Negation
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Abstract

This paper deals with some general issues regarding the interpretation of negation, including the relation between negation and presupposition and its relation with scalar implicature. As Horn (1989) documents in humbling detail, thinking about these matters goes back many centuries and has taken many different twists and turns. Needless to say, I cannot even attempt to do justice to the history of the study of negation here. My more limited goal is to present some basic questions regarding the semantics of negation and address how they relate to (i) the status of presuppositions, (ii) where and how scalar implicatures are derived and (iii) whether scalar implicature can be exploited to explain why certain expressions (Negative Polarity Items) are only licit in negative contexts. (On the topic of Negative Polarity Items see article 64 (Giannakidou) Polarity items.)

1. Negation and Contradiction
1.1. Contradiction and contrariness

One of the first words children learn—or so it seems to their parents—is no, and it is clear why: it is a semantically very useful word, one which helps us voice our disagreement in a simple and unmistakable way. The little child’s initial no may be a general, all-purpose one, but very soon we become proficient at using negation at several levels. Whereas no operates on a high, speech act level, as an answer to a question or as a disagreement with the content of a previous utterance, not takes lower scope, either over sentences (sentential negation, as in (1)) or over parts of sentences (constituent negation, as in (2)):

(1) Sandra didn’t call.
(2) I didn’t hear this from Simon but from Paul.

There are also morphological means of negating individual words by creating their negated counterparts, e.g., illegal vs. legal, unhappy vs. happy. In addition, antonyms can be argued to be related to each other by some sort of semantic negation relation, even if it is one that is not morphologically reflected, cf. hot vs. cold, young vs. old, few vs. many. (See Horn 1989 for details and qualifications.)

Obviously, a negated element and its nonnegative counterpart cannot both hold true simultaneously. Standing in opposition to each other, they are subject to
the Law of Contradiction, which states that a sentence $p$ and its negation (symbolized in propositional logic as $\neg p$) do not both hold at the same time.

Not all opposition is the same, though. If the negated element and its positive counterpart exhaust all the possibilities, the opposition is contradictory. If, however, there is a third option where neither the negation nor its non-negated counterpart holds, the opposition is merely contrary. The adjectives inanimate and animate, for example, can be argued to stand to each other in a contradictory opposition, for a given thing either satisfies one or it satisfies the other, and there seems to be no third option. In contrast, expensive and inexpensive stand in contrary opposition given that many things do not carry a price tag.

Whether the English sentential negation not creates an instance of contradictory or contrary negation has been a matter of considerable debate. Note that the negation operator $\neg$ in propositional logic gives rise to a contradictory opposition, having the semantics given in the truth table below. According to the table, $p$ is true whenever its negation $\neg p$ is false, and $p$ is false whenever its negation $\neg p$ is true. In other words, $\neg$ obeys the Law of the Excluded Middle, which states that either $p$ or its negation holds ($p \lor \neg p$):

<table>
<thead>
<tr>
<th>Tab. 63.1: truth table</th>
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<tbody>
<tr>
<td>$p$</td>
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<td>T</td>
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It is not immediately obvious, however, that the English word not gives rise to a contradictory negation as well and that it should be thought of as equivalent to $\neg$. The difficulty of assimilating the semantics of not to that of $\neg$ has to do with the fact that sentences in natural language are often understood in a way that certain information is (in a naïve, pre-theoretic sense) presupposed. Depending on how this presupposed information is analyzed, negation will result in contrary or contradictory opposition. Though the issue is quite general, it was first noted in connection with the semantics of definite descriptions (the present king of France, the essay Susan wrote last night). Going down a well-trodden path, I will also begin discussing it in this context (section 1.2). I will subsequently offer some concrete suggestions as to how this discussion can be carried to the clausal level (section 1.3).

1.2. (Definite) descriptions, presupposition and negation

When definite descriptions fail to pick out anything, what happens to the sentences they appear in? Are sentences like (3), (4) or (5) actually false if the speaker did not bike to school, if France is a republic or if Susan failed to write an essay last night?

(3) The bicycle I came with to school has a flat tire.
(4) The present king of France is bald.
(5) Susan brought the essay she wrote last night.
Or do these sentences involve a failure of presupposition, where this failure results in their not expressing any assertion at all or in their not having a truth value at all? Different philosophers, and, following them, different linguists have judged the matter differently.

For Frege (1892), and in a somewhat different form Strawson (1950), definite descriptions are not quantificational but referring expressions and can thus serve directly as arguments of predicates of individuals, e.g., bald:

(6) Bald(\text{the-present-king-of-France})

Importantly, on this view definite descriptions are said to presuppose the existence of a referent in the following sense: if they fail to refer, (an utterance of) a sentence containing them will neither be evaluated as true nor as false. Given that meaning is derived compositionally, this holds not only of (4) and (5) but also of their negated versions. Thus (7) comes out as lacking a truth-value if France is a republic:

(7) The present king of France isn’t bald.

On a Fregean view then, a sentence and its negation both entail their presuppositions; both (4) and (7) presuppose and entail that France has one and exactly one king. When the presupposition does not hold, semantic composition comes to a halt and neither the sentence nor its negation is assigned a truth value. Since a sentence and its negation only stand in the true-false relation to each other to the extent that their presuppositions are satisfied, sentential negation on this view creates a merely contrary opposition.

Not so for those who analyze definite descriptions not as referring expressions but rather as quantifiers with existential import (e.g., Russell 1905; Neale 1990). When the definite descriptions in (4) and (5) fail to describe anything, the sentences containing them come out as false rather than as lacking a truth value. Furthermore, if definite descriptions are quantifiers, it should be possible for them to scopally interact with other scope bearing expressions, including negation; on a quantificational, non-presuppositional view of definite description, (7), for instance, can be analyzed as ambiguous between (8) and (9):

(8) [The x: Present-king-of-France(x)] \neg Bald(x)
(9) \neg [The x: Present-king-of-France(x)] Bald(x)

When (4) is true, its negated version (7) is false both on the wide scope interpretation in (8) and on the narrow scope interpretation in (9). When (4) is false because there is no king of France, (7) is false on the reading in (8), which entails the existence of such a king, but actually true on the reading in (9). Finally, when (4) is false because the French monarch is blessed with beautiful locks, (7) is true under (8) as well as (9). As these examples illustrate, on a Russelian view, ‘failure of reference’ of a definite description does not result in a lack of truth value. Since any
third option besides from 'true' and 'false' is excluded in such instances, the
opposition created by negation is one of contradiction.

As is well-known, neither the Fregean nor the Russelian view on definite
descriptions is without problems. On a Fregean take it is not easy to explain why a
sentence like (7) can actually be true when France has no king—a reading that
obtains, for instance, when the sentence is continued by ...because there is no present
king of France. While a Russelian analysis can attribute this to the wide scope of the
negation (cf. (9)), a Fregean approach would require positing a special negation
which applies to presupposition ('external' negation). Doing so, however, seems
unappealing, both in light of Ockham's razor and because languages do not seem to
morphologically distinguish between internal and external negation (Horn 1989).

Another issue the Fregean view has to contend with is the fact that when the
presuppositions of a sentence fail, semantic composition does not seem to come to
halt altogether. After all, speakers do seem able to assign truth conditions to such
sentences; they can clearly say for instance what the world would have to be like for
(4) to be true. As a possible way out, instead of positing a halt of semantic
composition and the attendant truth value gap, one can give up a two-valued logic
and posit a third truth value, along with 'true' and 'false', namely 'valueless' (van
Fraasen 1968; Boër & Lycan 1976). Given the premium we put on keeping the logic
simple and two-valued, that is, as only recognizing the values 'true' and 'false', this,
however, may appear unappealing.

In contrast with the Fregean account, the Russelian one manages to maintain
a two-valued logic, an analysis of not along the lines of ¬, and is also able to capture
that The present king of France isn’t bald can be true when the definite description
fails to describe anyone, cf. (9). The problem of the Russelian account lies
elsewhere: it is not complete. Unless we supplement it, it offers no account of a
central fact the Fregean approach easily captures, namely the fact that normally (4)
is taken to be false when the French monarch has hair, not when France is no longer
a monarchy. Similarly, normally (5) is understood to be false in a context where
Susan forgot to bring the essay she wrote the previous night, not when she did not
write an essay that night to begin with.

1.3. Negation and backgrounded quantifier restrictions

Fortunately, the problem just noted for a Russelian analysis can be addressed, and
the idea that negation gives rise to a contradictory opposition maintained, if instead
of distinguishing between two truth values for not being true (false and valueless)
one distinguishes pragmatically between two reasons why a sentence is false. This
has been effectively advocated in Atlas (1993) and Horn (2006) (cf. his notion of
'assertorici inertial'). On this view, a sentence can be false in what we may call a
forthright way, namely when the part of it that counts as the foregrounded part
('assertion') is incorrect. Or it can be false in a less direct, pragmatically more
manipulative way. This happens when the information which is backgrounded is not
correct. (4), for instance, is false in a forthright way when the king of France is not
bald, and false in an indirect way when there is no longer a king of France. But on
either scenario it is false. Analogously, (5) is false in a direct way when Susan left the essay at home, and false in an indirect way when she did not write it to begin with.

The pragmatic effect of backgrounding seems to be that when we interpret a sentence with the backgrounded material B and foregrounded material F, B seems to tell us what the sentence is about. When we evaluate under what conditions we would judge the sentence true, our attention seems initially to be drawn to the foregrounded material and only at a second glance, so to speak, do we take into account the truth-conditional contributions of the backgrounded material. The preferred ways of evaluating (4) and (5) now follow if the restrictions of the definite descriptions, denoted by present king of France and essay she wrote last night, respectively, are systematically backgrounded.

The idea that the restrictions of quantifiers are pragmatically backgrounded finds support in the observation that quantificational restrictions ‘set the scene’. Even the restrictions of quantifiers whose restriction and scope are semantically interchangeable, namely symmetrical determiners like some, are felt to have a special, scene-setting status, which we can attribute to their being backgrounded (Herburger 2000). (10), for example, is (modulo focus) felt to be about the children and not about those who like spinach, even though switching the restriction and scope as in (11a) vs. (11b) would have no semantic (i.e., truthconditional) consequences.

(10) Some children like spinach.

(11) a. [Some x: Child (x)] Like-spinach (x)

       b. [Some x: Like-spinach (x)] Child (x)

Assuming then that restrictions of quantifiers are backgrounded in the way just described, on a view where not gives rise to a contradictory opposition, we can explain why (3) is normally taken to be false in a context where the king is bald: denoting a restriction to a quantifier, ‘present king of France’ is backgrounded. Given the pragmatics of backgrounded information, however, the preferred conditions where the sentence is false are those that make it false in a direct rather than indirect manner, that is, in a way where the falsity does not lie in the backgrounded material.

Our reward for this detour through the pragmatics of backgrounding is a semantics where sentential negation, at least in as far as sentences with definite descriptions are concerned, creates a contradictory rather than just contrary opposition and which, at same time, is able to do justice to pragmatically preferred ways of interpreting these kinds of sentences.

It is perhaps worth noting at this point that saying that the restrictions of quantifiers are backgrounded is similar but not equivalent to saying that they are presupposed. Apart from the general issues regarding the notion of presupposition discussed above, one difference lies in the fact that on a presuppositional view a restricted quantifier of the form [Q x: F(x)], where F(x) represents the restriction, presupposes that there are some things that are F. A backgrounding approach makes no such existential commitment.
One argument for the presuppositional view seems to come from the interpretation of *every*. Though the universal quantifier in predicate calculus lacks existential import, in many instances *every* seems strange when nothing satisfies its restriction. It seems bizarre, for instance, for a salesman to say (12) when there are no bicycles in the store:

(12) Every bicycle in the store is on sale.

On a presuppositional view this would be attributed to a failure of the presumed presupposition that there are bicycles in the store. As a result (12) should neither be true nor false (cf. Heim & Kratzer 1998). But, arguably, it is not the case that the question whether (12) is true or false does not even arise—-for (12) seems false. This, however, suggest that *every* has existential import (cf. Moravcsik 1991). This Aristotelian view of *every* is compatible with the truth of (13a) and the falsity of (13b), which are due to Heim & Kratzer (1998). It is compatible if we assume that the sentences are embedded under a mythology operator or that the sentence quantify over possible (mythological) individuals (Herburger 2000):

(13)  
   a. Every unicorn has exactly one horn.  
   b. Every unicorn has exactly two horns.

1.4 A quantificational analysis of negated sentences

The discussion on the relation between backgrounded information and negation has concentrated on definite descriptions, mainly because I was retracing history for expository reasons. An analogous argument can be made at the sentential level, I believe, if one considers how intonational focus affects the interpretation of a sentence (Herburger 2000). The basic idea has two parts. First, even sentences without overt adverbs of quantification involve quantification in their semantic interpretation. Second, the non-focused part of the sentence functions as a quantificational restrictor (cf. Rooth 1985 e.g.) and is pragmatically backgrounded. Negation then interacts with the quantifier restricted by the non-focused part much like it does with definite descriptions on the kind of analysis described above; it can take scope over the entire sentence or below the quantifier. Only if negation takes scope below the restricted quantifier does the sentence entail what is said in the backgrounded, non-focused part.

A classic way of saying that even sentences without overt adverbial quantifiers are instances of quantification is to say that sentences are descriptions of events (Davidson 1967; Parsons 1990; Schein 1993 a.o.). Assuming this, we can say that focus structures this quantification: in a simple sentence the non-focused part of a sentence comes to restrict the event quantifier whereas the focus only contributes to the scope of the quantifier. On this view, a sentence like (14) is interpreted as meaning that some contextually relevant visit to the movie theater by Helen was one where Alex was the companion. (14) thus has the logical form in (15):
Helen went to the movies WITH ALEX.

[Some e: C(e) & Went(e) & To(e, the movies)] WITH(e, ALEX)

The informational asymmetry between the non-focused and the focused part follows from the backgrounder of the non-focused material, which ends up restricting the event quantifier. The focused material contributes only to the scope and is, as a result, in the fore-rather than background. When negation enters the picture, we find that on the most salient reading the negation takes scope over the focus, i.e., the scope of the event quantifier (cf. (8) above):

Helen didn’t go to the movie WITH ALEX.

[Some e: C(e) & Went(e) & To(e, the movies)] ¬ WITH(e, ALEX)

The logical forms in (16) and (17) capture that (14) and (15) are both about Helen’s going to the movies. They also capture that (14) and (16) on its preferred interpretation both entail that such an event took place.

Just as we saw in connection with definite descriptions above, we can also observe that the sentence also has less salient reading, where the negation takes wide scope over everything, but where focus still structures the quantification of events. On this interpretation, the sentence is still about Helen going to see a film, but it does not entail that such an event took place:

Helen didn’t go to the movies WITH ALEX (because she didn’t go to the movies WITH ANYONE. She stayed at home and...).

[Some e: C(e) & Went(e) & To(e, the movies)] WITH(e, ALEX)

This reading is exactly parallel to the second reading of The present king of France isn’t bald discussed above, the reading that proved difficult to explain on the Fregean approach, but finds a natural explanation on a supplemented Russellian approach.

Regarding aboutness, it has been analyzed in detail in Portner & Yabushita (1998). On the view argued for here, every quantificational restriction encodes what the sentence is about at the point where the quantifier is interpreted. This holds not only of noun phrase quantifiers, but also of others, including in particular event or adverbial quantifiers, which themselves can include quantifiers either in the restriction or the scope. This results in various, at times nested instances of aboutness. Possibly, the various layers of aboutness are gathered together in a system similar to Potts’ (2005) computation of conventional implicature. (See also article 94 (Potts) Conventional implicature.) I will leave this for consideration elsewhere.

Recapitulating, if we adopt the view that definite descriptions and sentences are quantificational expressions—for instance, a Russellian account for definite descriptions and a Davidsonian account for sentences—and if we further adopt the notion of semantically normal but pragmatically backgrounded information, we can...
say that sentential negation creates a contradictory rather than just a contrary opposition. This is a welcome result because it allows us to remain logically austere. Of course, there is more one could and probably should say about the relation between negation and presupposition. I have said nothing, for instance, about the behavior of presuppositions like those triggered by again. My reticence is not only due to limitations of space but also has to do with the real possibility that ‘presupposition’ is but a mere catch-all for a series of similar but ultimately separate phenomena, which require separate analyses, see Boër & Lycan (1976). For details on the study of presupposition see article 91 (Beaver & Geurts) Presupposition.

2. Negation and logical entailments: Scalar implicature

Having argued that if a sentence is not true it is false, I now want to turn to a basic semantic fact about negation, one which turns out to have interesting linguistic consequences: negation reverses the direction of logical entailment. If a sentence p asymmetrically entails another sentence q, then the negation of q, \( \neg q \), asymmetrically entails the negation of p, \( \neg p \). For example, if (20) is true, so is (21):

(20) Mariana called both Monica and Michelle.
(21) Mariana called Michelle.

In the scope of negation, however, the conjunctive statement ceases to be the stronger one and becomes the weaker one instead, as the one-way entailment from (22) to (23) shows:

(22) Mariana didn’t call Michelle.
(23) Mariana didn’t call both Monica and Michelle.

Negation is not alone in reversing the direction of entailment, other elements do too, namely all those that create downward entailing contexts (e.g., Fauconnier 1975; Ladusaw 1980). Though (24) entails (25), when we replace some with every, which creates a downward entailing in its restriction, the direction of entailment reverses and we get an inference from the superset case (girl in the school) ‘downward’ to the subset case (girl in second grade).

(24) Some girls in second grade wanted to be Hermione.
(25) Some girls in the school wanted to be Hermione.

If we do the same in the scope of the quantifier rather than the restriction, we find that both the determiners some and every behave alike in that both license an upward inference from a subset case to a superset case, as shown by the entailment from (26) to (27):

(26) Every/some girl in second grade owns a blond and blue-eyed Barbie doll.
(27) Every/some girl in second grade owns a Barbie doll.
Direction of entailment matters in a number of linguistically relevant ways (see article 87 (Chierchia, Fox & Spector) *Grammatical view of scalar implicatures*). It matters, for instance, in the derivation of scalar implicatures.

A speaker is not lying, in the proper sense of lying, when she utters (28) in a context where she is fully aware that Gabriel can in fact recite the name of every single player on the team.

(28) Gabriel knows the names of some of the players on the Wizards team.

But in saying what she said, the speaker can be accused of having been misleading, of not having played by the rules of the discourse game, one of which demands that she speak the whole truth (cf. Grice’s 1975 Maxim of Quantity). As this example illustrates, when a speaker utters p, where p is entailed by q, the speaker often does so with the intention of conveying to the hearer that she has no grounds for believing that the stronger statement q holds. This invites the inference that the speaker knows that ¬q is true. This inference is available to the extent that one is willing to assume that ‘it is not certain that q’ is equivalent to ‘it is certain that not q’, a move which seems relatively benign (in fact an instance of a relevance based implicature, cf. Horn 1989), but which, strictly speaking, discards the possibility that the speaker remains agnostic as to whether q is true. This additional inference is dubbed the ‘epistemic’ step in Sauerland (2004). It will become relevant in an interesting way later.

Let us next consider more closely one of the defining characteristics of scalar implicatures, namely the way in which they are defeasible (Horn 1972):

(29) Gabriel knows the names of some of the players on the team—in fact, he knows the name of all of them.

That scalar implicatures should be so easily suspended is not surprising if they are not part of the literal meaning of the sentence and are not entailed by it either, but are merely part of what the sentence is taken to mean over and above what it literally states, given a particular discourse context and an implicit set of rules of cooperative behavior.

Another property that is typical of scalar implicatures (but perhaps not indispensable, see below) is that they are generated relative to lexically encoded stronger alternatives for the scalar terms. Examples of such ‘Horn scales’ are given in (30) (Horn 1972, 1989):

(30) a. boiling>hot>very warm>warm
    b. beautiful>pretty>attractive
    c. must>should>may
    d. terrible>bad>mediocre
    e. and>or
    f. every>most>many>some
In non-negative contexts, a statement with a scalar term always entails an alternative statement where, keeping everything else the same, the scalar term is replaced by one to its right. In negative contexts it is the other way around. (Note that hot>very warm>warm>lukewarm>cold>freezing does not qualify as a scale. Note also that the fact that some seems to be a member of the same scale as every provides another argument for saying that every has existential import, as was argued above.)

Since negation and other elements that create negative contexts reverse the direction of entailment, we actually expect that if a scalar expression is embedded in a negative context, this embedding will affect the implicatures the scalar expression generates. After all, scalar implicatures are generated by negating stronger alternative sentences which logically entail the original sentence and what counts as the stronger alternative depends on whether we are dealing with a negative context or not. As we saw, if p entails q, then, if someone utters q, we take her to implicate (but not assert) that she is committed to the truth of \( \neg p \) (see above). As we also saw, if p entails q, then \( \neg q \) entails \( \neg p \). Therefore, by neo-Gricean reasoning, if someone utters \( \neg p \), she is to be taken to implicate a commitment to the negation of the stronger statement, namely \( \neg \neg q \), which is equivalent to q. The prediction this reasoning makes when combined with the entailment reversing property of negation seems correct. Much in the same way that (28) above (Gabriel knows the name of some of the players) implicates that he does not know the names of all of the players, we can now observe that (31) implicates that it is not the case that he does not know the name of some of the players, which is the same as saying as that he knows the names of some of them. (Throughout I am abstracting away from uses of negations as in He is not smart, he is brilliant. These examples, already discussed in Jespersen 1917, are held to involve a special, meta-linguistic use of negation Horn 1989).

(31)   Gabriel does not know the name of all of the players.

In an analogous fashion, a Gricean analysis when applied to negative contexts also explains why or is felt to be exclusive in some contexts but not in others, thus supporting the ‘inclusive’ treatment of or analogous to the sentential operator from propositional logic. A conjunctive sentence like (32) unilaterally entails its disjunctive version in (33):

(32)   Janet consulted with Paul and Vera.
(33)   Janet consulted with Paul or Vera.

Uttering the latter therefore implicates the negation of the former: when someone says (32) we can take him to implicate that it is not the case that Janet consulted with both Paul and Vera. The exclusive reading of or thus reduces to a scalar implicature, and or itself retains its inclusive propositional calculus meaning, where the disjunction is true if at least one of its disjuncts is.

Negative contexts again invert everything. The disjunctive statement (34) is now the stronger of the two, entailing the conjunctive statement in (35):

(34)   Janet consulted with Paul or Vera.
(35)   Janet consulted with both Paul and Vera.

Uttering the latter therefore implicates the negation of the former: when someone says (34) we can take him to implicate that it is not the case that Janet consulted with both Paul and Vera. The exclusive reading of or thus reduces to a scalar implicature, and or itself retains its inclusive propositional calculus meaning, where the disjunction is true if at least one of its disjuncts is.

Negative contexts again invert everything. The disjunctive statement (34) is now the stronger of the two, entailing the conjunctive statement in (35):
Janet didn’t consult with Paul or Vera.

Janet didn’t consult with Paul and Vera.

Since there is no stronger statement for (32) that could be generated using a Horn scale, no scalar implicature is derived and or is merely interpreted in terms of its literal meaning in the same way as propositional operator, as an inclusive or ('at least one of the two').

Interestingly, the full force of the neo-Gricean prediction for negative or downward entailing contexts seems to have only been recognized rather recently (Levinson 2000; cf. also Horn 1989, 2005; Sauerland 2004; article 87 (Chierchia, Fox & Spector) Grammatical view of scalar implicatures). Moreover, not everyone seems to agree. Chierchia (2004) cites scalar implicatures in negative contexts as of several reasons to give up the neo-Gricean view of how semantics and pragmatics interact. Contrary to the popular view, he argues that the pragmatics gets to see parts of the sentence not only once the syntactic and semantic derivations are complete, but as soon as these parts are derived. One of the arguments he gives for the local derivation of scalar implicatures derives from sentences that contain a scalar term in the scope of disjunction (Chierchia 2004: 46):

(36) Mary is either working on her paper or seeing some of her students.

The problem with (36) is this: if one considers the scalar implicatures generated by some relative to the entire sentence, one predicts that (36) implicates that it is not the case that [either Mary is working on her paper or she is seeing all of her students]. This, however, entails that Mary is not working on her paper, which is certainly not an implicature the sentence has. Chierchia takes (36) to indicate that one should derive the implicatures of a scalar term (in this case some) as soon as the scalar term enters the picture and not at the end of the sentence. The resulting locally generated implicature is then projected and the semantic interpretation continues until the next scalar term, in this case or, is interpreted, when a second implicature is generated, namely that either Mary worked on her paper or that she saw some (but not all) of her students, but that she did not do both.

Returning to negative contexts now, Chierchia (2004) argues that negative contexts block the projection of regular scalar implicatures (e.g., 'some but not all') and, moreover, that they lead to the ‘recalibration’ of scalar implicatures. As a result of this locally stated recalibration, (31) (Gabriel doesn’t know the names of all of the players) is predicted to implicate that he knows the names as some. As we saw, however, this result is also available on a neo-Gricean account. The question is then whether disjunctive examples like (36) can also be explained on the classical conception of how semantics and pragmatics interact.

The challenge is taken up in Sauerland (2004), who proposes to calculate the implicatures of sentences containing various scalar terms with the help of a two-tier system containing provisional ('primary') implicatures, some of which are then allowed to turn strengthened into definitive ('secondary') implicatures. An important ingredient of Sauerland’s analysis consists of the novel scalar alternatives (34) and (35)
that he posits for disjunction. Whereas, as we noted above, on a traditional neo-
Gricean view scalar alternatives are generated by replacing one scalar expression
with the next lexicalized stronger one and keeping the rest of the sentence the same,
on Sauerland’s account a disjunction of the form ‘A or B’ is said to have as scalar
alternative not only ‘A and B’, as one might expect given an and>or Horn scale (see
above), but also the individual disjuncts ‘A’ and ‘B’. This idea is also used in article
87 (Chierchia, Fox & Spector) Grammatical view of scalar implicatures, and Fox
(2006) and the reader is invited to consult these papers for the relevant details,
which would take me too far afield here. My goal here is not to determine where
implicatures are generated, locally or globally. This is a big, hotly debated question.
My point is merely to reiterate what has been noted in the
literature at various
times (see above), namely that though there may perhaps be reason to abandon the
Gricean picture of how implicatures are generated, they are independent of
negation; negative environments are consistent with a Gricean conception of how
implicatures are generated.

3. Negation and logical entailment: NPIs

The entailment reversing property of negative contexts is not only relevant for the
generation of scalar implicatures, it also seems to play a role in accounting for the
distribution of NPIs (see also article 64 (Giannakidou) Polarity items). As noted in
Fauconnier (1975), NPIs like any, ever, budge an inch etc. seem to occur in those
counts where the scales are inverted, or where the direction of entailment on a
particular scale is inverted (Ladusaw 1980). These contexts, Ladusaw (1980) shows,
are downward entailing, licensing inferences from a superset to a subset case, as
briefly discussed in connection with the determiners every, no and some above. I am
simplifying matters here. Not all NPIs are licensed in all downward entailing context
(Zwarts 1998; van der Wouden 1997). And not all contexts that license NPIs are
downward entailing in an obvious way. Not so obvious cases include licensing by
only, if; adversative predicates, barely, most, exactly n (where n is a small number)
(e.g., Linebarger 1987). I will set these cases aside assum- ing that careful analysis
has shown, or will show, that they involve (some sort of) down- ward entailment
after all, cf. e.g., von Fintel (1999) on most of them, Herburger (2000) on only,
Ludlow (2002) on most, Schein (2001) on if and Horn (2006) on barely. (See also
article 64 (Giannakidou) Polarity items.)

The generalization that NPIs are licensed in negative contexts raises a
number of questions, the most intriguing of which is perhaps the licensing question.
Why should this generalization hold? What is it about negation that explains why in
language after language we find lexical items that are restricted to negative contexts
and why do these tend to be semantically similar?

The fact that NPIs and scalar implicatures are sensitive to the entailment
reversing property of negative contexts makes one wonder if there is a connection
between the licensing of NPIs and the generation of scalar implicature. A direct link
would, however, be rather remarkable, for the failure to license an NPI seems to
lead not just to oddness, but to something stronger, arguably to *, suggesting that
NPI licensing is a grammatical phenomenon. In contrast, the generation of
implicatures is traditionally considered a purely pragmatic phenomenon (cf. however Chierchia 2004 and article 87 (Chierchia, Fox & Spector) Grammatical view of scalar implicatures); sentences with odd implicatures are pragmatically bizarre, but not just because of that ill-formed. In what follows I review a family of approaches that aim to bridge this gap between pragmatics and grammar in order to find a solution to the licensing puzzle. These proposals have in common that they all suggest that NPIs give rise to scalar implicatures that are only felicitous in negative or downward entailing contexts. The discussion in this section summarizes some of the conclusions reached in Herburger & Mauck (2007, 2009).

One analysis that directly aims to exploit the internal semantics of NPIs to explain their distribution is Lahiri’s (1998) account of Hindi NPIs. It departs from the observation that Hindi NPIs are made up of an instance of ‘even’ (bhii) and a low scalar element, which is focused and with which bhii associates. (Other languages that have similar ‘even’ NPIs are discussed in Lee & Horn 1994).

\[(37)\]
\[
\begin{align*}
\text{ek bhii ‘anyone, even one’} & \quad \text{ek ‘one’} \\
\text{koii bhii ‘anyone, any (count)’} & \quad \text{koii ‘someone’} \\
kuch bhii ‘anything, any (mass)’ & \quad kuch ‘something, a little’ \\
zaraa bhii ‘even a little’ & \quad zaraa ‘a little’ \\
kabhii bhii ‘anytime, ever’ & \quad kabhii ‘sometime’ \\
kahiiN bhii ‘anywhere’ & \quad kahiiN ‘somewhere’
\end{align*}
\]

Lahiri (1998) takes the presence of bhii to trigger two implicatures, analogous to the implicatures that Kartunnen & Peters (1979) posit for English even: the existential implicature (some alternative to the focused element makes the sentence true) and the scalar implicature: the element that bhii associates with constitutes the least likely among the relevant scalar alternatives to make the sentence true. This offers an elegant solution to the licensing puzzle.

If p entails q, then p is semantically stronger than q and p is less likely than q. Assuming that bhii has the ‘least likely’ meaning described above and that it necessarily takes wide scope over elements responsible for negative contexts, the combination of bhii and the focused low scalar elements (e.g., one, a bit) predicts that the relevant expressions are only felicitous in those contexts where a low scalar elements will result in the least likely, semantically strongest among the alternative statements. This happens to be the case in negative or downward entailing contexts; (38) will be stronger than (39) only when embedded in a negative context, as the entailment from (40) to (41) shows:

\[(38)\] One person arrived.
\[(39)\] Two persons arrived.
\[(40)\] It is not the case that one person arrived.
\[(41)\] It is not the case that two persons arrived.

An account in some ways similar to Lahiri’s is proposed in Krifka (1995). Krifka assumes that an NPI like anything has the semantics of a low scalar expression and posits that it triggers stronger alternatives involving specific things, e.g., book or
pencil (rather than higher scalar terms, e.g., one thing>two things>three things...). In addition, he postulates two operators 'Scal.Assert' and 'Emphatic.Assert'. The first one takes scope over sentences containing weak NPIs like *anything, ever. The second one takes scope over sentences with strong NPIs like stressed *any, and at all, which have a narrower distribution than weak NPIs. These operators in combination with the basic meaning of the NPIs and the particular alternatives they are assumed to trigger give rise to scalar implicatures that only make sense in negative environments. Thus, Scal.Assert generates the implicature that all statements involving a more specific alternative would lead to falsity. This results in a contradiction for (42): its truth conditions require that Mary saw some thing. Yet, the implicature generated by Scal.Assert and the more specific alternatives require that there be no specific thing that she saw.

(42)  *Mary saw anything.

It is to this contradiction that Krifka attributes the unacceptability of the NPI in non-negative contexts like the one at hand. (42) of course contrasts with (43):

(43)  Mary didn’t see anything.

(43) asserts that there is nothing that Mary saw and, via Scal.Assert and the more specific alternatives, implicates that there is no specific thing that Mary saw. No contradiction ensues, and the sentence is acceptable.

Simplifying somewhat, Emphatic.Assert, which takes scope over sentences with strong NPIs, generates the implicature that the sentence containing the NPI entails the alternative statements that would be generated by replacing the NPI with stronger, more specific alternatives. In relevant respects this part of the analysis works similarly to Lahiri’s: since NPIs like ANY and at all are assumed to have the semantics of low scalar elements, similar to existential quantifiers, they will only lead to the strongest statements when compared to more specific alternatives (and be thus compatible with Emphatic.Assert) when they appear in negative contexts.

A third analysis that tries to explain the licensing puzzle in terms of implicatures generated by NPIs is developed in Chierchia (2006). Chierchia holds that NPIs like anything denote low scalar elements and adopts the claim that they induce widening of the domain of quantification (cf. Kadmon & Landman 1993). Given his localist analysis of implicatures (see above), he posits that any bears an uninterpretable feature [+σ], which needs to be checked by an operator σ, whose purpose is to lock in the pragmatic implicatures at the point in the derivation at which the operator appears. Chierchia claims that NPIs like any create alternative domains that are smaller than the domain of any, and, moreover, he assumes that NPIs trigger the presence of a covert ‘even’ operator, Ec. This operator requires that the proposition the sentence expresses entail all alternative propositions derived with the help of the smaller alternative domains.

On this view, a sentence like *I saw anyone when interpreted relative to a domain consisting of {a, b, c} will have to entail I saw someone relative to all of the following smaller alternative domains {a, b}, {a, c}, and {b, c}. It clearly will not, for
the sentence could be true if the speaker saw c, in which case the alternatives involving the set \{a, b\} would be false. Of course, as soon as the sentence is embedded in a downward entailing context, the inferences from big context set to small context sets will go through. In other words, positing \(E_c\) and making certain suppositions about the domain of alternatives, Chierchia (2006) predicts that NPIs are restricted to negative environments.

On a general level, the three approaches just summarized have a great deal in common. They tie together two phenomena which we know are sensitive to negation, namely the licensing of NPIs and the generation of scalar implicatures. This offers an exciting prospect of progress on the licensing question. It also raises a number of questions, however, which may not all have a satisfactory answer. Perhaps the licensing puzzle is not entirely solved yet.

One general issue any analysis that purports to explain the licensing question in terms of scalar implicatures licensed by (components of) NPIs has to contend with is the fact that unlicensed NPIs do not seem to result so much in pragmatic infelicity as in ungrammaticality. Unlike the pragmatically bizarre but nonetheless grammatical sentence (44) *Mary saw anything, clearly feels like an ill-formed sentence, irrespective of its pragmatics.

(44) Even Dick Cheney wanted to invade Iraq.

A second worry is that several NPIs seem to have synonymous non-NPI counterparts, e.g., *some and *any both can be argued to denote an existential quantifier with equivalent domains of quantification. Though Kadmon & Landman (1993) argue that *any differs from *some in requiring a widened domain of quantification, this is probably only true from stressed *any (Krifka 1995; Lahiri 1998). Note, for instance, that the contrast between (45) and (46) seems rather similar to that between (47) and (48) and therefore most likely due to the presence of a determiner as opposed to a bare plural, rather than ‘domain widening’:

(45) I don’t have potatoes.
(46) I don’t have any potatoes.
(47) I have potatoes.
(48) I have some potatoes.

Similarly, *ever and *sometime seem synonymous, but *ever is an NPI and *sometime is not.

If there are NPIs with synonyms that are not restricted to downward entailing contexts, no complete answer to the licensing puzzle will be found just by looking at the semantics of NPIs themselves. But if the semantics of NPIs is not enough to derive their distribution and something must be stipulated in addition, on top of the operators and lexically triggered alternatives Krifka and Chierchia (but not Lahiri) already invoke, then we do not really have an analysis that derives the distribution of NPIs from their semantics after all. Rather we have an analysis that accounts for the licensing puzzle with certain additional suppositions. And how good any such analysis is depends on its empirical coverage, its internal elegance.
and on how plausible the additional suppositions are. Thirdly, the analyses surveyed here also face a descriptive limitation. As Israel (1996) points out, not all NPIs are low scalar expressions and not all NPIs are thus suitable for making the strongest claim in a negative context, a claim, that is, that entails all alternative claims using higher scalar alternatives, as the ‘even’ analyses demand. In fact, some NPIs denote elements that occupy relatively high rungs on a Horn scale, for instance the NPI \textit{much} in (49) or the NPI \textit{all that} in (50):

\begin{enumerate}
\item[(49)] He didn’t like it much.
\item[(50)] Jane may not be all that smart.
\end{enumerate}

It is not obvious how to explain the distribution of these ‘understating’ NPIs by invoking an ‘even’ of some form. In fact, it seems impossible because the ‘even’ accounts exploit a low scalar semantics which these elements seem to lack.

Finally, there is also a technical issue concerning the scope of \textit{bhii}, Scal.Assert, Emphatic.Assert and E$. The way the analyses just summarized work, it is essential that the relevant operators take scope over the element responsible for the downward entailing context, rather than under it. This seems to violate the lexical integrity of NPIs that contain an instance of ‘even’, which speakers do not seem to intuitively decompose semantically (Lahiri 1998). In addition, it also requires a very specific and high scope for the operator (Rullmann 1997; Herburger 2003), which effectively amounts to saying that it behaves as a PPI. This arguably just pushes the problem elsewhere.

If the skepticisms just voiced are justified, then we are still faced with the mysterious generalization that NPIs are licensed in negative contexts. But while it is not easy to make sense out of this pattern, it may not be impossible either. I think it may be useful to take into account what happens pragmatically when negation combines with a low scalar element.

It seems no accident that so many NPIs are low scalar elements. In fact, the analyses we just considered heavily rely on this (though too heavily, as we saw, as they ignore the existence of understating NPIs). If the low scalar property is a typical property of NPIs but not a defining one, how do we explain it? As essentially already noted in Jespersen (1917), more recently in Israel (1996) (and many others as well), low scalar expressions are pragmatically useful in negative contexts, making a negation more ‘emphatic’. Compare, for instance (51) with (52):

\begin{enumerate}
\item[(51)] I don’t know.
\item[(52)] I don’t have the faintest idea.
\end{enumerate}

While both sentences deny that the speaker knows anything, the latter rules it out more categorically by explicitly eliminating the possibility that the speaker knows a bit about the matter. In light of the pragmatic usefulness of low scalar elements in negative contexts, one can hypothesize that \textit{some} of them come to be so frequently used in negative contexts that they over the course of time come to be restricted to such contexts. Which low scalar expressions take this route is in the end an arbitrary matter. If so, it would no longer be surprising that two low scalar
expressions in one language or across languages may share their meaning but not their distribution, i.e., that one but not the other is restricted to negative contexts. It would furthermore explain why one and the same lexical item may function as an NPI at one point of its history but not at another (see Herburger & Mauck 2007 for examples).

In more modern terms, we can say that those low scale elements that are only possible in negative contexts have acquired a morphological, uninterpretative feature \([u \text{ neg}]\) (cf. Klima 1964; Chierchia 2004). This feature lacks semantic content (in distinction to Israel's 1996 \(i\)-value) and needs to be checked syntactically in order for the NPI to be licensed. (Contra Chierchia 2004, however, for the reasons spelled out above, I do not assume that it is checked by a silent operator \(\sigma\) that freezes scalar implicatures.)

What about understating NPIs, which, as we saw, occupy a high rung on a Horn scale rather than a low one? Understating expressions are also useful pragmatically (Israel 1996).

As we saw in the previous section, (53) can and is normally taken to be true when Gwen purchased some prints. But, if we suspend the scalar implicature, the sentence can also be considered true when she bought none:

(53) Gwen didn’t buy many prints at the antiques shop.

Though it is often useful to make very strong claims to ensure one is really being understood, at times it seems preferable to understate matters. It can save one from pronouncing negative and unpleasant things (cf. They weren’t very enthusiastic about your proposal.) Vagueness and understatement are also rhetorically interesting and the basis of some subtle jokes. We can now speculate that to the extent that relatively high scalar expressions come to be restricted to negative contexts, i.e., acquire the feature \([+\text{NPI}]\), the suspension of the scalar implicature is conventionalized and they acquire their purely understating interpretation. As a result, speakers of English know that I didn’t like it much really means that the speaker did not like it, not that she liked it a bit. We can further speculate that understating NPIs are relatively scarcer than low scalar ones because it may be generally pragmatically more important to be emphatic and clear than to be understating and potentially vague (cf. Israel 1996).

If NPIs are semantically predisposed scalar expressions that have acquired a feature that grammatically forces them to appear only in a negative context, we might also have the beginning of an explanation of why sentences with unlicensed NPIs are judged ungrammatical rather than pragmatically bizarre: the \([u \text{ neg}]\) is simply not checked in non-negative contexts. I say beginning of an explanation because a complete account of course requires explaining how exactly the NPI feature is checked in negative contexts. And this, it turns out, is more of a challenge than one might initially think.

To just briefly show some of the issues involved, some of the syntactic literature assumes that NPIs can be simply licensed by an ‘affective’ element that c-commands them (Klima 1964 and many others since). But, as Ladusaw (1980) shows, this cannot be right—-at least not on standard assumptions about the syntax.
As briefly noted above, determiners differ in their entailment properties. Some, for instance, is neither downward entailing in its restriction or its scope, but in fact upward entailing in both. Every, on the other hand, is downward entailing in its restriction but upward entailing in its scope, and no is downward entailing in both its restriction and scope. Some is easy to explain on a simple minded syntactic account: it is simply not +affective. Every can also be made sense out of: it is affective and, via c-command, licenses an NPI in the part that it c-commands, namely the restriction. But no poses a problem, for it licenses NPIs both in the restriction and the scope but only c-commands the former.

The upshot of this is that a simple minded syntactic account will not do. But hopefully a sophisticated one will.

One possible solution to consider is Ludlow’s (2002) proposal. While I cannot fully explain this analysis here—it is quite involved—I want to sketch some of its major features. Ludlow first argues for adopting a particular logic as the metalanguage (L*). L* has a semantics for quantifiers which makes it possible to tell from the logical form of a sentence if a variable is in a downward entailing context or not: it is only when it appears in the scope of an even number of negation. He then makes a number of minimalist assumptions regarding the syntax-semantics interface (positing a great many functional projections), which make it possible to not only tell semantically if we are dealing with a downward entailing context, but also syntactically, since it is reflected by the local c-command of a negation. While the result is very interesting if one wants to argue that NPIs are syntactically licensed, as I am doing here, one can easily sense that the analysis is intricate. Given the limited scope of the present paper, I leave at these rather general level of descriptions and refer the interested reader for details to Ludlow (2002), and also Herburger & Mauck (2007) for a summary.

My conclusion regarding the licensing puzzled posed by NPIs is then limited to this: though it is clearly important to investigate the semantics of NPIs in order to better understand why they are restricted to negative contexts, the attempts we canvassed that rely on the presence of an even-like component are attractive but also raise a number of non-trivial questions. I take this to suggest that it may be worth to also consider alternative explanations of the licensing puzzle. In this context, I considered the more traditional view that NPIs are expressions that are pragmatically useful in negative contexts, leading to very strong or rather understated claims. I argued that what distinguishes NPIs from synonymous expressions that are not restricted to negative contexts is a feature which needs to be checked syntactically. How this is done exactly is an important matter an account of which I leave for consideration elsewhere.

4. References


