# Licensing Strong NPIs

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## 1 Weak vs. Strong NPIs

The goal of this paper is to give a perspicuous description of the difference in licensing conditions between weak and strong NPIs in English.

(1) Weak NPIs: *any, ever*
(2) Strong NPIs: Additive *either*
Punctual *until*
*In weeks/months/years*

I will not be discussing minimizers, which are sometimes grouped with strong NPIs. See Heim (1984) and Lahiri (1998) among others for relevant discussion.

The basic fact to be explained is that strong NPIs are licensed in a subset of the environments in which weak NPIs are licensed. There are two apparent dimensions along which licensers of weak and strong NPIs differ:

**I. Negative Strength**: among downward entailing (DE) operators, some are more negative than others (Zwarts 1998, von der Wouden 1997). The less negative do not license strong NPIs.

(3) a. No one said anything.
b. No one has visited in years.
(4) a. Not everyone said anything.
b. *Not everyone has visited in years.
c. Less than 3 students said anything.
d. *Less then three students have visited in years.
(5) ⟦No one⟧ ⇒ ⟦Not every one⟧

**II. Positivity:** some licensers of weak NPIs have a positive component to their meanings (Atlas 1996, Horn 1996, a.o.). These "positive" licensers do not license strong NPIs.

(6) a. Only Bill said anything.
b. *Only Bill has visited in weeks.
(7) a. I'm sorry I said anything.
b. *I'm sorry I have visited in weeks.

(8) a. *Only Bill left* implies that Bill left.
b. *I'm sorry I left* implies that I left.

These distinctions are generally treated differently in the theory of NPI-licensing. In this paper, I will suggest that the two dimensions can be collapsed into one, which will simplify the statement of NPI-licensing principles.

### 1.1 Basic Proposal

Negative Strength can be reduced to Positivity: negative expressions that are not strongest on their scale introduce positive implicatures that interfere with licensing. For example:

(9) *Not every* implicates *Some*
*No* introduces no implicature
So, *not every* does not license strong NPIs

## 2 Previous Solutions to the Two Problems

### 2.1 Negative Strength: Zwarts (1998)

I assume as background the Fauconnier/Ladusaw Hypothesis (FLH):

(10) An NPI $\alpha$ is licensed only if it occurs in the scope of $\beta$, where $[\![\beta]\!]$ is DE
(11) Downward Entailing (DE)
A function f of type $\langle\sigma, \tau\rangle$ is downward entailing (DE) iff for all x, y of type $\sigma$ such that $x \Rightarrow y$: $f(y) \Rightarrow f(x)$.

Zwarts added to FLH a condition that must be satisfied by strong NPIs.

(12) A strong NPI $\alpha$ is licensed only if it occurs in the scope of $\beta$, where $[\![\beta]\!]$ is anti-additive
(13) Anti-Additive (AA)
A function f of type $\langle\sigma, \tau\rangle$ is anti-additive (AA) iff for all x, y of type $\sigma$: $f(x) \wedge f(y) \Leftrightarrow f(x \vee y)$

Notice that if a function is AA then it is DE; consequently the functions that license strong NPIs are a subset of licensers of weak NPIs. In fact, (14) holds.

(14) F is Anti-Additive iff F is DE and $F(A) \wedge F(B) \Rightarrow F(A \vee B)$
(15) ⟦no⟧, ⟦never⟧ are AA
(16) ⟦few⟧, ⟦less than n⟧, ⟦not every⟧ are not AA

A good split, all things considered, but there are problems. It is often observed that non-AA operators can license strong NPIs.

(17) a. Few Americans have ever been to Spain.
Few Canadians have either. (Nathan 1999)
b. He invited few people$_i$ until he knew she liked them$_i$.
(de Swart 1996)
c. He was one of the few dogs I'd met in years that I really liked.
(Hoeksema 1996)

Other problematic expressions: *seldom*, *hardly ever*/*any*, *little*.

Is there a simple patch to Zwarts's theory for these cases? A logical property intermediate between DE and AA? De Morgan's laws don't define any—but there's no reason to feel beholden to them! (See below.)

### 2.2 Positivity: von Fintel (1999), Horn (2002/2006)

The problem here is a bit different, in that first we need to figure out why "positive" expressions license NPIs at all since they do not appear to be DE.

(18) Only Bill ate a vegetable.
#Therefore, only Bill ate cauliflower.

An answer: the meanings of these licensers divide into two dimensions, one positive and one negative. The licensing condition is made sensitive to only one of the dimensions. I take von Fintel's Strawson Entailment and Horn's Assertoric Inertia to be two solutions of this kind (I will use von Fintel as my representative example).

(19) ⟦only⟧ (x) (P) is defined only if P(x) = True.
If defined, ⟦only⟧ (x) (P) = True iff $\neg\exists y \neq x$: P(y) = True
(20) Strawson Entailment ($\Rightarrow_S$)
a. For p, q of type t: $p \Rightarrow_S q$ iff p = False or q = True.
b. For f, g of type $\langle\sigma, \tau\rangle$: $f \Rightarrow_S g$ iff for all x of type $\sigma$ such that g(x) is defined: $f(x) \Rightarrow_S g(x)$.
(21) Strawson Downward Entailing (SDE)
A function f of type $\langle\sigma, \tau\rangle$ is Strawson-DE
iff for all x, y of type $\sigma$ such that $x \Rightarrow y$: $f(y) \Rightarrow_S f(x)$.

Given these definitions, ⟦ *only Bill* ⟧ comes out SDE.

(22) Only Bill ate a vegetable
Bill ate cauliflower
Therefore, only Bill ate cauliflower [VALID]

If we restate NPI-licensing conditions in terms of SDE we explain why *only Bill* licenses *any* and *ever*.

(23) An NPI $\alpha$ is licensed only if it occurs in the scope of $\beta$, where ⟦ $\beta$ ⟧ is SDE.

### 2.2.1 Implications for the Licensing of Strong NPIs

The question we will address now is whether we should state the licensing conditions of stong NPIs in terms of Strawson entailment, as well. As noted above, *only Bill* does not license strong NPIs.

(24) *Only Bill likes WAFFLES, either.
*Only Bill has visited in weeks.
*Only $\text{Bill}_1$ arrived until $\text{his}_1$ birthday.

What is the reason? Is ⟦ *only Bill* ⟧ not Strawson AA? Or is it that Strawson entailment is not relevant to the licensing of strong NPIs?

(25) Strawson Anti-Additive (SAA)
A function f of type $<\sigma, \tau>$ is Strawson-AA
iff f is SDE and for all x, y of type $\sigma$: $f(x) \wedge f(y) \Rightarrow_S f(x \vee y)$.

(26) Only Bill drinks and Only Bill smokes
Therefore, only Bill drinks or smokes (cf. Atlas 1996)

The SDEness of ⟦ *only Bill* ⟧ and the validity of (26) suggest that ⟦ *only Bill* ⟧ is Strawson AA (cf. Rullmann 2003). The same is true of other SDE operators investigated by von Fintel, such as *regret* and the antecedents of conditionals—which also do not license strong NPIs.

(27) I have never gone to Amsterdam. *If I go to BRUSSELS either, I will buy you some chocolates. (Rullmann 2003)

(28) I didn't go to Spain. *I regret that I went to Portugal, either. (Rullmann 2003)

So, we must conclude that the licensing conditions of strong NPIs are stated in terms of *standard* entailment. For another view, see Atlas (1996) and Giannakidou (2006).

### 2.3 Conclusion

We have seen two separate stories that individually account well for the two contrasts between weak and strong NPIs. But the account is unsatisfying, since we account for a two-way contrast—weak vs. strong—with two different settings of two independent parameters.

| | Entailment | |
|---|---|---|
| | Standard | Strawsonian |
| DE | ??? | weak NPIs |
| AA | strong NPIs | ??? |

Is it possible to account for the difference between strong and weak with only one parameter? Also recall that there is some independent dissatisfaction with Zwarts's characterization of the licensers of strong NPIs.

## 3 A New Analysis

My proposal is that both weak and strong NPIs are looking for Downward Entailing licensers, but that they are looking for them at different levels. Weak NPIs only require a licenser that is DE in its truth conditions. Strong NPIs requires a licenser that is DE when the grammatical, non-truth-conditional aspects of its meaning (presuppositions and scalar implicatures) are taken into account.

### 3.1 Two Sources of Inspiration

#### 3.1.1 Krifka (1995)

Krifka (1995) is also dissatisfied with Zwarts (1998) as a characterization of strong NPI licensers. Krifka introduces distinct semantics and pragmatics for weak and strong NPIs:

(29) **Semantics:** weak and strong NPIs introduce different sets of alternatives into the computation. The alternatives to strong NPIs exclude marginal cases.

**Pragmatics:** the alternatives associated with weak and strong NPIs are exploited by different Assertion operators (**ScalAssert** vs. **EmphAssert**).

However, as Krifka notes, even with such differences, a merely DE operator would be sufficient to license a strong NPI. So, Krifka proposes an additional condition on strong NPIs:

(30) Strong NPIs are emphatic in nature.
(31) "Emphatic assertions tend to be emphatic 'across the board' ".
(Krifka 1995:231)

In order for a statement containing a strong NPI to be emphatic across the board, its licenser must be extreme in value with respect to its alternatives.

Krifka points out that a nice consequence of this view is that what counts as an extreme value may vary from context to context, allowing near-extremes like *hardly any* to license strong NPIs:

(32) Hardly anyone had visited in weeks.

I will attempt to say why specifically non-extreme licensers do not license strong NPIs.

### 3.1.2 Chierchia (2004)

Chierchia (2004), building on Krifka (1995), suggests that scalar implicatures may interfere with the licensing of (weak) NPIs. In particular, he offers a general account of intervention effects in NPI licensing.

Chierchia generates for every constituent a plain meaning and a strong meaning. The strong meaning is the plain meaning augmented with its scalar implicatures. Chierchia then argues that it is strong meanings that are relevant to NPI licensing.

(33) *Bill didn't give everyone anything.
NOT Bill gave EVERYone ANYthing.
(34) Stronger Alternative to (33):
NOT Bill gave SOMEone ANYthing

(35) Implicature (negation of stronger alternative):
NOT NOT Bill gave SOMEone ANYthing
"Bill gave someone something"
(36) Strong Meaning:
(NOT Bill gave EVERYone ANYthing) AND
(Bill gave SOMEONE ANYthing)

Note that the strong meaning no longer supports inferences from sets to subsets. If for example, we replace *thing* in (36) with *book*, we do not obtain a sentence that follows from (36).

(37) Strong Meaning not DE since (36) does not entail, for example:
(NOT Bill gave EVERYone ANYbook) AND
(Bill gave SOMEONE ANYbook)

This is, in essence, Chierchia's explanation of why non-weak scalar items interfere with NPI licensing—they interfere with DEness.

Chierchia is careful to formulate his analysis in such a way that cancellation of the implicature that interferes with licensing does not ameliorate intervention effects.

### 3.2 A Conservative Formalization

In this section I formulate my own analysis of the weak/strong distinction. The guiding light for the analysis is the idea that non-truth-conditional meaning is taken into account in the licensing of strong NPIs but not weak NPIs. I treat presuppositions as domain conditions on functions in the semantics. So, to neutralize their effect on weak NPIs I use Strawson entailment. For strong NPIs, I use standard entailment on meanings enriched with implicatures. I represent strong meanings with a covert *only* (cf. Fox 2003)

(38) a. $[\![ \text{few} ]\!]^{ALT} = \{ [\![ \text{no} ]\!], [\![ \text{few} ]\!], [\![ \text{not many} ]\!], [\![ \text{not every} ]\!] \}$
b. $[\![ \text{less than 3} ]\!]^{ALT} = \{ \ldots [\![ \text{less than 2} ]\!], [\![ \text{less than 3} ]\!], \ldots [\![ \text{less than n} ]\!] \ldots \}$
(39) a. $[\![ \alpha ]\!]^{ALT} = [\![ \beta ]\!]^{ALT}([\![ \gamma ]\!])$
b. $[\![$ few students $]\!]^{ALT} = \{[\![$ no student $]\!], \ldots [\![$ not every student $]\!] \}$
(40) Cross-categorial *only* (see Rooth 1985)
(41) $[\![ \text{ONLY } Q ]\!](C) =$ (C is the set of alternatives to Q)
$\lambda w.\lambda P_{<e,t>}. [\![ Q ]\!]^{w}(P)=1 \ \& \ \forall Q' \in C[ Q'(w)(P)=1 \rightarrow \forall w', P' [ [\![ Q ]\!]^{w'}(P')=1 \rightarrow Q'(w')(P')=1 ] ]$

**Licensing Principles:**

(42) A weak NPI $\alpha$ is licensed only if it occurs in the scope of $\beta$, where $[\![ \beta ]\!]$ is SDE.

(43) A strong NPI $\alpha$ is licensed only if it occurs in the scope of $\beta$, where $[\![ \text{ONLY } \beta ]\!]([\![ \beta ]\!]^{ALT})$ is DE.

(44) $[\![$ ONLY no students$]\!]([\![$ no students$]\!]^{ALT}) = [\![$ no students $]\!]$

(45) $[\![$ ONLY not every student$]\!]([\![$ not every student$]\!]^{ALT}) =$
$[\![$ many students but not every student $]\!]$

An analysis that separates truth conditions and presuppositions into separate dimensions of meaning (Karttunen & Peters 1979, Horn 2002) would allow both licensing conditions to be stated in terms of standard entailment.

### 3.3 Implication for Intervention

Note that the licensing condition on weak NPIs does not make use of strong meanings. Consequently, we lose Chierchia's account of intervention.

Recall, though, that Chierchia (2004) needs to ignore certain implicatures in the licensing of weak NPIs. DE expressions like *not many* have implicatures of their own.

(46) Not many students left
Strong meaning: Not many students left and some students left.

To prevent these implicatures from interfering with licensing, Chierchia draws a distinction between *direct* and *indirect* implicatures.

Indirect implicatures are implicatures introduced by reversal at DE nodes. Chierchia claims that only these interfere with NPI licensing. We might attempt to incorporate this distinction into our story:

(47) Entailments, Indirect Implicatures vs.
Direct Implicatures, Presupposition

Another option: adopt a different, perhaps syntactic, view of intervention. Some have argued that intervention in NPI licensing should be seen as part of a broader phenomenon (e.g. Beck effects). See Guerzoni (to appear) for a

recent view of this kind. It's not clear how Chierchia's proposal could extend to other cases of intervention.

### 3.4 Extension to Other Cases & Potential Problems

#### 3.4.1 Quantifiers that Typically Induce Implicatures and Sometimes License Strong NPIs

Recall the observation that negative expressions such as *few*, *hardly any/ever* and *little* are also capable of licensing strong NPIs. These are not scalar endpoints.

To account for their behavior, I borrow another idea from Krifka/Chierchia: *scale truncation*. Under certain exceptional contextual conditions, an expression near an endpoint can count as an endpoint.

(48) NO <FEW, NOT MANY, NOT EVERY>

Chierchia 2004: "What enables us to truncate a scale at the low end […] is that small amounts may be functionally equivalent to nothing." Chierchia notes that sentence such as (49) need not carry implicatures.

(49) Typically, few students in my class take an interest in semantics.

This is a bit vague though; let me propose a precise restriction on when a negative operator can act like a strong scalar endpoint.

(50) **Condition on Truncation:** to be able to act as a strong scalar endpoint a scalar item must be close enough to the endpoint.

I propose that to be considered "close enough" a scalar item must be Intolerant (see Löbner 1985, Horn 1989).

(51) A function f of type <<e,t>,t> is Intolerant iff
if f is not trivial[1], then for all x of type <e,t>, f(x)=0 or f(¬x)=0.

On its proportional reading, *few* is plausibly Intolerant. *Fewer than 4* is not.

[1]A function f is trivial iff for all x, f(x)=1 or for all x, f(x)=0. I include this clause to bring out the inclusion relations in (54). See Appendix for proof that AA⊆DE+Intolerant.

(52) a. #Few of my friends are linguists and few of them aren't.
b. #He rarely goes to church and he rarely doesn't go. (Horn 1989)
(53) Fewer than 4 of my friends are linguists and fewer than 4 aren't.

Someone unconvinced by my story might still be interested in DE+Intolerant as an intermediate category of negation between DE and AA.

(54) AA $\subset$ DE+Intolerant $\subset$ DE

I find support for this condition in the inability of cardinal *few* to license strong NPIs.

(55) There were few potatoes in the pantry.
??There were few in the refrigerator, either.

### 3.4.2 Quantifiers that seem not to Induce Implicatures but do not License Strong NPIs: DE Comparative Quantifiers

Krifka (1999) and Fox and Hackl (2006) argue that *more than n* quantifiers do not give rise to scalar implicatures.

(56) More than 3 students left early.
Does not implicate: It's not true that 5 students left early.

Krifka also makes this claim for negative comparative quantifiers, such as *less than/at most n*. If this is true, this is a problem since these quantifiers are DE. I would predict they license strong NPIs, contrary to fact.

(57) Less than 3 students left early.
Claim: No implicature

(58) Less than 3 students wrote on phonology.
*Less than 3 wrote on SEMANTICS, either.

Fortunately, the claim that DE comparative quantifiers introduce no implicature is less plausible than it is in the UE case. Krifka (1999) acknowledges that sentences like (57) typically give rise to an existential inference, which he analyzes as a presupposition. He supports this with evidence from anaphora.

(59) ?Less than 3 students left early.

And they only left because they felt ill.

I am not convinced this is a presupposition. Consider the following tests.

(60) a. ?Hey wait a minute! I had no idea some students left early.
b. Mary wants less than 3 students to walk out on her talk.

I believe it is a weak implicature. But if Fox and Hackl are correct, (61) holds.

(61) ⟦ ONLY less than 3 students ⟧(P) = ⊥

I suggest that if strengthening operator ONLY produces inconsistency, a weaker one steps in to generate an existential implicature.

(62) ⟦ W-ONLY Q⟧(C) = (C is the set of alternatives to Q)
$\lambda w.\lambda P_{<e,t>}$. ⟦ Q⟧$^{w}$(P)=1 & ∃Q'∈ C[ Q'(w)(P)=0 ]

We also note that DE comparative quantifiers are not Intolerant, so may perhaps never qualify as strong to serve as a strong scalar endpoint, except possibly in one case.

### 3.4.3 Less than one/zero

A problem that haunts semantic accounts of strong NPI licensing:

(63) a. ⟦ no ⟧ = ⟦ fewer than one ⟧ = ⟦ zero ⟧
b. *Fewer than one student has visited in weeks/either.

My theory does no better than an AA theory here, since *fewer than one student* does not intuitively give rise to such an existential implicature.

Possible response: follow Fox and Hackl in assuming all measurement domains are dense. The system will produce an implicature like ".3 students left" but the implicature doesn't see the light of day once it confronts our world knowledge about counting students. Fine for *fewer than one*, but will not work for *zero*.

Suppose the grammar (and implicature-generating mechanism as a part of it) can't distinguish one numeral from another. The grammar knows degree domains are ordered and possibly dense but doesn't know the names of degrees. Functions like ⟦ zero students⟧ are intuitively DE (even AA), do not

give rise to positive implicatures, but do not license strong NPIs. The grammar sees *zero* as just another number, like *sixty-four*.

(64) Zero students left early
No/*Zero students like SEMANTICS, either.
(65) a. On no/*zero occasion(s) did he mention my help. (cf. Deprez 1999)
b. No/*Zero students but Bill came. (cf. Moltmann 1995)
c. She drank no/*zero martinis, not even weak ones. (cf. Postal 2004)
(66) ?Zero students said anything.

I argued for Intolerance as a line dividing DE quantifiers that could act as endpoints from those that could not. Explicit proportionals like (67) are a problem.

(67) *Less than 1/3 of the students have visited in weeks.

Perhaps, grammar is not good at working out explicit proportions. Fox (2000) argues for a similar conclusion, given the possibility of wide scope in (68a)—apparently violating economy conditions.

(68) a. Rob doesn't speak more than half of the 9 languages spoken in Sydney. (Fox 2000)
b. Rob doesn't speak 5 of the 9 languages spoken in Sydney.

Tentative conjecture: the grammar cannot ascribe different grammatical properties to expressions because they contain different numerals.

## 4 Conclusions

- Both weak and strong NPIs seek DE licensers. Weak NPIs look for them in the truth conditions. Strong NPIs are forced to take presuppositions and implicatures into account when assessing DEness.
- A non-scalar endpoint can sometimes act as a scalar endpoint in context if it is Intolerant and can, therefore, license strong NPIs.
- DE comparative quantifiers do give rise to scalar implicatures and thus cannot license strong NPIs.
- *Less than 1/3* and *zero* may not be counterexamples to the theory, if we are correct that grammars cannot ascribe properties such as Intolerance to a phrase based on the identity of a numeral.

**Appendix: Proof that AA ⊆ DE+Intolerant**

Assume f is AA.

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Suppose f is not trivial, i.e., $\exists x\, f(x)=1 \;\&\; \exists x\, f(x)=0$.

Now suppose for reductio that $f(a)=1 \;\&\; f(\neg a)=1$ for arbitrary a.

Notice that $a \vee \neg a = U$, that is, the top element in the domain.

Since f is AA it follows that $f(a \vee \neg a) = f(U) = 1$

But, being AA, f is DE so for all y, such that $y \Rightarrow U$, $f(y)=1$

But all y are such that $y \Rightarrow U$, so for all y, $f(y)=1$

(This contradicts our assumption that f is not trivial)

So, for all z, $f(z)=0$ or $f(\neg z)=0$.

Therefore, f is Intolerant.

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