Discussion of Rohde et al. (2012) and Degen, Franke & Jäger (2013)

Meilin Zhan
October 29, 2014

Rohde, Seyfarth, Clark, Jaeger & Kaufmann (2012)

- High-level question: What are the predictions regarding which form-meaning mappings interlocutors will converge on?
- Evaluates alignment in a communication game with explicit superimposed costs and rewards for production and comprehension.

- Game-theoretic predictions in linguistic communication:

Figure 1. Various costs in referring expressions

  - ➢ *What are your predictions regarding the way interlocutors use low-cost ambiguous and high-cost unambiguous referring expressions? How do these predictions relate to implicatures in Grice (1975) and Levinson (2000)?*

- Experiment 1: Communicating about objects with divergent costs
  - 8 referential expressions – 6 unambiguous names that have various costs, and 2 low-cost ambiguous words.

Name	*Cost*	*Name*	*Cost*
"Rose"	-60	"Apple Tree"	-60
"Daisy"	-120	"Palm Tree"	-120
"Tulip"	-280	"Pine Tree"	-250
"Flower	-80	"Tree"	-80

Table 1. Referring expressions and their costs in Exp. 1

  - Sender's task: send a message to the Receiver; Receiver's task: guess what object the Sender intended.
  - Shared knowledge in the game

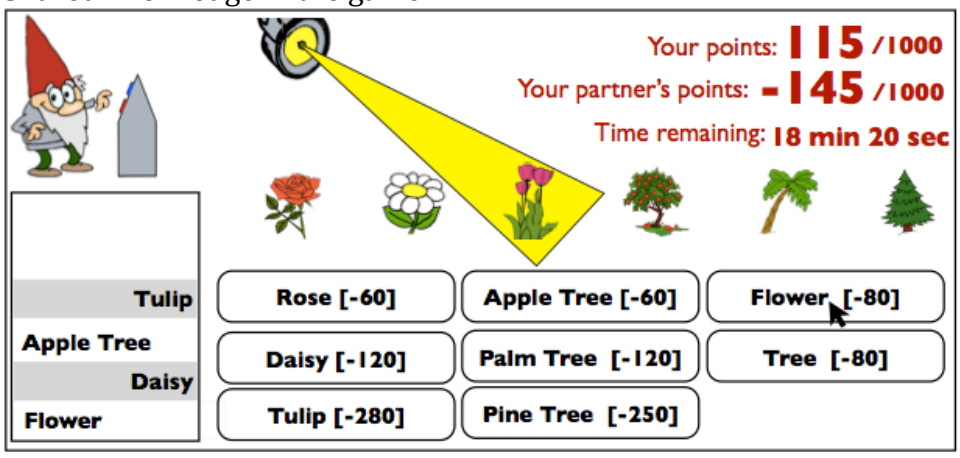


Figure 2. Interactive game environment in Exp.1&2

- Results & Analysis
  - Production (whether the Sender sent an ambiguous word)~***cost*** (the target object's unambiguous cost)
  - Comprehension (whether an ambiguous word resulted in successful communication)~***cost*** (the target object's unambiguous cost)
  - Interpretation of ambiguous words ~ ***trial number***

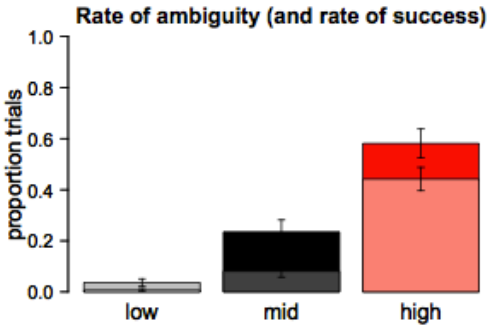


Figure 3. Rate of ambiguity and success

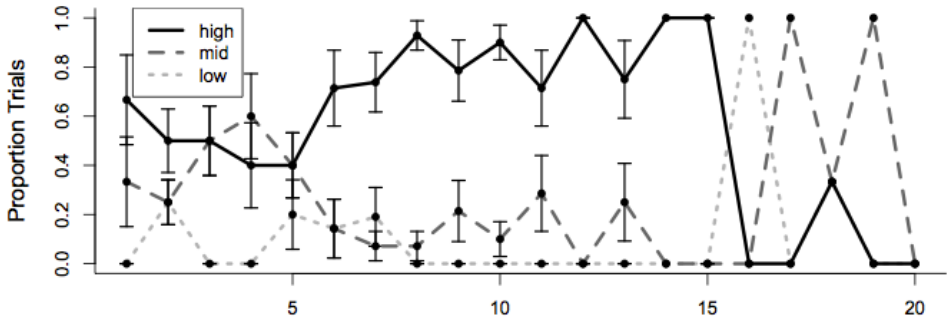


Figure 4. Interpretation of ambiguous words over trials

- Experiment 2: Communicating about object with similar costs
  - Game environment was identical with Experiment 1 except the costs.

Name	*Cost*	*Name*	*Cost*
"Rose"	-80	"Apple Tree"	-80
"Daisy"	-140	"Palm Tree"	-135
"Tulip"	-165	"Pine Tree"	-170
"Flower	-80	"Tree"	-80

  - Prediction: the revised costs may reduce the likelihood that players would coordinate their use of referring expressions.
  - Results: lower costs did not reduce players' motivation to conventionalize.
    - ➢ *Why the results are different from the prediction? What are the possible explanations?*

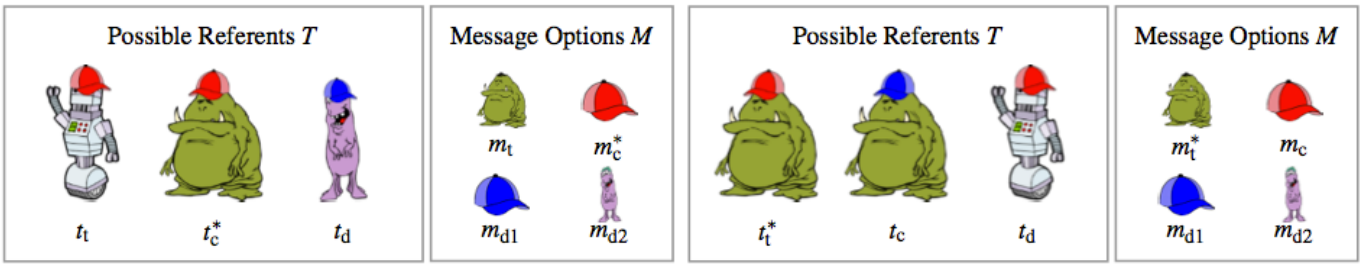
- General discussion
  - Sensitivity to relative costs
    - ➢ *How should production cost be measured?*
      - Future work: costs that are imposed naturally in regular conversation

Degen, Franke & Jäger (2013)

- High-level questions: How much do speakers and listeners take into account each other's perspective? How much influence do economy considerations have; do listeners weigh the speaker's production costs? (p. 376)

- Presents experimental data about production and comprehension of ambiguous referential expressions in an artificial language game
- Proposes a probabilistic model of back-and-forth reasoning that synthesizes Bayesian models and game theoretic approaches

- Referential language games



➢ *What are simple condition and complex condition? How does one draw inference in these conditions?*

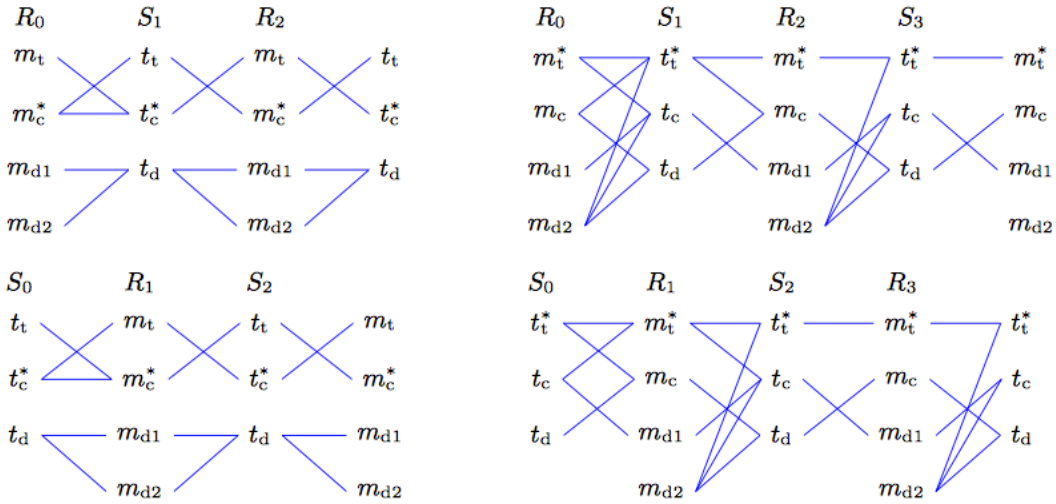
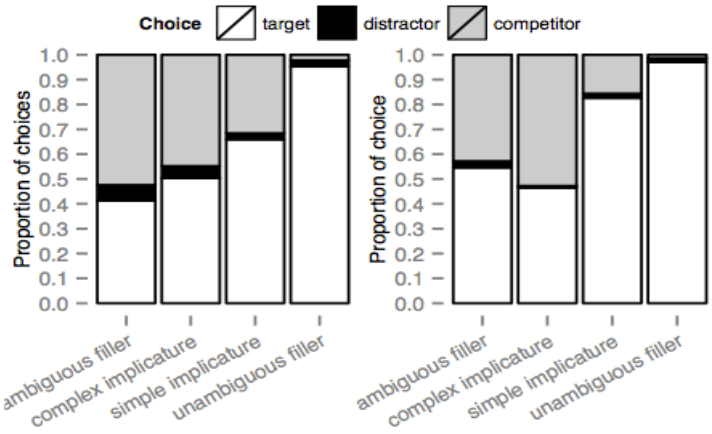


Figure 5. Qualitative predictions of the IBR model for simple and complex conditions.

- Experiment 1: Comprehension
  - Language learning stage
  - Inference stage
    - Participants were asked to send one of Zorx words provided in the trial to another participant to get them to pick out the intended object.
  - Results

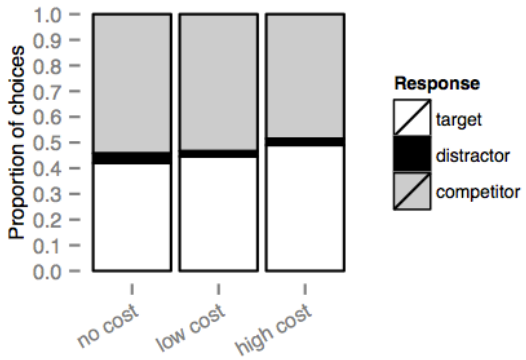


- Experiment 2: Production
  - Language learning stage and Production stage
    - Procedure same as the production trials in Experiment 1

- Experiment 3: Comprehension with costs
  - Tested whether listeners take into account speakers' preferences for producing minimally effort messages
  - Language learning stage, Cost estimation stage, and Inference stage
  - Three cost conditions: NO-COST, LOW-COST and HIGH-COST

$$\underbrace{\{RAV, ZUB, XEK, KOR\}}_{\text{free messages}} \cup \left\{ \underbrace{\begin{matrix}\{XAB, BAZ\} \\ \{XABI, BAZUZE\} \\ \{BAZU, XABIKO\}\end{matrix}}_{\text{costly messages}} \right. \quad \begin{matrix}\text{NO-COST} \\ \text{LOW- and} \\ \text{HIGH-COST}\end{matrix}$$

  - Results



- The Iterated Quantal Response (IQR) Model
  - Signaling games

T	$t_1, \ldots, t_a$	a set of *a* different states (referents)
M	$m_1, \ldots, m_b$	A set of *b* relevant expressions
B	(a, b)	Boolean matrix
c	$c_1, \ldots, c_b$	a vector of costs

  - Strategies
    - Sender strategy σ

- Receiver strategy ρ
- Expected Utilities
  - Sender's expected utilities: $EU(\rho) = T(\rho) - c$
  - Receiver's expected utilities: $EU(\sigma) = \mu(\sigma)$

- Best Responses
  - $BR(U) = N(\max \text{row}(U))$ (U is an expected utility matrix)
- Quantal Responses
  - $QR_\lambda(U_{ij}) \propto \exp(\lambda U_{ij})$ (λ is a rationality parameter)

- IQR
  - Defines a hierarchy of player types
  - Level-0 Sender and Receiver try to implement the literal meaning: $\sigma_0 = QR_\lambda(B - c)$; $\rho_0 = QR_\lambda(T(B)I_a)$
  - Level ($k+1$) player behavior is defined as a quantal repsonse to a belief that the other player is at most of level k.
    $\sigma_{k+1} = QR_\lambda(EU(\rho \leq k))$
    $\rho_{k+1} = QR_\lambda(EU(\sigma \leq k))$
- Model fitting
  - Two free parameters: λ, τ

➢ *Compare this model with the model of Frank and Goodman (2012) and the Iterated Best Response (IBR) model of Jäger (2012), what are the differences?*

References:

Degen, J. and Franke, M. (2012). Optimal reasoning about referential expressions. In S. Brown-Schmidt, J. Ginzburg, and S. Larsson (Eds.), *Proceedings of The 16th Workshop on the Semantics and Pragmatics of Dialogue*, pp. 2 - 11.

Degen, J., Franke, M., & Jäger, G. (2013). Cost-based pragmatic inference about referential expressions. In *Proceedings of the 35th Annual Conference of the Cognitive Science Society* (pp. 376-381).

Frank, M. C., & Goodman, N. D. (2012). Predicting pragmatic reasoning in language games. *Science*, *336*(6084), 998.

Grice, H. (1975). Logic and conversation. *Syntax and Semantics, Vol. 3: Speech Acts*, 41-58.

Jäger, G. (2012). Game theory in semantics and pragmatics. In Maienborn, C., Portner, P., and von Heusinger, K., editors, *Semantics: An International Handbook of Natural Language Meaning*, volume 3 (pp.2487–2516). Berlin: de Gruyter.

Levinson, S. C. (2000). *Presumptive meanings: The theory of generalized conversational implicature*. Cambridge, MA: MIT press.

Rohde, H., Seyfarth, S., Clark, B., Jäger, G., & Kaufmann, S. (2012). Communicating with cost-based implicature: A game-theoretic approach to ambiguity. In *The 16th Workshop on the Semantics and Pragmatics of Dialogue, Paris, September*.