Background: The Nature of Pragmatic Inference

- Pragmatics concerns context-dependent inferences (generally assumed to be linked to rational use of language by situated agents).
- How is this done (beyond and independent of particular algorithms, e.g., Gricean conversational maxims, relevance theory or argumentation theory)?

Mind-Reading
(see, e.g., Sperber and Wilson, 2002)
- Figure out epistemic state of interlocutors
- Determine inferences based on inferred epistemic state of addressee

Simulation Theory
(see, e.g., Carruthers and Smith, 1996, p. 3)
- Assume that interlocuter has same epistemic state as yourself
- Simulate likely inferences

- Difference might matter when agents’ epistemic contexts are not identical, that is, when they do not know and believe the same things (in real life: always)
- Not clear to which degree Mind-Reading is assumed to be psychologically real
- Mind-Reading is slow and error-prone (especially when agents share little common ground)

Epistemically Heterogeneous Social Networks

- Humans are an unusually social and cooperative species (for primates). As a consequence, all language learning (and most of language use) takes place in social networks.
- Linguistic theory is concerned primarily with an ideal speaker-listener, in a completely homogeneous speech community [...] (Chomsky 1965, p. 3)

- This position necessarily ignores everything related to variation
- Variation is a key ingredient in language change
- Two kinds of heterogeneity will be investigated:
  - contact in social networks; and
  - partly differing epistemic contexts.

Reinforcement Learning with Polya Urns

- Polya-Urns provide a mathematical model of reinforcement learning.
- Randomly draw a ball from the urn.
- If the ball corresponds to the correct answer, a further ball will be added to the urn.

Learning Internally Differentiated Lexical Items

- I assume internally differentiated lexical representations like Pasteur’s qualia structure.

Mutation

- At some point in simulation: change in the surrounding world → agents adapt lexical representations
- In a submeanings, two types are distinguished (Types keeps weight; Types initialized at 1)
- Instead of four submeanings, agents discriminate five different submeanings
- Epistemic state of mutants is superset of epistemic state of non-mutants

General Pattern: Absence of Mutation vs. Mutation (Regardless of Inference Method)

- Agents discard for production parts of their own epistemic state the interlocutor lacks

Pragmatics in Production

Mind-Reading Inferences

- Agents always take into account their full epistemic state for production

Simulation Inferences

- Significant differences (p-values taken from Kruskal-Wallis test for network of 3 x 10 agents):
  
<table>
<thead>
<tr>
<th>Mind-Reading</th>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCAt1</td>
<td>CCWMCt1</td>
</tr>
<tr>
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<td>PCt1</td>
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<tr>
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Mind-Reading Increases Lexical Distance

- With Mind-Reading inference, the lexical distance between agents of different islands is bigger than with Simulation inference
- Because Mind-Readers discard non-shared epistemic states, they leave a smaller footprint of their epistemic differences
- All things being equal, the less agents take into account other’s epistemic states, the more similar they become

Acknowledgments & Sample References

All simulations have been performed with the Common Lisp, using the graph library by Eric S. Schwartz (http://graphlib.sourceforge.net/). Networks have been drawn with GraphU (Gansner and North, 2000). Data analysis has been performed with GNU R.