KJELL JOHAN SAEBOE

ANAPHORIC PRESUPPOSITIONS AND ZERO ANAPHORA*

ABSTRACT. The purpose of this paper is to use an anaphoric notion of presupposition for solving the problem of zero argument anaphora. Since Shopen (1973) it has been known that many missing arguments have an anaphoric interpretation, but it has not been known how this interpretation arises. I argue that these arguments are involved in presuppositions. On an anaphoric account of presuppositions as in van der Sandt (1992) or Kamp and Roßdeutscher (1992), it can be shown that the zero arguments acquire an anaphoric interpretation through the presuppositions. The analysis rests on the principle that the Discourse Representation Structure for the presupposition is proper, so that the discourse referents for the zero arguments are in its universe and must be anchored to discourse referents in the context.

1. The Problem

It has been noted many times that some zero arguments are regularly interpreted existentially while other zero arguments are regularly interpreted anaphorically. But although intuitions converge that this different behavior of zero arguments is related to the semantics of the predicates, it has not proved possible to determine the responsible semantic property. Consider some examples of zero anaphora.

(1) John wants to sell his house.
Sue has **offered** one million, but he isn't **satisfied**.

(2) A sheep has been killed in the mountains.
Environmentalists **suspect** a poacher, but farmers **disagree**.

(3) Scrooge had buried a hoard of nuggets at his claim on Agony Creek.
He had **forgotten** completely, but the pills **reminded** him.

(4) It's dangerous to hypnotize people. You might do it to somebody with a gullible mind sometime, and that person would never **recover**.

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Tim Shopen in his pioneer paper (1973) claimed that the definiteness is due to the semantic structure of the verb and that there is a significant relationship with the notion of presupposition (p. 68). This remark has not been elaborated on, however, and he himself wrote the definiteness of the relevant argument into the lexical entry. The apparatus was not yet in place for analyzing the presuppositions in such a way that the anaphoric reading of the zero argument follows, but now I believe it is. The theory of anaphoric presuppositions recently developed in the framework of DRT provides us with the tool with which the problem can be solved.

2. Anaphoric Presuppositions

The central claim of this paper is that the zero complements that have an anaphoric interpretation are those that are involved in a presupposition and that an anaphoric notion of presupposition is both necessary and sufficient to account for the anaphoric interpretation. To understand the argument, it is useful to know how an anaphoric notion of presupposition works in cases where zero complements are not involved. Thus, in this section I review some of the motivation behind an anaphoric notion, and introduce a working version of the notion itself.

2.1. *Evidence of Anaphoricity*

Kripke (1991), Heim (1987), and Soames (1989) argue that certain presuppositions, notably those triggered by particles like *too*, adverbs like *again*, or verbs like *stop*, have properties that make even a context-oriented notion as proposed by Karttunen (1974) inadequate. It is not sufficient that the context entails the presupposition; the context must supply antecedents for variables occurring in the presupposition. Cases of **partial accommodation** provide particularly striking evidence of this. When a presupposition is not entailed by the context, we verify it as far as possible and only accommodate the rest. We tend to draw a distinction between the variables and the relations of the presupposition, verifying the former and accommodating the latter. Relevant data include the following, where there is a strong tendency, on account of the focus particle *also*, to infer that Joe was 15 in July 1933.

(5) Joe broke his leg in July 1933, and Jack **also** broke his leg at the age of 15.

Note that what is accommodated is stronger than necessary, so to speak; instead of accommodating that Joe broke his leg at the age of 15 (in

addition, maybe, to the event in July 1933), we accommodate that the event of his breaking his leg at the age of 15 was in fact the event of his breaking his leg in July 1933. This **accommodation effect** shows that accommodation does not consist in taking the shortest logical route to recreating the presupposition but preserves the discourse referents already present. Kamp and Roßdeutscher (1992) refer to such mixtures of presupposition verification and accommodation as **presupposition justification**. Accommodation effects support their conjecture that accommodating new discourse referents carries a higher price than accommodating new conditions on old ones.

This motivates a notion of presupposition on which presupposition verification is not just checking, or pattern matching, but also binding, or unification. Actually, this idea underlies Heim's (1982) theory of definite descriptions and Heim's (1983) strong admittance conditions: The context must entail the presupposition, where in contrast to Karttunen's definition of pragmatic presupposition (1974), the context and the presupposition are both not propositions but sets of pairs of worlds and variable assignments. In fact, one advantage of an anaphoric notion of presupposition is that the familiarity analysis of definite descriptions and personal pronouns follows without a particular familiarity condition – the general anaphoric framework provides the classical existential presupposition with an anaphoric interpretation.

2.2. *Presupposition in Discourse Representation Theory*

Two proposals have been made for an anaphoric conception of presuppositions in Discourse Representation Theory. In the theory of van der Sandt every instance of anaphora is an instance of presupposition and vice versa. Kamp's and Roßdeutscher's (1992) 'Principle of Presupposition Justification' mirrors van der Sandt's (1992) definition of presupposition resolution in all essentials. A sentence is provisionally represented in a bipartite structure, the presupposition and the assertion DRS, and as many as possible of the discourse referents of the former are mapped onto familiar discourse referents, respecting consistency of the merge of the context DRS and the so-called picture of the presupposition DRS under the mapping. Finally, the context DRS is merged with the so-called picture of the assertion DRS under the same mapping. Since binding has priority over accommodation of referents, accommodation effects like the one observed are in effect predicted.

The definitions given by van der Sandt (1992) and Kamp and Roßdeutscher (1992) are weak and nondeterministic, as they incorporate the

options for accommodation. Because the constraints on accommodation are so difficult to generalize, and because accommodation will play no immediate role in what follows, it is practical to state a simple, strong, deterministic condition. The following definition assumes that a sentence is represented in two provisional structures, one for the assertion and one for the presupposition.[1] To be sure, it is unrealistically strong in the general case, but it is reasonably adequate for our purposes.

> **Anaphoric Presupposition**
> Let C be any context DRS, S an assertion DRS and P the presupposition DRS of S. C + S/P is defined iff there is a unique function f: $U_P \rightarrow U_C$ such that the merge of C and "f(P)" is a logical consequence of C; then it is the merge of C and "f(S)".

This definition of presupposition can be contrasted with the following definition, roughly equivalent to Karttunen's (1974) notion of pragmatic presupposition.

> **Nonanaphoric Presupposition**
> Let C be any context DRS, S an assertion DRS and P the presupposition DRS of S. C + S/P is defined iff P is a logical consequence of C; then it is the merge of C and S.

To illustrate the definition, consider the analysis of a definite description as in (6). A definite description can be treated just like an indefinite description, only that it belongs to the presupposition structure instead of the assertion structure.

(6) Jane owns a house and a hotel. **The hotel** is on a square.

Let us suppose that the context consists in just the first sentence. Then the context, the assertion, and the presupposition of the second sentence can be represented as C, S, and P (a personal pronoun *it* would be represented in the same way except for the condition in P):

C $\langle\{x, y, z\}, \{Jane(x), house(y), hotel(z), owns(x, y), owns(x, z)\}\rangle$

S $\langle\{u\}, \{square(u), on\ (v, u)\}\rangle$

P $\langle\{v\}, \{hotel(v)\}\rangle$

There is one and only one function from the universe of the presupposition

[1] Though van der Sandt's recursive structure, where presuppositions can contain presuppositions, would be more adequate for the general case.

into the universe of the context such that the merge of the context and the so-called picture of the presupposition under the function is a logical consequence of the context, namely, the function mapping v onto z. The result is:

$$C + S/P = \langle\{x, y, z, u\}, \{Jane(x), house(y), hotel(z), owns(x, y), owns(x, z), square(u), on(z, u)\}\rangle$$

Are all presuppositions anaphoric? The definition is cast as a general principle, but, as Delin (1992) points out, factive presuppositions and cleft presuppositions are easily accommodated. Also, they do not seem to display accommodation effects. It may be that these presuppositions are not anaphoric in the sense that there are discourse referents to be anchored to already-introduced discourse referents, but that they are still subject to the same rule: They are anaphoric in a wide sense, but the anaphoricity does not show. This would mean that the universe of the presupposition DRS is empty and the content of the embedded clause is represented as a condition in the form of a sub-DRS. This reduces to Karttunen's pragmatic presupposition, where the presupposition is entailed by the context; but the same general definition applies. An anaphoric presupposition in the narrow sense is, then, a presupposition with a nonempty universe.

Anaphoric Presuppositions
An anaphoric presupposition in the narrow sense is a presupposition represented as a structure with a nonempty universe.

Anaphoric presuppositions in this sense are basically existential presuppositions in traditional terms, and the relevant triggers would seem to form a closed class: The definite article, particles like *too*, adverbs like *again*, and not very many more. But, as the next section shows, the notion of anaphoric presuppositions generalizes to a range of lexical presuppositions, triggered by predicates. Specifically, when a predicate with an omissible argument triggers a presupposition where the argument is involved, the presupposition becomes anaphoric once the argument is omitted. In this way, lexical presuppositions will be seen to play much of the same role as anaphora proper.

3. Zero Argument Anaphora: Theory

Since Shopen (1973) distinguished between indefinite and definite ellipsis, we have known that missing arguments sometimes have an existential interpretation but sometimes depend on context. The latter case gives rise

to so-called zero anaphora. But it has remained a mystery why these zero arguments behave like anaphors, and it has seemed necessary to mark this behavior lexically. My hypothesis is that this phenomenon correlates with presuppositions and that the context dependence in a missing complement can be independently described as an effect of presupposition. The idea is that the corresponding referent is introduced in the presupposition and that in the update process, the substituted referent is propagated to the assertion. Just as with definite descriptions, there is variable sharing between the assertion and the presupposition, and the variable is instantiated through the presupposition. Consider an example:

(7) John is finally stepping down as coach despite efforts to **dissuade** him.

The zero argument of *dissuade* is interpreted as 'from stepping down as coach', and it is not necessary to postulate a zero anaphor associated with the verb to predict this. Instead, I assume, and this assumption must be made anyway, that the verb triggers the presupposition that John has been planning to do what there have been efforts to dissuade him from doing. More precisely, a sentence *Susan dissuades John* asserts that Susan dissuades John from P, and presupposes that John plans to P. On the anaphoric notion of presupposition, P must be anchored to some familiar action Q such that John plans to Q; and once it is, Q replaces P in the assertion. Thus zero anaphors are not really anaphors but epiphenomena of presuppositions, and there will be no need to distinguish null complements with a definite interpretation in any other way than through the presence of a presupposition, which must be marked in the lexicon anyhow. Subsection 3.1 reviews descriptions of zero argument anaphora, and Section 3.2 presents hypotheses and principles of a presuppositional account. Section 4 discusses a variety of applications, and Section 5 confronts a number of problems.

3.1. *Definite Ellipsis*

Tim Shopen (1973) observed that 'lexically-determined constituent ellipsis' can be definite as well as indefinite. Since, it has become common knowledge that when an optional complement is not realized syntactically, the semantic result is either that the corresponding variable is existentially quantified over, that is, the empty argument is interpreted as though it were an indefinite, or it remains free, that is, the empty argument is interpreted as though it were a definite, an anaphor. For the former case, Shopen cites (8), where the 'source' role is left unexpressed.

(8) – Bill received a letter today.
– Who did he get it from?

It is a natural sequence for the second speaker to ask what he does because it does not conflict with any of the presuppositions of the initial statement . . . . The ellipsed SOURCE of *receive* is interrogated and the meaning of *receive* does not tell us that it should be uniquely identifiable. This is indefinite ellipsis. (p. 67)

Thomas (1979) followed up with a similar test for indefinite ellipsis (p. 57):

(9) – Have you been eating onions?
– I've been eating, but not onions.

Cases of definite ellipsis, on the other hand, are unacceptable in such sequences:

(10) – Do you expect to pass your driving test?
?– I expect to pass, but not my driving test.

(11) – When Mother told him to clean up his room, Bobby refused.
?– What did he refuse to do?

The question 'What did he refuse to do?' is an unnatural sequence because it rejects the presupposition of definiteness in 'Bobby refused'. [. . .] The definiteness of the ellipsis with *refuse* is due to the semantic structure of that verb (there is a significant relationship at this juncture with the notion of presupposition), as revealed in its lexical entry. (Shopen 1973, p. 68)

Shopen offered many more examples of definite ellipsis, ia. featuring the predicates *agree*, *continue*, *disapprove*, *persuade*, *suspect*, and *surprised*. For a few instances of zero anaphora complete with a suitable discourse antecedent, cf. (1)–(4) in 1. In (Sæbø 1984) I gave many authentic examples of indefinite as well as definite ellipsis. Two descriptive generalizations made there are that many of the verbs that require a definite interpretation of their missing optional complements express reactions and that in many cases the complements are infinitival or sentential. Cases of definite ellipsis in an individual argument are rare (note, however, *offer*), as are cases of indefinite ellipsis in an abstract entity argument (note, however, *think*).

There is reason to assume a semantic basis for the boundary between indefinite and definite ellipsis. On the other hand, it is not to be assumed that we can predict semantically when an argument is optional at all. This varies across languages, even among such closely related languages as English, German, and Norwegian. Many verbs with definite ellipsis in English correspond to verbs requiring overt anaphors in German or Norwegian. There are three possibilities, an argument is obligatory (1),

'definitely' optional (2), or 'indefinitely' optional (3); and both the boundary between (1) and (2) and that between (1) and (3) may be partly syntactically based, subject to parametric variation, partly simply arbitrary. It is for the boundary between (2) and (3) that the next section provides a semantic account, predicting that the anaphoricity in a zero argument cannot vary across languages; it should not be possible to find two otherwise synonymous verbs where an argument of one is definitely optional but the same argument of the other is indefinitely optional.

3.2. *The Source of Zero Argument Anaphora*

The problem of zero argument anaphora can be stated in the following question: Why should an inference like (12) be valid, while an inference like (13) should not? The latter inference is pragmatically plausible, but definitely not as semantically compelling as the former.

(12) When the Pope asked Galilei to renounce his theory, Galilei refused.

When the Pope asked Galilei to renounce his theory, Galilei refused to renounce his theory.

(13) Sue had not heard from Joe for months when suddenly, she received a letter.

Sue had not heard from Joe for months when suddenly, she received a letter from him.

Shopen's remark that there is a significant relationship with the notion of presupposition (p. 68) has not been elaborated on, and he himself writes the definiteness of the "activity proposed by a second party in an offer, a command or an invitation" into the lexical entry for *refuse*: "z = definite when ellipsed" (p. 69). Now clearly, it is unsatisfactory to have to indicate in every single case what intuitively appears as a function of some semantic property which the predicates in question have in common and which should be recoverable from the lexical entries anyhow. If it is correct, as Shopen claims, that the definiteness of the ellipsis is due to the semantic structure of the verb and that there is a significant relationship with the notion of presupposition, then that semantic structure and, specifically, its relationship with presupposition, should be explored. And I believe that with the notion of anaphoric presupposition at hand, there is a straightforward way of predicting when a zero argument is anaphoric and how zero anaphora works: It is anaphoric if (and only if) the predicate

triggers a presupposition involving the argument, and the zero anaphor is resolved in the same process in which the presupposition is verified.

HYPOTHESIS. A zero argument is anaphoric iff the predicate triggers a presupposition involving it.

Consider the definite case (12) as opposed to the indefinite case (13). It is probably safe to say that the verb *refuse* triggers the presupposition that the subject has been asked to do what he or she refuses to do. Specifically, the sentence *Galilei refused* presupposes that someone had asked Galilei to P and asserts that Galilei asserts his determination not to P. In terms of bipartite Discourse Representation Structures, the variable P appears both in the presupposition structure and in the assertion structure. On the other hand, the verb *receive* does not trigger a presupposition concerning the prepositional complement, so when the sentence *Sue received a letter* asserts that Sue received a letter from x, the variable x only appears in the assertion structure. Now if in the former case P is introduced in the presupposition structure and in the latter case x is introduced in the assertion structure, the definite interpretation of P and the indefinite interpretation of x follow – on the anaphoric notion of presupposition as described in Section 2.2.

Note, however, that the anaphoric concept of presupposition is essential for the definite interpretation of P to come about: If instead of the definition of anaphoric presupposition in Section 2.2 the definition of nonanaphoric presupposition is used, where no substitution of discourse referents takes place, the presupposition will be verified in a case like (12), but the zero argument referent will in the final representation remain free, and the inference will not come through.

The following two subhypotheses suggest themselves.

- When there is a (nontrivial) presupposition involving the relevant referent, it is introduced in the presupposition structure.
- When, on the other hand, there is no (nontrivial) presupposition involving the relevant referent, it is introduced in the assertion structure.

When a sentence with a zero argument is processed, the zero argument is rendered as a referent in the relevant argument places of the relevant relations in the assertion and, in the event, the presupposition. For the sentence to have an interpretation, this referent must be introduced in the assertion DRS or the presupposition DRS:

PRINCIPLE 1. The merge of the presupposition DRS and the assertion DRS is proper.

It is clear that if the relevant referent is introduced in the presupposition DRS, it is an anaphoric element, and it is also clear that if it is introduced in the assertion DRS, it is essentially novel; the universe of the presupposition DRS is the only place for an anaphoric element. Now the first subhypothesis follows from the following principle, saying, in effect, that the presupposition is prior to the assertion.

PRINCIPLE 2. The presupposition DRS is proper.

That is, the presupposition DRS does not contain free occurrences of referents (cf. Kamp and Reyle (1993, p. 111)). If the discourse referent representing a zero argument occurs in a (nontrivial) condition in the presupposition structure, it is introduced in that structure, it is in its universe. Now if, on the other hand, it does not occur in a (nontrivial) condition in the presupposition structure, prima facie it can belong to the universe of the presupposition DRS or to the universe of the assertion DRS. According to the second subhypothesis, it belongs to the universe of the assertion DRS. To secure this, we need the following conjecture.[2]

CONJECTURE. If a referent is in the universe of the presupposition DRS but does not occur in a (nontrivial) condition in that structure, it originates in an overt anaphor.

On this account, in contrast to overt anaphors, zero anaphors do not trigger the introduction of a referent in the presupposition. In general, the zero argument does not trigger the introduction of a referent; it is only on account of general rules of provisional DRS construction that the effect is the same as with an indefinite or a definite pronoun.[3] The difference between indefinite and definite ellipsis surfaces in where the referent is introduced; which universe it belongs to, but it originates in the absence or presence of a presupposition involving it.

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[2] While Principle 1 and 2 express language-independent propositions about presuppositions, this conjecture should be confined to languages like English, German, or Scandinavian. There are, surely, languages where zero anaphora is less restricted, for instance, Japanese.

[3] The statement that the effect is in the indefinite case the same as with an indefinite pronoun should be relativized: It will in general not be possible to pick up the discourse referent stemming from the zero argument with a pronoun. So the *anaphoric potential* of the zero argument will differ from that of an indefinite pronoun.

To be sure, the hypothesis would be falsified by a nonanaphoric zero argument involved in a presupposition, or by an anaphoric zero argument not involved in one. A comprehensive defense of it would depend on extensive empirical investigations. What can be concluded at this stage is that if the hypothesis is descriptively correct, there is a good theoretical reason for it, at least as regards the 'if' implication: A zero argument occurring in a condition in the presupposition structure is anaphoric by the independently motivated general definition of presupposition and Principle 2. The following section is intended to show for some select cases that the presuppositional analysis of zero anaphora is empirically motivated as well.

4. Zero Argument Anaphora: Applications

Many predicates that can have anaphoric zero arguments describe reactions and generate presuppositions as to the stimulus. The verbs *agree* and *refuse* are clear cases in point. The class of emotive past participle predicates like *surprised*, describing how the subject is affected by a piece of information presupposed to reach the subject, can also be subsumed under reaction predicates. These, in turn, are closely related to factive predicates where the fact argument can be zero, like *remember*. Finally, the presuppositions of state transition predicates like *recover* can be seen to involve optional arguments characterizing precondition states.

4.1. *Reactions*

Let us first consider the verb *agree*. This word has much in common with the focus particle *also* or *too*; in fact, it can almost be paraphrased as also believing. There are several variants of *agree*; the relevant one subcategorizes for a *that* clause. We seek a principled way of deducing (15) from (14):

(14) A sheep has been killed in the mountains.
Farmers believe it was a wolf, and the Sheriff **agrees**.

(15) A sheep has been killed in the mountains.
Farmers believe it was a wolf, and the Sheriff **agrees it was a wolf**.

Let us first consider (15) as a case of full match between presupposition and context. Simplifying and abstracting away from inessentials, we can represent this case as:

context: $\langle\{x_1\}, \{believe(x_1, \langle\{w\}, \{wolf(w)\}\rangle)\}\rangle$

assertion: $\langle\{x_3\}, \{believe(x_3, \langle\{w\}, \{wolf(w)\}\rangle)\}\rangle$

presupposition: $\langle\{x_2\}, \{believe(x_2, \langle\{w\}, \{wolf(w)\}\rangle)\}\rangle$

For (14), reducing the subDRS to a propositional referent, initially we have:

assertion: $\langle\{x_3\}, \{believe(x_3, K)\}\rangle$

presupposition: $\langle\{x_2\}, \{believe(x_2, K)\}\rangle$

However, this structure violates the principle that a presupposition be proper, so the correct result is a structure where the propositional referent is introduced:

presupposition: $\langle\{x_2, K\}, \{believe(x_2, K)\}\rangle$

The context stays the same, of course, or equivalently (cf. Asher 1993, 225ff.),

context: $\langle\{x_1, K'\}, \{believe(x_1, K'), K' = \langle\{w\}, \{wolf(w)\}\rangle\}\rangle$

Finally, on anaphoric presupposition (cf. 2.2), K' replaces K when the assertion is merged with the context, so that (14) in fact says the same as (15).

Shopen's paradigm verb *refuse* can be said to carry the presupposition that the subject has been requested to do what it announces its determination not to do:

(16) The board instructs the management to reduce employment, but it **refuses**.

context: $\langle\{x, y, P\}, \{instruct(x, y, P), P = \lambda y\langle y\ reduce\ employment\rangle\}\rangle$

assertion: $\langle\emptyset, \{refuse^*(w, Q)\}\rangle$

presupposition: $\langle\{v, w, Q\}, \{ask(v, w, Q)\}\rangle$

Here and in the following, *predicate** is supposed to designate the predicate stripped of its presupposition. It should not come as a surprise that in the majority of cases, there is no straightforward way of identifying the separate presupposition and assertion components of a predicate. Rather, *agree* is a special case in that it is almost possible to transcribe the presupposition and assertion in natural language predicates, but even here, it

represents an idealization. In general, what is required is in the presupposition a meta predicate just unspecific enough to cover the range of appropriate contexts, and in the assertion a meta predicate expressing the rest. Implicative verbs, of course, do permit an unambiguous formulation of the assertion:

(17) On Wednesday, the chief UN negotiator, Thorvald Stoltenberg, met with Mr. Izetbegovic to try and ease those fears. He clearly **failed**.

assertion: $\langle \emptyset, \{\neg P(x)\} \rangle$

presupposition: $\langle \{x, P\}, \{try(x, P)\} \rangle$

4.2. *Emotive Predicates and Factives*

Zero anaphora occurs regularly with a number of past participle verb forms like *surprised*, *impressed*, *delighted*, *shocked*, *relieved*. The syntactic category of the optional complement varies, but its semantic type is basically propositional.

(18) Sue told Joe she was pregnant. He was **surprised** that she was pregnant.

The fact that these past participles subcategorize for i.a. a *that* clause indicates that they are not true passives. For ellipsis, the salient fact is that the proposition in the theme role is involved in the presupposition of the predicate. That Joe is surprised that Sue is pregnant presupposes that Joe learns that Sue is pregnant. Thus (simplified with respect to the pronouns):

context: $\langle \{s, j\}, \{tell(s, j, \langle pregnant(s) \rangle)\} \rangle$

assertion: $\langle \emptyset, \{surprised^*(j, \langle pregnant(s) \rangle)\} \rangle$

presupposition: $\langle \emptyset, \{learn(j, \langle pregnant(s) \rangle)\} \rangle$

Now when the *that* clause is omitted, the double occurrence of the constant propositional referent $\langle pregnant(s) \rangle$ is replaced by a variable propositional referent K. The presupposition must be proper, so K is introduced in its universe.

(19) John was surprised.

assertion: $\langle \emptyset, \{surprised^*(j, K)\} \rangle$

presupposition: $\langle \{K\}, \{learn(j, K)\} \rangle$

This means that it must be mapped onto some propositional referent in the context. Strictly, there is none in the universe of the context, but it must, for independent reasons of abstract entity anaphora (cf. Asher 1993: 225ff.), always be possible to declare one for a constant abstract entity referent occurring in a condition.

Note that presuppositions that are not anaphoric in the sense that the universe is nonempty can become anaphoric in this sense if they involve an optional argument. In particular, this is the case with factive presuppositions: once the propositional argument is zero, it must be represented as a variable. In English, *know* can be used without an overt propositional complement, along with a range of other factive verbs and adjectives such as *forget*, *remind*, and *remember* (cf. (3) in Section 1), *notice*, and *aware*. Many have presuppositions over and above pure factivity; *forget* and *remember*, for instance, appear to presuppose in addition that the subject has known the proposition or other object, and *notice* appears to presuppose that the proposition or other object (not) noticed is epistemically accessible to the subject. Let us see how the zero argument of *know* acquires its anaphoric interpretation.

(20) It is not necessary to tell them the climb is dangerous. Sue **knows**.

assertion: $\langle\{z\}, \{Sue(z), believes(z, K)\}\rangle$

presupposition: $\langle\{K\}, \{K\}\rangle$

The propositional variable K appears in two different roles in the presupposition, both as a referent in the universe and as a condition, representing a sub-DRS encoding factuality. In the assertion it appears as a referent in a regular condition. Note, by the way, that the verb *know* shows a zero anaphor more often when the argument is a question than when it is a definite proposition, and then the fact condition is in effect tautologous; the presupposition is just that there is a question. This is sufficient for the anaphoric interpretation of the question variable.

(21) We asked a Lap woman which track to take to Goatteluobal, but she didn't **know**.

Note that it is in general impossible to *accommodate* a presupposition involving a zero argument, even though it is possible to accommodate the presupposition when the argument is nonzero, as in most cases considered so far. *Sue knows* cannot be interpreted without a context specifying a fact, while *Sue knows that the climb is dangerous* can well be interpreted without a context specifying that the climb is dangerous. This is in accordance with the theory of anaphoric presupposition (cf. 2). It is to be

expected on the assumption that accommodating discourse referents is more difficult than accommodating conditions; in particular, accommodation of a presupposition with a nonempty universe is more difficult than accommodation of a presupposition with an empty universe. The presupposition of *Sue knows* involves a discourse referent and accommodation would imply the introduction of that discourse referent, while the presupposition of *Sue knows that the climb is dangerous* only involves a condition and accommodation implies the addition of that condition. As it appears, accommodation is especially difficult when the discourse referent in the presupposition is involved in the assertion, as with personal pronouns, (unlinked) definite descriptions, or presuppositions involving zero arguments.

4.3. *Phase Presuppositions*

State transition verbs like *recover* or *return* and verb groups like *stop raining* have traditionally been analyzed in terms of a backward-looking presupposition and a forward-looking assertion, plus, as the case may be, some process of transition as part of the assertion. Thus *a recovers at t* would presuppose that *a* has been ill up to *t* and assert that *a* is well from *t* on, and that a process of recovery goes on at *t*. And *it stops raining at t* would presuppose that it rains some time up to *t* and assert that it does not rain some time from *t* on. Heim (1987) uses the Kripke-inspired example (22) to show that *stop* induces an accommodation effect (cf. Section 2.1). The interesting thing to note now is that the state type verb *cooking* is enclosed in parentheses in Heim's formulation. It is omissible, and in fact, its omission can be shown, using discourse referents at state type level, to be a case of zero anaphora via the backward-looking presupposition of *stop*.

(22) John is cooking.
He will stop (cooking) when tomorrow's football game starts.

We should be able to predict the validity of the inference from (4) in Section 1 to (23):

(23) It's dangerous to hypnotize people. You might do it to somebody with a gullible mind sometime, and that person would never **recover from the hypnosis**!

This is strongly reminiscent of a case treated by Kamp and Roßdeutscher (1992):

Our ultimate goal is to account for the validity of the following inference: The tourist came down with typhoid. After three weeks he was well again. A doctor from Izmir cured him. Conclusion: The doctor cured him of typhoid. (p. 76)

They reach this goal only by invoking discourse (rhetorical) relations. Let us see how it can be reached with recourse only to presuppositions. Kamp and Roßdeutscher offer the following analysis of a case like (24) (I simplify the representations slightly):

(24) John comes down with typhoid at t. He recovers at t'.

(25) John comes down with typhoid at t. He recovers from the typhoid at t'.

context: $\langle\{e, s, y\}, \{ANT(HEILEN)(e, j, y), typhoid(y), e \text{ at } t, PRE(HEILEN)(s, j, y), e)(s\}\rangle$

assertion: $\langle\{e', s', z\}, \{HEILEN(e', j, z), e' \text{ at } t', RES(HEILEN)(s', j, z), e')(s'\}\rangle$

The predicate *HEILEN* (from the German verb *heilen* ≈ *recover, cure*) is primitive, and the following meaning postulates relate transition predicates (C or $ANT(C)$), precondition state predicates, and result state predicates to each other.

1. $s: PRE(C)(u, v) \Leftrightarrow s: \neg RES(C)(u, v)$,
2. $\langle\{e, u, v\}, \{C(e, u, v)\}\rangle \Rightarrow \langle\{s\}, \{PRE(C)(s, u, v)\}\rangle$ and
3. $PRE(ANT(C)) \equiv RES(C)$ and $RES(ANT(C)) \equiv PRE(C)$.

By postulate 2, the precondition state, intuitively the state of having that from which the *HEILEN* event is a recovery, can be added to the assertion:

assertion: $\langle\{e', s', z, s''\}, \{HEILEN\{e', j, z), e' \text{ at } t', RES(HEILEN)(s', j, z), e')(s', PRE(HEILEN)(s'', j, z), s'')(e'\}\rangle$

Thus Kamp and Roßdeutscher do not treat the precondition as a presupposition. However, if it is treated as one, we can conclude (25) from (24):

assertion: $\langle\{e', s'\}, \{HEILEN(e', j, z), e' \text{ at } t', RES(HEILEN)(s', j, z), e')(s'\}\rangle$

presupposition: $\langle\{s'', z\}, \{PRE(HEILEN)(s'', j, z), s'')(t'\}\rangle$

The precondition state s'' is mapped onto the result state of the

ANT(*HEILEN*) event and the referent z for the illness is mapped onto the referent y for the typhoid. The representation of (25) differs only in that the condition *typhoid*(z) is part of the presupposition. Kamp's and Roßdeutscher's assertion structure incorporating the precondition yields the interpretation of (24) that John recovers from something, but the natural move of reidentifying the precondition as a presupposition yields the intended definite interpretation that John recovers from *it*.

5. Problems

The hypothesis that a zero argument is anaphoric iff involved in a presupposition (3.2) rests on the principle that the presupposition DRS is proper in one direction and on the conjecture that only an overt anaphor can trigger the introduction of a discourse referent in the presupposition DRS in the other. Both are problematic. Cases where apparently, an argument involved in a presupposition is not anaphoric, are discussed in Section 5.1, and cases where apparently, an anaphoric zero argument is not involved in a presupposition, in Section 5.2.

5.1. *Presuppositions and Indefiniteness*

At first sight, cases like (26) seem to contradict the assumption that a predicate like *recover* triggers a presupposition involving the state to recover from:

(26) John has just recovered from a serious illness.

The indefinite signals novelty, and novelty is incompatible with the presupposition. Referents for indefinite descriptions are introduced in assertion structures, not in presupposition structures. But these cases are reminiscent of cases like (27).

(27) John has written to the author of a book about Schubert.

That is, cases where, contrary to Heim's (1982, 373ff.) linking hypothesis, a new file card is introduced under accommodation without being linked by cross-references to some already-present file card(s). Evidently, the indefinite outscopes the definite. The assertion consists of two parts: First, there is a book y about Schubert, and second, John has written to z; and the presupposition is that y has an author z. In this way, the referent y in the presupposition is bound in a part of the assertion processed in advance. To see more clearly that this is a sensible analysis, consider

(28) John knew the crew on every ship in the harbor.

This sentence must be processed as a tripartite structure: the quantifier 'every ship x in the harbor', the presupposition 'x has a crew', and the associated assertion. Quantificational NPs appear as complements of predicates that supposedly trigger presuppositions, too:

(29) John refuses to do everything he is asked to.

The reasonable approach to these cases is, then, to decompose the sentence into three parts, processing the indefinite or quantificational NP at once. The sentences will presuppose nothing because the presupposition is preempted in the NP. (30) will be analyzed as 'there is something K John has heard on the radio such that (presupposition) John has learnt of K; (assertion) John is shocked* at K'.

(30) John is shocked at something he has heard on the radio.

What this shows is, first, that it is too simple to identify the carrier sentence with the entire incoming sentence, second, that we must qualify the principle that the presupposition DRS is proper. It may contain free occurrences of discourse referents as long as those occurrences represent bound variables.[4]

The claim that a presupposition involving a zero argument necessarily yields an anaphoric interpretation of the zero argument implies that each case of indefinite ellipsis is free of a presupposition. The question is whether this can be maintained, considering how widespread presuppositions are.[5] As a putative counterexample, consider the German verb *erkranken* (to fall ill) in contrast to the English verb *recover* discussed in Section 4.3; whereas the *from* complement of the latter is predictably definite as a zero argument, the *an* complement of the former is indefinite as a zero argument. The problem is that *erkranken*, too, triggers a presupposition involving the complement. However, the reason this does not result in a definite interpretation of the zero complement is that this presupposition is in a certain sense negative.

[4] An anonymous reader has suggested that indefinites contained in presuppositions, as in (26), signal that the presuppositions are to be accommodated rather than resolved. As far as I can see, if this approach is taken, the net result will be the same as if my analysis is adopted.

[5] In fact, if selectional restrictions were to count as presuppositions, there would be a problem with garden-variety indefinite-ellipsis verbs like *eat* or *drink*: If the infelicity of a sentence like *John drank the carrot* is attributed to presupposition failure, the sentence *John drank* might be expected to presuppose a condition involving the object referent, predicting a definite interpretation.

(31) Hans ist zu *t* an Typhus erkrankt. ('Hans came down with typhoid at *t*.')

(31) presupposes that Hans did not have typhoid just before *t*, the time of reference; in the terms of Kamp and Roßdeutscher, that there is no state *s* and no typhoid *y* such that Hans is in the *PRE*(*HEILEN*) relation to *s* and *y* and *s* abuts *t*. Now the sentence *Hans ist erkrankt*, where the complement is zero, will presuppose that there is no state *s* and no *y* such that Hans is in the *PRE*(*HEILEN*) relation to *s* and *y* and *s* abuts *t*, and this is not an anaphoric presupposition; the universe of the presupposition DRS is empty because the discourse referents *s* and *y* are in the scope of negation. The referent for the disease Hans has come down with is thus not really involved in the presupposition, it must be introduced in the assertion DRS. Indeed, the sentence presupposes that Hans was not ill with anything, and asserts that he has fallen ill with something.

5.2. *Presuppositions and Definiteness*

The claim that zero argument anaphora depends on presupposition is, of course, vulnerable to facts. It should not be possible to locate an anaphoric zero argument without being able to formulate a presupposition going with it. Now predictably, many presuppositions will be subtle, vague, and difficult to specify. In some cases, positing a presupposition risks circularity and comes close to stipulation. Consider a class of predicates describing how agents are ascribed to actions, like *suspect* and *blame*. It seems plausible that a sentence with *suspect* presupposes that (the subject believes) the action property of the *of* complement holds of somebody. So (32) would presuppose that (the police believe) the bomb has been placed. However, this presupposition is difficult to maintain in cases like (33).

(32) The police suspect the mafia of having placed the bomb.

(33) The police suspect Neonazis of having started the fire.

This sentence does not appear to presuppose that (the police believe) the fire was started by somebody. In fact, it appears to have two readings, one presuppositional and one non-presuppositional, where an accent on *started* correlates with the latter. By comparison, the verb *blame* appears to only permit a presuppositional reading. Evidently, the zero argument construction is based on the presuppositional reading. The other reading might be accounted for by saying that the property description, the *of* object, is processed in advance (cf. Section 5.1), in the appropriate belief context, restoring presuppositionality: 'The police believe the fire was

started by somebody, suspecting Neonazis (of having started it)'. Or, we might say that the zero argument construction coincides with the presuppositional reading because the other reading requires the *of* object to be in focus and a zero argument cannot be in focus.

In a number of cases where definite ellipsis is in principle possible, deleting an optional definite pronoun can be problematic, suggesting that the presupposition to some degree depends on the zero anaphor. Manfred Pinkal (1985, p. 76) noted that the German verb *verkaufen* (*sell*) shows indefinite ellipsis in its indirect (*an* or dative) object but definite ellipsis in its direct (accusative) object, as witnessed by:

(34) Kolumbus hat an Cortez verkauft.

(35) Kolumbus hat die Santa Maria verkauft.

The former sentence can only mean that Columbus has sold it to Cortez, while the latter sentence can only mean that Columbus has sold the Santa Maria to somebody. This asymmetry is prima facie mysterious. But on the reasonable assumption that *x verkauft y an z* presupposes that *x* has had *y*, both the definite interpretation of the direct object zero argument and the indefinite interpretation of the indirect object zero argument are predicted, as the presupposition involves only the former. Note, however, the following contrast:

(36) Cortez hat ein Schiff. Kolumbus hat es an ihn verkauft.

(37) ?Cortez hat ein Schiff. Kolumbus hat an ihn verkauft.

The zero anaphor does not have the same antecedence conditions as the anaphor *es*. Although the antecedent is available in the form of the indefinite *ein Schiff*, the zero anaphor is not resolved. By the same token, the presupposition that *x* has had *y* is felicitously accommodated in the case with the pronoun, (36), but not in (37). This situation can be accounted for in the following way. Recall that an anaphoric presupposition in general (cf. Section 2.1) and one involving a zero argument in particular (Section 4.2) is difficult to accommodate. This is evidently the case in (37), while in (36), there are two presuppositions, one for the pronoun and another for the verb, and the latter is not an anaphoric presupposition but a condition with a bound variable; once the former is resolved, it can be accommodated.

On the other hand, substituting an indefinite pronoun for a basically indefinite zero argument is sometimes problematic too. In such cases, it would appear that the zero argument, although not anaphoric, is not quite indefinite, either. (38) and (39) do not seem to have the same meaning:

(38) Sue had not heard from Joe for months when suddenly, she received a letter.

(39) Sue had not heard from Joe for months when suddenly, she received a letter from somebody.

The difference between an overt indefinite and indefinite ellipsis seems to be that the former imposes a novelty condition while the latter does not; *somebody* must in (39) be interpreted as 'somebody other than Joe', while the zero argument referent may coincide with the Joe referent or not. Possibly, relevance considerations can lead to the identification of the indefinite referent with a familiar referent, independently of the semantic representation.

Is it reasonable to describe zero anaphoric arguments of relational nouns, as in 'bridging' definite descriptions (*the captain*, *the crew*), in terms of presuppositions? Note that as long as the noun phrases are definite, it is not necessary to assume a presupposition for an anaphoric interpretation of the zero argument; given the presuppositional analysis of definite descriptions in general, the zero argument referent is in the presupposition. The 'ellipsis rule' stated by Zimmermann (1991, p. 199) (if α is a relational noun and $\emptyset$ an empty genitive NP the extension of $\alpha\emptyset$ is the set of x such that (x, y) is in the extension of α where y is relevant in the utterance situation) is redundant as far as anaphoric definite descriptions are concerned. And in fact, as Zimmermann notes, there is in principle the possibility of an indefinite interpretation, when the definite article is replaced by the indefinite: *A captain*. However, if a relational noun shows definite ellipsis as an indefinite, as does *victim* in (40), there is reason to assume a presupposition, such as: There is some event to be described as an accident, an attack, a calamity, or the like.

(40) In the night of the American bombardment, Anna Braun, a survivor, and her mother, a **victim**, were asleep in their beds.

To be sure, there are several cases of implicit anaphora remaining problematic on the account proposed; notably implicitly anaphoric adverbials like *2 miles away*, elliptic comparatives, implicitly deictic words like *come* and *go*, and nouns like *enemy*, where a presupposition is difficult to identify. It may ultimately turn out that some instances of zero argument anaphora are not presuppositionally but inferentially driven, depending on relevance, coherence, or informativeness considerations.

6. Conclusions

In a nutshell, I have tried to describe zero argument anaphors not as anaphors in their own right but simply as variables accidentally occurring in a presupposition. Unless the connection between definite ellipsis and presupposition is appreciated, covert anaphors are a variant of overt anaphors, which are presuppositional de se in that they introduce discourse referents in the presupposition structure. However, once the presuppositions of the predicates are taken seriously, the zero anaphors reduce to argument positions, so to speak; and via general properness principles, in particular prohibiting free occurrences in the presupposition structure, the referents surface in the position of anaphora, in the universe of the presupposition structure. Thus implicit anaphors come out as truly implicit in that they do not come with an instruction to find an antecedent, instead, such an instruction comes about indirectly through the presupposition involving them. In this way, it is not necessary to notate the anaphoricity of certain zero arguments as opposed to others.

Another advantage of this account is that it allows a uniform treatment of null anaphors which have no overt anaphor counterpart because the verb simply has no syntactic argument place to provide. Partee (1991) notes that "not all dependent elements take complements or otherwise offer a 'site' for a 'null pronoun'", as evidence against regarding (primarily deictic) null elements as concealed pronouns. The present account draws a sharp distinction between zero and overt anaphors, and this accords well with cases where it is not possible to substitute an overt anaphor. A clear example is the German verb *nachdrängen* (approximately two-place *replace* without a complement). This verb takes no complement, but semantically, it is two-place, and the second argument is invariably anaphoric. The anaphoricity comes about through the presupposition of *nachdrängen*(x, y): y disappears.

My primary concern has been to point out that given a certain conception of presupposition, a presupposition proves a sufficient condition for zero anaphora, and this mechanism can be shown to account for a considerable subset of zero anaphors in a language like English. Whether a presupposition is also a necessary condition is an empirical question. As elsewhere, there are a number of clear cases, but also quite a few less clear cases. In some, a case can be made that the predicate triggers a presupposition after all. But I leave the possibility open that the presuppositional account must ultimately be supplemented by some other principle.

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University of Oslo
Germanistisk Institutt
Postboks 1004
0315 Oslo
Norway