Remarks on the exhaustification approach to NPIs

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1 A simple exhaustification approach to NPIs

The goal is to develop a theory of NPIs that can derive the NPI Licensing Condition (we are ignoring non-monotone, including, Strawson-DE environments in the following as well as FC)

(1) **NPI Licensing Condition**
An NPI is acceptable only if it is in a DE environment

(2) **NPI Licensing Condition (corollary)**
An NPI is unacceptable if it is in not a DE (= UE) environment

An important step towards explanation was made by Kadmon & Landman (1993)

(3) **Kadmon & Landman's breakthrough idea** (paraphrased in alternative semantics)
a. NPIs induce alternatives (these compose in a Rooth fashion with other elements)
b. The alternatives are stronger than the NPIs ('domain widening')
c. Some constituent with an NPI has to be stronger than its alt's ('strengthening')

There are different ways of operationalizing this idea. The exh operationalization (Krifka 1995):

(4) a. $[\![\textbf{any(D)}]\!]^c = [\![\textbf{some(D)}]\!]^c = \lambda P.\lambda Q.\exists x(P(x) \,\&\, Q(x))$
b. $ALT(any(D)) = \{[\![\textbf{some}]\!]^c(D'): D' \subseteq D\}$
c. $[\![\textbf{exh(C)}]\!]^c = \lambda p.\ p \,\&\, \forall q \in C: p \not\Rightarrow q \rightarrow \neg q$ *(contradiction possible, for simplicity)*

(5) a. *John read any book
b. exh(C)(John read any(D) book) = 1 iff
John read some book in D & $\forall D' \subset D$: ¬(John read some book in D')

(6) a. John didn't read any book
b. exh(C)(¬John read any(D) book) = 1 iff ¬(John read some book in D)

The simple approach to NPIs delivers (only) the following prediction

(7) **Prediction of Krifka's approach**
An NPI is acceptable if it is in a DE environment

2 Chierchia's and Linebarger's puzzles

1. The simple exhaustification approach does not rule NPIs in UE environments (Chierchia)

(8) a. *Every boy read any book
b. exh(C)(every boy read any(D) book) = 1 iff every boy read some book in D & $\forall D' \subset D$: ¬(every boy read some book in D') *(consistent meaning)*

2. And it overgenerates when it comes to NPIs in DE environments (Linebarger)

(9) a. *I doubt that every boy read any of his books
b. exh(C)(I doubt every boy read any(D) book) = 1 iff I doubt that every boy read some book in D *(consistent meaning, no scalar implicature)*

(10) a. *I doubt that three boys read any of their books
b. exh(C)(I doubt three boys read any(D) book) = 1 iff I doubt that three boys read some book in D *(consistent meaning, no scalar implicature)*

Chierchia (2013) tackles these issues in two steps:

- domain intervention (Chierchia's puzzle)
- scalar intervention (Linebarger's puzzle)

3 Domain intervention

1. Multiple agreement with (nominal) domain-bearing objects

(11) **Minimality and intervention**
a. *Any* bears a domain feature that needs to be checked by exh
b. exh must target the closest potential domain-alternatives inducer
c. A domain-bearing element XP is closest to exh iff exh asymmetrically C-commands XP and there is no other domain-bearing YP such that exh asymmetrically C-commands YP and YP C-commands XP

2. Domain intervention can deal with the issue of universal quantifiers in UE environments (and with other UE quantifiers on plausible assumptions about their presuppositions)

(12) a. *Every boy read any book
b. exh(C)(every(B) boy read any(D) book)
c. C = {every boy in B' read some book in D': B'⊆B, D'⊆D}

(13) exh(C)(every(B) boy read any(D) book) = 1 iff every boy read some book in D & ∀B'⊆B, D'⊂D: ¬(every boy in B' read some book in D') *(contradiction)*

Importantly (for later), we also rule out universal quantifier interveners in DE environments

(14) a. *I doubt that every boy read any book
b. exh(C)(I doubt that every(B) boy read any(D) book) = 1 iff I doubt that every boy in B read some book in D & ∀B'⊆B, D'⊂D: ¬(I doubt that every boy in B' read some book in D') *(contradiction)*

3. But cardinal quantifier interveners are still admitted in DE environments

(15) a. *I doubt that three boys read any book
b. exh(C)(I doubt that three(B) boys read any(D) book) = 1 iff I doubt that three boys in B read some book in D *(consistent meaning)*

4 Scalar intervention

1. Besides domain alternatives, NPIs induce scalar alternatives

(16) a. $[\![\textbf{any(D)}]\!]^c = [\![\textbf{some(D)}]\!]^c = \lambda P.\lambda Q.\exists x(P(x) \,\&\, Q(x))$
b. $ALT_D(any(D)) = \{[\![\textbf{some}]\!]^c(D'): D' \subseteq D\}$
c. $ALT_S(any(D)) = \{[\![\textbf{some}]\!]^c(D), [\![\textbf{every}]\!]^c(D)\}$
d. $exh(C) = \lambda p.\ p \,\&\, \forall q \in C: p \not\Rightarrow q \rightarrow \neg q$

2. Exh has to associate with all intervening scalar/domain-alternatives inducing elements. Chierchia proposes that the alternatives of (weak) NPIs are exhaustified serially, that is, that they allow "seperate exhaustification" (this is implemented in feature hierarchy terms)

(17) a. *I doubt that three boys read any book
b. exh(Dom)(exh(Sc)(I doubt that three(B) boys read any(D) book))

(18) a. Sc = {I doubt that n boys in B read q book in D: n = some/three, q = some/every}
b. exh(Sc)(¬three(B) boys read any(D) book) = 1 iff
some boys in B read some book in D & ¬three boys in B read some book in D

(19) a. Dom = {some boys in B' read some book in D' & ¬three boys in B' read some book in D': B'⊆B, D'⊆D}
b. exh(Dom)(exh(Sc)(¬three(B) boys read any(D) book)) = 1 iff some boys in B read some book in D & ¬3 boys in B read some book in D & ∀B'⊆B, D'⊆D: ¬(some boys in B' read some book in D') ∨ (3 boys in B' read some book in D')
(contradiction)

3. To allow for some problematic cases, the order of exhaustification can be reversed if exh is adjacent to a scalar intervener (that is, if it is 'in the same segment' as the intervener)

(20) Few boys read any book

(21) a. #exh(Dom)(exh(Sc)(few(B) boys read any(D) book))
b. exh(Sc)(exh(Dom)(few(B) boys read any(D) book))

4. An objection pertaining to DE proportional quantifiers may be avoided by assuming a more sophisticated analysis of DE proportional quantifiers (Hackl 2001)

5 Domain intervention: plural definites, conjunctive DPs

1. Plural definite descriptions and conjunctive DPs do not license NPIs

(22) *The boys read any book

(23) *John and Bill read any book

2. This can be captured by relying on domain intervention (exh(Sc) left out for convenience)

(24) exh(Dom)(The(B) boys read any(D) book) = 1 iff every boy in B read some book in D & ∀B'⊆B, D'⊂D: ¬every boy in B' read some book in D' *(contradiction)*

(25) exh(Dom)(John and Bill read any(D) book) = 1 iff John and Bill read some book in D & ∀X∈{John, Bill}, D'⊆D: ¬X read some book in D' *(contradiction)*

3. Embedding the sentence in a DE environment does not change the prediction (there is no difference if exh(Sc) applies before exh(Dom) since it is vacuous in these configurations; Homogeneity Condition does not obviously affect this prediction)

(26) exh(Dom)(¬The(B) boys read any(D) book) = 1 iff ¬every boy in B read some book in D & ∀B'⊂B, D'⊆D: every boy in B' read some book in D' *(contradiction)*

(27) exh(Dom)(¬John and Bill read any(D) book) = 1 iff ¬John and Bill read some book in D & ∀X∈{John, Bill}, D'⊆D: X read some book in D' *(contradiction)*

4. This leads to a prediction that plural definite descriptions and conjoined DPs should be interveners in DE environments. This prediction does not appear to be borne out

(28) I doubt that the boys read any of their books

(29) I doubt that John and Bill read any of their books

6 Entanglement: multiple scalar items

1. The order of exhaustification may be reversed when local to the scalar item, while this is not possible if not local to the scalar item

(30) a. Few boys read any book
b. exh(Sc)(exh(Dom)(few(B) boys read any(D) book)

(31) a. *I doubt that three boys read any book
b. *exh(Sc)(exh(Dom)(¬three(B) boys read any(D) book)
c. exh(Dom)(exh(Sc)(¬three(B) boys read any(D) book)

2. Note the following contrasts (stable across contexts, across speakers)

(32) a. Few boys read The Brothers Karamazov or any French novel
b. *Few boys read The Brothers Karamazov and any French novel

(33) a. Less than 200 boys read The Brothers Karamazov or any French novel
b. *Less than 200 boys read The Brothers Karamazov and any French novel

3. Both orders of exhaustification are problematic: one violates the requirement that exh(Sc) precedes exh(Dom) if not local to the scalar item, while the other yields a contradictory meaning

(34) a. #exh(Dom)(exh(Sc)(few boys read The Brothers Karamazov or any French novel))
b. #exh(Sc)(exh(Dom)(few boys read The Brothers Karamazov or any French novel))

7 Entanglement: scalar exh preceding domain exh

1. Scalar exhaustification can in principle always precede domain exhaustification (otherwise: one can appropriately embed the respective clauses and avoid any possible locality confounds)

(35) a. *Many boys read any book
b. *Most boys read any book
c. *Several boys read any book

The following structure is legitimate and consistent

(36) a. *Many boys read any book
b. exh(Dom)(exh(Sc)(many(B) boys read any(D) book))

(37) a. Sc = {q boys in B read q' book in D: q = many/every, q' = some/every}
b. exh(Sc)(many(B) boys read any(D) book) = 1 iff many boys in B read some book in D & ¬every boy in B read some book in D (& ...)

(38) a. Dom = {many boys in B' read some book in D' & ¬every boy in B' read some book in D' (& ...): B'⊆B, D'⊆D}
b. exh(Dom)(exh(Sc)(many(B) boys read any(D) book)) = 1 iff
many boys in B read some book in D & ¬every boy in B read some book in D & ∀B'⊆B, D'⊆D: (¬many boys in B' read some book in D') ∨ (every boy in B' read some book in D') *(consistent meaning for cardinal/proportional many)*

8 A replacement of exh with even

1. A version of Krifka's, Lahiri's, etc., even theory of NPI licensing

(39) a. $[\![\textbf{any(D)}]\!]^c = [\![\textbf{some(D)}]\!]^c = \lambda P.\lambda Q.\exists x(P(x)\ \&\ Q(x))$
b. $ALT(any(D)) = \{[\![\textbf{some}]\!]^c(D'): D' \subseteq D\}$
c. $[\![\textbf{even(C)}]\!]^c = \lambda p: \forall q \in C: p \neq q \rightarrow p < q.\ p$

2. The even approach delivers the following prediction

(40) **Prediction of the even approach**
An NPI is unacceptable if it is in a UE environment

(41) *Every boy read any book

(42) a. *The boys read any book
b. *John and Bill read any book

(43) a. *Many boys read any book
b. *Most boys read any book
c. *Several boys read any book

No intervention is predicted for definites and conjunction in DE environments

(44) a. I doubt that the boys read any book
b. I doubt that John and Bill read any book

3. If enriched with Chierchia's notion of Minimality, with a more conservative assumption what alternatives are induced by scalar items other than *any*, it delivers intervention data

(45) a. *I doubt that every boy read any book
b. *I doubt that three boys read any book

But it still needs some locality provisions about scalar items closest to even

(46) a. Few boys read one book
b. *Few boys gave every boy any of his books

9 Extensions

1. The even theory can/must be enriched by exh (if we assume a single *any*)

(47) a. You can read any book
b. *You must read any book

However, not all NPIs allow for free choice. Potential empirical generalization (?): NPIs with 'dense domains' (temporal quantifiers, mass quantifiers) do not participate in free choice

(48) a. *You can ever read a book
b. *You can read any literature

2. But the distribution of exh needs to be constrained, as is well-known

(49) *Every boy read any book

(50) a. Exactly two boys read any book
b. *Two boys read any book

3. The distribution may be constrained by a combination of Minimality and a requirement of the prejacent of even (involved in NPI licensing) not to entail negation of relevant alternatives

(51) a. even(C)(exh(C')(every boy read any(D) book))
b. $\forall$D'$\subset$D: exh(C')(every boy read any(D)) $\Rightarrow$ $\neg$exh(C')(every boy read any(D'))

(52) a. even(C)(exh(C')(two boys read any(D) book))
b. $\forall$D'$\subset$D: exh(C')(two boys read any(D)) $\Rightarrow$ $\neg$exh(C')(two boys read any(D'))

Free choice: universal vs. existential modals

(53) a. *You can read any book
b. even(C)(exh(C')(can(you read any(D) book))
c. $\forall$D'$\subset$D: exh(C')(can(you read any(D))) $\not\Rightarrow$ $\neg$exh(C')(can(you read any(D')))

(54) a. *You must read any book
b. even(C)(exh(C')(must(you read any(D) book))
c. $\forall$D'$\subset$D: exh(C')(must(you read any(D))) $\Rightarrow$ $\neg$exh(C')(must(you read any(D')))