An Investigation of Conservativity

**Background**

- Determiners are words like every/some/most
- They express a relation between two sets
- Conservativity is a property that such a relation may or may not have

**Descriptive typological fact:** Every determiner attested in natural languages is conservative (Barwise and Cooper, 1981)

**Widely known in semantics but most standard theories predict conservative and nonconservative determiners equally likely** (Montague 1974, Heim and Kratzer 1998)

**Research Question**

Do children carry expectations of conservativity (a typological generalization) when learning determiners?

**Hypotheses**

- Hypothesis 1: Children's learning of determiners is constrained to consider only conservative meanings
- Hypothesis 2: Children's learning of determiners is not constrained to consider only conservative meanings

**Theoretical Background**

- Prerequisites for Experiment
- Experimental Design
- Methods, etc.
- Results and Conclusions
- Future Research
Theoretical details

- A determiner expresses a relation between the sets denoted by its internal and external arguments.

What is conservativity?

- A relation $R$ between sets is conservative iff
  $R(X)(Y) \iff R(X)(X \cap Y)$

  - Example: “Every dog is brown”
    - Truth condition: $D \subseteq B$
    - Intuitively:
      - It is OK to limit your attention to the dogs
      - Brown things that aren’t dogs are irrelevant
    - Formally:
      - $D \subseteq B \iff D \subseteq (D \cap B)$
      - Every dog is brown $\iff$ Every dog is a brown dog

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      - $D \cap B \neq \emptyset \iff D \cap (D \cap B) \neq \emptyset$
      - Some dog is brown $\iff$ Some dog is a brown dog

What is conservativity?

- A relation $R$ between sets is conservative iff
  $R(X)(Y) \iff R(X)(X \cap Y)$

  - Example: “Equi dogs are brown”
    - Truth condition: $|D| = |B|$
    - Intuitively:
      - It is not OK to limit your attention to the dogs
      - Brown things that aren’t dogs are relevant
    - Formally:
      - $|D| = |B| \iff |D| = |D \cap B|$
      - Equi dogs are brown $\iff$ Equi dogs are brown dogs

Previous Research on Novel word learning

- Most research on children’s learning of novel words focuses on nouns and verbs.
- Few studies on the acquisition of determiner meanings.
- Studies that investigate children’s knowledge of determiner meanings [Philip and Drozd], are silent with respect to conservativity.
Research Question

Do children carry expectations of conservativity (a typological generalization) when learning determiners?

Desiderata of experiment

- Experiment must test young children
- Novel determiner word
- Novel determiner meaning to avoid mapping to known determiner
- Way to expose children to meanings of a conservative and non conservative determiner
- The two meanings must be cognitively similar

Design

- Picky puppet task, accessible to young children and fun
- Novel determiner word, and meaning
- Create cards that depict a true instance of determiner meaning, visually available to kids
- Meanings are direct of inverses of each other

Our novel determiner: ‘gleeb’

- Gleen [girls] [like pizza]
- Conservative meaning:
  - “not all girls like pizza”
  - “at least one girl dislikes pizza”
  - Ignoring pizza-likers who aren’t girls is OK
- Non conservative meaning:
  - “not all pizza likers are girls”
  - “at least one non-girl likes pizza”
  - Ignoring pizza-likers who aren’t girls is not OK
- Recognising whether the required condition holds should be equally easy on either meaning

Picky Puppet

- Koala likes some things, but not others. He only likes things that are yellow. Can you help us put cards into piles?
**Modify the Picky Puppet**

- The picky puppet task doesn’t work because we are teaching children a new word
- Modify the task to teach new words by giving examples

**Example/Warm up**

- Koala likes some cards but not others. Can you help me figure out what kind of cards he likes? He said he only likes cards that are *splurfy*

**Experimental design: picky puppet**

- For this experiment, we want children to sort cards with scenes
- Each scene is either true on the meaning of the determiner being taught or not
Cards

• Need cards that can represent determiner meanings

• “Gleeb girls are on the beach”
• To make things clear, being a girl and being on the beach need to be clearly binary

Cards

• Beach/Park
• Boys/Girls

Cards

• “Gleeb [girls] [are on the beach]”
• Conservative version:
  – Not all girls are on the beach
• Nonconservative version:
  – Not all beach-goers are girls

Conservative true

• Gleeb girls are on the beach
• Nonconservative false

Nonconservative true

• Gleeb girls are on the beach
• Conservative false

Design

• Each child is exposed to only one novel determiner

• How does an experimental session work?
  – Warm ups (3 items)
  – Training Phase (5 cards)
  – Testing Phase (5 cards)
Scoring

- An experimenter recorded which pile the child placed the target card into
- Children were scored as ‘correct’ on that card if the pile corresponded to the determiner meaning taught in training phase

Method

- 2 conditions: children were taught that the puppet liked cards consistent either with the conservative or nonconservative meaning of the determiner
- Same stimuli cards and test sentence was used across conditions
- Children randomly assigned to condition

Participants

- 20 children
- 4;5 – 5;6
- Mean 5;0
- By condition:
  - Conservative: 4;5 – 5;5, mean 4;11
  - Nonconservative: 4;11 – 5;3, mean 5;1

Hypotheses

- Hypothesis 1: Children’s learning of determiners is constrained to consider only conservative meanings
  - Prediction: children should be able to learn a novel conservative quantifier, but not a novel nonconservative one
- Hypothesis 2: Children’s learning of determiners is not constrained to consider only conservative meanings
  - Prediction: children should do equally well at learning novel conservative determiners and novel nonconservative determiners

Results

<table>
<thead>
<tr>
<th></th>
<th>Conservative</th>
<th>Non-conservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cards correctly sorted out of 5</td>
<td>4.1</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Greater than chance (2.5) \( p < 0.001 \)
Not different from chance (2.5) \( p > 0.17 \)

Percentage 100% correctly sorted | 50% | 10% | \( p = 0.07 \)
Results summary

**Conservative**
- Number of cards properly sorted
  - Out of 5
  - Greater than chance (2.5)
  - p < 0.001

**4.1**
- Kids do learn the novel conservative determiner
- No evidence of learning nonconservative version
- Very early mirroring of the typological

Research Question

- Hypothesis 1: Children’s learning of determiners is constrained to consider only conservative meanings
- Prediction: children should do be able to learn a novel conservative quantifier, but not a novel nonconservative one

- Hypothesis 2: Children’s learning of determiners is not constrained to consider only conservative meanings
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Who learned the nonconservative one?
- One child ‘learned’ the nonconservative determiner (10% perfect)
- 4;11
- What did she do?
  - She told the puppet he was confused, because he thought that the boys were girls

  let’s look at how this indicates the learning of a conservative determiner meaning…

Who learned the nonconservative one?
- “Gleeb girls are on the beach”
- Target (nonconservative) meaning:
  - not all beach-goers are girls
  - at least one boy is on the beach
- Since the puppet had girls/boys reversed, this is consistent with “gleeb” meaning “some”
- Therefore, a conservative determiner was learnt

Conclusion

- No evidence for learning of the nonconservative determiner meaning in these subjects
- Early learning of the constraint is still a possible explanation

Outline
- Theoretical Background
- Prerequisites for Experiment
- Experimental Design
- Methods, etc.
- Results and Conclusions
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Future research

• Younger kids to check for early learning
  – Perhaps more practice?

• Novel determiners that are not logically built up from existing determiners ("gleeb" = "not all")
  – "Equi girls are on the beach"
  – "The number of girls is equal to the number of beach-goers"

Of dogs and kings

• Does the observed preference actually favour:
  – "living on" the internal arg. rather than external?
  – "living on" the set of girls rather than the set of beach-goers?

• With a different external argument we could control for this:
  – "Gleeb dogs are kings"
  – "Gleeb kings are dogs"

‘only’ is not a determiner

• The typological generalisation concerns a class of words defined distributionally

• The distribution characterising determiners:
  – Some dogs are brown
  – "Dogs are some brown"
  – "Dogs are any brown"
• ‘only’ does not have this distribution
  – Only dogs are brown
  – "Dogs only are brown"
  – "Dogs are only brown"

• Future research: test novel words with this wider distribution

Distribution of cards

<table>
<thead>
<tr>
<th></th>
<th>Conservative version</th>
<th>Nonconservative version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>Puppet likes 3 of 5</td>
<td>Puppet likes 3 of 5</td>
</tr>
<tr>
<td>Test</td>
<td>Puppet likes 3 of 5</td>
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</tr>
</tbody>
</table>

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(and to Microsoft, who has rockin’ clip art)