# Focus and Exhaustivity Revisited

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## 0. Introduction

In recent work on the semantics of question-answer pairs, much attention has been paid to the following phenomenon:[1]

(1) Q: Who solved the problem?
A: John.

The answer in (1) is likely to mean that only John solved the problem, the so-called exhaustive interpretation. Groenendijk and Stokhof(1983 & 1992, hereafter, G&S) convincingly argue that such an interpretation obligatorily occurs on the answer terms. This means that they treat exhaustivity as a semantic phenomenon. My goal in this paper is to explain exhaustivity in terms of focus and to show that it is a pragmatic phenomenon.

## 1. Previous Analyses

(2) exh $=\lambda\Psi\ \lambda P[\ (P)\&\ \neg\exists P'\{\ \Psi(P')\ \&\ P\neq P'\ \&\ P'\subset P]]$

(3) Example: M=< E, F>: E is Discourse Domain. F is the denotation function. E={a, b, c, d}, F(girl)={a, b, c}, and F(boy)={d}.

(4) Q: Who came to the party?
A: ( I don't know precisely, but )
a. at most two girls (came to the party.)
b. at least two girls (came to the party.)
c. no girls (came to the party.)

(5) a.<u>exh</u> $(\{\ X \mid \#(X \cap girl) \leq 2\}) = \{\{\varnothing\}\}$
b.<u>exh</u> $(\{\ X \mid \#(X \cap girl) \geq 2\}) = \{\{a,b\},\{b,c\},\{a,c\}\}$
c.<u>exh</u> $(\{\ X \mid \#(X \cap girl) = 0\}) = \{\{\varnothing\}\}$

(6) 'a term T might be regarded as positive if it implies that at least something in its quantificational domain has the property to which T is applied; T is negative if something in T's domain must not have that property'

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1) This paper is mainly based on Lee, Y-S (1995), and the discussion of Krifka (1999).

(7) *Only* (Q ) (*P* ) is true

iff $\sim\exists P'$ [ Q ($P'$) & $P \neq P'$ & $\forall$ x [$P'$(x)$\rightarrow P$(x) ]],

if Q is a positive quantifier

$\sim\exists P'$ [Q ($P'$) & $P \neq P'$ & $\forall$ x [$P$(x)$\rightarrow P'$(x) ]],

if Q is a negative quantifier.

(8) M= < E, $\oplus$, $\perp$, F>, where E is a structured discourse domain. $\oplus$ is the sum operator. $\perp$ is the bottom element of the structure. F is denotation function for basic expressions.

(9) a. part-relation, $\leq_p$: x $\leq_p$ y iff x $\oplus$ y= y

b. Atomicity, ATOM: ATOM (x) iff $\forall$z [z $\leq_p$ x$\rightarrow$ z = x ]

c. Identity, =: x=y iff $\forall$z [z $\leq_p$ x $\leftrightarrow$ z$\leq_p$ y ]

(10) A predicate P is collective iff $\forall$ x [ P(x) $\rightarrow\neg$ ATOM (x) ]

(11) DISTR$=_{def}$ $\lambda$P$\lambda$s$\forall$x [ x$\leq_p$ s$\rightarrow$ P(x)], (where the variable P is ranging over predicates, s is over sums of individuals.)

(12) <u>a. Collective readings</u>

*at most/least two girls:* $\lambda$P $\exists$G [ G$\in$ M (N) & G $\in$ girl & G$\in$ P],

where M(N) stands for a modified number.

For here, *at least two* ={ G| $\exists$G' $\in$ 2 [G $\supseteq$ G']}, and

*at most two* ={ G| $\exists$G' $\in$ 2 [G $\supseteq$ G']}. (Notice that 2 means the set of sum entities are two.)

<u>b. Distributive readings</u>

*at most two girls* =$\lambda$X[ $\forall$G [G$\in$X $\rightarrow$#(G $\cap$ girl) $\leq$ 2]

*at least two girls* =$\lambda$X[ $\forall$G [G$\in$X $\rightarrow$#(G $\cap$ girl) $\geq$ 2]

(13) the exhaustivized collective readings:

a. <u>exh</u>( at most two girls )={{a},{b},{a$\oplus$b},{a$\oplus$c},{b$\oplus$c}}

b. <u>exh</u>( at least two girls )= {{a, b},{b, c},{a, c},{a$\oplus$b},{a$\oplus$c},{b$\oplus$c},{a$\oplus$b$\oplus$c}}

c. <u>exh</u>( no girls )=0})={??}

(14) Q: what are the solutions to this equations?

A: (I don't know, but there are) at most two solutions.

## 2. Exhaustivity as a Pragmatic Phenomenon

(15) a. <all, most, many, some, few>

ex.) *I met all of the boys* entails *I met some of boys.*

b. <....5, 4, 3, 2, 1>

ex.) *I have five chairs* entails *I have four chairs.*

c. <love, like>

ex.) *I love her* entails *I like her.*

(16) <u>Pragmatic Scale</u> : $\leq$ is a pragmatic scale for R (predicate) iff for all x, y in the domain of $\leq$, if $R(x)$ and $x \leq y$, then $R(y)$.

(17) <u>Scalar Principle:</u>

If *R(x)* is uttered as the most information from a set of alternatives $R(y)$, $R(z)$,...., then we can conclude that $\forall y,x\ [\ y \leq x\ \&\ y \neq x \rightarrow \neg R(y)]$, otherwise $R(y)$ would have been uttered, with $y \leq x$.

(18) Q: How many people came to the party?

A: a. At least twenty.

b. Twenty.

## 3. Focus and Assertions

(19) <u>Common assumption of focus theories:</u>

a. Focus is a feature assigned to a syntactic node of a sentence.

b. Focus (feature) is associated with a focus-sensitive operators such as *even* or *only.* The operator c=commands its focus.

c. Focus is marked by sentence accent(or by special syntactic construction such cleft-sentence in English, or by a specially designated position as in Hungarian, or by focus plus particles as in Korean and Japanese.)

d. Semantically the focus marking partitions the sentence into two parts: The part in focus and the rest, commonly called the background.

(20) a. John kissed Mary.

b. John (and only John) kissed Mary,

among those under discussion, it was John who kissed Mary.

(21) a.[$_F$John]-ga Mary-ni okane-o yatta

-Nom -Dat money-Acc gave

'It was John who gave the money to Mary.'

b. John-ga[$_F$Mary]-ni okane-o yatta

'It was to Mary that John gave to Mary.'

c. John-ga Mary-ni[$_F$okane]-o yatta

'It was the money that John gave to Mary.'

d. *John-ga mainiti [$_F$gakkoo]-ni iku

every day school-to go

'It was to school that John and only John goes every day.'

(22)

a. [$_F$Herom lany] latta Peter.

'Only three girls saw Peter.'

b. [$_F$Heron lany] nem latta Peter.

'Three girls, didn't see Peter.'

(23) a. Three girls saw Peter. Indeed, five girls did.

b. *Only three girls saw Peter. Indeed, five girls did.

(24) ASSERT(<B,F>): B(F) is asserted with the following felicitous conditions:

a. $B(F) \cap C = C'$ & $C \neq C'$ & $C' \neq \{\varnothing\}$, where C is a common ground.

b. For every F′, $F' \in ALT_C(F)$, the speaker has good reasons not to assert B(F′):

For some F′s $B(F') \cap C = \{\varnothing\}$, in other words, B(F′) is false, for some F′s if $B(F') \cap C = C'$ & $C \neq C'$ & $C' \neq \{\varnothing\}$, it is less informative than B(F), and for some F′s the speaker doesn't have appropriate information on whether B(F′) is true or not.

(25) [$_F$John] kissed Mary.

a. Background: λx[x kissed Mary]

b. Focus: John

c. ASSERT(<λx[x kissed Mary], John>)

d. Result of computing c: John kissed Mary but no other people among the contextually salient alternatives.

(26) Q: Why do you think Mary is so healthy?

A: She drinks milk a lot.

(27) a. Leif is sexy.

b. Three professors are sexy.

4. Types of Focus and Exhaustive Assertion

(28) Q: Who called for me today?
A: a. Not Bert.
b. Anna but not Bert.

(29) CONTR(<B,F>): $\Leftrightarrow$ B(F) & $\forall$F′[F′ALT$_C$(F) & F′≠F′ & *Poss* (¬ B(F′))], where *Poss* is the possibility modal operator.

(30) ASSERTexh(<B,F>): $\Leftrightarrow$ B(F′) & $\forall$F′[F′ALT$_C$(F) & [ ¬ *Ness*(B(F)→B(F′))]→¬ B(F′)], where *Ness* is the necessity modal operator.

(31) a. ASSERTexh[$_F$Not Bert]
b. Background: λQ[Q(P)], P= *called me*, and Q is of type <<e,t>,t>.
c. Focus: Not Bert: λP[¬ P(b)]
d. ASSERTexh(<λQ[Q(P)], λP[¬ P(b)]>)
e. Result of computing of d:
¬ P(b)&$\forall$F′[F′∈ALT$_C$(λP[¬ P(b)]&
¬ *Ness* [¬ P(b)→B(F′)]→¬ B(F′)]

(32)a. [$_F$Not Bert]
b. Background: λQ[Q(P′)], P′= *called me*, and Q is of type <<e,t>,t>.
c. Focus: Not Bert: λP[¬ P(b)]
d. CONTR(<λQ[Q(P′)], λP[¬ P(b)]>):$\Leftrightarrow$¬ P′(b) &
$\forall$F′[F′∈ALT$_C$(λP[¬ P(b)] & λP[¬ P(b)]≠F′ & Poss(¬ F′(P′))]
e. Result of computing d.: Bert didn't called the questioner but possibly all the contextually salient alternative(s) to Bert who called the questioner.

(33) a. CONTR [$_F$Anna] but CONTR ([$_F$Bert])
b. Background: λQ[Q(P)], P stans for *called me*.
c. Foci: [$_F$Anna]: λP[P(a)], [$_F$notBert]: λP[¬ P(b)]
d. CONTR(<λQ[Q(P)], λP[P(a)>), CONTR(<λQ[Q(P)], λP[¬ P(a)>)
The computation of d is the same as (32).
e. Result of computing: Among contextually salient alternatives, Anna called the questioner but possibly all the other people didn't. In addition, Bert didn't call the questioner but possibly the other people called the questioner.

## 5. At least / most N CN and Exhaustivity

(34) a. **at least**($\langle B, F\rangle$):⇔

$\lambda P[\exists F'[F'\in ALT_C(F)\&F'\leq F\&B(F')(P)]]$

b. **at most**($\langle B, F\rangle$):⇔

$\lambda P[B(F')(P)\vee\neg\exists F'[F'\in ALT_C(F)\&F'\leq F\&B(F')(P)]]$

(Notice that$\leq$is a pragmatic scale. E.g., $3\leq 2$)

(35) [**at least**[$_F$two]] girls]

a. Background: $\lambda NN(girls)$, N is of the same type as that of the focus.

b. Focus: 2, 2 stands for $\lambda P'\lambda Q\exists x[P'(x)\&Q(x)\&|x|=2]$

c. **at least**($\langle\lambda NN(girls),2\rangle$)

d. Result of computing c: $\lambda P'[\exists F'[F'\in ALT_C(2)\&F'\leq 2\&\exists x[P(x)\&girls(x)\&|x|=F']]]$

(36) ASSERT[$_F$[at **least**[$_F$two]] girls]

a. Background: $\lambda TT(P)$, P=.came to the party

b. Focus: at least two girls:

$\lambda P'[\exists F'[F'\in ALT_C(2)\&F'\leq 2\&\exists x[P'(x)\&girls(x)\&|x|=F']]]$(=[1], for short)

c. ASSERT ($\lambda TT(P)$,[1]>)

d. Result of computing of c: The speaker asserts

$\exists F'[F'\in ALT_C(2)\&F'\leq 2\&\exists x[P(x)\&girls(x)\&|x|=F']]$

but for other alternatives $F'\in\{T|T=\lambda P\exists x[P(x)\&girl(x)\&|x|\geq n\&n\in N)$, where N is the set of natural numbers., B(F')s are not asserted because of the following reasons: Some are less informative than B(F). Some are false based on speaker's information, and so forth.

(37) [**at most**[$_F$three]] girls]

a. Background : $\lambda N.N$ (girls)(P), N is of the same type as that of the focus. P=came to the party.

b. Focus: 3, short for $\lambda P'\lambda Q\ \exists x[P'(x)\&Q(x)\&|x|=3]$

c. **at most** ($\langle\lambda N.N$ (girls), $3\rangle$)

d. Result of computing c: $\exists x[P(x)\&girls(x)\&|x|=3]\vee$

$\neg\exists F'[F'\in ALT_C(3)\&F'\leq 3\&\exists x[P(x)\&girls(x)\&|x|=F']]]$

(38) a. ASSERT[$_F$[at **most**[$_F$ three]] girls]

d. Result of computing of a: The speaker asserts

$\exists x[P(x)\&girls(x)\&|x|=3] \vee \neg \exists F'[F' \in ALT_C(3)\&F' \leq 3\& \exists x[P(x)\&girls(x)\&|x|=F']]]$.
But for other alternatives F′, $F' \in \{T|T=\lambda P \exists x[P(x)\&girl(x)\&|x| \leq n\&n \in N)$, where N is the set of natural numbers., (e.g., 1,2,4,...), B(F′)s are not asserted because of the following reasons: Some are less informative than B(F′). Some are false based on speaker's information, and so forth.

## 6.Concluding Remark

In this paper, we have reached the following conclusions; exhaustivity presupposes an alternative set to be compared. This can explain why the constituent in focus is associated with exhaustivity. The account of exhaustivity based on focus, the alternative set, and 'Scalar Principles' is not concerned with which category exhaustivity is associated with (cf. G&S's exh operator can only apply to terms). In addition, the domain of exhaustivity can be fixed with the help of the contextually salient set introduced by focus (cf. in G&S, nothing is mentioned about a way of restricting the domain of exhaustivity). Specifically, *at least / most N* based terms resist the operation of exhaustivity seen in G&S. Nevertheless, the effect of exhaustivity in terms of the ordinary assertional illocutionary force exists even on them. In short, the candidates for the exhaustivity satisfy the requirements that a focused constituent whose focus is bound by the $ASSERT_{exh}$ operator, and the alternatives can be arranged in an order of a 'Pragmatic Scale'. Thus, the effect of exhaustivity is a pragmatic phenomenon, and 'Scalar Principle' and focus are the main sources of exhaustivity.

## References

Barker, C. 1992. Group terms in English: representing group as atoms. *Journal of Semantics 9.* 69-93.

Fauconnier, G. 1975. Pragmatic Scales and Logical Structure. *LI 4.* 353-375,

Grice, H.P. 1975. Logic and Conversation. *In Syntax and semantics 3: Speech Act.*, ed. by Col & Morgan, 41-58. New York: Academic press.

Groenedijk, J. and M. Stokhof. 1983. On the semantics of questions and the pragmatics of answers. ms., University of Amsterdam.

Groenedijk, J. and M. Stokhof. 1992. A Note on Interrogatives and Advers of Quantification, 99-124, *In the proceedings of SALTII*. The Ohio State University, Columbus, Ohio.

Horn, L.R. 1972. *On the semantic properties of Logical Operators in English.* Doctoral Dissertation, UCLA.

Horn, L.R. 1981. Exhaustiveness and the Semantics of Clefts. *NELSII*. 125-142.

Jacobs, J. 1984. Funktionale Satzperspektive und Illokutionssemantik. *Linguistische Berichte 91.* 25-28.

Kadmon, N. 1987. *On unique and non-unique reference and asymmetric quantification*, Diss. Univ. of Massachusetts, Amherst.

Krifka, M. 1991. Some Remarks on Polarity Items. MS. University of Texas at Austin.

Krifka, M. 1992. A compositional semantics for multiple focus constructions. *In Informationsstruktur und Grammatik*, ed. by J. Jacobs, 17-53. (Linguistische Berichte, sonderheft 4).

Krifka, M. 1993. Focus and Presupposition in Dynamic Interpretation. *In Journal of Semantics 10.* 269-300.

Krifka, M. 1999. At least some determiners aren't determiners. In K. Turner (ed). *The Semantics/Pragmatics Interface from Different Points of View*, 257-291. North-Holland: Elsevier Science.

Kuno, S. 1973. The Structure of the Japanese Language. Cambridge: The MIT Press.

Landman, F. 1989. Groups I & II. *Linguistics and Philosophy 12.* 559-605 & 723-44.

Lee, Y-S. 1994. Negative Plarity Items and the Semantics of the Particles -to and -na in Korea. *Kansas Working Papers in Linguistics Vol.19*, the University of Kansas, Lawrence, Kansas. 89-123.

Lee, Y-S. 1995. Exaustivity, the Scalar Principle, and Focus Semantics. in Proceedings of the 13th *WCCFL.*

Link, G. 1984. Plurals. To appear in *Handbook of Semantics*, ed. by A. von Stechow &D.Wunderlich.

Roberts, C. 1991. Domain Restirction in Dynamic Semantics. MS., The Ohio State University.

Rooth, M.E. 1985. *Association with focus.* Doctoral Dissertation, Univ. of Massachusetts, Amherst.

Rooth, M.E. 1991. A theory of focus interpretation. In *Natural Language Semantics I*. 75-116.

Stalnaker, R. 1979. Assertion. In *Syntax and Semantics*, ed. by Peter Cole, 315-332. NewYork: Academic Press.

Stechow, A.von. 1990. Focusing and backgrounding operators. In *Disourse Particles, Pragmatics and Beyond*, 37-84. Amsterdam: John Benjamins.

Stechow, A.von. & T.E.Zimmermann, 1984. Term answers and contextual change. In *Linguistics* 22. 3-40.

Szabolcsi, A. 1981. The semantics of topic-focus articulation. In *Formal Methods in the study of language.*,ed. by Groenendijk et al, 513-541. Amsterdam: Mathematical Centre.