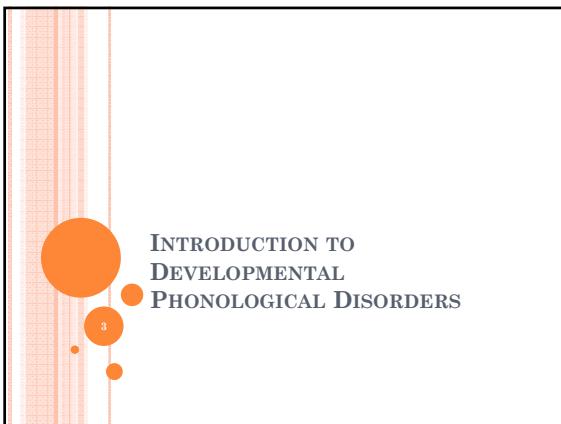


## OUTLINE

- Introduction to Developmental Phonological Disorders
- Phonological Development at Multiple Levels of Representation
- Treatment Planning
- Input Oriented Treatment Procedures
- Phonological Treatment Procedures
- Output Oriented Treatment Procedures
- Research Evidence



Participant 7 Age 4;5

Pretreatment:



Post-treatment:



## PARTICIPANT 7 QUESTIONS

- Pretreatment
  - What would you do with this child?
    - Approach to treatment?
    - Approach to target selection?
    - Approach to service delivery model?
- Post-treatment
  - What is this child's experience at school, in kindergarten and beyond, likely to be?



**PARTICIPANT 8 QUESTIONS**

- Pretreatment
  - What are the possible causes of this child's speech sound disorder?
- Post-treatment
  - Why did this child not make the same gains in treatment as the other Participant 7?
  - What is this child's experience at school, in kindergarten and beyond, likely to be?

9

**PHONOLOGICAL DEVELOPMENT AT MULTIPLE LEVELS OF REPRESENTATION**

Traditional View  
Multiple Levels of Representations  
Acoustic Representations  
Acoustic-Phonetic Representations  
Semantic Representations  
Articulatory Representations  
Phonological Representations  
Creating Linkages to Learn New Words  
Summary

A diagram showing three orange circles of increasing size, representing levels of representation: acoustic, acoustic-phonetic, and semantic. Below them is a grid of smaller circles. The number '10' is in the bottom left corner.

Phonological Process

A flowchart showing the phonological process from phonological planning to motor programming and execution. It includes a spectrogram, a tree diagram for [t], and a baby icon with the letters 'tu'.

Phonological Planning

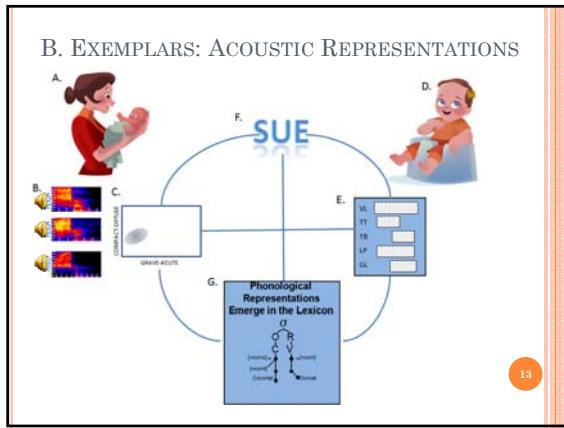
Motor Programming and Execution

tu

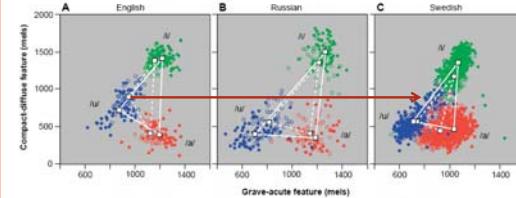
**MULTIPLE LEVELS OF REPRESENTATION**

A. Woman holding a baby  
B. Spectrograms  
C. Compartments  
D. Baby icon  
E. Grid of letters (VL, TT, TB, LP, GL)  
F. SUE (Spectrogram)  
G. Phonological Representations Emerge in the Lexicon (Diagram of a speech sound path)

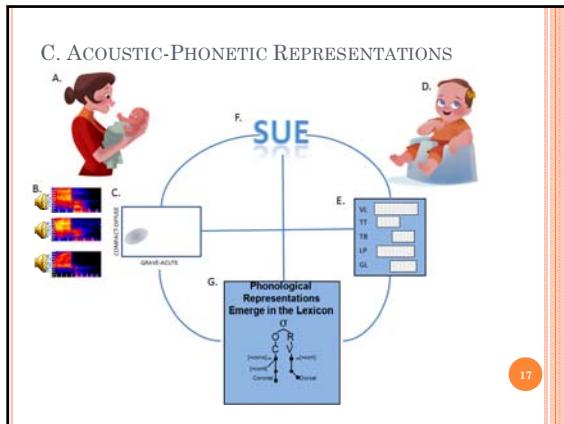
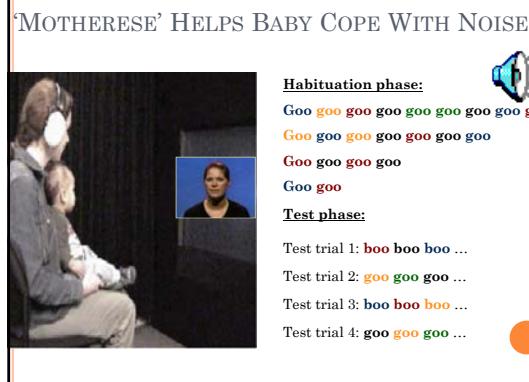
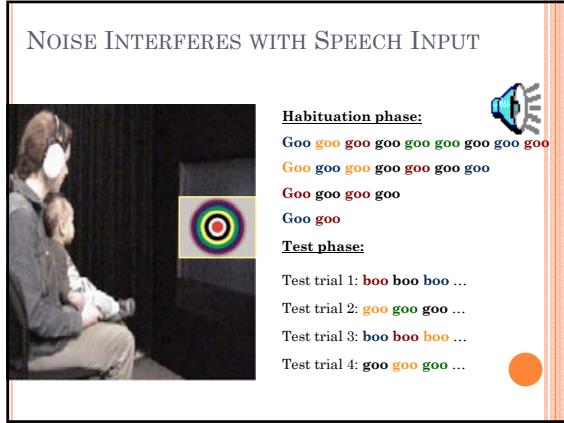
12



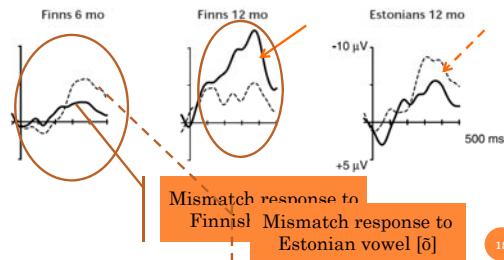
INFANT MUST LEARN A LANGUAGE SPECIFIC STRATEGY FOR ABSTRACTING ACOUSTIC-PHONETIC REPRESENTATIONS FROM THE INPUT



14

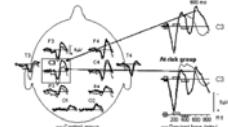


SENSITIVITY TO NON-NATIVE SPEECH SOUNDS DECLINES DURING THE FIRST YEAR



18

### SPEECH PROCESSING IN INFANTS WITH FAMILIAL RISK FOR DYSLEXIA

A. 

B. 

19

### SOCIAL INTERACTION AND PERCEPTUAL LEARNING

A. Foreign-language exposure

1 low exposure      Television exposure



B. Mandarin Chinese phonetic discrimination

/tɒʰ/ - /tɕ/

| Condition                           | Percent correct |
|-------------------------------------|-----------------|
| Live Chinese language intervention  | ~75% (red bar)  |
| American infants exposed to Chinese | ~75% (blue bar) |
| Television exposure                 | ~50% (red bar)  |
| Monolingually raised infants        | ~50% (blue bar) |
| Chance                              | ~50%            |

10 - 12      10 - 12      10 - 12

20

### F. SEMANTIC REPRESENTATIONS

A. 

B. 

C. 

D. 

E. 

F. SUE

G. Phonological Representations Emerge in the Lexicon

21

### PHONEMIC PERCEPTION BY TODDLERS

14 month olds

- Switch task:
  - 'neef' vs 'lim'
  - 'bi' vs 'di'
- ERP
  - 'bear' vs 'kobe'
  - 'bear' vs 'gare'

20 month olds

- Behavioural and ERP responses are obtained to all of these contrasts
- Vocabulary size better predictor than age

neef

Where's the bear?

22

### AMOUNT OF INPUT AND LEXICAL LEARNING

- Overall amount of parent speech accounts for a substantial amount of variation in vocabulary growth.
- The relative frequency of exposure to specific words is related to the order of acquisition of those words.

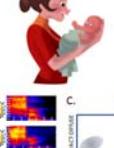
Huttenlocher et al (1991)

Hart & Risley (1995)

| Group         | Words per Hour     |
|---------------|--------------------|
| Professional  | ~2100 (48 M words) |
| Working Class | ~1300 (28 M words) |
| Welfare       | ~600 (12 M words)  |

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### F. ARTICULATORY REPRESENTATIONS

A. 

B. 

C. 

D. 

E. 

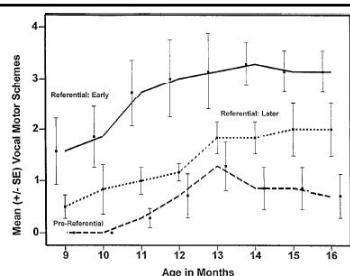
F. SUE

G. Phonological Representations Emerge in the Lexicon

24

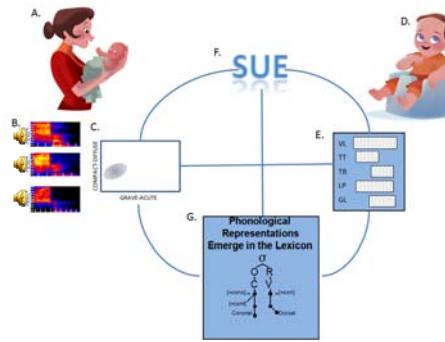
### VOCAL MOTOR SCHEMES PROMOTE THE TRANSITION TO REFERENCE

Figure 1. Mean number of VMS (Vocal Motor Scheme) consonants for Referential: Early (13–14 months), Referential: Later (15–16 months), and Pre-Referential children.

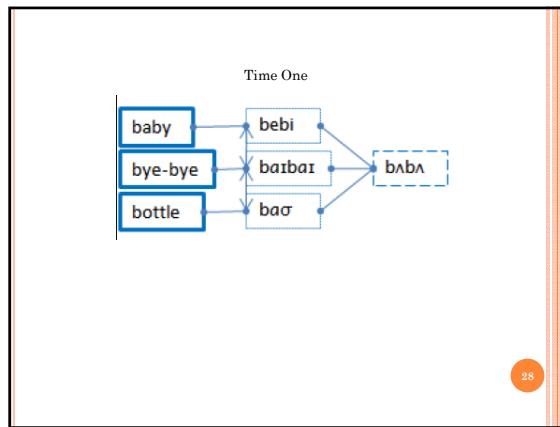
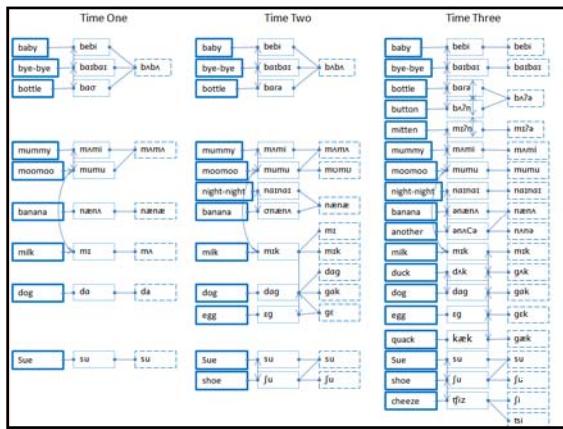


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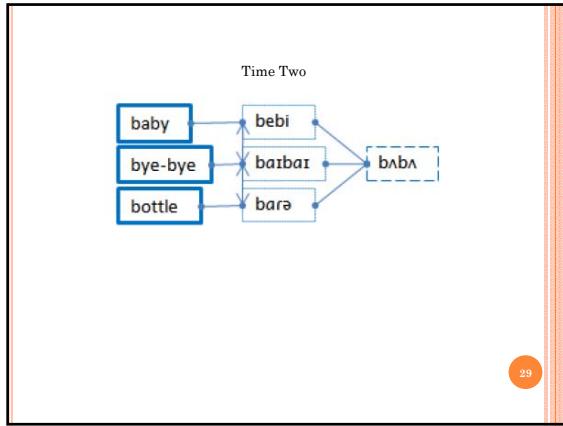
### F. EMERGENT PHONOLOGICAL REPRESENTATIONS



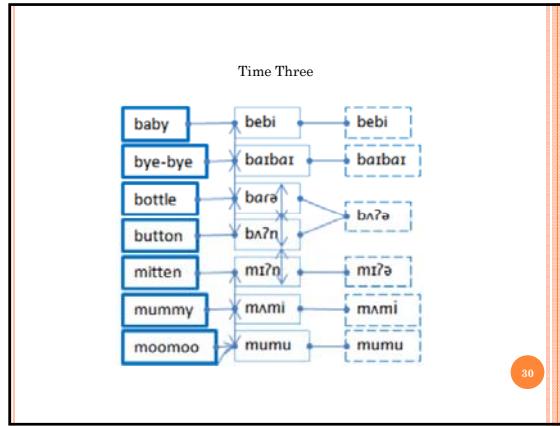
26



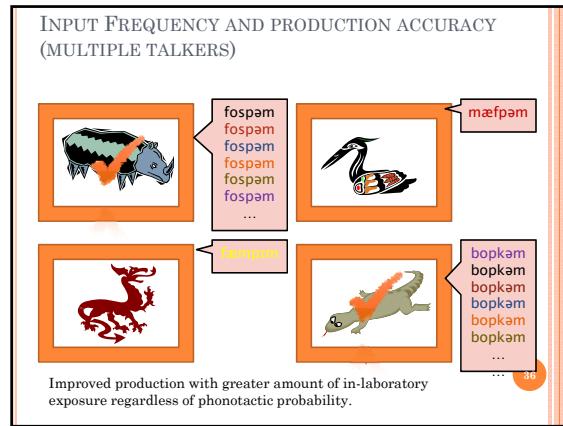
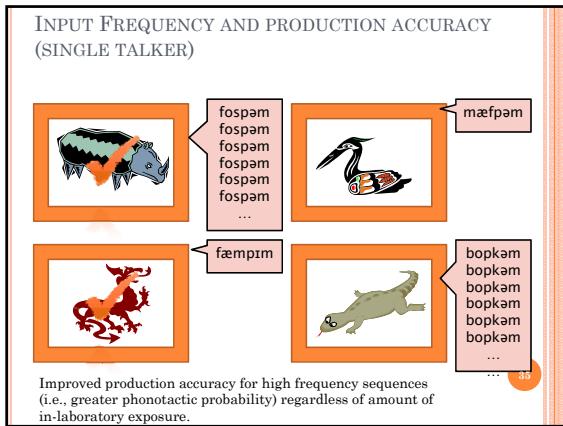
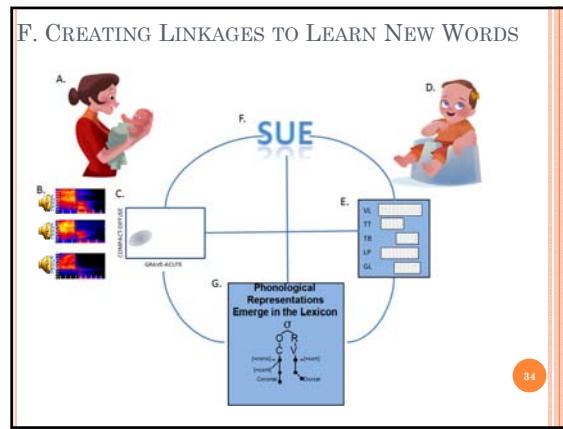
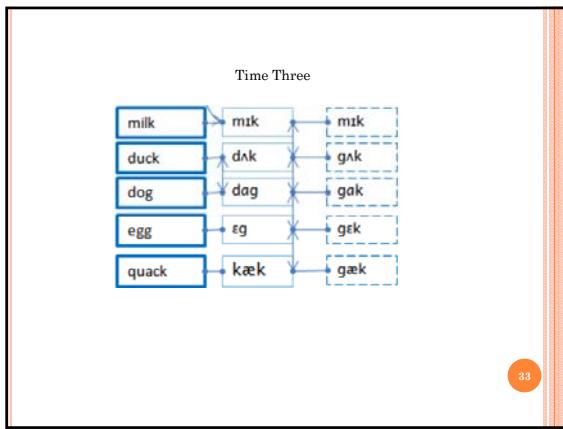
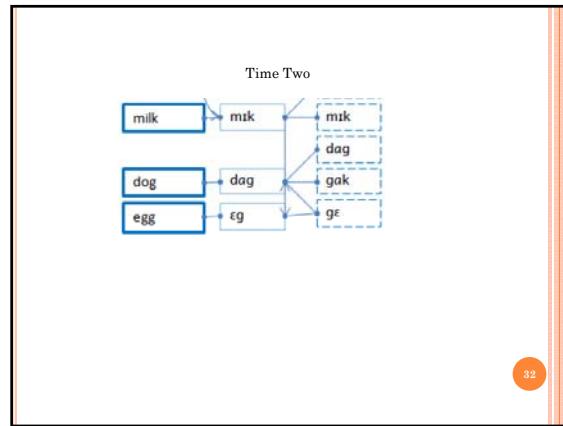
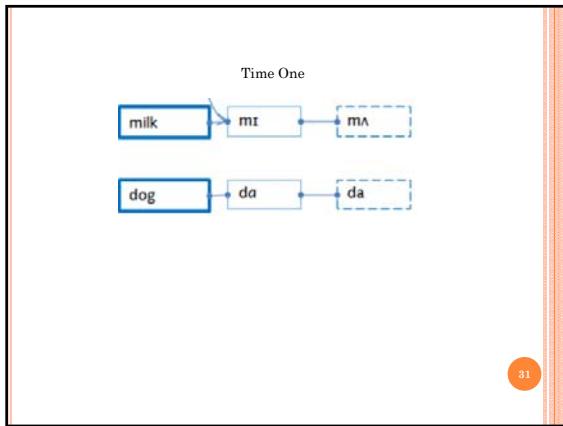
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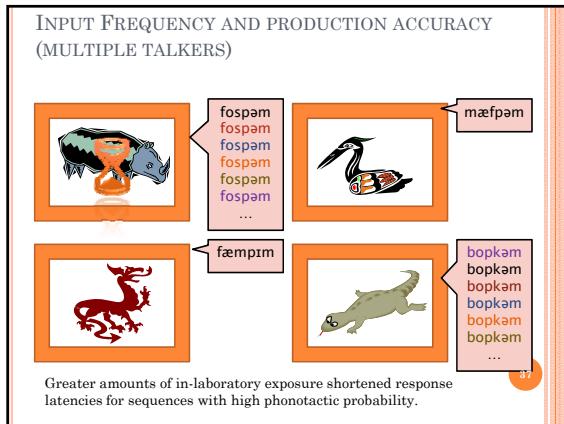


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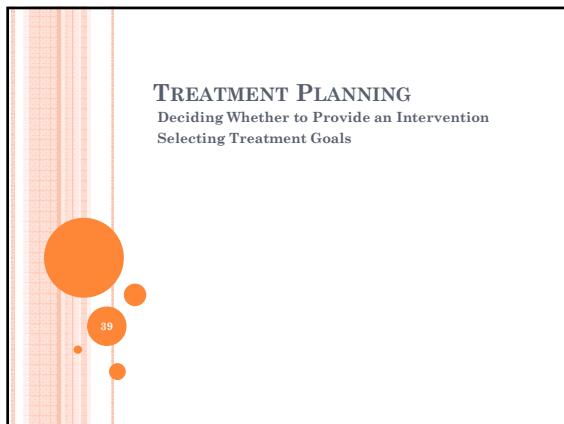




### SUMMARY

- Language input promotes the development of phonemic perception skills.
- Language input promotes the development of vocabulary skills.
- A large vocabulary promotes the development of phonological knowledge.
- Speech practice promotes speech motor control and influences phonological development.
- Listening to single talker speech input facilitates production of new words with familiar sound sequences.
- Listening to variable multi-talker speech input facilitates production of new words with unfamiliar sound sequences.

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### OPERATIONALIZING THESE PERSPECTIVES ON NEED FOR INTERVENTION

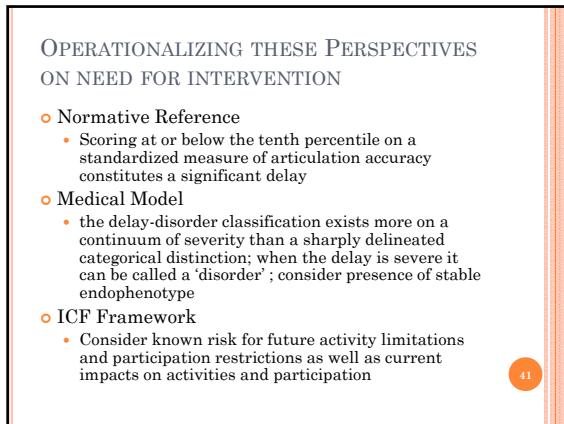
- Normative Reference
  - Scoring at or below the tenth percentile on a standardized measure of articulation accuracy constitutes a significant delay
- Medical Model
  - the delay-disorder classification exists more on a continuum of severity than a sharply delineated categorical distinction; when the delay is severe it can be called a 'disorder'; consider presence of stable endophenotype
- ICF Framework
  - Consider known risk for future activity limitations and participation restrictions as well as current impacts on activities and participation

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### THREE PERSPECTIVES ON NEED FOR INTERVENTION

- Normative Reference
  - treatment is prescribed if the child appears to be significantly delayed with respect to the mean of an appropriate reference group
- Medical Model
  - reserve treatment for children who are diagnosed with a phonological disorder as differentiated from delayed phonological development.
- ICF Framework
  - place a higher priority on treating impairments that impact on the child's activities and participation in specific contexts

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CASE STUDY 8-4

Preschool (CA = 5;4)

- SAILS:  $z = -1.62$
- GFTA-2: 1<sup>st</sup> percentile
- PCC: 45%, -4.46
- PPVT: SS = 115
- MLU: 1.77
- PAT:  $z = -1.84$
- Error Phonemes: [f t l dʒ θ v s z ð]
- Clusters reduced

First Grade (CA = 6;7)

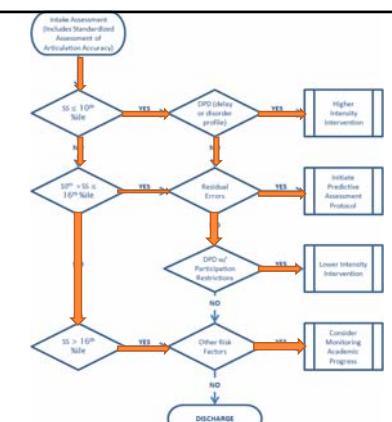
- SAILS:  $z = -2.11$
- GFTA-2: <1<sup>st</sup> percentile
- PCC: 53%, -8.6
- PPVT: SS = 95
- MLU: 2.95
- TOWRE: 91sw vs 81nw
- Error Phonemes: [g tʃ tʃl dʒθ v s z ð]
- Clusters reduced

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LONG-TERM OUTCOMES: SPEECH OR LANGUAGE DELAY AT AGE 5

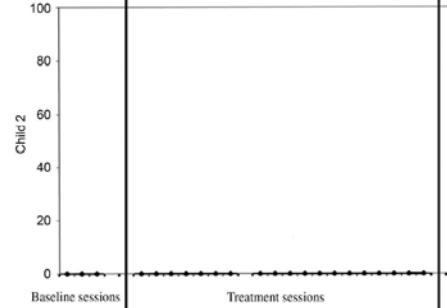
- 5x more likely to have reading disability in 2<sup>nd</sup> grade
- Almost half will have reading disorder
- More than half will have spelling disorder
- Boys 2 x more likely to have ADHD at age 12
- Girls 10 x more likely to have emotional disorder at age 12
- Boys 2 x more likely to have been arrested by age 19

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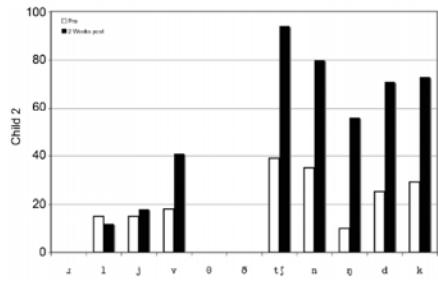
45

GOAL SELECTION: COMPLEXITY APPROACH



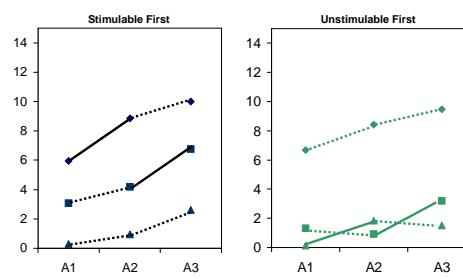
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GOAL SELECTION: COMPLEXITY APPROACH

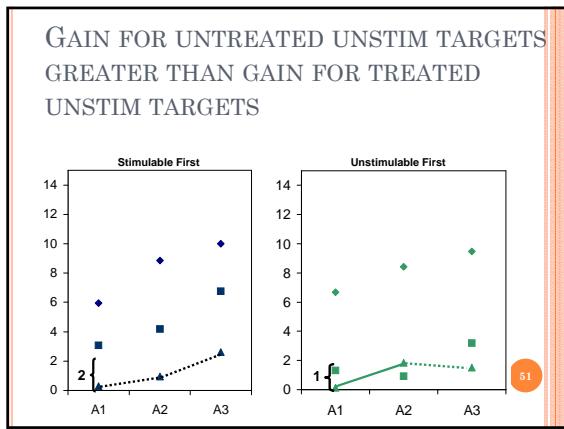
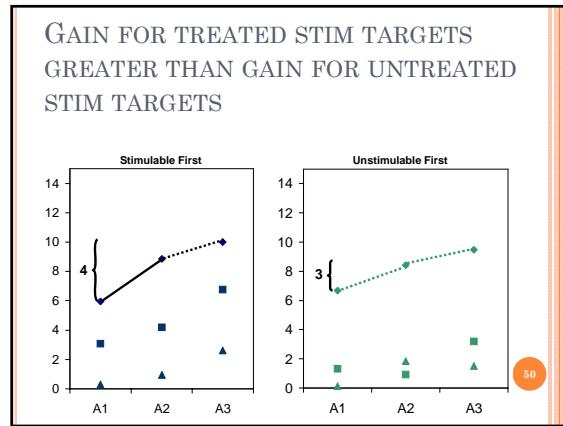
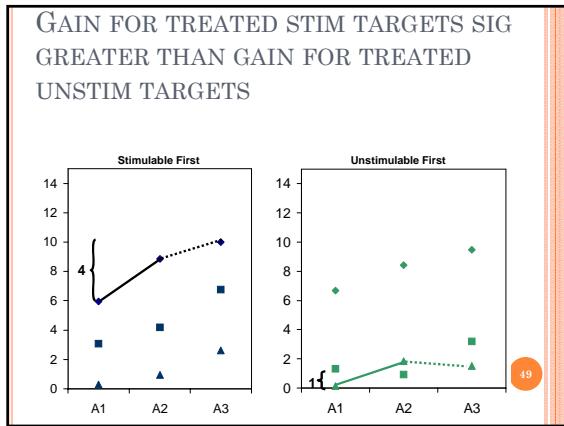


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CHANGE IN TREATED AND UNTREATED SOUNDS IN 6 WKS

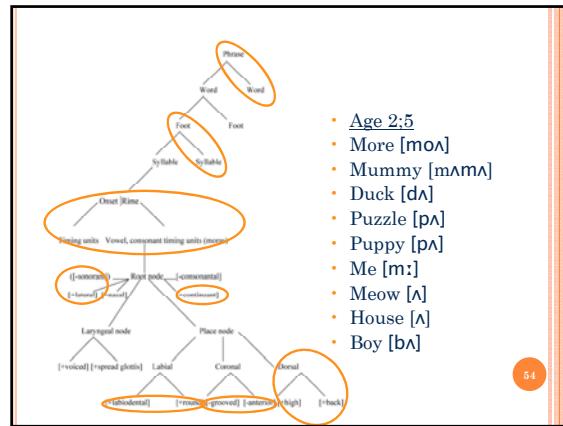
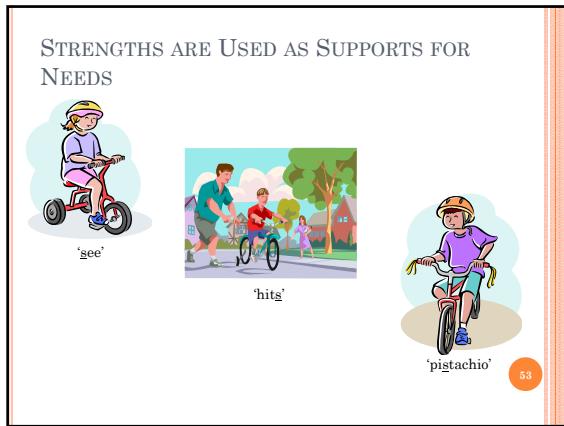


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#### PRINCIPLES OF GOAL SELECTION

- Take into account all factors associated with the child's DPD (perceptual, motoric, cognitive, psychosocial, linguistic)
  - Determine strengths and needs at all levels of the phonological hierarchy (phrase, word, syllable structure, segment, feature and associations between tiers)
  - Identify the child's default structures: be aware that these defaults may not correspond to the default/markedness relationships hypothesized for the adult system
  - Use a horizontal or cycles goal attack strategy to alternate between prosodic and segmental goals within a given treatment block, starting with prosodic goals.
  - Strengths are used as supports for needs; i.e., new syllable structures are targeted with established segments while new segments/features are introduced in the context of established word shapes/syllable structures.
  - With respect to segmental goals, marked features are targeted in emerging segments.
  - More complex and unstimulable segments may be introduced if the child is a 'risk-taker' but avoided for children who need to experience immediate success.
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### SUGGESTED GOALS

- Prosodic Level
  - Phrase
    - CV + CV phrases
  - Foot/word
    - CVCV words
  - Rime
    - V → VV
- Feature
  - Manner
    - Introduce labial glide /w/ in CV syllables
    - Stabilize labial stops and nasals → labiodental fricative
  - Place
    - Expand repertoire of vowels used in labial C + V syllables

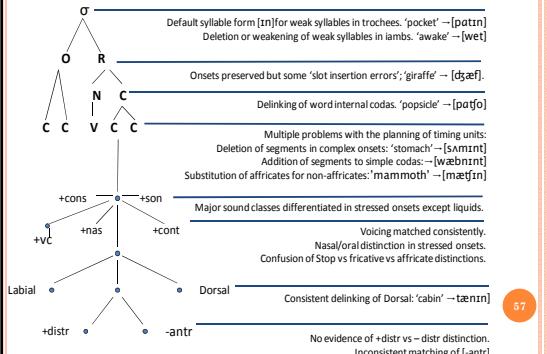
55

### 6 MONTH OUTCOME

- Age 2;5
  - Shower [dauwə]
  - Water [wʌtə]
  - Bath [bæ]
- More [mɔʌl]
- Mummy [mʌmɪ]
- Duck [dʌ]
- Puzzle [pʌl]
- Puppy [pʌp]
- Me [m:]
- Meow [ʌ]
- House [ʌ]
- Boy [bʌ]
- Age 3;1
  - No have baby [nə ha bei]
  - No open bottle [nə obi bɔ?o]
  - No cheerio [nə tʃiwo]
  - No cowboy horse ride [nə dʌboi ho wai]
  - Pink [pɪn]
  - Cup [tʌp]
  - Pen [pɛn]
  - Where cup go? [wɛ tʌ do]

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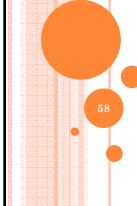
### DEMONSTRATION 11-2



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### INPUT ORIENTED TREATMENT PROCEDURES

Focused Stimulation and Auditory Bombardment  
Speech Perception Training  
(Dialogic Reading)



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### PRINCIPLES OF FOCUSED STIMULATION FOR PHONOLOGICAL THERAPY

- Have a specific target
- Identify the target for the child
- Do not mix up phonological and syntactic targets in the same session (alternate/cycle these targets)
- Initially, ensure high frequency of exposures to the target form with no pressure on child to produce it (auditory bombardment)
- Use slow, child directed register but do not use telegraphic speech
- Gradually introduce opportunities for the child to produce the form in the context of hybrid (balanced) naturalistic intervention contexts
- As correct productions begin to emerge, switch focus to prompting and then responding to child productions

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### FOCUSED STIMULATION PROCEDURES

- Time delay/slow rate
  - Slow pace of conversation; wait longer for response.
- Model
  - Present target form, often in contrast, without an opportunity for child production.
- Recast
  - Repeat some of the child's words while correcting or modifying the targeting form.
- Expansion
  - Repeat some of the child's words while adding content to expand the child's meaning.
- Imitation/feedback
  - Imitate the child's correct use of the target form.
- Question
  - Ask a question that may or may not include the target.

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#### FOCUSED STIMULATION VIDEO DEMONSTRATIONS

- [Michelle, Le Mouton](#)
- [J'aimeerais faire entrer...](#)

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#### PRINCIPLES OF SPEECH PERCEPTION INTERVENTION

- Provide exposure to highly variable natural speech input (acoustic-phonetic and talker dimensions)
- Provide information about prototypical members of the target phoneme category, and
- Provide information about the boundaries between the target phoneme category and neighboring categories
- Contrast target phoneme with actual (not simulated) misarticulations
- Directly engage the child with the input
- Provide informative feedback about the child's responses

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#### SAILS: VIDEO DEMONSTRATION

- [Shannon and Francoise: SAILS 'feet' module](#)

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#### DIALOGIC READING PARENT INTERVENTION

- Speech Disorders and Academic Impacts
- Selecting Books and See-Saw Book Reading Technique
- Prompts for Vocabulary Development
- Prompts for Verbal Reasoning
- Emergent Literacy (PA)
- Emergent Literacy (Letters)

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#### CLASSROOM BASED LANGUAGE INTERVENTIONS

- Wilcox et al. (2011): TELL Curriculum
- Schwanenflugel et al. (2010): PAVEd for Success
- Dickinson, D.K., & Tabors, P.O. (2001). *Beginning Literacy with Language*
- Wasik, B.A., Bond, M.A., & Hindman, A. (2006)
- Biemiller, A., & Boote, C. (2006)

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#### DRAMATIC READING STYLE

- Modify pitch and loudness of voice
- Use different voices
- Use gestures to illustrate actions
- Use facial expressions to illustrate emotion
- Use dramatic pauses to signal important events or transitions



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### DIALOGIC READING TECHNIQUES

- Prompt: Evoke a response from the child.
  - Completion
  - Recall
  - Open-Ended
  - Wh-Questions
  - Distancing
- Evaluate: Provide feedback to indicate whether the response was correct or not.
- Expand: Add information to the child's response OR ask a question to get more information.
- Repeat: Ask the child to repeat the correct response or the new information.

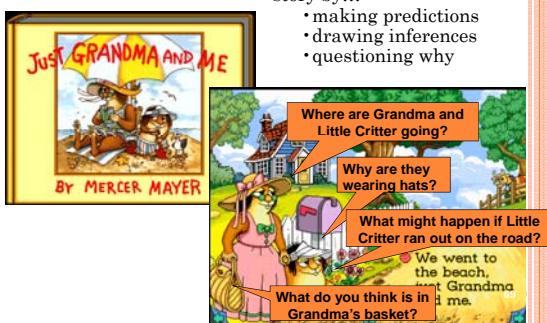
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### LANGUAGE INPUT IN HELPFUL INTERACTIONS



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### VERBAL REASONING



Actively make sense of story by...

- making predictions
- drawing inferences
- questioning why

### ANALYSIS AND COGNITIVE EXTENDING

- Follow the book reading with interactive, reflective conversation:
  - How?
  - Why?
  - When?
  - What if?
  - What next?
- Become involved in the lives of the characters
- Begin to understand motivations
- Think and talk about meanings of words
- Expand knowledge of the world

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### PHONOLOGICAL TREATMENT PROCEDURES

Meaningful Minimal Pairs Contrast Therapy

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### MEANINGFUL MINIMAL PAIRS

- A uniquely phonological therapy procedure in which words are used to teach the linguistic and communicative function of distinctive features.
- The procedure has two key components:
  - (1) teach the child a pair of words that differs by a single phoneme, e.g., 'tea' /ti/ versus 'key' /ki/; and
  - (2) arrange the environment so that the child experiences a communication breakdown if both words are produced as a homophone, e.g., 'tea' → [ti] and 'key' → [ti], thus motivating a change in production in order to avoid this situation.

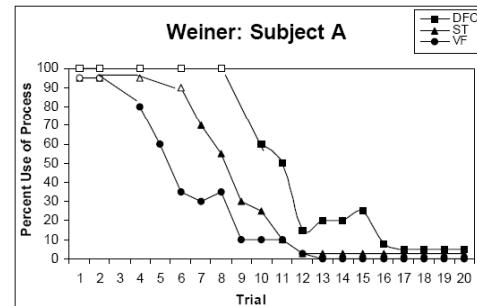
72

#### STEPS IN MINIMAL PAIRS PROCEDURE

- Test for Concepts
  - Does the child know the meaning of the words?
- Test for Discrimination
  - Can the child discriminate the phonemes that distinguish the meaningful minimal pair?
- Production Practice
  - Child produces the words in a context that provides opportunities for communication breakdown.
- Generalization
  - Repeat with new word pairs and phonemes until generalization has been achieved across the sound class at the word level.
  - Use traditional procedures to promote generalization to untrained words and to sentence level material.

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#### RESULTS FOR ONE CHILD



#### OUTPUT ORIENTED PROCEDURES

Challenge Point Framework  
Strategies for Achieving the Challenge Point  
Importance of Informative Feedback

75

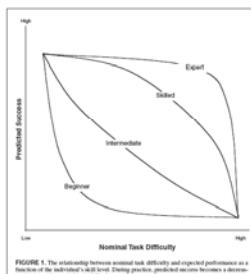
#### CHALLENGE POINT FRAMEWORK

- Learning is related to the information available and interpretable in a performance instance which in turn depends on the functional difficulty of the task.
- Learning requires the optimal amount of information (not too much, not too little).
- The optimal amount of information differs as a function of the skill level of the learner and the difficulty of the task.

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#### NOMINAL TASK DIFFICULTY

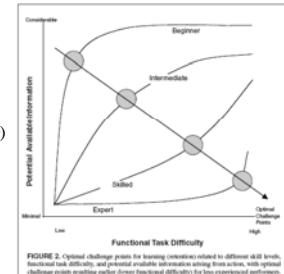
- Success during practice is predicted by nominal task difficulty but in relation to the learner's skill level.



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#### FUNCTIONAL TASK DIFFICULTY

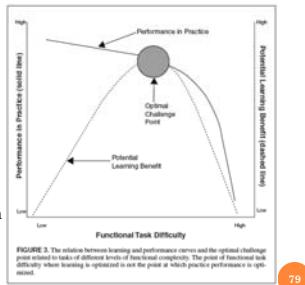
- Relevant information:
  - Inverse model (motor predictor)
  - Forward model (sensory predictor)
  - Sensory-feedback
- Potential information increases with functional task difficulty.



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### OPTIMAL CHALLENGE POINT

- The point of functional task difficulty where learning is optimized is not the point at which practice performance is optimized.
- (see handout for strategies to maintain speech practice at the challenge point)



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### INFORMATIVE FEEDBACK DURING PRACTICE

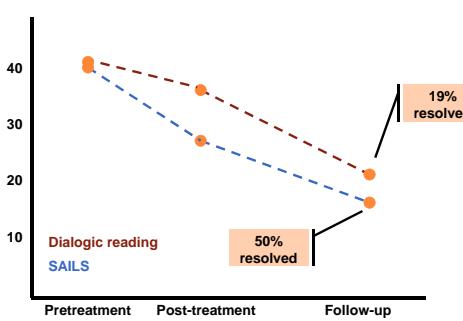
- Source of Feedback**
  - Intrinsic
  - Extrinsic
- Types of Feedback**
  - Knowledge of Performance
  - Knowledge of Results
- Edited Videos\Video 4 - Articulation Practice Inappropriate Contingencies.avi**
- Edited Videos\Video 1 - Phonetic Placement.avi**

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### RESEARCH FINDINGS

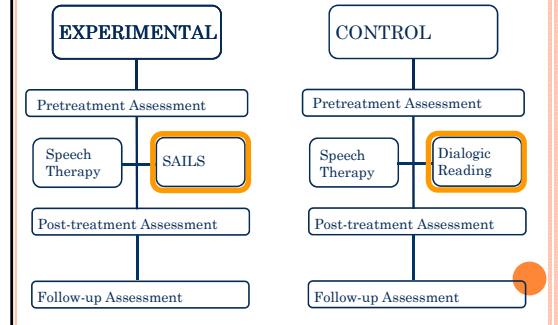
81

### RESULTS: GFTA ERRORS



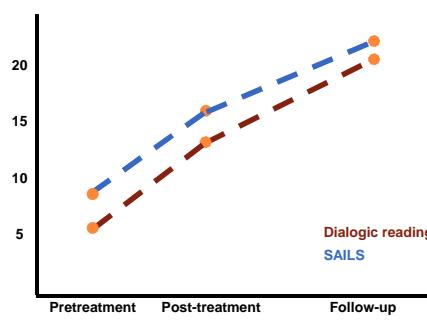
83

### RVACHEW ET AL., 2004: STUDY DESIGN



82

### RESULTS: PA TEST SCORES

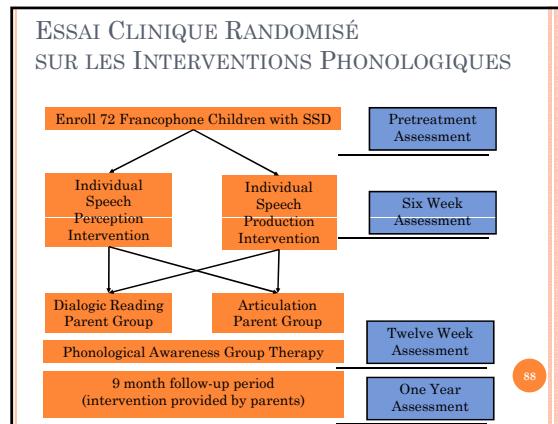


84

| CASE STUDIES                     |                |              |
|----------------------------------|----------------|--------------|
| Pretreatment                     | PA08 (Control) | PA07 (SAILS) |
| GFTA <sub>percentile</sub>       | 3              | 4            |
| PCC <sub>percent correct</sub>   | 51             | 66           |
| SAILS <sub>percent correct</sub> | 77             | 73           |
| PPVT <sub>percentile</sub>       | 40             | 48           |
| DSS <sub>raw score</sub>         | 3.54           | 4.56         |
| PA <sub>raw score/34</sub>       | 5              | 3            |

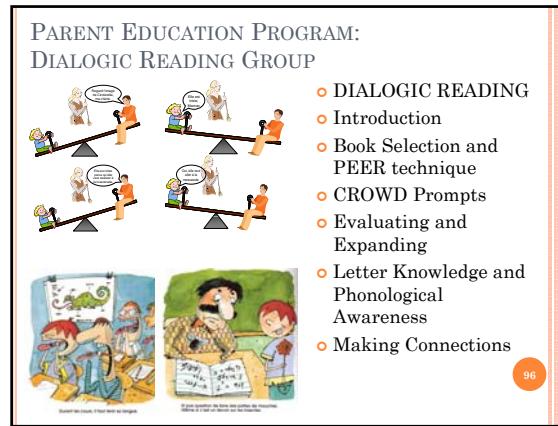
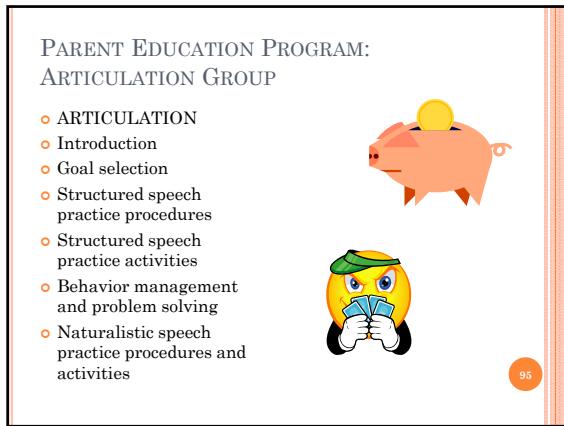
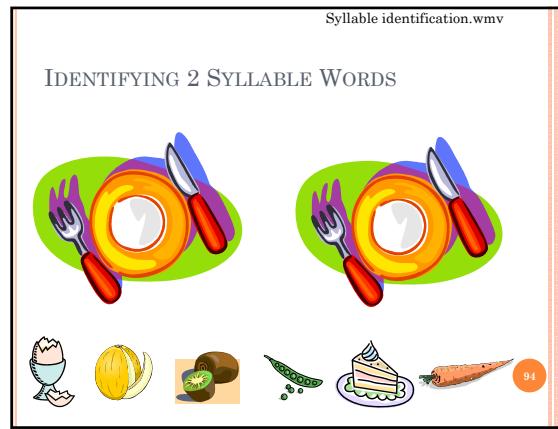
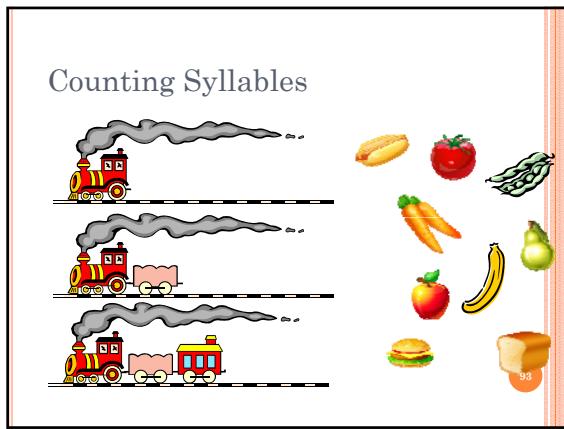
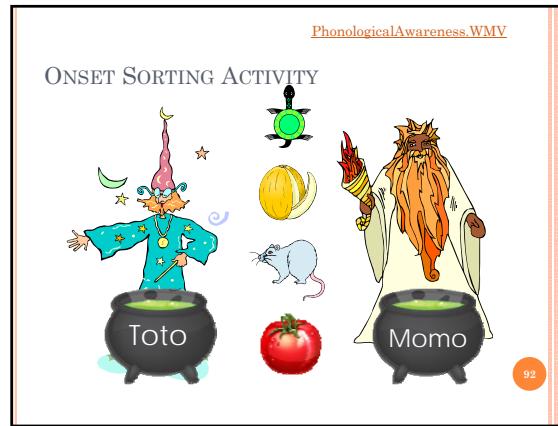
| Posttreatment                    | PA08 (Control) | PA07 (SAILS) |
|----------------------------------|----------------|--------------|
| GFTA <sub>percentile</sub>       | 1              | 17           |
| PCC <sub>percent correct</sub>   | 62             | 80           |
| SAILS <sub>percent correct</sub> | 69             | 90           |
| DSS <sub>raw score</sub>         | 7.13           | 6.48         |
| PA <sub>raw score</sub>          | 13             | 25           |
| ELA <sub>raw score</sub>         | 8              | 10           |

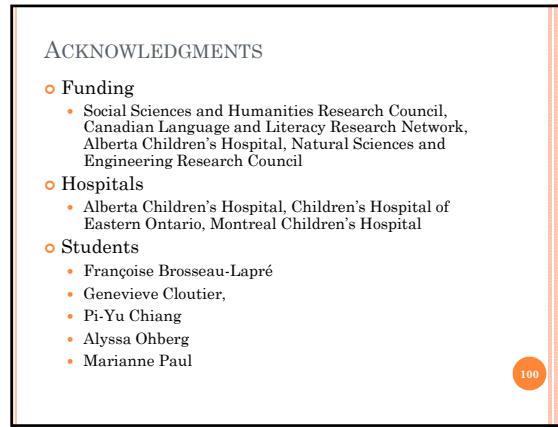
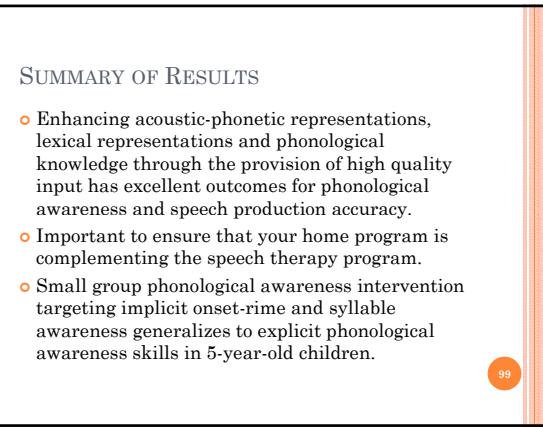
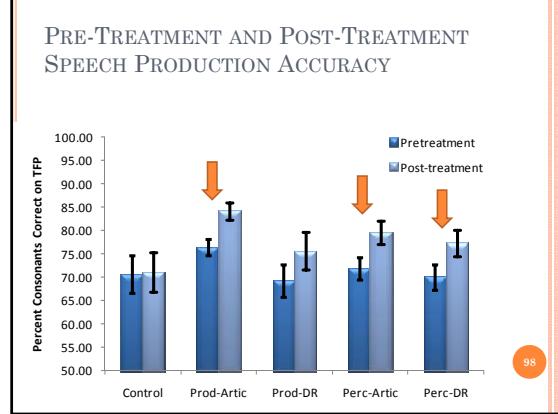
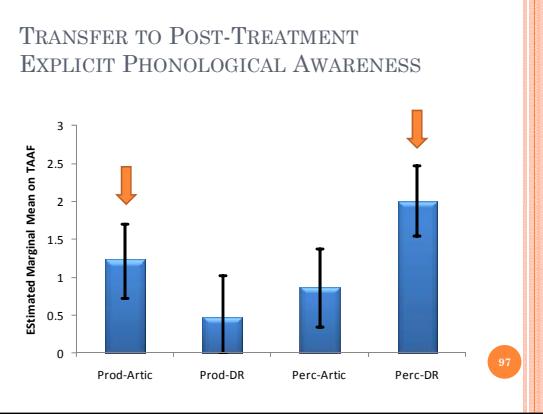
| Follow-up                      | PA08 (Control) | PA07 (SAILS) |
|--------------------------------|----------------|--------------|
| GFTA <sub>percentile</sub>     | 4              | 44           |
| PCC <sub>percent correct</sub> | 86             | 94           |
| PPVT <sub>percentile</sub>     | 87             | 68           |
| DSS <sub>raw score</sub>       | 5.23           | 7.16         |
| PA <sub>raw score</sub>        | 34             | 34           |
| ELA <sub>raw score</sub>       | 19             | 31           |



- SPEECH PRODUCTION INTERVENTION
- Identification
  - Stimulation including imitative models, phonetic placement and verbal instruction
  - Integral stimulation techniques, chaining and other techniques to facilitate correct production in words
  - Drill-play activities to promote practice in words, sentences and conversations
- Video demonstrations:
- Stimulation
  - Chaining
  - Drill-Play

- PHONOLOGICAL AWARENESS INTERVENTION
- Rime Matching
  - Onset Sorting
  - Syllable # Identification





## DEVELOPMENTAL PHONOLOGICAL DISORDERS: THE DYNAMIC INTERPLAY OF PHONETICS AND PHONOLOGY

### SLIDE OUTLINE, BIBLIOGRAPHY, AND HANDOUTS

#### Slide 1: Title Slide and Announcements

This presentation is based on the book, to be published in winter 2012:

Rvachew, S., & Brosseau-Lapré, F. (forthcoming). *Developmental Phonological Disorders: Foundations of Clinical Practice*. San Diego, CA: Plural Publishing, Inc.

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Please do not audio- or video-record this presentation because such recordings would violate my agreement with the parents of the children depicted in the case studies to be presented today.

#### Slides 2-9: Introduction to Phonological Disorders

Case studies taken from:

Rvachew, S., & Brosseau-Lapré, F. (2010). Speech perception intervention. In S. McLeod L. Williams, & R. McCauley (Ed.), *Treatment of Speech Sound Disorders in Children*. Baltimore, Maryland: Paul Brookes Publishing Co.

#### Slides 10-38: Phonological Development at Multiple Levels of Representation

Slides 12, 13, 17, 26, 34: Figure I-1, Rvachew & Brosseau-Lapré (forthcoming)

Figure I-1. Schematic of the emergence of phonological representations from the child's experience with language at multiple levels of representation: (A) language input; (B) stored acoustic exemplars, in this hypothetical example, the child's name as produced by the mother, the father and an older sibling; (C) acoustic-phonetic representations of linguistic units, in this example the vowel [u] derived from the distribution of F1-F2 values in the grave corner of the vowel space; (D) the child's experience with speech in the form of babbled syllables, (E) a motor score for a CV syllable comprised of a coronal sibilant combined with a rounded grave vowel; (F) the semantic representation for "Sue" stored in the lexicon; and (G) an emergent phonological representation for the word that reflects the child's experience with the phonetic characteristics of the word, the linkages between the representations of the word in multiple domains and the similarities and differences between this word and others in the lexicon at multiple levels of the phonological hierarchy.

Polka, L., Rvachew, S., & Molnar, M. (2008). Speech perception by 6- to 8-month-olds in the presence of distracting sounds. *Infancy*, 13, 421-439. (Slides 15 &16)

Cheour, M., Ceponiene, R., Lehtokoski, A., Luuk, A., Allik, J., Alho, K., et al. (1998). Development of language-specific phoneme representation in the infant brain. *Nature Neuroscience*, 1, 351-353. (Slide 18 and Figure 2-5 from Rvachew & Brosseau-Lapré, forthcoming).

Lyytinen, H., Aro, M., Eklund, K., Erskine, J., Guttorm, T., Laakso, M., et al. (2004). The development of children at familial risk for dyslexia: Birth to early school age. *Annals of Dyslexia*, 54(2), 184-220. (Slide 19)

Kuhl, P.K., Tsao, F., & Liu, H. (2003). Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning. *Proceedings of the National Academy of Sciences*, 100(159096-9101). (Slide 20)

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Hart, B. & Risley, T. (1992). American parenting of language-learning children: Persisting differences in family-child interactions observed in natural home environments. *Developmental Psychology, 28*, 1096-1105. (Slide 23)

See also:

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development, 74*(5), 1368-1378.

Huttenlocher, J. (1998). Language input and language growth. *Preventive Medicine, 27*, 195-199.

McCune, L., & Vihman, M.M. (2001). Early phonetic and lexical development: A productivity approach. *Journal of Speech, Language, and Hearing Research, 44*, 670-684. (Slide 25)

#### **Slides 27 to 33 and Handout #1: Figure 4-15 from Rvachew & Brosseau-Lapré (forthcoming)**

Figure 4-15. Hypothetical example of emerging phonological structure in the lexicon. Semantic representations shown as traditional orthographic spelling enclosed in solid boxes. Acoustic-phonetic representations shown as phonetic transcriptions enclosed in dotted boxes. Articulatory-phonetic representations shown as phonetic representations enclosed in dashed boxes. Linkages between levels of representation have rounded connectors (links from semantic to articulatory-phonetic representations are hypothesized but not shown due to space restrictions). Linkages between word forms in the lexicon have arrow-headed connectors. See text for discussion.

Richtsmeier, P.T., Gerken, L., Goffman, L., & Hogan, T. (2009). Statistical frequency in perception affects children's lexical production. *Cognition, 111*, 372-377.

#### Slides 39-56 Treatment Planning

Slides 40-43 including Case Study 8-4: Chapter 8, Rvachew & Brosseau-Lapré (forthcoming)

Slide 44: Chapter 7, Rvachew & Brosseau-Lapré (forthcoming), summarizing from:

Beitchman, J. H., Brownlie, E. B., Inglis, A., Wild, J., Ferguson, B., Schachter, D., et al. (1996). Seven-Year Follow-Up of Speech/Language Impaired and Control Children: Psychiatric Outcome. *Journal of Child Psychology and Psychiatry, 37*(8), 961-970.

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Slide 45: Figure 8-1, Rvachew & Brosseau-Lapré (forthcoming)

Figure 8-1. Flow-chart to facilitate treatment recommendations. SS = standard score (on a standardized measure of articulation accuracy; DPD = developmental phonological disorder. Predictive assessment protocol described in text and in Smit et al. (1990). See text for application guidelines with case examples.

Cummings, A.E., & Barlow, J.A. (2010). A comparison of word lexicality in the treatment of speech sound disorders. *Clinical Linguistics & Phonetics, 25*, 265-286. (Slides 46 & 47)

Slides 48-52:

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**Slide 57, Demonstration 11-2 and Handout #2: from Rvachew & Brosseau-Lapré (forthcoming)**

**Slides 58-74: Input Oriented Treatment Procedures****Slide 60 and Handout #3: Table 9-2 from Rvachew & Brosseau-Lapré (forthcoming)**

See also:

Fey, Marc E., Long, Steven H., & Finestack, Lizbeth H. (2003). Ten Principles of Grammar Facilitation for Children With Specific Language Impairments. *Am J Speech Lang Pathol*, 12(1), 3-15.

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Tyler, Ann A., Lewis, Kerry E., Haskill, Allison, & Tolbert, Leslie C. (2003). Outcomes of different speech and language goal attack strategies. *Journal of Speech, Language, and Hearing Research*, 46, 1077–1094.

Slide 63: Video from:

Rvachew, S., & Brosseau-Lapre, F. (2010). Speech perception intervention. In S. McLeod L. Williams, & R. McCauley (Ed.), *Treatment of Speech Sound Disorders in Children*. Baltimore, Maryland: Paul Brookes Publishing Co.

Slide 66: audio demonstration from “The Dark” by Robert Munsch, The Official Robert Munsch Website:  
<http://www.robertmunsch.com/playstory.cfm?bookID=30>

**Slide 67 and Handout #4: Table 9-5 from Rvachew & Brosseau-Lapré**

See also:

Whitehurst, G. J., Falco, F., Lonigan, C.J., Fischel, J.E., DeBaryshe, B.D., Valdez-Menchaca, M.C., et al. (1988). Accelerating language development through picture book reading. *Developmental Psychology*, 24, 552-558.

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Slide 66 demonstrates inferential reading script used in:

Rvachew, S., Nowak, M., & Cloutier, G. (2004). Effect of phonemic perception training on the speech production and phonological awareness skills of children with expressive phonological delay. *American Journal of Speech-Language Pathology*, 13, 250-263.

See also:

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**Slides 71-74 Phonological Treatment Procedures (Meaningful Minimal Pairs)**

Blache, S.E., & Parsons, C.L. (1980). A linguistic approach to distinctive feature training. *Language, Speech & Hearing Services in Schools*, 11, 203-207.

Blache, S.E., Parsons, C.L., & Humphreys, J.M. (1981). A minimal-word-pair model for teaching the linguistic significance of distinctive feature properties. *Journal of Speech and Hearing Disorders*, 46, 291-296.

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Slides 75 – 80 Output Oriented Treatment Procedures (Challenge Point Framework)

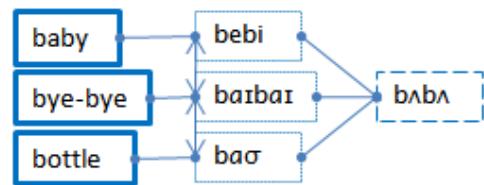
Guadagnoli, M.A., & Lee, T.D. (2004). Challenge point: A framework for conceptualizing the effects of various practice conditions in motor learning. *Journal of Motor Behavior*, 36, 212-224.  
Slide 79 and Handout #5: Table 10-3 from Rvachew & Brosseau-Lapré

Slides 81-99 Research Findings

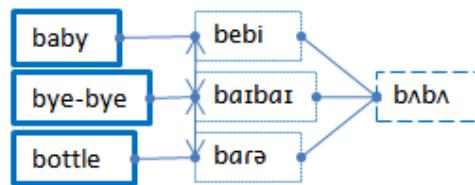
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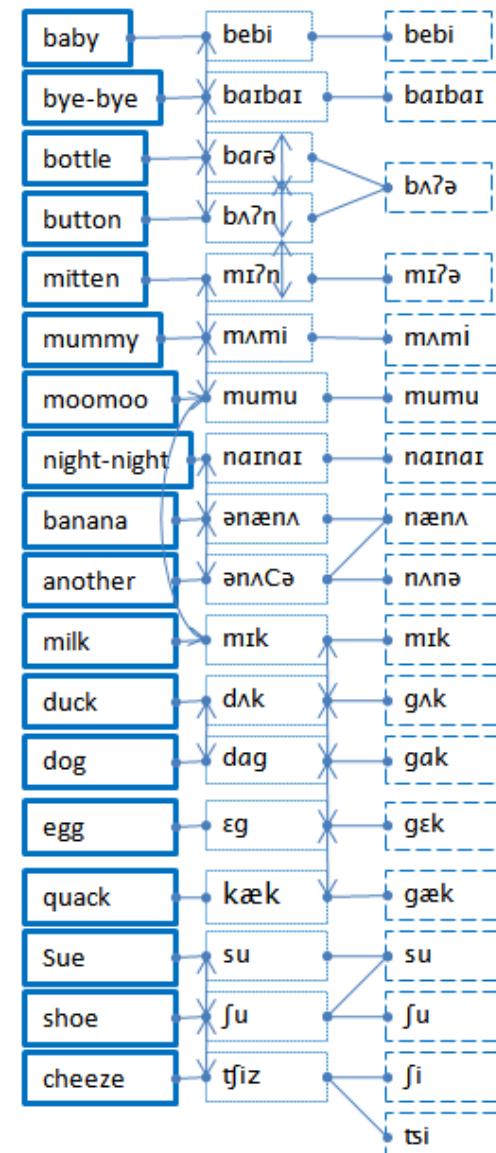
Time One



Time Two



Time Three

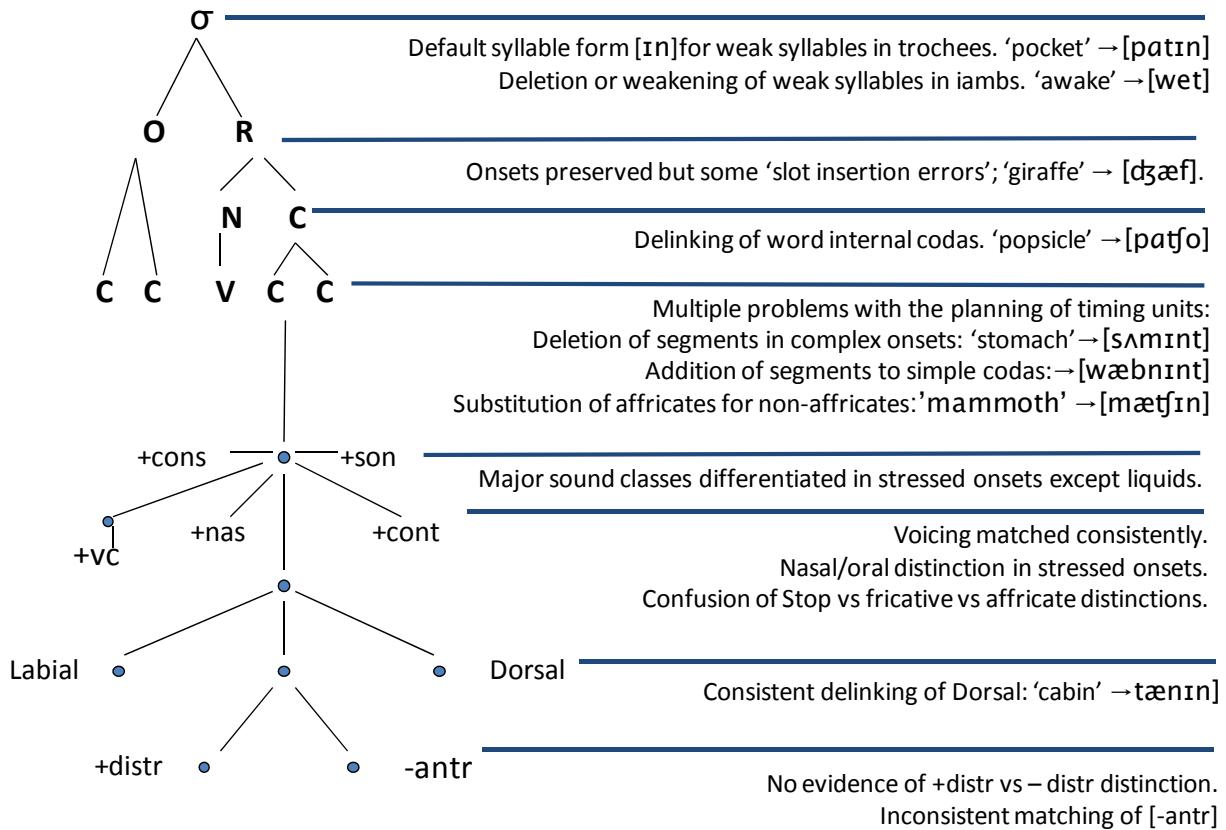


## Demonstration 11-2

## Selected Words from Speech Sample Recorded From 4-Year-Old Boy

|             |           |           |           |            |           |
|-------------|-----------|-----------|-----------|------------|-----------|
| abdomen     | 'æbən?ə   | giraffe   | 'dʒaf     | potato     | 'tedo     |
| achieve     | 'tsiv     | guitar    | 'ta       | pumpkin    | 'pʌmtin   |
| acknowledge | ə'nlədʒɪn | judgment  | 'dʒʌdʒɪn  | punishment | 'pʌmpɪʃɪn |
| adventure   | ə'ventʃə  | Kellog    | 'tənɪn    | rabbit     | 'wæbnɪnt  |
| alligator   | 'ægetə    | kerchief  | 'tetʃɪn   | recognize  | 'wɛtnaɪz  |
| although    | æ'θo      | magic     | 'mædʒɪn   | rubbish    | 'wʌvɪnt   |
| another     | 'nəvə     | mammoth   | 'mætʃɪn   | sadly      | 'sædi     |
| awake       | 'wet      | observe   | ə'zəb     | salad      | 'sæmɪnt   |
| boastful    | 'bofʊ     | pajamas   | 'dʒædʒɪnz | sausage    | 'sasɪnz   |
| cabin       | 'tænɪn    | parchment | 'pɑ:tʃɪn  | sherrif    | 'setɪn    |
| cages       | 'tædʒɪn   | piglet    | 'pɪnʌ     | stomach    | 'sʌmɪnt   |
| casino      | trɪ'tfino | pneumonia | 'monɪə    | toboggan   | tə'bʌnɪn  |
| crutches    | 'krʌtʃɪns | pocket    | 'pɑ:tɪn   | uniform    | 'ju:fom   |
| Edgar       | 'itə      | popsicle  | 'patʃo    | wagon      | 'wanɪn    |

## Graphic Summary of Mismatches in Child's Phonological System Relative to Adult Targets



## Suggested Treatment Goals (Prosodic)

1. Intermediate Goal: Expand repertoire of weak syllables in trochaic contexts (eliminate default [ɪn]).
  - 1.1 Specific goal: 'CVCV where all Cs are stimulable phones and C<sub>3</sub> is an obstruent.
  - 1.2 Suggested words: puppet, faucet, misses, famous, cages
2. Stabilize unfooted weak syllables in iambic contexts.
  - 2.1 Specific goal: V or CV shaped weak syllables in iambs within 2 and 3 syllable words.
  - 2.2 Suggested words: away, today, pajamas, bananas, potatoes, tomatoes
3. Establish coda in word internal contexts.
  - 3.1 Specific goal: Word internal codas in two syllable words with stimulable consonants.
  - 3.2 Suggested words: poptart, passport, inchworm, halftime, hambone

Table 9-2. Focused Stimulation Techniques Adapted to Enhance Phonological Knowledge with /ʃ/ as the Specific Goal in the Examples. Adapted from Proctor-Williams (2009). Dosage and distribution in morphosyntax intervention: Current evidence and future needs. *Topics in Language Disorders*, 29, Table 1. Used with permission of Lippincot Williams & Wilkins.

| Technique            | Description  | Example   |
|----------------------|--|---|
| Time delay/slow rate | Slow pace of conversation and rate of presentation and wait longer than is typical for a desired child response.                         | SLP: Here is a black (pause) shoe. Here is a red (pause) shoe. Oh, look, here is the other black (pause)<br><br>Child: [su] |
| Model                | Present target form, often in contrast, without an opportunity for child production.   | SLP: Look at Sherry. Sherry's shoe is too big. Look at Sue. Sue's shoe is too small. Oh no! Their shoes were switched.      |
| Recast               | Immediately respond to the child's utterance, repeating some of the child's words while correcting or modifying the target form.         | Child: [dɪs hə su]<br>SLP: It's her <u>shoe</u> .   |
| Expansion            | Immediately respond to the child's utterance, repeating some of the child's words while adding content that expands the child's meaning. | Child: [dɪs hə su]<br>SLP: This shoe is the right size for Sherry.  |
| Imitation/feedback   | Immediately respond to the child's utterance by imitating the child's correct use of the target form.                                    | Child: [dɪs hə ſu]<br>SLP: Yes, this is her shoe.   |
| Question             | Ask a question that may or may not include the target form in order to prompt production of the target form from the child.              | SLP: What will she do now?<br>Child: Put on the red shoe.   |

Table 9-5 Definitions of Dialogic Reading Techniques with Examples

| Technique    | Definition  | Literal Example  | Inferential Example   |
|--------------|---|--|---|
| Prompt       | Evoke a response from the child.  |  |   |
| Completion   |   | And the big bad wolf said...   | What would you say if the wolf came to our house?<br>You could say “Mr. Wolf...”            |
| Recall       |   | Do you remember how many pigs are in this story?   | The wolf is going to go down the chimney. What will happen to him?                          |
| Open-ended   |   | Tell me about this picture.  | Oh-oh, I see the wolf coming. Tell me what happens next.                                    |
| Wh-questions |   | What is this house made of?  | Look at the expression on the pig’s face here. What do you think he is feeling right now?   |
| Distancing   |   | Do you remember when you made a house from blocks yesterday and it fell down? Tell me more about that. | Can you think of a time when you felt scared like this? Tell me more about that.            |
| Evaluate     | Provide feedback to indicate whether the response was correct or not.                       | No, not one.   | I agree. The pig is scared.   |
| Expand       | Add information to the child’s response.<br><br>Or, ask a question to get more information. | Three, three little pigs.<br><br>Yes, you see a wolf.<br>What’s the wolf doing?                        | In fact, I think he’s terrified.<br><br>What will happen to the house when he blows on it?  |
| Repeat       | Ask the child to repeat the correct response<br><br>or the new information.                 | Count with me.<br>(pointing). One, two, three.<br><br>Say “The wolf is hiding.”                        | Say “terrified”.<br><br>No, it <u>won’t</u> . Say “The brick house <u>won’t</u> fall down.” |

Table 10-3

## Strategies for Altering Practice Conditions to Maintain Practice at the Optimum Challenge Point

*Table Continues*

Table 10-3 Continued

| Practice Component   | Practice Performance is Too High   | Practice Performance is Too Low   |
|----------------------|--|---|
| Knowledge of Results | <p>Provide summative information about response accuracy after sets of responses, e.g.,</p> <p>SLP: OK, I want to hear a handful of funny words. Say [fifi]</p> <p>Child: [fifi]</p> <p>SLP: Say [bubu]</p> <p>Child: [bubu]</p> <p>SLP: Say [ba'ba]</p> <p>Child: [ba'ba]</p> <p>SLP: Say: [mæmæ]</p> <p>Child: [mæmæ]</p> <p>SLP: Say [wə'wə]</p> <p>Child: [wə'wə]</p> <p>SLP: Pretty good but not quite the whole handful. You got 4 of them, (draws ring on the fingers of an outline of a hand drawn on a piece of paper with the syllables written on each finger that can be sent home for practice): [fifi], [bubu], [ba'ba], but not [mæmæ], good work on [wə'wə]. See if you can get all of them with mum and then you'll get the ring for this finger.</p> | <p>Provide information about response accuracy immediately on each trial, e.g.,</p> <p>SLP: Say ['bibi]</p> <p>Child: ['bibi]</p> <p>SLP: Good. Say ['bubu]</p> <p>Child: ['bubu]</p> <p>SLP: Another good one! Say ['babə]</p> <p>Child: ['babu]</p> <p>SLP: No, watch my lips and try again ['babə]</p> |

*Table Continues*

Table 10-3 Continued

| Practice Component       | Practice Performance is Too High   | Practice Performance is Too Low   |
|--------------------------|--|---|
| Knowledge of Performance | <p>Intermittently ask child for explicit evaluation of own performance, e.g.,</p> <p>SLP: Say: [wifa]</p> <p>Child: [wiwa]</p> <p>SLP: Oops, what happened there?</p> <p>Child: points to lower lip and then bites it.</p> <p>SLP: That's right, you forgot to bite your lip on the second part.</p> | <p>Frequently, provide explicit information about movement parameters after correct responses and incorrect responses.</p> <p>SLP: Say [fifa]</p> <p>Child: [fifa]</p> <p>SLP: Excellent, you bit your lip for the [f] sound.</p> |
| Stimulus Presentation    | <p>Move down the integral stimulation hierarchy (see Table 10-4).</p> <p>Cue access to internalized representation of the target, i.e., require spontaneous productions of the target forms</p>  | <p>Move up the integral stimulation hierarchy (see Table 10-4)</p> <p>Provide a model of the target form with maximum multimodal information about its characteristics.</p>   |