

Who Makes this Diagnosis?

A well- trained speech-language pathologist with specific experience in pediatric speech sound disorders, including motor speech disorders, is the appropriate professional to assess and diagnose CAS.

Whatever the history of identification or differential diagnosis, the evaluation and treatment of the child's speech sound disorder falls within the realm of clinical speech pathology. Thus, it is a speech- language pathologist who diagnoses CAS, not a neurologist or other medical practitioner.

-- ASHA Technical Report on CAS

Diagnostic Indicators of Childhood Apraxia of Speech

Problems:

1. Studies have been circular
 - Select children for certain CAS characteristics, then conclude that those characteristics identify CAS
 - Select children with CAS diagnosis -- which studies show are based on widely varying criteria (Forrest, 2003; Davis, Jakielski & Marquardt, 1998)
2. Children who stutter or who have "ordinary" phonological disorders may also show some features of CAS (Byrd & Cooper; McCabe, Rosenthal & McLeod; Shriberg, Aram & Kwiatkowski).

Most commonly cited features of CAS:

1. Receptive-expressive gap
2. Delayed or deviant syllable and word structures
3. Sequencing:
 - non-speech
 - speech
 - larger linguistic units
4. Stress errors
5. Choppy, "segregated", speech, in which syllables or words appear to be produced one by one, rather than flowing together into a whole utterance.
6. Vowel deviations
7. Phonemic awareness
8. Inconsistency – **of a certain type**

Types of inconsistency

“Inconsistency” has several different possible meanings as applied to child phonology:

- a. differential use of a certain phoneme or sound class in different word positions *Seen in young children developing typically and all children with phonological delays or disorders.*
- b. differential use of a certain phoneme or sound class in different word targets, even in the same word position.

Seen in very young children who are developing typically, usually in the first 40-60 words. Some early words persist in “frozen” form. May also occur in children with phonological disorders.

- c. differential use of a certain phoneme or sound class in multiple repetitions of the same word or measures of the frequency at which a given error type is used in multiple repetitions of the same word. Sometimes referred to as “token-to-token variability” (e.g., Seddoh et al. 1996). ***This is the type of inconsistency that is proposed as a diagnostic marker for CAS. Children with CAS may display the first two types of inconsistency as well, but these are not diagnostic markers of CAS.***

These features can be categorized into groups:

1. Features that are shared with other speech sound disorders:
 - receptive-expressive gap
 - limited consonant and vowel repertoires
 - phonemic awareness difficulties
2. Features that differ from those with other speech sound disorders with respect to the age at which they tend to be overcome or the extent to which they occur:
 - delayed or deviant syllable and word structures are commonly found in young and/or severe children with speech sound disorders. However, they are much more pervasive and persistent in children with CAS.
 - stress errors, especially weak syllable deletion, are common among young TD children as well as slightly older children with speech sound disorders. They are not expected beyond the age of 3 in TD children, nor beyond the age of 6 in children with other speech-sound disorders (with the exception of a few, very difficult words, such as "spaghetti"). They are much more pervasive and persistent in children with CAS (Velleman & Shriberg DATE).
 - sequencing errors occur among all speakers (as "slips of the tongue"). However, they are more common and pervasive among children with CAS than in TD children and children with other speech-sound disorders.
3. Features that are similar to those of dysfluency (stuttering):
 - excess equal stress and
 - choppy speech without smooth transitions

may both occur occasionally during a dysfluent moment. As well, both children who are dysfluent and children with CAS are likely to speak more fluently when they are producing familiar material or are under less communication pressure. However, children with CAS are less likely to have "islands of fluency". The overall pattern of symptoms usually make it possible to differentiate CAS from dysfluency, although children with CAS – like all children – may go through periods during which they have more trouble with fluency than at other times.
4. Features that are distinctively associated with CAS:
 - vowel deviations: The vast majority of children, even those with speech sound disorders, produce almost all vowels correctly (with the exception of rhotic diphthongs, such as "ir", "ar", "or", etc.) by the age of three (Austin & Shriberg, 1997).
 - token-to-token variability

Case History:

1. Family history of speech, language, hearing, or learning deficits
2. High frustration levels of child and parent; resulting behavior management problems
3. Excessive shyness, especially in unfamiliar social settings
4. Big difference in intelligibility levels with closest family member versus other family members, less familiar interlocutors, and strangers
5. Family member cited as interpreter
6. Gesture, leading parents to desired objects often heavily relied on
7. Mime, sign: conventional or idiosyncratic or both
8. Child tends to produce a word once, then “lose” it
9. Child produces particular words in automatic contexts only; unable to reproduce or imitate on request
10. Regression occurs
 - In unfamiliar contexts (situation, location, interlocutors, topic, etc.)
 - When task is altered or when a new task is introduced
11. Age-appropriate single-action **pretend play**, with delay in developing sequences of pretend play or nested pretend play episodes (actions with larger scheme)

Diagnosis of CAS:

A *dynamic*, ACTION-BASED disorder

Therefore, must consider:

Context: linguistic, pragmatic, physical, etc.

Performance load: linguistic complexity (phonological, morphological, syntactic, semantic), listener needs, interfering factors (internal as well as external)

Motor Speech/Non-Speech Assessment

Intake/history information:

1. Poor coordination of suck-swallow-breathe process, resulting in mild but frequent coughing/choking or spillage
2. Excessive drooling, especially when talking or engaged in other motor activities
3. Soft neurological signs (such as immature reflexes, mildly low muscle tone, and sensory hypersensitivity or hyposensitivity) may be noted or may have been noted in the past

If these symptoms are more than mild, an alternative or additional diagnosis of dysarthria should be considered.

Oral Mechanism Exam:

Emphasis within the oral mechanism exam should be on differentiating:

1. functional/automatic vs. volitional actions
2. single postures vs. sequences
3. simple contexts vs. more complex or novel contexts
4. ability to perform action at various cue levels: on command, with auditory model only, with visual model only, with tactile cue
5. ability to perform action smoothly and at an age-appropriate rate as well as accurately (trade-offs may be noted)
6. repetitions of same gesture (e.g., CV syllable) vs. alternations of gestures (e.g., alternating syllables [patapata] **or** [papupapu])
7. Recommended “maximal performance measures” for differential diagnosis: mean repetition rate of trisyllables, # attempts required for correct trisyllable production, mean fricative duration (Thoonen et al. 1999)

The following type of scale is useful:

- 5 = appropriate accuracy, fluency, and rate without cue
- 4 = appropriate accuracy, fluency, and rate with (one) auditory, visual, or tactile cue
- 3 = accuracy, fluency, or rate inappropriate with maximum of one cue
- 2 = accuracy, fluency, and rate inappropriate with maximum of one cue **OR** accuracy, fluency, or rate inappropriate, with more than one type of cue required
- 1 = accuracy, fluency, and rate inappropriate even with more than one type of cue
- 0 = unable to approximate even with cues

Maximum Performance Measures (Thoonen et al. 1996, 1999)

1. Monosyllabic and trisyllabic repetition

[papa..], [tata..], [kaka..], [pataka..]

- Maximum repetition rate: #syllables/sec

monosyllabic: spastic dysarthria (vs. CAS, WNL)

trisyllabic: CAS (vs. WNL)

- Attempts: # of attempts required to produce [pataka] correctly (*CAS vs. WNL*)

2. Maximum sound prolongation:

vowels: spastic dysarthria (vs. CAS & WNL)

fricatives: CAS (vs. WNL)

Note: Williams & Stackhouse (1998, 2000) demonstrated that rate may be less useful than consistency and accuracy for children between the ages of 3 and 5.

Verbal Motor Production Assessment for Children (VMPAC; Hayden & Square 1999). Normed on 1,000 children; child-friendly.

Divides verbal motor production into five scores:

- Global motor control,
- Focal oral motor control (speech and nonspeech),
- Sequencing of nonspeech, speech, and language,
- Connected speech and language and
- Speech characteristics (voice, fluency, rate).

Based upon Motor Speech Hierarchy (Hayden, 1986):

Stage VII: Prosody

- temporal aspects of speech production
- rate and intonation

Stage VI: Sequenced Movements

- precise acoustic targets
- accurate timing between targets

Stage V: Tongue

- tongue movements
- height and advancement

Stage IV: Lips and Face

- facial contraction
- lip movement
- symmetrical movement

Stage III: Jaw

- control of graded jaw movements

Stage II: Breath, Phonation, & Voice

- breath support
- phonatory and valving control to support speech

Stage I: Tone

- postural support for speech
- trunk, head, and neck control
- appropriate inhibition of oral-motor reflexes

Decreased global motor and speech characteristics scores associated with dysarthria;
decreased focal oral motor & sequencing (without GM decrease) associated with CAS

CAS/Motor Speech Tests: Limitations (McCauley & Strand, 2008)

1. Norming groups not well described
2. Reliability lacking
3. Validity lacking
4. Lack of clear-cut behavioral standards for treatment planning or measuring progress
5. Lack of statistical support

“Only the VMPAC provided norms that were adequately described.”

“The VMPAC came closest to ... meeting the operational definitions for .. reliability... but did not meet them due to lack of statistical detail.”

“The VMPAC was also the only test to meet any of the three operational definitions for validation (i.e., content validation).” (p. 88)

Early Motor Control Scales

Downward extension of VMPAC

Available from Brookes in May (?) 2008

By Deborah A. Hayden, Amy M. Wetherby, Julie E. Cleary, & Barry M. Prizant

For use with the Communication and Symbolic Behavior Scales (CSBS) toy kit and videos (Wetherby & Prizant - Brookes)

Oral mechanism exam results indicative of CAS:

1. Mandible is primary articulator; tongue does not move independently of jaw
 2. Groping or effort at initiation of speech
 3. Mis-sequencing, irregular rhythm, **overshoot** and **undershoot**
 4. Limb apraxia: Fine or gross motor planning difficulties, especially for action sequences (hands, whole body)
 5. Mild to moderate sensory hypersensitivity, hyposensitivity, or both in different areas of the face and/or body
 6. Poor coordination of feeding, including:
 - Mild gagging/choking
 - Resistance to certain foods due to their texture, combinations of texture, taste, temperature
 - Stuffing
 - Immature strategies for processing food in the mouth: sucking, squash/swallow, munching (chewing between front teeth), using fingers or utensils to move food to side for chewing
 - Apparent lack of awareness of food in the cheeks (pocketing) or on the lips, external cheeks or chin; inability to clear the lips using the tongue
 7. Poor ability to imitate speech sounds in absence of abnormalities of tongue, lips, or palate.
 8. Reduced awareness of articulatory positions; increased awareness of errors and of own difficulties
 9. More demonstration required for successful performance of sequential volitional oral movements.
 10. Improved performance with visual and tactual feedback.
 11. More difficulty performing actions in imitation or pretend than functionally
- NOTE: Imitation may be better in other contexts.
12. Difficulty transferring a learned motor skill to new contexts (poor stimulus generalization)
 13. Age-**in**appropriate variations in rate, loudness, fluency, voice quality

Differences between childhood dyspraxia and childhood dysarthria

In CAS:

1. Little or no muscle weakness; few or no problems with muscle tone.
 2. Difficulties more pronounced in more volitional contexts (e.g., increased communication pressure, original utterance).
 3. Difficulties far more pronounced for complex or sequential elements than for simple single elements. **Dyspraxia is a disorder of building larger elements from smaller ones.**
 4. Errors may **increase** apparent articulatory difficulty instead of simplifying:
 - additions of phonemes or syllables,
 - use of later developing phonemes out of sequence,
 - use of unusual clusters or use of clusters out of developmental sequence.
 5. Expressive language delays **not** caused by articulatory/phonological limitations alone:
 - Syntax
 - Morphology
 - Metaphonological awareness
- Persist even after child has become intelligible

Phonetic and Phonological Assessment

Intake/history information:

1. Pre-babble and babble vocalizations: few to no consonants; little vocal play; little variety in babble; described as a "quiet baby"
2. Slow and/or stair-step progress; new sound seemingly acquired may seem to be lost when next sound is introduced

Two coexisting issues:

1. Child's phonological system is developing and therefore immature; less prelinguistic practice (babble) than typical children have before attempting words
2. Child may be trying to compensate for speech motor planning difficulties, yielding unusual patterns

Limitations of standardized tests, especially single word articulation tests:

1. Articulation tests assess segments only, not syllable or word shapes
2. Many do not test vowels (Exceptions: T-MAC, PAT, AAPS)
3. Most test few clusters
4. Do not test stress patterns or prosody
5. Limited contexts (I, M, F; clusters; phrases; sentences; discourse)
6. Identify errors, not capabilities (e.g., child *can* produce clusters, albeit inaccurately)

Limitations of CAS tests (McCauley & Strand, 2008):

1. Norming groups not well described
2. Reliability lacking
3. Validity lacking
4. Lack of clear-cut behavioral standards for treatment planning or measuring progress
5. Lack of statistical support

Areas for assessment:

Phonetic repertoire (consonants and vowels)

Phonetic accuracy (articulation test; process test; Percent Consonants Correct – Revised)

Phonotactic repertoire (syllable and word shapes)

Phonotactic accuracy (process test)

Sequencing of sounds within syllables, syllables within words, etc. (TSSS)

Stress patterns and prosody (PEPS-C)

Phonotactics:

- What is the phonological structure of the language?
- Which phonological elements are allowed where?
- How do they combine in sequences and in hierarchies?

Summary of English Phonotactics:

1. What are the elements?

English syllables:

Must have nucleus to bear pitch, duration, stress; usually a vowel (except unstressed syllabic C's)

Optional onset; up to 3 C's in a row

Optional coda; up to 4 C's in a row

Allow diphthongs ("heavy" syllable)

Avoid "light" (lax, simple V) stressed syllables: [ɪ], [ɛ], [ʊ] not allowed in final position

English words:

Short; lots of one-syllable content words

Stress composed of loudness, pitch, duration

Stressed syllables also more accurate

Stress primarily trochaic (strong-weak); verbs tend to be iambic

Some suffixes have predictable stress (e.g., 'ism', 'atic')

Unstressed syllables reduced (e.g., to [ə]) or omitted

English phrases:

Function words come 1st and are unstressed, so phrases are usually iambic

Stress differentiates compound words from phrases

English sentences:

Any word can be stressed, even function words

Timing determined by stress patterns (stress-timed)

2. Which phonological elements are allowed where? How do they combine in sequences and in hierarchies?

Certain phonemes are restricted:

[ŋ], [ʒ] not in initial position

[h], [w], [j], [ɪ], [ɛ], [ʊ] not in final position

Sonority determines cluster sequences: vowel>glide>liquid>nasal>fricative>affricate>stop

Most sonorous consonants closer to the middle

Exception: initial clusters can have [s] > stop

3. Language is hierarchical: linear order of elements doesn't explain what's going on in syntax, morphology, or phonology

Expressive phonotactic development:

From 0 - 6 months:

- intonation differentiates mood ("hungry cry", "wet cry", etc.)

By 6 months:

- prosody of first language (final syllable lengthening; proportion falling vs. rising pitches)

From 6-12 months:

- pitch, rhythm, pause ("prosodic envelope") becomes language-specific
- child develops "words" that are recognizable by prosody alone

From 10-24 months:

- # of syllables in late babble and early words reflects ambient language
- # final consonants in late babble and early words reflects ambient language
- # weak initial syllables (iambic words produced correctly) reflects ambient language
- consonant usage (place and manner of articulation) reflects ambient language
- initial consonant deletion is common (normal) in languages with stress on end of word or medial geminate consonants
- child's "favorite babbles" provide template for early words

By 24 months:

- child produces coda C more accurately if onset+nucleus is frequent in ambient language
- child more likely to produce coda C or medial cluster if preceding vowel is lax

In summary:

- Language-specific influences begin to appear as early as 6 months, strong by 10-24 months.
- The first language can have a significant impact on interpretation of phonotactic patterns

Example: Initial consonant deletion

English: RED FLAG

French, Spanish, Finnish, Japanese: typical

How do such young children learn all of this information about their language?

Implicit learning:

1. is the development of expectations about frequencies of occurrence/probabilities of linguistic (and other) events
2. is 'incidental'/ unintentional; occurs merely through exposure to language
3. **occurs even without attention**
4. occurs in infants as well as adults; no age effects
5. occurs after exposure to both linguistic and non-linguistic stimuli
6. leads to the development of abstract categories and representations
7. occurs after exposure to both natural and unnatural language systems

In other words, we learn the rules because our brains keep track of what happens in the language and how often. If something happens often, that must follow the rule(s); if something never happens, that must break a rule.

Rationale for focus on phonotactics > phonetics with respect to CAS

Most commonly cited characteristics include:

- Delayed or deviant syllable and word shapes
- Difficulties with multisyllabic words
- In general, worse performance with increased length or complexity of target
- Sequencing issues (order of elements: features, segments, syllables, words...)
- Stress errors

Per Jacks, Marquardt, & Davis (2006), in CAS:

- phonotactic accuracy,
 - phonotactic complexity, and
 - phonotactic frequency
- determine phonetic accuracy

Phonology Glossary

- Independent analysis:** Analysis of the phonological patterns of a person's speech **without** reference to the target words. The actual elements which the person uses are tabulated, not his/her errors per se. This allows us to determine what the person is able to do (as opposed to what (s)he **cannot** do).
- Relational (comparative) analysis:** Comparison of a person's phonological patterns/productions to the target words/language to determine the error types and frequencies (e.g., processes).
- Target analysis:** Analysis of the adult phonological patterns which a child attempts to reproduce; analysis of the child's selection/avoidance patterns. (Example: Child may not attempt any word which includes a cluster, or may only attempt words which are reduplicative.)
- Incomplete syllable:** Syllable which does **not** include BOTH a supraglottal consonant AND a vowel (e.g., C alone or V alone or either combined with ʔ or h **only**).
- Supraglottal consonant:** Consonant with place of articulation within the oral cavity (i.e., **not** glottal stop, h).
- Open syllable:** Syllable without a supraglottal final consonant (CV, CVʔ, CCV, etc. e.g., "hi", "blow", "spree").
- Closed syllable:** Syllable with any supraglottal final consonant(s), regardless of initial consonant (VC, ʔVC, CVC, CCVC, CVCC, etc. e.g., "at", "hat", "strength").
- Consonant cluster:** Two or more adjacent consonants (including glottal consonants).
- Reduplication:** Same **whole** syllable repeated in word (baba, deede, gogo, etc.).
- Harmony:** Same C repeated (**goggie**, **tootie**, etc.) or same V repeated (**daba**, **boogoo**, etc.). Do not count word as harmonized if you have already counted it as reduplicated.
- Monosyllable:** Word with only one syllable.
- Disyllable:** Word with two syllables.

DIVIDING WORDS INTO SYLLABLES:

CV (consonant + vowel) is the "canonical" – universal, basic – syllable shape. Therefore, divide the word in such a way as to maximize the number of CV's.

Examples:

"pepper"	[pɛ . pə "]
"apple"	[æ . pəl]
"uh-oh"	[ʌ . ʔo]

Phonotactic Patterns/Processes

Check for the occurrence of the word shape error patterns listed below. Patterns that persist beyond the ages given below, especially if they occur very frequently, may be indicative of childhood apraxia.

Up to 18 Months

* Reduplication Syllable or larger unit is repeated within the word

Note: May persist in particular words if parents imitate the form

* Consonant-vowel assimilation : Consonants and vowels within syllables agree in place of articulation

- Tongue tip consonants co-occur only with tongue tip vowels (alveolar + high front)
- Back consonants co-occur only with back vowels (velar + high back)
- Lip consonants co-occur only with open-jaw vowels (labial + low or central)

Coarticulation: Overlap of Speech Gestures

Two causes:

Babble & early vocalizations -- Lack of differentiation between C and V articulatory gesture; inability to move tongue within syllable

At older ages: Efficient planning for speech. Language specific rules i.e., **learned**

More coarticulation in slower speech in adults

Results for 5-6 year-olds with CAS:

- More within-syllable coarticulation (immature)
- Less inter-syllabic coarticulation (mature, learned)

Maassen, Nijland & Van Der Meulen (2001)

Up to 30 Months:

* Consonant harmony

* Metathesis/migration: Consonants change places to achieve a phonotactic or distributional goal

Note: Some changes (such as [dɛks] for “desk”) may be correct in some dialects.

Metathesis may persist longer in longer words

* Syllable sequencing errors: whole syllables or words in a compound change places

* Omissions (e.g., final consonant deletion; cluster reduction)

* Medial consonant defaults

* Coalescence (mergers of sounds or syllables e.g., [sw-] or [tr-] becomes [f-])

Phonetic/Phonotactic Interactions

Phonetic vs. Phonotactic Repertoire: Velleman (2003)

Index of Phonetic Complexity: Jakielski (2000).

Phonological Mean Length of Utterance: Ingram (2002)

Test of Syllable Sequencing Skills (packaged with Moving Across Syllables)

- Criterion-referenced measure of place of articulation feature sequences (e.g., labial-alveolar)
- One, two, and three-syllable words
- Tracking of cue levels (none, auditory, visual or tactile)

(See Behavioral Objectives Worksheet in Part 3 of handout.)

“Assessment and Treatment of Childhood Apraxia of Speech”

Shelley Velleman, PhD., CCC-SLP

OSLHA March 6, 2009

Prosody

Voice:

- Inappropriate loudness patterns (monoloudness)
- Inconsistent hypernasality/hyponasality
- Inappropriate pitch patterns (monopitch)

Stress:

Development of word stress in English

- Children under 3 often omit unstressed syllables
 - especially from initial position in iambic words
 - onset consonant may be preserved
 - also from medial syllable in SWS word
 - final syllable typically preserved
- Learners of AAE tend to do this more often, to older ages

Stress in children with CAS

- Multisyllabic words mis-stressed or **monostressed**, especially excess equal stress
- Weak syllables omitted from multisyllabic words beyond age 6
- Sentences mis-stressed or mono-stressed, especially excess equal stress

Profiling Elements of Prosodic Systems – Children (PEPS-C; Peppe & Wells, 2002):

Assesses three parameters of prosody:

1. input vs. output
2. form vs. function
3. chunking vs. affect vs. interaction vs. focus

Chunking: Using intonation and pauses to differentiate individual nouns from noun phrases (e.g., chocolate, cake, and ice cream vs. chocolate cake and ice cream)

Affect: Use of intonation to indicate like or dislike or neutral emotion (e.g., [m:] with “so-so” intonation vs. with “yum” intonation)

Interaction: Use of intonation to indicate agreement or understanding vs. confusion

Focus: Use of intonation for emphasis in a sentence e.g., “cookies and **milk**” vs. “**cookies** and milk”

Assessment results indicative of CAS:

1. Phonetic repertoire:

- *Limited repertoires of consonants and/or vowels*
- *Developmentally unexpected phonetic repertoires* (e.g., child produces [k] but not [d] or [ɑʊ] but not [i])
- *Vowel deviations: Monophthongization (including rhotic diphthongs), diphthongization, “random” substitution*

2. Phonetic accuracy:

- *Decreased contrast among vowels; among consonants (Sussman et al. 2000, Nijland et al. 2002, Maassen et al. 2001, Nijland et al. 2003).*

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3. Phonological patterns

- *Timing characteristics:*
 - Voicing errors: [b]for /p/, [ʃ] for /v/, etc.
 - Affrication/deaffrication: tʃ for /t/ or vice versa, etc.
 - Epenthesis: [bəlu] for "blue", [ʃtu] for "shoe", etc.
 - *Space characteristics*
 - Shaping:
 - overshoot: Due to reduced oral awareness, children with CAS may overshoot in order to receive adequate sensory feedback, leading to stopping of fricatives/other consonants; frication of liquids and glides; vowel deviations to extreme edges of vowel triangle (i, a, u).
 - placement errors: fronting (e.g., velars to alveolar as in [ɛd] for “egg”), backing (e.g., alveolar to velar as in [gɪʃ] for “dish”).
- Placement errors alone are NOT indicative of CAS.**
 [Note: Undershoot (e.g., frication of stops, centralization of vowels) may be indicative of dysarthria.]

4. Delayed or deviant syllable and word structures:

- *Simplify structure: syllable deletion, final consonant deletion, cluster reduction, initial consonant deletion, monophthongization*
- *Maintain structure, simplify content: reduplication, harmony*
- *Complicate structure: epenthesis, diphthongization*
- *Chronological mismatch (phonotactics worse than phonetics)*

5. Sequencing:

- *Maintain structure, move content: migration, metathesis*
- *Decreased contrast available due to inconsistent placement of specific segments, features*

6. Prosody:

- *Weak syllable deletion*
- *Monostress, monopitch, monoloudness*
- *Excess equal stress (Shriberg et al. 1997b, c)*
- *Decreased contrast between stressed/unstressed (Shriberg et al. 2003)*
- *Decreased contrast between question/statement, etc.*

CAS vs. “Garden Variety” Phonological Disorders

Childhood Apraxia of Speech	Phonological Disorder
	no or very mild motor symptoms
	phonetics worse or = phonotactics

	prosody WNL
	weak syllable deletion fades
	few sequencing errors
	no or very few vowel deviations
	consistency/other types of inconsistency
	no difference or volitional better than automatic

Communicative effectiveness and intelligibility depend in part on:

- number of homonyms
- level of consistency/variability
- effectiveness of prosodic cues
- pragmatic skills including paralinguistic cues
- repair strategies

□ **Language Assessment**

Young/Severe

MEANS: How?

Can the child use oral, gestural, non-verbal, picture, or electronic means to convey a message?

MOTIVE: Why?

Does the child have communicative intents?

OPPORTUNITY: Who?

Is anybody listening?

Motive: Basic communicative intents: What is the child trying to accomplish?

- Requesting
- Giving
- Showing
- Rejecting/avoiding
- Greeting
- Commenting

Opportunity = Responsivity: Are key players in the child's environment child-focused?

- Attentive to potential communicative attempts?
- Responsive to the child's attempts?
- Semantically contingent?
- Phonetically contingent?

Means: Mode of communication

How is the child getting what he/she wants?

- Spontaneous vs. Imitative vs. Prompted

VOCALIZATIONS

- no vocalizations
- non-speech vocalizations
- vowel-only vocalizations
- simple non-rhythmic syllables
- simple repetitive rhythmic syllables
- simple syllables in language rhythm

- Of very limited variety
- More varied
- Very varied

GESTURES/SIGNS

Pre-symbolic

- Diexis (pointing)
- Reaching
- Other individualized gestures

Symbolic

- Single Gestures
- Use of objects or actions to "stand for"
- Combinatorial Gesture Sequences

NON-VERBAL

- Eye Gaze
- Physical manipulation
- Other idiosyncratic

Why are child's means ineffective?

Variability:

Several different forms* have same "meaning"

Homonymy:

Same form* has several "meanings"

*Forms = vocalizations, gestures, non-verbal

Language Characteristics: Older children

1. Syntax (Ekelman & Aram 1983)

- omissions and mis-selections of pronouns, main verbs, articles
- omissions and non-inversions of auxiliaries and copula in wh- and yes/no questions
- not attributable to phonological/phonetic difficulties

2. Morphology (Ekelman & Aram 1983)

- omissions of regular and irregular 3rd person singular forms
- omissions of regular and irregular past tense forms
- mis-sequencing of free and bound morphemes
- not attributable to phonological/phonetic difficulties
-

3. From preschool to early school age:

- gains in articulation did not eliminate language deficits,
- receptive as well as expressive language deficits were noted at both ages although expressive language consistently lagged behind receptive language, and
- there was a strong family history of language impairment in the families of the children with CAS (Lewis, Freebairn, Hansen, Taylor, Iyengar & Shriberg 2004)

Language findings indicative of CAS:

1. receptive-expressive gap

2. MLU low for chronological/mental age, due to:

- *omission of function words*
- *combinations of gesture + word used to achieve multiword utterances*
- *longer utterances that are unintelligible and therefore not included in MLU*

3. Word sequencing errors:

- *free morphemes out of order (e.g., "Beep pick-up trucks not")*
- *misplaced bound morphemes (e.g., "A rock don't floats" = "A rock doesn't float").*

4. Apparent word-finding difficulties:

- *Apparent semantic substitutions due to avoidance. Look for a consistent relationship between the substitutions and the target words:*
 -- *the targets contain sounds or sequences that the child is aware are difficult for him, and*
 -- *the substitution words are easier for that particular child to pronounce.*

[Note: 2 other types of word-finding difficulties **not necessarily** indicative of CAS:

1. Actual phonemic substitutions: A phonetically similar word is retrieved instead of the target (e.g., "banister" for "canister"). Typically:

- not semantically related to the targets, and
- not phonologically easier than the targets.

2. Actual semantic substitutions: Substitutions of related words for non-phonological reasons, due to retrieval error or compensation for non-retrieval. Substitution words are:

- semantically related to the targets, but
- not necessarily phonologically easier for the child to produce than the targets.]

Literacy Assessment

Assessment procedures:

- Formal test (e.g., PAT; CTOPP)
- Informal tasks: rhyming, blending, segmentation, etc.

Phonological Awareness Tasks

1. Awareness: nursery rhymes, alliteration, nonsense words, puns, simple word games
2. Discrimination and matching judgment tasks:
 - rhyming
 - word shape
 - alliteration
 - phonological oddity
3. Segmentation/blending
 - # syllables/word
 - breaking compound word into parts
 - breaking word into syllables
 - identifying sounds in words
 - # phonemes/word
 - blending words into compounds **or**
 - onset + rhyme into syllables, or
 - phonemes into words
 - syllable/phoneme deletion
 - segment addition

Task Analysis (Adapted from Stackhouse & Wells, 1997)

Peripheral auditory processing:

Is the child's peripheral hearing intact? (NB: if loss of certain frequencies, can affect speech sounds differentially.)

Does the task require listening?

Speech/non-speech discrimination:

Can the child discriminate between speech sounds versus other sounds? (Includes auditory figure/ground.)

Does the task require differentiating speech from non-speech?

Phonological recognition:

Does the child recognize the phonemes of the language when they occur in words?

Does the task require the child to recognize the phonemes in the words?

Phonetic discrimination:

Can the child hear the differences between similar speech sounds (e.g., [f] vs. [ɸ])?

Does the task require the child to discriminate between similar speech sounds?

Phonological representation:

Does the child have an accurate, detailed mental phonological representation of the word?
Does the task require the child to retrieve and process a previously-stored mental phonological representation of the word?

Semantic representation:

Does the child have an accurate, detailed mental semantic representation of the word (including breadth and depth of meaning)?
Does the task require the child to retrieve and process a previously-stored mental semantic representation of the word?

Motor program:

Does the child have an accurate, detailed motor program for the word?
Does the task require the child to retrieve and use a previously-devised motor program for the word?

Motor programming:

Can the child generate an accurate, detailed motor program for a new word?
Does the task require the child to generate a new motor program for the word?

Motor planning:

Can the child adjust the motor program for the context?
Does the task require the child to make contextual adjustments to the motor program for the word?

Motor execution:

Does the child have the physiological prerequisites (e.g., muscle tone, ability to grade motor commands) to carry out the motor plan?
Does the task require the child to produce the word?

Literacy findings indicative of CAS:

- *reduced perception of phoneme sequences (Bridgeman & Snowling 1988)*
- *reduced perception of vowels (Maassen, Groenen & Crul 2003)*
- *reduced perception of syllables (Marquardt, Sussman, Snow & Jacks, 2002)*
- *increased spelling errors not necessarily related to current speech errors (Snowling & Stackhouse 1983; Lewis et al. 2004)*
- *impaired identification and production of rhyme (Marion, Sussman & Marquardt 1993)*
- *reduced word attack, word identification (Lewis et al. 2004)*

REMINDERS

1. Some children with “ordinary” phonological disorders do exhibit some symptoms of apraxia; look for an overall pattern of apraxic-like deficits (or give a mixed diagnosis)
2. Symptoms change over time; it may get harder to identify mild-moderate CAS as the child learns strategies for overcoming it, especially in oral language.
3. TREAT THE SYMPTOMS, regardless of the label