Innocent Exclusion in an Alternative Semantics

Abstract. The exclusive component of unembedded disjunctions is standardly derived as a conversational implicature by assuming that *or* forms a lexical scale with *and* (Horn, 1972, Gazdar 1979). It is well-known, however, that this assumption does not suffice to determine the required scalar competitors of disjunctions with more than two atomic disjuncts (McCawley 1981, Simons 1998). To solve this, Sauerland 2004 assumes that *or* forms a lexical scale with two otherwise unattested silent connectives ($\mathbb{L}$ and $\mathbb{R}$) that retrieve the left and right terms of a disjunction.

A number of recent works have proposed an Alternative Semantics for indefinites and disjunction to account for their interaction with modals and other propositional operators (Kratzer and Shimoyama 2002, Alonso-Ovalle and Menéndez-Benito 2003, Kratzer 2005, Aloni 2002, Simons 2005, Alonso-Ovalle 2006). We note that the McCawley-Simons problem does not arise in an Alternative Semantics, because we can assume that the set of pragmatic competitors to a disjunction is the closure under intersection of the set of propositions that it denotes. An adaptation of the strengthening mechanism presented in Fox 2007 allows for the derivation of the exclusive component of disjunctions with more than two atomic disjuncts without having to rely on the $\mathbb{L}$ and $\mathbb{R}$ operators.

Keywords: Disjunction, Scalar Implicatures, Alternative Semantics.

1. The McCawley-Simons Puzzle

Unembedded disjunctions, like the one in (1b), are naturally interpreted as providing a list of mutually exclusive epistemic possibilities (Zimmermann, 2001). In the dialogue below, for instance, A can conclude that Sandy is reading exactly one book.

(1) a. A: “What is Sandy reading?”

b. B: “(She is reading) *Moby Dick* or *Huckleberry Finn*.”

Under the standard textbook analysis, the exclusive component of unembedded disjunctions is not truth-conditional. The standard textbook analysis assumes that natural language disjunction is (a cross-categorial version of) the binary inclusive disjunction of propositional logic.[1] Under this view, the sentence in (1b) expresses the proposition in (2), which is true in worlds where Sandy is reading both *Moby Dick* and *Huckleberry Finn*.[2]

(2) $M \vee H$

The exclusive component is standardly derived as a conversational implicature. To capture the exclusive component of a disjunction with two atomic members, like the one in (1b), we only need to assume that the speaker believes that the stronger proposition in (3b), which is expressed by the scalar competitor of (1b) in (3a), is false (Horn, 1972: pp. 78-79; Gazdar 1979). If the speaker believes the proposition in (2) and the negation of (3b), she believes that Sandy is reading exactly one book.

(3) a. Sandy is reading *Moby Dick* and she is reading *Huckleberry Finn*.

b. $M \,\&\, H$

Yet McCawley (1981) and Simons (1998) noticed that the derivation of the exclusive component of disjunctions with more than two atomic disjuncts is not that straightforward.[3] Consider, for instance, the sentence in (4a), together with the proposition that it expresses, in (4b).

(4) a. Sandy is reading *Moby Dick*, (she is reading) *Huckleberry Finn*, or (she is reading) *Treasure Island*.

b. $(M \vee H) \vee T$

The propositions in (5) are the meanings of the scalar competitors of (4a) that result from substituting one of more of the occurrences of *or* with *and*. However, assuming that (the speaker believes that) (4b) is true, but that any (or all) of the scalar competitors in (5) are false does not rule out the possibility that (the speaker believes that) Sandy is reading more than one of the books.

(5) a. $(M \,\&\, H) \vee T$

b. $(M \vee H) \,\&\, T$

c. $(M \,\&\, H) \,\&\, T$

To derive the exclusive interpretation of (4b) as an implicature we need to assume that (the speaker believes that) *all* the stronger propositions in (6) are false.

(6) a. $M \,\&\, H$

b. $M \,\&\, T$

c. $H \,\&\, T$

The issue of how these competitors are determined arises.

Sauerland (2004) proposes a syntactic algorithm that computes for (4a) a set of scalar competitors that include the meanings in (6) at the cost of assuming that *or* forms a lexical scale with two otherwise unattested silent connectives ($\mathbb{L}$ and $\mathbb{R}$) that retrieve the left and right terms of a disjunction. On the basis of Sauerland's algorithm, Fox (2007) puts forth a procedure that strengthens the meaning of (4a) by assuming that the competing propositions in (6) are false, thus solving the McCawley-Simons puzzle.

In order to capture their intimate connection with certain propositional operators, like modals, or the question forming operator, a number of recent works on the interpretation of indefinites have argued that they introduce into the semantic representation a set of propositional alternatives, (Kratzer and Shimoyama 2002, Alonso-Ovalle and Menéndez-Benito 2003, Kratzer 2005). Likewise, a number of recent works on disjunction have moved beyond the standard textbook analysis of *or* to capture the interpretation of disjunctions in modal environments (Zimmermann 2001, Aloni 2002, Alonso-Ovalle 2004, Geurts 2005, Simons 2005, Alonso-Ovalle 2006). Aloni 2002, Simons 2005 and Alonso-Ovalle 2006 assume that disjunctions introduce into the semantic derivation sets of propositional alternatives. In what follows, we will see that once an Alternative Semantics for disjunction is assumed, the McCawley-Simons puzzle does not arise. When combined with a variant of Fox's 2007 strengthening procedure, an Alternative Semantics can derive the exclusive implicature of disjunctions with more than two atomic disjuncts without having to rely on Sauerland's $\mathbb{L}$ and $\mathbb{R}$ connectives.

The discussion is organized as follows. Section 2 introduces the Sauerland-Fox algorithm for the computation of the exclusive implicature of *or*. Sections 3 to 5 show that once an Alternative Semantics for disjunctions is adopted, Fox's strengthening procedure does not need to rely on Sauerland's $\mathbb{L}$ and $\mathbb{R}$ operators. To conclude, section 6 points out an important difference between Fox's original strengthening procedure and its adaptation to an Alternative Semantics.

2. The Sauerland-Fox Algorithm

Under the standard assumption that *or* forms a Horn-scale with *and*, the disjunction in (4a), repeated in (7a) below, contains one scalar term in the scope of another.

(7) a. Sandy is reading *Moby Dick*, (she is reading) *Huckleberry Finn*, or (she is reading) *Treasure Island*.

b. $(\mathrm{M} \vee \mathrm{H}) \vee \mathrm{T}$

The scalar competitors of a sentence containing a scalar item s under the scope of another scalar item s' are determined in the system presented in Sauerland 2004 by computing the cross-product of the scales to which s and s' belong. To make the atomic disjuncts and their conjunctions visible in the pragmatics, Sauerland's system assumes that the standard Boolean operators *and* and *or* form a lexical scale with two silent binary connectives: $\mathbb{L}$ and $\mathbb{R}$, which retrieve the meaning of the left and right terms of a disjunction, as defined as in (8) below.

(8) Where $[\![\mathrm{A}]\!], [\![\mathrm{B}]\!] \in D_{\langle s,t\rangle}$,

a. $[\![\mathrm{A}\ \mathbb{L}\ \mathrm{B}]\!] = [\![\mathrm{A}]\!]$

b. $[\![\mathrm{A}\ \mathbb{R}\ \mathrm{B}]\!] = [\![\mathrm{B}]\!]$

For the sentence in (7a), the algorithm generates sixteen scalar competitors, which are associated with the thirteen meanings in the set in (9). Every individual disjunct is now a competitor for the whole disjunction, and so are all the conjunctions of the individual disjuncts.

$$(9)\quad \left\{\begin{array}{c} (\mathrm{M} \,\&\, \mathrm{H}) \,\&\, \mathrm{T}, \\ ((\mathrm{M} \vee \mathrm{H}) \,\&\, \mathrm{T}), ((\mathrm{M} \,\&\, \mathrm{H}) \vee \mathrm{T}), \\ (\mathrm{M} \,\&\, \mathrm{H}), (\mathrm{M} \,\&\, \mathrm{T}), (\mathrm{H} \,\&\, \mathrm{T}), \\ \mathrm{M}, \mathrm{H}, \mathrm{T}, \\ (\mathrm{M} \vee \mathrm{H}), (\mathrm{M} \vee \mathrm{T}), (\mathrm{H} \vee \mathrm{T}), \\ (\mathrm{M} \vee \mathrm{H}) \vee \mathrm{T} \end{array}\right\}$$

The generation of the set of competitors in (9) allows for a solution to the McCawley-Simons puzzle. To capture the exclusive component of the disjunction in (7a) we cannot simply assume that *all* the propositions in (9) that are stronger than the proposition in (7b) are false, because for any disjunction S, the set of propositions containing the proposition expressed by S and the negation of all its Sauerland competitors is an inconsistent set of propositions.[4] We get the required strengthening, however, if we consider what follows from every maximal consistent subset of the set containing the meaning of S and the negation of all its Sauerland-generated competitors.[5] Consider for instance the set $\mathscr{A}$ containing the proposition in (7b) and the negation of all propositions in the set in (9) other than the proposition in (7b). There are three maximal consistent subsets of $\mathscr{A}$. The intersection of these three sets is the set in (10).

$$(10)\quad \left\{\begin{array}{c} \neg((\mathrm{M} \,\&\, \mathrm{H}) \,\&\, \mathrm{T}), \neg((\mathrm{M} \vee \mathrm{H}) \,\&\, \mathrm{T}), \\ \neg(\mathrm{M} \,\&\, \mathrm{H}), \neg(\mathrm{M} \,\&\, \mathrm{T}), \neg(\mathrm{H} \,\&\, \mathrm{T}), \\ (\mathrm{M} \vee \mathrm{H}) \vee \mathrm{T} \end{array}\right\}$$

The disjunction in (7a) can be strengthened by assuming that all the proposition in the set in (10) are true.[6] The resulting proposition, in (11), is true in any world w in which Sandy is reading exactly one of the three books.

$$(11)\quad [\![(7\mathrm{a})]\!]^{+} = ((\mathrm{M} \vee \mathrm{H}) \vee \mathrm{T}) \,\&\, \neg(\mathrm{M} \,\&\, \mathrm{H}) \,\&\, \neg(\mathrm{M} \,\&\, \mathrm{T}) \,\&\, \neg(\mathrm{H} \,\&\, \mathrm{T})$$

Fox (2007) recently called attention to this type of strengthening procedure.[7] In his terminology, which I will adopt from now on, the propositions in all sets containing the proposition expressed by the disjunction and as many negated Sauerland competitors as consistency permits are said to be "innocently excludable".

Sauerland's algorithm allows for a solution to the McCawley-Simons puzzle, then, but at the cost of assuming a lexical scale with two silent connectives ($\mathbb{L}$ and $\mathbb{R}$). The role of $\mathbb{L}$ and $\mathbb{R}$ is to make the atomic disjuncts and their conjunctions readily available in the pragmatics. To the extent that there is an alternative way to make the atomic disjuncts and their conjunctions visible in the pragmatics, these operators become superfluous.

We will see next that once an Alternative Semantics for *or* is assumed, Sauerland's operators do become superfluous.

3. *Or* in an Alternative Semantics

In an Alternative Semantics, expressions of type τ are mapped to sets of objects in D_τ. Most lexical items denote singletons containing their standard denotations: the individual-denoting DPs in (12) are mapped to singletons containing an individual, and the verbs in (13) are mapped to singletons containing a property.[8]

(12) $[\![\text{Sandy}]\!] = \{\mathbf{s}\}$ $\quad$ $[\![\textit{Moby Dick}]\!] = \{\mathbf{m}\}$

$[\![\textit{Huckleberry Finn}]\!] = \{\mathbf{h}\}$ $\quad$ $[\![\textit{Treasure Island}]\!] = \{\mathbf{t}\}$

(13) $[\![\text{sleep}]\!] = \{\lambda x.\lambda w.\mathbf{sleep}_w(x)\}$ $\quad$ $[\![\text{read}]\!] = \{\lambda y.\lambda x.\lambda w.\mathbf{read}_w(x,y)\}$

Within this framework, it is natural to assume that *or* simply collects in a set the denotation of the disjuncts, thus introducing into the semantic derivation a set of alternatives.[9]

(14) *The* Or *Rule*

Where $[\![\mathrm{B}]\!], [\![\mathrm{C}]\!] \subseteq \mathrm{D}_\tau$, $\left[\!\!\left[\begin{array}{c} \mathrm{A} \\ \mathrm{B} \quad \mathrm{or} \quad \mathrm{C} \end{array} \right]\!\!\right] \subseteq \mathrm{D}_\tau = [\![\mathrm{B}]\!] \cup [\![\mathrm{C}]\!]$

Consider, as illustration, the disjunction in (7a), repeated below as (15).

(15) Sandy is reading *Moby Dick*, *Huckleberry Finn*, or *Treasure Island*.

In an Alternative Semantics, the disjunction in (15) denotes a set containing three propositions. We will assume that in (15) we have a DP disjunction, as in (16).[10]

(16) [$_{\mathrm{S}}$ Sandy [$_{\mathrm{VP}}$ is reading [$_{\mathrm{DP}_1}$ *Moby Dick* or [$_{\mathrm{DP}}$ *Huckleberry Finn* or *Treasure Island*]]]]

The denotation of DP_1 is a set containing three individuals: (a copy of) *Moby Dick*, (a copy of) *Huckleberry Finn*, and (a copy of) *Treasure Island*. This set of individual level alternatives combines with the denotation of the verb by functional application. Functional application is defined pointwise in an Alternative Semantics, as in (17) below: to combine a pair of expressions denoting a set of objects of type $\langle\sigma,\tau\rangle$ and a set of objects of type σ, every object of type $\langle\sigma,\tau\rangle$ applies to every object of type σ, and the outputs are collected in a set.

(17) *The Hamblin Rule*

If $[\![\alpha]\!] \subseteq D_{\langle\sigma,\tau\rangle}$ and $[\![\beta]\!] \subseteq D_\sigma$, then

$[\![\alpha(\beta)]\!] = \{\ c \in D_\tau \mid \exists a \in [\![\alpha]\!] \exists b \in [\![\beta]\!] (c = a(b))\ \}$ (Hamblin, 1973)

The set of individual alternatives introduced by *or* determines a set of propositional alternatives by means of two instances of functional application, as the tree of denotations in (18) below illustrates.

(18)

$$\left\{\begin{array}{c}\lambda w.\mathbf{read}_w(\mathbf{s},\mathbf{m}),\\ \lambda w.\mathbf{read}_w(\mathbf{s},\mathbf{h}),\\ \lambda w.\mathbf{read}_w(\mathbf{s},\mathbf{t})\end{array}\right\}$$

$$\{\mathbf{s}\} \qquad \left\{\begin{array}{c}\lambda y.\lambda w.\mathbf{read}_w(y,\mathbf{m}),\\ \lambda y.\lambda w.\mathbf{read}_w(y,\mathbf{h}),\\ \lambda y.\lambda w.\mathbf{read}_w(y,\mathbf{t})\end{array}\right\}$$

$$\{\lambda x.\lambda y.\lambda w.\mathbf{read}_w(y,x)\} \qquad \{\mathbf{m},\mathbf{h},\mathbf{t}\}$$

Under the standard analysis, unembedded disjunctions are existential claims: they convey that at least one of the disjuncts is true. The Alternative Semantics analysis sketched here does not attribute any quantificational force to *or* itself. The source of the quantificational force of disjunctions is external, as already argued for in Rooth and Partee 1982. The alternatives introduced by disjunction 'grow' until they become propositional and can feed a number of propositional quantifiers, like the Existential Closure operator in (19a) or the universal propositional operator in (19b), much as the alternatives introduced by indefinites have been argued to do in recent work on their interaction with propositional operators (Kratzer and Shimoyama 2002, Kratzer 2005, Menéndez-Benito 2005).

(19) Where $\mathscr{A}$ is a set of propositional alternatives,

a. $[\![\exists]\!]^w(\mathscr{A}) = \{\lambda w'.\exists p \in \mathscr{A} \ \&\ p(w')\}$

b. $[\![\forall]\!]^w(\mathscr{A}) = \{\lambda w'.\forall p[p \in \mathscr{A} \rightarrow p(w')]\}$

We will assume that the source of the existential force of unembedded conditionals is the Existential Closure operator in (19a).[11]

4. Generating the competitors

If disjunctions denote sets of propositions, we can assume that the set of scalar competitors to a certain disjunction S is determined by the meaning of S: it is simply the meaning of S closed under intersection.

(20) For any sentence *S*,

$$[\![\mathrm{S}]\!]_{\mathrm{ALT}_{\cap}} = \{p \mid \exists\mathscr{B}[\mathscr{B} \in \wp([\![S]\!])\ \&\ \mathscr{B} \neq \emptyset\ \&\ p = \bigcap\mathscr{B}]\}$$

The function $[\![\cdot]\!]_{\mathrm{ALT}_{\cap}}$ maps the sentence in (15), for instance, to the set in (21), which I will call "the set of conjunctive competitors" of (15).

(21) $$[\![(16)]\!]_{\mathrm{ALT},\cap} = \left\{ \begin{array}{c} \mathrm{M}, \mathrm{H}, \mathrm{T}, \\ \mathrm{M}\ \&\ \mathrm{H},\ \mathrm{H}\ \&\ \mathrm{T},\ \mathrm{M}\ \&\ \mathrm{T}, \\ \mathrm{M}\ \&\ \mathrm{H}\ \&\ \mathrm{T} \end{array} \right\}$$

We can now see that the McCawley-Simons puzzle does not arise: every atomic disjunct is in competition with the whole disjunction, and so are their conjunctions.[12]

5. Innocent exclusion in an Alternative Semantics

We can capture the exclusive component of the disjunction in (15) with the help of the set of its conjunctive competitors by appealing to the mechanics of innocent exclusion.[13] We will assume now that what counts for the determination of which competitors are innocently excludable is the meaning of each atomic disjunct.

(22) *Innocent exclusion*

The negation of a proposition p in the set of competitors of a sentence S ($[\![S]\!]_{ALT,\cap}$) is innocent if and only if, for each $q \in [\![S]\!]$, every way of adding to q as many negations of propositions in $[\![S]\!]_{ALT,\cap}$ as consistency allows reaches a point where the resulting set implies $\neg p$.

The disjunction in (15) denotes the set containing the proposition that Sandy is reading *Moby Dick*, the proposition that Sandy is reading *Huckleberry Finn*, and the proposition that Sandy is reading *Treasure Island*. There are three ways of adding to one member of this set as many negations of propositions in the set in (21) as consistency permits. The intersection of these three sets, the set in (23) below, is the set of competitors whose negation is innocent.

(23) $$\left\{ \begin{array}{c} \neg(\text{M \& H}), \neg(\text{H \& T}), \neg(\text{M \& T}), \\ \neg(\text{M \& H \& T}) \end{array} \right\}$$

We can replicate the results of the Sauerland-Fox algorithm by assuming that the strengthened meaning of (15) is the proposition that is true in a world w if and only if some proposition in its ordinary denotation is true in w, and all the propositions in (23) are also true in w.

(24) $[\![(15)]\!]^{+} = \lambda w.\exists p[p \in [\![(15)]\!] \ \& \ p(w) \ \& \ \forall q[q \in (23) \rightarrow q(w)]]$

In general,

(25) For any disjunction S,

where $\heartsuit([\![S]\!]_{ALT,\cap})$ is the set of innocent excludable propositions in

$[\![S]\!]_{ALT,\cap}$

$[\![S]\!]^{+} = \lambda w.\exists p[p \in [\![S]\!]\ \&\ p(w)\ \&\ \forall q[q \in \heartsuit([\![S]\!]_{ALT,\cap}) \rightarrow \neg q(w)]]$

There is no need to assume the $\mathbb{L}$ and $\mathbb{R}$ operators, then.

To conclude, I will like to point out an important difference between the definition of innocent exclusion presented in section 2, and the definition of innocent exclusion that we have just presented.

6. No atomic disjunct ignored

In the definition of innocent exclusion presented in section 2, it is the proposition expressed by the whole disjunction that determines which competitors are innocently excludable. In the definition of innocent exclusion in an Alternative Semantics, it is the propositions expressed by each individual disjunction that do so. The difference between the two procedures becomes apparent when we consider the disjunctions below:

(26) a. Sandy is reading *Moby Dick* or *Huckleberry Finn*.

b. Sandy is reading *Moby Dick*, *Huckleberry Finn*, or both.

Under the standard analysis, the disjunctions in (26a) and (26b) are logically equivalent: they both denote the proposition that is true in a world *w* if and only if Sandy is reading at least one of the two books. The Sauerland algorithm generates different scalar competitors for each disjunction: it generates four different competitors for (26a), and sixty-four for (26b) (resulting from computing the cross-product of three scales with four operators each). The meaning of these competitors, however, are the same in both cases: the ones in the set in (27).

(27) $\{M \vee H, M, L, M \,\&\, H\}$

The innocent exclusion procedure presented in section 2 takes into consideration the meaning of the disjunctions and the meaning of their competitors. Since the disjunctions in (26a) and (26b) have the same meaning and the meaning of their competitors are the same, the disjunction in (26a) is indistinguishable from the disjunction in (26b).[14] Something else must be responsible for the fact that the sentence in (26b) is not associated with an exclusivity implicature.

Under the Alternative Semantics analysis, the disjunctions in (26a) and (26b) denote different objects, the disjunction in (26a) denotes a set containing two propositions (the proposition that Sandy is reading *Moby Dick*, and the proposition that Sandy is reading *Huckleberry Finn*), and the disjunction in (26b) denotes a set containing three propositions (the proposition that Sandy is reading *Moby Dick*, the proposition that Sandy is reading *Huckleberry Finn*, and the proposition that Sandy is reading both books), as illustrated below.

(28) a. $[\![(26a)]\!] = \{M, H\}$

b. $[\![(26b)]\!] = \{M, H, M \,\&\, H\}$

The set of competitors generated by the function $[\![\cdot]\!]_{ALT,\cap}$ is the same for both disjunctions:

(29) $[\![(26a)]\!]_{ALT,\cap} = [\![(26b)]\!]_{ALT,\cap} = \{M, H, M \,\&\, H\}$

However, because the disjunctions denote different sets of propositions, and the innocent exclusion procedure takes into consideration each proposition in the meaning of a disjunction, the set of innocently excludable competitors is different. Take the disjunction in (26a). There are two ways of adding to each member of its denotation as many negated competitors as consistency allows. The proposition that Sandy is not reading both *Moby Dick* and *Huckleberry Finn* follows from each of them, and, so, it is innocently excludable. The strengthened meaning of (26a) conveys that Sandy is reading at most one of the two books. Consider now the disjunction in (26b). Because it denotes a set containing three propositions, we need to consider three maximally consistent sets. The proposition that Sandy is not reading both *Moby Dick* and *Huckleberry Finn* does not follow from every one of these sets, and, therefore, is not innocently excludable. Without further assumptions, we predict that the strengthened meaning of (26b) does not convey that Sandy is reading exactly one of the two books.[15]

7. Concluding Remarks

We have seen that once we adopt an Alternative Semantics for disjunction, the exclusive implicature can be computed on the basis of the meaning of the disjunction itself, without having to resort to Sauerland's connectives, because the meaning of a disjunction in an Alternative Semantics makes the meaning of the atomic disjuncts readily available in the semantics and pragmatics. We have also seen that the adaptation of Fox's strengthening to an Alternative Semantics allows for the distinction between logically equivalent disjunctions with different atomic disjuncts without further stipulations. This is possible because what matters for the determination of the computation of the implicature is not the standard truth-conditional content of the disjunction, but the meaning of each individual atomic disjunct.

Simons (1998) has already convincingly argued that the independent consideration of each atomic disjunct is specially relevant for the determination of the presupposition projection behavior of disjunctions.[16] Most recent work on indefinites and disjunction in an Alternative Semantics has been trying to capture the fact that in modals statements none of the propositional alternatives introduced by these expressions can be ignored — each and every one must be true at some accessible possible world (Kratzer and Shimoyama 2002, Kratzer 2005).[17] We should then conclude, perhaps, that the fact that the meaning of each atomic disjunct is also relevant in the computation of the exclusive implicature should not come out as a surprise.

Notes

[1] See David Dowty and Peters (1981, p. 33), Kamp and Reyle (1993, p. 192), de Swart (1998, p. 80), and Chierchia and McConnell-Ginet (2000, p. 80) among others. The analysis has been generalized to cover the cases where *or* operates over constituents whose denotations are not truth-values, but are in domains with Boolean structure: see, for instance, Gazdar (1979), von Stechow (1974), Keenan and Faltz (1978), Keenan and Faltz (1985), and Partee and Rooth (1983). Gazdar (1977), Pelletier (1977), Gazdar (1979), and Horn (1989) present the classical arguments in favor of treating *or* as inclusive disjunction.

[2] 'M' stands for the proposition that Sandy reads *Moby Dick* and 'H' for the proposition that Sandy reads *Huckleberry Finn*.

[3] Reichenbach (1947, p. 47) noted that if *or* is to be interpreted as exclusive disjunction, it cannot be a binary connective, because a binary exclusive connective does not capture the exclusive component of disjunctions with more than two atomic disjuncts. In connection with the derivation of the exclusive component as a scalar implicature, the problem was hinted at by McCawley in an exercise in the second edition of his textbook (McCawley (1993, p.324)). It was more recently addressed in Lee 1995, Lee 1996, and Simons 1998. From there, the puzzle

has been discussed in Schwarz 2000, Chierchia 2001, Fox 2003, Merin 2003, Sauerland 2004, Fox 2004, and Fox 2007.

[4] A set of propositions $\mathscr{A}$ is consistent if and only there is at least one world w in which all propositions in $\mathscr{A}$ are true.

[5] A proposition follows from a set of propositions $\mathscr{A}$ if and only if p is true in all worlds where all the members of $\mathscr{A}$ are true. A subset $\mathscr{C}$ of a set of propositions $\mathscr{A}$ is a maximal consistent subset of $\mathscr{A}$ if and only if the following conditions hold: (i) $\mathscr{C}$ is not the empty set, (ii) $\mathscr{C}$ is consistent, and (iii) for any proposition $p \in \mathscr{A}$, if $p \notin \mathscr{C}$, then $\mathscr{C} \cup \{p\}$ is inconsistent (I take this definition from Kratzer 1979, p. 125.)

[6] Notation: $[\![\alpha]\!]$ is the ordinary meaning of an expression α, and $[\![\alpha]\!]^+$ its meaning strengthened by the conversational implicature.

[7] As an anonymous reviewer points out, Fox's procedure finds a precedent in Gazdar's classical work (Gazdar, 1979). Gazdar proposes that a potential implicature becomes actual if it can be consistently added to every subset of potential implicatures that are consistent with the truth-conditional content of the statement, the common ground, and its actual clausal implicatures (Gazdar 1979, chapter 6). The reviewer points out that similar techniques for the generation of implicatures are used in Spector 2003 and Schulz 2004. Inconsistent sets of propositions also figure prominently in the definition of conditional necessity in a premise semantics (Veltman 1976, Kratzer 1977, Kratzer 1979). The anonymous reviewer mentions that the idea of reasoning based on maximal consistent subsets can be traced back to van Fraassen 1973.

[8] We will adopt an Alternative Semantics of the style developed by Charles Leonard Hamblin in his analysis of questions (Hamblin, 1973). A Hamblin semantics has been invoked in the analysis of focus (Rooth, 1985; Rooth, 1992), and indeterminate pronouns (Ramchand, 1997; Hagstrom, 1998; Kratzer and Shimoyama, 2002; Alonso-Ovalle and Menéndez-Benito, 2003). I use a two-typed language as my metalanguage (Gallin, 1975). World arguments are subscripted.

[9] I represent the internal structure of disjunctions at LF as flat. It is inmaterial for the discussion whether it is, but the reader is referred to Munn (1993) and den Dikken (2006), where the internal structure of disjunctive constituents is assumed *not* to be flat.

[10] The assumption that we have a disjunction of DPs in (15) is not essential for our purposes: in the type of semantics that we are assuming, the sentence in (15) would denote the same set of propositions if it were analyzed as an elliptical disjunction of sentences or VPs.

[11] The reader is referred to Kratzer 2005 and Menéndez-Benito 2005 for a discussion of the effects of these propositional operators in connection with the semantics of free choice indefinites, and to Alonso-Ovalle 2006 for a discussion of the consequences of assuming an external Existential Closure operator and how the universal propositional operator might help capturing the natural interpretation of disjunctions in the antecedent of non-monotone conditionals.

[12] Under this view, the number of competitors that an interpreter needs to consider to compute the implicature is smaller than the number of competitors that the interpreter would need to consider if the computation of the implicature requires applying Sauerland's algorithm. Consider for instance a disjunction S with five atomic terms. In an Alternative Semantics, all that matters for the strengthening is the intersection of the nonempty subsets of the meaning of S. Therefore, the interpreter needs to take into consideration thirty-one propositions, which are determined by the meaning of S $((|\wp(\llbracket S \rrbracket)| = 2^5) - 1)$. To consider the competing scalar meanings by appealing to Sauerland's algorithm, we need to assume that the interpreter has to go over two hundred and fifty-six sentences (= 4^4), some of which are logically equivalent, to determine the required competing meanings. It would be interesting to gather psycholinguistic evidence on whether the determination of the exclusive implicature is harder with longer disjunctions, and, if so, on how the difficulty grows with the number of atomic disjuncts.

[13] I am indebted to Angelika Kratzer for pointing out to me how innocent exclusion can be defined while assuming that unembedded disjunctions denote sets of propositions.

[14] The problem has been pointed out in Heim 2005.

[15] If the "at least n" analysis of numerals is adopted, a similar problem arises with sentences like (i), in which the whole disjunction is logically equivalent to one of the disjuncts (but see Breheny 2005 for differences between the "exacty n" interpretation of numerals, and the exclusive interpretation of disjunctions.)

(i) Sandy ate two or three bagels.

An anonymous reviewer points out that van Rooy and Schulz (2006) discuss a mechanism to deal with the exclusivization of disjunctions with logically dependent disjunctions. The proposal builds on Aloni 2003, which argues that every disjunct introduces its own discourse referent.

[16] Simons argues for the fact that in a dynamic setting, updating a context with a disjunction involves updating the context with each atomic term of the disjunction independently and collecting the outputs, as in (i) below.

(i) $c + [\ S_1 \text{ or } S_2 \text{ or} \ldots S_n\ ] = [c + S_1] \cup [c + S_2] \cup \ldots \cup [c{+}S_n]$ (Simons (1998, p. 154))

This is of course reminiscent of Hans Kamp's performative analysis of permission statements (see Kamp 1978 and van Rooij 2000).

[17] See Alonso-Ovalle 2006 for an overview of recent analysis of disjunction that deal with te problem of how to make sure that when disjunction is embedded under a modal, each disjunction is true in some accessible possible world.

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