Modeling and theory
Insights from the Syntagmatic-Paradigmatic Learner

Barend Beekhuizen
Leiden University & University of Amsterdam

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1 Overview of SPL
   - Representations
   - Processing
   - Learning

2 Main findings
   - Modeling issues, theoretical puzzles
   - Comprehension
   - Production

3 Competence and performance
   - Gaps in the theory
   - Comprehension
   - Representation
   - Production

4 Wrap-up
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4 Wrap-up
The general problem

- Mapping form to meaning
- Acquisition:
  - Arriving at adult state
  - Explaining developmental waypoints
- Starting point: Usage-Based framework
- Computational cognitive model as method
The Syntagmatic-Paradigmatic Learner

Flow of the model:

1. Model receives input item: pair of an utterance and a number of situations
2. Model tries to analyze using processing mechanisms and existing representations
3. Model updates grammar using learning mechanisms and best analysis
4. goto 1
Representations

Constructions: pairings of signifiers and signifieds, both for ‘grammar’ and ‘lexicon’
Figure: Constructions
Figure: Constructions

1 [ BALL / ball ]

2 [ [ ANIMATE ] [ MOVE / go ] ] |
   MOVE(AGENT(ANIMATE),LOCATION(SURFACE))
Representations

Constructions: pairings of signifiers and signifieds, both for ‘grammar’ and ‘lexicon’

Processing

An utterance in a situational context is analyzed using the set of known constructions and processing mechanisms
Overview  
Processing

Figure: Combine
Figure: Concatenate, bootstrap, ignore
Representations

Constructions: pairings of signifiers and signifieds, both for ‘grammar’ and ‘lexicon’

Processing

An utterance in a situational context is analyzed using the set of known constructions and processing mechanisms. Often many analyses possible, so find best one:

- Most frequently encountered constructions
- With fewest concatenate, bootstrap, and ignore operations.
**Representations**

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**Processing**

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- Most frequently encountered constructions
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**Learning**

Best analysis leaves trace in memory: 5 learning mechanisms.
Figure: Adding most concrete constructions
Figure: Updating the most concrete used constructions
Figure: Syntagmatization
Figure: Paradigmatization
**Figure:** Cross-situational learning
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SPL resolves some a priori issues (chapter 2)

- **Comprehensiveness**: comprehension and production
- **Simultaneity**: lexical and grammatical constructions
SPL resolves some a priori issues (chapter 2)

- Comprehensiveness: comprehension and production
- Simultaneity: lexical and grammatical constructions
- Reappraisal of the starting-small approach
- Learning as by-product of processing (immanence)
- Reappraisal of the competence-performance distinction
Main findings

Comprehension (chapter 5, 6)

- **Robustness**: making sense of utterance despite knowing little (using concatenation, bootstrapping)
- **Increasing coverage** of utterance and situation
- **Increasing accuracy** of picking out situation from 6 candidates
- **Varying mechanisms**: XSL precedes bootstrapping; bootstrapping dominates.
Production (chapter 7)

- **Experiment**: give model situation, ask to produce utterance
- **Increasing length** of produced utterance
- Hardly any **errors of omission**
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4 Wrap-up
- Linguistic knowledge grounded in language use
- So we can reason from child’s productions to its knowledge of language
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- So we can reason from child’s productions to its knowledge of language
- However:
  - Sample may not contain reflection of full potential
  - Other reasons for not producing some linguistic item
  - Interactivity of components invalidates line of reasoning
- Linguistic knowledge grounded in language use
- So we can reason from child’s productions to its knowledge of language
- However:
  - Sample may not contain reflection of full potential
  - Other reasons for not producing some linguistic item
  - Interactivity of components invalidates line of reasoning
- So: need to **account** for a linguistic competence and performance within Usage-Based framework.
- And show its **explanatory value**.
- **Not unique** to SPL: all UB computational models do so. However, interaction lexical/grammatical acquisition gives interesting effects
Comprehension

- Early abstraction
- Increasing use of more concrete constructions
- Does not entail loss of abstraction (to the contrary)

**Figure**: Abstraction of used length-2 and 3 constructions
Reflections of use on representations

- Look under the hood to obtain a fuller understanding of representational potential
- Abstractions are there, but not used so much
Figure: After 100 input items
Figure: After 500 input items
Figure: After 10000 input items
Linguistic competence in production

- Wysiwyg?
- No:
  - Lexical items may be known but not produced because grammatical constructions are not known yet
  - Interaction: competition between grammatical constructions
The unexpressed expressables

Words that are known but nonetheless not produced, because there is (1) an erroneous word outcompeting them or (2) there is no grammatical construction to ‘host’ them.

Figure: The expression of ‘second arguments’ over time
Why we need to focus on competence/performance

- Corpora hide potential for abstraction
- Simultaneity effects hide potential
  - Lexical knowledge hidden (unexpressed expressables)
  - Paradoxal blocking effects
Thank you