Why is nonword repetition deficient in specific language impairment (SLI)?

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Work conducted in collaboration with:

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Specific language impairment (SLI)

- Language does not follow normal developmental course
- Normal development in other areas
- Not due to hearing loss, physical abnormality, acquired brain damage
Nonword Repetition

Child listens to spoken nonwords and repeats, e.g.

2 syllables: hampent
3 syllables: dopelate
4 syllables: confrantually
5 syllables: pristoractional

*Items from Children’s Nonword Repetition Test (CNRep)*
– Gathercole & Baddeley, 1990
Nonword repetition in SLI

- Initial study by Gathercole and Baddeley (1990) showed marked deficits in SLI, for long (3+ syllables) but not short nonwords.


- Nonword repetition also poor in ‘resolved’ cases of SLI, and relatives of affected individuals.
Nonword repetition – a deceptively simple task

Factors that can affect performance:
- Poor auditory discrimination
- Top-down influence of linguistic knowledge
- Trace decay; storage capacity
- Motor programming problems

1. Perceive auditory signal
2. Encode into familiar units
3. Retain representation
4. Program articulators
Mismatch responses

- Enhanced negativity of electrophysiological response when a rare deviant response (red) occurs in a train of repeated standards (blue).

Graph shows responses averaged over 80+ trials at frontocentral site (FZ).

No task! Participant passively listens while viewing silent DVD.

MMN – 100-250 ms post onset, marker of discrimination

LDN – later response, postulated to indicate phonemic categorisation
ERP task to index phonological short-term memory

standard:  ba-bi-bu-be
deviant  da-bi-bu-be
          ba-di-bu-be
          ba-bi-du-be
          ba-bi-bu-de

N.B. task minimizes effects of vocabulary knowledge/serial ordering

Predictions re mismatch responses

- perceive auditory signal
  - Reduced MMN for all syllables

- encode into familiar units
  - Reduced LDN for all syllables

- retain representation
  - Reduced mismatch for later syllables

- program articulators
  - No impairment
## Participants

<table>
<thead>
<tr>
<th></th>
<th>Good Repeaters</th>
<th>Poor Repeaters</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 44</td>
<td>N = 15</td>
<td></td>
</tr>
<tr>
<td>Male:female</td>
<td>7:37</td>
<td>4:11</td>
<td>0.356</td>
</tr>
<tr>
<td>Age</td>
<td>43.4 (5.3)</td>
<td>44.2 (6.5)</td>
<td>0.634</td>
</tr>
<tr>
<td>Age left ft education</td>
<td>19.6 (2.7)</td>
<td>16.8 (2.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>WASI Non-verbal IQ</td>
<td>112.5 (12.6)</td>
<td>112.7 (12.9)</td>
<td>0.951</td>
</tr>
<tr>
<td>Digit repetition raw</td>
<td>10.6 (2.1)</td>
<td>9.23 (1.9)</td>
<td>0.035</td>
</tr>
<tr>
<td>Word reading scaled</td>
<td>93.9 (12.1)</td>
<td>83.9 (15.0)</td>
<td>0.012</td>
</tr>
<tr>
<td>Non-word reading scaled</td>
<td>100.4 (12.7)</td>
<td>86.3 (14.2)</td>
<td>0.001</td>
</tr>
<tr>
<td>TROG-2 scaled</td>
<td>101.7 (7.0)</td>
<td>97.5 (9.7)</td>
<td>0.072</td>
</tr>
<tr>
<td>Nonword repetition, raw*</td>
<td>41.0 (2.8)</td>
<td>33.3 (3.6)</td>
<td></td>
</tr>
</tbody>
</table>

* Groups selected on this variable: no overlap in scores
blue lines are grand averages for standards (ba-bi-bu-be) red lines show deviants
deviant da-bi-bu-be
blue lines are grand averages for standards (ba-bi-bu-be)
red lines show deviants
Poor nonword rep.        Good nonword rep.

blue lines are grand averages for standards (ba-bi-bu-be) red lines show deviants

deviant

da-bi-bu-be

ba-di-bu-be

ba-bi-du-be
Poor nonword rep.        Good nonword rep.

blue lines are
good averages for
standards (ba-bi-bu-be)
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deviant
da-bi-bu-be
ba-di-bu-be
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ba-bi-bu-de
Predictions re mismatch responses

1. Perceive auditory signal
   - Reduced MMN for all syllables
2. Encode into familiar units
   - Reduced LDN for all syllables
3. Retain representation
   - Reduced mismatch for later syllables
4. Program articulators
   - No impairment
SLI deficit in recall of nonwords is worse than for recall of same phonological sequences as list:

fiemoychee vs. fie ... moy ... chee
Adult ERP study: summary

- Those with poor nonword repetition fail to show LDN at 3\textsuperscript{rd} syllable position

- Suggests cumulative effect from processing of prior signals

- Not seen for 4\textsuperscript{th} syllable: is this because there is time to complete processing without another stimulus occurring?
Adult ERP study: conclusions

- Pattern of results not consistent with limited memory storage or rapid decay of representations

- Rather, the problem appears to be one of encoding phonological information when successive syllables occur at a rapid rate
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