Vowels and Diphthongs

- Subskill 1: Differential Shaping of the Vocal Tract
- Auditory Strategies
  - “By far the simplest and most effective strategy is to teach whatever vowels one is able to teach through auditory imitation so that auditory and orosensory-motor differentiation are simultaneously fostered.” p.231
  - Back vowels have lower pitches for F1 and F2, so may be more audible and discriminable
  - In other vowels, only F1 may be audible
Auditory Strategies

- First step is to provide an abundance of auditory models in the course of interactive communication.
- Examples: associate train with whistle sound /uu/, airplane with /ii/, cow with /mu/ etc.
- Training is also diagnostic: must determine what vowels child can hear, at what distance, and which vowels are discriminable.
- Have child build block tower as you produce various vowels.
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

Auditory Strategies

- Can use similar strategies with older kids; materials should be “congruent with the child’s maturity and interests” p.233
- Do not develop discrimination alone; best results come from simultaneous work on discrimination and production
- Whisper as teaching tool; formant structure is acoustically clear
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

Tactile Strategies

- Child can feel tongue height and configuration if he or she places a finger on teacher’s tongue during production
- Four steps
  - 1. Child feels movement toward and steady-state of vowel
  - 2. Child puts finger in own mouth to re-create movements
  - 3. Child maintains position after finger is withdrawn
  - 4. Achieves correct production without tactile cue
- Requires visual attention and motor-kinesthetic memory
- Strategy is most appropriate for teaching tongue targets for front vowels to children with limited residual hearing
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

Tactile Strategies

- Previous technique also useful for tense-lax distinctions
- Alternatively, can use fingertips on jaw to signal tense-lax
- Strong pressure for /i/, light pressure for /I/
- Usually results in effective imitation because of tendency to oppose force with equal force
- Child can also use orotactile cues, like tongue tip resting on lower front teeth or sides of tongue against upper molars
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- Visual Strategies
  - “Tongue positions for vowels cannot be adequately visualized unless an exaggerated model is provided.”
  - Problems with exaggeration as teaching tool?
  - If necessary, use a simple 3D model with moveable tongue, your two hands to represent the tongue and palate, or line drawings
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- **Subskill 2: Maintenance of Target Vocal Tract Configuration**
  - Why sustain vowels?
  - 1. Establishes ideal target position
  - 2. Lays foundation for consonant teaching
  - 3. Provides articulatory control of sufficient duration to allow for independent adjustment of larynx and articulators
  - How to do maintenance?
  - Reinforce each successful attempt
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

 Maintenance of Vocal Tract Configuration
  – Coordinate voicing with achievement of vowel target position
  – Voice on once position achieved, off when position released
  – Will avoid teaching diphthongization of all vowels
  – Besides, can’t sustain diphthongs, so sustaining them is not an appropriate goal
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- **Subskill 3: Rapid Repetition of Vowel Targets**
  - Once first three targets have been achieved and can be sustained in isolation for 3 seconds, should be initiated with a labial consonant /b/.
  - Use /b/ because it is visually accessible, but will not provoke nasality like /m/.
  - Next child should produce string of /b/ + vowel syllables on one breath etc.
Subskill 4: Rapid Alternation of Vowel Target Positions

- 1. Augments the motor-kinesthetic patterns associated with each vowel
- 2. Ensures that child can move easily from one target to another
- 3. Builds rate to 3 syllables per second, which is normal for running speech
- Alternate non-adjacent vowels; example “Who would know more of art must learn and then take his ease.”
- Use left/right hand associations for different vowels, such as /i/ and /u/
- Can use blocks or candies for different syllables
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- **Subskill 4: Rapid Alternation**
  - “If vowels are taught only in isolation or randomly in the context of consonants, the child will not:”
    - Derive strong motor-kinesthetic patterns
    - Adjust vocal tract quickly
    - Tongue will always start from “schwa” position
    - Contrary to running speech
    - “‘Give me one too, please,’ as an example of an utterance with no schwa postures at any point

- **Subskill 5: Independent Control of the Larynx and Articulators**
  - Produce all vowels at varying intensities, durations, and pitches
Order and Development of Target and Subskill Development

- Phonetic first, of course
- Step 1 vowels were on the chart form last exam?
- Phonologic level second
- Use “aw” and pretend to be hurt, “oo” for surprise etc.
- Transfer from phonetic to phonologic usually not difficult
- Child may initially use “buh” for “bucket, bus, been”, as do NH kids
- “It must be remembered that a natural language approach at the phonologic level is not precluded even if one has to adopt a vigorous, structured approach in order to develop phonetic level skills.” p.240
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- Remedial Treatment of Deviant Patterns
  - Generally requires redevelopment of the sound along the lines already discussed; rarely possible to find shortcuts for habitual errors

- Substitutions: use of incorrect vowel for intended one
  - Re-teach at phonetic level as needed
  - Avoid written form because does not always correspond with spoken form
  - Emphasize phonetic-to-phonologic transfer
Neutralization: extensive use of “schwa” in place of other vowels
- Strongly akin to substitution
- May stem from carelessness, insufficient automaticity, unfamiliarity with word, or excessive use of normal speaking process
- Example: “This problem is of some concern” can have up to 5 schwa productions
- HI kids must be trained to use appropriate stress and speak at a normal rate
- Avoids problems of lack of stress and speech being too slow
Prolongation: phonemes, syllables, words too long in duration

- Speech is a motor task; HI kids have no motor impairments; Can be taught to speak @ normal rates
- “Prolongation is, in the main, due to inadequate speech teaching.” p.243
- 11 possible causes on p.243-4
- Insist on automaticity and use of feedforward
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- Diphthongization: HI kids start from schwa, produce vowel, return to schwa
  - “Speech production is faulty when vowel targets other than /i/ and /u/ are diphthongized” unless appropriate to region
  - If habitual, literally start over
  - Master all 5 subskills with each vowel at phonetic level; then use phonologically at normal speaking rates
  - Very difficult process (analogous to accent reduction)
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- Exaggeration: exaggerated movements of tongue and jaw, which lead to abnormal tongue and lip target behaviors
  - No inherent connection between HI and exaggeration
  - Usually results from faulty teaching, reliance on vision, reinforcement for inappropriate patterns
  - Solution 1: teach child less exaggerated patterns
  - Solution 2: Consistently provide normal speech models
  - Can also speak with pen held in teeth to counteract tendency
Nasalization: when velum is down and excessive air escapes through nasal (rather than oral) cavity

- McClumpha (1966) reported that deaf participants rarely achieved velar closure and had much smaller velums than NH speakers
- Ling: use it or lose it?
- Phonetic treatment: produce /i/ and /u/ with tangible breath stream
- Phonologic: start with fricatives, semivowels and plosives
- Do not incorporate nasals until oral breath stream is well established
“Speech and the Hearing-Impaired Child: Theory and Practice” Ch. 15

- Context-Dependent Pitch: high pitch used with front vowels, low with back
  - Must establish pitch control over each vowel
  - Then progress through subskills previously described

- Multiple Faults
  - Treat concurrently
  - Phonetic first, then phonologically
“Corrections of an habitual fault should not be attempted when the child is in the process of communicating by speech since it could readily discourage the child from making further attempts. Responses to communicative speech should always be such that they provide the child with greater motivation.” p.248
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

- **Purpose:** Assessed how the vowel and diphthong production of young CI users varied over time and how performance on the Ling PLE corresponded with vowel and diphthong production during spontaneous speech.

- **Literature Review**
  - Tobey et al. (1991) measured production of /e/ with implant on and off
  - Found that vowels produced with implant off were longer in duration and had lower F2 values than when implant was on
  - Without auditory feedback, vowel produced in more central location
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

**Literature Review**

- Ling’s PLE evaluates nonsegmental aspects of speech, vowels and diphthongs, simple consonants, and consonant blends
- Abraham, Stoker, and Allen (1988) reported that PLE was used in over 180 facilities in US alone
- “In the PLE, vowels and diphthongs are evaluated through imitation in four hierarchical tasks, which are thought to represent a developmental sequence.” p.489
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

### Literature Review

- Info provided by PLE is primary determinant of objectives in speech treatment
- “Few if any investigators have attempted to relate performance on the PLE to performance in a spontaneous speech task, one that more closely mirrors a real-world communication interaction. It may be that consistent production of target sounds at advanced levels on the PLE does not relate to consistent or correct production during spontaneous speech.” p.490
- Conversely, might not do well on PLE but use sounds in speech
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

**Purposes**

- 1. Chronicle vowel and diphthong production by users of Cochlear Corp. Nucleus implant (specifically designed to code F1 and F2) over either 24 or 36 mos
- 2. Study correspondence between performance on PLE and performance in spontaneous speech
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

**Method**

- 8 prelingually deafened kids
- Age @ onset of loss ranged from congenital to 18 mos
- Age range 3;11 to 7;5 @ implant
- All using TC @ home and in school
- Signed English was the manual component
- Once in kinder, 5 kids mainstreamed, 3 not
- Speech treatment followed Ling model
- M = 3 tx sessions/week, some receive additional services
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

<table>
<thead>
<tr>
<th>Subject</th>
<th>Etiology</th>
<th>Age at onset</th>
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<tr>
<td>S8</td>
<td>viral infection</td>
<td>18 months</td>
<td>5:5</td>
</tr>
</tbody>
</table>
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

- **Method**
  - **Processing Strategy and Maps**
    - 22 electrode device
    - 2 strategies available: F0F1F2 estimates those values and transmits them; MPEAK coded F1 and F2, but also 3 high-frequency bands (2000-2800 Hz, 2800-4000 Hz, and > 4000 Hz)
  - **Data Collection**
    - PLE administered until majority of items in a section were not produced
    - Both child and examiner used speech and Signed English
    - Testing audio- and videorecorded
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

- Method
  - Data Collection
    - Spontaneous sample was conversational
    - Used story re-telling as needed
    - Transcriptions based on signed message
    - Sample lengths were unequal; used only first 100 words to control for this
    - Both signed words without speech and spoken words without sign included in word counts
    - Unintelligible spoken words not included
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

Method
- Data Collection
- Spontaneous Sample analyzed for:
  1. Number of times sound produced
  2. Number of different words in which sound occurred
  3. Number of times spoken sound matched its target
  4. Number of times sound could have been produced correctly
- 1 randomly selected sample from each child re-transcribed by 2 SLPs
- Agreement ranged from 62% to 84%
- Reliability on PLE was .92 for vowels and .98 overall
“Vowel and Diphthong Production by Young Users of Cochlear Implants and the Relationship between the Phonetic Level Evaluation and Spontaneous Speech” Tye-Murray & Kirk, 1993

- Your projections for results?
  - Vowel and diphthong accuracy in spontaneous speech?
  - Gains on PLE?
  - Correspondence between PLE and spontaneous speech?
  - Issues for discussion?