Getting more for less: Cross-domain parsimony for grammar learning

Parsimony is in the eye of the beholder, especially where language acquisition is concerned: any account of the emergence of grammar depends on — and must be evaluated with respect to — an array of assumptions about the nature of the input, pre-existing conceptual and linguistic capacities of the learner, and kinds of structures learned and phenomena explained. In this paper I describe a usage-based computational model of grammar learning that appeals to a notion of cross-domain parsimony, in two senses. First, like other usage-based approaches to acquisition, the model broadens the scope of inquiry to encompass aspects of communicative function and domain-general cognition. This expanded perspective allows the model to achieve more explanatory power with fewer domain-specific linguistic assumptions than approaches that focus more narrowly on the form domain. The model also directly invokes parsimony in a more technical sense, as the guiding principle for incrementally constructing a grammar that accounts for the input data. The inclusion of both form and meaning domains provides a richly structured basis for learning and evaluating candidate grammars from relatively few examples.

The model formalizes the idea that grammar learning is driven by meaningful use in context, drawing on methods and insights from several disciplinary domains: construction-based theories of grammar, in which the basic units are form-meaning pairs (*constructions*) [1]; cognitively motivated approaches to semantics, in which meaning is grounded in embodied experience and conceptualization [2, 3, 4]; and usage-based models of language learning, which emphasize the diverse conceptual, sensorimotor, pragmatic and statistical cues children use to achieve their goals, communicative and otherwise [5, 6]. The model takes as its representational basis Embodied Construction Grammar [7], a formalism designed to support two processes: language understanding, which uses constructions to interpret utterances in context; and language learning, which makes judicious changes to the current grammar to improve comprehension. I focus on the role of cross-domain considerations, illustrated by a case study of English motion expressions. When given utterance-context pairs like those below (taken from [8], shown with informal context descriptions), the model uses discrepancies between its linguistically analyzed (partial) meaning and the contextually inferred meaning to propose new constructions. These constructions are initially item-specific [5] (e.g., *put*-Thing-*here* and *put*-Thing-*down* constructions with mappings between the relevant word order relations and inferred motion events); the model gradually exploits structural form-meaning similarities to propose more general constructions (*put*-Thing-Place) that allow greater syntactic and semantic variation, eventually including variants of the Caused Motion construction. Candidate structural operations are evaluated using a heuristic that seeks the simplest grammar given the data encountered, taking both form and meaning into account.

(1) “put your pillow here”	Mother wants child to put pillow on bed.
(2) “put your head down”	Mother wants child to put head on pillow.
(3) “put the blanket over you”	Mother wants child to put blanket on child.
(4) “don’t you put that on my hair”	Mother doesn’t want child to put popsicle on her hair.

The inclusion of meaning and context allows the model to learn from limited data a variety of phrasal and clausal constructions for expressing paths, locations and motions, while providing a motivated rationale for limited (over-)generalization. Overall the model demonstrates how an integrated account of language structure, use and acquisition can be both generous in the scope of phenomena it addresses and parsimonious in its domain-specific assumptions.

References

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