Childhood apraxia of speech in preschool and school-age children - Part I: Assessment, Treatment Planning, and Motor Learning

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Agenda
Part I
8:30–10:00 Assessment of Speech Sound Disorders, Features of CAS
10:00 BREAK
10:15–11:45 Treatment planning, principles of acquisition and motor learning

Evidence-Based Practice
PowerPoint slides are not “evidence” that a particular evaluation procedure or treatment approach is most effective

I will distill information from several studies, but the information represents my take on the research

I am happy to point you toward the primary research and have provided several references for your review

Am I the Bearer of Bad News?
To diagnose CAS or other types of speech sound disorders, children must be regularly attempting verbal output and should be capable of verbal imitation.

- Language therapy may be a necessary precursor to speech therapy
- There isn’t one test that always reliably diagnoses CAS across all ages.
- But here are (relatively) agreed-upon features of CAS that can be identified with formal or informal tests

To treat speech in children with CAS, current evidence-based approaches require some form of drill. You can mix in play to keep kids engaged, but children must practice a lot of speaking.
- No clearly evidence-based solutions for children 0–3, or for children with CAS + severe ASD
- We’ll focus on the approaches that have evidence, but which require structured practice

Speech Sound Disorders
Phonological Disorders
Articulation Disorders
Motor Speech Disorders
Childhood Apraxia of Speech
Dysarthria

cf Shriberg et al., 2017
Childhood Apraxia of Speech

A neurological childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired.

The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody (ASHA, 2007).

CAS is not defined by...

- An overall lack of words or being non-verbal
- The presence of unusual speech errors such as initial consonant deletion, if such errors are produced predictably
- Slow/minimal progress in therapy

...This leads to the underdiagnosis/overdiagnosis problem (!)

Who diagnoses CAS?

Position Statement

Childhood Apraxia of Speech

Ad Hoc Committee on Childhood Apraxia of Speech

It is the policy of ASHA that the diagnosis and treatment of CAS are the proper purview of certified speech-language pathologists with specialized knowledge in motor learning theory, skilled in differential diagnosis of childhood motor speech disorders, and experience with a variety of intervention techniques that may include augmentative and alternative communication and assistive technology. It is the certified speech-language pathologist who is responsible for making the primary diagnoses of CAS, for designing and implementing the individualized and intensive speech-language treatment programs needed to make optimum improvement, and for closely monitoring progress. Children with developmental disabilities and disorders with high rates of comorbid conditions present a


Three Core Features of CAS

Inappropriate prosody

Listen for stress errors on multisyllabic words and phrases

Token-to-token inconsistency

Listen for consistency during multiple repetitions of the same multisyllabic words

Lengthened and disrupted coarticulatory transitions between sounds and syllables

Listen for sounds that are out of order, assimilation across syllables, lengthened segments, and pauses/gaps between syllables

(ASHA, 2007)

Other common features of CAS

The 3 core features of CAS aren’t necessarily sufficient

The field still needs research on this

Dr. Eddyte Strand article in the ASHA Leader about assessing apraxia

CAS Features – The Mayo Clinic System

Vowel distortions
Voicing errors
Distorted substitutions
Difficulty achieving initial articulatory configurations or transitionary movement gestures
Articulatory “groping”

Intrusive schwa
Increased errors in multisyllabic words
Slow speaking rate or slow DDK rate
Syllable Segregation
Equal stress or lexical stress errors

Shriberg, Potter, & Strand, 2011; Shriberg et al, 2017
Differential Diagnosis of Speech Sound Disorders

Speech Sound Disorders
- Phonological Disorders
- Articulation Disorders
- Motor Speech Disorders
  - Childhood Apraxia of Speech
  - Dysarthria

A simple psycholinguistic model
- Ideas, Syntax, Morphology, etc.
- Phonological categories, syllable structure
- Acoustic/Motor specifications of consonants and vowels
- Movement Planning (sequencing, timing); add prosody
- Execute

Speech/Motor programming
- Acoustic specification may be inaccurate
  - lateral release of air for /s/ - derhoticized /r/
  - speech perception

Articulation disorders: what process are disrupted?
- Movement goals may be inaccurate
  - lateral release of air for /s/ - derhoticized /r/
  - speech perception

Acoustic elements
- Voice onset time
- Spectral noise
- Formant structure

Movement goals associated with a phoneme
- Tongue position
- Lip movement
- Jaw height

/k/ Dorsum raised to velum Velum raised
/æn/ Tongue low-front Velum raised Vocal folds adduct
/T/ Tongue-tip/blade-up Velum lowered Vocal folds adduct

Motion Planning (sequencing, timing); add prosody

Morphology, etc.

Phonological categories, syllable structure
A simple psycholinguistic model

Assembling the movement goals
Specifying order, timing, speed and force of movements

Activating muscles with appropriate force and range of motion to be easily understood.

A simple psycholinguistic model

Phonological Disorder
Articulation Disorder
Childhood Apraxia of Speech
Dysarthria

Childhood apraxia of speech: what processes are disrupted?

Precision and consistency of movements underlying speech
Sequencing
Timing
Prosody

Dysarthria: what processes are disrupted?

Respiration
Phonation
vocal volume, quality
Resonance
slow or weak closure of VP port
Articulatory precision
limited range of motion
Distortions/imprecision
Poor build up of pressure
Dysarthria

A neurological childhood (pediatric) speech sound disorder in which the neuromuscular execution of speech is impaired.

Often associated with organic disorders, but doesn’t necessarily have to be (e.g., CP, Down Syndrome)

Features differ based on type of dysarthria (e.g., spastic, flaccid)

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**Assessment Tasks**

<table>
<thead>
<tr>
<th>Feature</th>
<th>CAS</th>
<th>Dysarthria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breath Support</td>
<td>Adequate breath support</td>
<td>Poor breath support (e.g., short utterance length)</td>
</tr>
<tr>
<td>Groping, False Starts</td>
<td>May be present</td>
<td>Unlikely to occur</td>
</tr>
<tr>
<td>Automatic Speech</td>
<td>More accurate than spontaneous</td>
<td>Equally affected</td>
</tr>
<tr>
<td>Vegetative functions</td>
<td>Unlikely to be affected (unless oral apraxia)</td>
<td>Likely to be affected</td>
</tr>
<tr>
<td>Speech sound errors</td>
<td>Substitutions, omissions, distortions, additions</td>
<td>Mostly distortions</td>
</tr>
<tr>
<td>Resonance</td>
<td>Normal or intermittent problems with resonance</td>
<td>More pervasive problems (e.g., hypernasality)</td>
</tr>
<tr>
<td>Prosody</td>
<td>Excess equal stress, stress shifts, syllable segregation</td>
<td>Reduced equal stress (monoloud/monopitch) depending on type</td>
</tr>
<tr>
<td>Speech rate</td>
<td>Slow rate?</td>
<td>Slow rate</td>
</tr>
</tbody>
</table>

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**Three Core Features of CAS**

- **Inappropriate prosody**
  - Listen for stress errors on multisyllabic words and phrases

- **Token-to-token inconsistency**
  - Listen for consistency during multiple repetitions of the same multisyllabic words

- **Lengthened and disrupted coarticulatory transitions between sounds and syllables**
  - Listen for sounds that are out of order, assimilation across syllables, lengthened segments, and pauses/gaps between syllables

(ASHA, 2007)
Assessing sequencing and transitioning in CAS

Shriberg’s Pause Marker
Between-word pauses of at least 150 msec. Identified acoustically.
- Occurs at an inappropriate linguistic place in continuous speech
- Abrupt, sudden onset or offset of energy
- May be immediately preceded or followed by a phoneme or word that includes significant change in amplitude, frequency or rate
- May include groping - pause that includes lip or tongue gesture or inappropriate voicing

Syllable segregation
“Noticeable gaps between syllables” when producing words of 3+ syllables.
- Within-word pauses

Segregation on ≥ 3% of multisyllabic words is outside the range of typical
(Murray, McCabe, Heard, & Ballard, 2015)

Syllable segregation examples
- Binoculars
- Photographic
- Propeller
- Trampoline
- Wheelbarrow
- Helicopter
- Caterpillar
- Octopus
- Watermelon
- Zipper
- Teacher
- Washcloth
- Dentist
- Splinter
- Window
- Thirsty
- Television

Diadochokinetic tasks

<table>
<thead>
<tr>
<th>Task</th>
<th>CAS</th>
<th>Dysarthria</th>
</tr>
</thead>
<tbody>
<tr>
<td>/papapapa/</td>
<td>Normal or slow&lt;br&gt;Rhythm disrupted?</td>
<td>Slow&lt;br&gt;Imprecise, weak&lt;br&gt;Frequent breaths</td>
</tr>
<tr>
<td>/tatatata/&lt;br&gt;/kakakaka/</td>
<td>Slow&lt;br&gt;Rhythm disrupted&lt;br&gt;Segmented syllables&lt;br&gt;Sequencing errors&lt;br&gt;Deleted sounds/syllables&lt;br&gt;Groping, false starts</td>
<td>Slow&lt;br&gt;Imprecise, weak&lt;br&gt;Frequent breaths</td>
</tr>
</tbody>
</table>
Maximum Performance Tasks
Evaluate speech motor functioning with DDK and sustained fricatives an vowels
Can aid in the differential diagnosis of CAS and dysarthria
(Rvachew, Hodge, & Ohberg, 2005)
Tutorial for administration and scoring found here:

Maximum phonation duration (MPD)
/ɑ/, repeated productions of /mama/
Maximum fricative duration (MFD)
Measure sustained /f/, /s/, and /z/
Max repetition rate – monosyllabic (MRRmono)
Alternating motion rates
Repetitions of /pʌ/, /tʌ/, /kʌ/
Max repetition rate – trisyllabic (MRRtri)
Sequential Motion Rates
Repetitions of /pʌtʌkʌ/

Case example: Difficulty with sequencing and transitioning
P32 Maximum Performance Tasks
P32 Sentence Repetition
Goal: Appropriate sequencing/transitioning across syllables in multisyllabic words and phrases

Assessing lexical stress
Produce multisyllabic words of various lengths and stress patterns
Listen for articulatory accuracy AND appropriateness of stress
Stressed syllables are HIGHER in pitch, LOUDER in intensity, and LONGER in duration
Errors may include
Equal stress
Stress shifts
**Segregation may or may not be present as well

Assessing prosody
LEXICAL STRESS OF MULTISYLLABIC WORDS
Common lexical stress patterns

Strong-Weak (Sw)
- table, money

Weak-Strong (wS)
- balloon, remote

Strong-Weak-Weak (Sww)
- calendar, elephant

Weak-Strong-Weak (wSw)
- banana, potato

Lexical stress errors: examples

Is the expected stressed syllable...

Grasshopper
Valentine
Chicken
Banana
Pajamas
Octopus
Jumping

Goal: Produce appropriate lexical stress in multisyllabic words

What features do you hear?

Dinosaur
Measuring cup
Xylophone
Shovel
Hippopotamus
Grasshopper
Basket
Ice cream

Toothbrush
Mailbox
Jump rope
Blanket
Spider
Swimming pool
Washcloth

I have 15 minutes to make a CAS diagnosis...here’s what I’d do...

Multisyllabic word tasks

Production of multisyllabic words
- Percent consonants correct
- Syllable segregation
- Lexical stress accuracy

DDK (“puh-tuh-kuh”) Can they generate accurate repeated sequences?

Assessing consistency

PRODUCING THE SAME WORDS MULTIPLE TIMES

These 4 variables achieved 91% correct classification for CAS (compared to “expert” judgment)

Murray et al., 2015
Standardized assessments which measure consistency

**Diagnostic Evaluation of Articulation and Phonology**

Ages 3-8 years

- 25-item list consisting of words 1 – 4 syllables in length
  - Most (11) are single-syllable words
- Administer 25 items in list three times
- Distractor task between administrations
- May be appropriate for preschoolers and those with moderate/severe impairment (the items aren’t too difficult)

Dodd, Hua, Crosbie, Holm, Ozanne, 2006

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**Assessing consistency**

Can also generate an informal assessment with multisyllabic words (e.g., refrigerator, hospital), or short phrases (e.g., “Buy Bobby a Puppy”)

- For preschoolers, pick “complex” words that are in their expressive vocabulary (e.g., computer, pajamas, elephant)

Inconsistency on repeated attempts may indicate problems with motor programming

Iuzzini-Seigel, Hagar, & Green (2017)

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**Phonological errors and inconsistency**

Different phonological processes may affect a single phoneme in a number of ways:

- which may make the phoneme seem inconsistent
- Look across sound classes for consistency
- Inconsistency may be observed across productions of a particular PHONEME because of phonological processes:
  - Example: inconsistently produced /s/?
  - /s/ may be deleted in clusters [d]
  - /s/ may be stopped and voiced in onset singleton [d]
  - /s/ may be stopped (and voiceless) in coda [t]

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**Word| Articulation Disorder| Phonological Disorder| CAS| ?**
---|---|---|---|---
Sneaker | [sni:kə] | [nita] | [dɛtə] | [ikə]
| [sni:kə] | [nita] | [ni:nə] | [ikə]
| [sni:kə] | [nita] | [kɪnə] | [ikə]
Stove | [stʌv] | [təb] | [kətəb] | [əb]
| [stʌv] | [təb] | [suv] | [əb]
| [stʌv] | [təb] | [vuv] | [əb]
Kissing | [kɪsɪŋ] | [tɪtɪn] | [dɪbən] | [dɪn]
| [kɪsɪŋ] | [tɪtɪn] | [kɪsɪn] | [dɪn]
| [kɪsɪŋ] | [tɪtɪn] | [kɪsɪn] | [dɪn]
Geese | [gɪz] | [dɪt] | [fɪs] | [ɪt]
| [gɪz] | [dɪt] | [ɡɪd] | [ɪt]
| [gɪz] | [dɪt] | [dɪt] | [ɪt]

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**Standardized assessments which measure consistency**

**Linguistics Articulation Test**

- 12 multisyllabic words, assessed 3 times
  - Most (10) are 3-syllable words
  - Consecutive administration
  - “Say eyelashes three times”
  - May be better for older children or those with more mild characteristics (the items are more challenging)

Bowers & Huisingh, 2010

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**Assessing consistency examples**

**Assessment of the same words produced multiple times**

- 4 yr old (table, fish)
  - 12 items
  - 3 administrations
  - 6 items
  - Inconsistently produced
  - Paired with inappropriate production
  - Goal: Improve consistency

- 6 yr old (Buy Bobby a puppy)
  - 12 items
  - 3 administrations
  - 6 items
  - Inconsistently produced
  - Paired with inappropriate production
  - Goal: Improve consistency

- 12 year old (rapid, repeated picture naming)
  - 6 items
  - 2 administrations
  - 3 items
  - Inconsistently produced
  - Paired with inappropriate production
  - Goal: Improve consistency
The presence of initial consonant deletion, backing, atypical cluster reduction, etc. don’t necessarily mean CAS is present

...but...

...they are not mutually exclusive either.

Relative Contributions
Many children have characteristics of multiple types of SSD
- Articulation errors
- Consistent phonological processes
- Prosodic disturbances, sequencing errors, etc.

What is the comparative impact of the characteristics of each disorder?
Select a treatment option that is appropriate for the areas of greatest need.

Relative Contribution?

Residual Speech Errors (Artic) | Childhood Apraxia of Speech

Suzie wore a simple red dress to lunch
The cops arrest a robber at the drug store
The eager squirrel travels far to get nuts
The silly dog barks and wants to chase the ice-cream man

Relative Contributions?

Plan treatment based on speech features, not the label

Using Assessment Data for Target Selection
Independent analyses may help you describe inventory

<table>
<thead>
<tr>
<th>Bilabials</th>
<th>Labiodental</th>
<th>Interdental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stops</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Fricatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affricates</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Liquids</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Glides</td>
<td></td>
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</tr>
</tbody>
</table>

Dynamic Evaluation of Motor Speech Skills (DEMSS)

Imitate words of varied difficulty
CV (e.g., do)
VC (e.g., eat)
Reduplicated CVVC (e.g., papa)
CVC1 (e.g., mom)
CVC2 (e.g., home)
Bisyllabic (one C, Two Vs) (e.g., puppy)
Bisyllabic (varied) (e.g., bunny)
Multisyllabic (e.g. peekaboo)

Identify accuracy, consistency AND level of support needed
* e.g., correct on first attempt, correct after cueing, never correct

For children with severe SSD and suspected CAS, this may help you determine relative strengths, areas of need, and facilitative strategies to help with treatment planning.
From diagnosis to therapy

<table>
<thead>
<tr>
<th>Ideas, Syntax, Morphology, etc</th>
<th>&lt;&lt;Language Therapy&gt;&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological categories, syllable structure</td>
<td>Contrast approaches, Phonological awareness</td>
</tr>
<tr>
<td>Acoustic/Motor specifications of consonants and vowels</td>
<td>Perception training, sound-specific motor-based treatment</td>
</tr>
<tr>
<td>Movement Planning (sequencing, timing), add prosody</td>
<td>Coordinate syllables and prosody in increasingly complex utterances</td>
</tr>
<tr>
<td>Programming</td>
<td>ROM, precision, force of movements</td>
</tr>
</tbody>
</table>

What process is disrupted?

Use assessment data (and present level of performance) to identify main impact or largest relative contributions

Write goals to address those areas
- Frequent Phonological Processes \( \rightarrow \) suppress phonological processes
- Limited Consonant Inventory \( \rightarrow \) add sounds to inventory
- Poor Respiration \( \rightarrow \) increase length of phrase per breath group
- Poor Lexical Stress \( \rightarrow \) produce appropriate lexical stress
- Frequent Syllable Segregation \( \rightarrow \) produce accurate transitions/connections between syllables
- Inconsistent Production of Multisyllabic Words Beginning with Weak syllables \( \rightarrow \)

Principles of Motor Learning

For Articulation Disorders, Dysarthria, and CAS, the problems are (primarily) in the motoric aspects of speech production

Similar principles are likely warranted in treatment

Over the last decade, Principles of Motor Learning have been increasingly applied to treatments of both Articulation Disorders and CAS

Motor Learning Principles

**Acquisition**
- Performance during practice (during therapy)

**Motor Learning**
- Retention or generalization of learned behavior
- Relatively permanent changes

See Maas et al., 2008

What is Motor Learning

**SESSON PERFORMANCE DATA**
- Assesses *acquisition* of motor pattern
- Performance within session on treated targets

**PROGRESS MONITORING DATA**
- Assesses *motor learning* (retention and generalization)
- Performance on untrained targets measured periodically
Sample Goals to address Learning

Prosody:
- Sam will produce appropriate lexical stress in untrained 2-3 syllable words without feedback or cues.

Sounds:
- Sam will produce /l/ and /d/ onsets in untrained 2-3 syllable words without feedback or cues.

Consistency/Transitioning:
- Sam will produce untrained 2, 3, and 4 syllable words with properly sequenced phonemes and smooth transitions between sounds and syllables without feedback or cues.

Motor Learning Principles

What affects acquisition and motor learning?

Feedback
- Feedback type: Knowledge of Performance vs. Knowledge of Results
- Feedback frequency: High frequency vs. Low frequency
- Feedback timing: immediate vs. delayed

Practice Conditions
- Practice amount: few vs. many trials
- Practice schedules: blocked vs. random (within a session)
- Practice variability: constant practice vs. variable practice
- Target complexity: simple vs. complex

Motor Learning Principles

Feedback Type

Knowledge of Performance
- Giving feedback on aspects of movement
  - "I saw your lips close when you made that /n/ sound."
  - "The back of your tongue didn't go up when you made the /n/ sound."
- Should enhance motor performance/acquisition

Knowledge of Results
- Giving feedback on accuracy of the motor movement
  - "That's right."
  - "Not quite."
- Should enhance motor learning/generalization

Motor Learning Principles

Feedback Frequency

High frequency
- Giving feedback on 90 – 100% of trials should aid performance/acquisition

Low frequency
- Giving feedback on 50 – 60% of trials should aid motor learning/generalization

Feedback frequency may depend on whether the child is ready to transition from a focus on acquisition to a focus on learning (Maas, Butella, & Paniniels, 2012)

Motor Learning Principles

<table>
<thead>
<tr>
<th>Child: &quot;up&quot;</th>
<th>Clinician</th>
<th>Knowledge of Performance or Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘uh’ [ə]</td>
<td>Bring those lips together. Watch me. Up.</td>
<td>KP</td>
</tr>
<tr>
<td>‘up’ [ʌ]</td>
<td>Yay! Those lips closed. Up!</td>
<td>KP</td>
</tr>
<tr>
<td>‘uh’ [ə]</td>
<td>Lips didn't close.</td>
<td>KP</td>
</tr>
<tr>
<td>‘up’ [ʌ]</td>
<td>You got 'em closed! One more time</td>
<td>KP</td>
</tr>
<tr>
<td>‘up’ [ʌ]</td>
<td>Great! Let's do it again!</td>
<td>KP</td>
</tr>
<tr>
<td>‘uh’ [ə]</td>
<td>Remember to close 'em at the end.</td>
<td>KP</td>
</tr>
<tr>
<td>‘up’ [ʌ]</td>
<td>Way to close those lips!</td>
<td>KP</td>
</tr>
</tbody>
</table>

Motor Learning Principles

<table>
<thead>
<tr>
<th>Child: &quot;go up&quot;</th>
<th>Clinician</th>
<th>Knowledge of Performance or Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go-uh</td>
<td>Remember to close those lips for &quot;up.&quot; Go up</td>
<td>KP</td>
</tr>
<tr>
<td>Go up</td>
<td>Great</td>
<td>RR</td>
</tr>
<tr>
<td>Go-uh</td>
<td>Not quite</td>
<td>RR</td>
</tr>
<tr>
<td>Go up</td>
<td>(smile and nod)</td>
<td>RR</td>
</tr>
<tr>
<td>Go up</td>
<td>Go up</td>
<td>RR</td>
</tr>
<tr>
<td>Go up</td>
<td>(pause...) You got it!</td>
<td>RR</td>
</tr>
</tbody>
</table>
Motor Learning Principles

Feedback Timing

Immediate feedback
- Should aid performance/acquisition

Delayed feedback (wait 2 – 3 seconds)
- Should aid motor learning/generalization

Immediate feedback
- Should aid performance/acquisition

Delayed feedback (wait 2 – 3 seconds)
- Should aid motor learning/generalization

Motor Learning Principles

Practice amount
- High frequency (many responses) probably aids both motor performance and motor learning

Clinically?
- Aim for a high response rate
- Structure sessions with quick motivators

Motor Learning Principles

Practice Schedules

Blocked practice
- Should result in better acquisition/performance
- Working on target A for 15 trials before moving to target B

Random Practice
- Should aid motor learning/generalization
- The order of the stimuli are mixed up throughout the session

Consider whether the child is ready to transition from a focus on acquisition to a focus on learning (Maas, Butella, & Farinella, 2012)

Motor Learning Principles

Homework Example
Motor Learning Principles

Complexity of response

Simple responses
- e.g., syllables, monosyllabic words
- may result in better performance/acquisition

Complex responses
- e.g., multisyllabic targets, phrases, sentences
- may help with learning/generalization

Clinically?
- Try to build up to a few complex targets quickly

Motor Learning Principles

Acquisition
- Constant practice
- Few, simple stimuli
- Blocked practice

Vs

Learning
- Many, complex stimuli
- Random practice
- Variability

Motor Learning Principles Summary

TO ACQUIRE A SKILL
(MOTOR PERFORMANCE)
- Knowledge of performance
- High frequency of feedback
- Immediate feedback
- Many trials per session
- Blocked practice
- Constant practice
- Small stimulus set
- Simple targets

TO RETAIN A SKILL
(MOTOR LEARNING)
- Knowledge of results
- Lower frequency of feedback
- Delayed feedback
- Many trials per session
- Random practice
- Variable practice
- Large stimulus set
- Complex targets

Ear Training

Do you hear evidence of...
- Impaired transitioning between sounds and syllables
- Impaired prosody
- Inconsistency