Signaling under uncertainty
Brochhagen, T.S.

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Human rational behavior (and the rational behavior of all physical symbol systems) is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor.

Herbert A. Simon, *Invariants of Human Behavior*

This investigation focused on the effects that solutions to two fundamental problems have on a changing linguistic system. The first problem is that of successful and efficient information transfer between boundedly rational agents. The second problem is that of the transmission of linguistic knowledge from proficient agents to naïve ones, who have not yet come to acquire semantic conventions or pragmatic dispositions to act on them. Solutions to both problems influence each other. The knowledge acquired by learners is, to a large extent, a product of solutions to the first problem. In turn, the linguistic means available to agents to solve the first problem are influenced by what they learn from others. We focused on the bearing of these solutions on conditions under which reliance on pragmatic inference is (not) favored over less equivocal semantic codification of information to be conveyed. In a nutshell, we showed that pragmatic recruitment in tandem with semantic underspecification offers greater flexibility to repurpose linguistic material, and that it can allow for the maintenance of simpler semantics that are easier to learn. In both cases communication comes to leverage contextual information and mutual reasoning – the unsaid – even if matters could be communicated more explicitly. Reversely, low rationality in choice or little variation in the information context provides can lead to stronger reliance on semantics over pragmatics.

In Chapter 3, we analyzed under which conditions safe functional exploitation of semantic ambiguity can come about. In particular, we showed that even when contextual expectations vary from one agent to the next, ambiguity can be a useful property for semantic conventions to harbor; because it allows interlocutors to
flexibly repurpose linguistic material to better suit their communicative preferences. Our analysis predicts that the challenge faced when not having a common contextual prior is overcome if interlocutors interact multiple times, thereby enabling them to adapt their linguistic behavior to each other. These predictions are, by and large, borne out in experimental data.

A particularly interesting issue left open in this chapter concerns the dialoginitial adoption of Anti-Horn-like signaling, as attested in Kanwal et al.’s (2017) data. Neither the model I proposed nor the experimental setup of Kanwal et al. explain this behavior satisfactorily. More importantly, I think that there is more to be said about it than that it is a mere product of chance or error. As stressed in Section 3.5, to understand why speakers start an interaction by associating an infrequent meaning with a preferred form, a better understanding of the formation of contextual expectations and beliefs about them is needed.

Chapters 4 and 5 looked at population-level dynamics at the interface between semantics and pragmatics. Chapter 4 focused on factors that may explain a division of labor between them. In particular, on scalar implicatures and their (lack of) lexicalization. Chapter 5 asked under which contextual conditions of use and learning underspecified semantic conventions are both learnable and functionally efficient, thereby coming to ingrain themselves in a population. To answer these questions, we proposed an application of the replicator-mutator dynamic, which tracks effects of functional pressure on successful and efficient communication and pressure for learnability. We showed how this model can be combined with probabilistic models of rational language use and highlighted the kind of novel questions about change at the semantics-pragmatics interface it allows us to ask. In particular, by taking the challenge serious that neither semantics nor pragmatics are directly unobservable; only the behavior effected by their joint interaction is available for agents to base their inference on.

One of the main open issues from Chapter 4 concerns the inductive learning bias in favor of simpler lexical representations we assumed. The good news is that much effort is being devoted to the development of diagnostics and studies to further our understanding of the nature and relationship between lexical representations, their complexity, and their acquisition. For the time being, this assumption should however be seen critically. This will hopefully motivate future research to speak to this matter.

Finally, I would like to see the analysis in Chapter 5 be supplemented with actual frequency data. This would add strength to the prediction that (lexical) ambiguity is diachronically persistent if meanings attached to a form are frequent and tend appear in contrasting contexts.

While, hopefully, progress was made, these open issues show that this investigation is not exhaustive. In terms of particular phenomena, I have answered some questions; and hope that the material worked out in each chapter goes some way to address more; or that it at least provides a good starting point to ask fruitful ones.
In more general terms, when it comes to the semantics-pragmatics interface what this investigation offered is an outline of future directions to take and a number of tools to embark in them. On this front, our contribution lies in the modular characterization that allows for isolated and joint inspection of functional pressure and learnability on evolutionary trajectories, as well for the inspection of how frequency and perception modulate these forces and, together, shape linguistic knowledge and behavior. For now only a rather constrained space of phenomena and factors was explored, leaving us with the modest predictions formulated in Chapter 6.