

Remarks on the exhaustification approach to NPIs

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ZAS, Berlin, 27.8.2014

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. $\llbracket \text{any}(\mathbf{D}) \rrbracket^c = \llbracket \text{some}(\mathbf{D}) \rrbracket^c = \lambda P. \lambda Q. \exists x (P(x) \ \& \ Q(x))$
 - b. $\text{ALT}(\text{any}(\mathbf{D})) = \{ \llbracket \text{some} \rrbracket^c(\mathbf{D}'): \mathbf{D}' \subseteq \mathbf{D} \}$
 - c. $\llbracket \text{exh}(\mathbf{C}) \rrbracket^c = \lambda p. p \ \& \ \forall q \in \mathbf{C}: p \not\Rightarrow q \rightarrow \neg q$ (*contradiction possible, for simplicity*)
- (5)
 - a. *John read any book
 - b. $\text{exh}(\mathbf{C})(\text{John read any}(\mathbf{D}) \text{ book}) = 1$ iff
John read some book in \mathbf{D} & $\forall \mathbf{D}' \subset \mathbf{D}: \neg(\text{John read some book in } \mathbf{D}')$
- (6)
 - a. John didn't read any book
 - b. $\text{exh}(\mathbf{C})(\neg \text{John read any}(\mathbf{D}) \text{ book}) = 1$ iff $\neg(\text{John read some book in } \mathbf{D})$

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. $\text{exh}(\mathbf{C})(\text{every boy read any}(\mathbf{D}) \text{ book}) = 1$ iff every boy read some book in \mathbf{D} & $\forall \mathbf{D}' \subset \mathbf{D}: \neg(\text{every boy read some book in } \mathbf{D}')$ (*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. $\text{exh}(\mathbf{C})(\text{I doubt every boy read any}(\mathbf{D}) \text{ book}) = 1$ iff I doubt that every boy read some book in \mathbf{D} (*consistent meaning, no scalar implicature*)

- (10) a. *I doubt that three boys read any of their books
 b. $\text{exh}(C)(\text{I doubt three boys read any}(D) \text{ book}) = 1$ 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. $\text{exh}(C)(\text{every}(B) \text{ boy read any}(D) \text{ book})$
 c. $C = \{\text{every boy in } B' \text{ read some book in } D' : B' \subseteq B, D' \subseteq D\}$

- (13) $\text{exh}(C)(\text{every}(B) \text{ boy read any}(D) \text{ book}) = 1$ iff every boy read some book in D & $\forall B' \subseteq B, D' \subseteq D: \neg(\text{every boy in } B' \text{ read some book in } D')$ (*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. $\text{exh}(C)(\text{I doubt that every}(B) \text{ boy read any}(D) \text{ book}) = 1$ iff I doubt that every boy in B read some book in D & $\forall B' \subseteq B, D' \subseteq D: \neg(\text{I doubt that every boy in } B' \text{ read some book in } D')$ (*contradiction*)

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

- (15) a. *I doubt that three boys read any book
 b. $\text{exh}(C)(\text{I doubt that three}(B) \text{ boys read any}(D) \text{ book}) = 1$ 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. $\llbracket \text{any}(D) \rrbracket^c = \llbracket \text{some}(D) \rrbracket^c = \lambda P. \lambda Q. \exists x(P(x) \ \& \ Q(x))$
 b. $\text{ALT}_D(\text{any}(D)) = \{\llbracket \text{some} \rrbracket^c(D') : D' \subseteq D\}$
 c. $\text{ALT}_S(\text{any}(D)) = \{\llbracket \text{some} \rrbracket^c(D), \llbracket \text{every} \rrbracket^c(D)\}$
 d. $\text{exh}(C) = \lambda p. p \ \& \ \forall q \in C: p \not\Rightarrow q \rightarrow \neg q$

2. Exh has to associate with all intervening scalar/domain-alternatives inducing elements. Chierchia proposes that the alternatives of (weak) NPIs are exhausted 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. $\text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\text{I doubt that three}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$
- (18) a. $\text{Sc} = \{\text{I doubt that } n \text{ boys in } B \text{ read } q \text{ book in } D: n = \text{some}/\text{three}, q = \text{some}/\text{every}\}$
 b. $\text{exh}(\text{Sc})(\neg\text{three}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}) = 1$ iff
 some boys in B read some book in D & $\neg\text{three}$ boys in B read some book in D
- (19) a. $\text{Dom} = \{\text{some boys in } B' \text{ read some book in } D' \text{ \& } \neg\text{three boys in } B' \text{ read some book in } D': B' \subseteq B, D' \subseteq D\}$
 b. $\text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\neg\text{three}(\text{B}) \text{ boys read any}(\text{D}) \text{ book})) = 1$ iff some boys in B read some book in D & $\neg\exists$ boys in B read some book in D & $\forall B' \subseteq B, D' \subseteq D: \neg(\text{some boys in } B' \text{ read some book in } D') \vee (\exists \text{ boys in } B' \text{ read some book in } D')$
(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. $\# \text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\text{few}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$
 b. $\text{exh}(\text{Sc})(\text{exh}(\text{Dom})(\text{few}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$

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 ($\text{exh}(\text{Sc})$ left out for convenience)

- (24) $\text{exh}(\text{Dom})(\text{The}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}) = 1$ iff every boy in B read some book in D & $\forall B' \subseteq B, D' \subseteq D: \neg\text{every boy in } B' \text{ read some book in } D'$ *(contradiction)*
- (25) $\text{exh}(\text{Dom})(\text{John and Bill read any}(\text{D}) \text{ book}) = 1$ iff John and Bill read some book in D & $\forall X \in \{\text{John, Bill}\}, D' \subseteq D: \neg X \text{ read some book in } D'$ *(contradiction)*

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

- (26) $\text{exh}(\text{Dom})(\neg\text{The}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}) = 1$ iff $\neg\text{every boy in } B \text{ read some book in } D \text{ \& } \forall B' \subseteq B, D' \subseteq D: \text{every boy in } B' \text{ read some book in } D'$ *(contradiction)*
- (27) $\text{exh}(\text{Dom})(\neg\text{John and Bill read any}(\text{D}) \text{ book}) = 1$ iff $\neg\text{John and Bill read some book in } D \text{ \& } \forall X \in \{\text{John, Bill}\}, D' \subseteq D: X \text{ read some book in } D'$ *(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. $\text{exh}(\text{Sc})(\text{exh}(\text{Dom})(\text{few}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$
 (31) a. *I doubt that three boys read any book
 b. * $\text{exh}(\text{Sc})(\text{exh}(\text{Dom})(\neg\text{three}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$
 c. $\text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\neg\text{three}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$

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 $\text{exh}(\text{Sc})$ precedes $\text{exh}(\text{Dom})$ if not local to the scalar item, while the other yields a contradictory meaning

- (34) a. $\# \text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\text{few boys read The Brothers Karamazov or any French novel}))$
 b. $\# \text{exh}(\text{Sc})(\text{exh}(\text{Dom})(\text{few boys read The Brothers Karamazov or any French novel}))$

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. $\text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\text{many}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}))$
 (37) a. $\text{Sc} = \{q \text{ boys in } B \text{ read } q' \text{ book in } D: q = \text{many/every}, q' = \text{some/every}\}$
 b. $\text{exh}(\text{Sc})(\text{many}(\text{B}) \text{ boys read any}(\text{D}) \text{ book}) = 1$ iff many boys in B read some book in D & \neg every boy in B read some book in D (& ...)
 (38) a. $\text{Dom} = \{\text{many boys in } B' \text{ read some book in } D' \text{ \& \neg every boy in } B' \text{ read some book in } D' \text{ (\& \dots): } B' \subseteq B, D' \subseteq D\}$
 b. $\text{exh}(\text{Dom})(\text{exh}(\text{Sc})(\text{many}(\text{B}) \text{ boys read any}(\text{D}) \text{ book})) = 1$ iff many boys in B read some book in D & \neg every boy in B read some book in D & $\forall B' \subseteq B, D' \subseteq D: (\neg \text{many boys in } B' \text{ read some book in } D') \vee (\text{every boy in } B' \text{ read some book in } D')$ (*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. $\llbracket \mathbf{any}(D) \rrbracket^c = \llbracket \mathbf{some}(D) \rrbracket^c = \lambda P. \lambda Q. \exists x (P(x) \ \& \ Q(x))$
b. $ALT(\mathbf{any}(D)) = \{ \llbracket \mathbf{some} \rrbracket^c(D') : D' \subseteq D \}$
c. $\llbracket \mathbf{even}(C) \rrbracket^c = \lambda p : \forall q \in C : p \neq q \rightarrow p < q. \ p$

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. $\text{even}(C)(\text{exh}(C')(\text{every boy read any}(D) \text{ book}))$
 b. $\forall D' \subset D: \text{exh}(C')(\text{every boy read any}(D)) \Rightarrow \neg \text{exh}(C')(\text{every boy read any}(D'))$
- (52) a. $\text{even}(C)(\text{exh}(C')(\text{two boys read any}(D) \text{ book}))$
 b. $\forall D' \subset D: \text{exh}(C')(\text{two boys read any}(D)) \Rightarrow \neg \text{exh}(C')(\text{two boys read any}(D'))$

Free choice: universal vs. existential modals

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