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THE DISCOURSE REPRESENTATION
OF NOUN PHRASES WITH NUMERAL DETERMINERS*

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0. Introduction

This paper is about NPs of the form numeral Common Noun (or n CN), such as three fish, four chairs and one trick. Discourse Representation Theory, as developed by Hans Kamp and Irene Heim,¹ provides a means of representing singular indefinite NPs, like a man, in a way that accounts both for the truth conditions these NPs give rise to, and for facts about discourse anaphora. I will argue for treating n CN in exactly the same way singular indefinites are currently treated in this theory, and against treating them like other NPs containing numerals and other plural NPs. I will use Kamp's framework, but I believe that everything I say can be translated into Heim's terms. I assume familiarity with the framework.

1. Proposed Treatments

There is an old debate about whether n CN gives rise to the same truth conditions as at least n CN, or the same truth conditions as exactly n CN. In "referential" positions, it has both an 'exactly' interpretation and an 'at least' interpretation. Take, for example, (1) and (2).

1. Three cats are pink.
2. Leif has four chairs.

(1) can be interpreted as saying that there are exactly three pink cats (e.g., answering the question How many cats are pink?). It can also mean that at least three cats are pink. Imagine, for example, that it's a comment about the people in the neighborhood being unreasonable with their pets. The hearer can respond with Oh, that's right. You probably mean Frazier's cats. There is one more pink cat, across the road. That is, the hearer knows that in fact at least four cats are pink, but accepts (1) as true (albeit incomplete in information). Similarly, (2) can be understood as saying that Leif has exactly four chairs, but it can also mean that Leif has at least four chairs (e.g., if it is said to someone who needs to borrow four chairs).

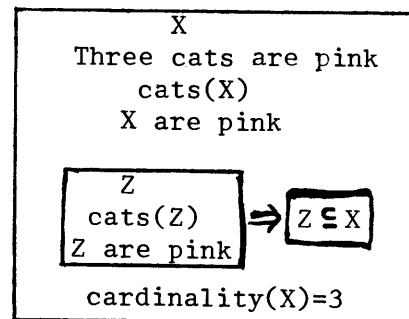
In "predicative" positions, n CN only has an 'exactly' interpretation. Sentence (3), for example, can't mean that there are at least four women and one man among the guests.

3. The guests are four women and one man.

This, together with the fact that the 'exactly' interpretation in "referential" positions is often the more prominent interpretation, suggests that the 'exactly' reading is the semantic one, and the 'at least' reading arises pragmatically.²

Accordingly, Kamp (p.c.) has suggested treating n CN just like he treats exactly n CN. Under his proposal, (1), for example, would be represented as in (4).

4. n CN 'EXACTLY'



The reference marker X represents a set. The simple conditions in DRS (4) say that X is a set of three pink cats. The conditional says that any set Z of pink cats is a subset of X, which means that X is in fact the set of all pink cats. Represented this way, then, the sentence is true iff there are exactly three pink cats. This representation allows for a unified treatment of n CN and other indefinite NPs with numerals and plural NPs, e.g., exactly n CN, at least n CN, at most n CN, most CN and about n CN (which are all represented with a conditional like the one in (4)).

Barbara Partee has suggested to me that the right way to represent n CN might be as illustrated in (5).

5. n CN 'AT LEAST'

<p style="text-align: center;">X Three cats are pink cats(X) X are pink cardinality(X)=3</p>
--

(5) represents an 'at least' reading. X represents a set of three pink cats again, but nothing in the DRS says that it is the set of all the pink cats. If X can be matched with a set of three cats in the world, whose members are pink, the sentence is true, regardless of whether there are more pink cats, outside of that set.

I assume that the 'exactly' representation, as in (4), is appropriate for "predicative" positions. I will argue that for "referential" positions, the 'at least' representation, as in (5), is better.³

2. Arguments

2.1. Intuitions

Singular indefinites (a CN), just like n CN, have an 'exactly' interpretation and an 'at least' interpretation. Speakers' intuitions about these readings have motivated treating a CN as being truth conditionally equivalent to at least one CN. Exactly analogous intuitions support the 'at least' treatment of n CN.

There is a clear intuition that the 'at least' reading associated with a CN and n CN is a "literal" meaning. (2) (repeated below) and (6), for example, can be "literally" true in a situation where Leif has ten chairs.

2. Leif has four chairs.

6. Leif has a chair.

I haven't found any speakers who disagree with this judgement. This strongly suggests that the 'at least' reading is semantic, and should be represented in the DRS.

The speakers' intuition is that in "predicative" positions, the 'exactly' reading is a "literal" meaning. For example, if there are seven women guests, (3) above is "literally" false. In "referential" positions, on the other hand, the 'exactly' reading does not seem to be "literal". Consider (2) and (6) again. If Leif has ten chairs, then in certain contexts, (2) and (6) would be misleading. For example, if we're listing the pieces of furniture that Leif has. But speakers generally agree that even

then, these sentences are not "literally" false.⁴ This suggests that the 'exactly' readings in "predicative" positions and in "referential" positions arise in two different ways, and that the 'exactly' reading in "referential" positions is not semantic, and should not be represented in the DRS.

Recall that the 'exactly' treatment of n CN unifies the treatment of n CN and other NPs with numerals and plural NPs. Let me remark that choosing the 'at least' treatment for n CN does not result in less uniformity. Rather, it unifies treatments in the right place: n CN is treated just like a CN is currently treated in Discourse Representation Theory, because n CN and a CN have identical semantic properties (which are not shared by NPs like at least n CN, about n CN, etc.).⁵

In the following sections, n CN always stands for n CN in "referential" positions.

2.2. Pragmatic Accounts For The Extra Reading

In this section, I will argue that the 'at least' treatment of n CN allows for a plausible pragmatic account of the 'exactly' reading, while it doesn't seem to be possible to assume the 'exactly' semantics and give a plausible pragmatic account of the 'at least' reading. I'll start by examining a pragmatic account for the 'at least' reading.

Given the 'exactly' treatment of n CN, one would have to say that the 'at least' reading arises when the DRS is evaluated with respect to a restricted domain of individuals. Take, for example, sentence (1) (Three cats are pink). (1) can be true in a situation where the domain of individuals which is relevant to the conversation (e.g., the animals in the neighborhood) contains more than three pink cats. Assuming the 'exactly' representation (as in (4)), this would be because (1) would then be evaluated with respect to a narrower domain. For example, it could be evaluated with respect to the domain of all the animals in the neighborhood which the speaker knows about, in which case it would claim that there are exactly three pink cats that the speaker knows of in the neighborhood.

This account does not work for all the 'at least' readings. First, in some situations, it is impossible to define a domain with respect to which the sentence could be evaluated so as to give it its 'at least' reading. Consider (2) (Leif has four chairs). How come (2) can be true even if Leif has ten chairs? Perhaps sometimes it could claim something like 'Leif has exactly four chairs that he is willing to lend'. However, (2) is also perfectly natural in a situation where Leif has ten identical chairs, and he is willing to lend any subset of them. Then, the "domain narrowing" account doesn't work, since there is no way to

construë (2) as claiming that inside some domain (which is sufficiently narrow), there are exactly four of Leif's chairs.

Secondly, the "domain narrowing" approach doesn't work for 'at least' readings in negative sentences. Consider (7).

7. Leif doesn't have four chairs.

Under the 'at least' reading of (7), if Leif has ten chairs, (7) is false. If this reading is analyzed as something like 'Leif doesn't have exactly four chairs he is willing to lend', then there is a wrong prediction, that the sentence would be true if Leif has more than four chairs to lend.

In addition to not being descriptively adequate, the "domain narrowing" account is ad hoc. It posits a new kind of manipulation of the domain of individuals, which doesn't seem to apply to anything other than n CN. Note that it is not a special case of the familiar phenomenon of domain selection, which is responsible for the fact that everybody in (8) can mean 'everybody in the world', 'all the people in the neighborhood', 'the whole department', etc.

8. Everybody loves Nora.

Domain selection applies to sentences with n CN, of course. For example, (2), (6) and (7) might be about chairs that Leif has in his office, rather than any chairs that he has. When domain selection has applied, these sentences still have their two readings. Domain selection applies to a large range of NPs, including NPs with numerals. (9), for example, can also be about chairs Leif has in his office.

9. Leif has exactly four chairs.

In contrast, the domain narrowing that's to account for 'at least' readings does not apply to NPs other than n CN. It can't apply to (9), for example, since (9) doesn't have an 'at least' reading.

Treating the 'at least' reading of n CN as semantic and giving a pragmatic account of the 'exactly' reading works much better.

Larry Horn, in his dissertation (1972), assigns n CN the 'at least' semantics, and treats the 'exactly' reading as a special case of a scalar implicature. Kempson (1982) also takes the 'at least'/'exactly' ambiguity of n CN to be a special case of the ambiguity of sentences with scalar implicatures. I think that Horn's approach is right, although there do appear to be some differences between the n CN cases and other cases of scalar implicatures.

Consider sentence (10).

10. She is competent at linguistics.

(10) has two readings, analogous to the readings associated with n CN. It may imply that "she" is not more than competent at linguistics, in which case it has an 'exactly' reading (she is exactly competent, no more and no less). Or, (10) can just say that "she" is no less than competent, that is, have an 'at least' reading (she is at least competent). Perhaps the two readings are even more obvious in examples like (11) and (12) below (from Kempson (1982), her (11) and (14)).

11. She isn't competent at linguistics: she is masterly at the subject.
12. I didn't invite John to supper: I invited John, Mary and Susanna.

Without the part after the colon, (11) would normally mean that "she" is less than competent in linguistics, and (12) would mean that John was not invited. These are 'at least' readings: (11) denies the claim that "she" is at least competent, and (12) denies that at least John was invited. With the part after the colon, (11) and (12) have 'exactly' readings. (11) now means that "she" is not exactly competent, and (12) means that the set of guests doesn't have exactly one member, John.

I think it is generally accepted, and for good reasons, that the semantic reading of examples like (10)-(12) is the 'at least' one, and that the 'exactly' reading is a scalar implicature, which arises pragmatically.⁶

The conclusion that the 'exactly' reading of n CN also arises pragmatically is not unquestionable, however. The distribution of readings and of readily available readings is not exactly the same with n CN and in the other cases. The 'exactly' reading seems to be more prominent with n CN than it is in the other cases. For example, (13) below often doesn't imply that only Leif was invited, whereas (14) would usually imply that no more than three guests were invited.

13. I have asked Leif for supper.
14. I have asked three guests for supper.

Moreover, while n CN always has an 'exactly' interpretation, it seems that other NPs sometimes don't. Compare (15) and (16).

15. Leif is sexy.
16. Three professors are sexy.

(15) doesn't seem to ever imply that Leif is the only sexy individual in the domain (except, perhaps, when Leif is focused). In contrast, (16) would often imply that only three professors in the relevant domain are sexy. In the light of these facts, it is conceivable that the 'exactly'/'at least' distinction is grammaticized as a semantic difference for n CN but not for the other cases.

Nevertheless, I think that the parallelism between the n CN ambiguity and the other scalar implicature ambiguities does support the view that the 'exactly' reading of n CN arises pragmatically. Examples like (10)-(12) do show that at least for some cases of an 'at least'/'exactly' ambiguity there has to be a pragmatic explanation of the 'exactly' reading. Therefore, if we take the n CN ambiguity to be a special case of the scalar implicature ambiguity, then not only is it possible to give a pragmatic account of one of the readings, but also, such an account would be independently motivated.

The following similarities in the behavior of n CN and the other examples provide further support for the claim that they are instances of the same phenomenon. Under negation, the 'at least' reading is (much) more readily available than the 'exactly' reading, both for n CN and for the other examples. For both, the 'at least' reading is nevertheless cancelable (as in (11) and (12) above and (17) below).

17. Leif doesn't have four chairs: he has five.

The scalar implicature is a "no more" implicature. For She is competent, the implicature is 'and no more than that'; for I asked John, the implicature is 'and no more people'; and for Leif has four chairs, the implicature is that he doesn't have more chairs. This implicature results in an 'exactly' reading: if Leif has at least four chairs and no more than four, then he has exactly four.⁷

As suggested in Horn (1972), the scalar implicature is governed by Gricean principles. (See Grice (1975).) It arises when the 'at least' reading is not relevant enough. Kempson (1982) outlines how the 'exactly' reading of n CN depends on relevance. Let me illustrate this with (2) (Leif has four chairs). If (2) is said to someone who needs to borrow four chairs, then its "literal" meaning (i.e., the 'at least' reading) is all the hearer needs to know. Knowing the exact number of chairs that Leif has would not add any relevant information. But if the question under discussion is what furniture Leif has, then it would be more relevant to know exactly how many chairs he has than to just know that he has at least four. Therefore, in this situation, the information that he has no more than four chairs would arise as an implicature.

Note that in affirmative sentences, like (2), the 'exactly' reading is a stronger claim than the 'at least' reading, and therefore likely to add relevant information. This fits well with the Gricean account of this reading.⁸

2.3. n CN Is Neither Like at least n CN Nor Like exactly n CN

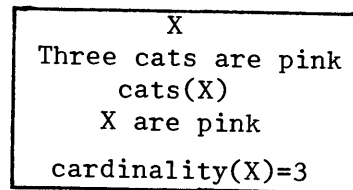
In this section, I will argue that n CN has to be assigned a discourse representation which differs both from the discourse representation of exactly n CN and from that of at least n CN, since it differs from both in its semantic properties. I will show that the 'at least' treatment of n CN presented above is superior to the 'exactly' treatment, in that it satisfies this requirement.

First, the representation of n CN should explain why it has two interpretations, while exactly n CN and at least n CN don't. Under the 'exactly' treatment of n CN (illustrated in (4)), n CN and exactly n CN have identical discourse representations. Therefore, this treatment fails to explain why exactly n CN differs from n CN in that it doesn't have an 'at least' reading.

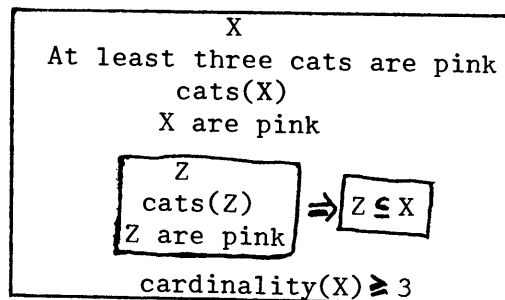
One might try to solve this problem by claiming that since exactly n is a marked expression, it resists pragmatic manipulations like the domain narrowing which creates 'at least' readings. Markedness, however, is a matter of degree, and one would expect it to yield contrasts which are also a matter of degree (degree of acceptability or prominence, for example). But the contrast we are concerned with is a clear cut distinction: either the 'at least' reading is available, or it isn't. Therefore, it seems unlikely that it results from a markedness difference.

If n CN is treated just like singular indefinites, as in (5) (repeated below), then its discourse representation is not identical to that of at least n CN, which is illustrated in (18).⁹

5. n CN 'AT LEAST'



18. at least n CN



Therefore, given this treatment, it is possible to explain why at least n CN differs from n CN in that it doesn't have an 'exactly' reading. I will use (5) and (18) to illustrate this.

The DRS in (5) contains a reference marker X representing a set. The 'exactly' reading of Three cats are pink is created by adding a scalar implicature to the information represented in its DRS. Assume that the scalar implicature is the claim that there are no more pink cats outside of the set represented by X. Adding this claim to the information represented in DRS (5) entails that there are exactly three cats, since the cardinality of the set represented by X is set as equal to 3.

Adding the same claim to the information represented in DRS (18) fails to create an 'exactly' reading. In (18), the set represented by X may have more than three members. Therefore, even if there aren't any pink cats outside of that set, there might still be more than three pink cats.¹⁰

The discourse representation of n CN should also explain why it differs from exactly n CN and from at least n CN with respect to anaphora. One more disadvantage of the 'exactly' treatment of n CN is that it fails to explain why a certain restriction on discourse anaphora holds of exactly n CN and of the 'exactly' reading of n CN, but not of the 'at least' reading of n CN.

Consider examples (19) and (20).

19. Exactly a hundred Hondas are defective.
The others are getting sold fast.
20. A hundred Hondas are defective.
The others are getting sold fast.

The others in (19) refers to all the Hondas other than those in the set of defective Hondas. That is, it refers to a complement of a set of a hundred Hondas. It can do so in any context of utterance, with no restriction. Under the 'exactly' reading of (20), the others in (20) can also always refer to a complement of a set of a hundred Hondas.

When (20) has its 'at least' reading, the others in (20) can not always refer to a complement of a set of a hundred. Consider (20) in a context of utterance where makes of cars are being divided into two categories: those with a hundred or more defective cars, and those with less than a hundred defective cars. In this context, (20) has an 'at least' reading; it doesn't have to imply that no more than a hundred Hondas are defective. Keep in mind that there might be 1000 defective Hondas. Can the others refer to a complement of a set of one hundred Hondas? All my informants agree that in the situation we are considering, it can't refer to a complement of a set of a hundred, unless the speaker has a

specific set of a hundred Hondas in mind (e.g., the set of Hondas that he or she has inspected).

The 'exactly' treatment of n CN does not explain these facts. The domain narrowing which is supposed to yield the 'at least' reading does not affect the DRS. Both when the domain is narrowed and when it isn't narrowed, the DRS of A hundred Hondas are defective, just like the DRS of Exactly a hundred Hondas are defective, contains a reference marker representing the set of all the defective Hondas, whose cardinality is in both cases 100. So nothing explains why when the domain is not narrowed, the others can refer to the complement of that set with no restriction, while when the domain is narrowed, it can only do so if the speaker has a specific set in mind.

If n CN is treated like singular indefinites, as in (5), there is no such problem. Assume that maximal collections like the set of all the defective Hondas are specific in the relevant sense.¹¹ In the DRS of A hundred Hondas are defective, there is a reference marker representing a set of one hundred Hondas, which is not necessarily the set of all defective Hondas. The 'exactly' reading arises when the set corresponding to the reference marker is pragmatically identified with the set of all defective Hondas. Therefore, under this reading, the set corresponding to the reference marker is always specific in the relevant sense, and the others can always refer to its complement. Under the 'at least' reading, the set of one hundred Hondas represented by the reference marker is not identified with the set of all the defective Hondas. Therefore, the others can only refer to its complement if there is something else which renders it specific, e.g., that it's the set of cars that the speaker has inspected.

For many speakers, n CN differs from at least n CN in anaphora possibilities. I will illustrate the facts of my own dialect using examples (21) and (22).¹²

21. Ten kids walked into the room.
They were making an awful lot of noise.
22. At least ten kids walked into the room.
They were making an awful lot of noise.

In (21), They must refer to a set of ten kids, while in (22), They can refer to the set of all the kids who walked into the room. Imagine, for example, that twelve kids walked into the room (in which case the first sentence in (21) is true). They in (21) can't possibly refer to all twelve kids, but They in (22) can. (In fact, the more prominent reading of (22), presented out of context, is with They referring to all the kids who walked in.)

The 'at least' treatment of n CN has no difficulty explaining these facts. The difference in anaphora possibilities follows from

the difference between the representation of n CN (as in (5)) and the representation of at least n CN (as in (18)). The antecedent for discourse anaphora is the reference marker in the discourse representation. In the DRS of Ten kids walked into the room, the reference marker stands for a set of ten kids, so a following pronoun must refer to a set of ten. In the DRS of At least ten kids walked into the room, the reference marker stands for the set of all the kids who walked into the room, so a following pronoun can refer to that set, no matter how many members it has.

FOOTNOTES

*I would like to thank Hans Kamp and Barbara Partee for many interesting discussions and helpful comments. Special thanks to Barbara, for her help and support. Thanks to Roger Higgins and Larry Horn for pointing out very relevant literature. Thanks to my informants, especially Nina Dabek, Al Huettnner, Joyce McDonough, Scott Myers, Peter Sells and Joyce Shyloski.

¹See Kamp (1981) and Heim (1982). I am using Discourse Representation Theory to refer to similar ideas developed by both authors, although it is not Heim's term.

²In this paper, the semantics/pragmatics distinction is not a matter of "having to do with truth conditions" or "having to do with discourse". By "semantic" aspects of meaning, I mean those which are fully determined by the discourse representation of the utterance, as it is constructed by construction rules (alone). By "pragmatic" aspects of meaning, I mean those which are not fully determined by that representation, but depend on other things as well.

³The difference in meaning between the two positions probably does not have to be stated as an ad hoc stipulation. It should be possible to make it follow from the interaction of general principles with the (unambiguous) semantics of the numeral, rather than posit a lexical ambiguity. See also Kadmon (1984), fn. 11.

⁴Note the contrast between this intuition and speakers' intuitions about cases of clear ambiguity, such as Leif can be found at the bank. There is a clear intuition that if the utterer of this last example meant the river bank, and Leif can't be found there, the sentence is "literally" false.

⁵See Kadmon (1984) for a more detailed discussion of this point. I argue there that a CN and n CN behave alike with respect to anaphora as well, and that if there are differences in prominence of readings between them, these are due to pragmatic factors.

⁶The alternatives are implausible. Take the semantic ambiguity hypothesis. One couldn't say that it's a property of

clauses in general that they are ambiguous between the two readings, since scalar implicatures can arise in connection with more than one word per clause. Therefore, one would have to say that John is ambiguous between 'just John' and 'John and possibly someone else', competent ambiguous between 'just competent' and 'competent and possibly something else', etc. This is an awful lot of extra ambiguity. Worse, it isn't always possible to find a candidate for the basis of the ambiguity. As Kempson (1982) points out, there doesn't seem to be one for the following quotation, for example. "It's no longer a crime to hold left wing views in Colombia: it's a crime to hold any views whatsoever." (The Times)

Similarly, it is implausible that the 'exactly' reading is the sole semantic reading. Again, there isn't always a basis for such a reading. Also, it yields very unintuitive results involving "literal" meanings, synonymy and entailments. (See Kempson (1982) for details.)

Finally, it is not a good idea to say that sentences with scalar implicature ambiguities are somehow semantically underspecified with respect to the 'at least'/'exactly' distinction. First, there is a speakers' intuition that the 'at least' reading is a "literal" meaning. Also, only when there is a whole range of possibilities for a certain aspect of meaning, does it make sense to say that it is not specified by the semantics and has to be determined pragmatically. This is the case with the domain of individuals being determined by domain selection, for example. But there is absolutely no need to approach the 'at least'/'exactly' distinction in this way, since here there are just two, well defined, readings.

⁷See Horn (1972) and Fauconnier (1975) on pragmatic scales and scalar implicatures.

⁸In negative sentences, like Leif doesn't have four chairs, the 'exactly' reading contradicts the semantic 'at least' reading. It is also a weaker claim (and therefore less likely to add relevant information). This explains why in negative sentences, the 'exactly' reading is hard to get (has to be forced by an additional statement and/or extra stress on the numeral).

⁹The conditional in DRS (18) is not necessary in order to get the truth conditions right, or even to explain why a pronoun in the following bit of discourse can refer to the set of all the pink cats (cf. example (22) below). I have argued in Kadmon (1984) that this conditional should be included in the DRS, to account for the fact that a following pronoun can't possibly refer to a set of pink cats which has more than three members but is smaller than the set of all pink cats. (Thanks to Peter Sells for discussions that helped clarify this point.)

¹⁰The DRS in (18) actually contains the information that there are no pink cats outside of the set X as it is; this infor-

mation is encoded in the conditional. The explanation as presented in the text would work regardless of whether at least n CN is represented with or without such a conditional (a question mentioned in fn. 9).

¹¹I have argued in Kadmon (1984) that for the purposes of anaphora, a set is "specific" iff the speaker has some way of distinguishing it in his or her mind from everything else in the model.

¹²See Kadmon (1984) for a discussion of other dialects.

REFERENCES

- Fauconnier, Gilles (1975) "Pragmatic Scales and Logical Structure", Linguistic Inquiry 6.3, 353-375
- Grice, H. Paul (1975) "Logic and Conversation", in P. Cole and J.L. Morgan (eds.), Syntax and Semantics 3: Speech Acts, New York: Academic Press, 41-58
- Heim, Irene (1982) The Semantics of Definite and Indefinite Noun Phrases, PhD dissertation, UMass, distributed by the Graduate Linguistics Students Association, UMass/Amherst
- Horn, Laurence R. (1972) On the Semantic Properties of Logical Operators in English, PhD dissertation, UCLA, reproduced by the Indiana University Linguistics Club, 1976
- Kadmon, Nirit (1984) "Indefinite Noun Phrases with Cardinality Indication", UMass Generals Paper, ms.
- Kamp, Hans (1981) "A Theory of Truth and Semantic Representation", in J. Groenendijk, T. Yanssen and M. Stokof (eds.), Formal Methods in the Study of Language, proceedings of the third Amsterdam Colloquium, Mathematical Center Tracts, Amsterdam
- Kempson, Ruth (1982) "Negation, Ambiguity and the Semantics-Pragmatics Distinction", paper presented at the Winter LSA Meeting