

# On the locus of question exhaustification\*

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Since Heim (1994), *wh* questions are often assumed to be ambiguous between exhaustive and non-exhaustive meanings. Based on evidence from *wh else* questions, I argue that the locus of question exhaustification cannot always (if ever) be low, below the *wh* phrase. Sometimes, exhaustification must be high, applying to the question as a whole. I also argue, contra Nicolae (2015), that low exhaustification (if existent) cannot be the only source of negative polarity licensing by *wh* questions.

## 1 Question exhaustification

### 1.1 Question exhaustivity

Since Heim (1994), *wh* questions are often taken to allow for both non-exhaustive (Hamblin 1973, Karttunen 1977) and exhaustive (Groenendijk and Stokhof 1982) meanings.

(1) Who lied?

(2)  $D = \{a, b, c, a+b, b+c, a+c, a+b+c\}$  (cf. Link 1983)

(3) a. **Non-exhaustive meaning**

$\{l(a), l(b), l(c), l(a+b), l(a+c), l(b+c), l(a+b+c)\}$

b. **Exhaustive meaning**

$\{l(a)-l(b)-l(c), l(b)-l(a)-l(c), l(c)-l(a)-l(b), l(a+b)-l(c), l(a+c)-l(b), l(b+c)-l(a), l(a+b+c)\}$

Heim (1994) and subsequent work motivate an exhaustive/non-exhaustive ambiguity as a prerequisite for a proper analysis of the class of *responsive* question embedders, which includes *know* and *surprise*.

(4) **Question embedding rule** (cf. George 2013)

$\|V_{\text{int}}\|(Q)(x) \Leftrightarrow \exists p[p \in Q \ \& \ \|V_{\text{decl}}\|(p)(x)]$

*surprise*: Q non-exhaustive

*know*: Q exhaustive

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## 1.2 Two loci for exhaustification

### (5) Non-exhaustive meaning

$\{I(a), I(b), I(c), I(a+b), I(a+c), I(b+c), I(a+b+c)\}$

### (6) Composition of non-exhaustive meaning

(cf. Karttunen 1977)

a. who  $\lambda x$  [x lied]

b.  $\| \text{who} \| = \lambda f_{e(st)}. \{f(x) \mid x \in D\}$

### (7) Exhaustive meaning

$\{I(a)-I(b)-I(c), I(b)-I(a)-I(c), I(c)-I(a)-I(b), I(a+b)-I(c), I(a+c)-I(b), I(b+c)-I(a), I(a+b+c)\}$

Existing analyses of question exhaustification can be classified according to where they take exhaustification to apply relative to the *wh* phrase.

### (8) Question exhaustification

a. **High, above *wh***: Heim (1994), Beck and Rullmann (1999), Theiler (2014), ...

b. **Low, below *wh***: George (2011), Nicolae (2015), Guerzoni and Sharvit (2014), ...

Under the present assumption about non-exhaustive question syntax and semantics, high and low question exhaustifiers can be spelled out as in the following, where *Q* is the non-exhaustive question meaning.

### (9) Question exhaustification

#### a. High

i.  $H$  [who  $\lambda x$  [x lied] ]

ii.  $\| H \| = \lambda Q_{(st)t}. \{Exh(Q)(p) \mid p \in Q\}$

#### b. Low

i. who  $\lambda x$  [L [x lied] ]

ii.  $\| L \| = \lambda p_{(st)}. Exh(Q)(p)$

(cf. Chierchia et al. 2011)

(10)  $Exh(Q)(p) := \lambda w. p(w) \ \& \ \forall q \in Q [q(w) \rightarrow p \sqsubseteq q]$

(cf. Chierchia et al. 2011)

Under this elaboration, the high exhaustifier is a type lifted low exhaustifier, designed to apply pointwise to the propositions in the non-exhaustive question meaning.

Chierchia et al. (2011) posit a silent operator with the meaning of *L* which syntax allows to attach at any scope site. On this view, low exhaustification is expected, preempting the need for high exhaustification.

## 1.3 Goals

- Based on evidence from *wh else* questions, argue that the locus of question exhaustification cannot always (if ever) be low.
- Argue (contra Nicolae 2015) that low exhaustification (if existent) cannot be the only source of negative polarity licensing in *wh* questions

## 2 *Who else*: a case for high exhaustification

- (11) a. Who lied?  
b. Who else lied?

*Else* in *who else* contributes (Harris 2014, Romero 1998): (i) an **additive presupposition**, the proposition that a salient individual  $r$  (below  $r:=a$ ) lied; (ii) **subtraction** of answers about  $r$  from the question denotation.

(12) **Non-exhaustive meaning**

- a. *Who lied?*  
i.  $\{\mathbf{I(a)}, I(b), I(c), \mathbf{I(a+b)}, \mathbf{I(a+c)}, I(b+c), \mathbf{I(a+b+c)}\}$   
ii. existence presupposition:  $I(a) \cup I(b) \cup I(c)$
- b. *Who else lied?*  
i.  $\{I(b), I(c), I(b+c)\}$   
ii. additive presupposition:  $I(a)$   
existence presupposition:  $I(b) \cup I(c)$

(13) **Composition of non-exhaustive meaning**

- a. i. who  $\lambda x$  [x lied]  
ii.  $\|\text{who}\| = \lambda f_{e(st)}. \{f(x) \mid x \in D\}$
- b. i. [who **else**]  $\lambda x$  [x lied]  
ii.  $\|\text{who else}\|^w = \lambda f_{e(st)}. \mathbf{f(r)(w)}. \{f(x) \mid x \in D \ \& \ r \not\subseteq x\}$

Subtraction of the answer about  $r$  strengthens the question's existence presupposition (e.g., Dayal 1996), which under present assumptions is the disjunction of the propositions in the question meaning.

(14) **Question exhaustification**

- a. **High**  
i.  $H$  [ [who else]  $\lambda x$  [x lied] ]  
ii.  $\{I(b)-I(c), I(c)-I(b), I(b+c)\}$   
additive presupposition:  $\mathbf{I(a)}$   
existence presupposition:  $I(b) \cup I(c)$
- b. **Low**  
i. [who else]  $\lambda x$  [L [x lied] ]  
ii. additive presupposition:  $\mathbf{I(a)-I(b)-I(c)}$  contradictory  
existence presupposition:  $I(b) \cup I(c)$  presuppositions

$\{I(a)-I(b)-I(c), I(b) \cup I(c)\}$  is inconsistent. So low exhaustification with *who else* is predicted to yield a contradiction, like the contradiction that may actually be perceived in (15).

- (15) a. #Who else is the only one who lied?  
b. #Who else is such that only they lied?

If *wh else* questions were found to allow for (non-contradictory) exhaustive meanings, this meaning could not be credited to low exhaustification, furnishing an argument for the existence of high exhaustification.

- (16) a.  $H [ [\text{who else}] \lambda x [x \text{ lied}] ]$   
 b.  $\#[\text{who else}] \lambda x [L [x \text{ lied}] ]$

## 2.1 Detecting exhaustivity with *who else* questions

### 2.1.1 *Who else* questions embedded under *know*

As implied by the question embedding rule from above, exhaustive question meanings have been motivated as the correct meaning of questions embedded under *know*.

- (17) **Question embedding rule** (cf. George 2013)  
 $\|V_{\text{int}}\|(Q)(x) \Leftrightarrow \exists p[p \in Q \ \& \ \|V_{\text{decl}}\|(p)(x)]$   
*surprise*: Q non-exhaustive  
*know*: Q exhaustive

- (18) Dan knows who lied.

Groenendijk and Stokhof (1982) first argued this by pointing to the validity of inferences that make reference to negative answers, and which are therefore captured only under the exhaustive question meaning.

- (19) Dan knows **who lied**  
 Bill did not lie  
 -----  
 Dan knows that Bill did not lie

Provided the additive presupposition is satisfied, intuitions about the relevant inferences with *who else* questions seem no different from those about other *wh* questions.

- (20) Dan knows who else lied.

- (21) Dan knows that Ann lied  
 Dan knows **who else lied**  
 Bill did not lie  
 -----  
 Dan knows that Bill did not lie

Given that in *wh else* questions, low exhaustification is preempted by contradiction, the validity of such inference furnishes an argument for the existence of high exhaustification.

- (22) a.  $H [ [\text{who else}] \lambda x [x \text{ lied}] ]$   
 b.  $\#[\text{who else}] \lambda x [L [x \text{ lied}] ]$

### 2.1.2 NPI licensing by *wh else* questions

The nucleus of a *wh* question (= scope of the *wh* phrase) is known to be an environment where weak negative polarity items like *any* or *ever* can be licensed (e.g., Borckin 1971, Krifka 1995).

(23) Who lied about anything?

Guerzoni and Sharvit (2007) observed that the licensing of weak NPIs in the *wh* question nucleus requires an exhaustive interpretation of the question.

(24) **Exhaustivity-licensing generalization** (Guerzoni and Sharvit 2007)

A weak NPI is licensed in the nucleus of a *wh* question only under an exhaustive interpretation of the question.

Aligned with the question embedding rule from above, Guerzoni and Sharvit support the exhaustivity-licensing generalization with contrasts like the one in (26).

(25) **Question embedding rule**

(cf. George 2013)

$$\|V_{\text{int}}\|(Q)(x) \Leftrightarrow \exists p[p \in Q \ \& \ \|V_{\text{decl}}\|(p)(x)]$$

*surprise*: Q non-exhaustive

*know*: Q exhaustive

(26) a. Dan knows who lied about anything.  
b. \*It surprised Dan who lied about anything.

Under present assumptions, the exhaustivity-licensing generalization requires that a NPI in the *wh* question nucleus be parsed with either H or L.

(27) a. H [who  $\lambda x$  [x lied about anything] ]  
b. who  $\lambda x$  [L [x lied about anything] ]

The relevant observation is now that *who else* questions are not judged to differ from bare *who* questions in terms of their ability to license weak NPIs.

(28) Who else lied about anything? (cf. (23))

(29) a. Dan knows who else lied about anything. (cf. (26))  
b. \*It surprised Dan who else lied about anything.

Hence *wh else* question with NPIs too must be parsed with L or H. Low exhaustification being preempted by contradiction, NPI licensing provides a second argument for the existence of high exhaustification.

- (30) a.  $H [ [ \text{who else} ] \lambda x [ x \text{ lied (about anything)} ] ]$   
 b.  $\#[ \text{who else} ] \lambda x [ L [ x \text{ lied (about anything)} ] ]$

## 2.2 Interim conclusion

Evidence from *wh else* questions suggests that the locus of question exhaustification cannot always be low. There is at present no evidence for low exhaustification in *wh* questions.

## 3 A note on the exhaustivity-licensing generalization

The above argument based on NPI licensing raises to salience the question what accounts for the exhaustivity-licensing generalization. How does question exhaustivity come to license NPIs?

- (31) Who lied about anything?

Nicolae (2015) replaces L with O and A: O is like L except that O encodes the truth of its prejacent as presupposed content. A, from Beaver and Krahmer (2001), converts presupposed into asserted content.

- (32) a.  $\text{who } \lambda x \mathbf{L} [ x \text{ lied} ]$   
 b.  $\text{who } \lambda x \mathbf{A} [ \mathbf{O} [ x \text{ lied} ] ]$

- (33) a.  $\| \mathbf{O} \| = \lambda p_{(st)}. \lambda w: p(w). \| \mathbf{L} \| (p)$   
 b.  $\| \mathbf{A} \| = \lambda p_{(st)}. [ \lambda w_s. p(w) ]$

This renders the composition of  $\| \mathbf{A} \|$  and  $\| \mathbf{O} \|$  equivalent to  $\| \mathbf{L} \|$ , so that the two structures in (32) are globally equivalent. However, unlike L, O is Strawson-downward entailing in the sense of von Stechow (1999).

O is thereby predicted to license NPIs on von Stechow's (1999) account. The meaning of O is in fact the meaning that von Stechow assumes for *only*, whose ability to license NPIs he aims to capture.

- (34) Only Ann lied about anything.

Provided that there is no other generally available source of NPI licensing in *wh* questions, this elegantly captures the exhaustivity-licensing generalization.

- (35) a.  $\text{who } \lambda x [ \mathbf{A} [ \mathbf{O} [ x \text{ lied about anything} ] ] ]$   
 b.  $*\text{who } \lambda x [ x \text{ lied about anything} ]$

But since A and O fully replicate the effect of L for the global question semantics, contradictory presuppositions are once again expected to arise for *wh else* questions with low exhaustification.

- (36) Who else lied about anything?
- (37) a. i.  $\#[\text{who else}] \lambda x [\mathbf{L} [x \text{ lied (about anything)}]]$   
 ii.  $\#[\text{who else}] \lambda x \mathbf{A} [\mathbf{O} [x \text{ lied (about anything)}]]$
- b.  $\{I(b)-I(c), I(c)-I(b), I(b+c)\}$   
 additive presupposition:  $I(a)-I(b)-I(c)$  contradictory  
 existence presupposition:  $I(b) \cup I(c)$  presuppositions

Hence Nicolae's (2015) low exhaustification account of the exhaustivity-licensing generalization undergenerates, leaving NPI licensing in the nucleus of a *wh else* question unexplained.

## 4 Conclusions

- *Wh else* question data suggest that low exhaustification is insufficient as a source of question exhaustivity. If the exhaustive/non-exhaustive ambiguity exists, high exhaustification must be available.
- *Wh else* question data also suggest that low exhaustification as an NPI licenser (Nicolae 2015) is insufficient as an explanation for NPI licensing by *wh* questions.
- Evidence for low question exhaustification is presently absent. Since an operator equivalent to a low exhaustifier has been motivated independently (Chierchia et al. 2011), this absence is conspicuous.

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