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Thomas Brochhagen, Michael Franke, and Robert van Rooij. Co-evolution of lexical meaning and pragmatic use, manuscript.


Steven T. Piantadosi, Joshua B. Tenenbaum, and Noah D. Goodman. Modeling the acquisition of quantifier semantics: a case study in function word learnability, under review.


Samenvatting

Wat wordt overgebracht gaat vaak verder dan wat er wordt gezegd. In plaats van het te vermijden, floreert alledaagse communicatie in het impliciete; in het onuitgesprokene; in het contextueel bepaalde. Dit onderzoek concentreert zich op deze kwestie door te vragen waarom, en onder welke voorwaarden, taal(gebruik) het onuitgesprokene ter hand neemt terwijl de zaken ook explicieter overgebracht hadden kunnen worden. Preciezer gezegd proberen we op een fundamenteel niveau te begrijpen waarom het werk verdeeld wordt tussen semantiek en pragmatiek. Dit doen we door te kijken naar de voorwaarden waaronder eigenschappen die van deze werkverdeling gebruik maken voortkomen. We analyseren deze voorwaarden door speltheoretische modellen van rationeel taalgebruik, reinforcement learning, (geïtereerd) Bayesiaans leren, en populatiedynamiek zoals de repliceerder-muteerderdynamiek op nieuwe manieren te combineren.

Onze analyse traceert taalverandering zowel op het niveau van geïtereerde interacties als op het populatieniveau. Beide niveaus brengen hun eigen perspectief mee en schijnen daarmee hun eigen licht op een gegeven eigenschap van taal. Dit maakt het mogelijk om verschillende, doch verweven, antwoorden te verschaffen op vragen als waarom alledaagse communicatie doorspekt is met semantische ambigüiteit; onder welke voorwaarden pragmatische inferenties mogelijk (niet) lexicalizeren; en, meer algemeen, wat voor werkverdelingen tussen semantiek en pragmatiek we kunnen verwachten voort te zien komen uit het krachtenveld en omgevingsfactoren die taal vormgeven te verkennen.

Op het niveau van geïtereerde interacties, analyseren we het opzettelijk gebruik van ambigue uitdrukkingen in dialoog. Aan de hand van eerdere verklaringen van ambigüiteit beargumenteren we dat context een belangrijke rol speelt in het mogelijk maken van de risicoloze uitbuiting van ambigüiteit. We slaan echter wat gaten in deze uitleg door de aanname dat dialoogpartners toegang hebben tot dezelfde contextuele informatie te betwijfelen en uiteindelijk op te geven. Deze kwestie ontvouwt zich in een grotere, waar het samenspel tussen context, de gesprekspartners’ subjectieve contextuele verwachtingen, en hun opvattingen
over elkaars verwachtingen een belangrijke rol spelen. We beredeneren dat de gezamenlijke uitkomst van deze factoren de voorwaarden bepaalt waaronder een functioneel voordeel voor ambiguïteit kristaliseert. Om deze ideeën tastbaar te maken stellen we een model van rationeel taalgebruik voor en koppelen het model aan simpele adaptieve dynamieken. We laten zien dat het model empirisch onderbouwde patronen van ambigu taalgebruik met succes voorspelt.

Op het populatieniveau staan eigenschappen emergent aan interacties aan de semantiek-pragmatiek interface voor uitdagingen die niet alleen taalgebruik, maar ook hun getrouwe overdracht over generaties omvatten. Nog semantiek nog pragmatiek zijn direct observeerbaar. In plaats daarvan zien leerlingen alleen het gedrag waarin de combinatie van semantiek en pragmatiek resulteert. Dit levert een probleem op omdat verschillende combinaties kunnen resulteren in (bijna) niet te onderscheiden zichtbare gedrag. In precieze zin vragen we wanneer en waarom reguliere pragmatische inferenties wel (of niet) lexicalizeren, en wanneer semantische onderspecificatie ofwel wordt behouden ofwel plaatsmaakt voor precieze uitdrukkingen. Om deze vragen aan te pakken formuleren we een model van de (co)evolutie van semantiek en pragmatiek. Het model houdt de effecten bij van functionele druk richting efficiënte informatieoverdracht en de effecten van druk richting leerbaarheid op zowel aparte als gecombineerde evolutionaire trajecten. We combineren dit model met modellen van pragmatisch taalgebruik op het niveau van het individu en dompelen het model onder in verschillende taalgebruik- en leeromgevingen.
Abstract

What is conveyed often goes beyond what is said. Rather than avoiding it, natural communication seems to thrive in the implicit; in the unsaid; in the contextually determined. This investigation centers around this issue by asking why and under which conditions language (use) may come to leverage or accommodate the unsaid when matters could be conveyed more explicitly. More precisely, at a fundamental level, we seek to better understand why there is a division of labor between semantics and pragmatics. We do so by looking at the conditions under which properties that draw from this division arise, which we analyze by combining, in novel ways, game-theoretic models of rational language use, reinforcement learning, (iterated) Bayesian learning, and population dynamics such as the replicator-mutator dynamic.

Our analysis traces linguistic change at the level of iterated interactions as well as at that of populations. Both levels come with their own perspective and thereby shed their own light on a given linguistic property. This allows us to explore different yet connected answers to questions such as why natural communication is rife with semantic ambiguity; under which conditions systematic pragmatic inferences may (fail to) lexicalize; and, more generally, what kinds of divisions of labor between semantics and pragmatics we can expect to arise from pressures and environmental factors that shape language.

At the level of iterated interactions, we analyze the deliberate use of ambiguous expressions in dialog. With previous explanations of ambiguity, we argue that context plays an important role in allowing for the safe exploitation of ambiguity. However, we inject some wrinkles into this explanation by calling into question and giving up the assumption that interlocutors have access to the same contextual information. This issue unravels into a larger one, where the interplay between context, interlocutors’ subjective contextual expectations, and their beliefs about each other’s expectations play an important role. We argue that the joint outcome of these factors determines the conditions under which a functional advantage for ambiguity crystallizes. We propose a model of rational language
use and couple it with simple adaptive dynamics to capture these ideas, and show that it succeeds in predicting empirically attested patterns of ambiguous language use.

At the population level, properties that draw from interactions at the semantics-pragmatics interface face challenges not only in language use, but also in their faithful transmission across generations. Neither semantics nor pragmatics are directly observable. Learners instead only witness the behavior in which their combination results. This raises an issue because different divisions could result in (almost) indistinguishable overt linguistic behavior. More precisely, we ask why and when regular pragmatic inferences do (not) lexicalize, and when semantic underspecification is either maintained or gives way to more precise expressions. To address these questions, we formulate a model of the (co-)evolution of semantics and pragmatics. This model tracks the effects of functional pressure toward efficient information transfer and the effects of pressure for learnability on separate as well as on combined evolutionary trajectories. We combine this model with individual-level models of pragmatic language use, and couch it in different environments of language use and learning.
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