The Onset of Principle C at 30 months: The role of vocabulary, syntactic development, and processing efficiency

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Questions

• Adult-like behavior in children
  – Adult-like grammatical knowledge
  – Heuristics which mimic adult-like behavior

• Non-adult-like behavior
  – Lack of adult-like knowledge
  – Inability to exhibit knowledge

• How can we accurately diagnose success or failure at a task?
A test case: Principle C

• Use knowledge of Principle C as a probe into diagnosis of success/ failure
• Principle C: A pronoun cannot c-command its antecedent

Anna_{i} and Katie_{j} are best friends

1) She_{i/j} likes candy
2) She_{i/*j} likes Katie_{j}
A test case: Principle C

• Principle C in acquisition research
  – Stable cross-linguistically
  – Robust knowledge in older children

• The caveat: younger children
  – High variability at 30 months
  – Adult-like understanding linked to vocabulary size

• Diagnosing behavior:
  – Do children with larger vocabularies have access to a heuristic?
  – Do children with smaller vocabularies have a block on exhibiting knowledge?

Lukyanenko, Conroy, & Lidz (in review)
Outline

• Background
• Previous Research
• Experimental design / method
• Results and Conclusions
*Question:* How early do children show knowledge of Principle C?

*Answer:* 28-32 months

*Finding:* effect of vocabulary size on evidencing knowledge of Principle C

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

Salience: (3s) *Oh look! Now they’re different!*

Sentence Mapping: (9s)
Reflexive cond: *She’s patting herself!*
Principle C cond: *She’s patting Katie!*

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

She’s patting herself!

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

She’s patting herself!

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

She’s patting Katie!

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

She’s patting Katie!

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

*She’s patting Katie!*

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

• CDI vocabulary size 76-675 words (median 509)
• 2 groups formed by median vocabulary size
• Dependent measure: difference score

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

- Some infants begin to show adult-like behavior in Principle C contexts at 28-32 months.
- Ability to behave in an adult-like manner is predicted by vocabulary size.

Lukyanenko, Conroy, & Lidz (in review)
Previous Research

• This data can’t unambiguously show knowledge of Principle C
• Preference data
• Many hypotheses could give the same results
  – Linear order
  – Clause-mate condition
  – Transitivity bias
  – Pragmatic effect of possibility of reflexive
• We set these concerns aside to focus on the vocabulary effect and its possible causes
What does it take to know Principle C?

**Representation**

- Word meanings
- Phrase structure
- C-command relations

**Algorithm**

- Referential (in)dependence
What does it take to know Principle C?

**Representation**
- Word meanings
- Phrase structure
- C-command relations
- Referential (in)dependence

**Algorithm**
- Lexical access
- Parsing
- Mapping to world/discourse model
What about vocabulary size?

What is vocabulary size indexing?

- Syntactic knowledge
- Processing efficiency
What about vocabulary size?

What is vocabulary size indexing?

• Syntactic knowledge

  Vocabulary size correlates with several measures of syntactic complexity:
  – MLU
  – Proportion function words in vocabulary

• Processing efficiency

Devescovi et al. (2005)
What about vocabulary size?

What is vocabulary size indexing?

• Syntactic knowledge
  Vocabulary size correlates with several measures of syntactic complexity:
  – MLU
  – Proportion function words in vocabulary

• Processing efficiency
  Processing speed at 24 months correlates with vocabulary growth at 36 months

Devescovi et al. (2005), Fernald et al. (1998, 2006)
What does it take to know Principle C?

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What does it take to *know* Principle C?

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Method

- 64 infants
  - 28;2-31;29 (mean 29;22)
  - CDI Vocabulary: 109-699 words (median 499)
- Between subjects design
  - Reflexive condition (she’s patting herself): n=32
  - Principle C condition (she’s patting Katie): n=32
- Preferential Looking Paradigm
- Experiment 1: Lexical access speed task
- Experiment 2: Principle C task
Exp 1: Lexical Access Speed task

- Goal: create a measure of lexical access speed
- Word-object mapping task (Swingley & Fernald 2002)
  - 8 trials per participant

  - Lexical access speed = mean time to re-orient to target on distractor-initial trials
Exp 1: Lexical Access Speed task
Exp 1: Lexical Access Speed task

![Exp 1 Distractor-initial trials](chart.png)
Exp 1: Lexical Access Speed task

Exp 1 Distractor-initial trials

Proportion looking to target vs. time for fast and slow speed conditions.
Exp 1: Lexical Access Speed task

No correlation between vocabulary size & processing speed.
Exp 1: Lexical Access Speed task

- Lexical access speed: 144-1147.5 ms (median 316.5)
- Fast group orients more quickly and reliably to the target video
- Lexical access speed ≠ vocabulary size
- Vocabulary size could still index other forms of processing
- Any effects of either predictor in the Principle C task will be independent
Exp 2: Principle C task

Salience: (3s) Oh look! Now they’re different!

Sentence Mapping: (9s)
  Reflexive cond: She’s patting herself!
  Principle C cond: She’s patting Katie!
Exp 2: Principle C task
Exp 2: Principle C task

Vocabulary

Difference Score

Reflexive condition

Speed
- fast
- slow

Vocabulary

- high
- low
Results

• Vocabulary size and lexical access efficiency are independent properties
• Vocabulary size predicts success on Principle C independent of effects of lexical access efficiency
• Lexical access speed matters only for low vocabulary infants
What does it take to *know* Principle C?

**Representation**
- Word meanings
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**Algorithm**
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Conclusions

• Vocabulary effect does not index differing speed of lexical access

• Vocabulary size is likely related to syntactic information (either having/lacking syntactic knowledge or being able to deploy it)

• Lexical access speed has an additional effect in low-vocabulary children; a possible additional bottleneck
Conclusions

• Vocabulary size and lexical access speed index different aspects of language development
• Children’s behavior can be influenced by many factors
• Pinpointing cause of children’s success or failure requires consideration of both children’s knowledge and ability to deploy this knowledge
Acknowledgments

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