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## Gapping in Disjunctions\*

This paper investigates a difference in interpretation between gapping in disjunctions and gapping in conjunctions that has not been previously identified. Specifically, modals which only have a wide-scope interpretation in gapping in conjunctions have an unexpected narrow scope interpretation in gapping in disjunctions. This fact is puzzling since it seems to be evidence against a well-motivated structure for gapping. I show that the solution is not to complicate the syntax of gapping structures, but to adopt an independently motivated Hamblin semantics for disjunction. This account makes sense of the difference between conjunctions and disjunctions without additional stipulations and makes several new predictions about the scope of modals and negation in gapping in disjunctions, which are born out.

### 1 Introduction

Ross (1967) first observed gapping, a coordination construction in which the verb, auxiliary, or modal (and sometimes other material) in the second conjunct is not pronounced (1).

- (1) Some ate nattoo and others — rice. (Ross 1970)
- (2) Some ate nattoo and others ate rice.

The gapping sentence in (1) is interpreted as if the unpronounced material *ate* were present in the second conjunct (2).<sup>1</sup> The structure I will adopt is one argued for by Johnson (1996) and others<sup>2</sup> in which the conjuncts are smaller than they appear to be on the surface (3). In this structure, the

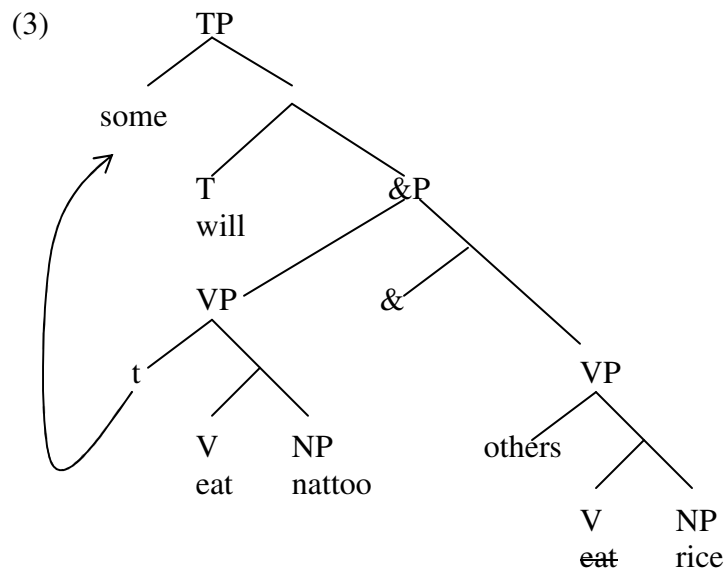
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\* Many thanks to Sabine Iatridou, David Pesetsky, Luis Alonso-Ovalle, Kyle Johnson, Kai von Stechow, and Irene Heim for their help with the research reported here.

<sup>1</sup> A central point of debate about gapping surrounds the process by which the gap is produced. Proposals have included head deletion of the verb, Right-node raising of the object followed by VP-ellipsis (as in pseudogapping), base-generation of a null verb, Across-the-Board movement of phrases or heads, and various combinations of these processes. I will not have anything new to add to the discussion of the mechanism for producing the gap, and the choice of one over the others will not make a difference to my arguments, as far as I can tell.

<sup>2</sup> Siegel (1987), Johnson (2001), Lin (2000, 2002), Coppock (2001).

sentence has a single T node, and the conjuncts are VPs (or vPs). This analysis adopts the VP-internal subject hypothesis (Koopman & Sportiche (1985, 1991), Kitagawa (1986), Fukui & Speas (1986), and Kuroda (1988)), in which VPs are propositional. The second subject remains *in situ* in its VP, while the subject of the first conjunct moves out of its VP in order to satisfy the EPP feature of T.



### 1.1 Cross-conjunct binding

There are various pieces of evidence in favor of the structure in (3). For instance, pronoun binding facts show that the subject of the first conjunct in a gapping structure has scope over material in the second conjunct (4) (Johnson 1996).

- (4) a. Not every girl<sub>1</sub> ate a GREEN banana and her<sub>1</sub> mother a RIPE one.  
 b. No boy<sub>1</sub> joined the navy and his<sub>1</sub> mother the army.

This fact is accounted for in (3) because the first subject moves to Spec, TP, while the second subject remains *in situ*. This fact would be mysterious, however, if the conjuncts were large enough to each contain its own T head, like their non-gapped counterparts in (5).

- (5) a. \*Not every girl<sub>1</sub> ate a green banana and her<sub>1</sub> mother sold a ripe one.  
 b. \*No boy<sub>1</sub> joined the navy and his<sub>1</sub> mother headed the army.

Thus, the pronoun binding facts support a structure in which the first subject asymmetrically c-commands the second subject.

## 1.2 Wide scope negation

Another piece of evidence that gapping involves VP-sized conjuncts is that sentential negation is interpreted outside of the scope of coordination (Siegel 1984, Oerhle 1987).

(6) Sally didn't skate on Saturday or Samantha on Sunday. *neg > or* (Lin 2002)

This sentence is interpreted with negation outscoping *or* (7)a, which is equivalent to (7)b. (by DeMorgan's Law ( $\neg(A \text{ or } B) = (\neg A \ \& \ \neg B)$ ):

- (7) a. It's not the case that Sally skated on Saturday or Samantha skated on Sunday.  
b. = Sally didn't skate on Saturday AND Samantha didn't skate on Sunday.

In other words, there is a single negation that is interpreted outside the site of disjunction. That this is the reading we get can be tested by an entailment diagnostic: disjunction having scope over negation entails only one or the other of the disjuncts; negation having scope over disjunction entails both of the disjuncts (Vainikka 1987). Since (6) entails both that Sally didn't skate on Saturday and also that Samantha didn't skate on Sunday, the diagnostic indicates that negation does indeed have widest scope. This follows directly from the structure in (3), since sentential negation is higher than VP, hence higher than the coordination.

However, if the site of conjunction were large enough to include T (and negation), we would expect (6) to have the same interpretation as (8).

(8) Sally didn't skate on Saturday or Samantha didn't skate on Sunday. *or > neg*

In (8) negation has only the narrow scope reading with respect to disjunction. This sentence only entails that one of the disjuncts be true: it would still be true if Samantha in fact skated on

Sunday, as long as Sally did not skate on Saturday. This is not the reading we get for (6). This fact tells us that the two sentences have different structures. In particular, the conjuncts in (6) are both c-commanded by the sentential negation.

### 1.3 Scope of modals

Scope facts about modals can also be used to show that the phrases conjoined in gapping are below the modal.

- (9) (In order to have the advantage in the boxing match ...)
- a. Mary must outweigh John and John must outweigh Mary by next Thursday.
  - b. Mary must outweigh John and John outweigh Mary by next Thursday.
  - c. Mary must outweigh John and John, Mary by next Thursday.<sup>3</sup>

With no gapping (9)a, the sentence is perfectly acceptable. It states that there are two different requirements, one for each of the boxers: in all the worlds in which Mary has the advantage in the boxing match, Mary outweighs John; in all of the worlds in which John has the advantage in the match, he outweighs Mary. This is expected, since there are two modals in the sentence.

With gapping (9)b&c, however, the sentence is grammatical, but states that an impossible situation must occur: in all possible worlds consistent with the requirements, Mary both outweighs John and is outweighed by him. This difference in interpretation would be unexpected if the conjuncts in (9)b&c were large enough to each contain a modal, as in the non-gapped counterpart (9)a. Further evidence for there being a single modal in the gapping example comes from data with *respectively*.

- (10) According to Coach M and Coach J, respectively,  
Mary must outweigh John and John must outweigh Mary by next Thursday.

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<sup>3</sup> Thanks to David Pesetsky for coming up with these examples.

When there are clearly two modals, using *respectively* to match coach to athlete's requirement is perfectly acceptable (10). However, with gapping, use of *respectively* leads to ungrammaticality (11).

- (11) \*According to Coach M and Coach J, respectively,  
Mary must outweigh John and John outweigh Mary by next Thursday.

If there were only a single modal, then there should be only a single modal base and this ungrammaticality is expected. It would be unexpected if there were two modals and the second one were deleted or moved out of the coordination—it that case (11) should be equally acceptable to (10). This is further evidence that the structure in (3) is the structure for gapping.

We can see the same thing by putting *respectively* at the end of the sentence. Let's say that there are different opinions about when an athlete should be at his or her peak weight. Mary's coach believes it is important to reach optimum weight several days before the match to give her body time to adjust; John's coach believes that it is enough to reach top weight by the day of the match. So according to their coaches' dictates ...

- (12) Mary must outweigh John and John must outweigh Mary by Monday and Thursday,  
respectively.
- (13) \*Mary must outweigh John and John outweigh Mary by Monday and Thursday,  
respectively.

The ungrammaticality of (13) indicates that there is a single modal in the sentence and, hence, that the coordination must be below the site of the modal.

A similar point has been made by Siegel (1984, 1987) and Oehrle (1987) with ability modals. In the non-gapped (14), two different things are claimed to be impossible: Ward eating caviar and Sue eating beans. With gapping, however, there is a single thing that is claimed to be impossible: Ward eating caviar while Sue eats beans (15).

- (14) Ward can't eat caviar and Sue can't eat beans. (Siegel 1984)  
(15) Ward can't eat caviar and Sue eat beans.<sup>4</sup>

With no gapping, (14) is interpreted as having two ability modals. With gapping, there is a single modal that seems to be deontic or circumstantial, and the sentence is interpreted as a claim about the possibilities of the situation (according to the dictates of etiquette, the speaker's view of what is desirable or polite, etc.). This modal seems to take the entire proposition *Ward eats caviar and Sue eats beans* as an argument.

The contrast between (14) and (15) has been used to show that there is a single modal in the gapping case. This point implicitly assumes that the reason that (15) is not interpreted as having an ability modal is that ability modals have control structures, not raising ones. That is, the reason that *can* in (15) cannot be interpreted as an ability is that, for control structures, you need as many modals as controllers. The fact that we get a non-ability interpretation, the argument goes, is because we have two possible controllers but only one modal; hence there is a single modal in structures like (15). This assumption about ability modals having control structures has been widely questioned, and I am not prepared to defend it. However, since we have shown with a non-ability modal (9) that the modal must have wide scope in a gapping sentence, I will take the question of the nature of the ability modal to be orthogonal to concerns about the structure for gapping.

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<sup>4</sup> There is an additional fact in the paradigm discussed by Siegel: (i) is claimed to have available the interpretations of both (14) and (15).

(i) Ward can't eat caviar and Sue beans.

This fact has been used to argue that (3) is not the only structure available for gapping. Lin (2002) argues that on the (14)-like distributed-scope reading, (i) has TP-level coordination, and on the (15)-like wide scope reading, (i) has VP-level coordination. According to her, the reason the distributed scope reading is not available for (15) is that the structural ambiguity is limited to gapping sentences that are missing the second verb as well as the modal. This solution is undesirable because it is not clear how to limit the ambiguity to sentences like (i), and the way that Lin does so is not very convincing.

There does not seem to be a similar contrast between (9)b&c. (9)b, with a verb present in the second conjunct, and (9)c, without one, seem equally to have only the wide-scope reading. However, with the *respectively* test, (9)c does seem to be better, which I have no account for at this time.

(ii) According to Coach M and Coach J, respectively, Mary must outweigh John and John Mary by next Thursday.

## 1.4 Determiner sharing

Another gapping environment that can be used to argue for the structure in (3) is determiner sharing. As first noticed by McCawley (1993), with certain determiners the determiner of the subject of the first conjunct can be shared with the subject of the second conjunct.

- (16) Too many Irish setters are named Kelly, German shepherds Fritz, and huskies Nanook.  
(17) The duck is dry and mussels tough, but Bocuse D'Or rehearsal goes well for chef Bumbaris. (McCawley 1993)

In (16), the determiner *too many* is interpreted in each of the conjuncts, though it is pronounced only in the first one. The parallel non-gapped sentences cannot share a determiner:

- (18) \*Too many Irish setters are named Kelly, German shepherds are named Fritz, and huskies are named Nanook.  
(19) \*The duck is dry and mussels are tough, but Bocuse D'Or rehearsal goes well for chef Bumbaris.

McCawley's generalization is that determiner sharing is dependent on verb gapping. Lin (2000, 2002) shows that determiner sharing is dependent not on gapping of the verb but on the absence of the auxiliary (Lin's Generalization).

- (20) a. The girls will drink whiskey, and — boys, drink wine.  
b. The girls will drink whiskey and — boys — wine  
b. \*The girls will drink whiskey, and — boys will drink wine.  
c. \*The girls will drink whiskey, and — boys will — wine.

Sharing of the determiner *the* between the conjuncts is possible only when T is missing from the second conjunct (20)a, b. The verb may be missing, too, but a gapped verb is not a sufficient condition for D-sharing (20)d. In fact, it is not even a necessary condition (20)a. What is

necessary is that there be only one auxiliary. The verbs can even be different, so long as T is missing from the second conjunct:

- (21) a. The boys will wash the dishes, and – girls, mop the floor.  
b. \*The boys will wash the dishes, and – girls will mop the floor.

(Lin 2000, 2002)

Since determiner sharing is dependent on there being a single T in the structure, we can take determiner sharing as another argument in favor of the structure in (3).

## 2 The Puzzle

Given the well-supported gapping structure in (3), a modal is predicted to always take wide-scope with respect to the coordination. This is because there is only one modal in the structure, and it originates above the conjoined phrases. This prediction holds for gapping sentences with conjunction.

- (22) Mary must outweigh John and John outweigh Mary by next Thursday.  
(23) Ward can eat caviar and Sue eat beans.

As discussed above, (22) is a contradiction, which shows that only the wide-scope reading for the modal is available. Similarly, (23) only has the meaning that in some of the deontically accessible worlds, the proposition *Ward eats caviar and Sue eats beans* is true. It does not have the distributed ability modal reading. In other words, there is a single modal each of these structures as expected, given (3).

The prediction does not hold for gapping sentences containing disjunction, however.

- (24) Mary must outweigh John or John outweigh Mary by next Thursday.

Example (24) is ambiguous between the wide- and narrow-scope readings for the modal (with respect to disjunction). On the wide-scope reading, there is one requirement, that by next Thursday John and Mary do not weigh the same amount (25)a. On the distributed scope reading,

(24) claims there are two separate requirements (one for Mary, one for John) and one or the other of them is true (25)b.

- (25) a. must ((Mary outweigh John) or (John outweigh Mary))  
b. (must (Mary outweigh John)) or (must (John outweigh Mary))

Thus, the wide-scope modal reading is available as expected, but a distributed modal reading is also available. This is surprising if the only structure for gapping is (3) and if the modal must originate above the coordination, as I have implicitly assumed in order to account for the conjunction facts.

The availability of the distributed scope reading for the disjunction counterpart of (23) is harder to see.

(26) Ward can eat caviar or Sue eat beans.

In this case, the two readings are truth conditionally equivalent under a standard semantics for modals and disjunction.

- (27) a. It is possible that (Ward eats caviar or Sue eats beans)  
 $\exists w (\text{Ward-eats-caviar}(w) \vee \text{Sue-eats-beans}(w))$   
b. It is possible that Ward eats caviar or it is possible that Sue eats beans  
 $\exists w \text{Ward-eats-caviar}(w) \vee \exists w \text{Sue-eats-beans}(w)$

There would be a diagnosable difference between (27)a and (27)b if the modal had a different interpretation in its wide and narrow scope incarnations (i.e., deontic/circumstantial and ability, respectively). But, as mentioned above, this difference relies on the assumption that an ability modal must have a control structure, and, hence, that the absence of an ability reading shows that there is only a single modal. If we do not adopt this assumption, is there any way to tell the difference between (27)a and (27)b as possible meanings for (26)?

## 2.1 ... *But I don't remember which*

Fortunately, there are several tests we can use to identify wide-scope disjunction. One of these is to follow the sentence with ...*but I don't remember which*. If disjunction has the widest scope in the sentence, then this continuation should be perfectly grammatical, as in (28). If disjunction has low scope, however, then the continuation should not be possible, as in (29). *But I don't remember which* seems to require that the constituent with which it combines be a disjunction; it is not enough to have a disjunction lower in the structure.

(28) John is a vegetarian or Mary is a vegan, but I don't remember which.

(29) \*John's sister or brother is a vegetarian and Mary is a vegan, but I don't remember which.

And, in fact, this continuation is fine with (26). I will use an example that is more salient on the distributed scope reading, but the same facts hold for (26). The context is that the host thinks that Ward is allergic to nuts and that Sue is allergic to lactose and so has decided not to make either of his two favorite desserts, peanut brittle and homemade ice cream. The speaker tells him that he actually can make one of the desserts, because one of the guests doesn't have the supposed food allergy, but the speaker can't remember which one.

(30) Ward can eat peanuts or Sue drink milk, but I don't remember which.

In this context, the continuation is perfectly acceptable, which tells us that (30) has a reading in which disjunction takes widest scope, i.e., the narrow scope modal reading. This is the reading that is not available for the conjunction counterpart (23).

In the case of the universal modal in (24), this test disambiguates in favor of the wide-scope disjunction reading, (32)b.

(31) Mary must outweigh John or John outweigh Mary by next Thursday, but I don't remember which.

(32) a. \*must ((Mary outweigh John) or (John outweigh Mary))

b. (must (Mary outweigh John)) or (must (John outweigh Mary))

With the continuation, (31) is no longer ambiguous. It only has the distributed modal reading, which is precisely the reading not available for gapping sentences with conjunction.

## 2.2 *Either ... or*

A second test for the height of disjunction is placement of *either*. Schwarz (1999) argues that *either* overtly marks the left edge of a disjunction. Hence, we expect that if *either* is placed at the left edge of the sentence, it will disambiguate in favor of widest scope for the disjunction (i.e., the puzzling distributed modal reading). In fact, *either* does disambiguate (24) just like the *but I don't remember which* test.

(33) Either Mary must outweigh John or John outweigh Mary by next Thursday.

Only the wide-scope disjunction reading (32)b is available for (33). The same test used on the existential modal sentence (26) is grammatical, showing that the distributed modal reading is available there as well.

(34) Either Ward can eat peanuts or Sue drink milk.

The *either ... or* facts can be taken as further evidence that a distributed modal reading is available in gapping sentences with disjunction.

## 2.3 *Whether ... or*

A third test for wide-scope disjunction is the alternative question reading in the complement of *whether*. *Whether* complements are ambiguous between an alternative question reading (Alt-Q) and a yes/no question (Y/N-Q) reading.

(35) I wonder whether Bill resigned or retired.

The embedded question in (35) has two possible readings. On one reading, I wonder whether Bill is still at his old job or not, i.e., whether he has resigned or retired or not. This is the Y/N-Q reading. Under this interpretation, the complement of *whether* (Bill resigned or retired) is implicitly contrasted with its negation (It's not the case that Bill resigned or retired). On the other reading for (35), I have heard that Bill has left his job and I wonder which of two circumstances is true: Bill resigned or Bill retired. This is the Alt-Q reading, in which what is contrasted is the two disjuncts with each other.

Han and Romero (2004) argue for an analysis of sentences like (35) in which, on the Alt-Q reading, disjunction has widest scope within the *whether* complement. That is, even though disjunction appears to be at the VP-level in (35), the sentence is actually derived from (36), in which disjunction has widest scope (within the *whether* complement).

(36) I wonder whether Bill resigned or Bill retired.

Their analysis accounts for several otherwise puzzling differences between *whether* and *either* and is well-supported by cross-linguistic data. We can take Han and Romero's arguments to support the use of *whether* as another test for wide scope disjunction. If we can get the Alt-Q reading, then disjunction must have widest scope. If only the Y/N-Q reading is available, then disjunction must have lower scope.

(37) I wonder whether Mary must outweigh John or John outweigh Mary by next Thursday.

(38) I wonder whether Ward can eat peanuts or Sue drink milk.

The embedded question in (37) is disambiguated in favor of the wide-scope disjunction reading (32)b. It means that I wonder which of the following is true: Mary must outweigh John or John must outweigh Mary. This is the unexpected distributed modal interpretation. The Alt-Q is also available in (38), indicating that there, too, we have unexpected wide-scope disjunction.<sup>5</sup>

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<sup>5</sup> In a recent paper, Ackema and Szendrői (2002) give an example with gapping and determiner sharing in a *whether* complement which they say has an unexpected distributed modal interpretation. Their example is:

(i) I don't know whether too many girls can't dance the samba or boys the tango.

We have seen three tests that show that a distributed modal reading is available in gapping sentences in which the coordination is *or*. In the case of deontic *must* in (24), both the distributed modal and the wide-scope modal readings are clearly available. I have not been able to come up with a test to show that the wide-scope modal reading is also available for the existential modal in (26), though the non-ability-modal reading is certainly a candidate for such a test. However, showing an ambiguity here is not necessary to illustrate the puzzle. The puzzle is that the distributed modal reading is unexpectedly available in gapping sentences with disjunction. This is surprising for two reasons.

One reason is that, as far as I know, this fact about disjunction is one of the only strong pieces of evidence that the structure in (3) is not (or not the only) structure for gapping. Any solution for the disjunction facts must also account for all the facts that motivated (3) in the first place. The other reason that the disjunction facts are surprising is that the conjunction examples, in contrast, behave as expected and do not allow a distributed modal reading. This difference between conjunction and disjunction is unexpected under the standard view of conjunction and disjunction as equivalent to the logical connectives  $\wedge$  and  $\vee$ .

### **3 Solution to the puzzle: the semantics of *or* vs. *and***

#### **3.1 Hamblin semantics**

Several recent papers have argued that a set-based, Hamblin semantics (Hamblin 1973) should be adopted for disjunction (Simons 2005; Alonso-Ovalle 2005; Aloni 2002, 2003). These papers extend Kratzer and Shimoyama (2002)'s analysis of indeterminate pronouns to disjunction. Under such an analysis, certain items (such as indeterminate phrases or disjunction) introduce sets of alternatives. Other elements combine with these sets point-wise, and the

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This example does seem to have a distributed modal meaning, but as discussed above, making this claim strictly on the basis of the availability of an ability modal reading is not without controversial assumptions. I believe that the point which should be made about their example is that an Alt-Q reading is available for the embedded question, which is unexpected if (3) is the correct structure for gapping and we keep a standard semantics for disjunction.

They use this example to argue both that Lin's Generalization about determiner sharing does not hold and also that (3) is not the correct structure for gapping. They do not, however, give a new characterization of the environments in which determiner sharing does hold or a satisfactory account of much of the data that initially motivated (3).

alternative sets “keep ‘expanding’ until they meet an operator that selects them” (Kratzer & Shimoyama 2002). There are several operators that can close the sets, as we will see below.

The definition of functional application with Hamblin sets is given in (39). The basic idea can be demonstrated with the (alternative reading of the) question in (40).

(39) Where  $[[\alpha]] \subseteq D_{\langle\sigma, \tau\rangle}$  and  $[[\beta]] \subseteq D_{\sigma}$ ,  
 $[[\alpha(\beta)]] = \{c \in D_{\tau} : \exists a \in [[\alpha]], \exists b \in [[\beta]] (c = a(b))\}$

(40) Did John marry Sally or Betty?  
 a. Q John married {Sally, Betty}  
 b. Q John  $\{\lambda x. x$  married Sally,  $\lambda y. y$  married Betty}  
 c. Q {John married Sally, John married Betty}  
 d. Which of the following is true: John married Sally, John married Betty.

The disjunction introduces an alternative set, in this case {Sally, Betty}. The verb is applied via point-wise functional application over the members of the alternative set, giving (40)b. Each of the functions in this new set then applies to the subject, giving (40)c. The set is then closed by the question operator which gives the meaning in (40)d.

This idea can be used to account for the difference between disjunction and conjunction in gapping. The basic form of my account is that Johnson and others are correct in thinking that the structure for gapping is (3). The apparently distributed modal reading with disjunction that we saw in section 2 is not an indication that the conjuncts are larger than VPs. Rather, this reading can be accounted for by keeping the independently motivated structure in (3) combined with a Hamblin semantics for disjunction.

### 3.2 Distributed modal reading with *or*

I will adopt a standard, Kratzerian semantics for modals, in which all modals take propositional arguments.

(41) Where  $f = \text{modal base}$ ,

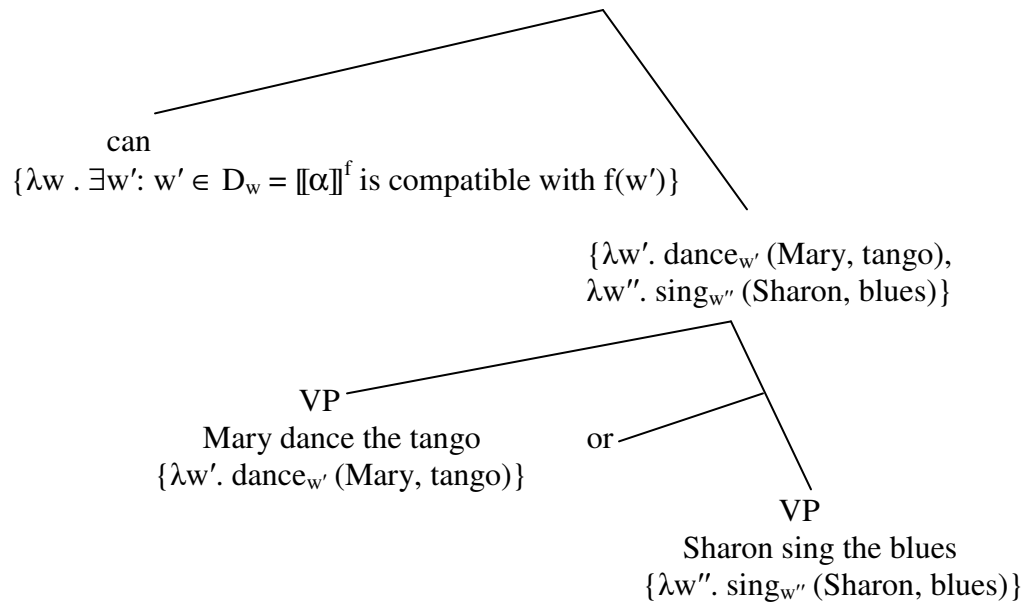
$$\llbracket \text{can } \alpha \rrbracket^f = \{ \lambda w . \exists w' : w' \in D_w = \llbracket \alpha \rrbracket^f \text{ is compatible with } f(w') \}$$

$$\llbracket \text{must } \alpha \rrbracket^f = \{ \lambda w . \exists w' : w' \in D_w = \llbracket \alpha \rrbracket^f \text{ follows from } f(w') \} \quad (\text{Kratzer 1991})$$

Take the gapping sentence in (42), which is compatible with all of the tests for wide-scope negation mentioned above. How does a Hamblin semantics give the distributed modal reading?

(42) Mary can dance the tango or Sharon sing the blues.

(43)  $\{ \lambda w . \exists w' : w' \in D_w . \{ \lambda w' . \text{dance}_{w'}(\text{Mary}, \text{tango}) \} \text{ is compatible with } f(w'),$   
 $\lambda w . \exists w' : w' \in D_w . \{ \lambda w'' . \text{sing}_{w''}(\text{Sharon}, \text{blues}) \} \text{ is compatible with } f(w') \}$



First we assume that the subject of the sentence, *Mary*, reconstructs back into its VP, leaving the modal to take a propositional argument. The meaning of each VP is constructed in the standard way, except that each VP denotes a singleton set containing a proposition, rather than simply denoting a proposition. Disjunction takes these two singleton sets and gives an alternative set containing two members: {Mary dances the tango, Sharon sings the blues}. The modal now combines via pointwise functional application (39), giving the alternative set at the top node of (43).

As mentioned above, the alternative set has to be closed by an operator. Since there is no overt operator in this case, the set is closed by existential closure (44). This gives us (45).

(44) Where  $\llbracket \alpha \rrbracket \subseteq D_{\langle s, t \rangle}$ ,  
 $\llbracket \exists(\alpha) \rrbracket = \{ \lambda w. \exists p \in \llbracket \alpha \rrbracket \& p(w) = 1 \}$  (Kratzer & Shimoyama 2002)

(45)  $\llbracket \exists (\{ \lambda w. \exists w': w' \in D_w . \left. \begin{array}{l} \lambda w'. \text{dance}_{w'}(\text{Mary, tango}) \\ \lambda w''. \text{sing}_{w''}(\text{Sharon, blues}) \end{array} \right\} \text{ is compatible with } f(w') \}) \rrbracket$   
 $= \{ \lambda w'''. \exists p \in \{ \lambda w. \exists w': w' \in D_w . \left. \begin{array}{l} \lambda w'. \text{dance}_{w'}(\text{Mary, tango}) \\ \lambda w''. \text{sing}_{w''}(\text{Sharon, blues}) \end{array} \right\} \text{ is compatible with } f(w') \}$   
 $\& p(w''') = 1 \}$   
 $= \{ \text{the proposition that is true in all worlds in which one of the two propositions } \{ \text{Mary can dance tango, Sharon can sing blues} \} \text{ is true.} \}$

So (42) denotes the (singleton set containing the) proposition that is true in all worlds in which one of the two propositions, Mary can dance the tango or Sharon can sing the blues, is true. This gives the distributed modal interpretation that we have been after, while allowing the structure to contain only a single modal.

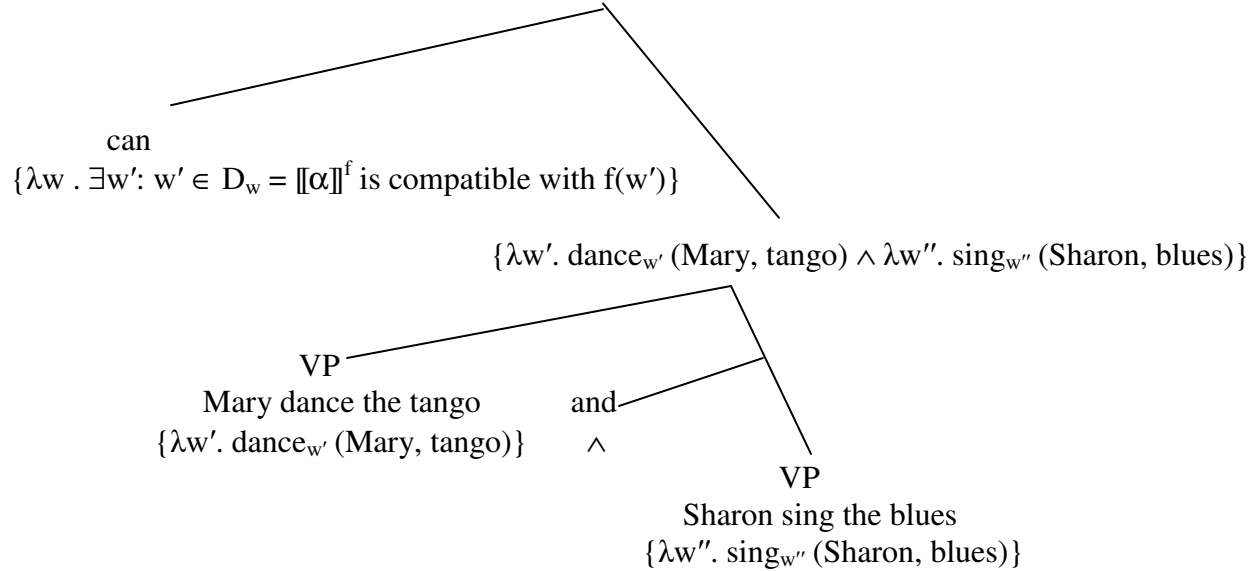
### 3.3 Wide-scope modal reading with *and*

How does this analysis account for the fact that only the wide-scope reading is available in the conjunction cases? *And*, unlike *or*, is still treated as a Boolean operation (intersection), with one modification. It takes singleton sets and returns a singleton set that contains every member present in both sets.<sup>6</sup> This means that the set at the node above (VP and VP) is a singleton set.

<sup>6</sup> As Kai von Stechow points out, these sets should not actually be singleton sets or the intersection of them (in every case except A and A) would give the null set. Instead, we think of them as also containing worlds. Then the intersection would be the set containing the worlds present in both conjuncts, which gives the right meaning. For the sake of simplicity, I will give a schematic version in which  $\{A\}$  and  $\{B\} = \{A \vee B\}$ . I do not think that doing so will make any wrong predictions, but von Stechow's point should be kept in mind.

(46) Mary can dance the tango and Sharon sing the blues.

(47)  $\{ \lambda w . \exists w' : w' \in D_w . ( \lambda w' . \text{dance}_{w'} (\text{Mary}, \text{tango}) \wedge \lambda w'' . \text{sing}_{w''} (\text{Sharon}, \text{blues})) \text{ is compatible with } f(w') \ \& \ p (w') = 1 \}$



The two VPs each denote a singleton set, as in (43). The difference is that here the set created by conjunction is the singleton set {Mary dances the tango and Sharon sings the blues}. The modal, as before, applies via point-wise functional application. In this case, though, there is only one member in the set denoted by its sister, so the set at the top node of (47) is also a singleton set, containing only a single modal. Applying existential closure to this gives us:

(48)  $\llbracket \exists ( \{ \lambda w . \exists w' : w' \in D_w . ( \lambda w' . \text{dance}_{w'} (\text{Mary}, \text{tango}) \wedge \lambda w'' . \text{sing}_{w''} (\text{Sharon}, \text{blues}) ) \text{ is compatible with } f(w') \} ) \rrbracket$

$= \{ \lambda w''' . \exists p \in \{ \lambda w . \exists w' : w' \in D_w . ( \lambda w' . \text{dance}_{w'} (\text{Mary}, \text{tango}) \wedge \lambda w'' . \text{sing}_{w''} (\text{Sharon}, \text{blues}) ) \text{ is compatible with } f(w') \} \ \& \ p (w''') = 1 \}$

$= \{ \text{the proposition that is true in all worlds in which one of the propositions in the set } \{ \text{Mary can dance tango and Sharon can sing blues} \} \text{ is true.} \}$

Since there is only one proposition in the set closed by existential closure, we get:

$= \{ \text{the proposition that is true in all worlds in which Mary can dance tango and Sharon can sing blues is true.} \}$

Hence, in the conjunction example we interpret only one modal (i.e., the wide-scope reading) because the set that the modal combines with contains only one element—it can't distribute over the conjuncts. Thus we get two different scope readings from the same syntactic structure, depending on whether we have a disjunction or a conjunction in the structure.

### 3.4 Undistributed character of sentential negation

I have been using modal examples without negation, because it turns out that there is a surprising difference between modals and negation in gapping in disjunctions: modals (can) distribute, but negation does not distribute. Why, if we are doing point-wise FA over the sets, does there seem to be only one negation in the negated version of a sentence like (42)?

(49) Johnny can't eat wheat or Sally drink milk.

This example does not mean that one of the propositions in the set {Johnny can't eat wheat, Sally can't drink milk} is true. Instead it means that no proposition in the set {Johnny can eat wheat, Sally can drink milk} is true: both *Johnny can eat wheat* and *Sally can drink milk* have to be false for (49) to be true.<sup>7</sup>

One way to show that negation does not distribute in these cases is that they fail the tests for wide-scope disjunction. Without negation, we used three tests to show that disjunction had widest-scope (hence, that the modal was distributed):

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<sup>7</sup> This actually seems not to be the case with the Ackema & Szendrői example in fn. 5. There the reading we get seems to have both the modal and the negation distributed in each conjunct:

(i) I don't know which of the following is true: the girls can't dance the samba, the boys can't dance the tango.

However, the context they give makes it clear that the *whether* complement should be interpreted as an alternative question. Let's assume I am right that the negation never distributes (syntactically or semantically) in this context. In that case, there would be a single wide-scope negation outside the scope of the alternatives. The presence of wide-scope negation would force the *whether* complement to be interpreted as a Yes/No question, equivalent to:

(ii) I don't know whether or not the girls can dance the samba or the boys can dance the tango.

If the answer to the embedded Y/N question is "No, it's not true that the girls can dance the samba or the boys can dance the tango," and we know from the context that we should be considering alternatives, then the question remains which of the disjuncts makes the disjunction false. This allows the listener to choose from " 'the girls can dance the samba' is false" and " 'the boys can dance the tango' is false," giving the appearance of a distributed negation. Thanks to Sabine Iatridou for making this point about the relationship between the Y/N-Q reading and the Alt-Q reading.

- (50) Ward can eat peanuts or Sue drink milk, but I don't remember which.  
 (51) Either Ward can eat peanuts or Sue drink milk.  
 (52) I wonder whether Ward can eat peanuts or Sue drink milk.

Once we add negation, though, the tests show that disjunction no longer has widest scope. (53) and (54) are ungrammatical, indicating that something has wider scope than disjunction. By comparing them the minimal pairs in (50) and (51), we can see that it is negation that has wider scope than disjunction. Similarly, (55) is grammatical, but not on the reading in which the *whether*-complement is interpreted as an Alt-Q. Unlike (52), it can only be interpreted as a Y/N-Q, which gives further evidence for negation having wider scope than disjunction.

- (53) \*Ward can't eat peanuts or Sue drink milk, but I don't remember which.  
 (54) \*Either Ward can't eat peanuts or Sue drink milk.  
 (55) I wonder whether Ward can't eat peanuts or Sue drink milk.

We can state it another way: (53) - (55) show that negation is not distributed over the disjuncts like the modals are. If it were, disjunction would have widest scope in these examples as well as in (50) - (52).

This fact turns out to fall out naturally from a Hamblin-style analysis. Recall that the alternative set introduced by disjunction has to be closed by an operator. In addition to existential closure, sentential negation can close the set (56).

- (56) Where  $\llbracket \alpha \rrbracket \subseteq D_{\langle s, t \rangle}$ ,  
 $\llbracket \neg(\alpha) \rrbracket = \{ \lambda w. \neg \exists p \in \llbracket \alpha \rrbracket \& p(w) = 1 \}$

So the negated version of (42) would give the same set as the non-negated one for the node directly above the modal, (57).

- (57)  $\{ \lambda w. \exists w': w' \in D_w. \{ \lambda w'. \text{dance}_{w'}(\text{Mary}, \text{tango}) \}$  is compatible with  $f(w')$ ,  $\lambda w. \exists w': w' \in D_w. \{ \lambda w''. \text{sing}_{w''}(\text{Sharon}, \text{blues}) \}$  is compatible with  $f(w')$  }

This set is closed by negation to give (58).

$$\begin{aligned}
(58) \quad & \llbracket \exists (\{\lambda w. \exists w': w' \in D_w. \lambda w'. \text{dance}_{w'}(\text{Mary}, \text{tango}) \text{ is compatible with } f(w')\}) \rrbracket \\
& \quad \lambda w''. \text{sing}_{w''}(\text{Sharon}, \text{blues}) \\
& = \{\lambda w'''. \neg \exists p \in \{\lambda w. \exists w': w' \in D_w \left\{ \begin{array}{l} \lambda w'. \text{dance}_{w'}(\text{Mary}, \text{tango}) \\ \lambda w''. \text{sing}_{w''}(\text{Sharon}, \text{blues}) \end{array} \right\} \text{ is compatible with } f(w')\} \\
& \quad \& p(w''') = 1\} \\
& = \{\text{the proposition that is true in all worlds in which there is no proposition in the set} \\
& \quad \{\text{Mary can dance tango, Sharon can sing blues}\} \text{ that is true.}\}
\end{aligned}$$

This gives the right interpretation, in which there is only one negation in the interpretation.

#### 4 Other modals and negation

We have seen that in negated sentences with *can*, a modal which takes narrow scope with respect to negation, the modal is interpreted distributedly and negation must be interpreted above the modal. This analysis makes predictions for interactions of negation and modals which take wide scope with respect to negation. In particular, it predicts that in those cases the negation will close the alternative set before the modal combines with it. We should not get a distributed modal reading in for those modals in sentences with negation, though we should be able to in cases without negation (i.e., existential closure could apply above the modal rather than below it).

This prediction is upheld by the negated version of the example with deontic *must* discussed above.

(59) Mary must not outweigh John or John outweigh Mary by next Thursday.

With negation, this example is no longer ambiguous. It only means that it must be the case that neither Mary outweighs John nor John outweighs Mary. How do we get this meaning from (59)? Deontic *must* scopes over negation, so negation closes the alternative set introduced by disjunction before the modal applies. The set that the modal combines with is now a singleton set, so we get a wide-scope modal interpretation.

- (60) a. must not {Mary outweighs John, John outweighs Mary}  
 b. must {the proposition that no proposition in the set {Mary outweighs John, John outweighs Mary} is true.  
 c. {the proposition that it is necessary that no proposition in the set {Mary outweighs John, John outweighs Mary} is true}

This gives the desired interpretation, that they must weigh the same amount by next Thursday. Sentential negation disambiguates in favor of the wide-scope modal reading, as predicted.

In fact, since we have seen that either existential closure or negation can close the alternative set, there should be another reading available for modals that take narrow scope with respect to negation. Existential closure should be able to freely apply before the modal distributes, followed by functional application applied to the modal, followed by negation. This would give a wide-scope negation, wide-scope modal interpretation.

To the extent that the ability/non-ability readings of the modal are a reliable indication of narrow vs. wide-scope for the modal, (61) seems to be ambiguous in the predicted way: (62) vs. (63).

- (61) John can't eat wheat or Sally drink milk.
- (62) a. not can {John eat wheat, Sally drink milk}  
 b. not {John can eat wheat, Sally can drink milk}  
 c. {the proposition that no proposition in the set {J. can eat wheat, S. can drink milk} is true}
- (63) a. not can  $\exists$  {John eat wheat, Sally drink milk}  
 b. not can {the proposition that is true in all worlds in which one of the propositions {John eat wheat, Sally drink milk} is true}  
 c. not {the proposition that it is possible that one of the propositions {John eat wheat, Sally drink milk} is true}  
 d. {the proposition that it is not possible that one of the propositions {John eat wheat, Sally drink milk} is true}

Since these two readings appear to be logically equivalent, however, so I will show the point with another modal that takes narrow scope with respect to negation.

With *have to*, the distributed modal and the non-distributed modal interpretations are clearly distinct.

- (64) John doesn't have to eat wheat or Sally drink milk.
- (65) a. not have-to {John eat wheat, Sally drink milk}  
b. not {John has-to eat wheat, Sally has-to drink milk}  
c. {the proposition that no proposition in the set {John has-to eat wheat, Sally has-to drink milk} is true.}
- (66) a. not have-to  $\exists$ {John eat wheat, Sally drink milk}  
b. not have-to {the proposition that is true in all worlds in which one of the propositions {John eat wheat, Sally drink milk} is true}  
c. not {the proposition that it is necessary that one of the propositions {John eat wheat, Sally drink milk} is true}  
d. {the proposition that it is not necessary that one of the propositions {John eat wheat, Sally drink milk} is true}

In (65), the modal applies via functional application to each member of the alternative set. This set is then closed by disjunction. This gives the distributed modal interpretation. In (66), existential closure applies to the alternative set first, followed by application of the modal to the singleton set created by existential closure, followed by negation. This gives the wide-scope modal interpretation. Both of these meanings are available for (64), as predicted.

To my knowledge, these facts about differences in the availability of distributed scope interpretations depending on the choice of modal have not been previously noticed. They would be completely puzzling under an account which did not posit Hamblin sets introduced by disjunction as well as the option of applying existential closure above the modal, as far as I can see. To the extent that this is true, these facts can be taken as evidence for the analysis I gave in section 3.

## 5 Conclusion and Outlook

In this paper I have shown that there is a reading available for modals in gapping in disjunctions that is not available for gapping in conjunctions. Furthermore, I have shown that it is possible to keep a uniform, well-motivated gapping structure for both cases and account for these differences by adopting an independently motivated Hamblin semantics for disjunction. This analysis makes predictions for the availability of the distributed modal reading depending on whether the modal used takes scope above or below negation, which are born out.

I have not yet had a chance to investigate if some of the other environments used to motivate the structure in (3) behave differently with disjunction. In particular, there appears to be some variation in the availability of sharing certain determiners depending on whether conjunction or disjunction is used. I hope to look more closely at determiner sharing to see if the analysis presented here might shed some light on some puzzling lexical restrictions on the construction.

## References

- Ackema, Peter and Krista Szendrői. 2002. Determiner Sharing as an instance of dependent ellipsis. *Journal of Comparative Germanic Linguistics* 5, 3-34.
- Maria Aloni. 2002. Free choice in modal contexts. *Arbeitspapiere des Fachbereichs Sprachwissenschaft*, University of Konstanz.
- Maria Aloni. 2003. On choice-offering imperatives. *Proceedings of the Fourteenth Amsterdam Colloquium*. Paul Dekker and Robert van Rooy, eds. ILLC, University of Amsterdam.
- Alonso-Ovalle, Luis. 2005. Distributing disjuncts over the modal space. *NELS* 35.
- Coppock, Elizabeth. 2001. Gapping: In defense of deletion. *CLS* 37.
- Fukui, N. and M. Speas (1986) Specifiers and projection. *MITWPL* 8, 128-172.
- Hamblin, C.L. 1973. Questions in Montague English. *Foundations of Language* 10, 41-53.
- Han, Chung-hye and Maribel Romero. 2004. The syntax of *whether/Q...or* questions: Ellipsis combined with movement. *NLLT* 22, 527-564.
- Johnson, Kyle. 1996. In search of the English middle field. ms. UMass, Amherst.

- Johnson, Kyle. 2000. Few dogs eat Whiskers or cats Alpo. *UMOP* 23, 59-82.
- Kitagawa, Y. 1986. *Subjects in Japanese and English*. Ph.D. dissertation, UMass, Amherst.
- Koopman, Hilda and Dominique Sportiche. 1985. Theta-theory and extraction. *GLOW Newsletter* 14.
- Koopman, Hilda and Dominique Sportiche. 1991. The position of subjects. *Lingua* 85.2/3. ed. J. McCloskey, 211-259 .
- Kratzer, Angelika. 1991. Modality. In A. von Stechow & D. Wunderlich, eds. *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*. Berlin: de Gruyter, 639-650.
- Kratzer, Angelika and Junko Shimoyama. 2002. Indeterminate pronouns: The view from Japanese. Paper presented at the 3<sup>rd</sup> Tokyo Conference on Psycholinguistics.
- Kuroda, S.-Y. 1988. Whether We Agree or Not: A Comparative Syntax and English and Japanese. *Linguisticae Investigationes* 12, 1-47.
- Lin, Vivian. 2000. Determiner sharing. *Proceedings of WCCFL* 19, 274-287.
- Lin, Vivian. 2002. *Coordination and Sharing at the Interfaces*. PhD dissertation, MIT.
- McCawley, James. 1993. Gapping with shared operators. *BLS* 19, 245-253.
- Oehrle, Richard. 1987. Boolean properties in the analysis of gapping. *Syntax and Semantics* 20, 201-240.
- Ross, John. 1967. *Constraints on Variables in Syntax*. PhD dissertation, MIT.
- Ross, John. 1970. Gapping and the order of constituents. In M. Bierwisch and K.E. Heidolph (eds.), *Progress in Linguistics*. The Hague: Mouton, 249-59.
- Schwarz, Bernhard. 1999. On the syntax of *either...or*. *NLLT* 17, 339-370.
- Siegel, Muffy. 1984. Gapping and interpretation. *Linguistic Inquiry* 15, 523-530.
- Siegel, Muffy. 1987. Compositionality, case, and the scope of auxiliaries. *Linguistics and Philosophy* 10, 53-75.
- Simons, Mandy. 2005. Dividing things up: The semantics of *or* and the modal/*or* interaction. *NALS* 13, 271-316.
- Vainikka, Anne. 1987. Why can *or* mean *and* or *or*? *UMOP* 12, 149-186.