

## **An Argument from Gapping for a Hamblin Semantics for Disjunction<sup>1</sup>**

### **1 The Puzzle**

#### **1.1 Conjunction**

In a gapping sentence, a modal takes scope over conjunction.

(1) In this bus, you can sit in the back and your child stand in the front.  
 $\diamond (Y \ \& \ C)$

$\neq$

(2) You can sit in the back and your child can stand in the front.  
 $(\diamond Y \ \& \ \diamond C)$

A: Hey ma'am what's with your child?

B: Can't he stand in the front?

A: You can sit in the back and your child can stand in the front  
...but whatever you do you have to be next to your child.

This reading is available for (2) but not for (1). ((1) is stronger than (2)).

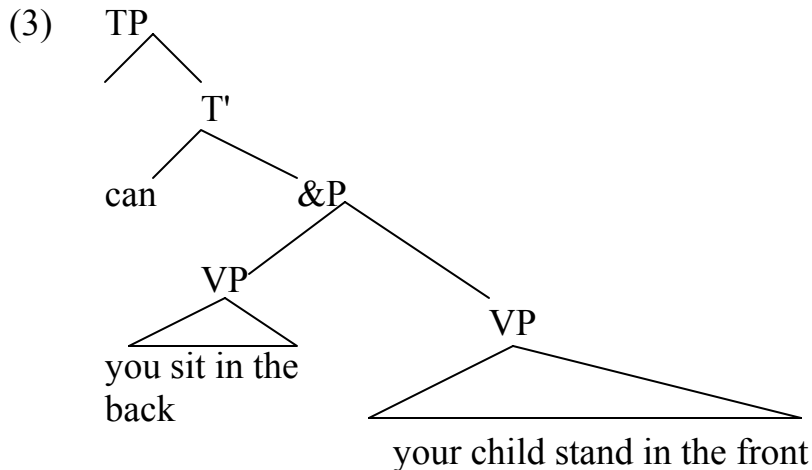
Why focus on gapping?

- Well-studied structure; fixes the syntactic scope of coordination.
- I adopt Johnson (1996, 2006)'s analysis of the structure for gapping, in which gapping always involves VP-level conjunction.

The structure, after reconstruction of the subject of the first conjunct, would be:

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## 1.2 Disjunction

With disjunction, however, there is an ambiguity between wide- and narrow-scope w.r.t the modal.

- (4) The Incredible Hulk must outweigh the Thing or the Thing outweigh the Hulk.<sup>2</sup>
- a.  $\square (H \text{ or } T) \dots$  they must not weigh the same.
  - b.  $(\square H \text{ or } \square T) \dots$  I don't remember which.

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<sup>2</sup> Intuitively, there are two readings of (4). However, since (b) entails (a) (i.e., all b worlds are also a worlds), one might wonder whether (b) is really an independent, possible interpretation. It is: in a downward-entailing context, the entailment relations are reversed: (a) entails (b). In this case, reading (b) is clearly allowed, which shows that it is an independent reading in (4):

There is a contest calling for comic books in which there are a series of fights between the Incredible Hulk and the Thing (from *The Fantastic Four*).

- (i) I like every comic book in which the Incredible Hulk must outweigh the Thing or the Thing outweigh the Hulk.

(i) could be true even if I only like the comics in which the fights only proceed if one of the characters weighs more than the other (i.e., they don't weigh the same).

### 1.3 If-clauses as evidence that there is a single modal syntactically

One might think that *and* and *or* have different syntactic scope. Here is some evidence that their syntactic scope-taking possibilities are the same.

Assumptions: each if-clause must have a modal to restrict; it is not possible to have an if-clause modifying (a covert modal in) the constituent within the scope of an overt *must*.

- (5) a. If you want to relax, Bill can give you a massage and Mary can give you your flu shot if you don't want to relax.
- b. ??If you want to relax, Bill can give you a massage and Mary your flu shot if you don't want to relax.
- (6) Why is the detective asking for handwriting samples?
- a. If the butler fails to dot his i's, he must have committed murder or the gardener must have embezzled if he forgets his umlauts.
- b. ??If the butler fails to dot his i's, he must have committed murder or the gardener have embezzled if he forgets his umlauts.

With both *and* and *or*, only one if-clause is allowed in the single modal, gapping context → only one modal syntactically in both cases.

### 1.4 Intervention effects: disambiguated by negation, *either*

Disambiguated by negation.

- (7) The Incredible Hulk must not outweigh the Thing or the Thing outweigh the Hulk.
- a.  $\Box \neg (H \text{ or } T)$  ... they must weigh the same.
- b.  $*(\Box \neg H \text{ or } \Box \neg T)$  ... I don't remember which.

Disambiguated by *either* (argued by Schwartz (1999) to overtly mark the left edge of disjunction).

- (8) a. Either the Incredible Hulk must outweigh the Thing or the Thing outweigh the Hulk.  
 b. The Hulk either must outweigh the Thing or the Thing outweigh the Hulk.  
 ( $\square H$  or  $\square T$ )
- (9) The Incredible Hulk must either outweigh the Thing or the Thing outweigh the Hulk.  
 $\square (H$  or  $T)$

Notice that with conjunction, *both* can only appear below the modal. Under the assumption that *both* similarly marks the left-edge of a coordination, this is further evidence that the modal may not have a distributed reading with conjunction, unlike with disjunction.

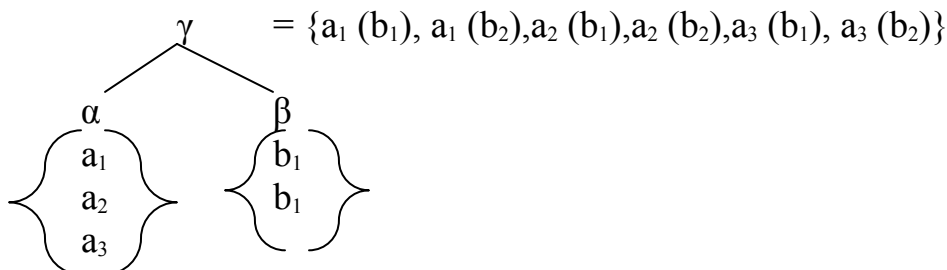
- (10) \*In this bus, Mary both can sit in the back and her child stand in the front.  
 ( $\diamond Y$  &  $\diamond C$ )
- (11) In this bus, Mary can both sit in the back and her child stand in the front.  
 $\diamond (Y$  &  $C)$

## 2 Solution

### 2.1 Hamblin Semantics (Hamblin (1973)):

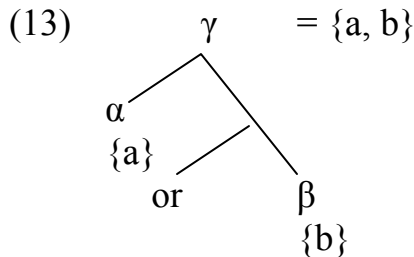
- i. pointwise combination (standard denotations, turned into sets)
- ii. certain operators apply to sets (non-standard denotations)  
*Or* is stipulated to be one such operator.

- (12) Functional Application via pointwise combination

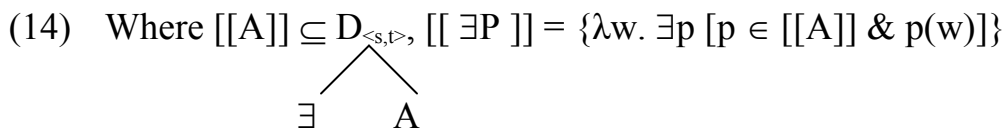


## 2.2 Disjunction

Disjunction applies to a set, gives you something that applies to a set, and gives you a set having as its members the denotations of each of its disjuncts<sup>3</sup> (Aloni (2002), Simons (2005), Alonso-Ovalle (2006)).



The scope of *or* is not its syntactic position, but the point of existential closure. Existential closure takes a set and gives you a singleton set:



*And*, on the other hand, has a traditional, Boolean meaning (modified to apply to sets). It takes two sets and returns a singleton set containing the join of the members of the two daughters.

## 2.3 Derivation of the two readings of (4)

- (4) The Incredible Hulk must outweigh the Thing or the Thing outweigh the Hulk.

The modal has a standard semantics and takes a propositional argument (reconstruction of the subject) (Kratzer 1991). It combines via pointwise functional application.

<sup>3</sup> (i) For any  $\alpha, \beta$  of conjoinable type  $\tau$ ,  $[[\alpha \text{ or } \beta]] = [[\alpha]] \dot{\wedge} [[\beta]]$   
 a. for  $T_1, T_2 \in D_t$ ,  $T_1 \dot{\wedge} T_2 = T_1 \vee T_2$  (=1 iff  $T_1 = 1$  or  $T_2 = 1$ )  
 b. for  $f_1, f_2 \in D_{\langle \delta, \tau \rangle}$ ,  $f_1 \dot{\wedge} f_2 = \lambda s_{\delta}. f_1(s) \dot{\wedge} f_2(s)$  (Alonso-Ovalle 2006)

Wide-scope disjunction reading of (4):

- (15) a.  $\exists \text{ Must } ((\text{the Hulk outweigh the Thing}) \text{ or } (\text{the Thing outweigh the Hulk}))$   
 b.  $\exists \text{ Must } ( \{H\} \text{ or } \{T\} )$   
 c.  $\exists \text{ Must } ( \{H, T\} )$   
 d.  $\exists \left\{ \begin{array}{l} \lambda w \forall w' [w' \in \mathcal{D}_w \rightarrow H(w')], \\ \lambda w \forall w' [w' \in \mathcal{D}_w \rightarrow T(w')] \end{array} \right\}$   
 e.  $\left\{ \lambda w. \exists p \left[ p \in \left\{ \begin{array}{l} \lambda w \forall w' [w' \in \mathcal{D}_w \rightarrow H(w')], \\ \lambda w \forall w' [w' \in \mathcal{D}_w \rightarrow T(w')] \end{array} \right\} \& p(w) \right] \right\}$
- = 1 iff one of the two propositions in the set (the Hulk must outweigh the Thing, the Thing must outweigh the Hulk) is true.

Narrow-scope disjunction reading of (4)

- (16) a.  $\text{Must } \exists ((\text{the Hulk outweigh the Thing}) \text{ or } (\text{the Thing outweigh the Hulk}))$   
 b.  $\text{Must } \exists ( \{H\} \text{ or } \{T\} )$   
 c.  $\text{Must } \exists ( \{H, T\} )$   
 d.  $\text{Must } ( \{ \lambda w. \exists p [p \in \{H, T\} \& p(w)] \} )$   
 e.  $\{ \lambda w \forall w' [w' \in \mathcal{D}_w \rightarrow \{ \lambda w''. \exists p [p \in \{H, T\} \& p(w'')] \} (w')] \}$   
 = 1 iff it is necessary that one of the two propositions {the Hulk outweighs the Thing, the Thing outweighs the Hulk} is true.

## 2.4 How negation disambiguates

Negation always closes an alternative set.<sup>4</sup> Therefore, disjunction will never have scope over negation. Since *must* (is lexically specified to) scope over negation, the absence of the distributed modal reading in (4) follows.

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<sup>4</sup> According to Kratzer & Shimoyama (2002), negation is a propositional quantifier that takes a set of propositions and returns {the proposition that is true in all worlds in which no proposition in A is true}. That is, existential closure is built into the definition of (propositional) negation.

- (17) a. Must  $\neg$  ((the Hulk outweigh the Thing) or (the Thing outweigh the Hulk))  
 b. Must  $\neg$  ( {H} or {T} )  
 c. Must  $\neg$  ( {H, T} )  
 d. Must (  $\{\lambda w. \neg \exists p [p \in \{H, T\} \ \& \ p(w)]\}$  )  
 e.  $\{\lambda w \forall w' [w' \in \mathcal{D}_w \rightarrow \{\lambda w''. \neg \exists p [p \in \{H, T\} \ \& \ p(w'')]\} (w')\}$   
 = 1 iff it is necessary that no proposition in the set {the Hulk outweighs the Thing, the Thing outweighs the Hulk} is true.

Given the facts about *either* in (8) & (9), it appears that *either* is another lexical item that induces existential closure, either by having  $\exists$  as part of its definition or by triggering  $\exists$  in its scope. This kind of an analysis of *either* can be traced back to Larson (1985). I will not have time to go through its implementation here.

### 3 A Prediction

For modals that scope below negation, both readings should be available in the counterpart of (7). This turns out to be the case with *have to*.

- (18) The Incredible Hulk doesn't have to outweigh the Thing or the Thing outweigh the Hulk.  
 a.  $\neg \square (H \text{ or } T)$  ... they must weigh the same.  
 b.  $\neg (\square H \text{ or } \square T) = (\neg \square H \ \& \ \neg \square T)$

In this case, we have the option of closing the alternative set via existential closure before pointwise application of the modal (giving reading (18)a) or closing the set at the point of negation (giving reading (18)b).

For conjunction, even with a modal scoping under negation, the distributed modal reading should not be available. This is what we see with *can*:

- (19) Ward can't eat caviar and Sue eat beans! (Siegel 1984)  
 $\neg \diamond (W \ \& \ S)$

$\neq$

- (20) It's not the case that (Ward can eat caviar and Sue can eat beans).  
 $\neg (\diamond W \ \& \ \diamond S)$

This is expected if conjunction, unlike disjunction, cannot introduce alternatives.

#### 4 Let Alone

A puzzle that arises from my proposal:

*Let alone* (and possibly the related *much less*) seems to have the same semantics as disjunction.

(21) John hasn't met the mayor of Cambridge, let alone Ted Kennedy.

≈ John hasn't met the mayor or Ted Kennedy.

There is also an extra component to the meaning of *let alone* that brings additional pragmatic, scalar requirements (Fillmore et al. 1988), which I will set aside here.

If we assume that *let alone* and *or* have the same semantics, we predict that the (semantic) scope possibilities are the same. That is the prediction I will test here.

(22) To be eligible for this job ...  
You don't have to publish an important paper, or your advisor cite you in her work.

a.  $\neg\Box (P \vee C)$   
 $= \Diamond\neg (P \vee C)$   
 $= \Diamond (\neg P \ \& \ \neg C)$   
There is a permitted world where you do neither.  
(i.e., can continue with  
... *all you have to do is file your dissertation.*)

b.  $\neg (\Box P \vee \Box C)$   
 $= (\neg\Box P \vee \neg\Box C)$   
 $= (\Diamond\neg P \ \& \ \Diamond\neg C)$

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There is a permitted world where you do not publish a paper  
and there is a permitted world where you are not cited.  
(i.e., consistent with the continuation  
...*but you do have to do one or the other.*)

(23) To be eligible for this job ...

You don't have to publish an important paper, let alone your advisor  
cite you in her work.

- a.  $\neg \Box (P \vee C)$   
... *all you have to do is file your dissertation.*
- b.  $*\neg (\Box P \vee \Box C)$   
...*but you do have to do one or the other.*

In principle, *let alone* could be paraphrased as narrow scope disjunction (a)  
or wide scope conjunction (b). The fact that (b) is not a possible paraphrase  
tells us that *let alone* is interpreted as narrow scope disjunction.

*Let alone* = narrow scope, NPI disjunction

Puzzle: why is this form of disjunction limited to narrow scope (like  
conjunction, unlike *or*)? Maybe *let alone* is equivalent to an NPI *or* that  
always brings with it an *either*, which fixes the (semantic) scope at the  
surface position.

## 5 Future Work: A Determiner Sharing Puzzle

Further differences between *and* and *or* in gapping that might fall out of this  
analysis.

Observation: determiners may be 'shared' in gapped sentences, but not in  
non-gapped ones (McCawley 1993):

- (24) a. Too many Irish setters are named Kelly, German Shepherds  
Fritz, and huskies Nanook.
- b. \*Too many Irish setters are named Kelly, German Shepherds  
are named Fritz, and huskies are named Nanook.

Certain determiners may be shared in gapped sentences with disjunction but not ones with conjunction (McCawley 1993, Johnson 1996):

- (25) a. Few dogs will eat Whiskas or cats Alpo.  
b. \*Few dogs will eat Whiskas and cats Alpo.
- (26) a. No dogs will eat Whiskas or cats Alpo.  
b. \*No dogs will eat Whiskas and cats Alpo.

Johnson (1996) uses the analyses by which *few* can be decomposed into *not* and *many* and *no* into *not* and *any* to account for (25)a and (26)a. In his analysis, there is a single negation scoping over the rest of the sentence; the first instance of *many* is overt; the second instance of *many* is a silent, negative polarity version of *many*. This analysis accounts nicely for (25)a and (26)a, but cannot account for the contrasts between the (a) and (b) sentences.

Under my analysis, if the quantifier *many* can combine via pointwise functional application just like the modal in (4), we have a less stipulative version of Johnson's analysis, and one that can account for the contrasts between the (a) and (b) sentences above, which his cannot: the quantifier can distribute in the disjunction cases (over the alternative set) but cannot in the conjunction case (because there is no alternative set to distribute over). A fully worked-out version of this hypothesis awaits further work.

## 6 Conclusion

By using gapping, a device that fixes the syntactic scope of coordination, I have investigated a difference in scope properties of conjunction and disjunction. This (semantic) scope difference in gapping sentences with modals can be accounted for by assuming a non-standard semantics for disjunction. This allows us to keep the assumption that sentences like both (1) and (4) have a single modal syntactically. The modal is appears to be interpreted twice in reading (4)b not because this reading has a different syntax from (1) and (4)a, but because it follows from assuming a single modal and a Hamblin semantics for disjunction. This result is desirable in that it is compatible with a well-supported theory of gapping in which

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modals take (syntactic) scope over coordination (Johnson 1996) and also in that it explains the otherwise puzzling facts involving negation.

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