

STRATEGIES FOR PHONOLOGICAL INTERVENTION

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LEARNER OUTCOMES:

- Participants will describe and contrast two different approaches to the selection of treatment targets for a child with a phonological impairment.
- Participants will explain two different phonological treatment approaches that utilize lexical contrasts and will give illustrative examples.
- Participants will provide and explain examples of two treatment activities that should promote literacy development.

A. Basic Principles and Assumptions

1. Most phonological impairments involve *systematic error patterns*. These can be derived from any type of representative (and preferably non-imitated) speech sample (e.g., a combination of two published tests) as long as it assesses:
 - a. all consonants of English in all word positions
 - b. a variety of consonant clusters
 - c. multisyllabic words
2. To fit the needs of the individual child, treatment should be based on a complete and detailed phonological analysis, including:
 - a. phonological processes/patterns (see attached list), with:
 - the sounds and positions affected
 - frequency of occurrence
 - age appropriateness
 - effect on intelligibility
 - examples

- b. phonetic inventory analysis, by sound class and position, including
 - sounds produced, even if not used correctly
 - inventory constraints
 - positional constraints
 - overused sounds
 - stimulability for absent sounds
 - c. Sounds used contrastively (to differentiate words with different meanings) – look for minimal pairs, homonyms, neutralization
 - d. analysis of syllable/word shapes
 - inventory of syllable/word shapes produced (even if not “correct”)
 - sequence constraints (e.g., no consonant sequences, or no velars preceding alveolars)
 - e. a rough measure of severity (e.g., PCC, as in Shriberg, 1993) and an estimate of intelligibility (ability to be understood), preferably derived from a conversational speech sample (which can also be used to judge rate of speech and fluency)
 - f. Possibly an assessment of phonological awareness (PA) skills, especially if there is a family history of literacy problems. PA is often assessed by metalinguistic tasks that involve, for example:
 - rhyming (or matching rhyming words)
 - segmenting (words into syllables, syllables into onsets (O) and rhymes (R) or into individual sounds)
 - synthesizing (blending words from individually presented O’s and R’s or individually presented phonemes)
 - elision (deletion of sounds from words)
3. For children with systematic sound errors that can be grouped into error patterns or processes, phonological intervention should be more efficient than a sound-by-sound approach that treats each sound error separately.
 4. Phonological treatment should result in *generalization* from carefully selected “key sounds” to untreated sounds undergoing the same pattern.
 5. **The goal of phonological treatment is not to perfect individual sounds, one or two at a time. Rather, the goal is to increase intelligibility as efficiently as possible by remediating entire patterns of errors and stimulating change in the child’s phonological system.**

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B. Selection of Remediation Targets – Note that these considerations overlap.

1. **Where to begin and what to target will depend on the individual child, his/her phonological patterns, phonetic abilities, age, and personal characteristics. Some general guidelines include:**
 - a. For efficiency, start at the highest level possible, i.e., the level at which the “breakdown” occurs; this usually involves real words.
 - b. Because the basic unit of speech production is the syllable, start at that level (with simple CV or VC syllables) whenever possible, targeting isolated sounds only when absolutely necessary.
 - c. If target sounds are already present in the child’s inventory (even if not used “correctly”), phonetic production training should not be a focus.
 - d. There is presently no research available to support the use of oral motor exercises to improve speech production skills in children with functional speech sound disorders (Lof, 2003).
2. Phonological Processes
 - a. To enhance generalization, select two or more processes to be targeted in close succession, choosing processes from different categories (e.g., syllable structure changes, changes in place, manner, voicing, etc.) and processes that should not interfere with one another, e.g., because they apply in different positions or contexts (IV, FCD).
 - b. If a child is just “delayed,” select processes that should result in early success because they are suppressed early (e.g., FCD, VF, IV, CR) or affect early-acquired sounds, such as front stops and nasals.
 - c. If early success is a primary concern, choose “optional” processes or processes that apply only in certain positions or that affect sounds that are already in the child’s inventory.
 - d. To increase intelligibility, focus on “crucial” processes that are unusual or pervasive (e.g., sound preferences, backing) or that significantly affect intelligibility.
 - e. To minimize frustration, target “interacting processes” separately so that the child does not have to “undo” several processes at once. For example, if VF interacts with both IV and FD, remediate IV and FD in the context of front stops – not velars, e.g., /t, p/ and /d, b/, while also working on initial /g / (voiced) and final /k / (voiceless).

3. Syllable Structures

- a. Target new sounds in syllable structures and positions that are already *in* the child’s repertoire. For example, if working on the new sound /g/, train it in CV syllables, if those are solidly in the child’s repertoire.
 - b. When targeting new syllable structures or positions (e.g., codas in CVC syllables), use sounds that are already *in* the child’s inventory (Bernhardt & Stemberger, 2000).
4. Target Sounds
 - a. To minimize the chances of overgeneralization, carefully select at least two sounds undergoing each process, choosing sounds from different place and/or manner classes, such as /l/ and /n/ for FCD.
 - b. To promote early success, select sounds that are in the child’s inventory, even if they are not used correctly, or sounds for which the child is stimutable (however, see Powell, 1991).
 - c. Sounds that should be relatively easy in the position of concern, without interference from other processes, e.g., nasals and voiceless sounds, particularly fricatives, in final position.
 - d. Sounds that should improve intelligibility markedly.
 - e. Early-acquired and/or frequently occurring sounds, and sounds that are of high value to the child, e.g., because they occur in his/her name.
 5. Training Words (see “problem”)
 - a. Carefully select 5 to 10 real words (or minimal pairs) for each target sound, taking into consideration the child’s syllable structures and other errors, e.g., tea vs. key for VF if a child produces primarily CVs.
 - b. Age-appropriate, meaningful, relevant, picturable, some verbs.
 - c. Words made up of sounds/syllable structures already in the child’s inventory; e.g., avoid words with clusters unless the target is CR.
 - d. When possible, avoid words containing sounds affected by the child’s other processes.

C. Intervention Strategies, Techniques and Approaches

1. "Training broad" vs. "training deep" (e.g., Elbert & Gierut, 1986; Williams, 2000). These terms are defined as follows:

a. Broad training (or "distributed") – Treatment is "distributed" over a large and varied set of items undergoing a particular rule; e.g., Williams (2000) contrasted initial /l/ systematically with each of the sounds it replaced /w, j, s, f/.

b. Deep training (or "massed" practice) – Treatment involves a limited set of items/exemplars. Williams (2000, p. 283) says that the aim is to "stabilize the accuracy of a sound," and she states that this approach addresses each sound error separately. (It should be noted that in an approach such as cycles, particular sounds are selected to "break into" the child's error pattern, not to perfect those individual sounds.)

c. Macher (2000) found that broad training resulted in greater generalization for a child with a *severe* phonological disorder, but outcomes of both approaches were similar for a child with a *moderate* disorder.

2. Cycles (Hodson & Paden, 1983, 1991) (see example)

- a. Designed to "facilitate the emergence of patterns" and to provide an opportunity for generalization of new sound patterns to occur, as happens in typical phonological development.
- b. Remediation proceeds in "cycles" (generally 2-4 months), with *several processes targeted sequentially* in each cycle. Hodson has "rules" for which processes to target early/late.
- c. Each process is targeted for 2-4 consecutive weeks in each cycle, with a different sound/cluster being targeted in each session or week, e.g., one week on final /k/, followed by one week on initial /g/ for VF.
- d. The importance of "facilitating contexts" is stressed, i.e., putting the target sound in contexts/environments that should make it easier to produce. (e.g., velar consonants in the context of back vowels).
- e. Tactile cues, etc. are used whenever necessary to obtain a few good productions of the target sound in each session so that new "kinesthetic images" are established.

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- b. Maximal Contrasts – (e.g., Gierut, 1990)
 - The sounds that are contrasted in minimal pairs of made-up or real words are *maximally different* from each other; -
 - they typically differ in place, manner, and voicing, and if possible, in major class, e.g., /f/ vs. /v/, or /p/ vs. /t/.
 - found to be effective, especially if both of the sounds that are contrasted are "unknown" to the child, i.e., absent from the child's phonetic inventory ("inventory constraints").
 - The goal is not to teach the sounds that are contrasted, but to *stimulate change in the child's phonological system and to expand the child's phonetic inventory*. (Sometimes called the "least knowledge" approach.)
 - c. Multiple Oppositions – Williams (2000)
 - advocated for cases in which several adult phonemic contrasts are "merged" or "neutralized," as in the use of [j] for a variety of other sounds ("phoneme collapses")
 - The "overused" sound is systematically paired with each of the sounds it replaces, as in fell-yell, sell-yell, shell-yell, etc.
 - Weiner, 1981, recommended a very similar approach for "sound preferences."
 - Supports "broad" training to change the child's phonological rule.
 - d. Before contrasting minimal pairs of words, it may be necessary to illustrate the contrast between the two sound classes, such as "quick" vs. "slow" sounds for the stop/continuant contrast (e.g., Monahan, 1984).
 - e. A "perceptual sorting" task is sometimes used in which the child "sorts" words according to whether or not they contain the target sounds (e.g., by raising his/her hand or pointing to a visual representation of the sound).
4. Phonological Awareness - the awareness of sounds and the ability to reflect on and manipulate them (e.g., Stackhouse, 1997).
 - a. Some children with expressive phonological impairments have difficulty developing phonological awareness skills and are therefore at risk for later literacy problems (e.g., Stackhouse, 1997).
 - a. In the metaphonological approach (e.g., Chabon, 1991), activities are designed to heighten children's awareness of sounds and to help them think about the rules of the language.

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- f. At the beginning and end of each session, 2-3 minutes are devoted to "auditory bombardment" – auditory stimulation with slight amplification. The child plays quietly while lists of words containing the target sound for that day are read aloud by the clinician.

Example of One Cycle

VF --- FCD ----- ST ----- SCR
 /g/ \ F /k/ /n/ \ /f/ /s/ \ /t/ /sm/ \ /st/

3. Lexical Contrast - Contrasts between sounds that can change meaning. These approaches capitalize on the fact that a child's sound errors may result in a loss of meaning or "homonymy," as in [ti] for both tea and key (Weiner, 1991). They can be used for both discrimination and production.
 - a. Minimal Pairs – Goes back at least to distinctive feature-based therapy, and has been widely used since about 1980 (e.g., Weiner, 1979). Utilizes pairs of *real words*, usually differing by just one feature ("minimally different") so that the client's attention is focused on one particular feature that is in error, e.g., [+voice] vs. [-voice] in minimal pairs such as pea-bee, ten-den, and coat-goat. Uses semantic contrasts to help the client realize that his/her sound error results in a loss of *meaning*. Examples:
 - Sue-shoe, sip-ship, sew-show (alveolar vs. palatal for *depalatalization*)
 - fan-pan, vote-boat, sea-tea (fricative vs. stop for *stopping*)
 - run-won, red-wed, rip-whip (liquid vs. glide for *gliding of liquids*)
 - Variations – Use of *one real vs. one made-up word*, as in pig vs. tig for /p/ vs. /t/. Although this makes it easier to find pairs of "words," it loses the semantic impact of minimal pairs (and involves identification rather than phoneme discrimination).
 - Use of the *correct sound vs. the error sound*, even if they differ in more than one feature, e.g., shoe vs. dew, or "d" vs. key. (It is unclear how to reinforce productions in which just one of the features is corrected.)

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- b. The "Metaphon" approach (Howell & Dean, 1991) focuses on increasing awareness and understanding of sound class differences, mainly through the use of classification techniques and minimal pair contrasts.
 - c. To promote *phonological awareness*, incorporate activities that involve rhyming, phoneme-grapheme correspondence, segmenting (e.g., clapping out syllables), blending, and determining which words begin or end with the target sound (e.g., Gillon, 2000). **For children with expressive phonological impairments, preferable to use receptive tasks that are not confounded by the child's sound errors.**
5. "Phonogroup" – preschool phonology group
 - a. To facilitate carryover to other environments, a **naturalistic** approach is used in which target sounds and words are presented and produced as a natural part or consequence of the activities ("social validity").
 - b. To avoid other potential problems (e.g., stuttering), an **indirect** approach is typically used in which the child's speech is not explicitly corrected (Conture, 1990).
 - c. To target a number of processes in close succession and to provide an opportunity for generalization to occur, a **cycles framework** is used, with each session focusing on a single phoneme or cluster.
 - d. Other principles
 - (1) no drillwork, but extensive modeling (auditory bombardment) throughout the session
 - (2) slow speaking rate gives time to process and respond
 - (3) active participation of all children in each activity
 - (4) reinforcement for participation in activities
 - (5) emphasis on peer interaction
 - (6) use of space and movement (4-5 varied activities/hour)
 - (7) parental involvement/training
 - (8) a combination of group and individual sessions is recommended
 - e. Group characteristics
 - (1) optimal number (4-6)
 - (2) restricted age range (1-2 years)
 - (3) similar in severity (moderate – severe)
 - (4) commonality of phonological errors (based on processes, inventories)
 - (5) other problems or behavioral concerns

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- f. Selection of *shared remediation targets* (processes, sounds, positions)
- g. **Behavioral objectives** (specify process, sound, position, level)
- “In order to demonstrate a decrease in the application of Depalatalization, the client will produce final /f/ with 60% accuracy while naming the final /f/ pictures to be erased from the chalkboard.”
- h. Selected **techniques** for groups (in “natural” conversational contexts)
- (1) modeling of a small set of **training words** containing the target sound in the appropriate position, e.g., fish, wash, dish, leash.
 - (2) providing **choices** between two target words, both of which are logical alternatives, e.g., “Do you want a dish or a fish?”
 - (3) use of “foils” (obvious lexical errors, *not* targets) to elicit “corrections,” e.g., while making a snack, the clinician refers to the blueberries as cherries to elicit the target word blueberries.
 - (4) minimal pairs, e.g., pea vs. bee
 - (5) modified sensory-motor, e.g., hop-pin, hop-pie, hop-pea
 - (6) modified paired stimuli, e.g., key-cake, key-comb, key-cane

D. Combining Phonology with other Goals

1. **Fluency** – Integrate phonology goals into indirect and naturalistic sessions (as in Phonogroup) that use slow rate (“turtle speech”) and include fluency goals (Conture, Louko & Edwards, 1993).
2. **Language** – Because expressive language problems often co-occur with phonological impairments, both areas should be addressed. Regarding “cross-domain effects,” Tyler et al. (2002) found that the children who received morphosyntax intervention also showed improvements in phonology.

E. Monitoring Progress

1. **Rationale**
 - a. **Accountability** – Is treatment making a difference?
 - b. **Clinician as researcher** – Need to systematically collect and analyze data in order to modify treatment as necessary.

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- b. **Decrease** in process application
 - (1) Increase in *correct* productions of sounds affected by the process
 - (2) Increase in productions that are *closer* to the target or productions in which the process does not occur (for example, productions of any final consonant if FCD is the target)
- c. **Addition of sounds** to the child’s phonetic inventory (e.g., Gierut et al.)

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c. Evidence Based Practice (EBP)

According to ASHA (2004), the goal of EBP is to integrate: the *best current evidence*, with *client values*, and *clinical expertise* to provide the best services possible.

- The **best evidence** involves contrasting experimental and control groups, conducting prospective studies, and randomly assigning participants to treatment groups.
- Single subject studies, correlational studies, and case studies provide a lower level of evidence.
- Most studies in speech-language pathology fall into these latter types.
- There is presently little *high-level* evidence regarding the treatment of speech sound disorders in children; more research is needed
- Treatment options should be evaluated systematically and critically.

2. Techniques for monitoring progress

- a. Use *session logs*, compiled to show change over time.
- b. **Probe** to assess generalization to untrained words, positions, sounds
 - Use probe words that are *different* from the words used in treatment.
 - Include several words to assess each sound in each position of concern, varying phonetic context, word length and syllable structure
 - Administer probe lists on a regular basis
 - Elicit *spontaneous* (nonimitated) productions of probe words, e.g., by use of a picture naming task.
 - Give no feedback regarding the child’s productions of the probe words.
- c. **Reanalyze** to assess process application, PCC, and phonetic inventory in a sample that is comparable to the original sample.
3. **Showing change in phonology**
 - a. **Increase** in correct production
 - (1) percent accuracy of specific phonemes or classes
 - (2) increase in overall accuracy (percentage of consonants correct or “PCC”)

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Some Common Phonological Processes

A **phonological process** is a systematic sound change that affects a class of sounds (such as velars or fricatives) or a sound sequence (such as /s/ + stop clusters) (Edwards & Shriberg, 1983).

A. Syllable Structure Changes

1. **Weak Syllable Deletion (WSD)** - An unstressed (weak) syllable is deleted. Up to 3½ for three-syllable words and up to 4-4½ for longer words.

banana [ˈnænə] television [ˈte.vɪzən] butterfly [ˈbʌf.aɪ]
2. **Final Consonant Deletion (FCD)** - Word-final consonants are deleted. Most words have final consonants by age 3, though they may not be correct.

dog [dɔ] cat [kæ] fish [fɪ]
3. **Reduplication (R)** - An entire syllable (or part of a syllable) is repeated. (An “early” process used extensively by some children; used rarely by others.)

pudding [ˈpʊpʊ] water [ˈwɔwɔ] blanket [ˈbʌbʌ]
4. **Cluster Reduction (CR)** - A sequence of two or more consonants is simplified, usually by deletion of the more difficult or “marked” element. Up to 3 in normal development; common in severe disorders.
 - a. **/s/ - Cluster Reduction** - Usually the /s/ is deleted, especially in initial clusters.

spoon [pʊn] snow [noʊ] mask [mæk]
 - b. **Nasal Cluster Reduction** - Either element may be deleted; this sometimes depends on the voicing of the obstruent.

sink [sɪk] lamp [læp] sand [sænd]
 - c. **Liquid Cluster Reduction** - The liquid is usually deleted. (An early stage in cluster acquisition.)

clown [kaʊn] green [ɡɪn] belt [bet]
5. **Epenthesis (E)** - A segment is inserted, often between two elements of a cluster.

green [ɡʻrɪn] frog [fɹowɔŋ] blue [bˈlu]

* Approximate ages of process “suppression” or “dissolution” are based in part on information in Grunwell (1982), Hodson and Paden (1991), and Ingram (1989).

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6. Coalescence (CO) - Features from two adjacent segments or syllables combine (Segment or Syllable Coalescence).
- swing [fɪŋ] snow [nəʊ] garage [gɑːʒ] balloon [bəʊn]
(Segment Coalescence) (Syllable Coalescence)
7. Metathesis (M) - Two sounds are reversed; this is usually not consistent.
- mask [mæks] basket [bæksɪt] blue [blu]
- B. Assimilation Processes - One sound is influenced by another and becomes more similar (or identical) to it. May be complete or partial, progressive or regressive.
1. Velar Assimilation (VA) - A sound becomes a velar due to the influence of a nearby velar (/k, g, ŋ). Up to age 2½; very common in early acquisition.
- duck [kæk] doggie [ˈdɔːgi] snake [neɪk]
(complete regressive) (complete regressive) (partial regressive)
2. Labial Assimilation (LA) - A sound becomes a labial due to the influence of a nearby labial. Noted in severe phonological disorders, as well as early normal development.
- gum [bʌm] table [ˈteɪbʊ] swim [fɪwɪm]
(partial regressive) (complete regressive) (partial regressive)
- C. Voicing Changes
1. Initial (Prevoicative) Voicing (IV/PV) - Voiceless obstruents are voiced in initial position (or preceding a vowel). Up to 2;8 or 3;0 in initial position.
- top [dɒp] cow [gəʊ] pig [bɪg]
2. Final Devoicing (FD) - Word-final obstruents are devoiced; may be exhibited even by four-year-olds (Hodson & Paden, 1981).
- pig [pɪk] bed [bet] nose [nos]
- D. Changes in Place of Articulation
1. Fronting of Velars (VF) - Velars are replaced by alveolars. "Suppressed" by about 3 years; common in disordered phonology.
- go [dɔ] wing [wɪn] cookie [ˈtʊtɪ]
2. Depalatalization or Palatal Fronting (PF) - Palatals are replaced by alveolars. Exhibited even by 4-year-olds (Hodson & Paden, 1981).
- show [sɔ] juice [dzʌs] watch [wɒts]

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- F. Vowel Changes - Vowel errors are rare in normal development. If vowel errors occur, try to find patterns. For example, vowels may be lowered, reduced to [ə], neutralized to [ʌ], etc.
- bed [bæd] mad [mæd] cat [kæt] bird [bɜːd]
- G. Some Unusual Sound Changes
1. Initial Consonant Deletion (ICD) - Word initial consonants are deleted. "Normal" only for /h/; common in severe disorders; rare for stops.
- hot [ɒt] toy [tɔɪ] shoe [ʃu]
2. "Atypical" Cluster Reduction (ACR) - The "unmarked" element of a cluster is deleted. (Examples may simply be put under /s/ CR, etc.)
- stop [sɒp] snow [səʊ] tree [tri] glue [glu]
3. Glottal Replacement (GR) - Consonant sounds are replaced by a glottal stop, usually in intervocalic or final position. (Normal for /t,d/ in some dialects).
- chicken [ˈtʃɪtʃɪn] money [ˈmʌŋi] tub [tʌʔ]
4. Velarization/Backing to Velars (BK) - Front sounds are replaced by velars (not due to assimilation); may include front fricatives.
- tea [ki] dough [gɔ] zoo [gu] feather [ˈfegə]
5. Lateralization (LAT) - Fricatives (generally sibilants) are produced with lateral emission or are replaced by a lateral fricative [ɬ].
- sip [ɬɪp] she [ɬi] fish [ɬɪ]
6. Neutralization (N) - One sound is used in place of several different adult sounds, so that adult phonemic contrasts are "neutralized" or "merged," e.g., neutralization of initial fricatives to [j].
- see [ji] thumb [jʌm] ship [jɪp] fish [jis]
- H. Interacting Processes - Two or more processes affect the same sound/cluster or have some influence on one another.
1. car [dɑr] **k→d/#** V (place, voicing)
Velar Fronting + Prevocalic Voicing
(k→t→d or k→g→d)
2. bridge [brɪʃ] **dʒ→ʃ/#** (manner, voicing)
Deaffrication + Final Devoicing
(dʒ→ʒ→ʃ or dʒ→t[ʃ]→ʃ)

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3. Labialization (LB) - Other front sounds are replaced by labials.
- mouth [maʊf] brother [ˈbrʌvə] see [fi]
4. Alveolarization (AL) - Other front sounds are replaced by alveolars.
- thumb [sʌm] leaf [wis] mother [ˈmʌzə]
5. (Inter)dentalization - Some (or all) sibilants (/s, z, ʃ, tʃ, dʒ/) are replaced by interdental fricatives [θ, ð] (interdentalization); or alveolar sounds, particularly sibilants /s, z/, are produced with the tongue tip tightly against the top front teeth (Dentalization).
- see [θi] nose [noʊð] sing [sɪŋ] zoo [zu]
- E. Changes in Manner of Articulation
1. Stopping (ST) - Fricatives/affricates are replaced by stops. Begins to disappear by 2½ - 3 for most sounds such as /f,s,ʃ/, but persists for some fricatives, e.g., /θ,v,dʒ/ ("late stopping").
- fall [pɒl] see [ti] this [dɪs] vest [best] chair [tʃeə]
2. Gliding of Fricatives (GF) - Fricatives are replaced by glides. Not as common as Stopping.
- food [wud] vase [wes] shoe [ju]
3. Gliding of Liquids (GL) - Liquids are replaced by glides. Applies up to 4;0 for /l/; persists longer for /r/.
- Light [jʌt] clown [kwaʊn] pillow [ˈpɪlo]
run [wʌn] green [gwiːn] very [ˈveɪri]
4. Vocalization (V) - Syllabic or postvocalic liquids are replaced by vowels. Exhibited even by some 4-year-olds; may persist longer for /r/. (Includes loss of r-coloring from rhotic vowels) /ɜː,ə,ɹ/.
- bell [beʊ] milk [mɪʊk] whistle [ˈwɪsɔ]
bird [bɜːd] car [kɑː] under [ˈʌndə]
5. Affrication (AF) - Fricatives are replaced by affricates.
- shoe [tʃu] bus [bʌts] fish [pɪʃ]
6. Deaffrication (DA) - Affricates are replaced by fricatives (e.g., tʃ→ʃ, dʒ→ʒ).
- chin [ʃɪn] juice [ʒʌs] page [peɪʒ]

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3. spoon [bʌn] **sp→b/#** V (syllable structure, voicing)
/s/ Cluster Reduction + Prevocalic Voicing
(sp→p→b)
4. duck [gʌ] Regressive Velar Assimilation + Final Consonant Deletion

/dʌk/ → /gʌk/ → /gʌ/

FROM NON-LINEAR PHONOLOGY PROSODIC HIERARCHY

- *Prosodic words* (have one main stress)
- *Feet* (combinations of strong + weak syllables)
- *Syllables* (made up of onsets + rimes)
- *Segments* (consonants and vowels)

Foot - A metrical unit, generally made up of a strong (stressed) and a weak (unstressed) syllable, or one strong syllable.

Types of feet:

Trochaic or left prominent: **Sw, SS, S** e.g., tiger, cowboy, girl (common in English)

Iambic or right prominent: **wS or sS**, e.g., garage, balloon, maintain

Components of syllables -

onset = any consonants preceding the nucleus (vowel) (up to 3 in English)

rime/rhyme = vowel (nucleus) + consonants following it in the coda

coda = any and all consonants following the nucleus in the syllable (up to 4 in English)

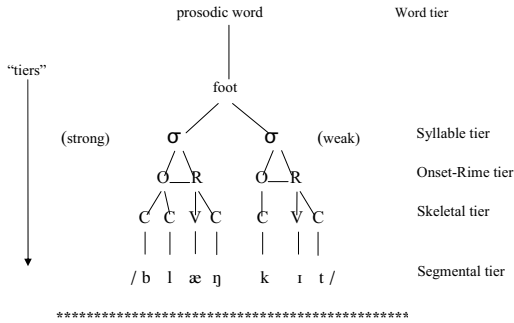
Problem: Which of the adult words listed below would be "unpronounceable" for a child who had the following output constraint? List at least one "repair" [process] that would work for each unpronounceable word, and show how the words would be said.

* **Complex**

lamb spoon this truck drink snow ant shoe

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Metrical Phonology representation of the word blanket (CCVC.CVC)



Optimality Theory (OT) - based on universal constraints

Examples of output constraints:

- *Dorsal = "No back consonants (velars/dorsals) are produced."
- *Complex(Onset) = "No clusters are produced in onset position."
- *Coda = "No syllable final consonants (codas) are allowed."
- Syl>Onset = "Syllables must have an onset."

Examples of "faithfulness" constraints:

MAX "No deletion." DEP "No insertion." DENT(Strident) "The strident feature is kept."

The "generator" produces a set of alternative output forms.

The "evaluator" selects the "optimal" output, given the constraints of the language.

Constraints are "ranked" differently for different languages and different children.

Constraints can be "re-ranked" over time ("demoted" or "promoted").

Processes can be seen as "repairs" for output constraints.

PROBLEM: SELECTING TRAINING WORDS

Things to keep in mind:

- Choose age-appropriate words that are meaningful, relevant, and picturable.
- Choose words that are within the child's *syllabic capabilities*; e.g., if the child produces no clusters, avoid words containing them (unless the target process is Cluster Reduction)
- If possible:
 - choose words containing sounds that are *in* the child's phonetic inventory;
 - avoid sounds that are beyond expectations for the child's age;
 - avoid sounds that are affected by the child's other processes or processes that are expected for the child's age.

Suppose that you were to begin working on **Initial Voicing with a client who also exhibited the following fairly consistent processes:

- /s/-Cluster Reduction,
- Liquid Cluster Reduction
- Vocalization
- Velar Fronting
- Depalatalization
- Final Devoicing
- Stopping of Fricatives

From the words listed below, select the four best training words for initial /p/ and the four best words for initial /t/. Give your reasons for choosing these *eight* words.

pig paste pin push pie plane pat pear paw
 train tan toast Tim tack tear tea tape toad

Consonant Sounds	SINGLETONS (Code by the sound produced.)				CLUSTERS* (Write clusters produced in appropriate box.)			
	Word Initial Syl. onset	Word Medial syl. onset syl. coda		Word Final Syl. coda	Word Initial Syl. onset	Word medial syl. onset syl. coda		Word Final Syl. coda
STOPS	/p/							
	/b/							
	/t/							
	/d/							
	/k/							
NASALS	/ŋ/							
	/m/							
	/n/							
	/ɳ/							
	/ɲ/							
FRICATIVES	/θ/							
	/ð/							
	/f/							
	/v/							
	/s/							
LIQUIDS	/z/							
	/ʒ/							
	/ʃ/							
	/ʒ/							
	/ʒ/							
AFFRICATES	/tʃ/							
	/dʒ/							
GLIDES	/l/							
	/r/							
Other Sounds	/w/							
	/j/							
	/h/							

CONSONANT INVENTORY CHART

PROBLEM: Compare the target sounds that would be selected if you were to use minimal pairs vs. maximal contrasts vs. multiple oppositions to treat this child's neutralization of initial voiceless fricatives.

SPEECH SAMPLE FOR PHONOLOGICAL ANALYSIS

SOURCE OF SAMPLE: object pictures CHILD: David
 DATE: _____ CA: 4;2

TARGET WORD	ADULT WORD	CHILD'S PRODUCTION	I SUBSTITUTIONS/PROCESS	M
1. ladder	/lædə/	[læʔə]		
2. vase	/ves/	[bes]		
3. ship	/ʃɪp/	[lɪʔ]		
4. apple	/æpl/	[æʔʊ]		
5. skate	/sket/	[teʔ]		
6. sugar	/ʃʊgə/	[lʊʔə]		
7. button	/bʌtən/	[bʌʔən]		
8. there	/ðeə/	[deə]		
9. sun	/sʌn/	[lʌn]		
10. black	/blæk/	[bæʔ]		
11. stop	/stɒp/	[tɒʔ]		
12. five	/faɪv/	[laf]		
13. nose	/noʒ/	[nos]		
14. frog	/frɔg/	[lɔʔ]		
15. grass	/græs/	[dæs]		
16. fish	/fɪʃ/	[lis]		
17. thumb	/θʌm/	[lʌm]		
18. cup	/kʌp/	[tʌʔ]		
19. coffee	/kɔfi/	[tɔfi]		
20. thread	/θrɛd/	[lɛʔ]		

**EXAMPLES OF PHONOLOGICAL INTERVENTION ACTIVITIES
THAT SHOULD PROMOTE PHONOLOGICAL AWARENESS**

1. **“FEEDING PHIL THE FISH”** – To heighten awareness of initial sounds
 - A picture of a large-mouthed fish named “Phil” is taped to the wall.
 - The children are told that Phil likes to eat only food that starts with the /f/ sound, like his name.
 - The children take turns pulling pictures out of the “food basket.”
 - Each food item is named as it is selected.
 - If the item begins with the /f/ sound (such as fan, phone, 4), the child gets to feed it to Phil the fish.
 - If the item does not begin with the /f/ sound, it is put in the “fridge” for possible use in a later session.

2. **NAME TAGS** – To foster awareness of phoneme-grapheme correspondence

At the beginning of a group phonology session devoted to the initial /f/ sound, children are shown large pictures of two words whose names start with /f/, such as fan and fish. The name of each item is written beneath the picture, with the initial f highlighted. Children are told that this is the way the /f/ sound is usually written, and they are asked to verbally choose a small picture of a fan or fish for their nametag. (If the names of the pictures have two syllables, such as football and feather, the children can clap out the syllables for segmentation practice.)

3. **RHYMING BINGO** – To heighten awareness of rhymes

If the target for the session is final /g/ (for Final Consonant Deletion or Velar Fronting), one entire activity (e.g., a bingo game) could involve words with the same “rime,” such as bug, rug, hug, mug, jug, tug. When the target words for the activity are introduced, and at every opportunity throughout the activity, the clinician talks about the fact that the words “rhyme” or “sound alike.”

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