Exhaustivity of embedded questions:
Challenges for both Gricean and grammatical theories of exhaustive inferences

Wataru Uegaki
JSPS/Keio (wuegaki@gmail.com)

ELSJ Symposium 'Formal Pragmatics'
May 24th, 2015

1 Scalar implicatures

(1) a. John ate **some** of the cookies.
⇒ John didn't eat **all** of the cookies.
b. Joe **or** Bill will show up.
⇒ Not both Joe **and** Bill will show up.
c. Its **warm** in Northern California today.
⇒ It is not **hot** in Northern California today. (Matsumoto 1995)

(2) **Maxim of quantity (Grice 1975)**
a. Make your contribution to the conversation as informative as is required.
b. Do not make your contribution more informative than required.

(3) **Scales (Horn 1972)**
a. The positive quantifiers: *some*, *many*, *most*, *all*.
b. The negative quantifiers: *not all*, *few*, *none*
c. Numerals: *one*, *two*, *three*, ...
d. Modals: *can*, *must*
e. Sentential connectives: *and*, *or*
f. Gradable adjectives: *warm*, *hot/cold*, *freezing*, etc.

(4) **A Gricean derivation of the scalar implicature of (1a)**
a. The speaker of (1a) could have uttered the following alternative:

ALT((1a)) John ate all of the cookies.

b. ALT((1a)) entails (1a), hence is more informative.
c. **Quantity**: If the speaker believed ALT((1a)), she would have said so.

d. It is not the case that the speaker believes ALT((1a)).

e. **Opinionatedness**: The speaker believes ALT((1a)) or ¬ALT((1a)).

f. The speaker believes ¬ALT((1a)).

(4) **Embedded implicatures** (Chierchia et al. 2012)

a. Joe didn't see Mary or Sue; he saw both.
⇒ 'It is not the case that [Joe saw Mary or Sue **and not both**].'

b. It is not just that you can write a reply. You must.
⇒ 'It is not the case that [you can write a reply **and you don't have to**.]'

c. If you take salad or dessert, you pay $20; but if you take both there is a surcharge.
⇒ 'If [you take salad or desert **and not both**], you pay $20.'

d. Every professor who fails most of the students will receive no raise; every professor who fails all of the students will be fired.
⇒ 'Every professor [who fails most **but not all** of the students] will receive no raise'.

e. Mary solved the first problem or the second problem or both problems.
⇒ [Mary solved the first problem or the second problem **and not both**] or both problems

(5) $[\![\mathsf{EXH}\ \varphi]\!] \Leftrightarrow [\![\varphi]\!]\ \&\ \forall p' \in [\![\varphi]\!]^{Alt}[p \subset [\![\varphi]\!] \rightarrow \neg p']$
'EXH φ' asserts φ and negates stronger alternatives.'

(6) a. NOT [EXH [Joe saw Mary or Sue]]

b. NOT [EXH [you can write a reply]]

c. If [EXH [you take salad or deseart]],...

d. Every professor [EXH [who fails most of the students]]...

e. [EXH [Mary solved the first problem or the second problem]] or...

(cf. Chierchia et al. 2012; Fox 2007)

2 Exhaustivity of embedded questions

(7) John *V*s which students came. ($V \in \{know, predict, be\ surprised, report...\}$)

Weakly-exhaustive (WE) reading 'John *V*s that the students who came came.'

Strongly-exhaustive (SE) reading 'John *V*s that the students who came came and the students who didn't come didn't come.'

Intermediately-exhaustive (IE) reading 'John *V*s that the students who came came, and for any student who didn't come, it is not the case that John *V*s that he came.'

(8) [**Situation**: there are three students, Ann, Bill and Chris. Every student is invited to a certain party, but only Ann and Bill came, and Chris didn't.]

John predicted which students would come.

WE reading John predicted that Ann and Bill would come.

SE reading John predicted that Ann and Bill would come, and he predicted that Chris woudn't.

IE reading John predicted that Ann and Bill would come, and it is not the case that he predicted Chris would come.

(9) **Klinedinst and Rothschild (2011)**

a. John predicted [Ans [which students would come]]. $\rightsquigarrow$ **WE**

b. John predicted [EXH [Ans [which students would come]]]. $\rightsquigarrow$ **SE**

c. EXH [John predicted [Ans [which students would come]]]. $\rightsquigarrow$ **IE**

(10) **The question dentoation and the Ans-operator**

a. $[\![\text{which students would come}]\!]^w = \left\{ \begin{array}{c} A, B, C, \\ A \,\&\, B, B \,\&\, C, C \,\&\, A, \\ A \,\&\, B \,\&\, C \end{array} \right\}$

b. $[\![\text{Ans}]\!]^w(Q) := \bigcap \{ p \in Q \mid p(w) = 1 \}$

c. $[\![\text{Ans [which students would come]}]\!]^w = A \,\&\, B$

(Hamblin 1973; Karttunen 1977; Heim 1994)

(11) **Alternatives**

a. $[\![\text{Ans [which students would come]}]\!]^{Alt} = \left\{ \begin{array}{c} A, B, C, \\ A \,\&\, B, B \,\&\, C, C \,\&\, A, \\ A \,\&\, B \,\&\, C \end{array} \right\}$

b. $[\![\text{John predicts [Ans [which students will come]]}]\!]^{\text{Alt}}$

$$= \left\{ \text{John predicted } p \;\middle|\; p \in \left\{ \begin{array}{c} A, B, C \\ A \,\&\, B, B \,\&\, C, C \,\&\, A \\ A \,\&\, B \,\&\, C \end{array} \right\} \right\}$$

(12) $[\![(9c)]\!]^w = 1$ iff [John predicted A & B] & ¬[John predicted A & B & C]

3 Problems: emotive factives

(13) **The existence of WE and the lack of SE for *be surprised***

[**Situation**: There are three students, Ann, Bill and Chris. Ann and Bill came but Chris didn't. John had expected that Ann, Bill and Chris would come.]

a. John was surprised which students came. (Judgment: **False**)

b. John was surprised which students didn't come. (Judgment: **True**)

(14) **The existence of WE and the lack of SE for *be happy***

[**Situation**: John is holding a party and invited all five students, i.e., Ann, Bill, Chris, Dana and Emma. John will be happy if at least one of Ann, Bill and Chris comes, but it doesn't matter to him whether the other two students come. At the party, only Ann and Bill showed up, which made John happy.]

a. John is happy which students came. (Judgment: **True**)

b. John is happy which students didn't come. (Judgment: **False**)

(Heim 1994; Beck and Rullmann 1999)

4 Proposal: a unified derivation

(15) EXH **is syntactically banned from the embedded position**

a. John predicted [Ans [which students would come]]. $\rightsquigarrow$ **WE**

b. *John predicted [EXH [Ans [which students would come]]]. $\rightsquigarrow$ **SE**

c. EXH [John predicted [Ans [which students would come]]]. $\rightsquigarrow$ **IE**

(16) a. V is UPWARD MONOTONIC iff
for any propositions p, p', if $p \Rightarrow p'$, then John $Vs\ p \Rightarrow$ John $Vs\ p'$

b. V is DOWNWARD MONOTONIC iff
for any propositions p, p', if $p \Rightarrow p'$, then John $Vs\ p' \Rightarrow$ *John Vs p*

c. V is NON-MONOTONIC iff
V is neither upward monotonic nor downward monotonic.

(17) **Upward monotonicity of cognitive/communication predicates**

a. John **{predicted/knows}** that Ann and Bill would came.
$\Rightarrow$ John **{predicted/knows}** that Ann would came.

b. John **{predicted/knows}** that Ann would came.
$\Rightarrow_s$ John **{predicted/knows}** that Ann and Bill would came.

($\Rightarrow_s$: STRAWSON-ENTAILMENT)[1]

(18) **Non-monotonicity of emotive factives**

a. John **is happy** that Ann and Bill came. $\not\Rightarrow$ John **is happy** that Ann came.

b. John **is happy** that Ann came. $\not\Rightarrow_s$ John **is happy** that Ann and Bill came.

(19) **Derivation of an SE reading from (15c) via the excluded-middle assumption**

(i) **IE:** John predicted that Ann and Bill came and
it is not the case that he predicted that Chris came.

(ii) **Excluded-middle assumption**: John had determinate predictions about whether Ann came, whether Bill came and whether Chris came.

[1]Strawson-entailment $\models_s$ is defined as follows:

(i) $\varphi \Rightarrow_s \psi_\pi \Leftrightarrow \varphi \,\&\, \pi \Rightarrow \psi$ (where ψ_π asserts ψ and presupposes π).

(i) & (ii) John predicted that Ann and Bill came and he predicted that Chris didn't come. (= **SE**)

(20) **Semantic account of neg-raising**:
John doesn't think that Ann came.
(i) **The wide-scope negation interpretation**: It is not the case that John thinks that Ann came.
(ii) **Excluded-middle assumption**: John thinks that Ann came, or John thinks that Ann didn't come.
(i) & (ii) John thinks that Ann didn't come. (= **The 'neg-raising' interpretation**)

(21) **Predicates do not exhibit neg-raising**
a. John didn't **write down** that Ann came.
⇏ John **wrote down** that Ann didn't come.
b. John didn't **publicize** that Ann came.
⇏ John **publicized** that Ann didn't come.
c. John didn't **read** that Ann came.
⇏ John **read** that Ann didn't come.

(22) **The same predicates lack SE readings**
a. John **wrote down** which numbers between 10-20 are prime.
⇏ John **wrote down** that non-primes between 10-20 are not prime.
b. John **publicized** which numbers between 10-20 are prime.
⇏ John **publicized** that non-primes between 10-20 are not prime.
c. John **read** which numbers between 10-20 are prime.
⇏ John **read** that non-primes between 10-20 are not prime.

5 Challenges

(23) **Distinct nature of the alternatives (Independence from focus alternatives)**
[**Situation**: There are three students, Ann, Bill and Chris.
Professor Jones only invited Ann and Bill and Professor Lee only invited Chris.]
John predicted [which students [Professor Jones]$_F$ would invite].
a. ⇝ ¬[John predicted that **Professor Jones** would invite Ann, Bill and Chris].
b. ??⇝ ¬[John predicted that **Professor Lee** would invite Ann and Bill].

(24) **Non-global scope**
a. At least one student predicted who came. (K&R: 16)
⇏ No student made any actually false prediction.
b. John frequently predicted which students would come.
⇏ John frequently made true predictions about who would come and infrequently made false predictions about who would come.

(25) **VP scope of** EXH
John EXH [$_{VP}$ predicted [which students would come]].

References

Beck, Sigrid and Hotze Rullmann. 1999. A flexible approach to exhaustivity in questions. *Natural Language Semantics* 7:249–298.

Chierchia, Gennaro, Danny Fox, and Benjamin Spector. 2012. Scalar implicature as a grammatical phenomenon. In C. Maienborn, K. von Heusinger, and P. Portner, eds., *Semantics: An International Handbook of Natural Language Meaning*, vol. 3, 2297–2332. Berlin: Mouton de Gruyter.

Fox, Danny. 2007. Free choice disjunction and the theory of scalar implicatures. In U. Sauerland and P. Stateva, eds., *Presupposition and Implicature in Compositional Semantics*, 71–120. New York: Palgrave Macmillan.

Grice, H. Paul. 1975. Logic and conversation. In P. Cole and J. Morgan, eds., *Syntax and Semantics*, vol. 3: *Speech Acts*, 43–58. New York: Academic Press.

Hamblin, Charles L. 1973. Questions in Montague English. *Foundations of Language* 10(1):41–53.

Heim, Irene. 1994. Interrogative semantics and Karttunen's semantics for *know*. In *Proceedings of IATL 1*, 128–144.

Horn, Laurence R. 1972. *On the Semantic Properties of Logical Operators in English*. Ph.D. thesis, UCLA.

Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics and Philosophy* 1(1):3–44.

Klinedinst, Nathan and Daniel Rothschild. 2011. Exhaustivity in questions with non-factives. *Semantics and Pragmatics* 4(2):1–23.

Matsumoto, Yo. 1995. The conversational condition on Horn scales. *Linguistics and Philosophy* 18:21–60.