Universidad del País Vasco
May 2004

Implicature Calculation, Pragmatics or Syntax, or both?

Danny Fox, MIT

1. Overall Plan

(1) John did some of the homework.
Standard logical rendition:
$\exists x(\text{homework}(x) \wedge \text{John-Did}(x))$

Problematic Inference:
John didn't do all of the homework.

(2) John bought 3 houses.
Standard logical rendition:
$\exists x(|x|=3) \wedge \text{houses}(x) \wedge \text{John-bought}(x))$

Problematic Inference:
John didn't buy 4 houses.

(3) John talked to Mary or Sue.
Standard logical rendition:
(John talked to Mary) $\vee$ (John talked to Sue)

Problematic Inference:
John didn't talk to Mary and Sue.

The neo-Gricean account: the source of these scalar implicatures is a reasoning process (undertaken by the hearer), which culminates in an inference about the belief state of the speaker.

An alternative Syntactic account: implicatures are represented in the grammar by an operator with a meaning akin to that of *only*.

- There is a systematic way to state the "scalar implicature" of a sentence explicitly: append the focus particle *only* to the sentence and place focus on scalar items.

(4) John did some of the homework.
Implicature:
John only did SOME of the homework.

For all of the alternatives to 'some', d,
if the proposition that John did d of the homework is true,
then it is entailed by the proposition that John did some of the homework.

(5) John bought three houses.
Implicature:
John only bought THREE houses.

For all of the alternatives to 'three', n,
if the proposition that John bought n houses is true
then it is entailed by the proposition that he bought 3 houses.

(6) John talked to Mary or Sue.
Implicature:
John only talked to Mary OR Sue.

For all of the alternatives to 'or', con,
if the proposition that John talked to Mary con Sue is true
then it is entailed by the proposition that John talked to Mary or Sue.

(7) The *only* implicature generalization (OIG): A sentence, *S*, as a default, licenses the inference/implicature that (the speaker believes) *onlyS'*, where *S'* is *S* with focus on scalar items.

The syntactic account is designed to derive the OIG. In simple cases the Neo-Gricean account derives the same generalization.

The goals of these lectures: To argue in favor of the syntactic account in the following way:

1. To show that despite initial appearances, the Neo-Gricean account predicts a generalization that is different from the OIG.
2. To present evidence that the OIG is the right generalization.
3. To draw various consequences for the meaning of *only* and for the nature of scales.

2. Some of the cases to be discussed

Neo-Grice's Reasoning (very rough outline)

Principles of communication require a speaker to use the most informative (strongest) true proposition from a certain designated set.

Under run-of-the-mill circumstances, (8alt) is a member of the designated set for (8).

(8) John did some of the homework.

(8alt) John did all of the homework.

These principles allow the listener to infer (upon hearing (8)) that unless the speaker believed that (8alt) were false, the speaker would have uttered (8alt).

Since the speaker didn't make this alternative utterance, it fallows that the speaker believes that (8alt) is false.

Derived Implicature: (S believes) it's not the case that John did all of the homework.

2.1. Problems of over-generation

2.1.1. The Puzzle of Disjunction:

(9) John did the reading or some of the homework.

Principles of communication should allow the listener to infer (upon hearing (9)) that unless the speaker believed that (9alt) were false, the speaker would have uttered (9alt):

(9alt) John did the reading or all of the homework.

Since the speaker didn't make this alternative utterance, it should fallow that the speaker believes that (9alt) is false.

Derived Implicature: (S believes) it's not the case that John did the reading or all of the homework.

Problem: $\neg(p \vee q) \equiv \neg p \wedge \neg q$; although we get the correct implicature that John didn't do all of the homework, we also get the incorrect implicature that John didn't do the reading (cf. Chierchia, Schwarz, Sauerland, and Yae-Sheik Lee, among others).

(10) The *only* implicature generalization (OIG): Utterance of a sentence, *S*, as a default, licenses the inference/implicature that (the speaker believes) *onlyS'*, where *S'* is *S* with focus on scalar items.

- Exactly the same problem arises in the semantics of *only*:

(11) Speaker A: John did the reading or some of the homework.
Speaker B: Is it possible that he did all of the homework.
Speaker A: No. he only did the reading or SOME of the homework.

(12) Question under discussion: Who is responsible for the fact that various things are missing from the kitchen, among them the ice cream and the candy?
A: I know that John ate the candy or some of the ice cream.
B: Do you think he might have eaten all of the ice cream?
A: No, he only ate the candy or SOME of the ice cream.

- There is a solution in the case of *only*, based on the notion of lumping developed in work by Kratzer (1988). This solution can be carried over to the problem with implicatures if we develop a theory that captures the OIG. However, once the Kratzer amendment is added, the neo-Gricean theories of implicatures can no longer capture the OIG.

2.1.2. Comparatives (joint work with Martin Hackl):

(13) a. John read 3 books.
Implicature: It's false that John read 4 books.
b. John read more than 3 books.
*Implicature: It's false that John read more than 4 books.

(14) a. *John only read more than 3 books.
b. John only read more than 3 books.

On the face of it, the facts are quite surprising both for the neo-Gricean account and for the syntactic alternative. However, under certain auxiliary assumptions about the nature of degree-scales the facts are expected under the syntactic account but not under the new-Gricean alternative.

Much of our discussion will center on motivating the auxiliary assumptions. Here we will direct much attention to extraction phenomena, mainly of degree operators.

2.1.3. Distributional Restrictions

(15) a. Winnie might smoke three cigarettes.
b. Winnie is allowed to smoke three cigarettes.
(Sauerland in press)

Only cannot outscope *might* (see von Fintel and Iatridou 2003)

(16) a. *Winnie only might smoke THREE cigarettes.
b. Winnie is only allowed to smoke THREE cigarettes.

2.2. Problems of under-generation

Krifka's Puzzle (Krifka 1998):

(17) 3 boys ate 7 apples.
Implicature: it is not true that 4 boys ate 8 apples.

(18) a. I introduced 3 women to 7 men.
Implicature: it is not true that I introduced 4 women to 8 men.
b. I only introduced THREE women to SEVEN men.

Intrusive Implicatures:
(Levinson 2000, Hurford 1974, Cohen 1977, Kempson 1986, Horn 1989, passim).

(19) a. The man whose reading one book is my brother. The man whose reading two books is my brother in law.

b. The man who's only reading ONE book is my brother. The man whose reading two books is my brother in law.

(20) a. The students who did the reading or the homework are in worse shape than the students who did both.
b. The students who only did the reading OR the homework are in worse shape than the students who did both.

3. Background

(21) John did some of the homework.
Standard logical rendition:
$\exists x(\text{homework}(x) \wedge \text{John-Did}(x))$

Problematic Inference:
John didn't do all of the homework.

(22) John bought 3 houses.
Standard logical rendition:
$\exists x(|x|=3) \wedge \text{houses}(x) \wedge \text{John-bought}(x))$

Problematic Inference:
John didn't buy 4 houses.

(23) John talked to Mary or Sue.
Standard logical rendition:
(John talked to Mary) $\vee$ (John talked to Sue)

Problematic Inference:
John didn't talk to Mary and Sue.

3.1. Option 1, strengthen the meaning of the relevant lexical items

(24) John did some of the homework.
Alternative logical rendition:
$\exists x(\text{homework}(x) \wedge \text{John-Did}(x)) \wedge$
$\neg\forall x(\text{homework}(x) \rightarrow \text{John-Did}(x))$

(25) John bought 3 houses.
Alternative logical rendition:
$\exists x(|x|=3) \wedge \text{houses}(x) \wedge \text{John-bought}(x)) \wedge$
$\neg\exists x((|x|>3 \wedge \text{houses}(x) \wedge \text{John-bought}(x))$

(26) John talked to Mary or Sue.
Alternative logical rendition:
[(John talked to Mary) $\vee$ (John talked to Sue)] $\wedge$
$\neg$[(John talked to Mary) $\wedge$ (John talked to Sue)]

(27) Standard Lexical Entries:

a. $[[\text{some}]] = \lambda A.\lambda B.\ A \cap B \neq \emptyset$
b. $[[3]] = \lambda A.\lambda B.\ |A \cap B| \geq 3$
c. $[[\text{or}]] = \lambda p.\lambda q.\ p = 1 \text{ or } q = 1.$

(28) Alternative Lexical Entries:

a. $[[\text{some}]] = \lambda A.\lambda B.\ A \cap B \neq \emptyset \text{ and } \neg(A \subset B)$ (=[[some but not all]])
b. $[[3]] = \lambda A.\lambda B.\ |A \cap B| = 3$ (=[[exactly 3]])
c. $[[\text{or}]] = \lambda p.\lambda q.\ p + q = 1$ (=[[ExOR]])

3.2. Evidence for Standard Lexical Entries

(29)a. John did some of the homework. For all I know he might have done all of it.
b. ≠John did some but not all of the homework. For all I know he might have done all of it.

(30)a. If John bought 3 houses, I will be very angry with him.
b. ≠If John bought exactly 3 houses, I will be very angry with him.

(31)a. John talked to Mary or Bill. I hope he didn't talk to both of them.
b. ≠John talked to Mary or Bill but not to both. I hope he didn't talk to both of them.

3.3. Option 2: Ambiguity

(32) 2 Lexical Entries:

a. $[[\text{some}_{\text{weak}}]] = \lambda A.\lambda B.\ A \cap B \neq \emptyset$
$[[\text{some}_{\text{strong}}]] = \lambda A.\lambda B.\ A \cap B \neq \emptyset \text{ and } \neg(A \subset B)$ (=[[some but not all]])
b. $[[3_{\text{weak}}]] = \lambda A.\lambda B.\ |A \cap B| \geq 3$
$[[3_{\text{strong}}]] = \lambda A.\lambda B.\ |A \cap B| = 3$ (=[[exactly 3]])
c. $[[\text{or}_{\text{weak}}]] = \lambda p.\lambda q.\ p = 1 \text{ or } q = 1.$
$[[\text{or}_{\text{strong}}]] = \lambda p.\lambda q.\ p + q = 1$ (=[[ExOR]])

3.4. The Exhaustivity Generalization

But this is a bad proposal for two reasons:

a. it misses a generalization, and
b. it's empirically inaccurate (downward entailing contexts)

3.4.1. The Generalization:

The phenomenon we are dealing with is pretty general, and multiplying meanings at will misses the generalization:

(33) a. It's warm outside. (Likely inference: It is not hot outside)
b. If it's warm outside, you don't need to take a sweater.

(≠If it's warm but not hot outside, you don't need to take a sweater).

(34) a. Mary is as tall as John is. (Likely inference: Mary is not taller than John is.)
b. Mary is as tall as John is. For all I know, she might be taller
(≠Mary is exactly as tall as John is. For all I know, she might be taller.)

(35) a. It's possible that there is a sneak in the box.
(Likely inference: It's not necessary…)
b. You shouldn't open the box if it's possible that there is a sneak inside.

(36) a. John started working on his experiment.
(Likely inference: he didn't finish)
b. If you start working on your experiment, we will all be happy.

The generalization refers to a class of lexical entries (quantifiers, numeral expressions, truth conditional operators, comparatives, modal operators…), which are members of postulated scales, Horn Scales.[1]

Quantifiers: {Some, Many/Much, Most, Every/All}
Numerals: {one, two, three,…}
Truth conditional operators {or, and}
Comparative operators {as, er}
Various gradable adjectives {warm, hot}, {small, tiny} {big, huge}, etc
Modal operators {possible, necessary}
…

(37) The Exhaustivity Generalization: utterance of a sentence, S, as a default, licenses the inference that (the speaker believes that) all of the scalar alternatives of S that are logically stronger than S are false (Henceforth, the Exhaustivity Inference).

The Scalar Alternatives of a sentence S, Alt(S), are the set of sentences that can be derived from S by replacing scalar items in S by their scale-mates.

(38) Example:
John bought 4 houses is a Scalar Alternative of *John bought 3 houses* . Since *John bought 4 houses* is logically stronger, The Exhaustivity Generalization tells us that utterance of *John bought 3 houses*, as-a-default, licenses the inference that (the speaker believes) that John didn't buy 4 houses.

3.4.2. Lexical Ambiguities are empirically insufficient (in downward entailing contexts the relevant inferences are reversed)

(39) John didn't do all of the homework.

[1] I represent Horn-Scales as unordered sets for reasons discussed in Sauerland (in press). In particular, the generalization needs to make reference to an ordering relation among sentences, which makes it unnecessary to order the lexical items.

Exhaustivity Inference:
John did some of the homework.

3.5. The (neo)-Gricean Account (Horn, Gazdar,…)[2]

The Exhaustivity Inferences do not follow from the semantics of sentences but rather from pragmatic reasoning about the belief-state of speakers.

3.5.1. The short version (which doesn't really work):

(40) John bought 3 houses.

(41) Hearer's reasoning:
If John bought 4 houses, that would have been relevant information. S did not provide me with this information. It is therefore reasonable to assume that S thinks that John did not buy 4 houses.

3.5.2. The formal nature of the set of alternatives

Why not the following:

(42) *Hearer's reasoning:
If John bought exactly 3 houses, that would have been relevant information. S did not provide me with this information. It is therefore reasonable to assume that S thinks that John did not buy exactly 3 houses.

If the exhaustivity inference is to follow from reasoning about the alternative utterances that the speaker avoided, something needs to be said in order to insure that we have the right set of alternatives.

(43)a. John bought 4 houses $\in$ {S: Hearer considers S as a possible alternatives when hearing (40)}
b. John bought exactly 3 houses $\notin$ {S: Hearer considers S as a pos. alt. when hearing (40)}

Necessary stipulation: {S: Hearer considers S as a possible alternatives when hearing X} = Alt(X)

3.5.3. As it stands the hearer is only justified in making a weaker inference
(Soames 1982:455-456; Groenendijk and Stokhof 1984)

(41) Hearer's reasoning:
If John bought 4 houses, that would have been relevant information. S did not provide me with this information. It is therefore reasonable to assume that S thinks that John did not buy 4 houses.

[2] The presentation in this subsection is based on class notes of Kai von Fintel and Irene Heim.

> Wait a second. That was a little hasty. All I can conclude at the moment is that S is not in a position to claim that John bought 4 houses. The reason for this could be that S thinks that John didn't buy 4 houses. But it could just as well be the case that S doesn't know whether or not John bought 4 houses.

Necessary assumption (opinionated speaker): When S is uttered by a speaker, s, the hearer's default assumption is that for every member of Alt(S), s has an opinion as to whether or not S is true.

3.5.4. The long version (which does work):

Hearer's assumptions:

1. Maxim of Quantity: speakers know that they have to make the most informative relevant contribution to a conversation.
2. Alternative Set: the set of candidates from which the most informative needs to be chosen is constructed with reference to Horn Scales; it is Alt(S).
3. Opinionated Speaker (OS): (as a default) speakers are assumed to have an opinion regarding the truth-value of Alt (S).

(44) Context: A speaker s utters the sentence, *John bought 3 houses*.

1. Given the maxim of quantity, we can infer that it's not the case that s thinks about one of the stronger alternatives in the designated set that it is true.
2. The set of alternatives contains *John bought 4 houses*, which is logically stronger than the speaker's utterance. Hence given 1 it's not the case that speaker thinks that this sentence is true.
3. Given OS the default assumption is that the speaker has an opinion as to whether *John bought 4 houses* is true or false. Given 2 (the conclusion that it's not the case that the speaker thinks that the sentences is true), we can conclude that the speaker thinks that it is false.

So we do not derive the conclusion that S is false, but only the conclusion that the speaker thinks S is false. This might be good enough. If a speaker utters a sentence and by that conveys his belief that a certain proposition, p, holds, it is natural that we will accept p whenever we accept the speakers utterance, and that p will seem to be an inference of the sentence. (However, much of the philosophical literature tries to derive something stronger, something like "mutual knowledge" of the speaker's belief that the stronger alternatives in Alt (S) are false.)

Question to ask: Does this really derive the Exhaustivity Generalization?

Not quite, instead:

(45) The Pragmatic Exhaustivity Generalization: utterance of a sentence, S, as a default, licenses the inference that (the speaker believes that) all of the scalar alternatives of S that are pragmatically/contextually stronger than S are false

The Scalar Alternatives of a sentence S, Alt(S), are the set of sentences that can be derived from S by replacing scalar items in S by their scale-mates.

Our discussion of comparatives will constitute an argument that the Exhaustivity Generalization is a better generalization than the Pragmatic Exhaustivity Generalization.

Standard terminology:

a. "Implicatures": inferences from sentences based on reasoning about speakers beliefs.
b. "Scalar Implicatures": Implicatures that rely on the Maxim of Quantity, Horn-Alternatives, and the assumption of an Opinionated-Speaker.

We will use the term "Scalar Implicatures" extensionally to refer to the type of "problematic inferences" we've looked at, even in when we will consider the syntactic account under which these inferences are not the result of reasoning about speakers beliefs.

4. An alternative, ambiguity, account (cf. G&S 1984; Krifka 1995)

4.1. Background: the semantics of *only* and association with focus

(46) a. Mary only introduced JOHN to Sue.
b. Mary only introduced John to SUE.
b. Mary only introduced JOHN to SUE.

LFa: only [C][$_{VP}$ Mary introduced John$_F$ to Sue]
LFb: only [C][$_{VP}$ Mary introduced John to Sue$_F$]
LFc: only [C][$_{VP}$ Mary introduced John$_F$ to Sue$_F$]

What the sentences in (46) say is that among the propositions in the set C, the only proposition that is true is the proposition that Mary introduced John to Sue. The sentences differ in the value of C something that needs to follow from the theory of focus (For discussion see Rooth (1995), Beaver and Clark (2003)).

(47) a. $C_{(46a)} = \{p_{st}: \exists x \in D_e$ and $p = \lambda w$. Mary introduced x to Sue in w$\}$.
b. $C_{(46a)} = \{p_{st}: \exists x \in D_e$ and $p = \lambda w$. Mary introduced John to x in w$\}$.
c. $C_{(46a)} = \{p_{st}: \exists x,y \in D_e$ and $p = \lambda w$. Mary introduced x to y in w$\}$.

(48) C is (a subset of) the focus value of VP (Foc(VP)).

(49) Informally: Foc(VP) is the set of propositions that can be derived from the interpretations of various modifications of VP; modifications in which focused constituents are replaced by various alternatives.

(50) $[[\text{only}]] = \lambda C_{<st,t>}.\lambda p_{st}.\lambda w\text{: } p(w) = 1.\ \forall q \in C.\ (q(w) = 1) \rightarrow (q = p)$

4.2. A modification in the semantics of *only*[3]

(51) a. John only talked to [Bill and Mary]$_F$.
#That's not true. Look, he talked to BILL.

b. John only read THREE books.
#That's not true. Look, he read two books.

(52) $[[\text{only}]] = \lambda C_{<st,t>}.\lambda p_{st}.\lambda w\text{: } p(w) = 1.\ \forall q \in C.\ (q(w) = 1) \rightarrow (p \Rightarrow q)$

(53) **The alternatives of Scalar items are their scale-mates.**

Consequence of this observation: the focus value of a sentence, S, in which the set of focused constituents is the set of scalar items in S is Alt(S)

(54) a. John only read THREE books. He didn't read FOUR.
b. John only read SOME books. He didn't read ALL books.
a. John only talked to Mary OR Sue. He didn't talk to Mary AND Sue.

4.3. The Postulation of a null exhaustivity operator[4]

(55) Speaker A: Look at these 10 boys. Which of them do you know?
Speaker B: I know John and Bill.
Inference: B doesn't know any of the other boys.

(56) EX(C)[I know [John and Bill]$_F$]

(57) $[[\text{EX}]] = \lambda C_{<st,t>}.\lambda p_{st}.\lambda w.\quad p(w) = 1 \text{ and } \forall q \in C.\ (q(w) = 1) \rightarrow (p \Rightarrow q)$

4.4. The Exhaustivity Generalization

(37) The Exhaustivity Generalization: utterance of a sentence, S, licenses, as a default, the inference that (the speaker believes that) all of the scalar alternatives of S that are logically stronger than S are false.

The Scalar Alternatives of a sentence S, Alt(S), are the set of sentences that can be derived from S by replacing scalar items in S by their scale-mates.

This generalization would seem to follow if, as-default, sentences are interpreted as answers to questions and the following stipulation holds:[5]

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[3] See Fintel, K. v. (1997). "Bare Plurals, Bare Conditionals, and *Only*." Journal of Semantics **14**: 1-56.

[4] Groenendijk, J. and M. Stokhof (1984). Studies on the Semantics of Questions and the Pragmatics of Answers, University of Amsterdam.

[5] In the end, the generalization will turn out to be false. Instead the OIG will be true.

(58) Stipulation: scalar items are inherently focused.[6]

Hope: We don't need this stipulation. The Exhaustivity Generalization holds only when the scalar item is focused which is often enough the case. (See von Rooy 2002.)

Welker (1994):

(59) a. I need four chairs.
b. John has four chairs.

(60) a. I need four chairs.
b. John has TWO chairs.

(61) I have three children.
default structure: EX(C)[$_S$ I have three$_F$ children].

[[(61)]] = 1 iff I have (at least) 3 children and every proposition in C that is true is entailed by the proposition that I have (at least) 3 children.
iff I have (at least) 3 children and every proposition in Alt(S) that is true is entailed by the proposition that I have (at least) 3 children.

The New Ambiguity Hypothesis: All sentences are systematically ambiguous. The source of this ambiguity is an optional exhaustivity operator.

Chierchia's Pragmatic Principle (cf. Dalrymple et. al 1994, 1998): When a sentence is ambiguous the default interpretation is the strongest alternative.

5. Comparatives

This section is based on work in progress with Martin Hackl.

(62) a. John has 3 children.
Implicature: John doesn't have 4 children.
b. John has more than 3 children.
*Implicature: John doesn't have more than 4 children.

This is a problem of over-generation for the Neo-Gricean account. An identical problem seems to arise for the ambiguity hypothesis.

However, it is not a problem for the OIG:

[6] See Krifka (1995) for a particular implementation of the stipulation.

(7) The *only* implicature generalization (OIG): Utterance of a sentence, *S*, as a default, licenses the inference/implicature that (the speaker believes) *only*S', where S' is (a minimal modification of) *S* with focus on scalar items.

(63) a. John only has THREE children.
b. *John only has more than THREE children.

The strategy: Explain why (63b) is bad, and then the lack of an implicature in (62b) would follow as a consequence of the ambiguity hypothesis.

5.1. An Explanation

(64) a. John weighs 120 pounds.
b. John weighs more than 120 pounds.
c. *John only weighs more than 120_F pounds.

In this case, the explanation of the facts is quite transparent: (64c) presupposes that John weighs more than 120 pounds, $120 + \varepsilon$ pounds; John, therefore weighs more than $120 + \varepsilon/2$ pounds, and, hence, there is a degree, *d*, greater than 120 such that John weighs more than *d* pounds.

In other words, if we assume that the set of degrees is dense (from which it follows that $120 + \varepsilon/2$ is a member of the set) the presupposition of (64c) ensures that the sentence will never be true, and this, is a plausible explanation for unacceptability.

The fact that (64b) lacks a scalar implicature follows in an identical manner from the ambiguity hypothesis.

But how could we get this explanation to carry over to the facts in (62) and (63)?

(65) The Universal Density of Measurements (UDM): Measurement Scales that are needed for Natural Language Semantics are *always* dense.

(66) a. I can only say with certainty that John weighs more than 120_F pounds.
b. I can only say with certainty that John has more than 3_F children.

(67) a. I can say with certainty that John weighs more than 120 pounds.
Implicature: I can only say with certainty that John weighs more than 120_F pounds.
b. I can say with certainty that John has more than 3_F children.
Implicature: I can only say with certainty that John has more than 3_F children.

One can presuppose it to have been demonstrated that x weighs more than 120 pounds, and subsequently assert consistently that there is no degree d, greater than 120, such that it has been demonstrated that x weighs more than d pounds. The reason for this is obvious: a demonstration that x weighs more than d pounds doesn't entail a

demonstration that x weighs d + ε pounds for some specific degree ε. (It is of course possible to make sense of this fact in possible world semantics, assuming a dense set of world corresponding to the degrees: for every ε there could be a world consistent with the demonstration such that in that world John weighs less than d + ε pounds. For a possibly related topic, see Lewis, 197x, Stalnaker 197x and Bennett 2003.)

The fact that the (a) and the (b) sentences continue to behave identically lends further support to the universality of the UDM, i.e. to the claim that, contrary to traditional assumptions, the linguistic system treats the (a) and the (b) sentences on a par.

Not all modal operators are alike:

(68) a. You're required to read more than 30 books.
Implicature: There is no degree greater than 30, d, s.t. you are required to read more than d books.
b. You're only required to read more than 30 books.

(69) a. You're allowed to smoke more than 30_F cigarettes.
*Implicature: There is no degree greater than 30, d, s.t. you are required to read more than d books.
b. *You're only allowed to smoke more than 30_F cigarettes.

If you are allowed to smoke more than 30 cigarettes, it follows that you're allowed to smoke 30 + ε cigarettes, for some degree, ε. This consequence would contradict the potential implicature, which is equivalent to the sentence in (69b).

A similar consequence does not follow when you are required to read more than 30 books. If you are required to read more than 30 books, there need not be a degree, ε, such that you are required to read 30 + ε books, and incoherence is avoided in exactly the manner we've discussed for the previous cases.

This of course follows from the fact that allowed is an existential modal (over possible worlds) and required is universal.

5.2. Why this is an argument for the syntactic account

Can the facts follow under the neo-Gricean account?

They could if the neo-Gricean could derive the Exhaustivity Generalization, but it doesn't follow, since the neo-Gricean only derives the Pragmatic Exhaustivity Generalization:

(37) The Exhaustivity Generalization: utterance of a sentence, S, licenses, as a default, the inference that (the speaker believes that) all of the scalar alternatives of S that are logically stronger than S are false.

The Scalar Alternatives of a sentence S, Alt(S), are the set of sentences that can be derived from S by replacing scalar items in S by their scale-mates.

(45) The Pragmatic Exhaustivity Generalization: utterance of a sentence, S, as a default, licenses the inference that (the speaker believes that) all of the scalar alternatives of S that are pragmatically/contextually stronger than S are false

The Scalar Alternatives of a sentence S, Alt(S), are the set of sentences that can be derived from S by replacing scalar items in S by their scale-mates.

If the Exhaustivity Generalization holds, the exhaustivity inference would not be consistent with the assertion in the relevant constructions. Consequently, the inference will not be licensed.

However, if the Pragmatic Exhaustivity Generalization holds, this will not be the case.

Homework:
1. Explain why
2. The Exhaustivity Generalization is stronger than the Pragmatic Exhaustivity Generalization. How could this lead to a problem of over-generation for the Pragmatic Exhaustivity Generalization?

5.3. Evidence for the UDM

5.3.1. An Extraction Problem

(70) I didn't read many of these books?
Question: Which books didn't you read?

(71) I don't weigh 190 pounds.
Question: *How much don't you weigh?

Rullmann (1995) suggests that the problem with the question in (71) is that it has no answer.

A question about degrees, which involves a *wh*-phrase such as *how much* or *how many*, needs to be answered by the largest degree that would satisfy a certain predicate. For example, the question in (72):

(72) How much do you weigh?
What is the maximal degree, d, such that John weighs (at least) d?

There is no maximal degree d such that you don't weigh d.

Evidence for this answer:

(73) a. *I have the amount of water that you don't.
b. I have an amount of water that you don't.

The definite article presupposes that there is a Maximal individual satisfying its sister argument.

(74) $[\![\text{the}]\!] = \lambda P_{<\alpha,t>}: \exists x P(x)=1 \text{ and } \forall y \neq x\ (P(y)=1 \rightarrow y \text{ is smaller than } x.$
$(\iota)x P(x)=1 \text{ and } \forall y \neq x\ (P(y)=1 \rightarrow y \text{ is smaller than } x.$

Problem (Rullmann and Beck, 1999):

(75) a. How much flower is sufficient to bake a cake?
b. What is the *minimal* degree, d, such that d is sufficient to bake a cake?

This is also a problem for the standard semantics of definite articles (von Fintel, Fox, and Iatridou, in progress).

(76) I have the amount of flower sufficient to bake a cake?

For the definite article, we might provide the following modification:

(77) $[\![\text{the}]\!] = \lambda P_{<e,st>} \lambda w: \exists x P(x)(w)=1 \text{ and } \forall y \neq x\ (P(y)(w)=1 \rightarrow P(x) \text{ asymmetrically entails } P(y)).$
$(\iota)x P(x)(w)=1 \text{ and } \forall y \neq x\ (P(y)(w)=1 \rightarrow P(x) \text{ asymmetrically entails } P(y)).$

For questions:

General statement: When answering a degree question, a speaker must provide the most informative answer that s/he believes to be true.

Two ways of encoding this (we will have evidence favoring A)

A. The Semantic Approach:[7]

(78) d? φ(d) = Among the true propositions of the form φ(d), which is the most informative one?

B. The Pragmatic Approach (Inspired by Heim 1994):

(79) d? φ(d) = for what degree, d, does φ(d) hold.

Speakers are required to give *all* true answers to a Question, and the way to do this, when the true answers are totally ordered by "informativeness" (entailment) is to provide the most informative answer.

[7] This is a revised version of Rullmann 1995, modified so that we maximize informativeness rather than position on a numeric scale.

But then, why is the question in (71) bad?

5.3.2. The Solution (density)

There is no most informative answer, since the set of degrees is dense.

There is some degree, d_J, such that John weighs exactly d_J.
The set of true answers to the question in (71) is:

A = {John doesn't weigh d: d> d_J}.

This set is (an infinite set which is) totally ordered by entailment, and the hearer has to provide the most informative answer.

There would be a most informative answer iff there was a minimal degree d in the set D

D = {d: d> d_J}

Our proposal: There is no most informative answer because there is no minimal degree in D.

5.3.3 Further evidence

Consequence #1: There are cases where a question (or a definite description) meets the relevant requirement despite the fact that negation is crossed by the wh-operator.

(80) How much are you sure that this vessel won't weigh?

(81) How much radiation are we not allowed to expose our workers to?

(82) The amount of radiation that we not allowed to expose our workers to

Minimal differences:

(83) a. ?How much radiation is the company not allowed to expose its workers to?
b. #How much food is the company not required to give its workers?

(84) a. ?How much radiation is the company required not to expose its workers to?
b. #How much food is the company allowed not to give its workers?

Suppose that there was an answer to (83b) (equivalent to (84b)). Let's say the answer is 3 bowls of rice. Since this answer is true, there is an allowed world, w_0, where the company doesn't give its workers d bowls of rice. Let's say that in w_0 the company gives its workers exactly 3- ε bowls of rice ($0<\varepsilon\leq 3$).

But given density there is a more informative answer. In w_0 the company doesn't give its workers 3- *ε/2* bowls of rice, and that is more informative.

Consequence #2: There are cases where a question doesn't meet the relevant requirement even though negation is not crossed by the wh-operator,

(85) a. *Before when did you arrive? (von Fintel and Iatridou, Since ~~Since~~).
b. Before when do you have to arrive?

(86) a. *More than how much does John weigh?
b. ??More than how much does he have to weigh in order to participate in this fight?

(87) a. *How many miles an hour did this car exceed?
b. How many miles an hour does this car have to exceed in order to loose its balance?

5.3.4. On the universality of the UDM

But didn't we quantify here over a discrete domain of degrees in (87)?
Not if UDM is assumed:

(88) *How many kids do you not have?

(89) a. If you live in China, how many children are you not allowed to have?
b. How many days a week are you not allowed to work?

(90) How many soldiers are you sure that the enemy doesn't have?

(91) a. ???Combien John n'a-t-il pas lu de livres?
How many John n'has-he not read of books
b. ? Combien peux-tu me dire avec (absolue) certitude que John n'a pas lu de livres?
How many can-you me tell with (absolute) certainty that John has not read of books
(Benjamin Spector, pc)

(92) a. *Combien Jean n'a-t-il (pas) d'enfants?
How many John n'has-he not of children
b.? Combien les chinois ne peuvent ils (pas) avoir d'enfants?
How many the chineese n'alloweed-them not have of-children?
(Valentine Hacquard, pc)

(93) a. ?How many feet do you have to be under to take this ride?
b. *How many feet is John under?

Semantics vs. pragmatics: When we are talking about the most informative answer, we mean logically strongest not contextually strongest..

We will, therefore, assume that the fact that the answer has to be the most informative one is not a fact of pragmatics but is rather part of semantics itself, yielding in certain cases contradictory propositions. I.e., we will adopt the Semantic Approach in A.

6. The Puzzle of Disjunction

6.1. The puzzle of multiple disjunction[8]

(94) Sue talked to John or Mary or Bill.

The strong meaning that we want for this sentence is the proposition that Sue talked to exactly one among John, Mary and Bill. But we don't get this meaning:

(95) p w (q w r)

p	q	r	q w r	p w (q w r)
1	**1**	**1**	**0**	**1**
1	1	0	1	0
1	0	1	1	0
1	0	0	0	1
0	1	1	0	0
0	1	0	1	1
0	0	1	1	1
0	0	0	0	0

The syntactic proposal is not better off (at the moment):

As we've seen, it works for ordinary (single) disjunction:

p	q	$p \vee q$	$p \wedge q$	$Ex[C](p \vee_F q)$
1	0	1	0	1
1	1	1	1	0
0	0	0	0	0
0	1	1	0	1

[8] I don't know how far back this observation goes, but see [Reichenbach, 1947 #4892], page 45.

But it fails once embedding (multiple disjunction) is allowed:

p	q	r	$p \vee (q \vee r)$	$p \wedge (q \vee r)$	$p \vee (q \wedge r)$	$p \wedge (q \wedge r)$	$Ex[c](p \vee (q \vee r))$
1	1	1	1	1	1	1	0
1	1	0	1	1	1	0	0
1	0	1	1	1	1	0	0
1	0	0	1	0	**1**	0	0
0	1	1	1	0	1	0	0
0	1	0	1	0	0	0	1
0	0	1	1	0	0	0	1
0	0	0	0	0	0	0	0

We get a meaning equivalent to $\neg p \wedge Ex[c](q \vee r))$

If we consider embedded EX we are back to ExOR.

4.2. The general puzzle (see Schwarz, Chierchia, Sauerland, and Gajewski[9])

(96) Jon ate the broccoli or some of the soup

(96') Strong Meaning:

b	as	ss	$b \vee ss$	$b \wedge ss$	$b \vee as$	$b \wedge as$	$Ex[c](b \vee ss)$
1	1	1	1	1	1	1	0
1	0	1	1	1	1	0	0
1	0	0	1	0	**1**	0	0
0	1	1	1	0	1	0	0
0	0	1	1	0	0	0	1
0	0	0	0	0	0	0	0

We get a meaning equivalent to $\neg b \wedge Ex[c](ss)$

(97) Let q be a formula that has at least one occurrence of a scalar item, such that q is not the strongest element in Alt(q):

$Ex[c](p \vee q)$ is equivalent to $\neg p \wedge Ex[c](q)$

Proof:

$\Rightarrow$

Let q' be an arbitrary sentence in Alt(q), which is stronger than q.

1. $Ex[c](p \vee q) \Rightarrow \neg (p \vee q') \Rightarrow \neg p$
2. Since $Ex[c](p \vee q) \Rightarrow p \vee q$, given 1 we get $Ex[c](p \vee q) \Rightarrow q$.

[9] Chierchia claims that the puzzle is more general. See Gajewski's discussion. If Chierchia has the right characterization, I have nothing useful to say. See Sauerland (2003) for an interesting argument against Chierchia's conclusion based on the principle that requires presupposition maximization.

3. Since $\neg (p \vee q') \Rightarrow \neg q'$, given 2 we get $Ex[c](p \vee q) \Rightarrow q \wedge \neg q'$. We didn't make any special assumptions about q', hence $Ex[c](p \vee q) \Rightarrow Ex[c](q)$

$\Leftarrow$

Assume $\neg p \wedge Ex[c](q)$ is true

1. it follows that q is true, and hence that $p \vee q$ is true.
2. Since $\neg p$ is true it follows that $\neg (p \wedge q')$ is true for every q'.
3. Since Ex[c](q) is true, $\forall q' \in \forall Alt(q)$, s.t. $q' \Rightarrow q$, $\neg(p \vee q')$ is true.

This problem arises in the same way under the neo-Gricean Account, since the latter is designed to capture The Exhaustivity Generalization, and sentences of the form $p \vee q$ where q is characterized as above are counter-examples to this generalization.

(37) The Exhaustivity Generalization: utterance of a sentence, S, as a default, licenses the inference that (the speaker believes that) all of the scalar alternatives of S that are logically stronger than S are false (Henceforth, the Exhaustivity Inference).

The Scalar Alternatives of a sentence S, Alt(S), are the set of sentences that can be derived from S by replacing scalar items in S by their scale-mates.

7. A Possible Solution

The problem is not a problem of implicatures per se:

(98) A: John talked to Mary or Sue or Jane.
B: Do you think he might have spoken to two of the three?
A: No, he only spoke to Mary OR Sue OR Jane.

(99) Question under discussion: Who is responsible for the fact that various things are missing from the kitchen, among them the ice cream and the candy?
A: I know that John ate the candy or some of the ice cream.
B: Do you think he might have eaten all of the ice cream?
A: No, he only ate the candy or SOME of the ice cream.

(100) A: You can eat the candy or some of the ice cream.
B: Can I eat all of the ice cream?
A: No, You can only eat the candy or SOME of the ice cream.

7.1. Background, Kratzer and the lumps of thought[10]

Assume the following conversation takes place at the end of a day in which B painted a still life with apples and bananas.

[10] Kratzer, A. (1989). "An Investigation of the Lumps of Thought." Linguistics and Philosophy **12**: 607-653.

(101) Dialogue with a lunatic:
A: What did you do today.
B: I did very little, the only thing I did was paint a still life.
A: That's not true. Look, you painted apples.
(pointing at the apples in the still life)

Kratzer's Intuition: If in the relevant time slice of the world w (the day of the utterance), B painted a single still life and this still life contained apples then, in w, the fact that B painted apples is part of the fact that B painted a still life.

(102) $[[\text{Only}]](C_{st,t})(p_{st})(w)$ is defined iff p is true. When defined its value is 1 iff for all $q \in C$, s.t. $q(w)=1$, the fact that makes q true in w is part of the fact that makes p true in w.

(103) $[[\text{Only}]](C_{st,t})(p_{st})(w)$ is defined iff p is true. When defined its value is 1 iff for all $q \in C$, s.t. $q(w)=1$, p lumps q in w.

(104) p lumps q in w, iff every situation in w in which p is true, q is true as well.
iff $\forall s\ [(w \geq s \text{ and } p(s)=1) \rightarrow q(s)=1]$[11]

For the details of the ontology, see Kratzer's paper. I will focus on some results that are relevant for the discussion that follows:

We clearly want as a result is that every situation in the relevant world in which B paints a still life is a situation in which B paints an apple. Here we might use our spatiotemporal intuitions to get the right result.

Similarly, something we clearly want is that for any world, w, and propositions, p and q, if $p(w)=1$ and $q(w)=0$, $p \vee q$ will lump p in w:

(105) Another lunatic:
A: What did John do today.
B: He did very little, the only thing he did was eat vegetables or fruit. (I don't remember which.)
A: That's not true. Look, he ate vegetables.

This lumping relation ($p \vee q$ lumps p in w) follows from Kratzer's assumption that propositions in Natural Language are *persistent*. (If $p(s) = 1$ and $s' \geq s$, then $p(s')=1$.) If there is a situation in w, s, s.t. $p \vee q(s)=1$, it's a situation in which $p(s)=1$, since the alternative option $q(s)=1$, would entail, by persistence, $q(w)=1$, contrary to assumption.

[11] See, Heim, I. (1990). *Only* and Lumping. UCLA and Universität Konstanz, as well as von Fintel (1997), and Fintel, K. v. (1999). "NPI Licensing, Strawson Entailement and Context Dependency." Journal of Semantics **16**(2): 97-148.

The idea that a world yields a lumping relation among its true propositions is supported by Kratzer's analysis of counterfactuals, which I will not go over here. However, it is important to mention that the assumption we made above about disjunction is a crucial component of Kratzer's account of counterfactual reasoning.

Two additional ingredients we will need:

1. An assumption that (at least in run-of-the-mill cases) existential propositions do not lump universal propositions.
   In particular, if every boy eats in w, it is not the case that the proposition that some boy eats lumps the proposition that every boy eats. Take a situation in which one of the boys eats and which doesn't contain the other boys. In this situation the proposition that some boy eats is true. However, persistence blocks this from being a situation in which the proposition that every boy eats is true.

   (106) A: What did John do today.
   B: He did very little. The only thing he did was read a book.
   A: That's not true. He read every book that was on the reading list.

2. A very similar assumption that (at least in run-of-the-mill cases) disjunctions do not lump conjunctions.

Heim's Problem (atelic predicates):

(107) A. What were you doing today.
B. (Not much) I was only painting a still life.
A. #That's not true you were also painting apples…

Assume that A's still life contains both apples and pears. If so, there is a situation of painting a still life which is not a situation of painting the apples, hence the proposition that B was painting the apples is not a sub-part of the proposition that he was painting a still life. This suggests that the lexical entry in (103) is still too strong.

Kratzer has weakened the requirement of true alternatives to p from being identical to p or being entailed by p to being lumped by p. But this weakening seems insufficient. We need a further weakening:

Alternative (cf., Kratzer 2002):[12]

(108) p lumps q in w iff every maximal pertinent situation $s \leq w$, s.t. $p(s)=1$ is a situation in which $q(s)=1$.

[12] Using Kratzer's (2002) notions we might consider the following:

(i) p lumps q in w iff every maximal $s \leq w$, s.t. s is a fact exemplifying p, $q(s)=1$.

(109) s is a pertinent situation such that p(s)=1, if there don't exist non-empty situations s_1 and s_2, such that $s_1 + s_2 = s$ and $p(s_1)=1$ but $p(s_2)=0$.

(110) s is a maximal situation of type A if there is no situation s' of type A, s.t. s < s'.

A different approach:

(111) p lumps q in w (q is a part of p in w) iff every pertinent situation that satisfies q is part of a pertinent situation that satisfies p.

7.2. Lumps and the disjunction puzzle

Before taking Kratzer's observation into account, we had the problem that Ex[c](p ∨ q) entails ¬p whenever q has a strong scalar alternative, q'. This entailment goes through because (p ∨ q') is stronger than (p ∨ q). And because, subsequently, the semantics of Ex[c](p ∨ q) excludes (p ∨ q'), hence excludes p.

But now the entailment doesn't go through. Now Ex[c](p ∨ q) excludes p ∨ q' only in a world in which it is not lumped by p ∨ q. But when p is true and q is false, every situation in which p ∨ q is true is a situation in which p is true, hence a situation in which p ∨ q' is true. Ex[c](p ∨ q) will exclude p ∨ q' only if q is true. But if q is true we indeed want both p and q' to be false.

(96) Jon ate the broccoli or some of the soup.
LF: EX [C] [Jon ate the broccoli or_F Jon ate $some_F$ of the soup].

(96) is true in w iff

a. the proposition p (= that Jon ate the b. or_{inc} Jon ate $some_{inc}$ of the s.) is true in w and
b. All propositions in C that are true in w are lumped by p in w.
C = b∨ss b∨as b∧ss b∧as

	b	ss	as	b or ss	b or as	b and ss	b and as	EX[c](b or ss)
a.	1	1	1	1	NL1	NL1	NL1	0
b.	1	1	0	1	NL1	NL1	0	"
c.	**1**	**0**	**0**	**1**	**L 1**	**0**	**0**	**1**
d.	**0**	**1**	**1**	**1**	**NL1**	**0**	**0**	**0**
e.	0	1	0	1	0	0	0	1
f.	0	0	0	0	0	0	0	0

EX[c](b ∨ ss) is equivalent to
(b ∨ ss) ∧ ¬(b ∧ SS) ∧ (ss→¬as)

a,b:
If b(w) = 1 and ss(w) =1, the following holds (doesn't matter whether or not as(w) =1) :
(b∨ss)(w) =1 (b∧ss)(w) =1
Since under such circumstances (b∨ss) doesn't lump (b∧ss),
Only[C](b or ss)(w)=0

c:

If b(w) = 1 and ss(w) =0, the following holds:
(b∨ss)(w) =1 (b∨as)(w) =1 (b∧ss)(w) =0 (b∧as)(w) =0
Since in w (b∨ss) lumps (b∨as), ***Only[C](b or ss)(w)=1***

d:

If b(w) = 0, ss(w) =1 and as(w)=1, the following holds:
(b∨ss)(w) =1 (b∨as)(w) =1 (b∧ss)(w) =0 (b∧as)(w) =0
Here, it is easy to convince ourselves that b∨ss does not lump b∨as. (The situations in which ss is true are identical to the situations in which b∨ss is true and the situations in which as is true are identical to the situations in which b∨as is true. Since ss does not lump as, as we've seen in the previous section b∨ss cannot lump b∨as.) Hence, ***Only[C](b or ss)(w)=0***

e:

If b(w) = 0, ss(w) =1 and as(w)=0, the following holds:
(b∨ss)(w) =1 (b∨as)(w) =0 (b∧ss)(w) =0 (b∧as)(w) =0
Here, of course, ***Only[C](b or ss)(w)=1***

f:

If b(w) = 0 and ss(w) =0, then (b∨ss)(w) =0 (b∨as)(w) =0 (b∧ss)(w) =0 (b∧as)(w) =0
Here, ***Only[C](b or ss)(w)=0***

(112) EX(C)(p or_F (q or_F r))

p	q	r	$p \vee (q \vee r)$	$p \wedge (q \vee r)$	$p \vee (q \wedge r)$	$p \wedge (q \wedge r)$	EX[c]($p \vee (q \vee r)$)
1	1	1	1	NL1	NL1	NL1	0
1	1	0	1	NL1	NL1	0	0
1	0	1	1	NL1	NL1	0	0
1	**0**	**0**	**1**	**0**	**L1**	**0**	**1**
0	1	1	1	0	NL1	0	0
0	1	0	1	0	0	0	1
0	0	1	1	0	0	0	1
0	0	0	0	0	0	0	0

(99) Question under discussion: Who is responsible for the fact that various things are missing from the kitchen, among them the ice cream and the candy?
A: I know that John ate the candy or some of the ice cream.
B: Do you think he might have eaten all of the ice cream?
A: No, he only ate the candy or SOME of the ice cream.

c	all	sm	c ∨ sm	c ∨ all		Only[c](c ∨ sm)
1	1	1	1	NL	1	0
1	0	1	1	NL	1	0
1	**0**	**0**	**1**	**L**	**1**	**1**
0	1	1	1	NL	1	0
0	0	1	1	0		1
0	0	0	0	0		undefined

We get the right result whether or not the disjunction is focused.

8. Cumulative Readings (Problem of over generation)

Consider the following sentence on the cumulative interpretation:

(113) 3 boys ate 7 apples.

Scha claims that the sentence is false if 4 boys ate 8 apples (cumulatively; henceforth 4 boys cum-ate 8 apples).

Krifka (1998) argues that this is an implicature:

(114) 3 boys ate 7 apples. And, it is even possible that 4 boys ate 8 apples.

"Grice's maxim of Quantity…will force the speaker to choose the highest numbers n, m such that the sentence *n boys ate m apples* is true. This is because the sentence *n boys ate m apples* entails sentences like *n' boys ate m' apples* for certain n' smaller than n and m' smaller than m."

Is this true?
Assume that it is.
Does the reasoning derive an implicature?

Let's see how we derive standard implicatures.

(115) Context: A speaker utters the sentence, S, *John bought 3 houses*.

1. Given the maxim of quantity, we can infer that there is no stronger alternative in the set of alternatives (Alt(S)) such that s thinks that it is true.
2. Alt(S) contains *John bought 4 houses*, which is logically stronger than the speaker's utterance. Hence given 1 it's not the case that speaker thinks that this sentence is true.
3. The default assumption is that the speaker has an opinion as to whether *John bought 4 houses* is true or false. Given 2 (the conclusion that it's not the case that the speaker thinks that the sentence is true), we can conclude that the speaker thinks that it is false.

Now let's try to derive this for the cumulative interpretation

(116) Context: A speaker utters the sentence, S, *3 boys ate 7 apples*.

1. Given the maxim of quantity, we can infer that it's not the case that s thinks about any of the stronger alternatives in Alt(S) that it is true.
2. Alt(S) contains *4 boys ate 8 apples*, which is logically stronger than the speaker's utterance. Hence given 1 it's not the case that speaker thinks that this sentence is true.

   Problem: As Krifka points out, *4 boys ate 8 apples* is not logically stronger. Assume that each of the 4 boys eats 2 apples.

This problem would be eliminated by any theory of implicatures that derives the OIG:

(10) The *only* implicature generalization (OIG): Utterance of a sentence, *S*, as a default, licenses the inference/implicature that (the speaker believes) *only*S', where S' is *S* with focus on scalar items.

In particular it is eliminated if implicatures are accounted for by an exhaustivity operator (EX):

EX(C)(3_F boys ate 7_F apples)(w) = 1 iff

a. The proposition that 3 boys cum-ate 7 apples is true in w. (I.e., there is a set of 3 boys, B, and a set of 7 apples, A, s.t. *eat'(A)(B)(w) =1)
b. For all integers n and m if the proposition that n boys cum-ate m apples is true in w, then this proposition is lumped in w by the proposition that 3 boys cum-ate 7 apples.

For any world, w, the proposition that 3 boys cum-ate 7 apples (if true in w) does not lump in w the proposition that 4 boys cum-ate 8 apples.

More generally the (neo) Gricean Scalar Implicatures (GSI) are really quite different from EX (or from anything that would be predicted the OIG). GSIs care about strength while EX doesn't. The two look so similar only because Alt(S) -- given the nature of Horn Scales -- is totally ordered under "strength". But various operators can in principle change the situation. If we had such operators, they could help us distinguish GSIs from EX. A cumulative operator on a verb is one such operator. Wonder if there are others.

9. A Pragmatic derivation of the OIG

Assumptions:

1. Every assertion is an answer to the question under discussion (QUD, sometimes implicit). Questions are sets of propositions, i.e. possible answers (Hamblin).

2. When a sentence, S, has scalar constituents the question is (in most cases) Alt(S).

3. Speakers must indicate when they don't think that their assertion is a maximal true answer to the QUD.

   $p \in$ Max-True(Q)(w) iff $p \in Q$ and $\forall q \in Q(q(w)=1 \rightarrow$ p lumps q in w).

(117) 3 boys ate 7 apples.

QUD: how many boys cum-ate how many apples.

Hearer's Inference: Since the speaker (s) made no indication that s/he is unable to provide a maximal true answer to the QUD, based on 3, I can conclude that s thinks that s/he is able to do so. This means that s thinks that the proposition expressed by *3 boys ate 7 apples* is maximal true answer to the QUD, i.e. that it lumps all of its true scalar alternatives.

(118) Who did you see?
I saw John.
(Implicature: I didn't see anyone else)

(119) Who did you do all day?
I painted a still life.
(Implicature: I didn't do anything that wasn't part of my painting of a still life)

10. Intrusive Implicatures

If Scalar implicatures require the postulation of a covert exhaustivity operator, we expect the operator to be embeddable. This suggests an approach to the phenomena of "Intrusive Implicatures" discussed quite extensively in the literature.

10.1. Negation

(120) a. John didn't read THREE books. He read FOUR.
b. John didn't talk to Bill OR Mary. He talked to Bill AND Mary.
b. John didn't talk to SOME girls. He talked to ALL girls.

10.1.1. Horn's account[13]

(120) are instances of meta-linguistic negation:

(121) $[[\text{not}_{\text{standard}}]] = \lambda p_t.\ p = 0$
$[[\text{not}_{\text{meta-linguistic}}]] = \lambda S_{\text{linguistic-expression}}$. It is inappropriate to utter S.

(122) a. I didn't manage to trap two monGEESE. I managed to trap two monGOOSES.
b. John didn't talk to XOMsky. he talked to CHOMsky.

(122) argues that meta-linguistic negation exists. How do we tell whether the sentences in (120) involve standard or meta-linguistic negation.

10.1.2. Horn's arguments:

1. Meta-Linguistic negation requires focus on the culprit.

This will remain a problem for what I propose. I will be able to capture the facts only by stipulation, but I will suggest that the stipulation might be more general.

2. *but* as a test for meta-linguistic negation

(123) a. John didn't read 3 books, but 4.
c. John didn't read 3 books, #but he read 4.
(cf. John didn't read 3 books, but he read 2.)

(124) a. John didn't talk to Bill OR Mary, but to Bill AND Mary.
b. John didn't talk to Bill OR Mary, #but he talked to Bill AND Mary.

(125) a. John didn't talk to XOMsky, but to CHOMsky.
b. John didn't talk to XOMsky, #but he talked to CHOMsky.

Horn's conclusion: There are two types of *but*. But_{NP} can go with meta-linguistic negation. But_{IP} ("concessive *but*") is restricted to regular negation. In different languages the two lexical items are associated with different sounds (Romance, Hebrew…).

But I'm not sure how good this argument is:

(126) a. John didn't read exactly 3 books, but exactly 4.
b. John didn't read exactly 3 books, #but he read exactly 4.

10.1.3. A possible challenge for a "meta-linguistic" account

(127) a. Fred convinced me that you read not TWO books, but THREE.

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[13] Horn, L. (1989). A Natural History of Negation. Chicago, University of Chicago Press.

b. Fred convinced me that you talked not to Bill OR Mary, but to Bill AND Mary.

(128) a. You can come to the movies with us because we didn't buy 2 tickets, but 3.
b. John was electrocuted because he didn't touch the red wire OR the blue wire, but both. (Kai von Fintel, pc)

(129) a. John was upset because I didn't eat SOME of the candy but ALL of the candy.
b. John was upset because I didn't bring TWO friends to the party as I had promised, but THREE .

c. John was upset because his kid didn't eat the Ice-cream OR the lollipop but BOTH of them.

10.2. Various Examples based on Levinson[14]

(130) a. Anyone who has SEVEN children is less miserable than anyone who has EIGHT.
b. #Anyone who lives in IRAQ is in less misery than anyone who lives in BAGHDAD.

(131) a. Every student who has THREE papers to write is better off than every student who has FOUR papers to write.
b. The man with TWO children near him is my brother; the man with THREE children near him is my brother in law.
c. #The man standing next to A BOY is my brother; the man standing next to BILLY is my brother in law.

(132) a. Every student who has to solve problem 1 OR problem 2 is better off than every student who has to solve problem 1 AND problem 2 .
b. The person you will see talking to a boy OR a girl will be my brother; the person you will see talking to a boy AND a girl will be my brother in law.

(133) a. Every student who has to solve SOME of the problems is better off than every student who has to solve ALL of the problems.
b. The person who can solve SOME of the problems is my brother; the person who can solve ALL of the problems is my brother in law.

10.3 A constraint on disjunction (Hurford 1974)

Hurford's Generalization: *A or B* is infelicitous when B entails A.[15]

(134) a. ??John is an American or a Californian.
b. ??I was born in France or Paris.

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[14]See, Levinson, S. (2000). Presumptive Meanings, MIT Press, and various references.
[15] See also Simons, M. (2000). Issues in the Semantics and Pragmatics of Disjunction. New York and London, Garland Pub.

Hurford used this generalization to argue for a strong meaning for disjunction (ExOR):

(135) I will apply to Cornell or UMASS or to both.

But we can extend this to other scalar items:

(136) a. I will read two books or three.
b. I will do some of the homework or all of it.

11. An Intervention Effect

Sauerland observes the following minimal pair:

(137) a. Winnie might smoke three cigarettes.
b. Winnie is allowed to smoke three cigarettes.

This would follow are derived via an exhaustivity operator:

(138) a. *Winnie only might smoke THREE cigarettes.
b. Winnie is only allowed to smoke THREE cigarettes.

A similar contrast arises in (139), Heim (2000):

(139) a. Winnie might smoke exactly three cigarettes.
b. Winnie is allowed to smoke exactly three cigarettes.

Heim (2000) points out that the contrast in (139) follows from von Fintel and Iatridou (2001) claim that epistemic modals are lethal interveners for certain dependencies.