Understanding Speech Sound Disorders:

Is It Phonological Disorder or Apraxia?

Marissa Mitchel, M.S., CCC-SLP
Speech-Language Pathologist
Geisinger Autism & Developmental Medicine Institute

Bethanny Smith-Packard, M.S., CGC
Simons VIP Genetic Counselor
Geisinger Medical Center
Overview

• Typical speech development
• Types of speech sound disorders (SSDs):
  – Phonological disorder
  – Childhood apraxia of speech
• Diagnostic assessment
• Intervention
• Prognosis
Typical Speech Sound Development

- Speech development begins before child speaks first word

- **2-4 mos.** Cooing (“aaah”, “ooo”)
- **6-8 mos.** Canonical babbling (“bababa”)
- **8-9 mos.** Variegated babbling (“badiga”)
- **9-10 mos.** Jargoning
- **12 mos.** FIRST WORDS
Infant

- hard palate
- soft palate
- tongue
- lips
- jaw

Adult

- hard palate
- soft palate
- tongue
- lips
- jaw
Speech Sound Development Chart

Horizontal bars indicate a range of typical sound development in children.

Types of Speech Sound Disorders

• **Articulation disorder** - a.k.a. functional speech disorder. Difficulty producing a few speech sounds.

• **Structurally-based SSD** - caused by structural differences in craniofacial anatomy (e.g., severe malocclusion, cleft palate, macroglossia)

• **Phonological disorder**

• **Motor speech disorders**:  
  – Dysarthrias  
  – Apraxia
Phonological Disorder

- **Phoneme** - smallest unit of sound that has a meaningful contrast

- Phonemes vary by:
  - Place of articulation ("pat" vs. "cat")
  - Manner of articulation ("tell" vs. "sell")
  - Voicing ("bit" vs. "pit")
Normal Development of Speech Perception

• All hearing children need to learn which sounds are part of their native language “inventory”

• Infants start out as “universal listeners”

• By the age of 1 year, they have acquired a native language sound system
What is phonology?

• The sound system of a language

  – Cognitive organization of speech sounds into phonemic categories

  – The rules that govern sound combinations, specific to a given language
## Normal development of child phonology

<table>
<thead>
<tr>
<th>Phonological Process</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-vocalic voicing</td>
<td>car = gar</td>
<td>A voiceless sound preceding a vowel is replaced by a voiced sound. Gone by age 3.</td>
</tr>
<tr>
<td>Word final devoicing</td>
<td>red = ret</td>
<td>A final voiced consonant is replaced by a voiceless consonant. Gone by age 3.</td>
</tr>
<tr>
<td>Final consonant deletion</td>
<td>boat = bo</td>
<td>A final consonant is omitted (deleted) from a word. Gone by age 3;3.</td>
</tr>
<tr>
<td>Velar fronting</td>
<td>car = tar</td>
<td>A back sound is replaced by a front sound. Gone by age 3;6.</td>
</tr>
<tr>
<td>Palatal fronting</td>
<td>ship = sip</td>
<td>sh or zh are replaced by s or z respectively. Gone by age 3;6.</td>
</tr>
<tr>
<td>Consonant harmony</td>
<td>cup = pup</td>
<td>The pronunciation of a word is influenced by one of the sounds it 'should' contain. Gone by age 3;9.</td>
</tr>
<tr>
<td>Weak syllable deletion</td>
<td>telephone = teffone</td>
<td>Weak (unstressed) syllables are deleted from words of more than one syllable. Gone by age 4.</td>
</tr>
<tr>
<td>Cluster reduction</td>
<td>try = ty</td>
<td>A cluster element is deleted or replaced. Gone by age 4.</td>
</tr>
<tr>
<td>Gliding of liquids</td>
<td>ladder = wadder</td>
<td>Liquids are replaced by glides. Gone by age 5.</td>
</tr>
<tr>
<td>Stopping</td>
<td>ship = tip</td>
<td>A stop consonant replaces a fricative or affricate. Gone by age 3 to 5.</td>
</tr>
</tbody>
</table>

Adapted from Caroline Bowen, speech-language-therapy.com
What is a phonological disorder?

• The use of immature and/or unusual phonological processes

• Disordered rules govern a child’s speech

• A “higher order” linguistic deficit
Examples of Disordered Phonology

• Using process of “fronting” at age 4 (e.g., “tat” for “cat”)
  – Child should stop employing this rule by 3 ½

• Using process of “backing” at any age (“ken” for “ten”)
  – Unusual process that does not typically occur in children developing speech normally
How common is phonological disorder?

• One of the most common developmental disorders (7.5% 3-11 year old children)

• Boys outnumber girls 3:1

• 50-75% have comorbid expressive language disorder; 10-40% experience difficulties with language comprehension

Source: Shriberg & Kwiatkowski (1994)
## Speech Sample: Riley (Age 4)

<table>
<thead>
<tr>
<th>Adult Word</th>
<th>Riley’s Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>cap</td>
<td>tap</td>
</tr>
<tr>
<td>sap</td>
<td>tap</td>
</tr>
<tr>
<td>trap</td>
<td>tap</td>
</tr>
<tr>
<td>go</td>
<td>doh</td>
</tr>
<tr>
<td>zoo</td>
<td>doo</td>
</tr>
<tr>
<td>mess</td>
<td>met</td>
</tr>
<tr>
<td>blue</td>
<td>boo</td>
</tr>
<tr>
<td>green</td>
<td>deen</td>
</tr>
<tr>
<td>banana</td>
<td>nana</td>
</tr>
<tr>
<td>umbrella</td>
<td>bella</td>
</tr>
</tbody>
</table>
Riley’s Rules

• **Fronting**: Consonants produced in the back of the mouth (k, g) are produced in the front (t, d).
  – Examples: “cap” → “tap”; “go” → “doh”

• **Stopping**: “Fricative” sounds (s, z) are replaced with “stop” consonants (t, d).
  – Examples: “mess” → “met”; “zoo” → “doo”

• **Cluster reduction**: When there is more than one consonant in a row, delete second consonant.
  – Examples: “blue” → “boo”; “trap” → “tap”
Riley’s Rules (Cont.)

• **Weak syllable deletion**: Unstressed syllables are deleted in words with 3 or more syllables
  – “banana” ➔ “nana” ; “umbrella” ➔ “bella”

• Can make predictions based on child’s phonological rule system
  – How would Riley pronounce “**crazy**”?

<p>| | |</p>
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<td><strong>Cluster reduction</strong></td>
<td><strong>cazy</strong></td>
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<tr>
<td>Fronting</td>
<td>tazy</td>
</tr>
<tr>
<td>Stopping</td>
<td><strong>tady</strong></td>
</tr>
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</table>
Childhood Apraxia of Speech (CAS)
A disorder by many names

- Developmental Verbal Dyspraxia (DVD)
- Developmental Apraxia of Speech (DAS)
- Verbal apraxia
- Speech dyspraxia

CAS
What is CAS?

• ASHA defines it as:

“...a neurological childhood speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of motor deficits...the core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody.”

• In short, a disorder of *motor planning/programming*
What isn’t CAS?

• NOT simply indicator of severity of impairment

• NOT caused by motor deficits, such as low muscle tone or weakness

• NOT the same thing as developmental coordination disorder/ dyspraxia
How common is CAS?

• One research group estimates prevalence at 1-2 children per 1000 (Shriberg et al., 1997a)

• 3.4 – 4.3% of children referred for speech delay of unknown cause were identified with suspected CAS (Delaney & Kent, 2004)

• Most agree that CAS is over-diagnosed
What causes CAS?

• For most children, CAS is *idiopathic*

• Occurs with higher frequency in some known genetic and metabolic syndromes
  – FOXP2
  – Galactosemia
  – 16p11.2 deletion?
    • (Raca et al., 2013)
Diagnostic Assessment

• Assessment and diagnosis by licensed speech-language pathologist
  – No single gold standard test

• Cannot reliably diagnose when child is minimally verbal
**Diagnostic Assessment**

**Phonological Disorder**
- Errors are rule-based and predictable
- Normal transitions between sounds
- Normal prosody and stress patterns
- Vowel distortions uncommon
- Resonance problems unlikely

**Childhood Apraxia of Speech**
- Errors are inconsistent in repeated productions of the same word
- Transitions between sounds are lengthened and disrupted
- Unusual prosody and irregular stress patterns
- Vowel distortions common
- May demonstrate intermittent hypernasality
Intervention

• Speech therapy is warranted for both disorders
• Other treatments are NOT supported by research:
  – No research support for vitamins/supplements
  – Non-speech oral-motor therapy is ineffective
Intervention: Phonological Disorder

• Children with phonological disorders LOSE phonemic contrasts
  – Example (Riley)- “tap” means: tap, sap, cap, trap
    
    ![Diagram showing phonemes /t/, /s/, /k/, /tr/]

• Therapy focused on highlighting lack of contrasts and emphasizing that sound errors can change the meaning of words
  – Minimal pairs
  – Multiple oppositions
Intervention: CAS

• Focus is on learning and practicing motor sequences required for speech

• Frequency of therapy

• Limited empirical support for specific therapy programs

• Augmentative and alternative communication (AAC)
Prognosis

• At risk for specific language and learning disabilities, especially reading problems

• Better outcomes with earlier intervention

• Prognosis depends on:
  – Severity
  – Comorbidities
  – Rate of initial progress

• Need for more research
For more information...

Children’s Speech Sound Disorders by Caroline Bowen, PhD: www.speech-language-therapy.com

American Speech-Language-Hearing Association www.asha.org

Childhood Apraxia of Speech Association of North America www.apraxia-kids.org
Understanding Speech Sound Disorders: Is It Phonological Disorder or Apraxia?

Marissa Mitchel, M.S., CCC-SLP
Speech-Language Pathologist
Geisinger Autism & Developmental Medicine Institute

Bethany Smith-Packard, M.S., CGC
Simons VIP Genetic Counselor
Geisinger Medical Center
bspackard@geisinger.edu

Please send any additional questions to the Simons VIP Coordinator.

coordinator@simonsvipconnect.org

Answers will be posted on the website.