Independent vs Relational Phonological Analyses

Independent
• Based solely on transcription form
• Can be used with unintelligible productions
• Suitable measures for very immature children
• Reflect child's phonetic ability at different levels of structure

Relational
• Based on transcription and target forms
• Requires gloss of child's production
• Better measures for more mature children
• Reflects child's phonological accuracy at different levels of structure

Uses of Independent Analyses
• Identify gaps in the child’s inventories
  • focus attention in therapy on expansion of stress patterns, word shapes, or segments in particular classes to fill those gaps
• Attend to possible sensory, motor, or structural causes of such gaps
  • oral-peripheral examination
  • audiological, medical or dental referral
• Measure phonological change in children whose productions are not easily glossed

Uses of Relational Analyses
• Identify patterns of error affecting stress patterns, word shapes, vowels, and consonants
• Quantify severity of impairment
• Quantify level of intelligibility
• Measure change in severity/intelligibility over time as an indicator of clinical improvement
• Assess the naturalness of child’s errors
• Assess the variability of error patterns

Independent Analyses
• “Inventories” of...
  • stress patterns
  • word shapes
  • vowels
  • consonants
• Syllable Structural Level

Relational Analyses
• “Target analyses” of...
  • stress patterns
  • word shapes
  • vowels
  • consonants
• Percentage Consonants Correct (PCC)
• PMLU and PWP
• Error Breakdown
• Phonological process analysis

Special Analysis: Variability
• Number of repeated words, showing same error
• Number of repeated words, all produced correctly
• Number of repeated words, showing different errors (A)
• Number of repeated words, one or more produced correctly (B)
• Number of repeated words (C)
• Variability index = A / (C – B)
Uses of Variability Analysis

- Identify instability in phonological system
  - therapy may then focus initially on trying to achieve greater consistency of production
- Identify phonological change in progress
  - therapy may then neglect those elements of the system that appear to be changing on their own
- Measure change in variability over time as an indicator of clinical improvement

Special Analysis: Homonymy

- **lexical type**: an adult word used by the child; for example, "dog", "cat", and "blanket" are three lexical types.
- **phonetic form**: a distinct phonetic shape independent of lexical type; for example, the forms [kæ], [dæ], [dɔ], [dɔɡ], and [dɔk] are five phonetic forms, no matter how many lexical types they represent.
- **phonetic type**: a distinct phonetic shape for any particular lexical type; for example, "cat" might be produced by the same speaker as [kæ], [dæ], or [tæ] and would thus have three phonetic types

Special Analysis: Homonymy

- **homonymous form**: a phonetic form that represents two or more lexical types; for example, [bɒt] is used for both "bath" and "blanket".
- **homonymous type**: a lexical type that has a homonymous form as one of its phonetic types; for example, "bath" and "blanket" both have [bɒt] as one of their phonetic types and thus they are both homonymous types.

Special Analysis: Homonymy

- Proportion of homonymous types = number of homonymous types / number of lexical types
- Ratio of homonymous types = (number of lexical types - number of homonymous types) / number of homonymous types
  - The ratio is then simplified so that the denominator is 1. For example, a ratio of 55 nonhomonymous types/11 homonymous types would give a ratio of 5:1.
  - This would mean that the child uses 5 non-homonymous types for every homonymous type used.

Uses of Homonymy Analysis

- Identify occurrence of homonymy
  - it can then be considered as an issue in target selection
  - transcription of homonymous forms should be verified to determine if child is marking phonemic contrasts in minimally perceptible ways
  - provides targets to be used in "minimal contrast" treatment activities
  - Measure change in homonymy over time as an indicator of clinical improvement

Severity Ratings and Production Accuracy

- Shriberg & Kwiatkowski (1982) showed that Percentage of Consonants Correct (PCC) correlates significantly with clinical ratings of severity.
- Created a severity scale based on PCC that creates a set of consistent categories.
### PCC and Severity

<table>
<thead>
<tr>
<th>Range</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>85% +</td>
<td>Mild</td>
</tr>
<tr>
<td>65-85%</td>
<td>Mild-moderate</td>
</tr>
<tr>
<td>50-65%</td>
<td>Moderate-severe</td>
</tr>
<tr>
<td>&lt; 50%</td>
<td>Severe</td>
</tr>
</tbody>
</table>

### Two New Measures

- Ingram & Ingram (2001) noted that PCC ignores the complexity of the words being produced.
- Proposed two new measures:
  - PMLU – phonological mean length of utterance
  - PWP – proportion of whole-word proximity (how correct the words tend to be)

### PMLU

- Based on words rather than utterances.
- Assumes that length of the words is a proxy for complexity.
- Compute an average of at least 25 DIFFERENT words.
- 1 point for each segment produced (consonants and vowels).
- 1 point for each correct consonant.

### PWP

- Compute PMLU for each word and divide by the PMLU of the target (i.e., the score for a fully correct version of the word).
- Compute an average for at least 25 different words.

### Example

- Child says /tɔr/ for /skɔr/ "score"
- PMLU = 4 points: 3 segments produced; 1 correct consonant.
- PMLU of target = 7 points: 4 total segments; 3 total consonants.
- PWP = 4/7 = 0.57

### PMLU and PWP

- Not clear if either of these represents a better index of clinical severity than PCC.
Study of PMLU / PWP and Severity Ratings

- Five experienced clinicians with at least 10 years experience rated 17 speech samples.
- 7 point severity scale.
- PMLU and PWP calculated on same samples (52-97 different words per sample).
- Also calculated PCC and PPC (percentage of phonemes correct).

PCC and Severity Ratings

- Using median PCC scores, 13/17 (76%) children were correctly categorized into the PCC severity categories by the current listeners.
- 2 were rated 1 category lower than expected.
- 2 were rated 1 category higher than expected.
- Suggested that the current ratings were consistent with the original (1982) study and that PCC is a reliable index of severity.

PMLU / PWP and Severity Ratings

- Significant correlations obtained with median severity ratings:
  - PMLU  -.781
  - PWP  -.756
  - PPC  -.743
  - PCC  -.706 *

PMLU / PWP and Severity Ratings

- Correlation coefficients suggest that PMLU and PWP may have a slightly stronger relationship with severity ratings.
- PPC and PCC involve a much simpler calculation but computerized analysis would eliminate this advantage.

PWP and Intelligibility

- Ingram & Ingram (2001) suggest that PWP is a good proxy for intelligibility.
- Using the ASHA project data set, Intelligibility Index (II; % of words understood in conversation) was then calculated.
- Correlations obtained:
  - II and PWP = .767
  - II and PCC = .618
  - II and PPC = .772

Summary

- PMLU and PWP are word level measures that may have some clinical value.
- PCC and PPC are segment level measures with a longer history in the field.
- In general, we should expect these measures to be highly correlated.
- Any striking differences among the 4 measures may indicate a specific problem area for a given child.