (15) No farmers who own several donkeys beat them$_i$. They$_i$ are too valuable.

But this use of the pronoun can only refer to a group of donkeys *simpliciter*, NOT to a group of donkeys owned, but not beaten by farmers. Given the simpler sort of binding, we would expect the second sentence in (14) to mean that few of the farmers scold the group of donkeys in question—which it apparently can mean. Nonetheless, the more prominent reading is the one, roughly, that few farmers who own several donkeys scold THE DONKEYS THEY OWN. This is the reading we're interested in. And on this reading, there is simply no appropriate antecedent in the sentence for *them*$_j$,—it's missing.

The combination of donkey anaphora and missing antecedent licensing arises in VP ellipsis as well:

> (16) Farmer Brown has never owned a donkey she hated, but every farmer who has has beaten it.

Thus, there appears to be a significant class of cases which raise questions about the Absorption Principle. We believe, however, that these are not counterexamples to the Absorption Principle.

In G&P, a pronoun and antecedent were linked in content by parameter-sharing. Because the basic idea behind this account of pronouns was first argued for by Quine, we shall call this a Q-Type account.

We assume that the above data falsify the following conjunction, implicitly assumed in G&P: (a) all anaphora can be accounted for by a Q-Type account; and (b), the Absorption Principle is correct.

In order for the above data to be accounted for at least one of these assumptions must be weakened or dropped. It is our purpose in this paper to argue that an illuminating account is open to us if we modify only assumption (a).

To begin with, assumption (a) can be falsified on grounds quite independent of the Absorption Principle. As Evans (1977) points out, pronouns *can* have antecedents whose scope they lie outside of.

(17) Mark owns exactly one car. It's green.

We cannot assume that the pronoun in the second sentence falls under the scope of the quantifier, *exactly one*, because that would yield the wrong interpretation, that there is exactly one car which is owned by Mark and is green. Clearly, thus, there are pronoun utterances whose interpretations fall outside the scope of their antecedents. To distinguish these pronoun occurrences from those open to a Q-Type account, we will follow the lead of a number of authors in the wake of Evans (1977), and call them E-Type.

Such uses of pronouns are quite widespread. Other examples have a (possibly non-monotone) quantifier with scope inside another operator outside of whose scope the pronoun lies.

(18) If you take at most one cookie, it won't be missed.

(19) The fact that John denies he has an offshore bank account means we're going to have a hard time locating it.

E-Type uses of pronouns are so ubiquitous it is somewhat surprising in retrospect that they were apparently not noticed prior to the 1970s.[3]

To summarize: we think that examples like (8), (9), (11) and (12) show that the conjunction of the Absorption Principle with the claim that there is only Q-Type anaphora is false. But (17) alone shows that there must also be E-Type anaphora. We think that (8), (9), (11) and (12) are all cases of E-Type anaphora: the NP parameters in these examples are absorbed, just as the Absorption Principle predicts. But a pronoun outside the scope

[3]While Kadmon's recent (1990) paper might be read as implying that example (17) doesn't prove the existence of E-Type uses as Evans claimed, we believe his argument is sound. For any generalized quantifier Q, the conservativity property guarantees equivalence of the proposition $\ldots Q(A, B)\ldots$ with the proposition $\exists X(X = A \cap B \wedge \ldots Q(A, X)\ldots)$. The price of analyzing quantified propositions in the latter way, as Kadmon does, is to empty the accessibility condition on reference markers in DRT of empirical content.

of that absorption is still able to relate anaphorically to the NP by taking it as an E-Type antecedent.

In this paper we try to explore some of the consequences of this view. The paper divides up as follows: sections 2 and 3 lay out the requirements for an analysis of E-Type pronouns, specifically pointing out a number of areas where the exact truth-conditions are problematic. Section 4 shows how a minimal account of E-Type anaphora deals with the putative counterexamples to the Absorption Principle. Section 5 discusses the status of the Absorption Principle in a system which allows E-Type anaphora, and argues that there are a number of important predictions which it still makes, particularly as regards possible quantifier scopes. Section 6 presents an analysis that tries to account for some of the basic facts about E-Type pronouns.

2 Some Puzzles about E-Type Pronouns

Puzzle 1. What is the propositional content of a statement involving an E-Type use of a pronoun, such as might be made using (20) or (21):

(20) Mark owns exactly one car. He should take good care of it.

(21) Few senators support the immigration bill. They will have to convert a lot of their colleagues.

Puzzle 2. If the discourse

(22) Noam wrote a book. It was not well received.

entails that Noam wrote just one book (as Evans has claimed), why isn't (23) parallel? How can the second sentence be true?[4]

(23) I bought a sage plant yesterday. I bought eight others with it.

Puzzle 3. What's odd about these?

(24) Nobody is at the door. I'm not going to let him in.

(25) John didn't plant any daisies. They need water.

Puzzle 4. Why doesn't (26) entail that a doctor examined Bill?[5]

[4]The example and the puzzle are due to Heim.

[5]This example is modeled on one pointed out by Barbara Partee.

(26) Either no doctor has examined Bill today or she didn't write anything on this chart.

(27) Either John has no children or they haven't been in touch with him in years.

Puzzle 5. If (26) requires that *any* doctor who has examined Bill have refrained from chart-writing, why doesn't (28) require that you hand over any quarter that you have to that beggar?[6]

(28) If you have a quarter, you should give it to that beggar.

3 The analysis: Basic Cases

We begin by discussing a central problem confronting any analysis of E-Type pronouns, the apparent quantificational variability of singular E-Type pronouns. We then discuss plural E-Type pronouns and some of the extra quantificational wrinkles of puzzles (7) and (8).

Consider the case of an anaphoric utterance of the pronoun *it* in a discourse like (29).

(29) Mark owns exactly one car. It's green.

Assume that the antecedent in the given discourse is the NP *exactly one car*. The content for a statement using the first sentence is something like:

(30) $(\text{EXACTLY-ONE}, T)$
where
$T = [\, x : (r \models \langle\!\langle \text{CAR}, x \rangle\!\rangle) \mid (s \models \langle\!\langle \text{OWNS}, \text{mark}, x \rangle\!\rangle)\,]$

Then the question is: what is the content of a statement using the second sentence? As a first approximation, we might try the the following content.

(31) $(s' \models \langle\!\langle \text{GREEN}, z_{(x:T)} \rangle\!\rangle)$

An important point here is that the pronoun parameter z occurs outside the scope of its antecedent's quantification. We take this to be diagnostic of E-Type anaphora. That is, two conditions must hold: first, the pronoun's antecedent must be quantified away(it cannot be referential); and second, the content of the pronoun must fall outside its antecedent's quantification.

[6] This example is modeled on one pointed out in Schubert and Pelletier (1989).

In (31), the pronoun parameter is restricted to be of Type T, the same type that is the argument of the quantifier EXACTLY-ONE in the previous sentence.[7] In general, let us call the type the pronoun depends on (here, the type of x such that x is a car owned by Mark in s) the Evans-type.[8] Clearly the Evans type depends both on the content of the previous utterance, and on determining the pronoun's antecedent in that utterance. In fact, it is just the conservative scope of the antecedent's quantification.[9]

If (31) were the content of an utterance of the second sentence in (29), the circumstances would be responsible for somehow anchoring the parameter z. In that sense, we could speak of the pronoun-use as "referential." However, we might just as well have prefixed the content with some operator, call it ∇, which quantified the pronoun parameter away. For the moment, let us consider ∇ simply a placeholder, to be filled by a specific quantifier, perhaps an existential, perhaps a definite, or perhaps a universal. A central issue in the analysis of E-Type pronouns is whether E-Type pronouns are (at least sometimes) referential, or whether there is always some operator ∇ which quantifies them away, and if so, what it is.

3.1 Quantificational Variability of E-Type Pronouns

We now try to show why there is an issue about the quantifcational force of E-Type pronouns. We proceed by examining a sampling of relevant examples which suggest referentiality or various quantificational forces that might be assigned to E-Type pronouns.

Our intuitions about the truth conditions of (29) are of little help here. If the first sentence is true, there will only be one such car. So, for this particular example, it is all the same if we analyze the pronoun as referential or quantify it away using existential, definite, or universal force. If it never mattered at all, we would doubtless settle on the weakest of the possibilities, the existential account. Then $\nabla = \exists$ and (31) can simply become (32):

(32) $\exists z(z : T)(s' \models \langle\!\langle \text{GREEN}, z \rangle\!\rangle)$

---

[7] For arguments that motivate this treatment of determiners as types of types, see Section 5 of this paper and G&P (1990b).

[8] We follow here and throughout the convention of representing parameters such as $y_{\langle\!\langle \text{NAMED}, y, \text{"MARK"} \rangle\!\rangle}$ simply as *mark*.

[9] The conservative scope of a quantification incoporates both the restriction type (the type of being a car in the example) and the scope type (the type of being an x owned by Mark in the example).

It is worth pointing out that in all the examples of E-Type pronouns discussed below, the pronoun has at least existential force (though not always an existential with widest possible scope). Thus (32), if not the correct analysis, at least captures a minimal requirement on the correct analysis. That is, all viable alternatives will have to entail (32). And in fact, all the alternatives we discuss do entail it.

There are examples that indicate that the quantificational force of E-Type pronouns is something stronger than the existential in (32). It is sometimes argued (in Kadmon (1987), for example), that the correct analysis must build in an implicature of the uniqueness of the description which the pronoun exploits. Thus, take (33).

(33) Noam wrote a book last year. It was not well received.

This discourse appears to implicate that Noam wrote just one book last year. In support of this claim, consider the oddness of

(34) Bill had a quarter. He gave it to a beggar, and later gave it to another beggar.

What this discourse seems to describe is a situation in which Bill generously gave a quarter to a beggar, somehow got it back, and then gave *the same quarter* to another beggar.[10] If we take both occurences of *it* to be anaphoric to *a quarter*, then the existential analysis would allow for the possibility of two quarters. But the discourse simply cannot be understood that way.[11]

To capture the uniqueness entailment of (33), we might represent the content of an utterance of the second sentence as:

(35) $the\ z(z : T)(s' \models \langle\langle \text{WELL-RECEIVED}, z; 0\rangle\rangle)$
where
$T = [\, x : T'(s \models \langle\langle \text{WRITE-LAST-YEAR}, \text{noam}, x\rangle\rangle)\,]$
$T' = [\, x \mid (r \models \langle\langle \text{BOOK}, x\rangle\rangle)\,]\,|$

We define $the\, z\, \phi$ to be true if and only if there is only one appropriate anchoring for z, and moroever that anchoring satisfies ϕ. The difficulties of

[10] For this example, we are indebted to Makoto Kanazawa.

[11] One might claim that the second *it* is anaphoric to the first, in which case, the existential analysis would associate it with the description *a quarter which Bill had which he gave to a beggar*. This would force the same quarter to occur in both transactions. However, that still doesn't explain why the second *it* cannot be anaphoric to *a quarter*; on an analysis in ∇ was simply existential quantification, this would allow for the possibility of two quarters.

this sort of analysis are discussed extensively in Kadmon (1987); the general outline of the problem can be illustrated with the help of a simple example due to Heim:

(36) I bought a sage plant yesterday. I bought eight others with it.

If we follow the view that ∇ = the, then the semantics of the second sentence of the above discourse becomes something like *I bought eight other sage plants (yesterday) with the unique sage plant I bought yesterday.* The assigned semantics would be self-contradictory, but the discourse does not appear to be. Thus, if there is a uniqueness implicature associated with E-Type pronoun use, that implicature must somehow be made defeasible.

Indeed, the same sort of defeasibility of a uniqueness implicature can be observed with respect to (33):

(37) Noam wrote a book last year. It was not well received. So he wrote a second book that very same year.

There is nothing desperately wrong with this discourse. Nevertheless, there is a clear sense that the facts in question might better have been expressed:

(38) Noam wrote a book that was not well received last year. So he wrote a second book that very same year.

We can roughly capture the facts by assigning a third quantificational force to ∇:

(39) $\exists\wedge\forall\, z(z : T)(s' \models \langle\!\langle \text{BUY-8-OTHERS-WITH}, \text{I}, z\rangle\!\rangle)$
where
$T = [\, x : [\, x \mid (s \models \langle\!\langle \text{SAGE-PLANT}, x\rangle\!\rangle)\,]\,]\mid s \models \langle\!\langle \text{BUY}, \text{I}, x\rangle\!\rangle\,]$

Here, $\exists\wedge\forall$ amounts to non-vacuous universal quantification: $\exists\wedge\forall\, z\, \phi$ is true if and only if ϕ is true for all appropriate anchorings of z, and, moreover, there is some appropriate anchoring that makes ϕ true. Since z in (39) is a restricted parameter, the quantification is over sage plants bought by the speaker in s. What the second sentence in (36) says, then, is that any such sage plant has to be such that eight others were bought with it, and that moreover there is such a sage plant.

Another sort of case that may illustrate a non-vacuous universal force for an E-Type pronoun is (26), repeated here:

(40) Either no doctor has examined Bill today or she didn't write anything on this chart.

Suppose Bill in fact has been examined by two doctors, one who did in fact write something on the chart, one who didn't. Many speakers judge the sentence false in such circumstances; others are undecided. No speakers feel comfortable awarding it an unqualified "true." Assigning either a definite or an existential value to ∇ makes it come out true.

In (40), we thus have a fairly clear case in which fixing ∇ to be universal appears to give the best account of the available candidates. We also have our first clear example of a non-referential use of an E-Type pronoun. In the previous examples, we could have given the pronouns widest possible scope, or even treated them as referential. In (40), it is clear that making the pronoun referential or giving it the widest possible scope, gives the wrong results. The reading we would get would entail that *there is a doctor x such that x examined Bill, and for all such x, either x examined Bill or x didn't write anything on this chart.*

What we want is a reading which allows for the possibility that there is no such doctor:

(41) $(\mathrm{NO}, T) \bigvee \nabla z(z : T)\langle\langle \mathrm{WRITE\text{-}ON\text{-}CHART}, z\rangle\rangle$
where
$T = [\, x : T' \mid \langle\langle \mathrm{EXAMINE}, x, \mathrm{bill}\rangle\rangle)\,]$
$T' = [\, x \mid (r \models \langle\langle \mathrm{DOCTOR}, x\rangle\rangle)\,]$

Thus, (41) gives us a clear case in which treating an E-Type pronoun as referential gives unsatisfactory results; some version of ∇ appears unavoidable. (42) is another such case:

(42) Every farmer who owns exactly one donkey beats it.

Here the same argument we used to motivate an E-Type analysis to begin with applies. Any attempt to extend the scope of the antecedent quantifier to include the pronoun will give us the wrong truth conditions.

An analysis of this example along the lines we have been sketching is straightforward:

(43) $(\mathrm{EVERY}, [\, x : S \mid \nabla z(z : T)(s' \models \langle\langle \mathrm{BEATS}, x, z\rangle\rangle)\,])$
where
$S = (s \models \langle\langle \mathrm{FARMER}, x\rangle\rangle) \wedge (\mathrm{EXACTLY\text{-}ONE} : T)$
$T = [\, y : T' \mid (s \models \langle\langle \mathrm{OWNS}, x, y\rangle\rangle)\,]$
$T' = [\, y \mid (r \models \langle\langle \mathrm{DONKEY}, y\rangle\rangle)\,]$

We have thus far seen examples that point in two different directions for the value of ∇: a definite quantifier in (35), and a non-vacuous universal quantifier in (39). The sage plant shows that uniqueness implicatures are defeasible, but (34) shows that the conditions of that defeasibility are not easy to state.

What we have not seen yet is an example that requires ∇ to be existential, as in (32). Puzzle 5 was meant to provide just such an example:

(44) If you have a quarter, please give it to me.

This example, from Schubert and Pelletier (1989) does not require that the addressee have only one quarter, nor if (s)he has more than one quarter, does (s)he have to give all of them up. One will do. Thus both the universal and the definite analysis seem to fail.[12]

3.2 Donkey Anaphora and E-Types

More examples in which ∇ is existential can be found if we assume donkey pronouns are E-Type. In some cases, both universal and definite values for ∇ get the truth-conditions flat-out wrong, as pointed out in Rooth (1987: Gärdenfors??). Speakers consistently judge sentences like

(45) No farmer who owns a donkey beats it

false if there is *any* farmer-donkey pair where the farmer owns the donkey and beats it. The universal treatment makes the sentence come out true if there is a farmer who owns two donkeys and (s)he beats only one of them. Note that the definiteness analysis of (35) would fare just as badly: the sentence comes out true, because none of the donkey-owning farmers are such that they have exactly one donkey and beat it.

It is worth pointing out here that the classical DRT analysis of Kamp 1981 and the parallel analysis of Heim (1982) gets the above facts just right, in both cases by not taking the pronoun to be E-Type. However the classical DRT analysis has other problems, in particular, the proportion problem, as it is referred to in Kadmon 1987:

(46) Most farmers who have a donkey beat it.

[12] Note that a standard DRT-style analysis of the sort given in Kamp (1981) fails as well, since it is equivalent to the universal analysis in this case.

Here one does not get the right truth conditions by quantifying over farmer-donkey pairs, for there may be many such, but still only a few farmers. Thus if there are five farmers, one of whom owns and beats a thousand donkeys, while the other four own a donkey apiece without beating them, then we still want the sentence coming out false. In such a case, however, quantifying over farmer-donkey pairs makes the sentence comes out true. This problem is easy enough to fix, by re-stating the truth-conditions for quantifiers, but then one immediately gets into the business of deciding between what we have here called the existential and universal analyses. Example (45) shows that sometimes the existential analysis is wanted. But for many speakers, the corresponding quantification with *every* requires the universal analysis: for every farmer x and every donkey x owns, x beats it. It is not at all clear that there is any single generally satisfactory answer for quantificational donkeys. Heim (1990) offers this gloomy summary:

> A number of authors, including Bauerle and Egli (1985) , Root (1986), Rooth (1987), and Reinhart (1987), have advocated variants of the following strategy. Suppose we view donkey sentences with relatives as involving not one but two quantifying operators. One is the QDet, and that binds only the variable corresponding to the head noun; the other is an implicit quantifier of sometimes universal, sometimes existential force, and this binds the indefinite and pronouns anaphoric to it.

Summarizing now: only the existential analysis gets the truth conditions right for (45) and (44). Only the universal analysis gets the truth conditions right in (40), and solves the sage plant problem of (36). Only the definite analysis satisfies our intuitions about uniqueness in simple discourses like (22) or (34). Yet those those same intuitions seem to evaporate in other cases, such as (36). Something makes the quantificational force of the pronoun appear to vary. What seems clear is that in some cases at least, the particular quantificational force that is used seems to be a matter for the pragmatics to decide:

(47) If you catch a Medfly, please bring it to me.

Consider a case in which the speaker is a biologist looking for samples on a field trip to Northern California. Then a single Medfly will do. This context gives a reading exactly parallel to that in (44); the existential analysis is called for. But now consider a case in which the speaker is a health department official engaged in eradicating the Medfly from Northern California.

Then every instance of a Medfly may be crucial, and what the speaker has in mind is that *any* Medfly found should be brought. For this reading the universal analysis will be required.

Note that the same indeterminacy applies to an analogous quantificational donkey-sentence:

(48) Anyone who catches a Medfly should bring it to me.

In Section 6, we present a uniform analysis that we believe accounts for the apparent quantificational variability of E-Type pronouns.

3.3 Plurals, Scope of ∇ and Extra Parameters

We turn now to some other issues, first, plural E-Type pronouns, which are often simpler than singular E-Type pronouns, and then some difficult cases involving more unusual quantificational antecedents.

Consider (49):

(49) Few senators support the immigration bill. They will have to win support from a lot of their colleagues.

Here in a discourse in which the pronoun *they* is anaphoric to *few senators*, it appears to pick out those senators who support the immigration bill. The content of the second sentence an utterance of the second sentence with that anaphoric relation would be:

(50) $\nabla_2 z(z = \text{EXT}(T))(s' \models \langle\langle \text{WIN-SUPPORT}, z \rangle\rangle)$
where
$T = [\ x : [\, x \mid (r \models \langle\langle \text{SENATOR}, x \rangle\rangle)\,] \mid$
$(s \models \langle\langle \text{SUPPORT-BILL}, x \rangle\rangle)\,]$

Here $\nabla_2 z$ means "z has a cardinality of at least 2 ", for whatever quantificational force is chosen. Thus, the analysis of this plural case is exactly like the singular case, with two differences (a) z is constrained to be equal to the extension of the Evans-type, not in it; and (b) there must be at least two z that make the second sentence of the discourse true. Note that, of the plurals, the distinction between the three solutions for ∇ vanishes. There can only be one z such that z is equal to the extension of the Evans-type.

We turn now to Puzzle 3.

(51) Nobody is at the door. I'm not going to let him in.

(52) John didn't plant any daisies. They need water.

All we need in order to account for these examples is existential import for the E-Type pronoun, which all versions of ∇ and ∇_2 have. On any account which grants the pronoun at-least existential import, it is clear that these examples are self-contradictory. If the antecedent of *him* in (51) is *nobody* then the only available interpretation is roughly: *nobody is at the door and there is a person at the door and I'm going to let the person at the door in.* Analogously, (52) must have the interpretation *John didn't plant any daisies and there are daisies John planted and all the daisies John planted need water.* We give a provisional semantics for (51) here; we will deal with (52) in detail below.

(53) (NO, T)

$\nabla z(z : T)(s' \models \langle\!\langle \text{LET-IN}, \text{I}, z; 0 \rangle\!\rangle)$
where
$T = [\, x : [\, x \mid (r \models \langle\!\langle \text{PERSON}, x \rangle\!\rangle)\,] \mid (s \models \langle\!\langle \text{IS-AT-THE-DOOR}, x \rangle\!\rangle)\,]$

Here the crucial point is that ∇ gets wider scope than the negation in the second clause, so that the second clause still has existential import: there is someone x who is at the door and I'm not going to let x in.

The right generalization about ∇ seem to be the following: it takes the widest scope it can without including its antecedent. Examples like the following provide independent justification for giving ∇ such wide scope:

(54) The US has a president. He used to be a Democrat.

(54) has no reading which makes it true at the time of the writing of this article. That is, it has no reading paraphrasable as as *there was a time t at which president of the US at t was a Democrat.* Hence we might characterize the *only* possible scope for the E-Type pronoun as the widest scope that does not include its antecedent.[13]

[13] One difficulty with this characterization arises in opaque contexts, as in Geach's famous hob-nob examples, if these are indeed E-Type anaphora: *Hob believes a witch blighted his mare and Nob believes she burned down his barn.* A similar case, *John thinks that he will catch a fish and he hopes I will grill it tonight,* is discussed in Heim (1990). In both cases "the widest scope not including the antecedent" will assign the pronoun a de re reading with respect to the attitude verb. That the issues involved in such cases may be orthogonal to issues about E-Type anaphora is suggested by the treatment in Saarinen (1978).

We turn now to a question which arises very naturally given the E-Type analysis sketched thus far: E-Type anaphora is by definition anaphora where the pronoun lies outside the scope of its antecedent. To accommodate such pronouns, we have assumed some simple machinery for determining the type which restricts the pronoun parameter with conditions that combine the restrictions on the antecedent with what was predicated of it. But what happens when the antecedent falls under the scope of other parameter absorptions, that is, when the restrictions placed on it, and the predications made of it, are themselves parametric? One might guess that E-Type anaphora becomes impossible, but as it turns out, this is not at all the case.

Let us consider a simple case:

(55) John didn't plant any pansies, but Bill did.

If the content of the sloppy reading of (55) were:

(56) $\neg\exists x\langle\langle \text{PLANT}, \text{john}, x_{r\models\langle\langle \text{PANSY},x\rangle\rangle}\rangle\rangle \wedge$
$\exists x\langle\langle \text{PLANT}, \text{bill}, x_{r\models\langle\langle \text{PANSY},x\rangle\rangle}\rangle\rangle$

then it would be easy to obtain the content of (57) along the lines we have sketched.

(57) They all came up.

It would be:

(58) $(\nabla_2)\, z\ \ (z = \text{EXT}([\, x \mid \langle\langle \text{PLANT}, \text{bill}, x_{r\models\langle\langle \text{PANSY},x\rangle\rangle}\rangle\rangle\,]))$
$\langle\langle \text{CAME-UP}, z\rangle\rangle$

However, an appropriate content for an utterance of (55) would be:

(59) $\langle\langle[\, y \mid \exists x\langle\langle \text{PLANT}, y, x_{r\models\langle\langle \text{PANSY},x\rangle\rangle}\rangle\rangle\,], \text{john}; 0\rangle\rangle \wedge$
$\langle\langle[\, y \mid \exists x\langle\langle \text{PLANT}, y, x_{r\models\langle\langle \text{PANSY},x\rangle\rangle}\rangle\rangle\,], \text{bill}; 1\rangle\rangle$

When interpreting (57), we cannot just get the Evans-type by picking up the type of x that is the scope of that quantification, namely,

(60) $[\, x \mid \langle\langle \text{PLANT}, y, x_{r\models\langle\langle \text{PANSY},x\rangle\rangle}\rangle\rangle\,]$.

Not only is (60) not the type we want, it is inappropriate because of containing a 'free floating' parameter y, which would not get anchored or abstracted away by the operation of any rule of the language. The secret of success here is to recognize that the role to be filled by the E-Type use of the pronoun is outside the scope not only of the quantification,

(61) $\exists x \langle\!\langle \text{PLANT}, y, x_{r \models \langle\!\langle \text{PANSY}, x \rangle\!\rangle} \rangle\!\rangle$,

but also of the abstraction,

(62) $[\, y \mid \exists x \langle\!\langle \text{PLANT}, y, x_{r \models \langle\!\langle \text{PANSY}, x \rangle\!\rangle} \rangle\!\rangle \,]$.

Since the abstract (62) enters into the content of the utterance by having its argument role filled with b, the natural thing to do is replace y by b in (62) to get the actual restriction (63) on the parameter corresponding to the E-Type pronoun.

(63) $[\, x \mid \langle\!\langle \text{PLANT}, \text{bill}, x_{r \models \langle\!\langle \text{PANSY}, x \rangle\!\rangle} \rangle\!\rangle \,]$

This, then, is the simplest case of E-Type anaphora in which the pronoun falls outside the scope not only of its antecedent, but of other absorptions. Typically, such cases will involve a type like the type in (62), a type formed by abstracting on a parameter occurring in the restriction on the pronoun's antecedent. In the case we looked at, that type is a VP content given an argument. Another possibility is that the abstract (62) enters into the content of the utterance not by having its argument role filled, but instead by itself filling an argument role, e.g., of a quantifier. In this case, we will see two different subcases: (i) some other parameter could substitute for the one abstracted over by the quantifier, (ii) no other parameter could. Cases of the second sort were discussed by Webber (1977):

(64) Every farmer bought a cow. My job is to keep watch over them as they graze.

Cases of the first sort also occur, e.g.,

(65) Every student wrote a paper. John submitted it to L&P.

Note that this discourse as a whole appears to presuppose that John is a student. A precise treatment of both types of cases is beyond the scope of the present paper; the important point here is simply this: it often happens that the type formed when the antecedent of an E-Type pronoun is absorbed is itself parametric. In such cases the formation of the Evans type involves some extra complication. Nevertheless, E-Type anaphora is still possible.

4 Absorption and Putative Counterexamples

We return now to the putative counterexamples to the Absorption Principle discussed in the Introduction. These were cases where a pronoun appeared to be anaphoric to an NP whose parameter must be absorbed, according to the Absorption Principle. We will discuss (8), repeated here:

(66) John vasket bilen sin. Den skinnende ren nå.
John washed his car. It is spanking clean now.

The right account of these cases, we believe, is that the the antecedent NP's parameter is absorbed in the first sentence; therefore, since the pronoun occurs outside the scope of its antecedent, the anaphoric relation is E-Type.

Assuming that sloppy readings are obligatory with the Norwegian reflexive *sin*, the content for an utterance of the first sentence in (66) is:

(67) $\langle\!\langle [\, x, y \mid \langle\!\langle \text{WASH}, x, y_{(r \models \langle\!\langle \text{CAR}, y \rangle\!\rangle \wedge \langle\!\langle , \text{OWNS}, x, y \rangle\!\rangle)} \rangle\!\rangle \,], \text{john} \rangle\!\rangle$

Now suppose in an utterance of the second sentence of (66), the pronoun *den* is taken to be anaphoric to *bilen sin*, setting up circumstances in which E-Type anaphora is required. Now when we try to form the Evans type from the scope of the absorption of the pronoun, we find that it is parametric:

(68) $[\, y \mid \langle\!\langle \text{WASH}, x, y_{(r \models \langle\!\langle \text{CAR}, y \rangle\!\rangle \wedge \langle\!\langle , \text{OWNS}, x, y \rangle\!\rangle)} \rangle\!\rangle \,]$

As discussed in the last section, such a parametric Evans type cannot be directly used unless the pronoun falls inside the scope of whatever binds the parameter x. In this case, the parameter x is bound in the VP *washed his own car* and the pronoun is in the next clause. Thus, a non-parametric type must be constructed. In this case, the parameter x is abstracted on to make the subject role of the VP, and that role is labeled with the subject parameter. Thus, we replace x above with that parameter to yield:

(69) $[\, y \mid \langle\!\langle \text{WASH}, \text{john}, y_{(r \models \langle\!\langle \text{CAR}, y \rangle\!\rangle \wedge \langle\!\langle \text{OWNS}, \text{john}, y \rangle\!\rangle)} \rangle\!\rangle \,]$

This is now non-parametric and can be used to restrict the pronoun parameter. Using T to stand for the above Evans-type, the content of an utterance of the second sentence in (66) would be:

(70) $\nabla z (z : T)(s \models \langle\!\langle \text{SPANKING-CLEAN}, z \rangle\!\rangle)$

The same approach will work for the missing antecedent cases discussed in Section 1.

(71) John has not read a Russian novel he hated. But Bill has. It was *War and Peace*.

We are concerned here with the sloppy reading of the VP-ellipsis, the reading on which what is at issue is John's reading novels John dislikes and Bill's reading novels Bill dislikes. On this reading, the content of the VP *read a Russian novel he disliked* must be

(72) $[x \mid \exists y \langle\!\langle \text{READ}, x, y_{(r \models \langle\!\langle \text{RUSSIAN-NOVEL},y\rangle\!\rangle \wedge \langle\!\langle \text{HATE},x,y\rangle\!\rangle)} \rangle\!\rangle]$

We will now attempt to determine the content of an utterance of the third sentence of discourse (71). Intuitively, the antecedent for the pronoun is the NP *a Russian novel he disliked*, with parameter y, but when we try to find the Evans-type that corresponds to that antecedent, we find, first of all, that the antecedent is absorbed in type (72) (whose body is parametric in x), and second, that that type is used in two places in the content of the discourse. We first consider the case where the occurrence of the type we use is the second occurrence, that is the occurrence predicated of Bill; this will lead us to the intended interpretation of the discourse. Then we consider the alternative analysis, which will lead to a contradictory interpretation of the discourse.

The situation here is entirely analogous to the situation discussed for example (55). The argument-role formed by abstracting on the parameter x is fed the argument *Bill*. To find the Evans-type, we substitute that parameter into the type in (72). The result is:

(73) $T = [y \mid \langle\!\langle \text{READ}, \text{bill}, y_{(r \models \langle\!\langle \text{RUSSIAN-NOVEL},y\rangle\!\rangle \wedge \langle\!\langle \text{HATE},\text{bill},y\rangle\!\rangle)} \rangle\!\rangle]$

The only parameters in this type are parameters accounted for by the circumstances (the parameter *bill*, which will be anchored to some individual named "Bill"). This then is an appropriate type to use as our Evans-type. Calling (73) T, the content of the third sentence of (71) is:

(74) $\nabla z(z : \text{T})\langle\!\langle \text{EQUAL}, z, \text{W\&P}\rangle\!\rangle$

Suppose that we had instead used the second occurrence of type (72) in the content of the discourse to form our Evans type. There the argument fed to the type is the parameter for John rather than the parameter for Bill. The result of our substitution would have been:

(75) $T' = [y \mid \langle\!\langle\ \text{READ}, \text{john}, y_{(r \models \langle\!\langle \text{RUSSIAN-NOVEL},y\rangle\!\rangle \wedge \langle\!\langle \text{HATE},\text{john},y\rangle\!\rangle)} \rangle\!\rangle]$

But then our content for the discourse as a whole would have contained the conjunction:

(76) $\langle\!\langle [\, x \mid \exists y \langle\!\langle$ READ, x, $y_{(r \models \langle\!\langle \text{RUSSIAN-NOVEL}, y \rangle\!\rangle \wedge \langle\!\langle \text{HATE}, \text{x}, y \rangle\!\rangle)} \rangle\!\rangle\,]$, john; $0 \rangle\!\rangle \wedge$
$\nabla z (z : T')(s \models \langle\!\langle \text{EQUAL}, z, \text{W\&P} \rangle\!\rangle)$

But, since ∇ always has at least existential force, this claims there is no Russian novel that John has read and hated and that there is a Russian novel that John has read and hated, and it's *War and Peace*. This is contradictory.

We can also provide an account of the $\bar{\text{N}}$ anaphora facts exhibited in (14) if we assume that $\bar{\text{N}}$ contents are nonparametric types.[14] We first consider a simple case in order to show the basic lines of the treatment. Let $*$P refer to the plural predicate holding of an entity e iff P holds of all the atoms in e (cf. Link, 1983). Furthermore, let $T = [\, d \mid r \models \langle\!\langle *\text{DONKEY}, d \rangle\!\rangle\,]$. Then we represent the first sentence in (77) as (78):

(77) Pedro owned several donkeys. Raul bought two $\emptyset$.

(78) $\langle\!\langle \text{OWNED}, p, x_{\langle\!\langle \text{T}, x \rangle\!\rangle \wedge \langle\!\langle >, |x|, 1 \rangle\!\rangle} \rangle\!\rangle$

NI&L distinguish two readings of $\bar{\text{N}}$ anaphors. The less common, but logically simpler reading is the "unrestrained" reading. On this reading the content of the second utterance is merely that that Raul bought two donkeys:

(79) $\langle\!\langle \text{BOUGHT}, r, y_{\langle\!\langle \text{T}, y \rangle\!\rangle \wedge \langle\!\langle \geq, |y|, 2 \rangle\!\rangle} \rangle\!\rangle$

The more common, and logically more complex, reading is the "restrained" one, with the content that Raul bought two of the donkeys THAT PEDRO OWNED.

In order to represent the restrained reading, we need an Evans-type as well as (80), which leads to a representation of content (81). This can only hold if Raul bought two of the several donkeys that Pedro owned—exactly the restrained reading.

(80) $T_E = [\, d (d : T') \mid s \models \langle\!\langle \text{OWN}, p, d \rangle\!\rangle\,]$
where $T' = [\, d \mid r \models \langle\!\langle *\text{DONKEY}, d \rangle\!\rangle\,]$

[14] This deviates from the proposal in NI&L, in which $\bar{\text{N}}$ contents were plural entities. The more familiar type denotations ease presentation here, particularly that of donkey anaphora.

(81) $\langle\langle \text{BOUGHT}, r, y_{\langle\langle T_E, y\rangle\rangle \wedge \langle\langle \geq, |y|, 2\rangle\rangle} \rangle\rangle$

We omit illustrating the treatment of simple quantified antecedents, and turn directly to $\bar{\text{N}}$ anaphors with missing (donkey) antecedents.[15] We represent the first sentence in (82) as (83), given the defintion of T:

(82) $T = [\, f(f : T'') \mid r \models \exists\, d(d : T')\langle\langle \text{OWN}, f, d\rangle\rangle \,]$
where
$T' = [\, d \mid (r \models \langle\langle *\text{DONKEY}, d\rangle\rangle)\,]$
$T'' = [\, f \mid (r' \models \langle\langle *\text{FARMER}, f\rangle\rangle)\,]$

(83) P knows several [farmers who own donkeys$_j$]$_i$. Most $\emptyset_i$ beat them$_j$.

(84) $\langle\langle \text{KNOW}, p, x_{\langle\langle \text{T}, x\rangle\rangle \wedge \langle\langle >, |x|, 1\rangle\rangle} \rangle\rangle$

And the unrestrained reading of the anaphoric utterance is just:

(85) $\langle\langle \text{MOST}, x_{\langle\langle \text{T}, x\rangle\rangle \wedge \langle\langle \text{ATOM}, x\rangle\rangle}\ \langle\langle \text{BEAT}, x, \mathbf{PRO}\rangle\rangle \rangle\rangle$

We note a potential antecedent for **PRO** in the restriction on the variable bound by MOST, viz., the variable d in T (defined above). The associated E-Type is just:

$$T'_E = [\, d(d : T') \mid r \models \langle\langle \text{OWN}, x, d\rangle\rangle \,]$$

N.B. that the variable f in T (cf. 82) has been renamed x above, reflecting the fact that T has been required to hold of x. Given this E-Type, we can specify the content of the anaphoric utterance more exactly:

$$\langle\langle \text{MOST}, x_{\langle\langle \text{T}, x\rangle\rangle \wedge \langle\langle \text{ATOM}, x\rangle\rangle}\ \nabla\, z_{\langle\langle T'_E, z\rangle\rangle} \langle\langle \text{BEAT}, x, z\rangle\rangle \rangle\rangle$$

So the second utterance describes a situation in which most farmers who own donkeys beat (at least) some of the donkeys they own. The restrained

[15] We should note, however, that the NI&L treatment provides an explanation for the apparent absence of restrained readings with genuinely quantificational antecedents, i.e., the apparent failure of sequences such as the following to admit a restrained interpretation:

Few men smoked. Some drank.

But we note that an explanation should follow from whatever mechanism explains the normal failure of these genuinely quantificational examples to support pronominal anaphora—provided that this explanation makes the E-Types unavailable.

reading of the $\bar{N}$ anaphor is straightforwardly obtained by adding a condition to T above (which amounts to using the E-Type construal of *farmers*).

This treatment here preserves the benefits of the NI&L analysis even while maintaining the Absorption principle. What has been emphatically abandoned is the hypothesis that anaphoras always involves the re-use of of the content of some previsous linguistic form; but the mere existence of E-Type anaphora demonstrates that anaphora cannot (always) merely reuse contents.

5 The Status of the Absorption Principle

In G&P, we claimed that the Absorption Principle explains why sentence (86) has no "sloppy identity" reading when *she* is anaphoric to *her mother* if *her* is simultaneously anaphoric to *my wife*,

(86) My wife forgot her mother's birthday this year, and so did she

While it is true that no Q-Type analysis will license this anaphoric relation, there is an E-Type analysis that will. The question arises then, what force does the AP have in our revised system? In this section we argue that the AP still makes important predictions; first, about anaphora; second, about Quantifiers, particularly, for the revised account of Quantification given in G&P 1990b.

Even in combination with with E-Type analysis, the Absorption Principle, taken together with some natural restrictions on E-Type anaphora, makes a number of predictions. Consider:

(87) Every student revised *a paper he wrote.* # *It* was accepted by L & P.

Here the indicated anaphoric relation is impossible. The Absorption Principle rules out the possibility of a Q-Type analysis.[16]

[16] In order to explain why no anaphora at all is possible here, we must also explain why no E-Type analysis is possible. Since E-Type anaphora allows a pronoun to be anaphorically related to a quantifier whose scope the pronoun lies outside off, the question arises of why this isn't possible in every case. Possibly some constraint of the following sort is required:

The Distinguishability Requirement

The antecedent clause must not implicate that there is more than one witness to the Evans-type.

We turn now to predictions made by the Absorption Principle for cases of Q-Type anaphora. These basically concern what readings are available. Here is an example discussed in detail in G& P.

(88) Alice praised the book she hated and Betty did too.

The claim about this case is that there is no *reading* of this sentence in which the elliptical VP is given a sloppy interpretation and Alice and Betty are *understood* as praising the same book. Contrast:

(89) Alice praised the book because she hated it and Betty did too.

Here there is a *reading* available on which the elliptical VP is assigned the sloppy interpretation, and yet Alice and Betty praise the same book. It is important to stress that we are not claiming that the truth conditions of (88) require that Alice and Betty praise different books. Rather we are saying there is no *reading* which requires that they praise the same book. This contrasts with the facts for (89), where there is such a reading, namely the one on which the definite is given wide scope over both VP's. The Absorption Principle entails that there is no wide-scope option for (88).

Finally there are predictions made by the Absoprtion Principle that concern scope directly, and do not involve anaphora. Consider another example discussed in G&P:

(90) Carol hasn't yet met the author of a book about anaphora.

The general tendency is for indefinites inside the VP to take narrow scope inside negation, and for definites to take wide scope. Yet there is no way in 90) for both the definite and the indefinite to take their "natural" scopes. This is due to the analysis of the NP *the author of a book about anaphora*:

(91) y_ρ where
$\rho = (s_\mu \models \langle\!\langle \text{AUTHOR-OF}, y, x_\tau \rangle\!\rangle))$
$\tau = (s'' \models \langle\!\langle \text{BOOK-ABOUT-ANAPH}, x \rangle\!\rangle)$

Here the restriction μ is what makes the definite NP definite:

(92) $\mu = \text{UNIQUE}(s, [\, y \mid \langle\!\langle \text{AUTHOR-OF}, y, x_{(s'' \models \langle\!\langle \text{BK-ABT-ANAPH}, x \rangle\!\rangle)} \rangle\!\rangle \,])$

Here UNIQUE is a relation holding between a situation s and a property P, if and only if there is exactly one individual that has P in s. The important point here is that y depends on x in (92). Thus if x is absorbed, y must be. If the indefinite takes scope inside negation in (90), the definite must too.

There is another another more theory-internal function served by the Absorption Principle. In a system which recognizes the distinction between Generalized Quantifiers and Referential NP's, it gives us a unified explantion of certain scoping facts common to both Generalized Quantifiers and Referential NP's. Consider:

(93) *Every student* revised at least two papers *he* wrote.

When the indicated anaphoric relation holds, the Quantificational NP ***at least two papers he wrote*** must take scope inside that of ***every student.*** This is simply because that NP is associated with a parameter dependent on the subject NP's parameter. Hence, when subject quantfiier is quantified in, the object quantifier must already be quantified in. This is entirely parallel to the judgement for (87). The explanation for both facts is the same, and that explanation crucially involves an appeal to the Absorption Principle.

Although the facts in (93) and (87) are quite analogous, there was no single explanation for them in the system of G&P. G&P relied on the Absorption Principle to rule out the unwanted reading of (87), but appealed to their analysis of GQ's to rule out the unwanted reading of (93).

For this and related reasons, G&P (1990b) abandoned the Generalized Quantifier analysis. Instead of being relations on properties, Quantificational Determiners became types of types.

To illustrate first with a simple example, consider (94):

(94) Most elephants don't fly.

On the Generalized Quantifier analysis this is:

(95) $\langle\!\langle \text{MOST}, \ [x \mid (r \models \langle\!\langle \text{ELEPHANT}, x \rangle\!\rangle)], \ [x \mid (s \models \langle\!\langle \text{FLY}, x; 0 \rangle\!\rangle)] \rangle\!\rangle$

We propose instead that it is:

(96) $(\text{MOST}, [x_{(r \models \langle\!\langle \text{ELEPHANT}, x \rangle\!\rangle)} \mid (s \models \langle\!\langle \text{FLY}, x; 0 \rangle\!\rangle)])$

Note that the quantified noun phrase *most elephants* fills the subject argument role of the VP *don't fly* with a parameter restricted to elephants, just as the noun phrase *an elephant* would. Thus Quantified NP's on this account are more like Referential NP's than they were on the old account.

We are now in a position to give a unified explanation of the "scope" facts in (93) and (87). In both cases the NP containing a pronoun is treated as restricted parameter, y. In both cases, y depends on the pronoun parameter

x. Thus, in both cases, the maximal scope of the pronoun parameter is also the maximal scope of y.

As a bonus, the G&P analysis of Quantification makes a unified treatment of NP semantics possible, one which will still maintain the distinction necessary for an adequate analysis of Q-Type anaphora. The Described Objects of both kinds of NPs are restricted parameters.

With this view, we can now give the semantics for Referential NPs and Quantificational NPs with a single semantic composition rule. That rule will simply place the restriction given by the NP's $\bar{N}$ on the NP's described object. Quantifying in is a separate phenomenon, mediated by facts in the circumstance, as sketched in G&P. But even there, Referential NPs and Quantificational NPs can be alike. Both kinds of NP can quantify in.

The revised analysis of Quantification proposed in Gawron and Peters (1990b), taken together with the Absorption Principle, thus allows a very natural account of some basic facts of NP semantics.

6 The Proper Treatment of E-Type Anaphora

In closing, let us summarize our final analysis of E-Type uses of pronouns, which both captures their existential import for the quantification that is their antecedent and explains the apparent fluctuation in their force.

Singular and plural pronouns behave slightly differently in E-Type use; so we have two cases to consider:

(i) E-Type uses of the singular pronouns *he*, *she*, *it* and their accusative and genitive congeners,

(ii) E-Type uses of the plural pronoun *they* and its accusative and genitive congeners.[17]

Singular and plural are alike, however, in that E-Type uses of *he*, *she*, *it* and *they* impose restrictions (as do deictic and Q-Type uses) on the value the pronoun can take on (roughly that they be male, female, inanimate and at least two in number, respectively). Recall also that, in contrast with Q-Type anaphoric uses of non-reflexive, third person pronouns, E-Type uses are possible only when the scope of the antecedent does not include the pronoun.

[17] Reflexive pronouns (*himself*, *herself*, *itself* and *themselves*) and non-third person pronouns (*I*, *you*, *we* and their accusative and genitive congeners) do not have E-Type uses.

To bring out a distinguishing feature of singular E-Type pronouns, we consider the discourse

(97) Noam wrote a book last year. It was not well received.

Together with the rules of English, the circumstances of utterance of the discourse (97) determine that the content of the first statement in it is (98).

(98) $\exists y \langle\!\langle\ [x \mid \langle\!\langle \text{WROTE LAST YEAR}, x, y_{\langle\!\langle \text{BOOK},y \rangle\!\rangle}, \rangle\!\rangle], \text{noam}\ \rangle\!\rangle$

The circumstances of utterance determine that the antecedent of *it* in the second statement is the constituent

$$\exists y \langle\!\langle\ [x \mid \langle\!\langle \text{WROTE LAST YEAR}, x, y_{\langle\!\langle \text{BOOK},y \rangle\!\rangle}, \rangle\!\rangle], \text{noam}\ \rangle\!\rangle$$

of (98). So the semantic rules determine that the Evans type T_E for this use of *it* is $[y \mid \langle\!\langle\ [x \mid \langle\!\langle \text{WROTE LAST YEAR}, x, y_{\langle\!\langle \text{BOOK},y \rangle\!\rangle}, \rangle\!\rangle], \text{noam}\ \rangle\!\rangle]$. Intuitively, we want this E-Type use of *it* to have as its content the object that is of this type, provided that the object is nonhuman. That is, we want the pronoun's content to be $z_{(z:T_E) \wedge \langle\!\langle \text{HUMAN},z;0 \rangle\!\rangle}$.[18]

The obvious question is: What if nothing is of the Evans type, or more than one thing is of that type? The question gets different answers in the two cases. If nothing is of the Evans type, the clause containing the E-Type pronoun should be false, giving E-Type pronouns existential import for their antecedent. We accomplish this by insisting that the restricted parameter as which an E-Type pronoun is interpreted be existentially quantified away. We mentioned in Section 3 that the scope of this quantification is as large as possible without including the quantification that is the pronoun's antecedent.

If the Evans type has more than one object in its extension, we must account for the fact that the E-Type pronoun picks out a single object. We capture this by using a choice function χ in interpreting E-Type uses of singular pronouns.[19] We interpret an E-Type use of *it* for which the

[18] When an object of an Evans type is human, an E-Type utterance of *it* cannot have that person as its content. This fact is what prevents an E-Type use of *it* with antecedent *an astrologer* in

(99) Noam quoted an astrologer last year. # It was flattered.

[19] A choice function is a function γ such that $\gamma(S) \in S$ for any nonempty set S.

Evans type is T_E as $\chi(ext(T_E))$ provided this object is nonhuman. All E-Type uses of pronouns with the same antecedent will thus get the same interpretation. Accordingly the restricted parameter (the E-Type pronoun *it*'s content) above should instead be

$$z_{(z=\chi(ext(T_E))\wedge\langle\langle \mathrm{HUMAN},z;0\rangle\rangle}.$$

Therefore, an E-Type use of *it* gets a well-defined value if and only if neither of two conditions obtains:

(i) $ext(T_E)$ is the empty set,

(ii) $\chi(ext(T_E))$ exists and is human.

In the event no value is defined for an E-Type use of *it* or another pronoun, any basic proposition is false which is supposed to have the pronoun's interpretation as an immediate constituent, there being no object of the type to which the existentially quantified parameter is restricted.

We explain the apparent fluctuation in force of singular E-Type pronouns, described in Section 3, with the aid of the following hypothesis:

> (100) The choice function χ used in interpreting E-Type uses of singular pronouns is fixed for a discourse and is not under the control of any speaker participating in that discourse.

The key fact is that no speaker controls χ; neither the speaker whose utterance provides the antecedent for an E-Type use of a singular pronoun, nor the possibly different speaker who makes E-Type use of the pronoun fixes χ with their utterance. Because of this, the only way someone who utters a singular E-Type pronoun can be sure of speaking truthfully (or otherwise accurately) is to take care that the truth (accuracy) of her utterance is not affected by whatever choice χ may make out of the extension of the Evans type that the pronoun picks up from its antecedent. We appeal to this fact in explaining all of the apparently different forces (purely existential, definite singular, non-vacuous universal) encountered in Section 3.

The fact that the pronoun may denote any object of the Evans type allows one to be sure of speaking the truth in stating:

> (101) I bought a sage plant yesterday. I bought eight others with it.

just in case one did buy (at least) nine sage plants the previous day.

Let us first discuss why

(102) Either no doctor has examined Bill today or she didn't write anything on this chart

appears to claim that *every* doctor who examined Bill today refrained from writing anything on the chart. The explanation is, in fact, straightforward. The E-Type pronoun *she* is interpreted as the restricted parameter

$$z_{(z=\chi(ext(T_E))\wedge\langle\langle \text{FEMALE},z\rangle\rangle}$$

where the Evans type T_E is

$$[\,y \mid \langle\langle\ [\,x \mid \langle\langle \text{EXAMINED TODAY}, x, \text{bill}\rangle\rangle\,],\, y_{\langle\langle \text{DOCTOR},y\rangle\rangle}\ \rangle\rangle\,]$$

This restricted parameter is existentially quantified with scope over just the second disjunct of (102). So the proposition that is asserted to be true unless the first disjunct is is

$$\exists z\langle\langle[\,x \mid \exists v\langle\langle \text{WROTE ON CHART}, x, v\rangle\rangle\,],\, z_{(z=\chi(ext(T_E))\wedge\langle\langle \text{FEMALE},z\rangle\rangle}; 0\rangle\rangle$$

If the first disjunct of (102) is false, the Evans type T_E has a nonempty extension, S; in that case, the truth of the second disjunct, and therefore of the whole statement, depends just on whether the member of S that χ chooses didn't write anything on the chart (and is female). So if more than one doctor examined Bill today, the statement's truth depends entirely on which one of them the function χ chooses. Since the speaker has no control over which one is chosen, the speaker's responsibility to assure that his statement is true can be met only if all of those doctors wrote nothing on the chart (and are female).

Note that this pragmatic explanation of the appearance of universally quantified force does not claim that the content of the speaker's assertion is a universally quantified proposition. The actual content, according to our analysis, is more like a singular proposition. If two doctors examined Bill today and one wrote something on the chart but the other didn't, an utterer of (102) might be lucky enough to speak the truth because χ happened to choose the doctor who didn't write on the chart. However, it would not be responsible to make the statement in such a situation since the speaker might just as easily be unwittingly making the false statement that the other doctor didn't write on the chart. Thus one should assert (102) only if no examining doctor wrote on the chart.

We similarly derive an explanation of the fact that it is incorrect to state:

(103) No farmer who owns a donkey beats it

if every donkey-owning farmer refrains from beating at least one donkey she owns but some farmer owns more than one donkey and beats at least one of them. The speaker has no control over which donkey the pronoun *it* will denote for each of the farmers. Thus the appearance of something akin to universal quantification comes from the fact that if more than one witness is of the Evans type of the antecedent, then the pronoun must be able to denote any of them without detracting from the accuracy of what is said. The only added twist in this case is that the Evans type T_E is $[\,y \mid \langle\!\langle \text{OWNS}, x, y_{\langle\!\langle \text{DONKEY}, y \rangle\!\rangle} \rangle\!\rangle\,]$, which has a parameter x for a farmer. It is precisely this, of course, which allows the value of E-Type *it* to vary with the farmer who owns the donkey.

E-Type use of a pronoun can appear to carry the quantificational force of definiteness arise because all E-Type pronouns with the same antecedent denote the same value. Thus

(104) Bill had a quarter. He gave it to a beggar, and later gave it to another beggar.

describes two events involving the same quarter.

The appearance of mere existential force in

(105) If you have a quarter, you should give it to that beggar.

comes from the fact that the pronoun does actually denote just one single object of the Evans type (if it denotes at all). The content of the conditional assertion is that the addressee should give the beggar the one quarter in his or her pocket which *it* denotes. Thus no assertion is made that the addressee should give more than one quarter to the beggar. Of course, the injunction asserted in (105) nevertheless applies indifferently to any quarter the addressee has in his or her pocket, not singling out one above the others as the one that should be given away, for the same reason we discussed in connection with apparently universal E-Type cases.

Our account gives no uniqueness entailment from an E-Type pronoun. If there is an implicature following from

(106) Noam wrote a book. It was not well received.

that Noam wrote exactly one book, then that is a separate matter. Note that uniqueness can at most be an implicature, since examples like (101) show

uniqueness is cancellable. Moreover, in the face of examples like (102) and (103), it is hard to even argue for a generalized conversational implicature.

E-Type uses of the plural pronouns *they*, *them*, and *their* are interpreted as a parameter

$$z_{(z=ext(T_E))\wedge(\mathrm{Card}(z)\geq 2)}.$$[20]

In these plural cases, no choice is needed of one member from the multi-membered extension of the Evans type.

Recall that the antecedent of an E-Type pronoun is not a syntactic NP but rather a constituent of content, in particular the counterpart of the closure of an utterance of a syntactic NP. For example, the antecedent of the E-Type use of *they* in (107) is not the NP *any pansies*.

(107) John didn't plant any pansies. But Bill did. They all came up.

Instead the antecedent is the constituent of the content of *But Bill did* that is the counterpart of the closure of *any pansies*. (The circumstances of utterance of *they* determine this fact.) More precisely, in the content

(108) $\langle\!\langle [\, x \mid \exists_2 y \langle\!\langle \mathrm{PLANT}, x, y_{\langle\!\langle \mathrm{PANSY}, y\rangle\!\rangle}\rangle\!\rangle\,], \mathrm{john}; 0\rangle\!\rangle \wedge$
$\langle\!\langle [\, x \mid \exists_2 y \langle\!\langle \mathrm{PLANT}, x, y_{\langle\!\langle \mathrm{PANSY}, y\rangle\!\rangle}\rangle\!\rangle\,], \mathrm{bill}; 1\rangle\!\rangle$

of the first two subutterances in (107), the antecedent of the E-Type use of *they* is the second occurrence of the closure $\exists_2 y \langle\!\langle \mathrm{PLANT}, x, y_{\langle\!\langle \mathrm{PANSY}, y\rangle\!\rangle}\rangle\!\rangle$. Now this closure, and thus the type $[\, y \mid \langle\!\langle \mathrm{PLANT}, x, y_{\langle\!\langle \mathrm{PANSY}, y\rangle\!\rangle}\rangle\!\rangle\,]$, have a parameter x for the planter of the pansies in question, while the Evans type for this pronoun should have the anchored parameter 'bill' in place of x. To obtain the Evans type, we observe that when a parameter of the closure that serves as antecedent is abstracted on with a scope that does not include the E-Type pronoun (as x is in (108) in forming a property), and the argument role produced by this abstraction is filled (with 'bill' for the relevant occurrence of the property), then the Evans type is the result of replacing the first parameter by what fills the argument role.[21] Therefore, in this case T_E is $[\, y \mid \langle\!\langle \mathrm{PLANT}, \text{'bill'}, y_{\langle\!\langle \mathrm{PANSY}, y\rangle\!\rangle}\rangle\!\rangle\,]$. So the content of the final subutterance of (107) is $\exists z \langle\!\langle [\, x \mid \forall y \langle\!\langle \mathrm{CAME\ UP}, y_{y\in x}\rangle\!\rangle\,], z_{(z=ext(T_E))\wedge(\mathrm{Card}(z)\geq 2)}\rangle\!\rangle$.

[20] In a fragment more closely concerned with plural logic, one might follow Link's lead and take the pronoun to denote the 'individual sum' of the set.

[21] If the argument role produced by abstracting over parameters like x is not filled, other cases arise, as in Webber's

(109) [(i)]Every farmer bought a donkey. It's my job to feed them.

This analysis fully captures the behavior of E-Type *they* except for two facts, which we stipulate:

(i) the NP whose closure is the counterpart of the pronoun's antecedent must have the same grammatical number as the pronoun, and

(ii) no E-Type pronoun can c-command (what would have been) its antecedent (if that weren't missing).[22]

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