A multiple process solution to the logical problem of language acquisition Brian MacWhinney

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Abstract

Outline

- Logical problem of language acquisition:
  - input to learner is inconsistent, incomplete (not enough positive and negative evidence)
  - corrective feedback is ignored
  - ergo, children rely on innate, universal constraints: UG
- The article presents alternative solutions:
  - conservatism
  - item-based learning
  - competition
  - cue-construction
  - monitoring
  - indirect negative evidence
- Studies reveal that input to children is not as poor as claimed
- Much of syntactic structures claimed to be unlearnable can be learned using demonstrably available positive data.

The Gold framework

Inducing languages from evidence alone (empiricism according to rationalists)

Assumptions

- No negative evidence
- Input is just a set of sentences ('text presentation')
- Output is an exactly matching formal grammar

Results:

- An infinite language is not learnable,
  not even in infinite time! (Gold 1967)
- Without negative evidence or innate constraints
  there can be no recovery from overgeneralization
- But: input is more than just words (context, meaning, intentions)
- But: output probably probabilistic rather than exact grammar
- But: language is stochastic (past experience is representative of language as a whole)

Unfortunately, only the second *but* is discussed by MacWhinney.

Error-free learning

In the 1980s POS arguments shifted from negative to positive evidence.
Claim: error-free learning without positive evidence for eg.:

- Negative polarity items (*I ever walked)
- Binding conditions (*He$_1$ said that Bill$_2$ hurt himself$_1$).
  But: children do make mistakes.
- AUX fronting (*is the man who _ talking is strange?).
  But: lots of positive evidence from wh-questions.

Conclusion: no evidence for error-free learning without positive evidence.

Solutions

MacWhinney presents an emergentist account.
Acquisition is multiply-buffered by the following processes:

- conservatism: wait for positive evidence before extending grammar
- item-based learning: constructions are first acquired separately, only later integrated into grammar

Recovery from overgeneralization:

- competition: different forms compete based on analogy and evidence ('goed' receives analogic pressure, 'went' has evidence)
- cue-construction: arbitrary features added to forms to restrict application of some construction (*I watered the flowers flat)
- monitoring: listen to self, compare own productions against adult language
- indirect negative evidence: keep track of frequencies, low counts are 'negative' evidence

Competition

- An item-based construction is a mapping of arguments to predicates.
- Has one correct mapping (CM), many incorrect mappings (IM)
- Both have analogic support, only CM has positive evidence
- Groups of CMs form Feature-Based constructions, which support analogy making.
- Construction is learned when CM dominates IM.

"In essence, the logical problem of language acquisition is then restated as the process of understanding how analogical pressures lead to learning courses that deviate from what is predicted by simple learning on positive exemplars for individual item-based constructions."

Consequences

- Recovery from overgeneralization is no longer a logical problem
  - Little evidence for truly error-free learning without relevant positive data
  - Recovery possible with four processes: competition, cue construction, monitoring, indirect negative evidence
  - Alternative characterization of target grammar
  - Input to children is not unparsable or degenerate
- Item-based pattern is pivotal, positive data crucial
- There is an alternative to the UG.

Criticism

- Meaning only mentioned in passing ('predicates'), but meaning has a rich structure (synonomy, homonymy, hyperonymy etc. etc.)
- Competition model: how to figure out which items are in competition with each other?
- Gold framework irrelevant, eg. Probably Approximately Correct (PAC) framework more appropriate. Two results:
  - a learnable language must have a finite VC-dimension (complexity of hypothesis space)
  - learning algorithm must be efficient ('try all grammars' not feasible)

  What does this mean for linguistics? Either the space of grammars is strongly constrained (UG), or the learning algorithm takes shortcuts.
- Naigles: children already generalize in comprehension before they do in production, casts doubt on role of conservatism, comprehension not as item-based as production
- MacWhinney does not address differences in comprehension and production