From implicatures to NPI-licensing

1. Monotonicity again

- Recall: for a propositional function, we define its monotonicity pattern based on whether it reverses and preserves the direction of entailment in its propositional argument.

(1) For a one-place propositional operator π, its monotonicity is defined as follows:
  a. π **upward-entailing** (UE) iff for any two sentences p and q s.t. $p \Rightarrow q$: $\pi(p) \Rightarrow \pi(q)$;
  b. π **downward-entailing** (DE) iff for any two sentences p and q s.t. $p \Rightarrow q$: $\pi(p) \Leftarrow \pi(q)$;
  c. π is **non-monotonic** (NM) iff π is neither UE nor DE.

Example:

(2) Mary is a semanticist. $\Rightarrow$ Mary is a linguist.
  a. Possibly, Mary is a semanticist. $\Rightarrow$ Possibly, Mary is a linguist. (UE)
  b. Mary isn't a semanticist. $\Leftarrow$ Mary isn't a linguist. (DE)
  c. If Mary is a semanticist, we will hire her. $\Leftarrow$ If Mary is a linguist, we will hire her. (DE)

- To discuss the monotonicity pattern of a non-propositional function, we need the notion of **generalized entailment**, which is cross-categorically defined for items of any **entailing type**.

(3) **Entailing type**
  a. t is a basic entailing type.
  b. If τ is an entailing type, then for any type σ, $\langle\sigma, \tau\rangle$ is an entailing type.

(4) **Generalized entailment '$\Rightarrow$'** (Fintel 1999)
  a. If ϕ, ψ are of type t, $\phi \Rightarrow \psi$ iff ϕ is false or ψ is true.
  b. If β, γ are of an entailing type $\langle\sigma, \tau\rangle$, $\beta \Rightarrow \gamma$ iff for all α s.t. α is of type σ: $\beta(\alpha) \Rightarrow \gamma(\alpha)$.

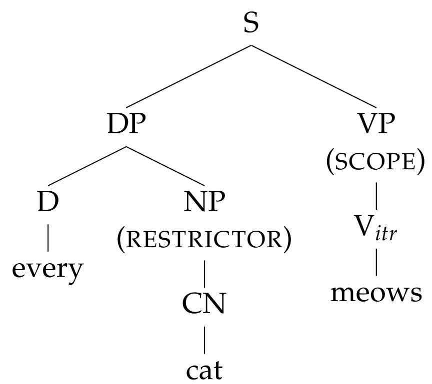
  – The basic case (4a) is defined based on truth values: a truth-value entails another iff it is not the case that the first is true and the second is false.
  – In (4b), a function entails another iff the result of applying the first function to any argument entails the result of applying the second function to the same argument.
    E.g. $[\![\textit{smart student}]\!] \Rightarrow [\![\textit{student}]\!]$, because for any x of type e, $[\![\textit{smart student}]\!](x) \Rightarrow [\![\textit{student}]\!](x)$.
  – All the aforementioned cases can also be understood from a set-theoretic perspective: for any two sets A and B, $A \Rightarrow B$ iff $A \subseteq B$.

- The (non-)monotonicity of a function (here '$\Rightarrow$' stands for generalized entailment.)

(5) For a function f of type $\langle\sigma, \tau\rangle$, its monotonicity is defined as follows:
  a. f is DE iff for all x and y of type σ s.t. $x \Rightarrow y$, $f(y) \Rightarrow f(x)$.
  b. f is UE iff for all x and y of type σ s.t. $x \Rightarrow y$, $f(y) \Leftarrow f(x)$.
  c. f is NM iff f is neither DE nor UE.

Example: A quantificational determiner has two arguments — a restrictor (the left argument) and a scope (the right argument).

(6)



Consider the monotonicity pattern in the restictor and the scope of a quantificational determiner:

(7) $[\![$smart student(s)$]\!] \Rightarrow [\![$student(s)$]\!]$

a. Some smart student(s) passed the exam. $\Rightarrow$ Some student(s) passed the exam. (UE)

b. Every smart student passed the exam. $\Leftarrow$ Every student passed the exam. (DE)

c. No smart student passed the exam. $\Leftarrow$ No student passed the exam. (DE)

(8) $[\![$invited Andy and Billy$]\!] \Rightarrow [\![$invited Andy$]\!]$

a. Some student invited both Andy and Billy. $\Rightarrow$ Some student invited Andy. (UE)

b. Every student invited both Andy and Billy. $\Rightarrow$ Every student invited Andy. (UE)

c. No student invited both Andy and Billy. $\Rightarrow$ No student invited Andy. (DE)

- The (non-)monotonicity of an environment (after Gajewski 2007)

(9) a. If α is of type δ and $\mathbf{A}$ is a constituent that contains α, then $\mathbf{A}$ is DE w.r.t. α iff the function $\lambda x.[\![\mathbf{A}[\alpha/\mathbf{v}_\delta]]\!]^{g[v_\delta \to x]}$ is DE, where $\mathbf{A}[\alpha/\mathbf{v}]$ is the result of replacing α with a trace $\mathbf{v}$ in $\mathbf{A}$. (E.g., "every A is B" is DE w.r.t. A since $\lambda x.[\![$every $A/v_{\langle e,t\rangle}$ is $B]\!]^{g[v\to x]}$ is DE.)

b. UE and NM environments are defined analogously.

Exercise: For each of the following determiners, determine the monotonicity pattern in its restrictor and in its scope: *few*, *at most three*, *less than three*, *at least three*, *no more than three*, *many*

2. Negative Polarity Items (NPIs)

- NPIs (e.g., *any*, *ever*) must appear in DE environments (Fauconnier 1975, 1979; Ladusaw 1979). Prototypical DE environments include:

(10) Under the semantic scope of negation or other negative adverbial
  a. John didn't read any papers.
  b. * John read any papers.
  c. I never/rarely/seldom read any books about syntax.
  d. * I sometimes/always/sometimes read any books about syntax.

(11) Within the scope of negative quantifiers
  a. Few/no/at most 3 students read any papers.
  b. * Many/most students read any papers.

(12) In the left argument of universal quantifiers
  a. Every student who has read any papers passed the exam.
  b. * Every student who has read some papers passed any exams.
  c. * Some student who has read any papers passed the exam.

(13) In the antecedent of conditionals
  a. If John knows any big names, he will be invited.
  b. * If John is invited, he will know any big names.

(14) *Without*
  a. John came without any pen or pencil.
  b. * John came with any pen or pencil.

- The following NPI-licensing environments don't seem to be DE at the first sight, but there can be a way to define them as DE:

(15) The restrictor of *only*
  a. Only JOHN met with anything
  b. * Only anyone met with John.

(16) Questions (polar questions and *wh*-questions)
  a. Did you buy any tomatoes?
  b. Who read any books?

(17) Adversative predicates (*doubt*, *be surprised*)
  a. I doubt that John invited any student.
  b. I am surprised that John said anything at the meeting.

(18) Comparatives
  a. John is taller/shorter than anybody.
  b. John is nastier than ever.

(19) *against* (cf. *for*)
  a. Susan voted against every approving any of the proposals.
  b. * Susan voted for every approving any of the proposals.

3. Chierchia (2006, 2013)

- The grammatical (G-)view (Fox 2007, Chierchia *et al*. 2012, among others) was first introduced to analyze scalar implicatures. (See the last handout.)

  Chierchia (2006, 2013) extends the G-view to NPI-licensing with assumptions compatible with the strict DE condition. The main assumptions are:

  – The determiner *any* is lexically equivalent to the existential quantifier *some* but has a grammatical feature [D].[1] This feature obligatorily activates a set of domain (D-)alternatives.

    (20) a. $[\![any_D]\!] = \lambda f \lambda A.\exists x \in D[A(x) \wedge f(x)]$
    b. $\text{D-ALT}(any_D) = \{\lambda f \lambda A.\exists x \in D'[A(x) \wedge f(x)] \mid D' \subseteq D\}$

  – In syntax, the [D] feature must be checked off by a c-commanding O_D-operator. In semantics, exercising an O_D-operator affirms the assertion of the prejacent and negates all the D-alternatives that are not entailed by the assertion of the prejacent.

    (21) $[\![O_D(\text{S})]\!]^w = 1$ iff $[\![\text{S}]\!](w) = 1 \wedge \forall \phi \in \text{D-ALT(S)}[[\![\text{S}]\!] \not\subseteq \phi \to \phi(w) = 0]$

- Consequences:

  – If the prejacent of O_D is UE w.r.t. *any*, the above exhaustification yields contradiction, causing ungrammaticality. For example:

    (22) * John read any papers.
    a. LF: O_D [$_\text{S}$ John read any$_D$ papers]
    b. $[\![\text{S}]\!] = \exists x \in D[\textsf{paper}(x) \wedge \textsf{read}(j, x)]$
    c. $\text{D-ALT(S)} = \{\exists x \in D'[\textsf{paper}(x) \wedge \textsf{read}(j, x)] \mid D' \subseteq D\}$
    d. $\forall D'[D' \subset D \to \neg\exists x \in D'[\textsf{paper}(x) \wedge \textsf{read}(j, x)]]$
    (for any D' such that $D' \subset D$, John read no paper in D'.)
    e. $[\![O_D(\text{S})]\!] = [\![\text{S}]\!] \wedge (22d) = \bot$
    (# John read a paper in D, but for any D' s.t. $D' \subset D$, he read no paper in D'.)

  A mini model:

    (23) a. $D = \{p_1, p_2\}$
    b. $[\![\text{S}]\!] = R(j, p_1) \vee R(j, p_2)$
    c. $\text{D-ALT(S)} = \{R(j, p_1) \vee R(j, p_2), R(j, p_1), R(j, p_2)\}$
    d. $[\![O_D(\text{S})]\!] = R(j, p_1) \vee R(j, p_2) \wedge \neg R(j, p_1) \wedge \neg R(j, p_2) = \bot$

  – The above contradiction can be avoided if the prejacent of O_D is DE w.r.t. *any*: the D-alternatives are all entailed by the assertion, and thus the O_D-operator doesn't affect semantics. Hence, *any* is licensed in DE contexts.

    (24) John didn't read any papers.
    a. LF: O_D [$_\text{S}$ not [John read any$_D$ papers]]
    b. $[\![\text{S}]\!] = \neg\exists x \in D[\textsf{paper}(x) \wedge \textsf{read}(j, x)]$
    c. $\text{D-ALT(S)} = \{\neg\exists x \in D'[\textsf{paper}(x) \wedge \textsf{read}(j, x)] \mid D' \subseteq D\}$
    d. $[\![O_D(\text{S})]\!] = [\![\text{S}]\!] = \neg\exists x \in D[\textsf{paper}(x) \wedge \textsf{read}(j, x)]$

  Discussion: How does Chierchia's analysis explain the licensing of NPIs in the antecedent of a conditional? Write out the steps.

[1] Chierchia (2006, 2013) also assumes that *some* and *any* have a [σ] feature which activates scalar alternatives. This assumption not relevant to NPI-licensing, but plays a role in the computation of scalar implicatures and free choice inferences.

4. *Only*: An NPI-licenser and NPI-unlicenser

4.1. The NPI-licensing effect of *only*

- NPIs can be licensed in the right argument of DP-*only* or the unfocused part under VP-*only*, although these environments are not DE.

(25) Right argument of DP-*only*

a. Only JOHN_F read any papers.

b. * JOHN_F read any papers.

Only JOHN_F ate *vegetables* for breakfast.
$\not\Rightarrow$ Only JOHN_F ate *kale* for breakfast.

(26) Unfocused part under VP-*only*

a. Mary only gave any books to JOHN_F.

b. * Mary gave any books to JOHN_F.

Mary only gave *fruit* to JOHN_F.
$\not\Rightarrow$ Mary only gave *apples* to JOHN_F.

- **The Strawson DE analysis of NPI-licensing** (von Fintel 1999):
A (weak) NPI is only grammatical if it appears in the argument of a Strawson DE function. The Strawson DE condition grants the presuppositions of the consequent sentence when the validity of a downward inference is assessed.

(27) A function f of type $\langle \sigma, \tau \rangle$ is **Strawson DE** iff
for all x and y of type σ s.t. $x \Rightarrow y$ $\underline{\text{and } f(x) \text{ is defined}}$: $f(y) \Rightarrow f(x)$.

"*Only*+NP" is a Strawson DE function: *only* presupposes the truth of its propositional prejacent (Horn 1969); the scope of "*only*+NP" is DE when the prejacent presupposition of *only* is satisfied:

(28) $[\![only_C]\!] = \lambda p \lambda w : p(w) = 1. \forall q \in C[p \not\subseteq q \rightarrow q(w) = 0]$ (After Horn 1969, Rooth 1985)

(29) Kale is a vegetable. $x \Rightarrow y$
John ate kale for breakfast. $f(x)$ is defined
Only JOHN_F ate vegetables for breakfast. $f(y)$
$\therefore$ Only JOHN_F ate kale for breakfast $\therefore f(x)$

- **The G-view of NPI-licensing** (Chierchia 2006, 2013; inspired by Krifka 1995 and Lahiri 1998)

Chierchia extends the G-view of NPI-licensing to the licenser *only*: the unfocused part of the asserted exhaustivity inference is DE and hence forms an NPI-licensing environment.

(30) Only JOHN_F read any papers.

a. O_D [$_S$ only [JOHN_F read any_D papers]]

b. Presupposition of S: $\lambda w. \exists x \in D[\textsf{paper}_w(x) \wedge \textsf{read}_w(j, x)]$
(John read some papers in the total domain D.)

c. Assertion of S: $\lambda w. \forall y \in D_e\ [\exists x \in D[\textsf{paper}_w(x) \wedge \textsf{read}_w(y, x)] \rightarrow y \leq j]$
(For any individual y, if y read some papers in the total domain D, then y is John.)

d. $\text{D-ALT(S)} = \{ [\![\text{only [JOHN}_F \text{ read any}_{D'} \text{ papers]}]\!] : D' \subseteq D \}$
$= \{ \lambda w. \forall y \in D_e[\exists x \in D'[\textsf{paper}_w(x) \wedge \textsf{read}_w(y, x)] \rightarrow y \leq j] \mid D' \subseteq D \}$

The prejacent presupposition (30b) is irrelevant for assessing the [D] feature of the weak NPI *any* (Gajewski 2011). The asserted component (30c) is DE w.r.t. the domain variable D. Therefore, *any* is licensed in (30), as it would be in any DE environments.

4.2. The NPI-unlicensing effect of *only* (Xiang 2017)

- Unsurprisingly, *only* cannot license an NPI that appears in its F-associate:

(31) a. Only [some/*any students]$_F$ saw John.
b. Mary only gave [some/*any books]$_F$ to John.

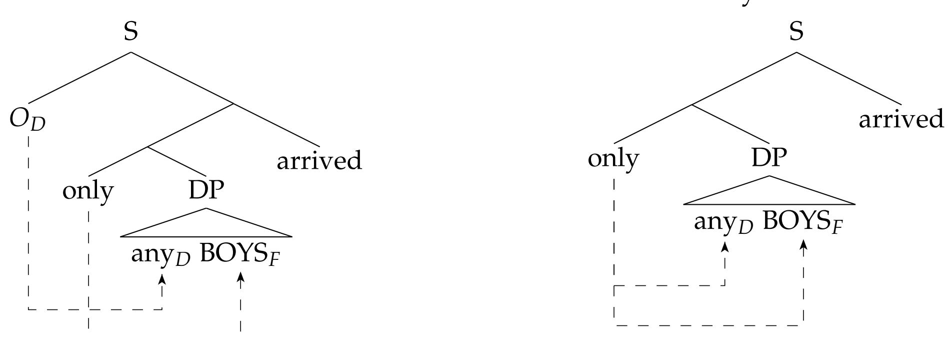
However, the part of an *only*-clause where an NPI can appear is not always equivalent to the part that is not F-associated with *only*. (Drubig 1994, Wagner 2006)

(32) a. Only [some/*any BOYS$_F$] arrived.
b. John only read [some/*any PAPERS$_F$], (he didn't read any books).

  - DP-*only* doesn't license an NPI that appears within its left argument, regardless of whether this NPI is part of its focus associate.
  - VP-*only* doesn't license an NPI if this NPI and the focused item appear within the same island.

- Xiang (2017): *Only* is not just an NPI-licenser but also an "NPI-unlicenser."
  - Recall Chierchia (2006): an NPI is not licensed if assessing its [D] feature yields a contradiction. Thus, an O_D-operator "unlicenses" an NPI if its argument is non-DE w.r.t. this NPI.
  - New assumption: *Only* also can check off [D] in syntax and triggers exhaustification over D-alternatives in semantics. Thus, by locality:

(33) *Only any BOYS$_F$ arrived.
a. Traditional G-view b. New analysis



  - If the prejacent clause of *only* is non-DE w.r.t. an NPI, using *only* to exhaustify the D-alternatives of the prejacent clause returns an inference that contradicts the prejacent presupposition, making the NPI unlicensed.

(34) **Semantics of DP-*only***
a. $[\![\text{only}(\alpha_\tau)(P_{\langle\tau,st\rangle})]\!] = \lambda w.\forall a \in [\![\alpha]\!]^{f,d}[[\![P]\!](a)(w) = 1 \rightarrow [\![P]\!]([\![\alpha]\!]^0) \subseteq [\![P]\!](a)]$
b. Presupposition: $[\![P]\!]([\![\alpha]\!]^0)$

Computation of (33b):

(35) a. $[\![\text{any}_D \text{ BOYS}_F]\!]^0 = \lambda f.\exists x \in D[B(x) \wedge f(x)]$
b. $[\![\text{any}_D \text{ BOYS}_F]\!]^f = \{\lambda f.\exists x \in D[g(x) \wedge f(x)] : g \in D_{\langle e,st\rangle}\}$
c. $[\![\text{any}_D \text{ BOYS}_F]\!]^d = \{\lambda f.\exists x \in D'[B(x) \wedge f(x)] : D' \subseteq D\}$

d. $[\![S]\!] = \lambda w.\forall \mathcal{P} \in [\![\text{any}_D \text{ BOYS}_F]\!]^{f,d}[\mathcal{P}([\![\text{left}]\!])(w) \rightarrow [\![\text{any}_D \text{ BOYS}_F]\!]^0([\![\text{left}]\!]) \subseteq \mathcal{P}([\![\text{left}]\!])]$
$\Downarrow$

e. $\lambda w.\forall \mathcal{P} \in [\![\text{any}_D \text{ BOYS}_F]\!]^{d}[\mathcal{P}([\![\text{left}]\!])(w) \rightarrow [\![\text{any}_D \text{ BOYS}_F]\!]^0([\![\text{left}]\!]) \subseteq \mathcal{P}([\![\text{left}]\!])]$
$= \forall D'[D' \subset D \rightarrow \neg\exists x \in D'[B(x) \wedge L(x)]]$
(For any proper subdomain D', no boy in D' left.)

f. Presupposition of S: $\exists x \in D[B(x) \wedge L(x)]$
(Some boys in the total domain D left.)

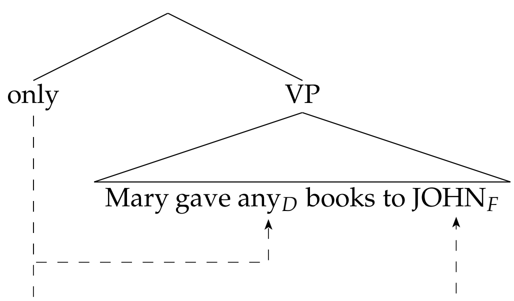
g. (35e) contradicts (35f). For example, let $D = \{a, b\}$, then:
$(35e) = \neg L(a) \wedge \neg L(b)$ (Neither *a* nor *b* left.)
$(35f) = L(a) \vee L(b)$ (*a* or *b* left.)

– In the case of VP-*only* association, the above contradiction can be avoided by F-movement, which is however island-sensitive.

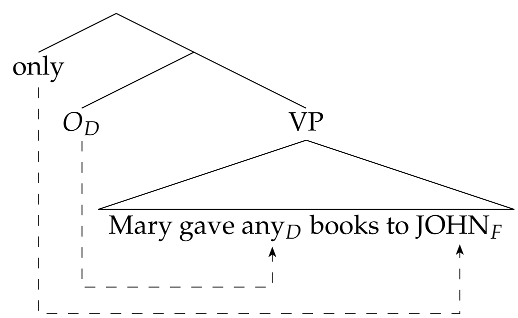
(36) Mary only gave any books to JOHN_F.

a. #Without F-movement

(i) Without O_D



(ii) With O_D



b. $^{\text{OK}}$With F-movement