Longitudinal Evaluation of the Speech & Literacy Profile of Children with Inconsistent Speech Errors

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Disclosures

• Brigid McNeill and Gail Gillon
  – University of Canterbury paid staff members.
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  – I have no other financial or non-financial relationships with any materials described or used in this presentation.
Outline

• Rationale
  – Children with inconsistent speech errors
• Methodology
• Speech development over time
• Literacy development over time
• Association between speech and literacy performance
• Spelling
• Conclusions
CAS Differential Diagnostic Features

Inconsistent
- Token-token
- Not other forms of variability

Coarticulatory transition
- Prolonged sounds
- Prolonged pauses between sounds

Prosody
- Phrasal
- Sentential

ASHA, 2007
Male, aged 7;6, McNeill & Gillon, in process
Male, aged 7;6; McNeill & Gillon, in process
Inconsistency as a potential diagnostic feature

• Lack of validation of inconsistency, particularly over time.

• Standardized Assessment
  – Diagnostic Evaluation of Articulation and Phonology (Dodd et al.)
  – 40% inconsistent

• Token to token inconsistency also present in children with other forms of SSD
Childhood Apraxia of Speech

Identify diagnostic features

Inclusion criteria

Describe group
Dodd’s Differential Diagnosis

- Articulation (12)
- Delay (57)
- Disorder (20)
- Inconsistent (10)
- CAS (1)

Broomfield & Dodd, 2004 (n = 320)
Inconsistency: Implications for Literacy

- Children with speech disorder are more likely to experience literacy difficulties (e.g., Anthony et al., 2013)

- Across the literature
  - 30-80% of children with speech disorder have concomitant literacy difficulty
  - Language factors

- No correlation between speech severity and literacy outcome (e.g., McNeill et al., 2009; Rvachew et al., 2005)

- Association between use of atypical speech errors and literacy outcomes (e.g., Preston et al., 2013; Dodd’s work)
Phonological Awareness:
Standard Scores

Holm et al., 2009
Methodology

- Track the speech and literacy development of children with inconsistent speech errors over time

Age matched and reading matched comparison groups
Participant Selection Process

SLPs refer children aged 4;6 to 7 years

55 children with SSD assessed

45 children with inconsistent speech

10 children with consistent speech errors

Profiles not suitable to grouping (n=4)

Attrition (n=2)

N = 39
## Participants: Time 1

<table>
<thead>
<tr>
<th></th>
<th>Inconsistent SD (n = 39) Mean (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (months)</td>
<td>67.6 (10.8)</td>
</tr>
<tr>
<td>Sex</td>
<td>31 boys, 8 girls</td>
</tr>
<tr>
<td>Nonverbal IQ</td>
<td>100.9 (9.2)</td>
</tr>
<tr>
<td>Receptive Vocabulary</td>
<td>95.3 (11.5)</td>
</tr>
<tr>
<td>PCC</td>
<td>57.5 (20.4)</td>
</tr>
<tr>
<td>PVC</td>
<td>89.5 (17.6)</td>
</tr>
<tr>
<td>Inconsistency %</td>
<td>57.3 (11.8)</td>
</tr>
</tbody>
</table>
Measures

• Intervention intensity and type tracked across the study
• Non-verbal IQ
  – PTONI
• Speech
  – DEAP (Dodd et al., 2002)
  – PCC, PVC, Inconsistency
  – Connected speech (Westerveld & Gillon)
  – Oro-motor (VMPAC)
• Language
  – Receptive Vocabulary (PPVT)
  – Sentence structure (CELF-4)
  – Personal narrative
Measures

• Phonological awareness
  – Test of Phonological Awareness (Torgesen & Bryant, 2004)

• Reading
  – Woodcock-Johnson
    • Letter ID, Word Attack, Passage Comprehension

• Spelling
  – Test of Written Spelling
  – Experimental tasks
Results

Speech and Literacy Performance Over Time
Speech Over Time

Inconsistency data for typical and SSD aged 3;0 – 6;11 taken from Holm et al. (2007) & Dodd (2005)
Literacy Over Time (standard scores)
Literacy over time (% within expected range)
Lachlan (Time 5; 7 years, 9 months)

1. Dresses
2. Softness
3. Sweeter
4. Teller
5. Sadly
6. Uneasy
7. Thinker
8. Boats
9. Discontent
10. Brightly

* Spelling task from Apel et al. (2012)
Arthur; 8 years 8 months

<table>
<thead>
<tr>
<th>Item</th>
<th>Spoken attempt</th>
<th>Written attempt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kangaroo</td>
<td>/dæŋəru/</td>
<td>welmn (welmn)</td>
</tr>
<tr>
<td>Girl</td>
<td>/dal/</td>
<td>Imal (Imal)</td>
</tr>
<tr>
<td>Shark</td>
<td>/zak/</td>
<td>amkl (amkl)</td>
</tr>
<tr>
<td>Bridge</td>
<td>/wedʒ/</td>
<td>Wltmo (wltmo)</td>
</tr>
<tr>
<td>Cake</td>
<td>/deɪk/</td>
<td>Kmko (Kmko)</td>
</tr>
</tbody>
</table>

* Spelling items from the inconsistency subtest of the DEAP (Dodd et al., 2002)
Association between Speech and Literacy Performance

RESULTS
Partial correlation between PCC and literacy (controlling for age)

<table>
<thead>
<tr>
<th>Item</th>
<th>PPVT</th>
<th>TONI</th>
<th>PA</th>
<th>Word ID</th>
<th>Read Comp</th>
<th>Spelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCC1</td>
<td>0.39*</td>
<td>0.34</td>
<td>0.17</td>
<td>0.51*</td>
<td>0.48*</td>
<td>0.51*</td>
</tr>
<tr>
<td>PCC2</td>
<td>0.51*</td>
<td>0.25</td>
<td>0.34</td>
<td>0.48*</td>
<td>0.36*</td>
<td>0.39*</td>
</tr>
<tr>
<td>PCC3</td>
<td>0.48*</td>
<td>0.43*</td>
<td>0.36*</td>
<td>0.55*</td>
<td>0.50*</td>
<td>0.36*</td>
</tr>
<tr>
<td>PCC4</td>
<td>0.41*</td>
<td>0.28</td>
<td>0.41*</td>
<td>0.50*</td>
<td>0.42*</td>
<td>0.33</td>
</tr>
<tr>
<td>PCC5</td>
<td>0.47*</td>
<td>0.40</td>
<td>0.44*</td>
<td>0.58**</td>
<td>0.50*</td>
<td>0.44*</td>
</tr>
</tbody>
</table>

* Significant at the .05 level, ** significant at the .001 level
Partial correlation between PVC and literacy (controlling for age)

<table>
<thead>
<tr>
<th>Item</th>
<th>PPVT</th>
<th>TONI</th>
<th>PA</th>
<th>Word ID</th>
<th>Read Comp</th>
<th>Spelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC1</td>
<td>0.35</td>
<td>0.17</td>
<td>0.14</td>
<td>0.26</td>
<td>0.23</td>
<td>0.24</td>
</tr>
<tr>
<td>PVC2</td>
<td>0.33</td>
<td>0.30</td>
<td>0.26</td>
<td>0.35</td>
<td>0.28</td>
<td>0.32</td>
</tr>
<tr>
<td>PVC3</td>
<td>0.45*</td>
<td>0.33</td>
<td>0.31</td>
<td>0.45*</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>PVC4</td>
<td>0.46*</td>
<td>0.23</td>
<td>0.53*</td>
<td>0.47*</td>
<td>0.35*</td>
<td>0.31</td>
</tr>
<tr>
<td>PVC5</td>
<td>0.58**</td>
<td>0.35*</td>
<td>0.64**</td>
<td>0.64**</td>
<td>0.47*</td>
<td>0.41*</td>
</tr>
</tbody>
</table>

* Significant at the .05 level, ** significant at the .001 level
Partial correlation between Inconsistency and literacy (controlling for age)

<table>
<thead>
<tr>
<th>Item</th>
<th>PPVT</th>
<th>TONI</th>
<th>PA</th>
<th>Word ID</th>
<th>Read Comp</th>
<th>Spelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incon1</td>
<td>-0.56**</td>
<td>-0.23</td>
<td>-0.37*</td>
<td>-0.34</td>
<td>-0.27</td>
<td>-0.30</td>
</tr>
<tr>
<td>Incon2</td>
<td>-0.52*</td>
<td>-0.26</td>
<td>-0.19</td>
<td>-0.38*</td>
<td>-0.24</td>
<td>-0.42*</td>
</tr>
<tr>
<td>Incon3</td>
<td>-0.60**</td>
<td>-0.50*</td>
<td>-0.25</td>
<td>-0.41*</td>
<td>-0.27</td>
<td>-0.31</td>
</tr>
<tr>
<td>Incon4</td>
<td>-0.59**</td>
<td>-0.28</td>
<td>-0.53*</td>
<td>-0.58**</td>
<td>-0.38*</td>
<td>-0.39*</td>
</tr>
<tr>
<td>Incon5</td>
<td>-0.58**</td>
<td>-0.43*</td>
<td>-0.48*</td>
<td>-0.56**</td>
<td>-0.42*</td>
<td>-0.40*</td>
</tr>
</tbody>
</table>

* Significant at the .05 level, ** significant at the .001 level
Participants with and without word level reading difficulty

<table>
<thead>
<tr>
<th></th>
<th>Word reading difficulties (n=14)</th>
<th>Typical reading (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>71.4 (9.3)</td>
<td>67.8 (7.2)</td>
</tr>
<tr>
<td>PPVT</td>
<td>93.9 (14.1)</td>
<td>97.0 (10.7)</td>
</tr>
<tr>
<td>Nonverbal IQ*</td>
<td>96.0 (8.5)</td>
<td>104.5 (8.6)</td>
</tr>
<tr>
<td>Sentence Structure</td>
<td>7.7 (2.7)</td>
<td>9.3 (2.9)</td>
</tr>
<tr>
<td>Oro-motor</td>
<td>5.3 (2.1)</td>
<td>6.1 (3.0)</td>
</tr>
<tr>
<td>PA*</td>
<td>78.2 (8.8)</td>
<td>84.1 (10.8)</td>
</tr>
</tbody>
</table>

* Significant at the .05 level, ** significant at the .001 level
Inconsistent vs Inconsistent + RD

PCC

* Significant at the .05 level
Inconsistent vs Inconsistent + RD
PVC

* Significant at the .05 level
Inconsistent vs Inconsistent + RD
Inconsistency %

* Significant at the .05 level
RESULTS

Comparison of Spelling Performance of Age-Matched and Reading-Matched Comparison Groups
Spelling Study (Time 5)

• Aim
  – To examine metalinguistic abilities underlying spelling in children using inconsistent speech errors and age-matched and word-reading matched comparison groups.
## Spelling Participants (Time 5)

<table>
<thead>
<tr>
<th></th>
<th>Inconsistent speech errors (n=31)</th>
<th>Age-matched (n=31)</th>
<th>Word reading-matched (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 girls, 31 boys</td>
<td>7 girls, 31 boys</td>
<td>7 girls, 31 boys</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>89.2 (9.7)</td>
<td>89.2 (9.3)</td>
<td>77.9 (9.4)**</td>
</tr>
<tr>
<td><strong>PPVT</strong></td>
<td>97.5 (11.2)</td>
<td>102.6 (8.4)</td>
<td>101.2 (9.3)</td>
</tr>
<tr>
<td><strong>Word Reading</strong></td>
<td>32.3 (10.5)</td>
<td>42.1 (9.4)**</td>
<td>32.9 (9.2)</td>
</tr>
</tbody>
</table>
Measures

- Phonological awareness (TOPA)
- Morphological awareness (Wolter et al.)
  - Receptive
    - E.g., ‘know-knowledge’
  - Expressive
    - E.g., ‘Science’: Laura talked to the _______
- Orthographic awareness (Apel et al.)
  - E.g., blif, blith, bliff
- Spelling
  - Test of Written spelling
  - Experimental (Apel et al.)
Comparison (Raw Scores)
<table>
<thead>
<tr>
<th>Spelling Item</th>
<th>Max 7;0</th>
<th>Finn (Age-Match)</th>
<th>Sam (Read-Match)</th>
</tr>
</thead>
<tbody>
<tr>
<td>dresses</td>
<td>guess</td>
<td>dresses</td>
<td>dress</td>
</tr>
<tr>
<td>softness</td>
<td>soft</td>
<td>softness</td>
<td>Sokenins</td>
</tr>
<tr>
<td>sweeter</td>
<td>Set</td>
<td>SweeTer</td>
<td>Sweeer</td>
</tr>
<tr>
<td>teller</td>
<td>Write</td>
<td>talla</td>
<td>Feelie</td>
</tr>
<tr>
<td>sadly</td>
<td>Slal</td>
<td>sadly</td>
<td>Sadly</td>
</tr>
</tbody>
</table>
Summary and Conclusions

- Inconsistent speech errors are relatively stable over time.

- Children using such errors are vulnerable to phonological awareness, reading and spelling difficulties.

- Children with a history of using such errors should be monitored for spelling development.

- Further research required to examine utility of integrated speech-spelling intervention for this group.
  - E.g., core vocabulary.
Thank you and time for questions!

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