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## Binding Implicit Variables in Quantified Contexts

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1. **Background and Overview.** It is well-known that English third-person pronouns can function variously as deictic or demonstrative elements, as discourse anaphors, and as bound variables, as illustrated in (1), (2), and (3) respectively.<sup>1</sup>

- (1) Deictic or demonstrative: *Who's he?*
- (2) Discourse anaphoric: *A woman walked in. She sat down.*
- (3) Bound variable: *Every man believed he was right.*

In a typical use of (1), the pronoun gets its value from the non-linguistic context of the utterance, the context in which the speech act occurs. In a discourse anaphoric case like (2), the pronoun takes its value from the constructed discourse context. In a bound variable case like (3), the pronoun is interpreted as a variable bound by a variable-binding operator associated with the interpretation of *every man*.

Unified treatments of these uses of pronouns became available with the work of Kamp (1981) on discourse representation theory and Heim (1982, 1983) on file change semantics. Extensions to temporal and locative anaphora, where similar ranges of behavior can be found, have been made by Bäuerle (1979), von Stechow (1982), Hinrichs (1981), Partee (1984b), and Cooper (1986), among others. Some temporal examples are given in (4-6).

- (4) Deictic past reference time: *I didn't turn off the stove.*
- (5) Discourse anaphoric reference time: *Mary woke up sometime in the night. She turned on the light.*
- (6) "Bound variable" past reference time: *Whenever John wrote a letter to Mary, she answered two days later.*

For arguments that (4) must be understood as anchored to a contextually definite past reference time rather than (as in traditional tense logic) as involving existential quantification over past times, see Partee (1972). Example (5) is parallel to example (2) in that the reference time which anchors the tense in the second sentence in (5) is introduced by an indefinite description ("sometime in the night") in the preceding sentence. And example (6) shows bound-variable-like behavior of the reference time: the dependent element *later* in the main clause is interpreted, in effect, as "later than *t*", with *t* the letter-writing time that is quantified over by the *whenever*-clause.

Against this background, the descriptive and theoretical concerns of this paper can be stated as follows. First, as the central descriptive concern, I want to argue for the need for

extensions of treatments of pronominal anaphora to a much broader class of contentful context-dependent elements which can also exhibit bound-variable-like behavior, such as *local*, *enemy*, *foreigner*, *arrive*, *opposite*, *unfamiliar*. A key claim on which this concern rests is that "anaphoric" or "dependent" elements which exhibit the range of types of behavior illustrated in (1-3) and (4-6) occur as commonly (proportionally) among open-class as among closed-class items.

Among the demands that a descriptively adequate treatment of such elements will place on the lexicon is the need for a way to lexically specify constraints on the kinds of contexts that different dependent elements may be sensitive to. For example, although English third-person pronouns exhibit the full range of behavior illustrated in (1-3), there are other dependent elements that do not. The first-person pronoun *I* in English can anchor only to the utterance context<sup>2</sup>, as *he* does in (1), and has no behavior analogous to that of the pronouns in (2) and (3). Thus we cannot use *I* as a bound variable even when quantifying over speakers<sup>3</sup>; (7) and (8) below have no readings where *I* ranges over the speakers in question.

(7) Every speaker has difficulty stopping when *I* should.

(8) Every person in line said that *I* had been waiting for over an hour.

On the other hand, English reflexives like *himself* and *myself* have only bound variable uses<sup>4</sup> and can only find their antecedents sentence-internally. The plural first-person pronoun *we* presents an interesting descriptive challenge: its interpretation is a group which must include the *I* of the utterance context, but whose other members may be anchored to any of the kinds of contexts given in (1-3) or to a combination thereof, as *I* will illustrate later.

I should note explicitly that there are many other properties of anaphoric-like elements that need to be explored within and across languages. I will be focussing here on the variation illustrated in (1-3) and (4-6), particularly on evidence that shows that large numbers of open-class lexical items act as though their meaning includes something like a bound-variable part. It is this behavior that I think argues most strongly for a need to integrate this kind of context-dependence more thoroughly into sentence-grammar. But I think that this is probably just the tip of an iceberg, and that once we start looking more systematically at the possible extension of typological classifications of pronoun-like elements to large parts of the open-class vocabulary, we will find a very large and fertile field of study opening up.

The theoretical concern that naturally emerges from such observations is how to articulate a theory which illuminates both the commonalities and the differences between pronouns and other dependent elements, and the kinds of parameters along which such

elements can vary both within and across languages. I do not have such a theory to offer here, but I will suggest some properties that I believe such a theory should have. At the very least I am convinced that we need a more comprehensive theory of context-dependent elements in which pronouns occupy one relatively extreme position on a continuum and open-class predicates with descriptive content and no dependence on context are at the other. If words like *local*, *enemy*, *arrive*, etc. which have both descriptive content and pronoun-like context-dependence in their meanings are the norm rather than the exception, then we can't rest with theories which divide lexical meanings into constants (names, predicates, "R-expressions") and variables, or into constants, variables, and demonstratives, treating these as disjoint classes.

In section 2 I will present some of the kinds of data that support my basic descriptive claims about the varied kinds of context-dependence, including bound-variable-like behavior, of many open-class words. In section 3 I will make some brief comparisons between pronouns and this broader class of dependent elements with respect to syntactic constraints. Since the similarities raise the natural suggestion that the "pronoun-like parts" of the meanings of open-class context-dependent words might just reflect the presence of some kind of null pronouns at some syntactic level of representation, I will discuss this possibility in section 4, along with my reasons for finding it implausible and preferring to explore other approaches. Finally, in section 5, I will offer some positive suggestions in the direction of a unified theory of "quantified contexts", building on Heim's view that the basic semantic values of expressions are their context-change potentials. I think it should be possible to extend earlier insights of Stalnaker, Kamp, Heim, and others so as to bring context-dependence and semantic content even closer together and to forge a more unified treatment of context-dependence and variable-binding; but my suggestions in this section remain speculative.

2. Initial Data. The possibility of bound-variable-like dependence of open-class predicates was first brought to my attention by the work of Jonathan Mitchell in the early 1980's (see Mitchell (1986).) Mitchell's observations included examples like (9) below.

- (9) (a) John visited a *local* bar.  
 (b) Every sports fan in the country was at a *local* bar watching the playoffs.

Ignoring the sense of *local* which contrasts with *regional*, *national*, *international*, etc., we can say that *local* has to be anchored to some reference location, and means something like "in the vicinity of [the reference location]". In example (9a), the reference location could be the utterance location, or, if the sentence is part of a longer narrative with John as the

protagonist, the reference location could be wherever John was at the time. These represent deictic and discourse anchors respectively. While *local* in (9b) could also be understood as anchored to the utterance location or some specific discourse location, the most likely interpretation and the one I am most interested in here is one with a "bound variable reference location" -- i.e., a possibly different location for every sports fan (his home or home town, for instance, or whatever it is that makes a bar "your local bar".)

A similar phenomenon, though one which looked more like a case of a null argument, had been noted by Dowty (1982), who gave examples (10a,b) below:

- (10) (a) Bill was nervously biting his nails. Everyone noticed. [13]
- (b) Every secretary made a mistake in his final draft. The good secretary corrected his mistake. Every other secretary didn't even notice. [16]
- (c) Every man who shaves off his beard expects his wife to notice.

Intransitive *notice* is interpreted like transitive *notice* with a contextually definite object (unlike intransitive *eat*, which is interpreted as having an existentially quantified object argument). In (10a), the discourse context provides the understood value for the "missing object". Dowty offers (10b) as an example parallel to Karttunen's well-known "paycheck" sentences, where the missing object acts like a kind of "pronoun of laziness." And in (10c) we have an example that permits a bound variable interpretation, where the understood argument of *notice* is, for each man, his own newly beardless state.

The examples in (9) concerned an adjective, (10) a verb; Partee (1984a) observed that the same behavior can be found with one-place versions of some relational nouns, like *enemy* and *friend*, as in (11).

- (11) (a) An *enemy* is approaching.
- (b) John faced an *enemy*.
- (c) Every participant had to confront and defeat an *enemy*.

*Enemy* in (11a) is likely to be understood as my or our enemy; note that *approaching* in (11a) is itself context-dependent, and if the context supported an understood goal argument of *approaching* other than me or us, the interpretation of *enemy* would probably shift accordingly. (This phenomenon is easier to observe if one changes the example to past tense.) In (11b), a likely interpretation of *enemy* is an enemy of John or of John's group, partly because of the choice of verb<sup>5</sup>. And in (11c), we have the possibility of a bound variable reading, where who counts as *enemy* or *friend* could be different for different participants.

The case of *enemy* raises interesting issues concerning the relative primacy of the two-place relation *enemy of* and the one-place property that results when the second argument is filled in -- e.g. the one-place property that Richard Nixon had in mind in compiling his "Enemies List", which might be expressed as "enemy of Richard Nixon". The two-place relation is clearly more general, but, as Mitchell (1986) argued<sup>6</sup>, it does not follow that every instance of the one-place property is best analyzed as derived from the two-place one by filling in or quantifying over one argument place. In particular, an egocentric one-place version of *friend* or *enemy* may be ontogenetically and developmentally prior to the emergence of the two-place relation, and may remain directly accessible even for those who have fully acquired the two-place version. I could imagine (I have no empirical evidence, so I present this just as a possibility in principle) that dogs may have one-place concepts of *friend* and *enemy* -- ways of classifying people and other dogs into one category or the other -- but may lack completely the possibility of classifying some person A as a friend of B but an enemy of C. And children may well go through a stage where they similarly have a "one-place egocentric" concept of *friend* and *enemy* before developing the two-place concept that would let them acquire the adult interpretation of those words. If that were the case, then we should not analyze the child's early use of the one-place *enemy* as resulting from two-place *enemy* with an argument filled in, e.g. as meaning "my enemy" (much as we have learned to analyze children's earliest uses of *bit* and *took* as unanalyzed morphemes rather than as "correct" past tense forms.) The question would then remain open whether the one-place egocentric concept is lost when the two-place one is acquired, or whether it remains active; the corresponding linguistic question is whether the apparently one-place common noun *enemy* is to be analyzed in all occurrences as having an implicit argument or context parameter, as it must in (11b) and (11c) on the given readings, or whether it sometimes maps directly onto the old egocentric one-place concept, as it could in (11a). It would also be interesting to look for evidence for a stage at which *enemy* takes a "point-of-view" contextual parameter but not yet an explicit argument, as a possible bridge between the purely egocentric version and a fully "objective" two-place relation; such evidence might take the form of the use of sentences like (11b) but no possibility of using *enemy* with an *of*-complement or a genitive.

Returning to our central data, it is also of interest that the famous "donkey-pronoun" sentences like (12), whose successful analysis is one of the central arguments for the theories of Kamp (1981) and Heim (1982), also have analogues with a wider class of context-dependent elements, as in (13).

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

(13) (a) Every man who stole a car abandoned it 2 hours later.

(b) Every man who stole a car abandoned it  $\left. \begin{array}{l} \text{within 50 miles.} \\ \text{50 miles away.} \end{array} \right\}$

In the standard donkey-sentence (12), the pronoun *it* in the matrix has an indefinite NP antecedent *a donkey* embedded in a relative clause on a quantified subject. In the examples in (13), both the dependent and the antecedent are implicit, but their relative locations in the sentence are just as in (12). So in (13a), for instance, the temporal adverb *2 hours later* has an implicit reference time parameter that must be specified for the expression to be interpretable. Where does the reference time come from? On the relevant reading, it's understood as 'when he stole the car', i.e. a time indefinitely and implicitly given by the relative clause on the quantified NP, a variable time that will be different for different occurrences of men stealing cars.

As a final set of initial data, to illustrate some of the further variety of aspects of context that can be implicitly quantified over in sentence-internal constructions, consider the richness of spatial and perspectival structure presupposed by systems of locative deixis and locative anaphora, as described for instance by Fillmore (1975) for English (see Weissenborn and Klein (1982) for a sampling of equally rich but often different contextual factors on which the interpretation of locative deixis and anaphora depends in other languages.) To start from examples in simple discourse contexts, note the differences in possible interpretations of the italicized expressions in (14b, b', b''), taken as alternative continuations to (14a). In particular, note the ways in which the respective interpretations of *away*, *ahead*, and *farther away* depend upon different presupposed properties of the context which must be supplied or inferred in order to interpret the expressions at all.

(14) (a) John entered the store and saw a woman he knew.

(b) Three feet *away* was a small child.

(b') Three feet *ahead* was a small child.

(b'') Three feet *farther away* was a small child.

In the case of *away* in (14b), we need only a single reference location, which in the given example could easily be either John or the woman; *three feet away* is then understood as three feet from that location in any direction. *Ahead* in (14b') requires more: its interpretation requires both a reference location and a direction of orientation which qualifies as 'forward'. In the given example two likely possibilities would be (i) John's location and his direction of travel as he entered the store, or (ii) the woman's location and the direction of John's line of sight when he saw her. *Three feet ahead* is understood in either case as three feet from the reference location in the reference direction. *Farther away* in (14b'') requires two reference

locations (one as for *away* and the other as an implicit argument for the comparative) and perhaps an orientation, although it may be only a cancellable implicature that the child is in the same direction from John as the woman is. Be that as it may, it is not uncommon for contextual parameters such as spatial orientation, point of view, direction of sight or motion, etc., to be crucial for the interpretation of locative deictics and locative "dependents", as Fillmore and others have richly demonstrated. The new point I want to add to these observations is that we find sensitivity to these same factors in sentence-internal quantified constructions, so that the integration of context-dependence with the sentence grammar of variable-binding constructions has somehow got to include such aspects of context as axis of orientation as well as more "reference-like" parameters such as "reference time" and "reference location".

To illustrate this last claim with an example that combines properties of the implicit "donkey anaphor" cases illustrated in (13) with the rich locative structure illustrated in (14), consider (15).

- (15) Every traveler who stops for the night imagines that there is a more comfortable place to stay a few miles *farther on*.

Consider in particular the interpretation of the italicized phrase *farther on*. Its interpretation requires, and we can easily provide via inference from the interpretation of the subject noun phrase, two reference locations and a path; its meaning is paraphrasable as something like "more distant from [source reference location] along [path from source] than [comparison-base reference location]". (No weight should be placed on my choice of terms for identifying the relevant contextual parameters; there is much written in this area, and I am not an expert in it.) What I want to draw attention to is that we are readily able to interpret the needed parameters in (15) in terms of the (variable) traveler's path of travel; for each traveler, we can identify the traveler himself as the source, his route *qua* traveler as the path, and the place where he stopped for the night as the comparison-base reference location. And these will in general be different for each traveler, i.e. they act like bound variables. But much as Cresswell (1973) argued against the analysis of contexts as discrete tuples of contextual parameters in the early years of the study of indexicality, I will want to suggest that the implicitness and indirectness of all of this information in the subject NP of (15) argues against trying to treat such cases by adding explicit variables over locations, paths, directions of travel, etc., in some syntactic level such as a level of deep structure or a level of logical form. I want to suggest rather that in cases like this we want the possibility of "quantifying over contexts" in a rather holistic sense, although my suggestions fall far short of providing an articulated theory. But first let's look at some of



the respects in which syntax *does* clearly play a role in the interpretation of such constructions.

3. Syntactic Constraints. To summarize the observations I will make in this section, it appears that the constraints on the syntactic location of dependent items like *local*, *enemy*, *notice*, *later*, *ahead*, *farther on*, etc. relative to the syntactic location of the material that provides the understood anchor or "antecedent" for the dependent element are very similar to the constraints or pronominal anaphora of both "coreferential" and "bound variable" types. I cannot state the constraints with any precision or confidence, however, for several reasons: (i) as in the case of pronominal anaphora, judgments are often conflicting and unclear; (ii) the history of the study of pronominal anaphora makes it clear that far more work than I have put into this question would have to precede any even halfway trustworthy generalizations; (iii) and to make matters even harder in this case, both the dependents and the "antecedents" are hard to localize in many of the most interesting of these cases; their very implicitness and the uncertainty of whether they exist in the syntax at all means that questions such as whether the "antecedent" c-commands the "dependent" in a given case run the risk of being ill-founded and unanswerable questions. Hence what follows is brief and approximate.

With those caveats, I will claim that the basic (precede and) command types of syntactic constraints on sentence-internal "bound" context-dependence and "discourse-anchored" context-dependence are either just like the constraints on the corresponding uses of pronouns or slightly less restrictive (perhaps closer to the anaphoric uses of definites<sup>10</sup>); in clear cases, the judgments generally agree. So for instance (16a), with a referential anchor, is grammatical, just as backwards coreferential pronominal anaphora is as long as the pronoun doesn't directly c-command the antecedent. But (16b), with a quantified anchor, is pretty bad when we try to interpret *away* as anchored to the variable pigeon locations, in line with the observation that for bound-variable anaphora a quantified antecedent must usually c-command the pronoun.

- (16) (a) From five feet *away* I tried to toss a peanut to *the pigeon*.
- (b) #?From five feet *away* I tried to toss a peanut to *every pigeon*.

Certainly the difference in acceptability in (17a) and (17b) is in the expected direction: it is much harder in (17a) than in (17b) to understand there to be possibly different local unions involved for the different professors.

- (17) (a) #?The leader of the *local* union wrote a letter to *every untenured professor in the state*.

- (b) *Every untenured professor in the state received a letter from the leader of the local union.*

The same contrasts are illustrated in (18a-c), where on the quantified reading we are interested in nearness to each respective senator.<sup>10</sup> The relative badness of (18b) on a bound interpretation of *nearest* seems comparable to, if perhaps slightly less pronounced than, the relative badness of a bound variable pronoun in the same position, as illustrated in (19a-c).

- (18) (a) Only the *nearest* photographer got a good picture of *Reagan*.  
 (b) #?Only the *nearest* photographer got a good picture of every senator.  
 (c) *Every senator* directed a smile at the *nearest* photographer.
- (19) (a) Only *his* top aide got a good picture of *Reagan*.  
 (b) #?Only *his* top aide got a good picture of every senator.  
 (c) *Every senator* directed a smile at *his* top aide.

Given these similarities in syntactic constraints between open-class dependent elements and pronouns, and given their similar ranges of semantic behavior as illustrated in section 2, there are at least two ways one might proceed to try to account for the new data. One way, the one I favor, is to try to redesign our theories so that open-class-context-dependent elements like *enemy*, etc., are the general case, and pure pronouns and context-independent content words are extreme cases at opposite poles. But another approach with considerable plausibility would be to posit empty pronouns in the representations at some appropriate level to make the anaphoric or pronoun-like parts of the meanings of these various dependent elements explicit. This is particularly plausible for examples like *notice*, *away*, *enemy*, which can be argued to have an argument structure that would naturally accommodate an implicit argument (*notice x*, *away from x*, *enemy of x*.) The phenomena I have been discussing might just be reflections of the behavior of a certain kind of empty category, one which might or might not be identical to some previously posited empty category.

I have no conclusive arguments against the latter approach, but I can and should say something about my reasons for being skeptical about it.<sup>12</sup> The following section is directed to that issue.

4. Why not do it all with pronouns? The question of this section is not an easy one. I'm familiar with a lot of the properties of real pronouns, and I can demonstrate some clear differences between the behavior of overt pronouns and the behavior of the "empty" pronouns that might be posited in the open-class cases. But I'm in the uncomfortable position of not being at all familiar with the properties of empty pronouns and

not being sure whether that's inevitable because there aren't any or whether my resistance to acknowledging their existence has just prevented me from learning to recognize them and become acquainted with their properties. In any case, all I can do here is offer some of my own reasons for finding it implausible to try to "do it all with pronouns", reasons which might well evaporate if a suitable theory of such pronouns were developed. (It is in any case perfectly consistent with these arguments that some of the cited examples might use some kind of null pronouns.)

What I mean by a "do it all with pronouns" approach, or "uniform pronoun approach" for short, would be an approach which analyzes intransitive *notice* as differing minimally from the phrase *notice it*, but with a phonologically null pronominal element in place of the *it*, and which then proceeds to find ways to analyze *all* context-dependent predicates of the sort I have been discussing into a context-independent lexical predicate plus suitable pronouns or pronoun-like elements, presumably filling argument positions of the given predicate.

The problems I see for such a uniform pronoun approach are of two sorts, the first concerning the antecedents and the second concerning the decompositional analysis of the dependent elements. The first is that overt pronouns in their discourse anaphoric and bound variable uses normally require overt antecedents.<sup>13</sup> We will see below some examples with quantified contexts but no overt "antecedent" where a bare dependent element like *nearby* without an overt pronominal argument can be used, but a corresponding form with an overt pronoun cannot (*near it*, *near there*). The second problem is that not all dependent elements take complements or admit of a plausible (to me, at least) decomposition into a context-independent predicate plus pronominal arguments. We will also see examples of that below. But it is clear, as I indicated above, that these problems are not necessarily insurmountable; they can simply be taken as challenges by those who would prefer to try the uniform pronoun approach.

I gave some initial hints of my arguments against the uniform pronoun approach in my discussion of (15) in section 2. To make the arguments more explicit, let's look at some other examples.

As a first example consider the discourses in (20a-c) containing *left* and *right*. *Left* and *right* as used in these examples are context-dependent with two arguments or parameters: to the left of *what* and *from whose point of view*. The former is naturally expressed as an argument of an *of*-complement, but the latter can only be made explicit via the sort of paraphrase just given ("from the point of view of *x*")<sup>14</sup> which looks like some sort of an adjunct more than an argument. The ungrammatical (20b) represents an attempt to make the second "argument" overt as a source or experiencer.

- (20) (a) John had a black spot on the middle of his forehead.  
*To the left of it* (from John's point of view/from an observer's point of view) was a green "A".  
 (b) ...\*? to the left of it from/for him  
 (c) Every man had . . . [same data]

For a similar set of examples, but showing the existence of idiosyncratic lexical variation among similar words in the ability to take overt pronominal arguments, consider (21a-b).

- (21) (a) Citizens of every country tend to find  $\left. \begin{array}{l} \textit{foreign cars} \\ \textit{foreigners} \\ \textit{strangers} \end{array} \right\}$   
 attractive.  
 (b) [*foreign to them/that country*], [*a stranger to them/that country*], \*[*a foreigner to them/that country*]

All the examples in (21a) are well-formed, with the context-dependence of *foreign*, *foreigner*, and *stranger* all left implicit. But (21b) shows that while *foreign* and *stranger* can also take overt pronominal arguments, *foreigner* evidently cannot. (Whatever approach one takes to these phenomena, it is already a challenge to try to imagine how to represent such apparent idiosyncratic differences between a lexical item's subcategorization for overt pronominal arguments and its semantic dependence on given (potentially covert) context parameters.)

The following examples use the dependent adjectives *opposite*, *different*, and *similar*. These adjectives can take an overt pronominal argument when there is an overt accessible NP antecedent for the pronoun, but in the examples in (22) the "antecedent" for the use of *opposite*, etc., while sentence-internal and even quantified, is indirect and inferential with respect to its introduction of a child-rearing method (22a), a strategy (22d), a sleep pattern (22e), a problem (22f), and does not support the use of a pronoun.

- (22) (a) Not everyone who thinks their parents did a bad job of bringing them up actually switches to the *opposite* child-rearing method.  
 (b) Interpretation: for each x, the child-rearing method *opposite* to the method used by x's parents in bringing x up.  
 (c) \*... the child-rearing method *opposite* to *it*.  
 (d) Every beginning general who loses his first battle switches to a *different* strategy in his second. (\* a strategy *different* from *that/it*)  
 (e) Why do so many people marry people with the *opposite* sleep pattern? (\* sleep pattern *opposite* from *that/it*)  
 (f) I wish that just once when I had just worked out a good solution for one client, my next client would come in with a *similar* problem. (\* *similar* to *it/that*)

The similar but good examples (23) below contrast minimally with (22d) above, strongly suggesting that it is not the simple lack of an overt NP antecedent denoting a strategy that makes (22d) bad, but the combination of that fact with the fact that the inferred strategy in (22d) may be a different one for each general. Neither of these factors alone is fatal: (23a) lacks an NP antecedent for the strategy but introduces a unique strategy in the VP "played hard-to-get"; (23b) introduces an NP antecedent for the strategy but, as in typical donkey-pronoun sentences, as a quantified indefinite it may be a different strategy for each general.

- (23) (a) Few of the women who had played hard-to-get in the 50's switched to the *opposite* strategy after their first divorces in the 70's. (also OK: strategy *opposite to that*)  
 (b) Every beginning general who loses his first battle using one strategy switches to a *different* strategy in his second. (also OK: a strategy *different from that*)

This last-illustrated phenomenon can also be seen with example (13), repeated below.

- (13) (a) Every man who stole a car abandoned it 2 hours later.  
 (b) Every man who stole a car abandoned it  $\left. \begin{array}{l} \text{within 50 miles} \\ \text{50 miles away} \end{array} \right\}$

We cannot substitute *later than that*, *within 50 miles of there*, *50 miles away from there* in (13a-b) as they stand, but if we added a simple *at some time* or *somewhere* in the respective antecedent relative clauses then we could.

Turning back to the locative domain, it seems to me that many of the parameters to which locative delctics and dependents are sensitive are reflections of the richly structured presupposed spatial/motional context in which such expressions are used rather than "arguments" of those expressions in any familiar sense. And even when such expressions can be used with a pronominal argument, the way locative anchoring works when we quantify over shifting 'points of view' or displacements of the understood axes of orientation does not seem to be the same as the way pronominal anchoring works (though I am far from being able to articulate the differences in any systematic way.) The examples in (24) illustrate these claims.

- (24) (a) In all my travels, whenever I have called for a doctor, one has *arrived* (*set out*, *\*departed*) within an hour.  
 (b) ... *\*arrived there*, *\*set out for there* ...  
 (c) ... *\*arrived here*, *\*set out for here* ...

The contrasts in (24) are particularly interesting in suggesting differences between *here*, *there*, and an implicit contextual point-of view. I believe the anchor for *arrive* and *set out* in (24a) is the I in the sense that it is "my" point of view that establishes the frame of reference. The implicit reference place being quantified over is wherever I was on any given occasion of calling for a doctor; that reference place provides the needed goal parameter (or argument) for *arrive*. (The contrast between *set out* and *depart* I don't understand, but my location also apparently serves as the goal for *set out*. It may be that *depart* obligatorily requires a specified source and *set out* doesn't.)

Now part of what's interesting in this case is that my varying location seems to be something like a quantified-over shiftable "here". But the actual word *here*, as shown by the impossibility of (24c), does not allow such a bound-variable interpretation. Although *here* is more shiftable than I and can anchor to a third-person discourse protagonist's subjective point of view in a narrative, it cannot anchor to a quantified antecedent as would be required for (24c) to be well-formed. *There*, on the other hand, can function perfectly well as a bound variable, but its antecedent or anchor must be "third-person-like", a place looked at from somewhere else, so to speak, not the "here" of ego's point of view. This is apparently the source of the badness of (24b). In fact if we just changed "called for a doctor" to "called from any place for a doctor", (24b) would become fine; "any place" apparently provides a sufficiently externalized perspective on the places where I was when I called to license *there*.

Putting the examples in (24a,b,c) together, we can roughly summarize the situation by saying that *here* must be anchored to the *origo* of the utterance or discourse and disallows a bound variable use; *there* can be anchored to the non-first-person reference location of the utterance, discourse or sentence-internal context. Including the possibility of acting as a bound variable; while *arrive* with its implicit goal parameter can anchor to an explicit or implicit *origo*<sup>15</sup> in the utterance context, the discourse context, or a sentence-internal quantified context. The behavior of the latter thus has properties which overlap those of first-person and third-person locative anaphors but is interestingly different from both.

To summarize this section, I suggest that it would be most fruitful to try to get a picture of the full range of behavior of different open-class and closed-class context-dependent and anaphoric elements, looking at all of them on their own terms, so to speak, before reaching any conclusions about the extent to which it is possible and appropriate to regiment all the cases into a narrow typology using decomposition, for instance, to bring the unfamiliar kinds of cases into line with more familiar patterns.

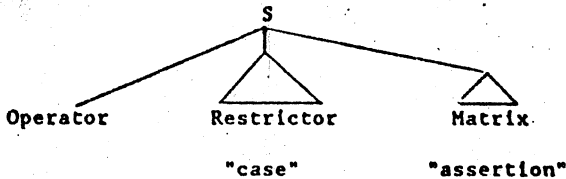
5. Steps toward a unified theory of "quantified contexts".

5.1 Contexts, cases, and tripartite structures. My goal in

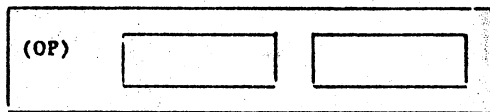
this section is to try to suggest ways in which natural extensions of the work of Stalnaker, Lewis, Kamp, Heim and Kratzer might help us to unify context-dependence and variable binding in the kinds of ways the data presented above appear to demand. Stalnaker (1978, 1984) made the notion of conversational background prominent and emphasized the two-way dynamics of the relation between the context and the interpretation of successive sentences, the latter both depending on and affecting the former. Lewis (1979) posits a "conversational scoreboard" as an abstract accompaniment to the interpretation process: the "scoreboard" is used to record relevant aspects of the context, such as speaker, reference time, currently most salient individuals, etc.; the scoreboard is updated as the conversation progresses.

What the examples in the previous sections have shown is that many elements can be sensitive "in the same way" to various aspects of any of three different sorts of context: the external context of the utterance, the discourse-level linguistic context, and the sentence-internal linguistic context, which in quantificational constructions can be a quantified context. This last shows the necessity of integrating the relevant "scoreboard" information into the recursive mechanisms of sentence grammar. The parallel sensitivity to all three kinds of context is reminiscent of the behavior of pronouns which motivated the Kamp-Heim theory, and suggests the use of "tripartite structures" as in the Kamp-Heim treatment of donkey-sentences. These tripartite structures, illustrated schematically in tree form in (25a) and in Kamp's box-like Discourse Representation Structure (DRS) in (25b), have historical antecedents in Lewis's (1975) treatment of adverbs of quantification, in McCawley's (1981) emphasis on the preference of natural languages for restricted rather than unrestricted quantification, and in Kratzer's (1977) work on the semantics of modals and conditionals.

(25) a.



b.



The work of Kamp, Stalnaker, Lewis, Heim, and Kratzer (and others) has made great progress in bringing context-dependence and semantic content closer together. Heim's theory is expressed in terms of "context-change potential", and the manipulations of

context in the process of interpretation in her framework are reminiscent of the familiar manipulations of the time index, world index, and variable assignments in other theories.

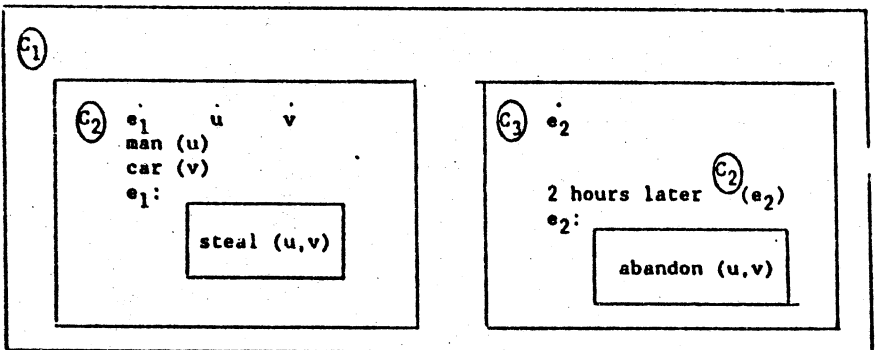
Kamp's and Heim's theories incorporate a notion of accessibility for potential antecedents of pronominal elements; this notion, though syntactically expressible, is fundamentally semantically determined.<sup>17</sup> In a structure like (25a) or (25b), a pronoun in one part can anchor to an antecedent in any higher part, where *higher than* (not their term) is defined as follows: the restrictor is higher than the matrix, and the outer discourse structure is higher than either. As Heim has emphasized, the satisfaction of presuppositions in quantificational and non-quantificational structures shows a similar sensitivity to this kind of structure: the presupposition in the matrix can be satisfied via material introduced in the restrictor clause or anywhere "higher".

So it seems very natural to add the generalized context-dependence we've been discussing to this same schema: a context-dependent element of any kind in the matrix clause can anchor onto material in the restrictor or anywhere "higher". This then would seem to unify pronominal anaphora, presupposition, and the varieties of context-dependence illustrated in the previous sections. This observation does not, of course, constitute a theory; fleshing out a real theory along these lines will take much more work.

But I can give a rough sketch of the sort of treatment I imagine; (26) below represents a first approximation in extended DRS terms to a structure for (12a), repeated below.

(12a) Every man who stole a car abandoned it 2 hours later.

(26) DRS for (12a) (first approximation)





The circled  $C_0$ ,  $C_1$ , etc. represent nested contexts:  $C_0$  the external context of utterance,  $C_1$  the context of the discourse at the point at which (12a) is evaluated,  $C_2$  the (quantified) context of the restrictor clause, and  $C_3$  (understood as an extension of  $C_2$ ) the context of the matrix, which is thus embedded within all three of the others. In (26), the element *later* in the matrix needs an anchor: my suggestion is that rather than introduce an explicit time variable to mediate this dependency, we simply index *later* to some accessible context. It is part of the lexical semantics of *later* that whatever context it anchors to must have, either overtly or inferably, a reference time to interpret *later* in terms of. For the quantified interpretation, illustrated in (26), *later* is marked as anchored to the context  $C_2$ , whose (variable) reference time would be times of the stealing events that are being quantified over.

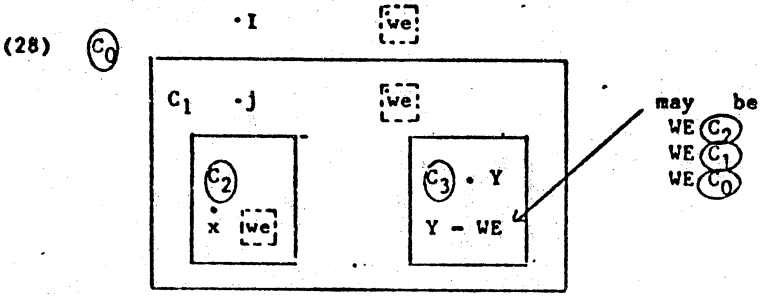
In general in such tripartite structure, the matrix is interpreted relative to a "case" as established by the "restrictor". The specification in the restrictor will generally establish a partially-defined context. In (26), for instance, each "case" (i.e. each car theft) provides an implicit time, place, original owner, motive, method, and undoubtedly more. Insofar as the whole construction is interpreted as quantifying over such "cases", with the matrix interpreted in the quantified context established by the restrictor, we may then be able to interpret many context-dependent elements in the matrix just by indexing them globally to the context of the restrictor, without having to posit explicit variables for time, place, manner, motive, etc.

**5.2 Syntactic and semantic c-command-type restrictions.** The kinds of c-command restrictions discussed in section 3 should probably be related to the construction and manipulation of nested contexts, and to the hierarchy of accessibility for pronominal anaphora as graphically articulated in file change theory or DRS theory. It is important to realize that most occurrences of expressions are located in many contexts at once, including nested contexts such as were illustrated in (26). For many dependent elements, particularly those sensitive to first-person-like *I*, *here*, *now* parameters of the context, just indexing them to a whole context may suffice, since many relevant aspects of context seem to be of a "unique-per-context" sort (e.g. the temporal anchor for *later* in (26).) But this is clearly not the case for third-person pronouns, and may be similarly too strong for other third-person-like elements such as locative *there*.

The idea of nested contexts and indexing to context can be further illustrated with an example involving *we*, showing not only ambiguity in nested context situations, but the possibility of anchoring to a context which draws elements into itself from some of the higher accessible contexts.

Consider the sample text in (27) and the DRS in (28).

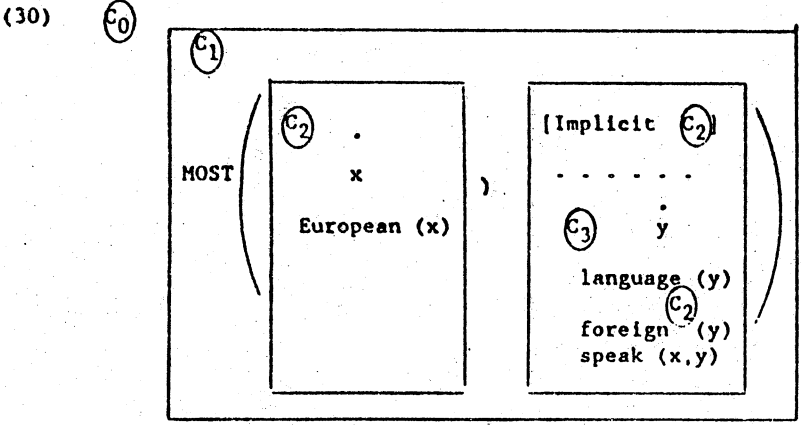
(27) John often comes over for Sunday brunch  
 Whenever someone else comes over too,  
 we (all) end up playing trios. (Otherwise  
 we play duets.)



The *we* that occurs in the matrix has as its most plausible interpretation a bound variable interpretation anchored to (accommodated into) the restrictive clause; that *we* in turn can be understood to denote a group including me, John, and the somebody else being quantified over in the sentence, i.e. a combination of individuals from the external utterance context, the discourse context, and the context of quantification. Of course there are other readings in principle possible for the *we*: it could anchor to the utterance context alone (*we* being then some particular known individuals in the speech situation, e.g. my family) or to the discourse situation alone (where it would likely pick up *John and me* as the salient group).

As another example of nested contexts, consider sentence (29) and the rough DRS (30) for it.

(29) Most Europeans speak a foreign language.



If, as in the given diagram, we anchor *foreign* to the quantified context  $C_2$ , we mean *foreign* from each European's point of view - French for Germans, English for Danes, etc. However, the sentence could also be used by the stereotypical "ugly American" to say why he doesn't like to travel in Europe: to him the Frenchman speaking French is speaking a foreign language. That would be represented by anchoring *foreign* to  $C_0$ , giving the egocentric point of view. And an anchoring to the discourse content  $C_1$  could represent the egocentric point of view of a discourse protagonist - e.g. in a narrative about a certain ugly American and his attitudes.

The sentence (31), offered by Gregory Ward, shows the same ambiguities and more.

(31) Most foreigners speak a foreign language.

While both occurrences of *foreign* could be egocentrically anchored to  $C_0$  (the ugly American again), a more interesting reading is one where the first occurrence of *foreigners*, which will be in the restrictor clause, is anchored to the utterance or discourse context, while the second, in the matrix, is anchored to the restrictor, i.e. to the perspective of the (variable) subject.

5.3 Lexical information about dependent elements. One of the principal tasks that faces the working out of a theory along the lines of these suggestions is to articulate a framework in which the relevant lexical information about dependent elements can be appropriately captured. In general, I think we can say that dependent elements, both closed-class and open-class, are interpreted as *functions from contexts to semantic values or referents*. This means that we would have to specify at least the following three kinds of information about each dependent element:

- (32) (i) what *kind(s)* of context it can anchor to (utterance situation, discourse, sentence-internal);  
 (ii) *requirements* on the context for the element to be defined, as presuppositions or implicatures. (e.g. *farther on* requires a point of view and a reference location.);  
 (iii) *meaning*, generally as a function of the elements required in (ii), which is presumably why they're required. (*Farther on*: "more distant from the point-of-view location along the point-of-view directional orientation than the reference location is").

When a dependent element occurs in several nested contexts at once, the requirements of type (i) and (ii) may or may not disambiguate it; if not, plausibility factors may disambiguate it or it may remain genuinely ambiguous. The ease with which we

seem to disambiguate most such elements in natural speech may partially account for the apparent lack of attention to their pronoun-like properties. For the pronouns, there is essentially no descriptive meaning beyond the identification with an antecedent, so one can't help but notice their dependence properties, a point which leads us to the topic of the next section.

5.4 Pronouns as an extrema case. As I have tried to suggest throughout this paper, I believe that the general case of lexical meaning is a combination of inherent meaning and dependence on context. As we seek a theory that adequately captures the right amount of power, the right constraints, and the right articulation of important properties and parameters, we have to simultaneously try to analyze the linguistically relevant properties of contexts and the relevant properties of the lexical items.

One observation that seems to surface from the examples we have looked at is that some aspects of contexts seem to be generally unique per context, at least if we analyze contexts into the right size chunks: e.g. reference time, reference place, point-of-view. And there seems to be a corresponding subclass of context-dependent elements which anchor onto such properties of contexts, and for which indexing to a choice of context is therefore probably sufficient and appropriate, rather than trying to introduce an overt empty pronoun or variable to try to capture the anchoring via explicit identity. I suspect, as I mentioned above, that this is more generally the case for "first-person-like" dependents which anchor to the *I-here-now* or point of view of a context, the implicit versions of which seem to be much more shiftable and bindable than their explicit counterparts (as discussed above in connection with example (24).)

Other aspects of contexts, such as salient individuals, are not generally unique per context, and for the corresponding dependent elements which anchor onto them, there may be more than one potential anchor per context and hence a need to structurally indicate not only the choice of anchoring context but the choice of a particular antecedent within it. This is probably the general rule for third person pronouns and "third-person-like" dependents in general, and if so, this would support something like the familiar uses of indexing and coindexing mechanisms. I am therefore not proposing the elimination of explicit variables or indices altogether, but just arguing that not all context-dependence should be so represented.

Third-person pronouns, then, appear from this perspective to be a limiting case of a broader phenomenon. They have essentially no descriptive content of their own, so that their interpretation is exhausted by a description of their anchoring and binding possibilities. They may have many potential antecedents per context, and their antecedents must normally be overt NP's, especially in the bound-variable case. From a broader

perspective we can see that none of these properties hold of all dependent elements.

6. Summary. The fact that context-dependent phenomena of many kinds operate even in quantified contexts argues strongly for the integration of such kinds of context-dependence into sentence grammar. Theories such as DRS theory and file change semantics which emphasize the dynamics of context change have helped to unify the treatment of presupposition and anaphora in quantified constructions, and although much work remains to be done, it looks possible and necessary to generalize and extend these ideas to context-dependence of many kinds. It will be important to look at as many languages as possible, and as many kinds of "pronoun-like" elements as possible, and to try to identify other linguistically relevant aspects of context that the interpretation of such elements can be sensitive to. Several approaches to further work in this direction suggest themselves, and I expect that parsing them all will be valuable. One task is to go through studies of the properties of pronouns (in various languages and in various theories) and see which of these properties extend to or contrast with properties of open-class context-dependent elements. Another important task is to start from studies of context-dependence of many kinds and in many languages, and see which properties need to be recognized within sentence grammar, using the behavior of bound-variable contexts as a diagnostic. I would expect that we will find many purely pragmatic context-dependent phenomena that do not integrate into sentence grammar, such as e.g. the use of honorific forms.

When we have a better idea of the range of the phenomena, both in terms of the class of dependent elements and in terms of the properties of contexts they are dependent on, we will be in a better position to identify properties and parameters that play an explanatory role in the overall organization of the system(s) of dependence. The observations in this paper suggest what some of the important properties might be, but the central questions in this area are still open ones.

#### Acknowledgments

Earlier versions of this material were presented at the Linguistics Institute in 1986, at the 6th Amsterdam Colloquium on Formal Linguistics in 1987, and at colloquia at Cornell, the University of Massachusetts, and at Swarthmore College. I am grateful for useful comments received at CLS and on all those earlier occasions, particularly from Emmon Bach, Steve Berman, Wayles Browne, Janet Fair, Irene Heim, Jim Huang, John Kingston, Angelika Kratzer, Richard Larson, David Pesetsky, Luigi Rizzi, and Jerry Sadock.

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**Footnotes**

1. See, for instance, Partee (1984b). I am ignoring finer distinctions and controversies which are irrelevant to the main concerns of this paper
2. In Amharic, on the other hand, the first-person pronoun is also used as a logophoric pronoun coreferential with the subject of a verb of saying or believing (Emmon Bach, p.c.); I would conjecture that this would lead to bound variable possibilities in examples like (8) below, though not (7).
3. There does seem to be the possibility of a bound-variable use of *I*, not with quantified antecedents, but in the formation of relative clauses by predicate abstraction in certain cases where tension between syntactic agreement and semantic interpretation undoubtedly plays a role. Thus (1) below tends to admit a bound variable reading of the second *I*, perhaps even as its preferred reading.
  - (i) I'm the only one around here who will admit that I could be wrong.
4. Some speakers can also apparently get external referential anchoring for the English reflexives. The difference shows up in tests for strict vs. sloppy identity in examples like (i) and (ii), where the bound variable-only "dialect" gets only sloppy identity (Bill voted for himself), and the other "dialect" can also get a strict-identity reading (Bill voted for John/me).
  - (i) John voted for himself, and so did Bill.
  - (ii) I won't vote for myself unless Bill does.
5. Among the important properties I am ignoring here are some that would be involved in distinguishing between reflexive-like and non-reflexive-like "implicit arguments", including issues of locality requirements on the relation between antecedent and implicit argument.
6. Mitchell discusses a variety of examples of perspectival properties including some for which various species seem to be "hard-wired" for an egocentric version. The information a bat obtains from its sonar system is an example of such a case; all the information it obtains about distance and direction and speed of motion of objects it detects are relative to the bat's own position, orientation, and direction and speed of motion.
7. Janet Fair reported to me after the oral presentation of this paper that her 3-year-old had gone through a noticeable evolution in the understanding of enemy from about 33 months to about 36 months, including passage from the question "What's an enemy?" to the questions "What's an enemy to a mouse?", "What is an enemy to a bear?"
8. These examples were first brought to my attention by Roger Schwarzschild.
9. I'm not sure whether shuffling these pairs yields available contextual anchors as well or not; I suspect not. If John's line of sight is the same as his direction of motion, we can't tell;

if he sees the woman to his left while walking straight ahead through the door, my intuition is that we have to be consistent in the sense of taking both the location and the orientation from the same conjunct of (14a). This intuition is reinforced by the fact that if we give the second conjunct of (14a) a separate temporal adverb, such as "and two minutes later saw...", then (14b') must get its temporal and locative anchors all from the same conjunct, presumably the second.

10. Irene Heim (personal communication) noted that weak crossover effects tend to be milder in German examples with die Mutter 'the mother' than in corresponding English examples with his mother. The context-dependent elements I discuss may line up more with the anaphoric definites than with the overt pronouns, where these differ; in fact, anaphoric definites may well be an example of the kind of context-dependence I am trying to treat here.

11. It was pointed out to me by Zi-Qiang Shi that (18b) improves noticeably if the (episodic) got is replaced by (generic or habitual) gets. This would seem to be the result of introducing quantification over situations of photographing, and no longer limiting the quantification to the senators. But I have no explanation in detail.

The following examples, from John Kingston, are likewise generic, and it may be that the for everybody in (i) and (iii) is a adjunct delimiting the domain over which the generic claim holds.

- (i) The nearest exit isn't the best for everybody.
- (ii) The girl next door is the best wife for every man.
- (iii) A seat in the local bar is the best place to watch the superbowl for everybody.

An even harder apparent class of counterexamples was pointed out to me by Wayles Browne; these have the structure of "MIGS and pilots" sentences.

- (iv) The successors were better than the predecessors.
- (v) The successors are always an improvement over the predecessors.

I have no account for (iv) and (v).

12. I will offer what seems to me to be rational grounds for my skepticism, but I have to confess to sometimes wondering if I don't have a temperamental objection to the uniform pronoun approach. I have resolved several times in the past to try to work out an analysis with pronouns, and have not been able to bring myself to do it. But I hope someone will try to work out such a theory so that results can be compared.

13. The claim that overt pronouns require overt antecedents requires caveats. It accounts for the difference between my old examples (i) and (ii), but (ii) is not totally ungrammatical with a substantial pause before it, and other instances of "accommodated" antecedents can be found in the literature.

- (i) One of the ten balls is missing from the bag. It's under the couch.
- (ii) Nine of the ten balls are in the bag. #It's under the couch.

14. Jerry Sadock pointed out in discussion that to his right is unambiguous in a way that to the right of him is not.
15. A term introduced by Bühler (1934); see discussion in Weissenborn and Klein (1982).
16. The double arrow in (16) and (28) is an abbreviation for a special case of the operator of (25a,b), (30), namely for the selective universal quantifier.
17. This is pointed out by Heim (1982) and discussed more fully by Chierchia and Rooth (1984).

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