

**Fast, Fun, Effective Phonology Practices  
for Children with Severe Phonologic Disorders**  
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**Why focus on speech sound disorders?**

- *10% of school-age children have speech sound disorders.*
- *80% are estimated to need services.*
- *50-70% will have academic difficulty with risk for literacy problems.*
- *Children with speech sound disorders represent the largest percentage of school-based clinicians' caseloads.*

Perspectives on Treatment of Speech Sound Disorders

- Phonetic Perspective
  - *Motor based*
  - *Behavioral influence*
  - *Focus on individual phonemes one at a time*
  - *Traditional therapy*
  - *Production errors*
  - *Non stimuable sounds*
- Perceptual Perspective
  - *Lack of discrimination of sound contrasts*
  - *Perception of another's production*
  - *Perception of self production*
- Oral Motor Perspective
  - *Assumption that both speech and non-speech oral movements are deficient*
  - *Assumption that non-speech oral exercises will assist in development of speech movements*
  - *Frequently associated with apraxia diagnosis*
- Phonemic/Phonological Perspective
  - *Severe to profound impairment*
  - *Focus on child's sound system*
  - *Facilitation of patterns*
  - *Focus on assessment*
  - *Focus on target selection*
  - *Consider stimulability*

Implications of the Phonological Perspective for Clinical Practice

*Assessment*  
*Target Selection*  
*Intervention*

## Types of Phonological Knowledge

Articulation

Perception

Phonological rules and phonotactic constraints

### Six types of Productive Phonological Knowledge displayed by children with phonological disorders (Gierut, 1987)

<b>Lexical Distribution</b>	<b>Breadth</b>	<b>Phonological Rule Representation</b>	<b>of</b>
1	adult-like	all pos/all mor	none
2	adult-like	all pos/all mor	optional or obligatory rules
3	adult-like	all pos/some mor	fossilized forms
4	adult-like	some pos/all mor	positional constraint
5	adult-like	some pos/some mor	combination of types
6	non-adult-like	all pos/all mor	inventory constraint

### Six types of phonological Knowledge: Type 2 (Gierut et al., 1987)

*A child displaying Type 1 knowledge of target /s/ would produce this sound correctly in all word positions and for all morphemes. /s/ would never be produced incorrectly.*

*A child displaying Type 2 knowledge of target /s/ would produce the sound correctly for all morphemes and positions. However, a phonological rule would apply to account for observed alternations between, for example, /s/ and /t/ in morpheme-final position.*

*A child displaying Type 3 knowledge of target /s/ would produce this sound correctly in all positions. However, certain morphemes that were presumably acquired early and acquired incorrectly (fossilized forms) would always be produced in error.*

*A child displaying Type 4 knowledge of target /s/ would produce the sound correctly for all morphemes in, for example, initial position. However, production of /s/ would be incorrect for all morphemes in medial and final positions.*

*A child displaying Type 5 knowledge of target /s/ would produce the sound correctly in, for example, initial position. However, only some morphemes in this position would be produced correctly. All /s/ morphemes in post-vocalic positions would be produced incorrectly.*

*A child displaying Type 6 knowledge of target /s/ would produce this sound incorrectly in all word positions and for all morphemes. /s/ would never be produced correctly.*

## Issues in target selection

- Stimulability
- Consistency of errors
- Developmental sequence
- Productive phonological knowledge

## Assumptions about Target Selection

- Earlier or later developing sounds?
- Absent or inconsistent sounds?
- Stimulable or non-stimulable sounds?
- Less or more linguistic complexity?
- One or more than one target sound?
- Targets from the same class or different classes?
- Clusters or singletons?

## Target Selection

*Based on the Work of Gierut and Colleagues  
(Gierut et al.)*

### Critical period through age 8

#### WHAT to work on:

*Stimulable/non-stimulable*

*Most/least phonological knowledge*

*Early/late developing*

*Least/most marked (linguistically complex)*

## Markedness and Major Sound Classes

### Markedness

- Order of least to most markedness
- **Obstruants**
  - *stops -- fricatives – affricates*
- **Sonorants**
  - *nasals -- glides – liquids*
- **More marked assumes less marked**

*If the child can make the more marked (harder) sound, he can make the less marked (easier) sound.*

### **Target Selection based on Phonological Knowledge**

(Dinnsen & Elbert, 1984; Elbert et al., 1984; Gierut et al., 1987)

- Target selection based on sounds with **most** phonological knowledge provides **faster generalization of the target sound** to other contexts.
- Target selection based on **least** phonological knowledge provided **greater generalization to other sounds** and sound classes.

### **Implications for target selection based on Stimulability**

**(Powell, Elbert & Dinnsen, 1991)**

- Targeting stimulable sounds provides faster generalization of production of the target sound in other contexts.
- Targeting non-stimulable sounds provides more widespread generalization to other sounds and sound classes.

### **Target selection based on Order of Acquisition of Sounds**

**(Powell & Elbert, 1984)**

- Targeting earlier and later developing clusters both provided generalization to both treated and untreated categories.
- Differential learning patterns were noted among children.
- One child who was taught early developing did not generalize to later.
- All children who were taught later developing did generalize to earlier.

### **Generalization: Early Acquired v. Later Acquired Sounds**

**(Gierut, Morrisette, Hughes, Rowland, 1996)**

- Greater learning occurred for later developing sounds.
- Later developing sounds showed more continued improvement post treatment.
- Teaching later developing sounds produced greater system wide change.
- Targeting early developing sounds provided greater generalization of the sound to other contexts.
- Targeting later developing sounds provided greater generalization to other sounds and sound classes.

- Children treated on early developing/greater knowledge sounds showed greater progress toward acquisition of target sounds during therapy sessions
- Generalization to other untreated sounds was similar for the two groups
- Both groups added approximately 2.5 untreated phonemes to their inventories (range 0-7)
- Improvement occurred for untreated stimuable phonemes, but little improvement occurred for untreated unstimuable phonemes
- Confirmed the need to find ways to help children imitate sounds

### Clusters and Adjuncts (Gierut, 1999)

#### Real clusters versus adjuncts

- Clusters: from less to more sonority
  - stop glide, fricative glide
- Adjuncts: /s/ stop

#### Sonority Sequencing Principle

Easier clusters are those which have the greatest difference in sonority between the first and second segment: /pl/ over /fl/

### Teaching Clusters (Williams, 1991)

#### ***Hypothesis based on Gierut's work:***

- Teaching two new sounds in a cluster may result in acquisition of two new sounds and clusters.

#### ***Results:***

- If the child had some knowledge of the sounds and no sequences, learning occurred.
- If the child had sequences and inventory constraints for the sounds, learning occurred.
- If the child had inventory constraints for the sounds and did not have sequences, learning did not occur.

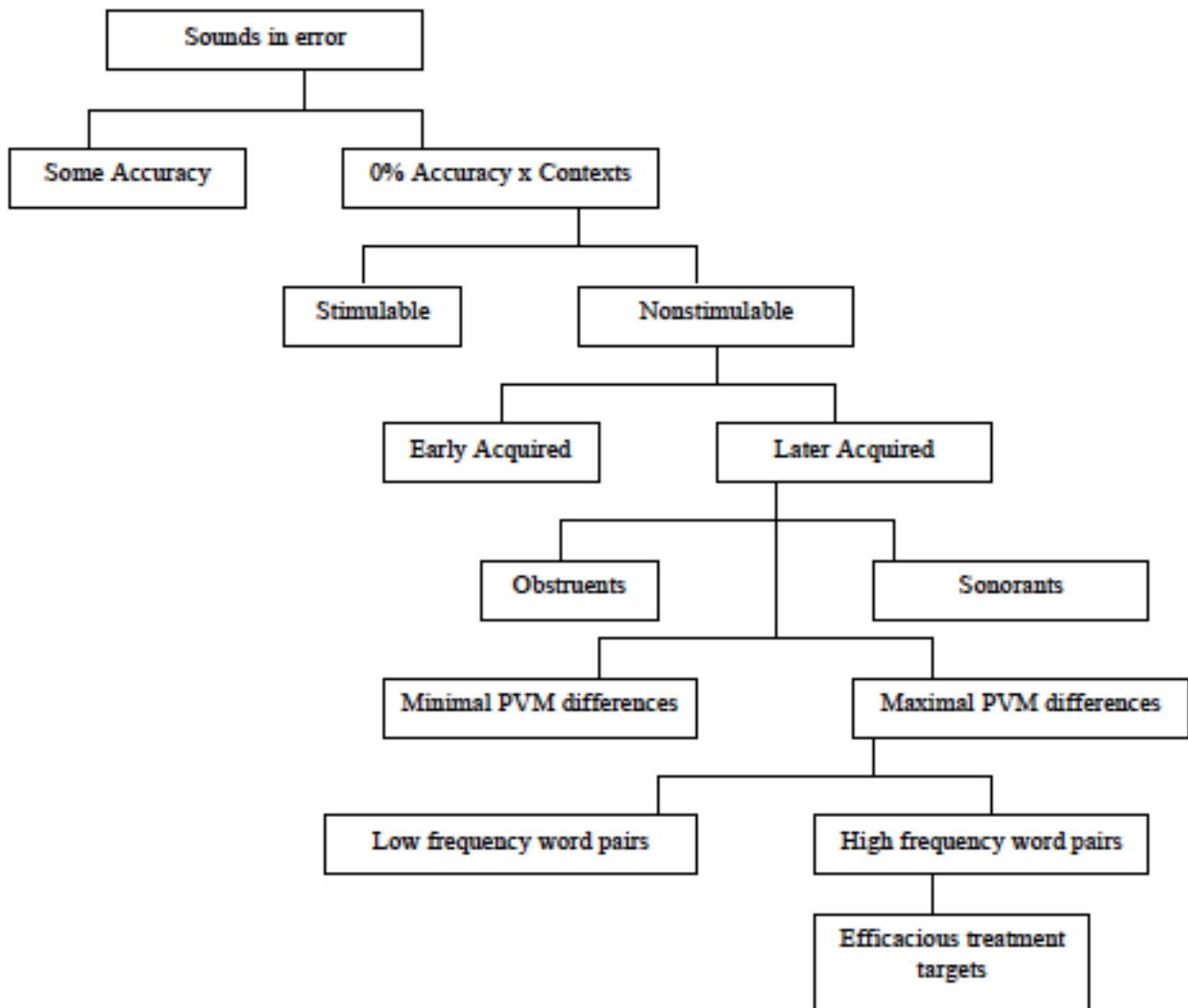
#### **Markedness**

- **Distinctive feature markedness**
  - *stops -- fricatives -- affricates*
  - *nasals -- glides -- liquids*
- **Sonority sequence markedness**
  - *most to least sonorant versus similarity*
- **More marked assumes less marked**

## Learnability

*Outside of existing grammar*  
*Markedness*  
*Attack strategies*  
*Horizontal*  
*Vertical*

**Clinical Decision Tree**  
(Gierut, 2005, OSLHA Presentation)



### **Ramifications for Assessment**

1. Choose an assessment with a large sample of words and one phoneme in multiple contexts
2. Language Sample
3. Productive Phonological Knowledge Protocol
4. Phonetic Inventory

### **Designing Phonological Intervention**

#### Minimal Pair Selection

### **Designing Therapy**

**(Fey, 1992)**

#### Fey's Principles:

- modification of groups of sounds that share a common pattern
- less emphasis on correct sound production and focus on neutralized contrasts
- more emphasis on using speech sounds for communication purposes

*"I believe that there is only one therapy procedure that embodies all of the three principles ... the notion of minimal contrasts ... and the functional use of speech to transmit unambiguous messages."*

### **Minimal Pairs**

- Definition: Two words having differing meanings that differ by only one phoneme

### **Assumptions about the nature of the contrasting pairs**

- Target versus substituted sound
- Target versus another established sound
- Two new target sounds
- Multiple targets versus substituted sounds

## Types of Feature Oppositions in Minimal Pairs

### 1. Minimal Oppositions

Child's error contrasted to target

[we]	ray
[wek]	rake
[tot]	goat
[ti]	key
[wek]	lake
[do]	go

### Minimal feature oppositions

		Feature difference
toe	sew	
hit	hick	
toe	doe	
goat	coat	
nail	sail	
bat	back	
comb	cone	
do	zoo	

### 2. Maximal Oppositions:

		Feature differences
run	pun	
sew	go	
fast	last	
cone	phone	
show	bow	
peal	real	
man	ran	
lead	feed	

## Minimal Pair Selection (Gierut et al.)

**HOW to work on it:** *Minimal Pair Contrasts*

- **Minimal/maximal** oppositions
- **One/two** new sound(s)

## Target Selection: Nature of Oppositions

Consonant Chart

		bilabial	labiodental	interdental	alveolar	palatal	velar	glottal
<b>Obstruent</b>	Stops	p b			t d		k g	
	Fricatives		f v	θ ð	s z	ʃ ʒ		
	Affricates					tʃ dʒ		
<b>Sonorant</b>	Nasals	m			n		ŋ	
	Liquids				l	r		
	Glides	w				j		h

Adapted from Gierut, 2002 Ohio Speech-Language-Hearing Association Convention presentation and Moats, L.C. (2000). *Speech to Print*. Baltimore: Paul H. Brookes Publishing.

### Maximal Opposition Approach to Phonological Treatment (Gierut, 1989)

- one child
- initial consonant deletion with nearly complete phonetic inventory except /f, v, r/
- /m, b, w, j/ used in initial position
- Paired a sound that he used in the initial position contrasted with a **maximally** different sound: e.g. /s/ contrasted with /m, b, w/
- the child learned 16 new initial consonants with only 3 sets of maximal oppositions.
- The child reorganized his phonological system to include word initial consonants.
  
- Maximal pairs resulted in greater improvement in target sounds, more additions of untreated sounds and less over generalization to known sounds.
- Learning was enhanced by maximal differences and major class distinctions.
- Hierarchy of effectiveness:
  - multiple and major class distinctions > multiple distinctions > few distinctions

### **Greatest widespread system change:**

- minimal pairs comparing two **new** phonemes differing by **maximal** and **major** class features.
- The **major** class distinction may be more important than the number of features.

*“This result suggests that it may be unnecessary to teach children that newly learned phonemes are in some way related to other existing phonemes in their grammar by setting up explicit minimal pair comparisons” (p. 1056)*

*“Thus, the evidence implies that treatment comparing two new phonemes may be an important structural variable in conditioning phonological change.  
The results also suggest that treatment involving two new phonemes may motivate change in untreated phonemes, but perhaps only when pairs differ by a major class feature . . .” (p. 1056)*

### **Influence of Word Frequency on Phonological Change (Morrisette & Gierut, 2002)**

*Treatment of high frequency words resulted in greater generalization to treated and untreated sounds within and across sound classes*

### **Principles for making this work in the school setting**

A Winning Formula (Rvachew, 2004):  
traditional articulation therapy  
+ perceptual training  
+ training in letter identification  
+ training in sound-symbol relationships  
+ onset identification  
= in greater progress than articulation therapy alone.

### **Updated Principals for making this work in the school setting**

- Careful selection of targets - complex, late developing, non-stimulable phonemes
- Meaning-based therapy
- Maximal phonemic contrasts – see page 14
- Multiple targets
- Teach stimulability
- Build a bridge to phonics
- Use high-frequency words

### **What does therapy look like?**

- Stimulability training - the “magic wand”
- Road to the Code
  - Evidence-based practice for phonemic awareness
  - Adding rhymes to onsets
- Maximal oppositions using 2 target sounds (sometimes cognate pairs)

### **Writing IEP Goals**

- Think in terms of **intelligibility**
- Clearly **define** intelligibility in the goal - e.g. "The percentage of words spoken correctly during a 10-minute language sample."
- Objectives may be written with respect to maximal pairs, processes, or specific phonemes

### **Brice - Present Levels**

*On the Clinical Evaluation of Language Fundamentals- Preschool, Brice's scores fell within the expected range for his age, with the exception of Expressive Vocabulary, which was below average. He also demonstrated the following syntax errors: pronoun substitution (them/they, her/she), regularization of past tense (falled/fell), deletion of plural forms and verb endings, weak syllable deletion. On phonological testing, Brice demonstrated errors on the following sounds: [TH, t, d, s, z, sh, ch, dg, j, r, g] and consonant clusters. He also demonstrated the following error processes: backing, weak syllable deletion, stopping, gliding, vocalization and cluster reduction. His spontaneous speech intelligibility is estimated at 60%, based on a language sample.*

### **Brice - Annual Goal**

During a language sample of at least 50 utterances, Brice's overall speech intelligibility (words with errors/total words spoken) will be at least 75%.

### **Brice - Sample Objectives**

1. Brice will imitate maximal word pairs (such as shook/cook) containing his target sounds correctly 8/10 trials.
2. Brice will name familiar maximal pairs containing his target sounds correctly 8/10 trials.
3. Brice will imitate sentences containing pronouns he, she, they correctly 8/10 trials.

### **Worth the time?**

- ★ *One hour of transcription and analysis may equal less than a year of therapy*
- ★ *Global change and generalization*

## REFERENCES

- Bernhardt, B. H., & Stemberger, J. P. (2000). *Workbook in NonLinear Phonology for Clinical Application*. Austin, TX: Pro-Ed. [www.proedinc.com](http://www.proedinc.com).
- Bernthal, J., Bankson, N., Flipson, P. (2009) *Speech Sounds Disorders*. Boston: Allyn & Bacon.
- Bleile, K. (2002). Evaluating articulation and phonological disorders when the clock is running. *AJSLP*, 11, 243 – 249.
- Clinical Forum: (1992) *Phonological assessment and treatment*, LSHSS, 23, 225-232.
- Davis, B., Velleman, S. (2000) *Differential diagnosis and treatment of developmental apraxia of speech in infants and toddlers*. *Infant-Toddler Intervention*, 10, 3.
- Fey, M.E. (1992). *Articulation and phonology: Inextricable constructs in speech pathology*. LSHSS, 23, 225 – 232.
- Fey, M., Cleave, P., Ravid, A., Long, S., Dejmal, 4., Easton, D. (1994) *Effects of grammar facilitation on the phonological performance of children with speech and language impairments*, JSHR, 37, 594-608.
- Gierut, J. (1990) *Differential learning of phonological oppositions*. JSHR, 33, 540-549.
- Gierut, J. (1998) *Treatment efficacy: Functional phonological disorders in children*. JSLHR, 41, S85-S100.
- Hoffman, P. Norris, J., Monure, J. (1990) *Comparison of process targeting and whole language treatments for phonologically delayed preschool children*. LSHSS, 21, 102-109.
- Hoffman, P. (1990) *Spelling, phonology and the speech-language pathologist: A whole language perspective*. LSHSS, 21, 238-243.
- Khan, L.M. (2002). *The sixth view: Assessing preschoolers' articulation and phonology from the trenches*. *AJSLP*, 11, 250 – 254.
- Klein, (1996) *Phonological/traditional approaches to articulation therapy: A retrospective group comparison*. LSHSS, 28, 314-323.
- Koegel, R., Koegel, L., Van Voy, K., Ingham, J. (1988) *Within-clinic versus outside-of-clinic self monitoring of articulation to promote generalization*. JSHD, 53, 392-399.
- Masterson, J. (1993) *Classroom-based phonological intervention*. *American Journal of Speech-Language Pathology: A Journal of Clinical Practice*, 2, 5-9.
- Miccio, A.W. (2002). *Clinical problem solving: Assessment of phonological disorders*. *AJSLP*, 11, 221 – 229.
- Montgomery, J., Bonderan, 1. (1989) *Serving preschool children with severe phonological disorders*. LSHSS, 20, 76-84.
- Norris, J.A., Hodson, B., Scherz, J., and Bleile, K. (2002). *Five views of the Elephant: Perspectives on the assessment of articulation and phonology in Preschoolers*. *AJSLP*, 11, 213 – 214.
- Powell, T. (1991) *Planning for phonological generalization: An approach to treatment target selection*. LSHSS, 1, 21-27.
- Rvachew, S. (1994). *Speech perception training can facilitate sound production learning*. JSHR, 37, 347-357.
- Rvachew, S. & Nowak, M. (2001). *The effect of Target Selection strategy on phonological learning*. JSLHR, 44, 610 – 623.
- Rvachew, S., Ohberg, A., Grawburg, M., & Heyding, J. (2003). *Phonological awareness and phonemic perception in 4-year-old children with delayed expressive phonology skills*.

- AJSLP, 12, 463-471.
- Saben, C., Ingham, J. (1991) *The effects of minimal pairs treatment on the speech sound production of two children with phonological disorders.* JSHR, 34, 1023- 040.
- Schwartz, R. (1992) *Clinical applications of recent advances in phonological theory.* LSHSS, 23, 269-276.
- Schlosser, K. G., Phillips, V. L. *Building literacy with interactive language charts.* Scholastic Inc.
- Tyler, A., Sandoval, K. (1994) *Preschoolers with phonological and language disorders: Treating different linguistic domains,* LSHSS, 25, 215-234.
- Tyler, A., Randall Figurski, G., Langsdale, T. (1993) *Relationships between acoustically determined knowledge of stop place and voicing contrasts and phonological treatment progress.* JSHR, 36, 746-759.
- Tyler, A.A. & Tolbert, L.C. (2002). *Speech-Language assessment in the clinical setting.* AJSLP, 11, 215 – 220.
- Velleman, S., Strand, K. (1994) *Developmental apraxia.* In Bernthal, J., Bankson, N. (eds) *Phonological Characteristic for Special Populations.* New York: Thieme Medical Publishers, Inc.
- Warren, J. *The piggyback song book series.* Warren Publishing House Inc.
- Williams, A.L. (2002). *Prologue: Perspectives in the assessment of children's speech.* AJSLP, 11, 211 – 212.
- Williams, A. (1991) *Generalization patterns associated with training least phonological knowledge.* JSHR, 34, 722- 733.
- Williams, A. (1993) *Phonological reorganization: A qualitative measure of phonological improvement.* LSHSS, 3, 44-51.
- Winner, M. Elbert, (1988) *Evaluating the treatment effect of repeated probes,* JSHD, 53, 211- 218.

### Target Word Creation Grid

Target Sound	[- ɛr]	[bɪ - ]	[hæ -]	[-ʃ]	[- æd]
m	mare		ham		mad
b	bear	bib			bad
p	pair, pear				pad
w	wear			wish	
f	fair	Biff (I just put a picture of someone and name him "Biff")	half	fish	fad
v			have (high frequency word!)		
θ			hath		Thad (see "Biff")
ð	there				
t	tear	bit	hat		tad
d	dare	bid	had (high frequency word)	dish	Dad
n		bin			
l	lair	Bill (see Biff ☺)	Hal		lad
s					sad
z			has (high frequency word)		
ʃ	share		hash		shad (a fish)
ʒ					
tʃ	chair	don't go there...	hatch		Chad
dʒ					
j					
r / ʒ	rare				rad
k	care	Bic	hack		cad
g		big	hag		gad
h	hair				had

m					
b					
p					
w					
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