Acquired Apraxia of Speech: Diagnosis, Assessment, & Treatment
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Disclosures

OUTLINE OF THE AFTERNOON

- 12:45 - 1:00 Definitions and Overview
- 1:00 - 2:00 Features and assessments
- 2:00 - 2:15 Break
- 2:15 - 3:15 Making the diagnosis
- 3:15 - 3:45 The treatment evidence
- 3:45 - 4:00 Break
- 4:00 - 4:45 Holistic treatment planning
- 4:45 - 5:00 Conclusions

"Apraxia of speech is a distinct motor speech disorder distinguishable from the dysarthrias...and aphasia"

"Apraxia of speech is a disorder of motor speech programming manifested primarily by errors in articulation and secondarily by compensatory alterations of prosody"

(Darley et al., 1975, p. 267)

"In diagnostic applications, apraxia of speech is simply defined as a syndrome—a collection of signs and symptoms that occur together and form an identifiable pattern. " p. 369


"The thought comes instantly...that's the same...The issue is getting the sounds out."

Person with AOS
Which is different from the rest?

- **Apraxia of Speech (AOS):** A neurologic speech disorder that interferes with the motor planning/programming of speech production. Almost always coexists with aphasia—a language disorder.
- **Dysarthria:** A neurologic speech disorder that reduces the strength, speed, range, steadiness, or accuracy of speech movements.
- **Phonemic paraphasia:** A phenomenon where speech sounds sound as if they are substituted, added, omitted, or rearranged.
- **Aphasia with phonemic paraphasia (APP):** A neurologic language disorder that affects language processing in spoken and written modalities, where phonemic paraphasia is part of the presentation.

The differential diagnosis:

- **Apraxia of Speech (AOS):** A neurologic speech disorder that interferes with the motor planning/programming of speech production. Almost always coexists with aphasia—a language disorder.
- **Dysarthria:** A neurologic speech disorder that reduces the strength, speed, range, steadiness, or accuracy of speech movements.
- **Aphasia with phonemic paraphasia (APP):** A neurologic language disorder that affects language processing in spoken and written modalities, where phonemic paraphasia is part of the presentation.

We don’t always agree about who has AOS and who has APP

From conceptual definition to behavioral definition

Traps to avoid in assessment

- Not using a motor speech evaluation
- Relying on speech features that don’t differentiate
- Assuming that making sound errors = AOS
- Diagnosing severe aphasia as AOS
- Listening for something that is only vaguely defined

Diagnostic criteria for AOS:

1. Slow speech (long segments, long pauses)
2. Altered prosody (equalized stress; separated syllables)
3. Speech sound distortions
4. Combined sound distortions and sound substitutions/additions
APP is diagnosed by exclusion

AOS
- Sound substitutions, omissions, additions; Self-corrections, intermittent accuracy

ARTICULATION:
- Errors that sound distorted
- Errors that sound like distorted substitutions

PROSODY:
- Prolongation of segments and intersegmental intervals
- Equalization of stress or inaccurate stress assignment

APP
- Sound substitutions, omissions, additions; Self-corrections, intermittent accuracy

Other features:
- Attempts to self-correct
- Increasing errors with increasing phonetic complexity
- Increasing errors with decreasing word frequency
- Speech initiation difficulties
- Awareness of errors
- Difficulties with clusters, affricates, fricatives, liquids
- Perseverative errors
- Reduced phonetic repertoire
- Automatic speech superior to propositional speech
- Islands of error free speech
- Problems with SMRs
- Social anxiety and fatigue

THE MOTOR SPEECH EVALUATION

Words with sound errors (%)

WAB: Picture description
MSE: Word repetition task


“If I can't say something, I will use another word ...I will find another word that is smaller.”
Person with AOS

The speech sample matters

Connected speech
- Speaker decides what to say
- Several potential lexical and syntactic complications
- Lower sensitivity to sound production errors. Prosodic abnormality less specific to speech production.

Motor speech evaluation
- Examiner/protocol determines what is to be said
- Few lexical and syntactic complications
- Higher sensitivity to sound production errors. Prosodic abnormality more specific to speech production.
What if there was a test that was both sensitive and specific to apraxia of speech?

What if I could measure the behavior instead of just relying on my own impression?
Segment prolongation and inter-syllabic pauses

- E.g. mean pause duration, mean vowel duration
- Syllables with pauses longer than 150 ms

“constitution”

WORD SYLLABLE DURATION
Rate in multisyllabic words

WSD: Word syllable duration

Duration of multisyllabic words

\[
\begin{align*}
\frac{\text{# of syllables produced}}{\text{Duration of multisyllabic words}}
\end{align*}
\]

> 350 ms is longer than normal, <250 is wnl

WSD; “television” 711 ms / 4 = 178 ms
“zippering” 1350 ms / 3 = 450 ms

Word syllable duration (WSD)
“constitution”  2925 ms /4 = 731 ms

LEXICAL STRESS

Stress equalization
- E.g. primary stress on the second syllable:
  - potato, collection, tomato
  - Is there a clear and accurate stress differentiation?
- Pairwise Variability Index
  - $PVI = 100 \left( \frac{d_1}{d_1 + d_2} \right)$ where $d$ is the vowel duration
  - Lower values indicate more similar duration (stress equalization)

PVI$_{dur}$ for two speakers: “connection”

PVI$_{dur}$ example: “position”

- $d_1$=172 ms, $d_2$=182 ms
  - $PVI=5.6$
  - WSD=461 ms

- $d_1$=39 ms, $d_2$=87 ms
  - $PVI=76.2$
  - WSD=223 ms

- $d_1$=81 ms, $d_2$=107 ms
  - $d_2-d_1=26$, mean=94
  - $PVI=27.7$
  - WSD=771 ms

- $PVI_{dur}$ = 771 /3
  - **WSD= 257 ms**

Whole word accuracy (first full attempt*)

- No phonemic errors = 1
- One or more phonemic errors = 0

*First attempt with correct number of syllables or nearly correct number of correct syllables

Chapel Hill Multilingual Intelligibility Test in English (CHMITe) aphasia.unc.edu

- Hearing normal
- Severe impairment:
  - <50% word accuracy for multisyllabic words, < 40% CHMIT-e

Error frequency and sound error severity

- **Mild impairment:**
  - >50% word accuracy for multisyllabic words

- **Moderate impairment:**
  - <50% word accuracy for multisyllabic words, > 40% CHMIT-e

- **Severe impairment:**
  - <50% for multisyllabic words, < 40% CHMIT-e
Are sound errors variable or consistent?

- "...articulatory inconsistency on repeated productions of the same utterance" (Wertz, LaPointe, & Rosenbek, 1984, p. 81).
- "...relatively consistent in terms of type and invariable in terms of location." (Wambaugh et al., 2006, p. xvii).

The answer depends on how consistency and errors are defined.

What we do know about error consistency in AOS

- Average error frequencies are consistent
- People have difficulties with certain sounds and sound combinations
- Many tend to favor certain errors
- Phonetic form is inconsistent

The word complexity measure

- Table of word complexity measures.
What are distortion errors?

- Imprecise articulation
- Phonetic ambiguity
- Sound error captured only with narrow phonetic transcription
- Not co-articulation, dialect, or accent

Spot the speaker with AOS
(spectral mean over time; 24 repetitions)


Distortion types in AOS

What is a distorted substitution error?

- Combination of a phoneme substitution (or addition) and a distortion
  - e.g. for “dad”
  - [dʒ.aũd]

“Really hard word and I need to think about words and I need to think how tongue is thinking about.”

Person with AOS

Case Study mild/moderate to mild AOS

To document recovery with AOS quantitatively

….and based on the lived experience


Motor speech evaluation

<table>
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<th>Measure</th>
<th>9 weeks</th>
<th>79 weeks</th>
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<tr>
<td>Speech sound production</td>
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<tr>
<td>CHMT single word intelligibility (%)</td>
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<td>MSE monosyllabic accuracy (%)</td>
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<td>MSE di- and multisyllabic accuracy (%)</td>
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<td>&quot;mild-moderate&quot; &quot;mild&quot;</td>
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<td>Speaking rate for multisyllabic words</td>
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<td>Syllable duration (ms)</td>
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<tr>
<td>&quot;slow&quot; &quot;WNL&quot;</td>
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Week 14: “I know that you guys are going to say—Well you sound great...You’ve made so much progress. It’s true and I’m so grateful but if I’m being honest again it’s still hard to know that you’re still not all the way back to what you were before.”

Week 18/19: Overall, it’s getting easier and taking less focus. I still have to think but I...it requires less complete focus than it used to."
Week 22. It’s hard to know that you’re the same person but that you sound different. And I know that I’m sounding a lot more like myself, voice-wise, but I’m still working so hard to make it come out.

Week 13: I’m slowly starting to be able to talk faster.

“Sometimes I feel that speaking is a great accomplishment. Don’t hold it against me.”

Person with AOS

Running speech, multisyllabic word repetition

**Sample 1:** Aphasia with phonemic paraphasia (Wernicke), sentence repetition, “catastrophe”

**Sample 2:** Aphasia with phonemic paraphasia (Conduction), WAB picture, “catastrophe”

**Sample 3:** Apraxia of Speech (Broca), WAB picture, “catastrophe”

**Sample 4:** Apraxia of Speech (Global), WAB picture, “gingerbread”

**MAKING THE DIAGNOSIS**

**Option A: Clinical impression**
Examples of sound errors in APP (i.e. no AOS)

“constitution” “stethoscope”
“volcano” “stethoscope”
“harmonica” “spaghetti”
“flat” “spaghetti”

People with AOS also produce sound errors that sound “phonemic” to listeners

Substitution errors “pink,” “zip”
Omission errors “flatter,” “flattering”
Addition errors “nine,” “sport”

Sound distortions are more common in AOS than in APP. Examples:

“stethoscope” “tote”
“stethoscope” “poor”
“spaghetti” “bib”

Self-corrections occur in APP (especially in classic conduction aphasia)

“church” “stethoscope”
“gingerbread” “The shipwreck washed up on the shore”

Self-corrections also occur in AOS*

“harmonica” “thickening”
“shade” “fox”

Sound and pause prolongations are common in AOS

“thicker” “gingerbread”
“shush” “catastrophe”
“thick” “The shipwreck washed up on the shore”

*They are often referred as conduit d’approche
Syllable segmentation sounds like:

Audible pause between syllables
Equalized stress across syllables

Multisyllabic words in AOS: Slow rate and syllable segmentation

“stethoscope”
“constitution”
“harmonica”
“harmonica”
“gingerbread”
“spaghetti”

Speech is both consistent and inconsistent in AOS

“spaghetti”
“artillery”
“constitution”
“rhinoceros”
“harmonica”
“catastrophe”

Speech is both consistent and inconsistent in APP

“rhinoceros”
“catastrophe”

When diagnosing coexisting dysarthria, listen/watch for:

- Similar quality across speech tasks
  - Propositional/automatic, repetition/discourse, phonetically easy/complex
- Pharyngeal signs
  - harsh, strained, breathy, monopitch, monoloudness, short phrases, low pitch
- Resonatory signs
  - continuous hypernasality
- Confirmatory signs
  - facial, lingual, or palatal weakness
  - dysphagia

Why differential diagnosis is difficult

1. The “Checklist Approach,” is problematic because:
   - Checklists vary
   - Interpretation of behaviors vary
   - Weighting of criteria vary
   - Attention and priorities vary

2. Speech production is complex and clinical populations are heterogeneous
   - The AOS – APP dichotomy is too simplistic
   - Some profiles are easy to recognize; others are not
   - Recognizing the disorder “when you hear it” is not justifiable
Option B: Data analysis

Case examples, quantitative metrics

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<th>Speech quality</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
<th>Case D</th>
<th>Case E</th>
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<td>Intelligibility Test (%)</td>
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<td>58</td>
<td>92</td>
<td>98</td>
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<tr>
<td>Multisyllabic Word Accuracy (%)</td>
<td>0</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td>97</td>
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<tr>
<td>Distortions (N segments)</td>
<td>83</td>
<td>52</td>
<td>58</td>
<td>92</td>
<td>98</td>
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<tr>
<td>Segm. substitutions (%)</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Phonemic complexity ratio</td>
<td>3.6</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
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<tr>
<td>Word syllable duration (ms)</td>
<td>520</td>
<td>446</td>
<td>210</td>
<td>197</td>
<td>225</td>
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<tr>
<td>Pause duration (ms)</td>
<td>443</td>
<td>310</td>
<td>87</td>
<td>82</td>
<td>96</td>
</tr>
<tr>
<td>Pairwise Variability Index</td>
<td>11</td>
<td>25</td>
<td>77</td>
<td>89</td>
<td>98</td>
</tr>
</tbody>
</table>

What if there was a way to get pertinent measurements automatically…. Then base diagnosis on evidence-based interpretation?

"The goal of therapy is to help the apraxic patient regain voluntary accurate control in programming the position of his articulators to produce phonemes and phoneme sequences"  
(Darley et al., 1975, p. 279)
“The first priority in treatment is to ensure that people with communication disorders have functional means to communicate. Communication access in AOS and CAS is usually most efficiently enhanced by making the communication environment supportive and providing training for clients, partners, and parents to use effective listening, multimodal communication, and adequate time for the interaction. Communication strategies should be considered early on, and not as a last resort.”


“There is no evidence from randomized trials to support or refute the effectiveness of therapeutic interventions for apraxia of speech. “

“There is a need for high quality randomized trials to be undertaken in this area.”


Articulatory kinematic (AK) approaches: “recommended” for moderate to severe AOS

“Really hard word and I need to think about words and I need to think how tongue is thinking about”

Person with AOS
Rate/rhythm control (RRC) approaches: Options to consider for AOS

Clinicians should be aware of such treatments as potentially viable approaches, but clinician and patient preference should have a considerable role in the decision making process; clinicians should be attentive to new literature pertaining to the treatment option.


"Slowing down makes it easier to get the words right." Person with AOS

What is the treatment goal?

• Reproduction of stimuli?
  • Acquisition of behavior

• Reorganization of the organism?
  • Maintenance and generalization
  • Retention and transfer

Principles for learning generalization

• Response generalization
  • Emergence of untrained responses

• Stimulus generalization
  • Transfer of behavior to conditions or situations that are different from those in which training occurred


“unison/choral speech”….aka “integral stimulation”…. aka “speech entrainment,” etc…


“Watch me, listen to me, say it with me”
The classic eight-step continuum (AK)  
more → less support  

**Targets:** Functional words and phrases  
**Methods:** Maximal support, gradually faded and replaced by self-generated responses and volitional control; repeated practice; role playing  
**Outcome:** Ability to generate targets in staged dialogue  
**Evidence:** Case studies  

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Sound production treatment (SPT; AK)  
less → more support  

**Targets:** Consonants that are particularly difficult, typically in 8-10 treated items  
**Methods:** Response-contingent hierarchy with integral stimulation, graphemic cues, articulatory placement, and external feedback.  
**Outcome:** Accuracy (%) of target sounds in repetition probes. Improvements for both treated and untreated (phonemically similar) targets—response generalization  
**Generalization:** Good response generalization, limited stimulus generalization (better for high levels of acquisition for long treatment period).  
**Evidence:** Series of single case experimental designs  

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Treatment hierarchy for SPT  
less → more support (Wambaugh et al., 1998)  

**Step 1:** Modeling/Imitation  
*"Say chair….tear"  "Say chair"…."Say tear"*  
**Step 2:** Modeling + Visual cue/Imitation  
*"chair….tear" while pointing to written word*  
**Step 3:** Integral Stimulation  
*"Watch me, listen to me, and say it with me….chair"*  
**Step 4:** Modeling with Silent Juncture/Imitation  
*"Say the word like this, ch…..air)*  
**Step 5:** Articulatory Placement/Modeling  
*"Your tongue was not raised"*  
---

Sound Production Treatment modified  
less → more support  

**Step 1** – Modeling/repetition of target word  
*If correct, 5 additional repetitions*  
**Step 2** – Written letter cue + modeling/repetition  
**Step 3** – Integral stimulation – up to 3 attempts  
**Step 4** – Articulatory placement cues and integral stimulation  

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Motor Learning Guided treatment (MLG; AK)  

**Targets:** Meaningful words and phrases (in chunks of five)  
**Condition:** Face-to-face, independent home practice, telehealth  
**Methods:** Written word plus clinician model (SGD), client repeats, clinician repeats gives knowledge of result (e.g. “the third one was the closest”); repeat each chunk; varied order; varied pausing.  
**Outcome:** Accurate oral reading accuracy for target words and phrases.  
**Evidence:** Case studies  

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Script training (combined tx)  
more → less support  

**Targets:** Monologues or dialogues  
**Methods:** Integral stimulation, repetition, independent production  
**Outcome:** Production of script words and phrases, increased speech rate and fluency, improved morphosyntax  
**Generalization:** Stimulus generalization  
**Evidence:** Small group studies and single case experimental design  

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I had a stroke.
Speaking is hard.
But I can understand you.


Response Elaboration Training (RET) modified for persons with AOS (combined tx)

**Step 1:** Elicitation of a response “Tell me as much as you can about this picture or anything that reminds you of it.”

**Step 2:** Reinforcement

**Step 3:** Request elaboration

**Step 4:** Reinforcement and combination

**Step 5:** Model and request repetition

**Step 6:** Elicit with picture after (>5 second) delay

Steps 1–6: Request repetition and give integral stimulation as needed


M-RET: evidence

- Single case experimental design (MBD across behaviors)
- Expected outcome: Increased correct information units CIU
- Response generalization to new picture sets

Combined aphasia and apraxia of speech treatment, CAAST steps 1-2

**Step 1:**
- Therapist—Presents action picture and says, “Tell me anything about this picture; what does it remind you of?; what’s happening?”
- Participant—No response.
- Therapist—“You could say something like man spills ... or ... drops a cup.”
- Participant—“Spill.”

**Step 2:**
- Therapist—“Spill, great.” Referring to a sentence frame, asks participant to indicate where to write “spill.”

**Step 3:**
- Therapist—“What does the man spill?” Participant—“Milk.”

**Step 4:**
- Therapist—“Milk, good, spill milk.” Referring to the sentence frame, asks the participant where to write “milk.”

**Step 5A:**
- Therapist—“Repeat after me ... spill milk.” Participant—“Spill milk.”

**Step 5B:**
- Therapist—“Good try, but not quite correct. Let’s concentrate on this sound (underlines the “s” on the sentence frame) and try again ... spill milk.”
- Participant—“Spill milk.”
- Therapist—“That’s right. Now, let’s say it three more times.”


CAAST, steps 3-4

**Step 3:**
- Therapist—“What does the man spill?” Participant—“Milk.”

**Step 4:**
- Therapist—“Milk, good, spill milk.” Referring to the sentence frame, asks the participant where to write “milk.”


CAAST, step 5

**Step 5A:**
- Therapist—“Repeat after me ... spill milk.” Participant—“Spill milk.”

**Step 5B:**
- Therapist—“Good try, but not quite correct. Let’s concentrate on this sound (underlines the “s” on the sentence frame) and try again ... spill milk.”
- Participant—“Spill milk.”
- Therapist—“That’s right. Now, let’s say it three more times.”

CAAST, step 6

Step 6:
• Therapist—Removes the picture and imposes a 5 s delay (e.g., “Wait and then I’m going to ask you to say it again”).
  Participant—“Milk.”
• Therapist—“Good try, but not quite. Watch me and try it with me . . . spill milk.”


CAAST: evidence

• Single case experimental design (MBD across behaviors)
• Expected outcome: Increased correct information units CIU
• Response generalization to new picture sets


How are these treatments similar?

What if there was a way to customize treatment to the patient’s specific behavioral profile?

What if it was possible to count on treatment effects in daily life and have those treatments also include psychological wellbeing?

HOLISTIC TREATMENT PLANNING

Principles of adult learning

• Adults must want to learn
• Adults will learn only what they feel they need to learn
• Adults learn by doing
• Adult learning focuses on problem solving
• Experience affects adult learning
• Adults learn best in an informal situation
• Adults want guidance and consideration as equal partners in the process

### Principles of Motor Learning

1. Stages of learning
   - a) Cognitive stage
   - b) Associative stage
   - c) Autonomous stage

2. Pre-practice considerations
   - a) Motivation and goal setting
   - b) Instructions
   - c) Perceptual pre-training
   - d) Modeling

3. Practice
   - a) Amount
   - b) Schedule
   - c) Variability
   - d) Whole and Part

4. Augmented feedback
   - a) Structure
   - b) Timing

### Motivation as Foundation

**Self-Determination Theory**

**Innate Psychological Needs**
- Autonomy
- Competence
- Relatedness


### The OPTIMAL Theory of Motor Learning (Wulf & Lewthwaite, 2016)

Motor learning, motivation, and retention are enhanced when learners:

1. Expect to perform competently
2. Experience autonomy in their own learning
3. Focus their attention on external outcomes


### OPTIMAL Principle 1: Expected Performance Competence

- Expectation of ineffective or modest performance → rumination
- Not addressed in AOS treatment programs:
  - What do our learners expect of themselves during our treatment programs?
  - How might these expectations affect outcomes?
- Confidence-strengthening is integral to the FOURC model (Haley et al., 2019)
- Instead of verbal explanation, we use video self-modeling.
- People with aphasia like this (Harmon et al., 2017)

### OPTIMAL Principle 2: Learner Autonomy

- Learners prefer, perform, and retain best under conditions where they can exert some control over their environment and learning experience.
- Trust choices that are seemingly peripheral to the learning task (e.g., order of practice targets, color of materials) enhance learning.
- Collaborative (patient-centered) treatment planning is fantastic, but day-to-day autonomy matters too.
- Customized targets are fairly common in clinical treatment protocols, but choice of methods is unusual:
  - Some choices in home programs, still limited
  - Often, there want more choices and flexibility (Harmon et al., 2017)
OPTIMAL Principle 3: External attentional focus

- Movement outcomes are diminished when learners attend to how their bodies move rather than the desired movement effect.
- Unnecessarily conscious controlmode that disrupts automaticity and conscious control.
- Internal focus for speech: Where is my tongue?
- External focus for speech: What am I trying to say?
- Internal focus is closely related to sound-based treatments, external focus is closely related to word- and phrase-based treatments.

What we learned in a preliminary study:

- People with aphasia want to play a more active role in determining goals and targets.
- They do not always feel that practice is effective and feel that motivation depends on seeing progress.
- SLPs and clients want flexibility to choose and adapt techniques and strategies.
- Everyone wants results in real communication.
- People usually don’t practice enough.

Action for Speech: Core Features

- Self-selected conversation as target; accuracy and fluency outcomes.
- Progression of self-generated cues.
- SLP assumes coaching role.
- Stimulus generalization is expected.
- Conditions are improved for psychological well-being.

Action for Speech (Overview)

In this program, you will practice three conversation topics. The first step is to select the topics you want to work on. The next step is to select ten things you want to say about each topic. We will take photos to help you remember the 3 conversations and the 10 things you want to say about each one.

You will use a tablet computer to practice at home. We will meet twice per week to keep you on track.

With this program, you decide when to practice and what does you want to use to be successful. We will tell you about choose you have. We will help you make the treatment work for you.
10 phrases for each conversation topic

Self-modeling → Competence
- The user records 1-3 video practice cues with SLP assistance.
  Whenever possible, the user models what to say
- Include at least one cue that helps the user be successful more than 85% of the time.
- Length of target (one word, some words, all words)
- Speaker role (unison, user alone after repetition, SLP alone)
- Production rate and articulatory clarity
- Alerts/Isolated practice/Phonetic derivation for problematic sections
- With increased accuracy, more subtle cues may be introduced

Three self-generated practice cues

Structure of the ActionSC therapy session
- Review home practice log, share data
- Review phrases and cues (client leads), Clinician gives feedback when requested. New video cues are recorded as needed
- Confirm practice plan for next session

Conversations
I like that movie
It wasn’t good
What do you want to watch?
Tyler Perry
I like comedy
I’ve seen that one
See any good movies?
Black Panther
Coming over to watch a movie?
What time?
Hi NAME, are you working tonight?
NAME, I need help
Let me call NAME
Hi NAME
Tell me about your girl
What are you doing today?
Are you here?
Hello

60-year-old woman with Broca’s aphasia (AQ=52.6)


**Results**

- Number of practice clicks
- Accurate target words (%)

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<thead>
<tr>
<th>Number of practice clicks</th>
<th>Accurate target words (%)</th>
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**Action for Conversation...**

**Conclusions: Assessment and diagnosis**

- AOS is best diagnosed through systematic assessment and measurement
- Both AOS and APP involve sound errors; AOS additionally involves sub-phonemic distortions and abnormal prosody
- AOS is a behavioral syndrome that resembles other behavioral syndromes and boundaries among them are fuzzy
- Main features of AOS can be measured, often in clinically feasible way

**Conclusions: Treatment**

- Most AOS treatments are articulatory-kinematic in nature
- Most rely on combinations of repetition, oral reading, and integral stimulation
- Most treatments result in learning
- Response generalization is more common than stimulus generalization
- Most treatments consider the patient a passive recipient
- It is also possible/logical to base treatment on motivational theory

**LET’S TALK!**

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