

Bilingual Phonological Development and Disorders

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Research is a Team Sport

Bilingual Language Lab

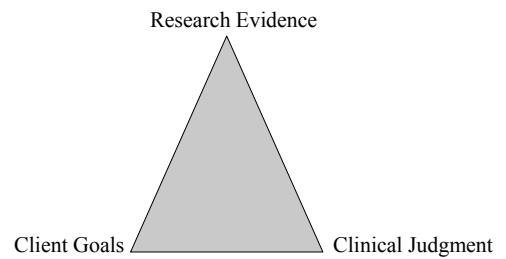
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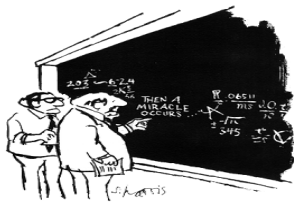
Words to Live By (courtesy of A. Einstein)

- ♦ “*Insanity*: doing the same thing over and over and expecting different results.”
- ♦ “In the middle of difficulty lies opportunity.”

Evidence-Based Practice



Evidence-Based Practice



"I think you should be more explicit here in step two."

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What Evidence Underlies Bilingual Phonological Intervention?

Intervention Studies with Bilingual Children

- ◆ Holm, Ozanne, & Dodd (1997)
- ◆ Holm and Dodd (1999)
- ◆ Holm & Dodd (2001)
- ◆ Ray (2002)

Holm, Ozanne, & Dodd (1997)

- ◆ 5-year-old Cantonese-English speaking bilingual boy
- ◆ heard & spoke Cantonese at home until the age of 3;3, until school
- ◆ treated in two phases (/s/ then cluster reduction) but in English only
- ◆ treatment on /s/ resulted in changes on /s/ in both languages
- ◆ treatment of cluster reduction improved cluster production in English but not in Cantonese

- ◆ Strengths
 - Provided treatment in 2 phases
 - Examined language pair other than Spanish-English
- ◆ Limitations
 - Case study
 - Tx in only English
 - Clusters already highly accurate in Cantonese (60-70%)
 - Are there really clusters in Cantonese?
 - Almost twice as many Tx sessions for /s/ compared to clusters

Holm and Dodd (1999)

- ◆ intervention in English only to a 4;6 Punjabi-English speaking child
- ◆ exposed almost exclusively to Punjabi until entered daycare at 3;0
- ◆ Results indicated increased consonant accuracy in both English and Punjabi

- ◆ Strengths
- ◆ Limitations
 - Detailed information on the child's phonological skills before/after Tx not presented
 - Specific Tx targets not specified
 - Did not account for effects of the clinic-, parent-, and teacher-based aspects of Tx

Holm & Dodd (2001)

- ◆ 5-year-old sequential bilingual child acquiring Cantonese and then English (at school around age 3)
- ◆ Tx in English only
- ◆ (1) Tx on /s/ (distortion)
 - within and across language generalization on /s, ʃ, tʃ/; clusters
- ◆ (2) Tx on cluster reduction and gliding
 - decrease in patterns in English but not in Cantonese (no data for Cantonese reported)

- ◆ Strengths
 - Treatment on multiple targets
- ◆ Limitations
 - no information on pre-Tx phonological skills
 - Tx in English only
 - Treatment on multiple targets

Ray (2002)

- ◆ 5-year-old trilingual (Hindi, Gujarati, and English) boy with a mild phonological disorder
- ◆ born in the U.S.; exposed to Hindi and Gujarati from birth; English when he entered school at age 4, but exposed to it prior to that time
- ◆ Initial consonant accuracy: English (70%); Hindi (80%); Gujarati (85%)
- ◆ types of errors similar across the three languages
- ◆ Tx in English only using minimal contrasts
- ◆ Practice at home as well

Ray (cont.)

- ◆ Results:
 - decreased the percentage-of-occurrence of phonological patterns in the child's speech in all three languages
 - increased consonant accuracy in all three languages
 - improved percentile rank on a standardized English articulation assessment

- ◆ Strengths
 - Monitored skills in both languages
 - Outcome measures included formal and informal tools
- ◆ Limitations
 - The effect of clinician and home practice not accounted for
 - Not clear if and how generalization took place across the child's languages
 - Specific types of generalization (e.g., within-class vs. across-class) were not specified.

What do we Know?

- ◆ "Know" the phonological systems of both languages.
- ◆ Describe (broadly and deeply) phonological skills in both languages.
- ◆ During intervention, monitor phonological skills in both languages.

What Do We Do when We Know that We Don't Know?

- ◆ Assess broadly and deeply
- ◆ Ask the right question.

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Bilingual Phonological Assessment

Assessment

- ◆ Perform A Detailed Case History
 - Language history
 - % input in each language
 - % output in each language
 - Use
 - Proficiency
- ◆ Ask parents what a “typical” day is like for their child.

Case History (Yavaş & Goldstein, 1998)



- ◆ Do the child's parents, family members, teachers, friends...understand the child all, some, none of the time?
- ◆ Does the child sound like other children of the same age?
- ◆ How intelligible is the child?
- ◆ What consonants does the child produce (front-back; initial-final)?
- ◆ What vowels are produced (all, some)?
- ◆ What dialect does the child speak?

Assessment

- ◆ Complete additional “routine” assessments
 - Oral-peripheral exam
 - Hearing screening/evaluation
- ◆ Assess Language
 - MLU-w

Assessment

- ◆ Obtain Speech Samples in both languages
 - Single word sample
 - Connected speech sample (conversation or narrative)
 - Perform phonetic transcription of each sample
 - Use a software program such as Computerized Profiling (www.computerizedprofiling.org) (Long, Fey, & Channell, 2004) for efficient transcription and analysis.

Assessment

- ◆ Perform An Independent Analysis
 - Determine the phonetic inventory of the child in both languages using the single word and connected speech samples.
 - Organize inventory by place of articulation (e.g., bilabial, alveolar, etc.) and manner of articulation (e.g., stops, nasals, etc.).

Spanish vs. English Phonetic Inventory

Stops	Spanish	p b t d k g
	English	p b t d k g
Nasals	Spanish	m n ɲ
	English	m n ŋ
Fricatives	Spanish	f s x
	English	f v s z θ ð ʃ ʒ h
Affricate	Spanish	tʃ
	English	tʃ dʒ
Liquids	Spanish	l
	English	l ɹ
Flap	Spanish	r
Trill	Spanish	r
Glides	Span./Eng.	w j

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Assessment

- ◆ Perform A Relational Analysis
 - Overall accuracy by language
 - Consonants
 - Vowels
 - Accuracy of shared and unshared phonemes by language

Perform Relational Analyses

- ◆ Vowels
 - error patterns
 - ◆ Consonants
 - Error types
 - Substitutions
 - Omissions
 - Distortions
 - Additions
 - phonological patterns/processes
 - intelligibility
 - contextual effects
 - stimulability
- } By manner class
(stops, nasals, etc.)

Describe Phonological Patterns in each Language (Yavaş & Goldstein, 1998)

- ◆ 4-way distinction

1. Common Patterns

- ♦ Syllabic Patterns
 - Cluster reduction
 - Final consonant deletion
 - Unstressed syllable deletion
- ♦ Substitution Patterns
 - Stopping
 - Fronting (palatal, velar)
 - "Liquid" simplification (flap, trill, etc.)
- ♦ Assimilation
- ♦ *Developmental*
 - cluster reduction in 3;6
- ♦ *Non-development*
 - cluster reduction in 5;6

2. Uncommon patterns

- ♦ initial consonant deletion
 - /sop/ → [op]
- ♦ backing
 - /plet/ → [plek]

3. Cross-linguistic Effects

- ♦ The substitution of a sound not in the child's ambient language
 - /fɪʃ/ → [fɪʃ]
- ♦ Frequency of occurrence of cross-linguistic effects = ≈ 1% (<10%) (Goldstein, Fabiano, & Iglesias, 2003; Goldstein & Washington, 2001)
- ♦ Monolingual children also use sounds not in their ambient language (Smit, 1993)
- ♦ Not Errors so Not Treated

4. Dialect Features (Goldstein & Iglesias, 2001)

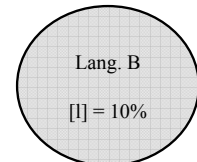
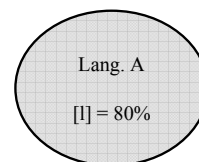
- ♦ NOT ERRORS SO NOT TREATED

Describe Common/Unique Phonological Elements

- ♦ Analyze sounds common to both languages and unique to each language.
 - What's the rationale?

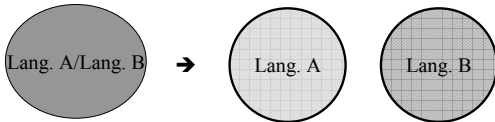
Rationale

- ♦ Learning will not be parallel across the bilingual child's two languages

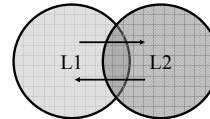


Models of Language Representation

Unitary System Model (e.g., Vogel, 1975): single storage system for both languages; however, languages do differentiate over time.



Interactional Dual Systems Model: (Paradis, 2001): The two phonological systems show separation for some features but interact with each other for others.



Evidence of Interaction

Accuracy of Shared and Unshared Phonemes

- Shared Phonemes: Phonemes with overlapping features (e.g., /p/ is common to both English and Spanish)
- Unshared Phonemes: Phonemes that have features that do not overlap (e.g., The Spanish trill /r/ and the English approximant /ɹ/)
 - Shared phonemes demonstrate higher accuracy than unshared phonemes (Fabiano, 2006; Fabiano & Goldstein 2004a, 2004b; Goldstein, Fabiano, & Iglesias, 2003)

Shared and Unshared Phonemes

Shared Phonemes (English and Spanish)	Unshared Phonemes
/m, n, b, p, t, k, g, f, tʃ (ch), s, ð (th-vd.), l/	English /h, v, dʒ (j), ŋ (ng), ʃ (sh), ʒ (zh), z, θ (th-vl.)
	Spanish /x, ɣ (g-spirant), r, r (flap), β (b-spirant)/

Shared vs. Unshared Consonants (Goldstein, Fabiano, & Iglesias, 2003)

	Accuracy-English	Accuracy-Spanish
Shared		
typically developing	93.5%	93.7%
phon. disordered	83.3%	84.6%
Unshared		
English		
typically developing	81.7%	n.a.
phon. disordered	59.8%	n.a.
Spanish		
typically developing	n.a.	76.6%
phon. disordered	n.a.	48.6%

based on Stockman's Min. Competence Core (1996)

Phonological Skills in Bilingual Children

What do we know?

- ◆ Phonological structures--vowels, consonants, syllable types, etc.--are not the same for each language (Hammond, 2001).
- ◆ Different developmental trajectories occur in each language (e.g., Goldstein et al., 2005).
- ◆ Order of acquisition and phonological patterns will differ (e.g., Vihman, 1995).

Compared with Monolingual Children, Bilingual Children:

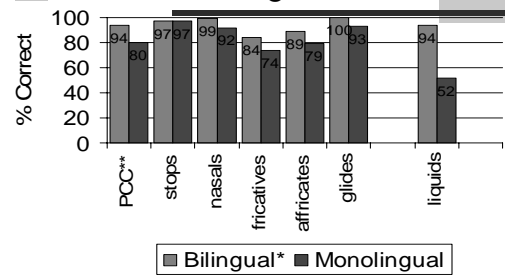
- show an overall lower intelligibility rating
- make more consonant & vowel errors
- produce more uncommon error patterns
- exhibit more phonological patterns
- exhibit higher percentages-of-occurrence for many phonological patterns
- However, the children were tested only in English.

Gildersleeve, Davis, & Stubbe (1996); Gildersleeve-Neumann & Davis (1998)

Phonological Development

- ◆ Bilingual children < 4-years-old
 - speech sound development in bilingual children is **dissimilar** to monolingual children (Fabiano, 2006; Gildersleeve et al., 1996)
- ◆ Bilingual children > 4-years-old
 - speech sound development in bilingual children is **similar** to monolingual children (Gildersleeve et al., 1998; Goldstein & Washington, 2001; Goldstein et al., 2005)

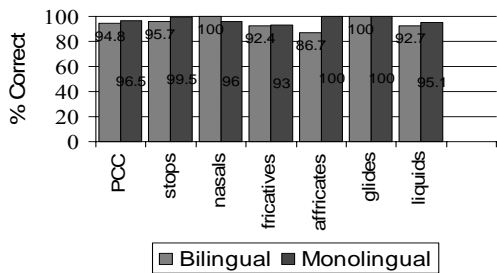
Bilinguals* vs. Monolinguals**: English



*Goldstein & Washington, 2001; 12 children aged 4;0-4;11, mean = 4;7

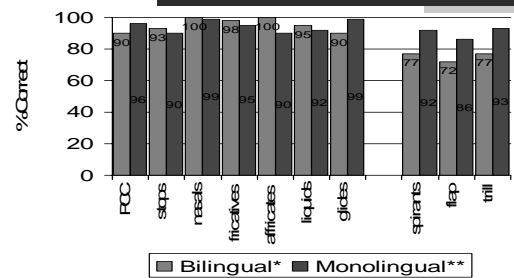
**Austin & Shriberg, 1997; manner data-Smit, Hand, Freilinger, Bernthal & Bird, 1990)

Bilinguals vs. (predominantly) Monolinguals: English



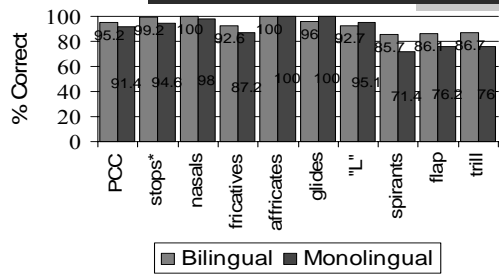
*Goldstein, Fabiano, & Washington, 2005; 15 children aged 5;0-5;5, mean = 5;2

Bilinguals vs. Monolinguals: Spanish



*Goldstein & Washington, 2001; **Goldstein & Iglesias, 1996a

Bilinguals vs. (predominantly) Monolinguals: Spanish

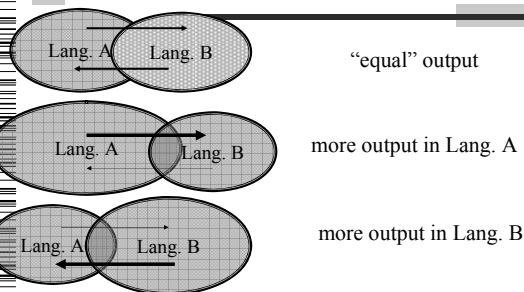


Goldstein, Fabiano, & Washington, 2005; 15 children aged 5;0-5;5, mean = 5;2
*p = .005

Bilingual vs. Monolingual Development

- ♦ Group data indicate that bilingual language development is (statistically) similar, although not identical, to monolingual language development, assuming
 - the children are matched on age, gender, level of output, linguistic community, SES, language history, language experience.
- ♦ Question: What effect does frequency of output have on consonant accuracy?

Strength of Language Output



Correlation between Output & Accuracy (Goldstein, Fabiano & Washington, 2005)

- ♦ English
 - No significant correlation between output and overall consonant accuracy or accuracy by sound class
 - Correlations ranged from .05 to .55
 - All effect sizes were negligible or small
- ♦ Spanish
 - No significant correlation between output and overall consonant accuracy or accuracy by sound class
 - Correlations ranged from .04 to .73
 - All effect sizes were negligible or small

Varying Levels of Output (Goldstein, Lange, Rodriguez, Bunta, & Burrows, 2007)

- ♦ What are the expressive phonological skills in Spanish-English bilingual children with varying levels of output in each language?
- ♦ Evidence of frequency of input/output on language skills (e.g., Gutierrez-Clellen & Kreiter, 2001; Peña, Bedore, & Rappazzo, 2003).

Method

- ♦ 70 typically developing children, ages 4;3 to 7;1 (mean = 5;8)
 - 10 monolingual Spanish speakers
 - 10 monolingual English speakers
 - 50 Spanish-English bilingual speakers
 - Bilinguals sub-divided into 5 subgroups by frequency of output per parent report (Restrepo, 1998)

- ◆ Group 1: English 0% --Spanish 100%
- ◆ Group 2: English 5-20% --Spanish 80-95%
- ◆ Group 3: English 25-40% --Spanish 60-75%
- ◆ Group 4: English 45-55% --Spanish 45-55%
- ◆ Group 5: English 60-75% --Spanish 25-40%
- ◆ Group 6: English 80-95% --Spanish 5-20%
- ◆ Group 7: English 100% --Spanish 0%

- ◆ Single word phonology assessment in English and/or Spanish (Peña et al., in development)
- ◆ phonological analyses
 - Independent analysis examining the phonetic inventories of the children
 - Overall percent segments, vowels, and consonants correct-revised (Shriberg, Austin, Lewis, McSweeney, & Wilson, 1997)
 - Percentage-of-occurrence of phonological patterns
 - Accuracy for early-, middle-, and late-developing sounds

Early, middle, and late developing sounds

- ◆ English (Shriberg, 1993)
 - Early 8 /m, b, j, n, w, d, p, h/
 - Middle 8 /t, ɲ (ng), k, g, f, v, tʃ (ch), dʒ (j)/
 - Late 8 /ʃ (sh), θ (th-vd), s, z, ð (th-vl), l, ɹ (r), ʒ (zh)/
- ◆ Spanish (after Acevedo, 1993)
 - Early 6 /p, d, n, t, j, w/
 - Middle 6 /k, g, x, m, f, ɲ (ny)/
 - Late 6 /tʃ (ch), b, l, r (trill), r (flap), s/

Results: Phonetic Inventory

- ◆ English
 - Bilinguals tended to omit [v] and [θ] (theta)
 - Monolinguals tended to omit [θ] (theta) & [ð] (eth)
- ◆ Spanish
 - Bilinguals tended to omit [ð] (eth), [x], and [r] (trill)
 - Monolinguals included all segments, except for one child who omitted [x] and [r] (trill)

Results: Accuracy Measures

- ◆ English
 - No significant difference between groups on vowel accuracy, consonant accuracy, early-, middle-, late-developing sounds
- ◆ Spanish
 - Significant differences on vowel accuracy and accuracy of early-6 sounds by Study Group
- ◆ *Use and Proficiency* predicted speech sound accuracy

Results: Phonological Patterns

- ◆ English & Spanish
 - No significant difference between bilingual group and percentage-of-occurrence for phonological patterns, except for unstressed syllable deletion and fronting.

Implications

- ◆ Relationship between bilingual group and phonological skills is generally neutralized
- ◆ In neither English nor Spanish is frequency of output related to phonological skills
- ◆ Some differential language effects
- ◆ Ask parents about *use* and *proficiency*

Bilingual Children with Phonological Disorders will Exhibit

(Dodd, Holm, & Wei, 1997; Holm & Dodd, 1999; Goldstein, 2000; Holm, Dodd, Stow, & Pert, 1998; McLeod & McCauley, 2003)

- Low intelligibility to family and individuals outside the immediate family.
- Low consonant accuracy in BOTH languages.
- A greater number of phonological patterns than monolinguals.
- Similar, although not identical, phonological skills to monolinguals with phonological disorders
- Similar phonological patterns in both languages:
 - weak syllable deletion, final consonant deletion, cluster reduction, stopping, backing, and fronting

Bilingual Children with Phonological Disorders will Exhibit

- Dissimilar phonological patterns in both languages:
 - more final consonant deletion in English than Romance languages
- Mainly early developing, but some later developing, phonemes in the two inventories.
- A large number of substitution errors in BOTH languages (with cross-linguistic effects and dialect features *taken into account* during scoring)
- Substitutions for both early developing and later developing phonemes in BOTH languages.

Summary: Bilingual vs. Monolingual Development

- ◆ Bilinguals are similar, but not identical, to monolinguals.
 - Consider individual variation.
 - Consider the phonological structure of each language.
- ◆ Assessment must occur in both languages to address these issues, obtain an appropriate differential diagnosis, and plan intervention.

Intervention

What Do We Do when We Know that We Don't Know?



"I fed all the data in to the computer. The print-out reads 'How the hell should I know?'"

What Do We Do when We Know that We Don't Know?

- ◆ Use what you know about intervention and apply to bilinguals

Principles of Intervention (Grunwell, 1997)

- ◆ Intervention is based on a complete assessment.
- ◆ There is “order in the disorder.”
- ◆ Principle purpose of Tx is phonological reorganization facilitated by:
 - Using contrastive word pairs to show the relation between production & adult target
 - Focused practice (80-100 responses in 20-30 min. session) to stabilize new contrasts

General Considerations to Remediate using Processes (Smit, 2004)

- ◆ Focus on patterns that
 - contribute greatly to unintelligibility (e.g., ICD before palatal fronting)
 - are eliminated early in normal acquisition
 - typically persist in children with disorders
- ◆ establish sounds in a variety of sound classes and word structures
- ◆ train more than one sound for each process

General Principle

- ◆ **Old forms, new functions**
 - Child can produce /s/ in the word-initial position of CVCV words
 - /sofa/ → [sofa]
 - Then target /s/ in intervocalic position
 - [kæssəl] (castle)
 - /s/ is now “mastered”
- ◆ **Old functions, new forms**
 - Child can consistently produce CVCVC words
 - Target /tʃ/ in word-initial position of CVCVC words

What Do We Do when We Know that We Don't Know?

- ◆ Assess broadly and deeply
- ◆ Ask the right question.

Clinical Question I

- ◆ What is the *ultimate* language goal for the child?
 - English only
 - For example, assess in English only.
 - Bilingual
 - For example, provide services in both languages.
 - Heritage (i.e., non-English) language only?

Please Remember
English is the
Only Language
Permitted on the
Third Floor



How to Decide

- ◆ How many people are right-handed?

Clinical Question II

- ◆ *Do ask:* “In what language should I treat?”

Language of Intervention

Language A Only



Treat in Language A

Language B Only



Treat in Language B

Language A & Language B



Clinical Question II

- ◆ *Do ask:* “In what language should I treat?”
- ◆ *Should ask:* “When do I treat in English and when do I treat in the other language?”

Rationale

- ◆ Phonological structure differences
 - English contains a retroflex “r” but Spanish contains flap and trill.
- ◆ Knowledge is distributed across the two languages.
 - Child speakers of Romance languages (Italian) are more accurate on multisyllabic words in comparison to speakers of Germanic languages (English) (Vihman, 1995).

Decision Process

- ◆ Choose the Goal
- ◆ Choose the Approach
- ◆ Choose the Language

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Choosing Phonological Targets

English	
Syllable final consonants	I
Syllable initial consonants	II
Syllable inclusion	III
Clusters	IV
Vowels	V
Liquids	VI

Choosing Phonological Targets

English		Spanish
Syllable final consonants	I	Syllable inclusion
Syllable initial consonants	II	Syllable initial consonants
Syllable inclusion	III	Clusters
Clusters	IV	Syllable final consonants
Vowels	V	Liquids/flap/trill
Liquids	VI	Vowels

Goal Attack Strategies (Fey, 1986)

- ◆ **Vertical strategy:** one goal is taught at a time until criterion is reached
 - *Bilingual Correlate:*
 - focus on a goal that is specific to one language.
 - consider how a target generalizes from one language to the other.
 - Example: remediate /s/ in English and monitor it in Cantonese.

Horizontal Strategy

- ◆ more than one goal is addressed in each session
 - *Bilingual Correlate:*
 - target one goal in Language A and one goal in Language B within the same session, although the targets would be divergent.
 - Example: target final consonants in English and aspirated affricates in Hmong.

Cyclical Strategy

- ◆ a number of goals are addressed in a cyclical fashion, but only one goal is incorporated at a time within a session
 - *Bilingual Correlate:* rotate not only targets but also languages
 - Example:
 - Weeks 1-4: /s/ in Language A
 - Clusters in Language B
 - Weeks 5-8: Clusters in Language A
 - /s/ in Language B

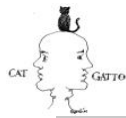
Decision Process

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- ◆ Choose the Approach
- ◆ Choose the Language

2 General Approaches to Intervention (Kohnert & Derr, 2004; Kohnert et al., 2005)

- ◆ Bilingual Approach
- ◆ Cross-Linguistic Approach

Bilingual Approach



- ◆ focus on elements common to both languages
 - sounds (e.g., /s/)
 - sound combinations (e.g., C/l/)
 - syllable types (e.g., CV syllable)
 - word shapes (e.g., CCV\$CVC)
- ◆ **OR**

- ◆ Treat error patterns (or sounds in error) exhibited with similar rates in both languages
 - Unstressed syllable deletion
 - Cluster reduction
 - Stopping
 - /s/

- ◆ Treat error patterns (or sounds in error) exhibited with dissimilar rates in both languages
 - Final consonant deletion
 - Liquids simplification (/l/)
 - /tʃ/

Cross-Linguistic Approach

- ◆ focus on skills unique (i.e., non-overlapping) to each language:
 - Consonants (e.g., flap/trill)
 - Vowels (e.g., rhotics)
 - syllable types (e.g., CCCV)
 - word shapes
 - word length
 - phonological patterns (e.g., final consonant devoicing)

Regardless of Approach,

- ◆ Monitor generalization within and across the two languages
- ◆ Do not view these 2 approaches as mutually exclusive
- ◆ Be prepared to deliver intervention in ***both*** languages

Decision Process

- ◆ Choose the Goal
- ◆ Choose the Approach
- ◆ Choose the Language

Initial Language of Intervention Depends on:

- ◆ language history (relative experience with each language)
- ◆ use in each language (how frequently the child utilizes each of the languages)
- ◆ proficiency in each language (how well the child understand and produces each language)

Initial Language of Intervention Depends on:

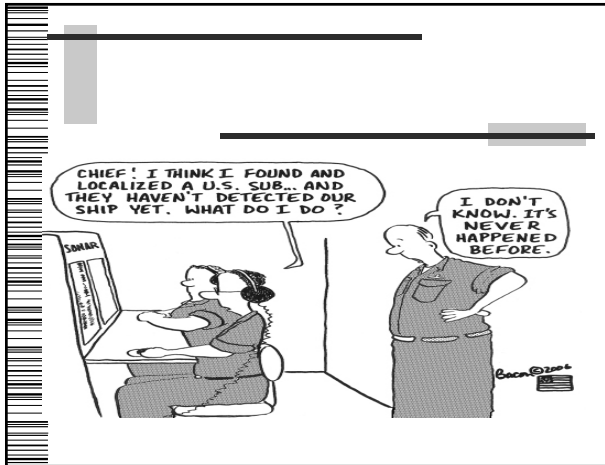
- ◆ environment (where and with whom the child uses each language)
- ◆ family considerations; the family's goals (as part of EBP)
- ◆ child's phonological skills and errors/error patterns in each of the two languages

Structure of Intervention Sessions

- ◆ 1 SLP for Language A and 1 SLP for Language B
- ◆ 1 day in Language A and 1 day in Language B
- ◆ 1 goal in Language A and 1 goal in Language B

Monitor Progress (Williams, 2003)

- ◆ Efficiency
- ◆ Effects
- ◆ Effectiveness



Efficiency

- How long did it take for the client to achieve the goals?
 - number of treatment sessions
 - chart client's learning then examine the slope of the change
- How much effort was needed to facilitate changes
 - examine child's response level (always need imitation or was there a move to spontaneous production?)
 - determine the hierarchy needed to produce change (many incremental steps or a few gradual steps)
 - how much cueing was needed to learn the new sound?

Effects

- ◆ Was the change significant?
 - Graph and inspect data
 - Complete pre-/post-treatment measures (percent correct consonants, intelligibility, severity)
 - Take broader measures
 - family/non-family ratings
 - familiar/unfamiliar listeners

Effectiveness

- ◆ Was therapy responsible for the changes?
 - baseline data → treatment data → withdrawal data (i.e., test-teach-retest)
 - generalization probes
 - follow-up data (weeks to months after working on sound/pattern)