Trade-offs between content, utterance length, and error rate in sentence production

Amanda J. Owen Van Horne & Shanju Lin
Dept of Communication Sciences and Disorders & DeLTA Center
University of Iowa

Introduction

• **Assumptions of trade-offs in sentence production**
  - A limited capacity in language production
  - Increases in difficulty in one domain may lead to reliance on more familiar or more readily accessible structures at the next level.
  - Bock & Levelt, 1994

• **Trade-offs between language domains**
  - As phonological complexity increases, clausal complexity and grammatical accuracy decrease.
  - Masterson & Kamhi, 1992

• **Trade-offs between language and content**

  **Sentence length**
  - Sentences with errors are longer than those without errors.
  - Scott & Windsor, 2000; Achenbaugh & Owen Van Horne, in prep

  **Argument structure complexity**
  - More errors in sentences with greater number of arguments.

  **Discourse type**
  - Error rate increases in narrative and expository contexts compared to conversation.
  - Thordardottir, 2008

• **Trade-offs between language and a child’s ability**

  **Working memory capacity**
  - Higher NWR score, longer MLU and more accurate in verb morphology in discourse.
  - Thordardottir, 2008

  **Emergent language skills**
  - Disrupted sentences are 1) longer and more complex than fluent sentences, and 2) more apt to be sentences on the “leading-edge” of the child’s production capacity.
  - Rispoli & Hadley, 2001

Questions

1. Does working memory capacity (NWR) predict narrative and single sentence production ability?

2. To what extent does children’s error rate reflect their typical production ability in relation to demands placed on them?
Method

Stimuli

- Sentence production: Describing 24 motion event videos
- Working memory: NWR
  (Dollaghan & Campell, 1998)
- 3 narrative retells following SALT protocols
  (Miller, 2009)

Motion Event Coding

<table>
<thead>
<tr>
<th>Example</th>
<th>Length in words</th>
<th># Elements mentioned</th>
<th>Grammaticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>He is driving to the swing.</td>
<td>6</td>
<td>2 (M, G)</td>
<td>Yes</td>
</tr>
<tr>
<td>The ant go to the truck.</td>
<td>6</td>
<td>1 (G)</td>
<td>No</td>
</tr>
<tr>
<td>The pig fly under the bridge and fly to the castle.</td>
<td>11</td>
<td>3 (M, P, G)</td>
<td>Yes</td>
</tr>
<tr>
<td>The airplane go underneath the net and then he go to the balloon so he can pop them.</td>
<td>18</td>
<td>2 (P, G)</td>
<td>No</td>
</tr>
</tbody>
</table>

Motion Event Description Length in wds # Elements Grammaticality
Sheep was going to bags. 5 1
Monkey walked over a hill to grapes. 7 3
The car went from a fire into the camp, the camp where he sleeps, and then he went to a backpack. 21 3
The elephant was flying an airplane then he goed to the shovel and a boat came with, and it went to the shovel too. 24 2

Participants

<table>
<thead>
<tr>
<th></th>
<th>AGE</th>
<th>SLI</th>
<th>MLU</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Age</td>
<td>7;1 (4.3 - 9.11)</td>
<td>7;1 (4.2 - 9.10)</td>
<td>4.7 (4.0 - 4.11)</td>
</tr>
<tr>
<td>MLUw</td>
<td>7.73 (5.04 - 10)</td>
<td>6.48 (5.42 - 7.5)</td>
<td>6.38 (5.30 - 7.74)</td>
</tr>
<tr>
<td>SPELT-3</td>
<td>112.82 (104 - 122)</td>
<td>78.5 (73 – 86)</td>
<td>113.82 (100-127)</td>
</tr>
<tr>
<td>CELF-4 ELI</td>
<td>113.94 (93 - 130)</td>
<td>69.89 (51 - 85)</td>
<td>110.53 (96 - 130)</td>
</tr>
<tr>
<td>KBIT - 2</td>
<td>113 (89 - 130)</td>
<td>95.18 (80 – 130)</td>
<td>104.76 (92 – 130)</td>
</tr>
</tbody>
</table>

Results

Does working memory capacity (NWR) predict narrative and single sentence production ability?

NWR accuracy, Frog Story MLU

NWR accuracy, Frog Story FVMC

NWR does not predict utterance grammaticality or number of errors in single sentence descriptions.

Motion Event Description Length in wds # elements
Sheep was going to bags. 5 1
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Note: we collapsed TD groups to increase variance
Slopes are ns diff (p=.16)
Intercepts are marginally sig (p=.09)

TD: FVMC = .749 + .2527 (NWR)
SLI: FVMC = .412 + .5971 (NWR)
F(3, 45) = 10.71, p<.0001,
Adj R² = .38
Note: we collapsed TD groups to increase variance
Slopes are ns diff (p=.16)
Intercepts are marginally sig (p=.09)
To what extent does children’s error rate reflect their typical production ability in relation to demands placed on them?

Conclusions

- As seen in Thordardottir (2008), NWR predicts MLU and grammatical accuracy in narratives.
  - Next Step: Need to code information in narratives to confirm the role of working memory in communicating content in addition to standard measures!
- NWR may predict whether children will be good communicators, not just utterance length and error rate.
  - Children with poorer NWR were less efficient communicators:
    - Said long, repetitive sentences & used circumlocutions, but included less relevant content.
    - Said short, uninformative sentences.
- Children who typically produce longer sentences in narratives, produce longer sentences and more information in a sentence production task.
  - When children produce sentences that are longer than their typical sentence length, they are more likely to make errors.
- Working memory capacity interacts with the demands placed on the system.
  - Children who have poor working memory are also more likely to make errors in long sentences, but NWR alone doesn’t predict number or presence of an error.
  - The influence of working memory and typical utterance length can be thought of as a continuum. These are highly related factors. We can’t fit a model that includes both Frog Story MLU and NWR.
  - NWR leads to a better fitting model for predicting errors; NWR predicts typical utterance length.
- NWR and Frog Story MLU fit best when Group is not a factor; similar fit when only TD children or only SLI children are included.

Acknowledgements

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Contacts: amanda-owen-vanhorne@uiowa.edu, shan-ju-lin@uiowa.edu