The Effectiveness of Conversational Script Training for Acquired Apraxia of Speech

Kathryn Atkinson, M.A., CCC-SLP/BC-ANCDS

Jenna Brusie, B.S.

Central Michigan University

Michigan Speech-Language-Hearing Association
Kalamazoo 2012
Today’s Session

- Treatment Approaches
- Motor Learning - Principles and Theories
- Question & Answer
- Client Background
- Script Training
- Video Clips
- Question & Answer
A neurologic speech disorder reflecting an impaired capacity to plan or program sensorimotor commands necessary for directing movements that result in phonetically and prosodically normal speech. It can occur in the absence of physiologic disturbances associated with the dysarthrias and in the absence of disturbance in any component of language.
AOS Treatment Guidelines from Academy of Neurologic Communication Disorders & Sciences
Treatment Guidelines for Acquired AOS - ANCDS

Academy of Neurologic Disorders & Sciences (ANCDS) developed documents describing AOS practice guidelines

Available on website: www.ancds.org

Document published in 2006

Comprehensive & extensive literature review of available evidence for treatment of acquired AOS

Guidelines are based on reviews and assessments of scientific levels of evidence
The following general categories of AOS treatment were found:

- Articulatory kinematic
- Rate and/or rhythm
- Alternative/Augmentative communication (AAC)
- Intersystemic facilitation/reorganization, and
- Other (described later in presentation)
Levels of Evidence
<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Grading Criteria</th>
<th>Grade of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Systematic review of RCTs including meta-analysis</td>
<td>A</td>
</tr>
<tr>
<td>1b</td>
<td>Individual RCT with narrow confidence interval</td>
<td>A</td>
</tr>
<tr>
<td>1c</td>
<td>All and none studies</td>
<td>B</td>
</tr>
<tr>
<td>2a</td>
<td>Systematic review of cohort studies</td>
<td>B</td>
</tr>
<tr>
<td>2b</td>
<td>Individual cohort study and low quality RCT</td>
<td>B</td>
</tr>
<tr>
<td>2c</td>
<td>Outcome research study</td>
<td>C</td>
</tr>
<tr>
<td>3a</td>
<td>Systematic review of case-control studies</td>
<td>C</td>
</tr>
<tr>
<td>3b</td>
<td>Individual case-control study</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>Case-series, poor quality cohort and case-control studies</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>Expert opinion</td>
<td>D</td>
</tr>
</tbody>
</table>

Source: Ann Surg © 2004 Lippincott Williams & Wilkins
Articulatory-Kinematic Treatment
Articulatory Kinematic Treatments

Rationale:

- Half of investigations by ANCDS were considered to be this type of treatment category.
- Based on assumptions consistent with Rosenbek, Lemme, Ahern, Harris, & Wertz’s (1973) definition of AOS.
- “Non-linguistic sensorimotor disorder of articulation...Therefore, therapy should concentrate on the disordered articulation....(and) emphasize the regaining of adequate points of articulation and the sequencing or articulatory gestures.”
- Techniques of AK treatment focuses on improving spatial & temporal components of speech production.
Articulatory Kinematic Techniques

- Consists of motoric practice of speech targets
- Verbal production is required
- Most techniques also rely on modeling/repetition tasks
- Variation of modeling – ‘integral stimulation’
  - Better known as “watch me, listen to me, say it with me”
- Articulation placement cues also component of AK treatment; typically provided for error sounds
- Prompts for restructuring oral and muscular phonetic targets (PROMPT) example of AK treatment
Most of participants in guidelines study presented relatively wide range of stimuli utilized; frequently short sentences or phrases. Limited number of functional target utterances. Consisted of personal productions, e.g., “My name is _____”; “I want to eat”. Single, real words also utilized. Selection of target sounds varied; all perceived problematic for AOS speaker. Isolated nonwords/syllables chosen as treatment targets.
In most AK investigations, probes of targeted stimuli used to evaluate effectiveness.

Outcomes usually reported as positive.

Data suggests that training sufficient number of exemplars (e.g., 8-10 phonetic targets) likely to result in progression to untrained exemplars of specific sound.

Production of untrained sounds not likely to occur; treatment effects ‘sound specific’.

Treatments targeting words, phrases, sentences generally resulted in item specific improvements.
AK Treatment Candidacy

- All patients within AK literature were diagnosed with severe AOS
- Patient should wish to improve speech production
- Some research participants were mute or produced significantly limited verbal stereotypes
- Basic candidacy includes disrupted speech production
- Patients were noted to present with sufficient auditory comprehension for following instructions
Conclusions of AK Treatment Studies

- More than half of AK studies were ‘experimental’ in nature, e.g., single subject designs
- AK studies, as a whole, assigned Level B
- Considered “probably effective”
- AK treatments for AOS likely to produce speech production gains, even for chronic and/or severe AOS
Rate/Rhythm Treatment
Rate and/or Rhythm Treatments

Rationale:

- Underlying premise is that AOS is disruption in timing of speech production
- Rhythm control treatments may facilitate re-establishment of temporal patterns
- Hypothesized central pattern generators (CPGs) involved in speech production; may be dysfunctional in AOS
- Rhythmic treatments may help ‘reset’ the CPGs
- Further slowing AOS speech rate thought to provide additional motor planning/programming time and sensory feedback processing
An external source of control was provided, e.g., metronome.

Rates of production varied across and within investigations.

Target productions were trained to the beat of a metronome.

Additional techniques such as verbal feedback, clinician modeling, computer display, and hand tapping noted.

Rate control research also included the use of a pacing board.
Types of productions systematically manipulated in terms of perceived increased complexity:

- For example, use of nonspeech movements (tongue elevation) to rhythm/beat of metronome documented.
- Progressed to AMR practice, then multisyllabics, and sentence production.
- Other targets have included reiterative nonsense syllables, isolated vowels, and vowel combinations.
Outcomes in Rate/Rhythm Control

- Improvements in speech production reported even when no direct sound training occurred.
- Positive changes occurred for trained words as well as for untrained words with same stress pattern.
- Results mixed in regard to generalization to untrained words with different stress patterns.
Conclusions for Rate/Rhythm Treatment

- Participants generally had less severe AOS
- Candidates demonstrated need to improve behaviors amenable to rate/rhythm practice
- Evidence suggested Level C rating
- Treatment is “possibly effective”
- Gains may be seen as improvement of articulation, increased fluency, reduced rate or decrease in overall AOS symptoms
Intersystemic Facilitation/Reorganization Treatment
Rationale:

- Involves utilization of relatively intact system/modality to facilitate functioning of impaired modality
- Treatment effects probably derived from provision of afferent or efferent cues
- Use of limb gestures in reorganization may provide additional organizational framework for speech production
Intersystemic Facilitation Techniques

- Gestural reorganization most frequently studied technique
  - Limb gesture approach
  - Meaningful gestures (e.g., Amer-Ind)
  - Nonmeaningful gestures (e.g., finger-counting)
- In all but one study, gestures were paired with verbalizations
- Singing has also been technique for AOS
- Using graphic stimuli considered to be form of intersystemic facilitation
- Treatment has targeted verbal production at word, phrase, and sentence levels.
Outcomes of IF/R Treatment

- In most investigations, IF/R appeared to improve verbal productions.
- Improvements documented as improved accuracy of articulation and increase in test scores.
- Improvements in articulation may be sound dependent; generalization to untrained sounds was variable.
- Maintenance of gains measured in only 1 investigation; decrease in accuracy during treatment withdrawal phases noted.
- Rated as Level C; “possibly effective.”
AAC Treatment
Alternative/Augmentative Communication (AAC) Approaches

- Common motivation for using AAC was perceived need to improve communication through other modalities than speech
- AAC approaches largely individualized for each participant
- Comprehensive systems may include:
  - Incorporation of natural speech
  - Communication book
  - Spelling system
  - Drawing system
  - Gestural system
  - Communication partner training
  - Writing/orthographic systems
Outcomes for Use of AAC with AOS

- Positive outcomes reported for most of subjects using AAC
- Outcome measures varied and included increases in:
  - Formal speech/language test scores
  - MLU
  - Adequacy in conveying predetermined utterances
  - Communicative success
  - Acquisition of symbols
  - Self-initiation of writing strategy
- Outcomes can be negatively affected by potential AAC user not readily accepting the system
Candidacy Issues

- Majority of participants were considered to have ‘severe’ or ‘moderate-severe’ disorder
- Issues for candidacy in AAC use not restricted to individuals with AOS
- Individuals must be motivated to use AAC system
- Must have adequate motor skills to access AAC; presence of limb apraxia may be limiting factor
- Must also possess sufficient visual perceptual skills
- Impairments in comprehension, reading and writing must also be considered
Conclusions from AAC/AOS Research

- Overall, quality and levels of evidence inadequate to determine treatment effects
- AAC approaches may be appropriate for some individuals with AOS in these situations:
  - Extremely limited verbal output
  - Communication needs not likely to be met through speech production skills
- Insufficient data to determine success of AAC use
- Successful use of AAC may be heavily dependent on nature of individual’s aphasia
Other Treatment from Research
Sentences alone and in pseudoconversations with significant other (SO)
SO taught communication strategies to use with person with AOS
Head movements paired with nonspeech & speech production
Biofeedback for increased tension interfering with speech/language production
Imitation versus silent rehearsal
Limited studies above not of sufficient quality from which to draw adequate conclusions
Principles of Motor Learning in MSDs
Principles of Motor Learning in Treatment of Motor Speech Disorders

Speech production is a motor skill
- Motor learning literature may valuable information on facilitation of (re)learning/organization of speech motor system
- Ultimately, may improve quality of life for persons with MSD

Clinical decisions for treatment must include the following factors:
- Practice structure
- Stimulus selection
- Nature of feedback

Speech production, as a motor skill, is governed by similar principles of motor learning.

Consistent with EBP philosophy:

“Treatment of MSDs must be guided by the best available knowledge about motor skill learning, and that this knowledge base includes evidence from nonspeech motor learning research.”

Unknown whether impaired motor systems are sensitive to same principles of learning as intact systems.

In absence of evidence to the contrary, principles of intact motor learning can provide framework for treatment efforts.
Important to consider distinction between performance during acquisition and retention/transfer.

Learning, which is a permanent change in capability for skilled movement, must be measured by retention and/or transfer tests.

Retention = performance levels after practice completion.

Transfer (generalization) = whether practice on one movement affects related but untrained movements.
Schema Theory Information
Assumes motor programs are generalized (GMP)

GMP is abstract movement pattern that specifies relative timing and relative force of muscle contractions, whereas the absolute timing and force are specified by *parameters*.

To select optimal instructions to the musculature and control the body in a wide range of situations, the motor system must know:

- The relations among the initial conditions
- The generated motor commands
- The sensory consequences of these motor commands
- The outcome of the movement
Schemas = memory representations that encode the relations among types of information based on past experience with producing similar actions involving the GMP. These types of information temporarily available in short-term memory and used to update or create 2 different schemas:

- Recall schema
- Recognition schema
Encodes the relations among the initial conditions, the parameters used to execute the movement, and the outcome of the movement.

In order to produce movement, system supplies recall schema with the movement goal (intended outcome) and information about current conditions

From this, recall schema computes appropriate parameters
Recognition Schema

- Encodes the relations among initial conditions, sensory consequences of movement, and outcome of movement.
- Given movement goal and initial conditions, recognition schema predicts sensory consequences that will occur if movement goal is reached.
- Allows the system to evaluate movements by comparing actual sensory consequences with expected sensory consequences.
- Mismatch between actual & expected consequences represents error signal used to update recall schema.
- Before recognition schema can be used to judge accuracy of movement, system must first learn which sensory consequences are considered “correct.”
- In some cases, the reference to “correct” depends on feedback from an instructor, e.g., clinician to client so that internal error signal may serve to correct errors in the future w/o external feedback.
Schema Theory (cont)

- Schema Theory assumes series of GMPs occur in a particular serial order and become integrated or “chunked” into a single, larger GMP with large amounts of practice.

- If any of these are unavailable following movement, no schema updating can occur:
  - Relations among the initial conditions
  - Generated motor commands
  - Sensory consequences of these motor commands
  - Outcome of the movement

- Schema Theory appears to provide framework for speech motor programming.
Speech Motor Learning Principles
MSDs and Speech Motor Learning

Schema Theory emphasizes motor programming and appears particularly applicable to MSDs.

AOS may involve deficit in activating and/or parameterizing GMPs due to any of the following:
- Damage to GMP
- Schema that supplies the parameter settings is impaired
- Both of the above

Disruptions in processing somatosensory feedback:
- Information about initial conditions is unavailable or incorrect

Damage to recognition schema may lead to poor error detection:
- Augmented (clinician-provided) feedback about accuracy especially critical
Principles of Motor Learning

- Prepractice
- Structure of Practice
- Practice Distribution
- Practice Variability
- Practice Schedule
- Attentional Focus
- Movement Complexity
- Feedback Type
- Feedback Frequency
- Feedback Timing
Prepractice

- Largely independent of specific training program employed
- Intended to prepare learning for the practice session

Important goals to ensure:
- Proper motivation to learn
- Adequate understanding of task (including “correct” responses)
- Stimulability for expected responses (to avoid frustration due to complete inability to produce target)
Motivation enhanced by understanding the relevance of practice tasks and treatment activities toward overall goal, e.g., improved speech

Reduce risk of communication breakdown

Select functionally relevant targets

Include client in target-selection process

Set specific goals vs asking client to “do your best”

Task understanding important for learning

Avoid lengthy or complex task instructions, especially with comprehension disorders
Structure of Practice

Practice amount: refers to amount of time spent practicing movements

Large number of practice trials provide more opportunities to establish relationships among various types of movement information

Large practice trials thought to enhance stability of recall and recognition schemas

Large practice trials requires many occurrences of motor program retrieval; may automatize the activation of GMPs

This evidence available in research involving nonspeech motor skills
Refers to how a given (fixed) amount of practice is distributed over time, regardless of ‘blocked’ or ‘random’ schedule.

Evidence suggests distributed practice (more time between practice trials or sessions) results in greater learning than massed practice (less time between trials/sessions).

Distribution across several days is frequently encountered in clinical settings.

LSVT is example of “massed” practice.

Distributed practice facilitates both short-term performance and long-term learning in nonspeech domain.
Practice Variability

- Constant practice refers to practice on only 1 variant (parameterization) of a movement (GMP)
- Variable practice targets more than 1 variant of a given movement
- Experiences with wide range of movement outcomes, initial states, and sensory consequences for a particular GMP should result in more reliable schema
- A more reliable schema should facilitate transfer to other movements of same general class, but not to movements that require different GMP.
- Variable practice appears to benefit learning of absolute aspects of movements (schema rules)
- Constant practice early in practice benefits learning of relative aspects of movements (GMPs)
Practice Schedule

- **Random practice** – practice schedule in which different movements (GMPs) are produced on successive trials and where target for upcoming trial is not predictable to learner.

- **Blocked practice** – practice schedule in which learner practices a group of same target movements before beginning practice on next target.

- Random practice may reduce occurrence of overgeneralization & facilitate maintenance.

- Random practice resembles daily life situations, e.g., conversation.

- Evidence that random practice enhances motor learning as documented in retention & transfer tests in nonspeech motor domain.
Internal focus: involves concentrating on aspects of movements, e.g., kinematic, somatosensory (articulatory placement cues)

External focus: concentrating on external task-relevant aspects of movements to achieve a goal (CV production)

Speakers with MSDs may benefit from using an external focus not only during practice but also in everyday communication

External focus has strong learning advantage over internal focus in nonspeech motor domains

External focus promotes movement automaticity and greater retention/transfer
Motor skills typically involve multiple components (complex)

Intuitively appealing to segment complex movement into component parts during practice

Targeting complex behaviors promotes learning relative to targeting simple behaviors, although evidence of this in MSD research is just emerging

Targeting nonspeech oral motor movements does not transfer to complex speech acts

If person’s goal is speech production, important to provide treatment trials in speech-like productions

Effects of part vs whole practice depend on nature of speech task
Two types of augmented feedback:

Knowledge of results (KR)
- information about the movement outcome after completion of a movement
  - “You missed the target”
  - “Correct” vs “Incorrect” verbal feedback from clinician
  - Clinician decision to try sound again or move to different target

Knowledge of performance (KP)
- refers to nature or quality of movement pattern
  - “Your lips did not close for that sound”
- Inherently provided at levels of cueing hierarchy more specific to performance error

KR & KP appear to be equally effective in most cases

KP feedback appears useful for novel tasks or if person cannot distinguish correct vs incorrect productions
Feedback Frequency

- Refers to how often augmented feedback is provided during practice.
- Appears to interact with other factors such as, practice variability, task complexity, and attentional focus.
- Effects of feedback frequency also depend on skill complexity.
- Simple skills benefit from reduced frequency; more frequent feedback may be needed during complex skill learning.
- Reduced feedback frequency appears to benefit GMP learning but not parameter learning.
- External focus feedback provided frequently may benefit learning.
- Clinicians typically provide high-frequency, immediate feedback.
- Recent research supports reduced frequency in intact speakers and those with AOS.
Feedback Timing

- Refers to when feedback is provided relative to task performance
- Typically given after completion of a movement but can be provided simultaneously
- Delaying feedback for a few seconds after end of movement can benefit learning:
  - Learners spontaneously evaluate their own performance based on intrinsic feedback
  - Instructing participants to estimate own errors after task completion shown to enhance learning
- Summary feedback – information about performance after several trials; both delayed & reduced frequency feedback
### TABLE 1. Practice conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Options</th>
<th>Description</th>
<th>Notes</th>
<th>Evidence in speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice amount</td>
<td>Small vs. large</td>
<td>Small: low number of practice trials or sessions. Large: high number of practice trials or sessions</td>
<td>Potential interaction with practice variability (high number of constant practice trials may be detrimental to learning)</td>
<td>No systematic evidence</td>
</tr>
<tr>
<td>Practice distribution</td>
<td>Massed vs. distributed</td>
<td>Massed: practice a given number of trials or sessions in small period of time. Distributed: practice a given number of trials or sessions over longer period of time</td>
<td>No systematic evidence</td>
<td></td>
</tr>
<tr>
<td>Practice variability</td>
<td>Constant vs. variable</td>
<td>Constant: practice on the same target, in the same context (e.g., syllable-initial /l/). Variable: practice on different targets, in different contexts (e.g., syllable-initial and final /l/, /z/, /b/)</td>
<td>Potential interactions with practice schedule, amount, complexity, and feedback variables</td>
<td>Limited evidence for benefit of variable practice in impaired speech motor learning; no evidence from MSD</td>
</tr>
<tr>
<td>Practice schedule</td>
<td>Blocked vs. random</td>
<td>Blocked: different targets practiced in separate, successive blocks or treatment phases (e.g., treatment on /l/ before initiating treatment on /z/). Random: different targets practiced intermixed (e.g., practice on /l/ and /z/ in each session)</td>
<td>Potential interactions with practice schedule, amount, and complexity</td>
<td>Limited evidence for benefit of random practice, in impaired speech motor learning and treatment for AOS</td>
</tr>
<tr>
<td>Attentional focus</td>
<td>Internal vs. external</td>
<td>Internal: focus on bodily movements (e.g., articulatory placement). External: focus on effects of movements (e.g., acoustic signal)</td>
<td>Focus must be task-related</td>
<td>No systematic evidence</td>
</tr>
<tr>
<td>Target complexity</td>
<td>Simple vs. complex</td>
<td>Simple: easy, earlier acquired sounds and sound sequences (e.g., plosives, CV-syllables). Complex: difficult, later acquired sounds and sound sequences (e.g., affricates, CCVC syllables)</td>
<td>Potential interactions with practice schedule, feedback variables, and learner's skill level</td>
<td>Limited evidence for benefit of targeting complex items in treatment for AOS</td>
</tr>
</tbody>
</table>

**Note.** Options that may be expected to enhance learning are indicated in bold. GMP = generalized motor program; MSD = motor speech disorder; AOS = apraxia of speech.

### TABLE 2. Feedback conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Options</th>
<th>Description</th>
<th>Notes</th>
<th>Evidence in speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback type</td>
<td>KP vs. KR</td>
<td>KP: knowledge of performance, how a sound was produced (e.g., biofeedback). KR: knowledge of results, whether a sound was correct or incorrect</td>
<td>Potential interactions with learner's error detection abilities</td>
<td>No systematic evidence</td>
</tr>
<tr>
<td>Feedback frequency</td>
<td>High vs. low/summary-KR</td>
<td>High: feedback after every attempt at production (regardless of accuracy). Low: feedback only after some attempts at production (regardless of accuracy)</td>
<td>Potential interactions with practice variability, attentional focus, complexity, and learner's skill level and error detection abilities</td>
<td>Some evidence for benefit of reduced feedback frequency in treatment for AOS and speech motor learning in hypokinetic dystarhia</td>
</tr>
<tr>
<td>Feedback timing</td>
<td>Immediate vs. delayed</td>
<td>Immediate: feedback immediately following attempt at production. Delayed: feedback provided with a delay (e.g., 5 s)</td>
<td>Potential interactions with attentional focus</td>
<td>Some evidence for delayed feedback in treatment for AOS and hypokinetic dystarhia</td>
</tr>
</tbody>
</table>

**Note.** Options that may be expected to enhance learning are indicated in bold.
**Clinical Implications**

- Distinction between performance during practice versus retention & transfer critical
- Performance during practice does not necessarily predict retention/transfer
- Clinicians should not be misled by changes observed during treatment
- Relative (GMP) and absolute (parameter) aspects of movement respond differently to practice & feedback variables
- In order to implement optimal conditions of practice & feedback, must determine whether selected targets involve GMPs (lexical stress patterns) or parameters (pitch level, speech rate, loudness)
Client Information for Current Study
Participant

Mr. J – Caucasian, middle-age male; lives in rural area of Michigan
Sustained cerebral vascular accident (CVA) in 2005
Diagnosed with mild receptive/expressive aphasia; severe apraxia; right hemiplegia
Mr. J received treatment through an outpatient facility until 2006 until insurance coverage was maximized
Mr. J initiated speech-language services at the Carls Center for Clinical Care & Education/Speech-Hearing Clinic (CMU Speech-Hearing Clinic) at Central Michigan University in May 2009
At time of initial evaluation at the CMU Speech-Hearing Clinic, Mr. J relied heavily on writing telegraphic messages with his left/nondominant hand, gestures & facial expressions
Mr. J was able to communicate during initial assessment that he desired to verbally interact with others socially in daily interactions
Speech & Language Skills

- Spontaneous speech noted to be laborious with overt oral groping on verbal attempts to open-ended questions.
- Used nonverbal modalities to communicate via facial expressions, head nods, and writing telegraphic responses.
- Verbal responses consisted of “yeah,” “no,” and “wow.”
- Receptively, understood questions & statements if modified for rate and complexity.
- Able to communicate during initial assessment that he desired to verbally interact with others socially in daily interactions.
Aphasia Diagnostic Profiles (ADP) Standard Scores:
- Lexical Retrieval – 7 – Aphasic
- Phrase Length – 5 – Nonfluent
- Auditory Comprehension – 9 – Mixed Nonfluent
- Aphasia Severity – 88
- Alternative Communication – 101
- Behavioral Profile – 110

Scores were at least 1-2 SDs below the mean, with exception of auditory comprehension.

Many subtests greatly affected by language deficits.

Test of Nonverbal Intelligence – 3 (TONI-3) – raw score of 27/Deviant Quotient = 94 (Average)
Reading Comprehension Battery for Aphasia (RCBA)

- Word Visual: 90%
- Word Auditory: 100%
- Word Semantic: 100%
- Functional Reading: 60%
- Synonyms: 90%
- Sentence-Picture: 90%
- Paragraph-Picture: 30%
- Paragraph-Factual: 80%
- Paragraph-Inferential: 80%
- Morpho-Syntax: 30%
# Apraxia Battery for Adults – 2 (ABA-2)

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diadochokinetic Rate</td>
<td>Severe</td>
</tr>
<tr>
<td>Increasing Word Length</td>
<td>Moderate</td>
</tr>
<tr>
<td>Limb Apraxia</td>
<td>Moderate</td>
</tr>
<tr>
<td>Oral Apraxia</td>
<td>Moderate</td>
</tr>
<tr>
<td>Utterance Time Polysyllabic Words</td>
<td>Severe</td>
</tr>
<tr>
<td>Repeated Trials</td>
<td>Severe</td>
</tr>
</tbody>
</table>

No. of observable articulation characteristics of apraxia – 8/15

Diagnosed with moderate-severe apraxia of speech (AOS)
### Multimodal Communication Screening Task for Persons with Aphasia (MCST-A)

<table>
<thead>
<tr>
<th>Subtest/Skill</th>
<th>Accuracy</th>
<th>Response Types</th>
<th>Cueing Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Symbol messages to request basic needs or answer biographical information</td>
<td>100%</td>
<td>Picture, Spell</td>
<td>Expansion</td>
</tr>
<tr>
<td>Combining 2-3 symbols</td>
<td>60%</td>
<td>Picture, Spell</td>
<td>Repetition, direct visual attention, confirmation</td>
</tr>
<tr>
<td>Categorizing</td>
<td>100%</td>
<td>Picture</td>
<td>None needed</td>
</tr>
<tr>
<td>Using environmentally-stored phrases in context</td>
<td>100%</td>
<td>Picture</td>
<td>Repetition</td>
</tr>
<tr>
<td>Storytelling using descriptive scene sequence</td>
<td>0%</td>
<td>Picture, Spell</td>
<td>Repetition, Expansion</td>
</tr>
<tr>
<td>Story retelling using descriptive scene sequence</td>
<td>0%</td>
<td>Picture, Spell</td>
<td>Repetition, Expansion</td>
</tr>
<tr>
<td>Telling about locations from a map</td>
<td>100%</td>
<td>Picture, Gesture, Spell</td>
<td>None needed</td>
</tr>
<tr>
<td>Spelling</td>
<td>100%</td>
<td>Spell</td>
<td>None needed</td>
</tr>
</tbody>
</table>
Quality of Communication Life Scale (QCLS) - 2009

Tool used to determine impact of communication disorder on:
- Relationships/interactions with communication partners
- Participation in social, leisure, work & education activities
- Overall quality of life (QOL)

Designed as 5-point rating scale (5 is highest rating/improved perception of QOL)

Mr. J’s ratings averaged 4.4/5.0 – overall QOL perceived as ‘good’

High QOL ratings for self-acceptance, independence, confidence, humor, & hobbies

Reduced QOL for telephone use and being included in others’ conversations
Initial Treatment Outcomes Using AK Treatment Approach
Initial Treatment Approach

Treatment focused on:

- CV/VC word imitation
- Verbally imitate names of daily living objects
- Follow written contextualized one-step directions
- Respond to functional questions and initiate question forms via an AAC device (owned device recommended from previous therapy setting)

Cueing hierarchy for imitative verbalizations based on the *Integral Stimulation Method/Eight-Step Task Continuum* (Rosenbek et al, 1973)
Integral Stimulation Method

Step 1 – “Watch me”; “Listen to me” – simultaneous production
Step 2 – “Watch & listen”; client imitates after a delay; clinician ‘mimes’ utterance silently
Step 3 – “I’ll say it first & you say it after me”; no simultaneous cues provided by clinician
Step 4 – Clinician produces utterance once; client produces several times consecutively w/o cues
Step 5 – Written stimuli with simultaneous production by client; client reads target utterance from card
Step 6 – Written stimuli with delayed production by client; written stimuli removed before verbal production by client
Step 7 – Appropriate utterance elicited by question; imitative model abandoned
Step 8 – Target utterance produced in ‘role-play’ situation
Treatment Outcomes with AAC Approach
Use AAC device to ask 3 “wh”-questions on 3 occasions:
- Used device appropriately in structured situation on 2 occasions
- Clinician programmed questions into device for Mr. J
- Mr. J frequently used device as a ‘model’ and verbally imitated the words typed rather than as AAC

Use AAC device to answer 3 “wh”-questions on 3 occasions:
- Required very frequent assistance/cueing to access device correctly

Use AAC to repair communication breakdown on 3 occasions:
- Consistently used only the delete key to repair breakdown
Goals and Progress
Goals & Progress - Fall 2009

- Imitate CV words at 65% accuracy from baseline 56% accuracy:
  - Progressed to 92% accuracy immediate repetition; working toward verbal production of written target stimuli
- Imitate VC words at 65% accuracy from baseline 59% accuracy:
  - Progressed to 85% accuracy; working toward immediate & successive repetition of VC words
- Imitate name of daily living activity objects at 80% accuracy from 70% with verbal/visual cues:
  - Ranged from 69%-79% over the treatment period. Verbal/visual cues necessary for articulator placement. Errors noted consisted of voicing difficulties & vowel distortions
- Follow written contextualized 1-step directions at 70% accuracy from baseline 60%:
  - Progressed to 80% accuracy if reading direction silently; 87% accuracy when written direction was also read aloud by clinician
Correctly produce CV & VC words, at 85% accuracy:
- CV – progressed from baseline 40% to 65%
- VC – progressed from baseline 50% to 83%

Correctly imitate CVC words – 65% accuracy:
- Progressed from 27% to 63% accuracy

Goal for verbal imitation of common objects discontinued this treatment period

Goal for use of AAC device to repair communication breakdowns:
- Discontinued once Mr. J communicated he was not interested in using the AAC device in everyday situations

Introduced Anagram & Copy Treatment (ACT) and Copy & Recall Treatment (CART)
Correctly produce CV & VC words 80% of the time, given up to 2 visual/auditory cues:
- Progressed from baseline 64% to 72% accuracy; performance varied significantly from 38%-90%
- Added cueing from *Moving Across Syllables* (Kilpatrick, Stohr, & Kimbrough, 1990)
- Continued vowelization & voicing errors noted

Correctly produce CVC words 65% of the time, with up to 3 visual/auditory cues:
- Progressed from baseline 43% to average 74%; performance ranged from 36%-94%
- Added cueing from *Moving Across Syllables* (Kilpatrick, Stohr, & Kimbrough, 1990)

Verbally imitate 10 functional 2-3 word phrases containing core words chosen by Mr. J with up to 5 verbal & motoric cues, 50% of the time:
- Progressed from baseline 20% to 66% accuracy; performance ranged from 20-90% over the semester
Quality of Life Issues

During Summer 2010 semester, Mr. J communicated feelings of isolation & loneliness due to communication barriers.

He also expressed desire for companionship.

Clinician assisted him in joining online stroke support forums and discussion boards.

Computer use new skill for Mr. J; constant assistance and modeling required in therapy to access internet sites.

When provided written instructions for computer navigation, independence in computer use increased.

Unfortunately, computer use discontinued when Mr. J was unable to afford home internet services.
Summation of Previous Therapy Outcomes:

- Therapy conducted 2-3 times/week, dependent on client-clinician-supervisor availability
- Duration of therapy approximately 6-8 months
- Clinic followed academic calendar, so ‘breaks’ in therapy every 12-14 weeks
- Verbal production had not progressed beyond immediate and delayed imitation skills of single syllable words & short phrases
- Discontinuation of AAC
- Discontinuation of computer/internet support networks
Conversational Script Training for Acquired Apraxia of Speech
Script Training Principles

Based on the Instance Theory of Automatization (Logan, 1988)

Automaticity occurs due to retrieval from memory of complete, context-bound, skilled performances

Script Training was initially developed to promote verbal communication on client-selected topics (Holland, Milman, Munoz, & Bays, 2002)

Goal is for individuals for whom speech is no longer automatic to produce islands of fluent speech in conversation

Previously used as a treatment approach to improve automatic language production in adults with aphasia

To become automatic, scripts must be practiced as phrase or sentence-length units vs. syllable or ‘one word at a time’ approach (Youmans, Holland, Munoz, & Bourgeois, 2005)

For individuals with aphasia resulting in expressive speech difficulties, repeated practice of phrases and sentences can lead to automatic and effortless speech productions
Acquired Apraxia of Speech

Apraxia & Script Training
(Youmans, Youmans, & Hancock, 2011)

Apraxia of speech is associated with disturbance in the automaticity of fluent speech production

Script training is hypothesized to be a functional therapy approach for individuals with acquired apraxia of speech in order to improve ease of speech production in the functional contexts targeted
“Script Training Treatment for Adults with Apraxia of Speech”
(Youmans et al., 2011)

Accepted through *American Journal of Speech-Language Pathology* in August 2010

Published in *American Journal of Speech-Language Pathology*, February 2011

Previous published research revealed script training is functional treatment approach successful for persons with aphasia (Youmans et al., 2005)

Had not been applied to persons with apraxia of speech.

This study revealed script training was successful & functional for 3 subjects with apraxia of speech.
Effectiveness of Conversational Script Training for Acquired Apraxia of Speech
Purpose of Current Study

• This case study was intended to provide further support for the use of conversational script training for a client with acquired apraxia of speech & mild non-fluent aphasia.
Youmans et al. (2011) provided convincing evidence for use of script training for adults with apraxia of speech

Decision made to replicate study based on participant’s:

- Desire to communicate verbally
- Indication that traditional apraxia treatment was not motivating
- Limited progress beyond immediate and delayed imitation of single syllable words & short phrases
- Refusal to use AAC device (given to him by previous clinic) to communicate
Procedure

- Therapy conducted 2-3 times/week, dependent on client-clinician-supervisor availability
- Script training therapy was conducted from September 2010 - Present
- Clinic followed academic calendar with breaks in therapy every 12-14 weeks

Therapy Sessions Included:
- 10 minutes of unstructured conversation
- 40 minutes of blocked/random practice of phrases
  - Breaks as needed based on client frustration level
- 10 minutes targeting other goals (sentence writing, computer use)
Script Development

- Client and clinician formulated scripts (4-8 sentences in length) to use in personally relevant contexts

Phrase Acquisition

- Scripts were trained one phrase at a time in *blocked* practice
- After 90% accuracy was achieved for 3 phrases in blocked practice, phrases were rehearsed in *random* trials
- Continued practice of mastered phrases to promote maintenance
Feedback

- Opportunity to correct errors independently before given feedback
- Specific feedback on articulator placement and accuracy of production
- Knowledge of performance (KP) and knowledge of results (KR) feedback
- Positive reinforcement of verbal attempts

Data Collection

- Data collected at baseline, treatment, and maintenance periods
- Based on number of words correct independently in blocked and random trials
Cueing Hierarchy

Modified from Youmans et al. (2011)

**Blocked Practice**
- Clinician model of target phrase
- Target phrase in unison with visual cues
- Target phrase with clinician fading voice
- Independent productions with visual cues
- Independent productions

**Random Practice**
- Random trials with visual cues
- Independent productions in structured conversation
- Random trials with unfamiliar communication partners given visual cues
- Independent productions in structured conversation with unfamiliar communication partners

**Types of Visual Cues**
- Sentence Strips
- Silent Posturing
- *Moving Across Syllables* Visual Cues (Kirkpatrick, Stohr, & Kimbrough, 1990)
- Individualized cues for vowel production
Moving Across Syllables: Training Articulatory Sound Sequences - Therapy tool developed for children with difficulty sequencing sounds

Created by Jill Kirkpatrick, Pamela Stohr, and Debora Kimbrough (1990)

Designed to assist in training sequencing skills within and across syllables

Visual cuing techniques used and modified for use with client

Example: /t/ /d/ - Touch lightly above your upper lip with your index finger. Remove your finger as you say the sound

No vowel cues included, therefore visual cues were developed by clinicians as needed
Client’s Scripts

Client determined settings that he would most like to communicate and created meaningful phrases that could be used in his environment.

**Conversation Starters**
- Hi! How are you?
- Would you like to get dinner?
- When are you free?
- How should I get a hold of you?
- Great! See you then.

**Aphasia**
- I had a stroke in 2005.
- Speaking is hard for me.
- But I can understand you.
- Please slow down.
Script Acquisition

**Conversation Starters**

<table>
<thead>
<tr>
<th>Conversation Starters</th>
<th># Sessions to Reach 90% Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi! How are you?</td>
<td>8</td>
</tr>
<tr>
<td>Would you like to get dinner?</td>
<td>16</td>
</tr>
<tr>
<td>When are you free?</td>
<td>12</td>
</tr>
<tr>
<td>How should I get a hold of you?</td>
<td>6</td>
</tr>
<tr>
<td>Great! See you then.</td>
<td>3</td>
</tr>
</tbody>
</table>

**Aphasia**

<table>
<thead>
<tr>
<th>Aphasia</th>
<th># Sessions to Reach 90% Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>I had a stroke in 2005.</td>
<td>8</td>
</tr>
<tr>
<td>Speaking is hard for me.</td>
<td>12</td>
</tr>
<tr>
<td>But I can understand you.</td>
<td>6</td>
</tr>
<tr>
<td>Please slow down.</td>
<td>4</td>
</tr>
</tbody>
</table>
Summary of Script Acquisition

Conversation Starter

- Hi! How are you?
  - Met 90% accuracy in 7 sessions
- Would you like to get dinner?
  - Met 90% accuracy in 14 sessions
- When are you free?
  - Met 90% accuracy in 12 sessions
- How should I get a hold of you?
  - Met 90% accuracy in 7 sessions
- Great! See you then.
  - Met 90% accuracy in 3 sessions

Script Mastery

- Met 90% accuracy of all 5 lines in 34 sessions
Summary of Script Acquisition

Aphasia

- I had a stroke in 2005.
  - Met 90% accuracy in 8 sessions
- Speaking is hard for me.
  - Met 90% accuracy in 12 sessions
- But I can understand you.
  - Met 90% accuracy in 6 sessions
- Please slow down.
  - Mastery still in progress

Script Mastery

- Mastery of the script is still in progress
Script Accuracy

**Conversation Starters**

Aphasia
Effect size calculated to contrast pre-treatment and post-treatment levels of performance (Cohen, 1988)

Benchmarks used for determining degree of effect (Beeson & Robey, 2006):

- Small Effect- 6.0
- Medium Effect- 12.0
- Large Effect- 18.0

**Conversation Starters**

- 111.96 (large effect)

**Aphasia**

- 38.26 (large effect)
Conclusions

- Overall, script training was a functional, effective treatment for this client.
- Met objective of obtaining relatively fluent and errorless production of the “conversation starters” script and the first 3 phrases of the “aphasia” script.
  - “Hi! How are you?” was mastered relatively quickly.
    - May be attributed to automaticity of the phrase prior to his CVA and/or previous treatment targeting the phrase in isolation.
  - Subsequent lines were mastered with gradually fewer sessions over time.
    - 14 sessions for “Would you like to get dinner?” – 3 sessions for “Great! See you then.”
- Often self-corrected errors during independent productions.
Conclusions

- Demonstrated generalization of script production in other settings with clinicians present
  - Began producing the scripts outside of the clinic setting with a significant other
  - Generalization to other non-therapy environments is minimal
- Maintained mastery of phrases over a 6 month period including breaks in therapy
  - Maintenance of each phrase was highly variable session to session and was likely influenced by:
    - Client frustration level, fatigue, and/or illness reducing accuracy of verbal productions
    - Frequent breaks in therapy due to academic calendar
    - Limited trials of phrases in random practice when new lines were introduced in blocked practice
Conclusions

- Client’s productions continue to contain minor errors during maintenance periods and random practice.
  - However, he is able to use self-monitoring to restart and correct error phrases.
- Often has difficulty initiating lines of the script.
  - Once initiated, script is typically executed fluently due to motor automaticity.
- Client’s prosody continues to have limited inflection.
  - Prosody continues to sound more natural with random practice.
Limitations

Although script training was proven effective for this client, continued research is suggested in order to determine the overall effectiveness of script training for all individuals with apraxia of speech.

- Scripts are limited to one context, making generalization to other speaking contexts difficult.
- Breaks in therapy negatively influenced motor automaticity and rate of script acquisition for this client.
- Clinician changes each academic semester may have led to variability in cueing, feedback provided, and data collection during script acquisition.


Please direct any comments or questions to:

- Katie Atkinson, M.A., CCC-SLP, BC-ANDS
  - gowar1ka@cmich.edu
- Jenna Brusie, B.S.
  - brusi1jl@cmich.edu
Type of Practice

- Blocked Practice
- Random Practice
Attentional Focus

- Internal Focus
- External Focus
Feedback Type

- Knowledge of Performance
- Knowledge of Results
Immediate Feedback

Reduced Feedback