Treatment and Intervention of Speech Sound Disorders

Lynn Williams, Ph.D.

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Chapter One

Intervention Strategies

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Workshop Objectives

Make it ACAP

- Assessment
  - PVM and SPACS analyses
- Target selection
  - New perspectives on old procedures
  - New approach: distance metric
- Intervention
  - Contrastive approaches
  - Additional intervention options
  - Structure of intervention

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Defining Speech Sound Disorders

- Speech Sound Disorders (SSD) in children is a complex neurodevelopmental disorder that is quite diverse and ranges in both severity and type of disorder[1]
  - SSD include articulatory, phonological, and motor speech disorders and have been identified as one of the most prevalent types of communication impairment among children
  - Further, SSD can co-occur with other impairments of communication, such as language impairment, literacy difficulties, or fluency
- Given the complexity of SSD, differential diagnosis is essential to designing effective intervention
- Sound clinical decision-making based on reasoned evidence-based practice is required to select the most appropriate intervention approach given the characteristics of the child's SSD and the clinician's expertise

1. Shriberg, 2010

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Linguistic Profiling[1]

Linguistic Profile	Characteristics
Phonological Delay	Phonological rules or processes are evident and are characteristic of younger TD children
Consistent Deviant Phonological Disorder	Presence of both unusual errors **and** typical errors, which signal the child has impaired understanding of the ambient phonological system
Inconsistent Deviant Phonological Disorder	Exhibit delayed **and** non-developmental error types *and* variability of production of single word tokens (at least 40%)
Articulation Disorder	Unable to produce particular perceptually acceptable phones
Childhood Apraxia of Speech (CAS)	Deviant surface speech production patterns that may sound similar to Incon Dev Phono Dis, but difference is the proposed level of breakdown and symptomatology

1. Dodd, 1995; 2005

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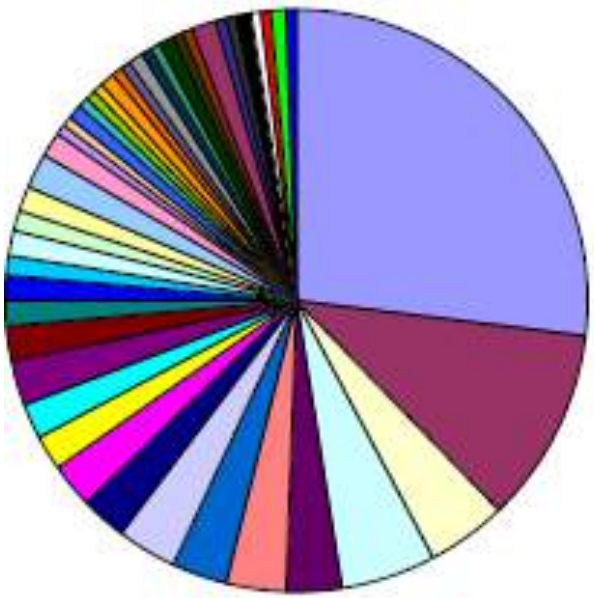
Which one do you select?



Baker and McLeod, S. (2008, November). EBP and speech sound disorders: What do we know?

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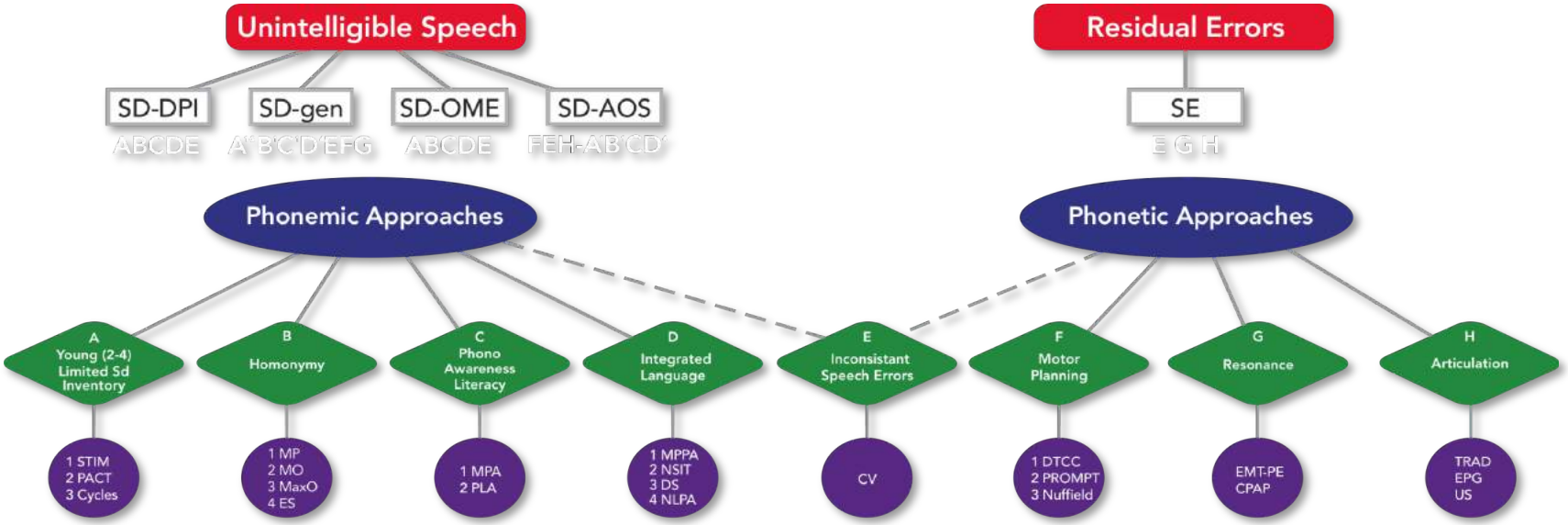
Intervention Options Decision Tree



STIM: Stimulability Treatment
PACT: Parents and Children Together
MP: Minimal Pairs
MO: Multiple Oppositions
MaxO: Maximal Oppositions
ES: Empty Set
MPA: Metaphonological Approach
PLA: Psycholinguistic Approach

MPPA: Morphophonological Approach
NSIT: Naturalistic Speech Intelligibility Training
DS: Dynamic Systems
NLPA: Nonlinear Phonological Approach
DTTC: Dynamic Tactile and Temporal Cueing
EMT-PE: Enhanced Milieu Therapy - Phonology Emphasis
CPAP: Continuous Positive Air Pressure
TRAD: Traditional Articulation (Van Riper)
EPG: Electropalatography
US: Ultrasound

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Lynn Williams, 2008

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Traditional or Phonological

- Traditional approaches focus on individual sound learning
  - Emphasis is on placement and sound production accuracy
- Phonological approaches focus on **system-wide change**
  - Emphasis is on generalization and system shifting

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Children with Homonymy: Contrastive Approaches

Approach	Classification	Characteristics	Population
Minimal pairs	Unintelligible speech/ homonym	Contrastive work pairs (error—target)	Preschool-school-age children with mild to moderate SSD (common phonological errors)
Multiple oppositions	Unintelligible speech/ extensive homonymy resulting from phoneme collapses	Contrastive work pairs (error—targets)	Preschool-school-age children with moderate to severe SSD
Maximal oppositions	Unintelligible speech/ gaps in inventory	Contrastive work pairs (known—unknown)	Preschool-school-age children with moderate to severe SSD
Empty set	Unintelligible speech/ gaps in inventory	Contrastive work pairs (unknown—unknown)	Preschool-aged children with moderate to severe SSD

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Homonymous or Non-Homonymous

- Homonymous approaches **directly** confront child's rule by contrasting his or her error with the new target sound(s) to be learned
  - Minimal pairs and multiple oppositions
- Non-homonymous approaches **indirectly** address child's rule with assumption that greater contrastive distinction of word pairs facilitates learning
  - Maximal oppositions and empty set

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Non-Homonymous Approaches: MaxO and ES

- Ideally, the target sound(s) for MaxO (one target) and ES (two targets) are
  - Missing from child's inventory
  - Marked (phonologically complex)
  - Non-stimulable
  - Later developing
- The comparison sound (MaxO) should be
  - Known, independent of error, and maximally different
- The second target sound (ES) should be
  - Unknown, independent, and maximally different

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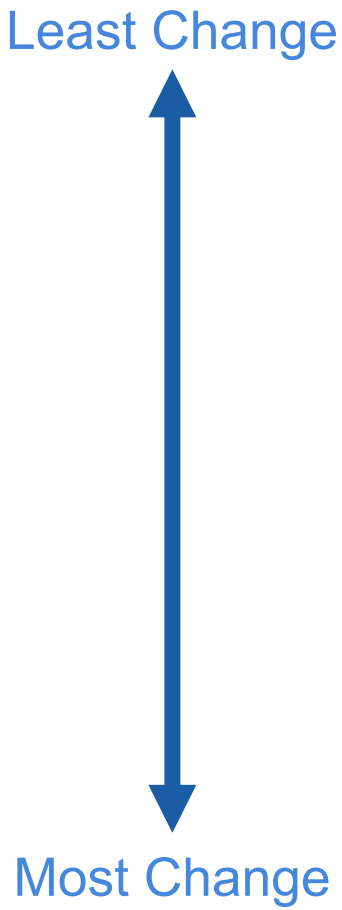
Non-Homonymous Approaches: MaxO and ES (cont.)

- Target contrasted with known sound (MaxO)
  - Nonmajor feature distinction
- Target One contrasted with Target Two (ES)
  - Nonmajor feature distinction
- Target contrasted with known sound (MaxO)
  - Major feature distinction
- Target One contrasted with Target Two (ES)
  - Major feature distinction



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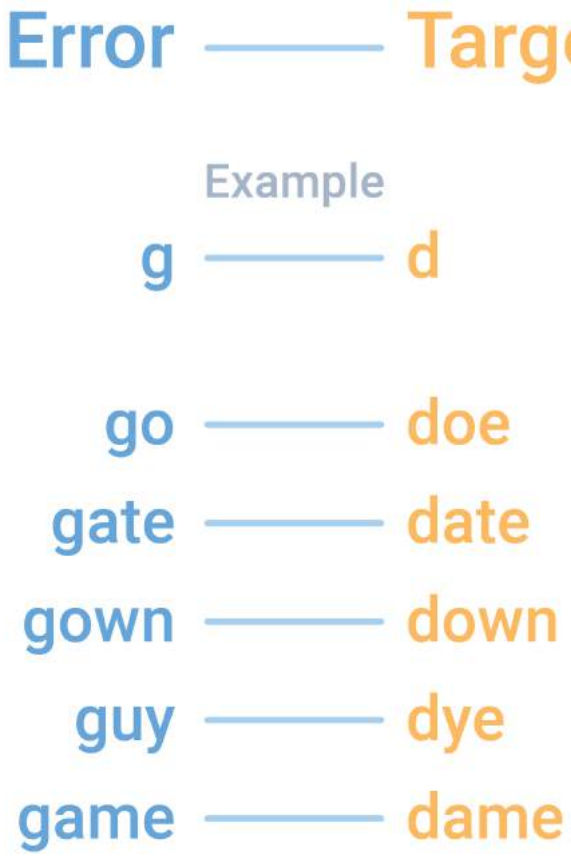
Designing Treatment for Adam

Minimal pairs: contrasts the child's error with the target sound



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Designing Treatment for Adam (cont.)

Maximal oppositions: contrasts a "known", independent, and maximally different sound with the target sound

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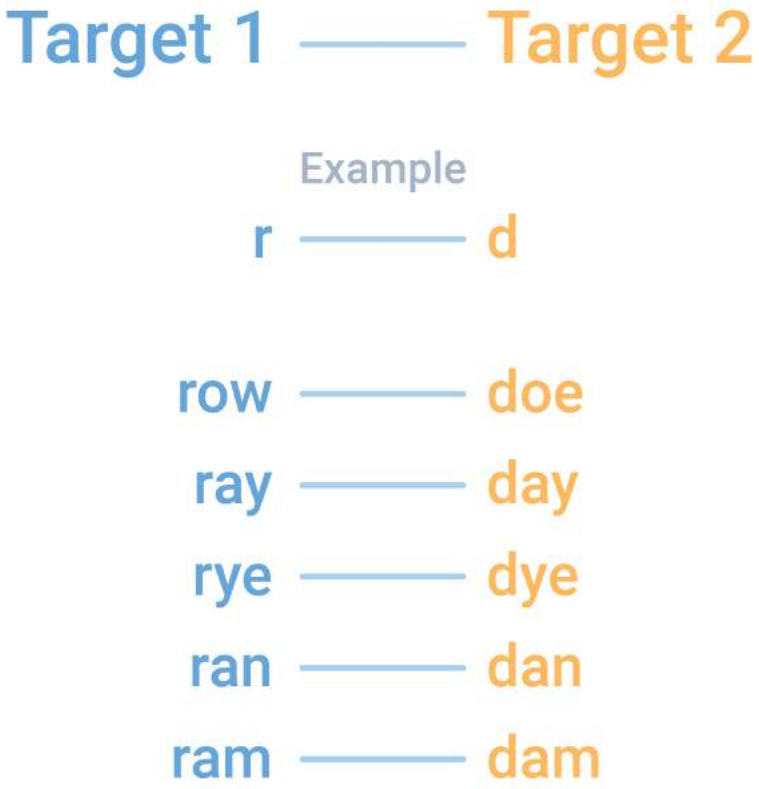
Designing Treatment for Adam

Empty set: contrasts two target sounds that are unknown, independent, and maximally different from each other



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Designing Treatment for Adam

Multiple oppositions: Contrasts child's error with several target sounds from across an entire rule set

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Multiple Oppositions

- Assumes learning is facilitated by the size and nature of linguistic “chunks” presented to the child
  - Learning of the whole is greater than the sum of its parts
- Assumes learning is a dynamic interaction between child’s unique sound system and intervention
- Predicts learning will be generalized across a rule set and result in system-wide restructuring
  - For example, learning will generalize to obstruents and clusters collapsed to [g] in the 1:17 phoneme collapse

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Characteristics/Population for MO

Comparative Factors	Specifications
Age	3;0 to 6;0
Population	Multiple speech errors and unintelligible speech
Intervention Agents	SLP; supplemental parental support
Key Components	Direct and focused intervention using meaningful words: Some NSW that are given meaning
Broad Goals	Increase speech intelligibility Reduce homonymy
Target Selection	Linguistic: distance metric
Level of Focus	Speech output
Session Type	Generally individual, but also group (30 to 45 minutes twice a week)
Technology	Illustrations; SCIP™

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Intervention for Adam: Multiple Oppositions

Concept	Rationale	Specification
Part-Whole Learning	Phonologic learning is facilitated by enlarging the relevant frame of learning defined by a more diverse range of input structures from across a rule set (for example, phoneme collapse)	Two to four target sounds are selected from a phoneme collapse and contrasted in larger contrastive word sets (for example, multiple oppositions) with the child's error substitute
Systemic (Re)Organization	1. **Compensatory strategies**: phoneme collapses are viewed as compensatory strategies developed by child to accommodate adult sound system with limited child system 2. **Phonetic Resemblance**: the collapses reflect child's attempt to "match" his/her limited system to adult system along a particular phonetic dimension	• Intervention is directed at phonological reorganization through manipulation of the child's phoneme collapses • The phoneme collapses become a "means to an end" in achieving phonological reorganization • Targets are selected from across the phoneme collapse using a Distance Metric to create the greatest amount of change in the least amount of time

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Intervention for Adam: Multiple Oppositions (cont.)

Concept	Rationale	Specification
Child-Based Approach	Intervention is directed to child's phonologic strategies rather than to an a priori set of rules or processes, which will result in more efficient phonological change	• Intervention is based on reduction/elimination of phoneme collapses • **Restructure** sound system based on new and diverse set of linguistic input ("chunks") presented to child

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Video Examples of Four Contrastive Approaches

- Minimal pairs
- Maximal oppositions
- Empty set
- Multiple oppositions

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Chapter Two

Intervention Options

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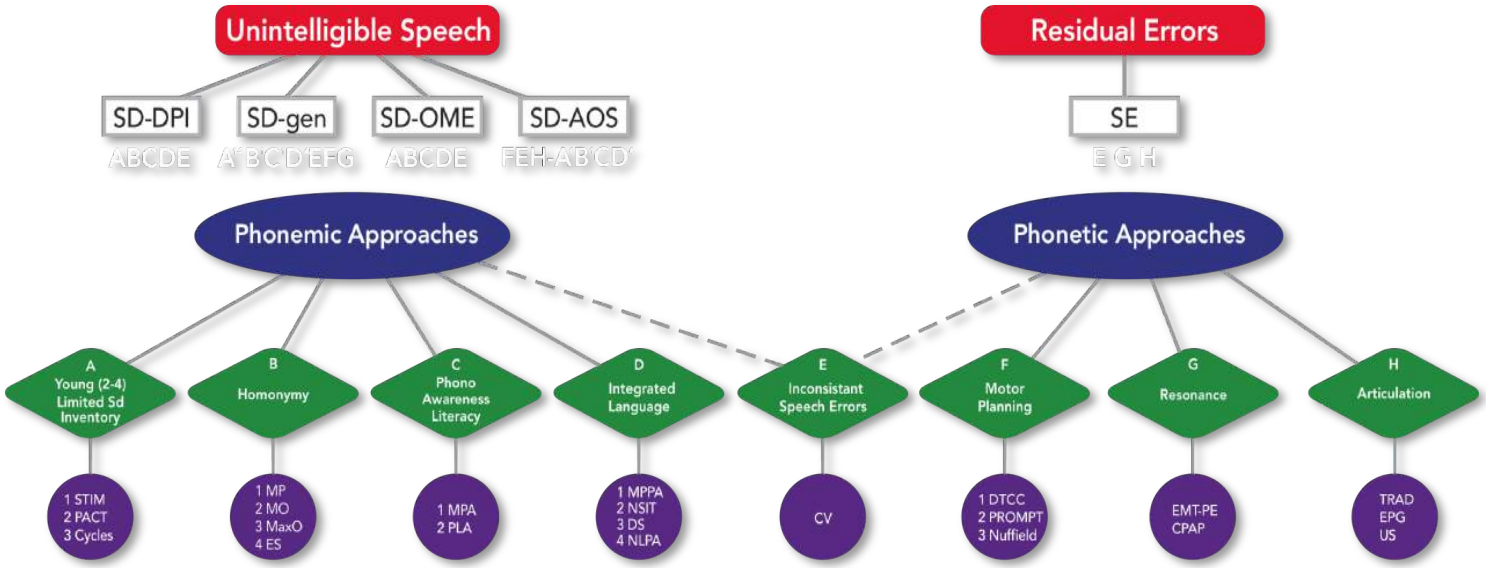
Intervention Options Decision Tree



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Comparison of Intervention Approaches for Young Children

Approach	Classification	Characteristics	Population
Stimulability approach	Unintelligible speech	Increased inventory by making sounds stimulable	Young children (two to four years) with limited sound inventory
PACT	Unintelligible speech	Work with parents	Pre-school aged children with moderate to severe SSD
Cycles	Unintelligible speech	Address several goals in cyclical manner	Young children (two to four years) with limited sound inventory

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Comparison of Intervention Approaches Addressing Phonological Awareness/Literacy

Approach	Classification	Characteristics	Population
Metaphonological approach	Unintelligible Speech	Includes phonological awareness activities in addition to production activities	Preschool-aged children with moderate to severe SSDs
Psycholinguistic approach	Unintelligible Speech	Addresses links between speech and literacy	Preschool and school-aged children with moderate to severe SSDs

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Comparison of Integrated Intervention Approaches

Approach	Classification	Characteristics	Population
Morphopho-nemic approach	Unintelligible speech	Addresses morphological errors simultaneously with phonological errors	Preschool-aged children with morophophonological errors
Naturalistic speech intelligibility training	Unintelligible speech	Uses conversational recasts to direct focus on speech errors in conversation	Pre-school aged children with SSDs
Neuro-networking (whole language)	Unintelligible speech	Address speech within broader context of language	Pre-school aged children with SSDs
Nonlinear phonological approach	Unintelligible speech	Address speech within syllable and phrase level	Pre-school aged children with SSDs

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Comparison of Phonetic Intervention Approaches

Approach	Classification	Characteristics	Population
Core Vocabulary	Unintelligible speech and residual errors	Addresses inconsistent speech errors (word inconsistency)	Preschool-aged children with moderate to severe SSDs
Dynamic tactile and temporal cueing	Unintelligible speech	Addresses motor planning and programming	CAS
PROMPT	Unintelligible speech	Motor planning; motor execution	CAS; dysarthria
Nuffield dyspraxia programme	Unintelligible speech	Motor planning; motor execution	CAS

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Chapter Three

The Structure of Intervention

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Structure of Intervention

- How many treatment exemplars is enough
- Where do I start
  - Imitative or spontaneous
- How many responses do I get
  - Density of responses
- When is “enough” enough

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Duality of Phonology

- Two levels of learning
  - Production
  - Rule
- Phonetic: phonemic continuum

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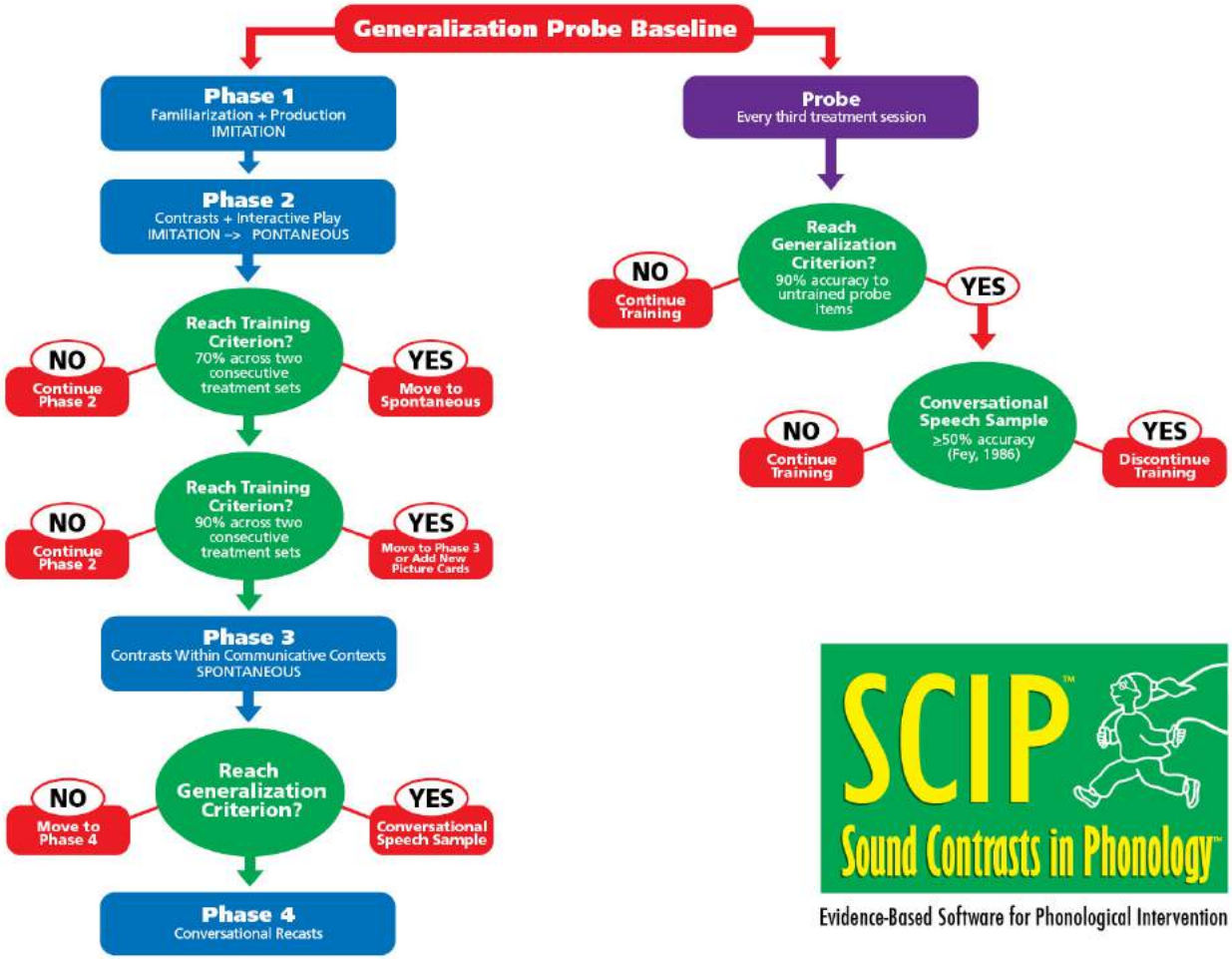
Treatment Paradigm for Contrastive Intervention



SCIP™
Sound Contrasts in Phonology™
Evidence-Based Software for Phonological Intervention

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Goals of Phonological Intervention

- Child learns the new **rule**
- Production of new contrast becomes **automatic**
  - Density of responses
  - Bridging activities to program for generalization

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Phase I: Familiarization and Production

- Familiarization
  - Rule
  - Sounds
  - Vocabulary
- Production
  - One treatment set yields twenty responses
    - Five contrasts times four repetitions

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Contrasts Data Sheet

Name _____ Approach _____

Goal _____ Clinician _____

	Contrast 1		Contrast 2		Contrast 3		Contrast 4		Contrast 5	
Word Pairs:	____	____	____	____	____	____	____	____	____	____
Date ____	1. ____	____	____	____	____	____	____	____	____	____
I S	2. ____	____	____	____	____	____	____	____	____	____
___%										
I S	3. ____	____	____	____	____	____	____	____	____	____
___%	**4.** ____	____	____	____	____	____	____	____	____	____
Date ____	5. ____	____	____	____	____	____	____	____	____	____
I S	6. ____	____	____	____	____	____	____	____	____	____
___%										
I S	7. ____	____	____	____	____	____	____	____	____	____
___%	**8.** ____	____	____	____	____	____	____	____	____	____
Date ____	9. ____	____	____	____	____	____	____	____	____	____
I S	10. ____	____	____	____	____	____	____	____	____	____
___%										
I S	11. ____	____	____	____	____	____	____	____	____	____
___%	**12.** ____	____	____	____	____	____	____	____	____	____
Date ____	13. ____	____	____	____	____	____	____	____	____	____
I S	14. ____	____	____	____	____	____	____	____	____	____
___%										
I S	15. ____	____	____	____	____	____	____	____	____	____
___%	**16.** ____	____	____	____	____	____	____	____	____	____
Date ____	17. ____	____	____	____	____	____	____	____	____	____
I S	18. ____	____	____	____	____	____	____	____	____	____
___%										
I S	19. ____	____	____	____	____	____	____	____	____	____
___%	**20.** ____	____	____	____	____	____	____	____	____	____

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Multiple Oppositions Data Sheet

Contrast 1	Date		Date		Date		Date		Date		Date	

Contrast 2												

Contrast 3												

Contrast 4												

Contrast 5												

Target	Percent Correct	Response Level	Percent Correct	Response Level	Percent Correct	Response Level	Percent Correct	Response Level	Percent Correct	Response Level	Percent Correct	Response Level
	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S
	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S
	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S
	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S	___%	I S

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Criteria: Treatment and Generalization

Treatment Criteria

- 70% accuracy across two consecutive treatment sets (IMIT to SPON)
  - Phase two
- 90% accuracy across two consecutive treatment sets
  - Phase two, add new pictures **or** move to phase three

- Generalization Criteria
  - 90% accuracy on target in untrained probe items
  - If this is met, 50% accuracy on target in conversation

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Phase Two: Contrasts and Naturalistic Activity

- Imitation
  - Comparison word first, then target word
  - Slower models, physical prompts, focus
    - Antecedent event
  - Shadowing, set-ups
    - During
  - Feedback
    - Consequent event
  - Gradually fade supports, then switch order of presentation
- Naturalistic Play Activities
  - Sound-loaded communication-centered activities
  - Dense responses
    - Generally at least twenty responses in five to eight minutes)

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Phase Three: Contrasts within Communicative Contexts

- The focused practice and the play are intertwined
- Play games with the contrasts
  - Go fish, memory and concentration, teacher, what's missing

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Phase Four: Conversational Recasts

Develop sound-loaded communicative scenarios

- Naturalistic Speech Intelligibility Training (NSIT)
- Immediate recasts (“hotspots”)

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Vowel Errors

- Children with multiple sound errors often also exhibit vowel errors
- Can use contrastive approaches of MP and MO to treat vowel errors (PI or ESL)

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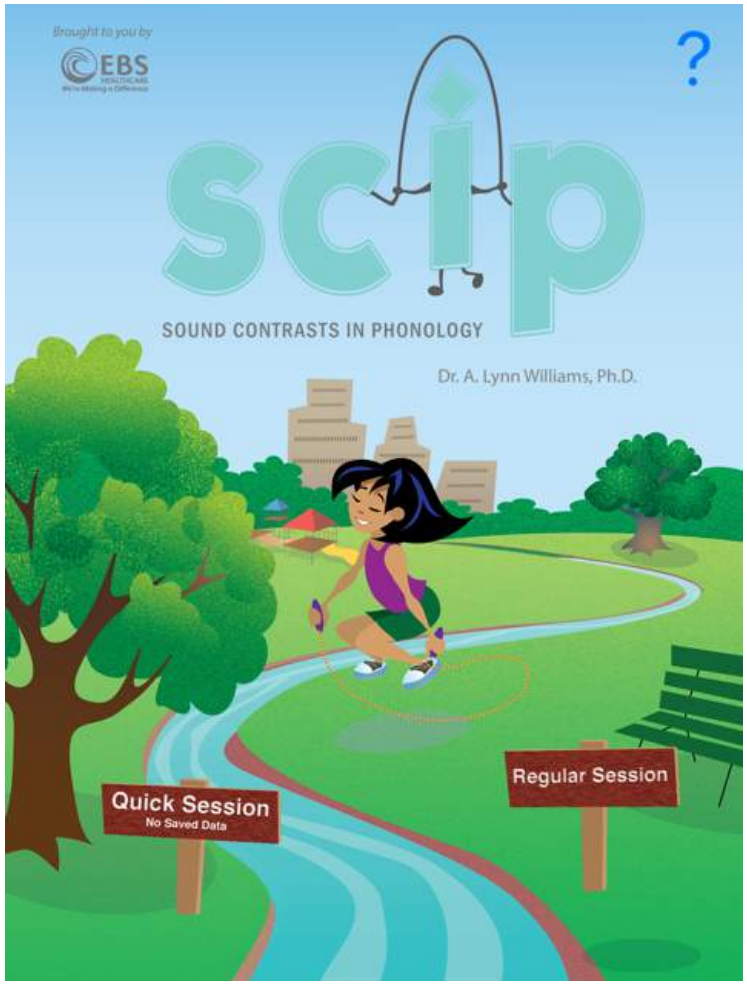
SCIP: Sound Contrasts in Phonology



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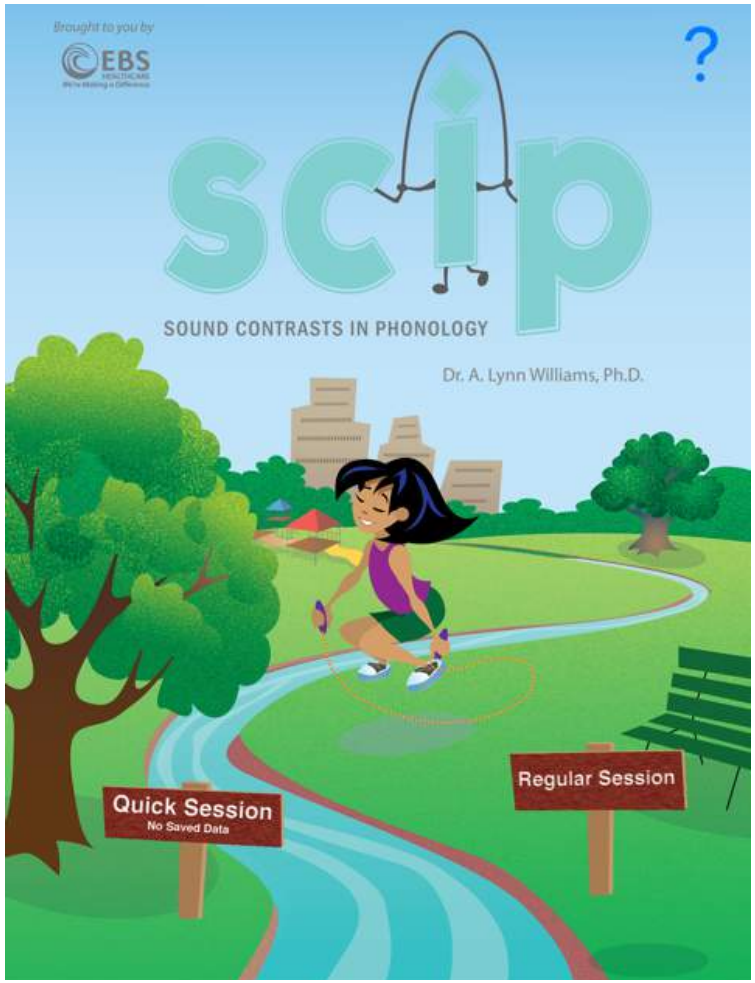
SCIP

SCIP provides a “better, faster, cheaper” approach in the development of intervention materials to increase SLP access to newer models of phonologic intervention, decrease SLP time and effort in developing individualized treatment materials, and potentially have a profound impact on the nature of phonological intervention



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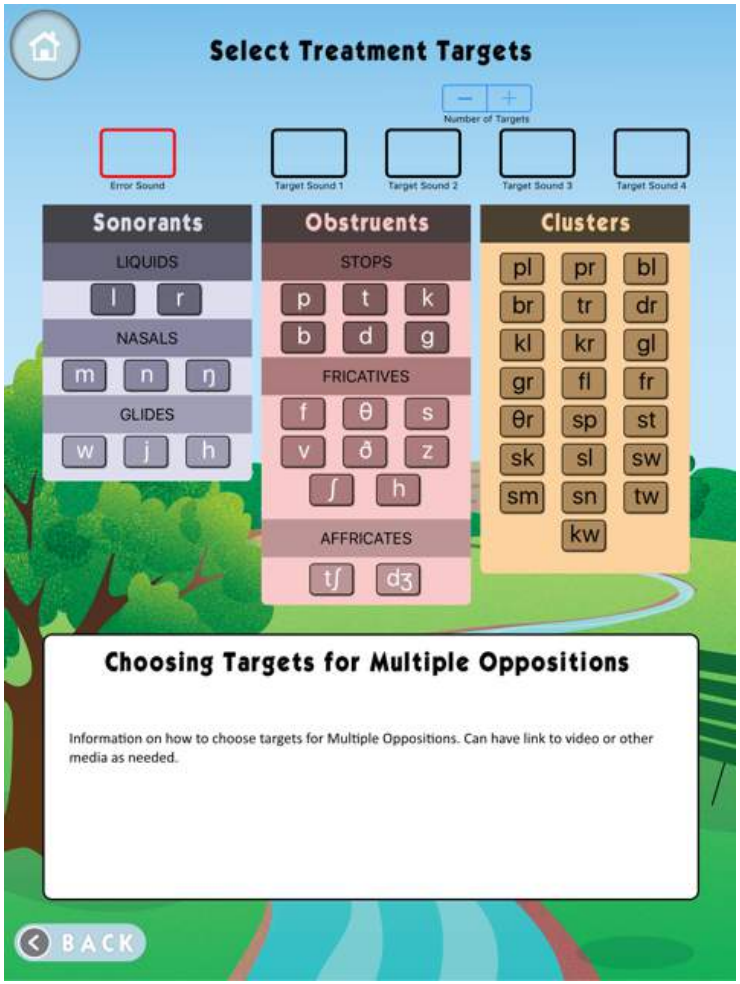

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Unique Features of Computer-Based Interventions (CBI)

- Computer is a ‘tool’ not a ‘type of intervention’
- Assists in **delivery** of intervention
- Consistent and controlled presentation of stimuli
- Reliable recording of performance
- Supports attention
- Can deliver a range of types of interventions
- Can be customized to child’s specific needs

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Wrap Up: Intervention

- How do we select the most appropriate approach
- How do we integrate the analysis, target selection, and intervention planning
- Is one approach best

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Chapter Four

Clinical Decision Making and Phonological Analysis Management

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Clinical Decision-Making

1. Examine client's needs
   - Assessment and analysis results
     - Severity, intelligibility, consistency, stimulability
     - Differential diagnosis
       - PI
       - AI
       - MSD
     - Breadth of problem (language, literacy, etc.)
   - Case history
   - Other information
     - Child's previous treatment experiences, communication experiences, academic settings

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Clinical Decision-Making (con't)

2. Evidence-based practice (EBP)
   - Strongest available evidence given your client's needs, your clinical abilities, and the support available to you to implement the approach
3. Practice-based evidence (PBE)
   - What probe data, standardized testing, and other methods will you use to document child's progress

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Phonological Analysis Summary and Management Plan

How do we integrate analysis, target selection, and intervention

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Phonological Analysis Summary and Management Plan[1]

1. SUMMARY OF PHONOLOGICAL ANALYSIS (choose one)		
Position	Phoneme Collapses (2-4 predominant across positions)	Phonological Processes (2-4 predominant across positions)
WORD-INITIAL		
WORD-FINAL		

Vowel Errors? Yes / No

Patterns? ☐ Backing ☐ Fronting ☐ Centering ☐ Tensing

☐ Inconsistent errors

☐ Word inconsistency ☐ Phoneme Inconsistency

☐ Prosody errors

☐ Increased errors in multisyllabic words

☐ Increased errors in conversation than in single words

☐ Stimulable for sounds OUT of phonetic inventory?

List stimulable sounds: _____

List non-stimulable sounds: _____

ADDITIONAL INFORMATION:

Child's motivation: High / Low
Language impairment? Yes / No
Expressive language impairment? Yes / No
Receptive language impairment? Yes / No
Phonological Awareness Deficit / Reading Difficulty? Yes / No

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Phonological Analysis Summary and Management Plan[1] (cont.)

2. CLINICAL IMPRESSIONS	
Differential Diagnosis	Classification (Dodd, 2005)
Phonological Impairment (PI) ☐ PI only ☐ PI/LI ☐ expressive / receptive / both ☐ phonological awareness / literacy	☐ Phonological Delay ☐ Consistent Deviant Phonological Disorder ☐ Inconsistent Deviant Phonological Disorder ☐ Other _____
Articulation Impairment (AI) ☐ AI ☐ AI Residual Errors ☐ AI Compensatory Errors	☐ Articulation Disorder ☐ Other _____
Motor Speech Disorders (MSD) ☐ CAS ☐ Dysarthria	☐ Childhood Apraxia of Speech ☐ Other _____

3. TARGET SELECTION		
Phonological Rule/Error Pattern (listed by priority order)	**Target Selection Approach** ☐ Traditional ☐ Phonological Complexity ☐ Distance Metric	**Intervention Target(s) / Position(s)**

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Phonological Analysis Summary and Management Plan[1] (cont.)

4. INTERVENTION APPROACH	
Intervention Group	**Approach**
Homonymy: Contrastive Approaches	☐ Minimal Pairs ☐ Multiple Oppositions ☐ Maximal Oppositions ☐ Empty Set
Limited Phonetic Inventory: Approaches for Young Children (2-4 years)	☐ Stimulability Approach ☐ EMT-PE ☐ Cycles ☐ PACT
Phonological Awareness / Literacy	☐ Metaphonological Approach ☐ Psycholinguistic Approach
Integrated Intervention Approaches	☐ Morphosyntax Phonological Approach ☐ NSIT ☐ Dynamic Systems (Whole Language) ☐ Non-Linear Phonological Approach
Phonetic (Motor Planning) Intervention Approaches	☐ Core Vocabulary ☐ DTTC ☐ PROMPT ☐ Nuffield Dyspraxia Approach ☐ Developmental Dysarthria Intervention ☐ Traditional Articulation Approach
Other	

5. EVALUATION PLAN		
Measurement	Frequency	Criterion
☐ single-word probe ☐ conversational sample		

Speech-Language Pathologist: _____ Date: _____

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Clinical Example

Adam

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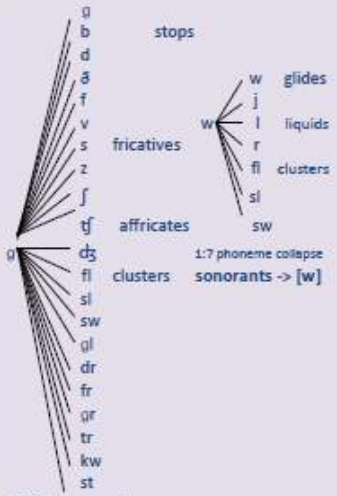
Phonological Analysis Summary and Management Plan[1]

Client: Adam (4:6) Date: _____

1. SUMMARY OF PHONOLOGICAL ANALYSIS (choose one)		
Position	Phoneme Collapses (2-4 predominant across positions)	Phonological Processes (2-4 predominant across positions)
WORD-INITIAL		1. ST + BA + VOI 2. CR 3. BA 4. DA
WORD-FINAL		

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Phonological Analysis Summary and Management Plan[1] (cont.)

Vowel Errors? Yes / (No)

Patterns? ☐ Backing ☐ Fronting ☐ Centering ☐ Tensing

☐ Inconsistent errors

☐ Word inconsistency ☐ Phoneme Inconsistency

☐ Prosody errors

☐ Increased errors in multisyllabic words

☐ Increased errors in conversation than in single words

☑ Stimulable for sounds OUT of phonetic inventory?

List stimulable sounds: b, f, v, s, z, l

List non-stimulable sounds: d, ð, ʃ, ʧ, ʤ, r

ADDITIONAL INFORMATION:

Child's motivation: (High) / Low

Language impairment? (Yes) / No

Expressive language impairment? (Yes) / No

Receptive language impairment? Yes / (No)

Phonological Awareness Deficit / Reading Difficulty? (Yes) / No

1. CLINICAL IMPRESSIONS	
Differential Diagnosis	Classification (Dodd, 2005)
Phonological Impairment (PI) ☐ PI only ☑ PI/LI ☑ (expressive) / receptive / both ☑ phonological awareness / literacy	☐ Phonological Delay ☑ Consistent Deviant Phonological Disorder ☐ Inconsistent Deviant Phonological Disorder ☐ Other _____
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Motor Speech Disorders (MSD) ☐ CAS ☐ Dysarthria	☐ Childhood Apraxia of Speech ☐ Other _____

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Phonological Analysis Summary and Management Plan[1] (cont.)

2. TARGET SELECTION		
Phonological Rule/Error Pattern (listed by priority order)	Target Selection Approach ☐ Traditional ☐ Phonological Complexity ☑ Distance Metric	Intervention Target(s) / Position(s)
1. obstruents + clusters → [g]	Distance Metric	g ~ d, f, ʧ, st/#___
2. sonorants + clusters → [w]	Distance Metric	w ~ r, sl/#__

3. INTERVENTION APPROACH	
Intervention Group	Approach
Contrastive Approaches	☐ Minimal Pairs ☑ Multiple Oppositions ☐ Maximal Oppositions ☐ Empty Set
Approaches for Young Children (2-4 years)	☐ Stimulability Approach ☐ EMT-PE ☐ Cycles ☐ PACT
Phonological Awareness / Literacy	☑ Metaphonological Approach ☐ Psycholinguistic Approach
Integrated Intervention Approaches	☐ Morphophonemic Phonological Approach ☐ NSIT ☐ Dynamic Systems (Whole Language) ☐ Non-Linear Phonological Approach
Phonetic Intervention Approaches	☐ Core Vocabulary ☐ DTTC ☐ PROMPT ☐ Nuffield Dyspraxia Approach ☐ Developmental Dysarthria Intervention ☐ Traditional Articulation Approach
Other	

4. EVALUATION PLAN		
Measurement	Frequency	Criterion
☑ single-word probe	Every 3rd tx session	90% accuracy on target sound
☑ conversational sample	After achieve narrow probe generalization criterion	50% accuracy on target sound

Speech-Language Pathologist: Lynn Williams Date: 3/24/11

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Chapter Five

Question and Answer

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Updates in Treating Speech Disorders in Children

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