EXHAUSTIVITY & FREE CHOICE

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Consider the well-known *free choice effect*:

(1) a. You may take the dancing class or the juggling class.
b. $\rightsquigarrow$ You may take the dancing class.
c. $\rightsquigarrow$ You may take the juggling class.

Although the facts in (1) have been recognized since at least von Wright 1968, we are still lacking an adequate account of them. One possible strategy would be to say that *somehow*, the truth-conditions of (1a) are those of:

See also Kamp 1973.

Arguably, the problem also arises if disjunction takes widest scope—cf. Zimmermann 2000:

(2) a. You may take the dancing class or you may take the juggling class.
b. $\rightsquigarrow$ You may take the dancing class.
c. $\rightsquigarrow$ You may take the juggling class.

(3) $\Diamond \mathtt{D} \wedge \Diamond \mathtt{J}$.

But if the truth-conditions of (1a) were those of (3), we would be hard pressed to avoid predicting that

(4) [[No student]$_i$ [t$_i$ may take the dancing class or the juggling class.]]

has the truth-conditions of:

(5) $\neg \exists x(\mathtt{student}(x) \wedge \Diamond(\mathtt{D}(x) \wedge \mathtt{J}(x)))$.

And the problem with this prediction is that, unlike (5), (4) does not seem compatible with

Cf. Kratzer & Shimoyama 2002, Alonso-Ovalle 2005.

(6) Some student may take the dancing class.

A second possibility is that the inferences in (1) are implicatures of some kind or other. Now, this strategy seems unavailable to the Neo-Gricean. For ALT(1a) will be the following set:

(7) $\{\Diamond(\mathtt{D} \vee \mathtt{J}) \Diamond \mathtt{D}, \Diamond \mathtt{J}, \Diamond(\mathtt{D} \wedge \mathtt{J}), \Box(\mathtt{D} \vee \mathtt{J}), \Box \mathtt{D}, \Box \mathtt{J}, \Box(\mathtt{D} \wedge \mathtt{J})\}$.

And on any reasonable interpretation of $\Diamond$, each of

(8) a. $\Diamond \mathtt{D}$.
b. $\Diamond \mathtt{J}$.

asymmetrically entails (1a). So the Neo-Gricean story would predict the following primary implicature:

Given our limited discussion of Spector 2007, we are not in a position to determine whether this is also a consequence of that view. But it is clearly a consequence of the view in Sauerland 2004.

(9) a. $\neg \mathtt{B} \Diamond \mathtt{D}$.
b. $\neg \mathtt{B} \Diamond \mathtt{J}$.

essentially contradicting the inferences in (1b) and (1c).

Can the grammatical approach do any better? Before answering this question, let me make a few adjustments to our working definitions.

Last week, we worked with the following entry for EXH. First, we had:

(10) $[\![\text{EXH}]\!]_c(X)(p) := \lambda w.p(w) = 1$ and $\forall q \in X,\ q(w) = 1 \to p \subseteq q$.

We then fixed:

(11) a. $\text{NW}(\varphi) := \{[\![\psi]\!] : \psi \in \text{ALT}_c(\varphi)$ and $[\![\varphi]\!] \notin [\![\psi]\!].\}$
b. $A_\varphi := \{p \in \text{NW}(\varphi) : \forall q \in \text{NW}([\![\varphi]\!])([\![\varphi]\!] \cap \neg p \notin q)\}$
c. $[\![\text{EXH}\ \varphi]\!] = [\![\text{EXH}]\!](A_\varphi)([\![\varphi]\!])$.

However, for reasons that will become apparent later on, we need to adopt an alternative definition:

(12) a. $\text{NW}(X, p) := \{q \in X : p \notin q\}$
b. $\mathcal{E}(X, p) := \{q \in \text{NW}(X, p) : \forall r \in \text{NW}(X, p)(p \cap \neg q \notin r)\}$.
c. $[\![\text{EXH}]\!]_c(X)(p) := \lambda w.p(w) = 1$ and $\forall q \in \mathcal{E}(X, p),\ q(w) = 0$
d. $\text{ALT}^*(\varphi) = \{[\![\psi]\!] : \psi \in \text{ALT}(\varphi)\}$.
e. $[\![\text{EXH}\ \varphi]\!] = [\![\text{EXH}]\!](\text{ALT}^*(\varphi))([\![\varphi]\!])$.

I will sometimes write $\mathcal{E}(\varphi)$ instead of $\mathcal{E}(\text{ALT}(\varphi), [\![\varphi]\!])$, and $\text{NW}(\varphi)$ for $\text{NW}(\text{ALT}(\varphi), [\![\varphi]\!])$.

There is an implicit assumption here that, on a Neo-Gricean story, any implicature of a sentence (other than ignorance implicatures) is derived from the assumption that the speaker must believe in the relevant implicature. Thus, for a Neo-Gricean to derive (1b) and (1c) from an utterance of (1a), she must derive the negation of each of (9a) and (9b).

ITERATED EXHAUSTIFICATION AND FREE CHOICE EFFECTS

Let us start by noting that we cannot derive the free choice effects from the following LF.

(13) $\Diamond\ \text{EXH}(\mathtt{D} \vee \mathtt{J})$.

For (13) will be equivalent to

(14) $\Diamond((\mathtt{D} \vee \mathtt{J}) \wedge \neg(\mathtt{D} \wedge \mathtt{J}))$.

which is consistent with the negation of (8a) and that of (8b).

Note that, on this reading, we predict that (1a) entails that you are not required to take both classes, but not that you are not allowed to take both.

Placing the exhaustivity operator in matrix position will not help either:

(15) $\text{EXH}\ \Diamond(\mathtt{D} \vee \mathtt{J})$.

Using the definition in (12), we first check that the prejacent of (15), which is just:

(16) $\Diamond(\mathtt{D} \vee \mathtt{J})$,

generates the following set of scalar alternatives (for now, let us ignore the alternatives triggered by $\Diamond$):

Here is the full story, including the alternatives triggered by the modal. The set of non-weaker alternatives includes, in addition to those in (17), each of the following:

$$\Box\mathtt{D}, \Box\mathtt{J}, \Box(\mathtt{D} \vee \mathtt{J}), \Box\mathtt{D} \wedge \mathtt{J}.$$

$\mathcal{E}((16))$ would then be:

$$\{[\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!], [\![\Box\mathtt{D}]\!], [\![\Box\mathtt{J}]\!], [\![\Box(\mathtt{D} \vee \mathtt{J})]\!], [\![\Box(\mathtt{D} \wedge \mathtt{J})]\!]\}.$$

The conjunction of the negations of each of these sentences is consistent with (16). Hence, we predict that (15) is equivalent to:

$$\Diamond(\mathtt{D} \vee \mathtt{J}) \wedge \neg \Diamond (\mathtt{D} \wedge \mathtt{J}) \wedge \Diamond(\neg(\mathtt{D} \vee \mathtt{J})).$$

(17) $\{\Diamond(\mathtt{D} \vee \mathtt{J}), \Diamond\mathtt{D}, \Diamond\mathtt{J}, \Diamond(\mathtt{D} \wedge \mathtt{J})\}$.

We then have:

(18) $\text{NW}(16) = \{[\![\Diamond\mathtt{D}]\!], [\![\Diamond\mathtt{J}]\!], [\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!]\}$.

As a result, since $\neg\Diamond\,\mathtt{D}$ and $\Diamond(\mathtt{D} \vee \mathtt{J})$ entails $\Diamond\mathtt{J}$ (and ditto for $\neg\Diamond\,\mathtt{J}$ and $\Diamond\mathtt{D}$) we have:

(19) $[\![(15)]\!] = [\![\Diamond(\mathtt{D} \vee \mathtt{J}) \wedge \neg\Diamond\,(\mathtt{D} \wedge \mathtt{J})]\!]$.

Hence, (15), much like (13), is compatible with the negation of (8a) and that of (8b).

Surprisingly, however, adding yet *another* exhaustivity operator yields the desired result. The computation is not quite straightforward, so it is worth going through it step by step. The LF we want to interpret is this:

(20) [[EXH R_1][[EXH R_2] You may take the dancing class or the juggling class.]].

We have already computed semantic value of the prejacent of the matrix EXH, in (19). What we need now is to compute the value of R_1. This will be the set of propositions expressed by sentences of the form:

It is here that the difference between the new and the old entries for EXH shows up. In computing the alternatives to (15), we need to hold fixed the value of R_2.

(21) $[\![\text{EXH}]\!](\text{ALT}^*(16))(p)$.

where p is in $\text{ALT}^*(16)$.

We thus need to determine the value of $\mathcal{E}(\text{ALT}^*(16), p)$ for each $p \in \text{ALT}^*(16)$:

(22) a. $\mathcal{E}(\text{ALT}^*(16), [\![\Diamond\mathtt{D}]\!]) = \{[\![\Diamond\mathtt{J}]\!], [\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!]$.
b. $\mathcal{E}(\text{ALT}^*(16), [\![\Diamond\mathtt{J}]\!]) = \{[\![\Diamond\mathtt{D}]\!], [\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!]$.
c. $\mathcal{E}(\text{ALT}^*(16), [\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!]) = \varnothing$.

Hence:

(23) a. $[\![\text{EXH}]\!](\text{ALT}^*(16))([\![\Diamond\mathtt{D}]\!]) = [\![\Diamond\mathtt{D} \wedge \neg\Diamond\,\mathtt{J}]\!]$.
b. $[\![\text{EXH}]\!](\text{ALT}^*(16))([\![\Diamond\mathtt{J}]\!]) = [\![\Diamond\mathtt{J} \wedge \neg\Diamond\,\mathtt{D}]\!]$.
c. $[\![\text{EXH}]\!](\text{ALT}^*(16))([\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!]) = [\![\Diamond(\mathtt{D} \wedge \mathtt{J})]\!]$.

Now, each of the propositions in (23) are in $\mathcal{E}(\text{ALT}^*(15), [\![(15)]\!]$, the following set of sentences is consistent:

Note that

$$\neg(\Diamond\mathtt{D} \wedge \neg\Diamond\,\mathtt{J}) \wedge \neg(\Diamond\mathtt{J} \wedge \neg\Diamond\,\mathtt{D})$$

is equivalent to

$$\Diamond\mathtt{D} \leftrightarrow \Diamond\mathtt{J}.$$

And

$$\Diamond(\mathtt{D} \vee \mathtt{J}) \wedge \Diamond\mathtt{D} \leftrightarrow \Diamond\mathtt{J}$$

is equivalent to

$$\Diamond\mathtt{D} \wedge \Diamond\mathtt{J}.$$

Cf. Kratzer & Shimoyama 2002.

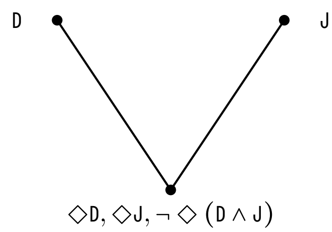
(24) $\{\neg(\Diamond\mathtt{D} \wedge \neg\Diamond\,\mathtt{J}), \neg(\Diamond\mathtt{J} \wedge \neg\Diamond\,\mathtt{D}), \neg\Diamond\,(\mathtt{D} \wedge \mathtt{J}), \Diamond(\mathtt{D} \vee \mathtt{J})\}$.

as is witnessed by the following simple model:

This means that (20) is equivalent to:

(25) $\Diamond(\mathtt{D} \vee \mathtt{J}) \wedge \neg\Diamond\,(\mathtt{D} \wedge \mathtt{J}) \wedge \neg(\Diamond\mathtt{D} \wedge \neg\Diamond\,\mathtt{J}) \wedge \neg(\Diamond\mathtt{J} \wedge \neg\Diamond\,\mathtt{D})$,

which in turn is equivalent to:



(26) $\Diamond \mathsf{D} \wedge \Diamond \mathsf{J} \wedge \neg \Diamond (\mathsf{D} \wedge \mathsf{J})$.

This gives us the desired free-choice inferences. But one is left wondering: why does the preferred reading of (1a) contain *two* exhaustivity operators?

IGNORANCE IMPLICATURES AND ITERATED EXHAUSTIFICATION

One of the advantages of the proposal in Sauerland 2004 is that it predicted the so-called *ignorance implicatures*:

(27) a. Seth will take the dancing class or the juggling class.
b. $\neg\mathsf{B}$(Seth will take the dancing class).
c. $\neg\mathsf{B}$(Seth will take the juggling class).

In contrast, the grammatical approach by itself is silent on this.

The grammatical approach needs to be supplemented with a broadly Gricean, pragmatic story in order to generate ignorance implicatures. In contrast with the Neo-Gricean approach, however, this story can rely on a formulation of QUANTITY that is not sensitive to the syntactic structure of the uttered sentence.

Cf. Fox 2007, p. 77.

Recall that the symmetry problem arises only because we were using the Gricean reasoning to move from the ignorance implicature to what are essentially secondary implicatures—which in turn correspond to the observed scalar implicatures. On the present approach, the derivation of scalar implicatures does not proceed via the derivation of ignorance implicatures, and hence we do not face a symmetry problem.

(28) BASIC QUANTITY INFERENCE: If ψ asymmetrically entails φ and ψ is relevant to the question under discussion in *c*, then an utterance of φ in *c* implicates $\neg\mathsf{B}\psi$.

What is the relationship between the presence (or absence) of exhaustivity operators and BASIC QUANTITY INFERENCE? One possible story:

(29) A covert EXH is disallowed unless the result generates fewer ignorance implicatures.

Fox 2007. Cf. Fox & Spector 2015.

On this account, additional layers of exhaustification are in general disallowed, unless they eliminate ignorance implicatures.

Cf. Chierchia 2004 on the claim that stronger readings are preferred, as well as the 'Strongest Meaning Hypothesis' in Chierchia, Fox & Spector 2012, p. 2327.

(30) a. Seth will bring tea or coffee.
(i) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring tea).
(ii) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring coffee).
(iii) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring tea and coffee).

(iv) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring tea or coffee but not both).

b. [[EXH R_1] Seth will bring tea or coffee].

(i) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring tea).

(ii) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring coffee).

(iii) $\rightsquigarrow \neg\mathsf{B}$(Seth will bring tea and coffee).

And we can check that adding an additional exhaustivity operator to (30b) results in the same ignorance implicatures, since embedding (30b) in an additional exhaustivity operator does not affect its truth-conditions:

(31) a. [[EXH R_2] [[EXH R_1] Seth will bring tea or coffee]]

b. $X = \textsc{alt}^*(30a) = \{[\![\mathtt{T} \vee \mathtt{C}]\!], [\![\mathtt{T}]\!], [\![\mathtt{C}]\!], [\![\mathtt{T} \wedge \mathtt{C}]\!]\}$

c. $[\![\textsc{exh}]\!](X)(\mathtt{T} \vee \mathtt{C}) = [\![(\mathtt{T} \vee \mathtt{C}) \wedge \neg(\mathtt{T} \wedge \mathtt{C})]\!]$.

d. $[\![\textsc{exh}]\!](X)(\mathtt{T}) = [\![\mathtt{T} \wedge \neg\mathtt{C}]\!]$.

e. $[\![\textsc{exh}]\!](X)(\mathtt{C}) = [\![\mathtt{C} \wedge \neg\mathtt{T}]\!]$.

f. $[\![\textsc{exh}]\!](X)(\mathtt{C} \wedge \mathtt{T}) = [\![\mathtt{T} \wedge \mathtt{C}]\!]$.

g. $Y = \textsc{alt}^*(30b) = \{[\![(\mathtt{T} \vee \mathtt{C}) \wedge \neg(\mathtt{T} \wedge \mathtt{C})]\!], [\![\mathtt{T} \wedge \neg\mathtt{C}]\!], [\![\mathtt{C} \wedge \neg\mathtt{T}]\!], [\![\mathtt{T} \wedge \mathtt{C}]\!]\}$

h. $\mathcal{E}(Y, [\![(30b)]\!] = \{[\![\mathtt{T} \wedge \mathtt{C}]\!]\}$.

i. $[\![(31a)]\!] = [\![(30b)]\!]$.

In contrast, iterating an exhaustivity operator as in (20) does end up ruling out some ignorance implicatures, since (20) (which I repeat below as (32a)) is strictly stronger than (15) (which I repeat below as (32b)):

(32) a. EXH(You may take the dancing class or the juggling class).

(i) $\rightsquigarrow \neg\mathsf{B}$(You may take the dancing class).

(ii) $\rightsquigarrow \neg\mathsf{B}$(You may take the juggling class).

(iii) $\rightsquigarrow \neg\mathsf{B}$(You may take the dancing class and the juggling class).

b. EXH EXH(You may take the dancing class or the juggling class).

(i) $\not\rightsquigarrow \neg\mathsf{B}$(You may take the dancing class).

(ii) $\not\rightsquigarrow \neg\mathsf{B}$(You may take the juggling class).

(iii) $\rightsquigarrow \neg\mathsf{B}$(You may take the dancing class and the juggling class).

That the second exhaustivity operator is not disallowed does not, of course, suggest that the reading in (32b) should be preferred. Why then is that the preferred reading?

Two possibilities:

- The additional exhaustivity operator is added in order to avoid implausible ignorance implicatures—in this case, the implicature that the speaker is does not have a view on whether you may take the dancing class or on whether you may take the juggling class.
- The additional exhaustivity operator is added because it results in strenghtening, and stronger meanings should be preferred (cf. Chierchia, Fox & Spector

Cf. Fox 2007. These ignorance implicatures may seem implausible either because we think the speaker is an authority on the matter or because we engage in a bit of 'meta-pragmatic' reasoning (cf. Kratzer & Shimoyama 2002, Alonso-Ovalle 2005): if the speaker had just said 'You may take the dancing class' she would have implicated the negation of 'You may take the juggling class' (and vice-versa). That she did not utter eiher of those would thus suggest that she believes that the potential implicatures are not true, which is just the negation of the ignorance implicatures.

2012).

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