Free Choice Disjunction as a Rational Speech Act

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Proposal

Goal: Derive Free Choice Inference (FCI) and Exclusivity Inference (EI) using the Rational Speech Acts Framework (RSA, Frank & Goodman 2012).

Main Contribution: Reconciling exhaustification based models (Fox, 2007) with game-theoretic accounts in the style of iterated best response (Franke, 2011).

Technical Innovation: Incorporating lexical uncertainty in the style of Bergen et al. (2016) in order to derive Free Choice within RSA.

Introduction

Free Choice Inference (FCI):

(1) You may take an apple or a pear.
   a. ⇝ You may take an apple.
   b. ⇝ You may take a pear.

Exclusivity Inference (EI):

(2) You may take an apple or a pear.
   a. ⇝ You may not take both.

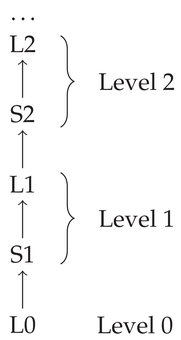
The RSA Framework

Communication is modeled as a speaker and a listener recursively reasoning about each other's goals and behavior.

$$P_{listener\,0}(w|u, [\![\cdot]\!]_i) \propto [[u]]_i(w)P(w)$$
$$P_{speaker\,1}(u|w, [\![\cdot]\!]_i) \propto \left[P_{listener\,0}(w|u, [\![\cdot]\!]_i)\right]^{\alpha}$$
$$P_{listener\,1}(w|u) \propto P(w)\sum_{[\![\cdot]\!]_i} P_{speaker\,1}(u|w, [\![\cdot]\!]_i)$$
$$P_{speaker\,n}(u|w) \propto \left[P_{listener\,(n-1)}(w|u)\right]^{\alpha} \qquad (n > 1)$$
$$P_{listener\,n}(w|u) \propto P(w)P_{speaker\,n}(u|w)$$

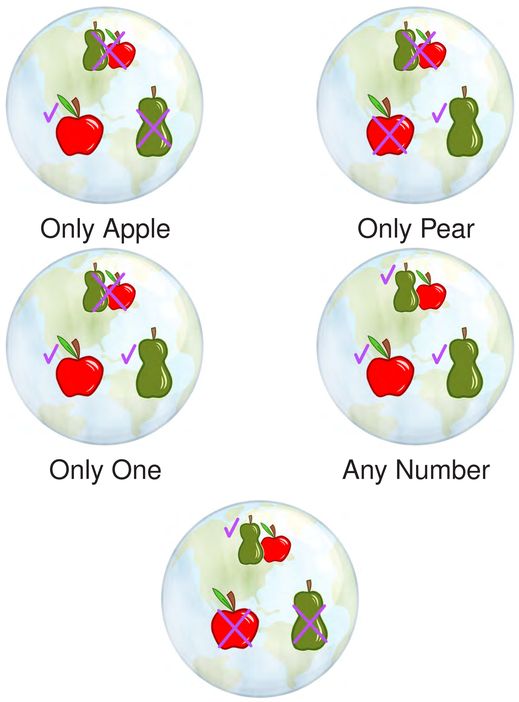
Where:

$[\![\cdot]\!]_i$: Utterance-meaning mapping
u: Utterance
w: World state
α: Temperature



World States

We assume the following state space:



Utterances & Meanings

	Only Apple	Only Pear	Only One	Any Number	Only Both
$[\![$You may take an apple$]\!]_i$					
$[\![\cdot]\!]_1$	1	0	1	1	1
$[\![\cdot]\!]_2$	1	0	1	1	0
$[\![\cdot]\!]_3$	1	0	0	0	0
$[\![$You may take a pear$]\!]_i$					
$[\![\cdot]\!]_1$	0	1	1	1	1
$[\![\cdot]\!]_2$	0	1	1	1	0
$[\![\cdot]\!]_3$	0	1	0	0	0
$[\![$You may take an apple or a pear$]\!]_i$					
$[\![\cdot]\!]_1$	1	1	1	1	1
$[\![\cdot]\!]_2$	1	1	1	1	0
$[\![\cdot]\!]_3$	1	1	1	1	0
$[\![$You may take an apple and a pear$]\!]_i$					
$[\![\cdot]\!]_1$	0	0	0	1	1
$[\![\cdot]\!]_2$	0	0	0	1	1
$[\![\cdot]\!]_3$	0	0	0	0	1

Deriving Free Choice and Exclusivity Inferences

We derive FCI and EI from pragmatics. We also derive the comparative weakness of EI relative to FCI.

Deriving FCI: A model that assigns (near-)zero probability to the worlds Only Apple, Only Pear, and Only Both upon hearing the disjunction can be considered to have derived FCI.

- Our model derives FCI for the level-1 pragmatic listener. Here we show L1 with uniform priors.

Utterance \ State	Only Apple	Only Pear	Any Number (FCI, no EI)	Only One (FCI, EI)	Only Both
"You may take an apple"	1	0	0	0	0
"You may take a pear"	0	1	0	0	0
"You may take an apple or a pear"	**0**	**0**	**0.5 (0)**	**0.5 (1)**	**0**
"You may take an apple and a pear"	0	0	0 (0.5)	0	1 (0.5)

Deriving EI: Assigning a low probability to the Any Number world upon hearing the disjunction.

- With uniform priors as above, we do not derive EI.
- To explain why EI is weaker than FCI, it should be possible to derive free choice and still assign a high probability to the Any Number world.
- In our model, EI arises when we assume non-uniform priors. E.g., doubling the prior on the Only One world shifts posterior probability to it, away from Any Number (see the violet numbers).
- Similarly boosting priors of the Only Apple or Only Pear worlds barely affects their posteriors.

The Point: The listener always derives FCI (Any Number, Only One). Whether or not EI arises is dependent on the prior. High/low priors on the Any Number world correspond to high/low posteriors.

Comparison with Previous Work

Fox (2007):

- Fox licenses Exh insertion whenever it eliminates ignorance inferences. This is not enough to rule out LFs that are actually unavailable, such as $\diamond\text{Exh}(A \vee B)$, which don't give rise to free choice.
- Our model derives the absence of free choice under negation, whereas Chierchia (2013) notes that Fox (2007) doesn't explain why Exh can't be inserted under negation.

Franke (2011):

- For Franke, L1 expects the speaker never to use the disjunction. If the speaker uses it nonetheless, Franke stipulates that L1 interprets disjunction literally; L2 then reasons that the speaker would prefer this message only in the Only One world.

References

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