Implicit word learning and verb knowledge in infants with typical and delayed language

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Background

Typical Language Development & Early Language Delay
- Typically developing infants easily and effortlessly implicitly learn novel words and link these to novel meanings (e.g. Graf Estes et al., 2007).
- Children at risk for Specific Language Impairment (SLI) often have delayed onset and slower acquisition of first words.

Infants learning of object-label pairs was examined using a trial paradigm such as regular verb morphology should be impaired in children with SLI.

According to the PDH account, we should begin to see a relationship between infants’ implicit learning abilities and acquisition of regular and irregular verbs.

In both typically developing infants and those at risk for SLI.

Is there a relationship between implicit word-learning abilities and regular and irregular verb acquisition in typically developing infants and infants with language delay at 18-months?

Implicit Learning & Specific Language Impairment
- SLI may be secondary to deficits in implicit procedural learning (Ullman & Pierpoint, 2005).
- The Procedural Deficit Hypothesis (PDH) derives from Ullman’s declarative-procedural (DPY) model of acquisition and use (Ullman, 2001; Ullman & Cognis, 1999; Ullman & Pierpoint, 2005).

Type of memory
- Declarative
- Non-declarative (procedural)

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Acknowledgments: We are grateful to children and families who participated.

Predictions & Question
- The PDH account predicts that aspects of grammar that depend on the procedural system – such as regular verb morphology – should be impaired in children with SLI.

Methods

Participants
- Two groups of 18 month-old toddlers (N = 42) *
  - All infants had normal hearing, and normal nonverbal intelligence.
  - Delayed Language N=23
    - Varies percentiles in comprehension and/or production vocabulary above 10th percentile
    - May have had some family history or speech or language delay
  - Typical Controls N=19
    - At or above 20th percentile on both comprehension and production*

Order of object-label pairings randomly presented from looking time for the first three trials or max. of 25 trials.

Infants participated in a novel object-label habituation task.

Phase 1: Language Exposure Phase
- Same as Graf Estes et al., 2007.
- Infants were exposed to one of two artificial languages.
- Each language was 2.5 minutes in length.
- Only reliable cue to the word boundaries was transitional probability.

Phase 2: Habituation (Training)
- Infants participated in a novel object-label habituation task.
  - Two novel 3D objects were paired with two words from the exposure language using Habit 2000 Software (Cohen, Altmann, & Chaput, 2000).
  - Infants saw/heard two different label-object pairs, one at a time as novel objects moved side to side across screen.
  - Order of object-label pairings randomly presented.
  - Habituation criteria was met once looking time across three consecutive trials decreased 50% from looking time for the first three trials or max. of 25 trials.

Phase 3: Test Phase
- Infants learning of object-label pairs was examined using a Same/Not trial paradigm.
- Presented with two types of pairings, one at a time in random order.
- Learning was measured by increased look time to incongruent compared to congruent pairs.

Results

Habituation Phase
- The two groups did not differ in the number of trials to reach habituation criteria (TYP=7.41, p = .964 (Figure 1).

Test Phase
- Typical group showed the expected pattern and approached a significant difference by looking longer to the incongruent “switch” trials than same trials (TYP = 3.65, p = .07 (Figure 2).

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Typical Language Group (N=19)

<table>
<thead>
<tr>
<th>MB-CDI: WG</th>
<th>MB-CDI: WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Words Understood</td>
<td>62.57 (17.36)</td>
</tr>
<tr>
<td>Words Produced</td>
<td>51.57 (26.38)</td>
</tr>
</tbody>
</table>

Delayed Language Group (N=23)

<table>
<thead>
<tr>
<th>MB-CDI: WG</th>
<th>MB-CDI: WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Words Understood</td>
<td>42.57 (37.36)</td>
</tr>
<tr>
<td>Words Produced</td>
<td>36.52 (23.11)</td>
</tr>
</tbody>
</table>

Summary
- Consist with the prediction, infants in the DL group did not differ from the TYP group in the number of irregular verbs reported in their vocabulary.
- However, compared to the TYP group (who were able to show the expected pattern to implicitly learn novel words), the DL group showed no evidence of implicit learning and had significantly fewer regular verbs.
- This project suggests implicit learning abilities may also show up in the earliest stages of regular and irregular verb acquisition.
- This may be an important factor to consider for young infants and toddlers at risk for SLI.

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