A COGNITIVE-BASED NAMING TREATMENT APPROACH IN APHASIA

Naomi Hashimoto, PhD, CCC-SLP & Kelsey Mofett, BA Eastern Michigan University Communication Sciences & Disorders Program

BACKGROUND

Aphasia Defined

- "....aphasia as an acquired selective impairment of **language modalities and functions** resulting from a focal brain lesion in the language-dominant hemisphere that affects the person's communicative and social functioning and quality of life and the quality of life of his or her relatives and caregivers." Papathanasiou & Coppens, 2022
- "...a good way to define aphasia is to make sure we include four elements in our definition: 1. It is acquired; 2. It has a neurological cause; 3. It affects reception and production of **language** across modalities; 4. It is not a sensory, motor, psychiatric, or intellectual disorder." Halowell, 2023
- "A language impairment that crosses all input and output modalities." Brookshire, 2015.

Aphasia Defined

- Acquired
- Neurogenic Based Condition



- Negative Impact on Language Modalities of Communication
 - Understanding
 - Speaking
 - Reading
 - Writing

Cognitive Deficits in Aphasia

• Systematic Reviews

- Murray, L., Salis, C., Martin, N., & Dralle, J. (2018). The use of standardised short-term and working memory tests in aphasia research: A systematic review. *Neuropsychological Rehabilitation*, *28*, 309-351. <u>https://doi.org/10.1080/09602011.2016.1174718</u>
- Salis, C., Kelly, H., & Code, C. (2015). Assessment and treatment of short-term and working memory impairments in stroke aphasia: A practical tutorial. *International Journal of Language & Communication Disorders*, *50*, 721-736.

• Special Issue

• Martin, N., Salis, C., & Minkina, I. (2018). Short-term and working memory deficits in aphasia: Current issues in theory, evidence, and treatment. *Journal of Neurolinguistics*, *48*, 1-226.

Cognitive Deficits in Aphasia

- Increasing recognition that cognitive deficits are frequently observed in PwA
 - Attentional Deficits
 - Deficits in Inhibition Control
 - Short-Term Memory Deficits
 - Reduced Processing Speed
 - Working Memory Deficits

Aphasia Defined - Revisited

• Aphasia may be considered a selective breakdown of language processes along with a co-occurrence of, or an interaction with, breakdowns in cognitive processes. Linguistic-cognitive deficits therefore contribute toward the deficits observed in PwA.





WHAT IS WORKING MEMORY?

Working Memory Defined

• "The term working memory refers to a brain system that provides **temporary storage and manipulation** of the information necessary for such **complex cognitive tasks** as language comprehension, learning, and reasoning...Working memory has been found to require the **simultaneous storage and processing of information**". Baddeley, A. (1992). Working Memory. *Science*, *255*, 556-559.

Working Memory Defined

 "Working memory refers to cognitive processes that retain information in an unusually accessible state, suitable for carrying out any task with a mental component." Cowan, N. (1999). An Embedded Process Model of Working Memory. In A. Miyake & P. Shah (Eds): *Models of Working Memory: Mechanisms of Active Maintenance and Executive Control*. Cambridge University Press.

Everyday Working Memory Tasks

• Spell the word, *registration*, backward.

• What is 20% of 33.50?

• Mina, who is second from the right, is the one who played on my soccer team last year. Point to Mina.

Common Working Memory Tests

• Digit Span Backward

- Recall of digits in backward order.
 - Repeat these digits in backward order: 3-4-2-7-1.

• (Modified) Listening Span Task

- A processing task (e.g., answer yes/no questions; sentence reading; math problem-solving) given along with a set of stimuli (e.g., letters, words, shapes) to be remembered for later recall.
 - Answer the following questions *yes* or *no*. Also, remember the last word in each sentence: 1. Is a whale small? 2. Does a whale live in the sea? 3. Is a whale red? What were the last words of each of those questions?

Common Working Memory Tests

N-back Task

- Presentation of a continuous sequence of letters/numbers, during which time participants have to decide if the current stimuli matches previously presented stimuli n-trials before.
 - Press the key if this letter is the same as the letter you saw \underline{X} (one, two) trials ago.



WORKING MEMORY APPROACHES TO TREAT ANOMIA IN APHASIA

A Review of the Literature

Review of Working Memory – Aphasia Treatment (Zakarias et al., 2019)

- Nature Working Memory Treatment
 - Repetition of Sentences Reconstruction of Sentences Using Word Cards Reading Sentences Aloud
 - Modified Reading Span Task Grammatical Judgments & Recall of Semantic Categories
 - Attention Process Training -2 Program
 - N-back
 - Manipulation/Reconstruction of Words (Oral Spelling)

Review of Working Memory – Aphasia Treatment (Zakarias et al., 2019)

- Evidence
 - 100% of WM studies reported improvements on measures of language
 - Spoken Sentence Comprehension
 - Repetition
 - Picture-Word Matching
 - Object & Action Naming
 - Reading Comprehension
- Functional Outcomes
 - Inconsistent reports of improved functional communication
 - Only 1 of 4 communication questionnaires reported improvements in communication
 - One study reported improvements on a WM questionnaire, while another did not report any changes in this area

SEMANTIC FEATURE ANALYSIS (SFA) APPROACH TO TREAT ANOMIA

A Review of the Literature

Semantic Feature Analysis Approach

• Description of Treatment Protocol

- Treatment focuses on semantic features associated with a target picture to treat naming deficits in PwA.
- Use of a "semantic feature analysis chart".
- Individuals provide one or more verbal responses for each feature for a targeted picture, but variations exist (e.g., written or verbal responses; self-generated features or clinician generated features; recognition or production format).



Semantic Feature Analysis Approach

- Rationale
 - Approach is based on the concept of spreading activation within the semantic system.
 - The presentation of semantic features closely related to the target will result in a spreading of activation to other closely related targeted concepts.
 - Targeted concept receives a higher level of activation than other similar concepts because there is a convergence on it, facilitating the ease in naming it.



Semantic Feature Analysis Approach

• Evidence

- Recent systematic reviews (Efstratiadou et al., 2018; Maddy et al., 2014; Quique et al. 2019) have found positive results
 - Improvement in naming of trained items is reported in majority of PwA.
 - **Clinical efficacy,** as measured by treatment effect size calculations, have primarily been found in the small treatment effect sizes.
 - Maintenance of these treatment gains at one month and beyond is typically reported for most studies.
 - Generalization to untrained items, however, has been inconsistently observed.

WORKING MEMORY – SEMANTIC FEATURE ANALYSES NAMING APPROACH

Current Study

Rationale Working Memory – SFA Approach

- An approach, such as the SFA approach, has resulted in improved naming of trained items immediately following treatment.
- The SFA approach has also resulted in maintenance of treatment gains at least one month following completion of treatment.
- Therefore, the SFA approach, coupled with WM tasks, should produce robust treatment effect sizes (Beeson & Robey, 2006).
- Further, if WM is considered a central and fundamental construct of cognition, improved naming of untrained items may also be observed.

Purpose of Study

 One aim of this exploratory study is to describe a combined WM-SFA approach and examine its feasibility in PwA. Is the proposed protocol doable for PwA?

 Another aim was to explore the impact of the combined approach on naming abilities in PwA. Can an approach that incorporates working memory elements in a naming treatment approach improve picture naming abilities? METHODS

Participants

	Р1	P2	P3
Age (Years)	76		72
Education (Years)	College	High School	College
Post-Stroke (Years)	5	1	25
Etiology	Left MCA CVA	Left MCA CVA	Left MCA CVA

Stimuli

- Treatment List 1, Treatment List 2, and Control (Untreated) List 3
 - N = 12-15 per list
- Pictures represented a variety of semantic categories (e.g., food; animals; tools)
- Lists were balanced in terms of word frequency, number of syllables, & AoA norms





Assessments

• Language Assessments

- Western Aphasia Battery-Revised (Kertesz, 2006)
 - Aphasia Severity
 - Aphasia Type
- Boston Naming Test (Kaplan et al., 2001)
 - Naming Severity
- Speech Assessment
 - Apraxia Battery for Adults -2 (Dabul, 2000) or Duffy's Motor Speech Exam (Duffy, 2020)
 - Presence of Motor Speech Disorders (MSD)
 - Severity of MSD (if present)

Assessments

- Quality of Life Measure
 - Stroke and Aphasia Quality of Life-39 (SAQOL-39) (Hilari et al., 2003)
- Working Memory Assessments
 Digit Span Forward/Backward

 - Modified Listening Span Task (Ivanova & Hallowell, 2014)
 - Picture Span Forward/Backward (Dede et al., 2014)
- Pre-treatment assessments were administered over a period of 4-5 days.
- All assessments were conducted in-person.

Working Memory Tasks

- Digit Span Forward/Backward
 - Spans of 3 5
 - Eight sequences per span
 - Sequences were randomly selected

3-Digit Span		Di	git Span Lis	sts Backward
1-3-6	6	3	1	
2 - 4 - 5	5	3	 2	
3 - 9 - 4	4	9	3	
4 - 2 - 1	1	2	4	
5 – 9 – 2	2	9	5	
6-7-4	4	7	6	
7 - 3 - 6	6	3	7	
8-1-3	3	1	8	

TOTAL ____

4-Digit Span

-2-4-7	7	4	2	1	
-1-5-8	8	5	1	2	
- 6 - 2 - 9	9	2	6	3	
-7-3-1	1	3	7	4	
-6-9-4	4	9	6	5	
-4-7-5	5	7	4	6	
- 5 - 8 - 2	2	8	5	7	
- 5 - 2 - 6	6	2	5	8	

TOTAL

Working Memory Tasks

- Modified Listening Span
 - Comprehension Section (Processing Score)
 - Participant points to the picture that corresponds to the sentence.
 - Storage Section (Storage Score)
 - A word is spoken.
 - Types of sentences vary in terms of length and syntactic complexity.
 - Span of 2 6 (Objects to recall range from 2-6)

Modified Listening Span – Span of 2



Point to "The lady is calling the girl".

Point to "The boy is touching the lady".

Modified Listening Span – Span of 2



Working Memory Tasks

- Picture Span Forward/Backward
 - Spans of 2-6
 - Five sequences per span



Span 2 Items F Desk Nail	Respons	ses	Cor	rect Trials rrect Items /2	/5 5 /10			
	(Desk)) (Na	ail)					
Fish Chair			<u> </u>	/2				
	(Fish)	(Ch	nair)					
Door Church			<u> </u>	/2				
	(Doo	r) (Ch	urch)	12				
King Hat	(0:)		-	/2				
Horse Pen	(King) (на	t)	12				
	(Horse	e) (Pe	n)	/-				
Span 3		, (· -				Correct Trials	/5	
tems		Resp	onses			Correct Items	/15	
Shirt Cake T	ruck					/3		
		(Shirt)	(Cake)	(Truck)				
Dress Lock	Car _					/3		
		(Dress)	(Lock)	(Car)		12		
rot Hand Pi	none .	(Ret)	(Hand	/Phone	7	/3		
Tree Nose Fl	lag	(FOL)	(nanu	(Fhone	,	/3		
	- 6	(Tree)	(Nose)	(Flag)	-	1-		
Bed Glass C	oat					/3		
		(Bed)	(Glass)	(Coat)				
Span 4							Correct Trials	/5
tems			Response	25			Correct Items	/20
Desk Book H	House F	oot _	(0, 1)	(0)		15	/4	
Curr User De			(Desk)	(BOOK)	(House)	(Foot)	14	
oun neart ba	III NHITE	•	(Sun)	(Heart)	(Ball)	(Knife)	/4	
Phone Hand	Door	Church	(Sun)	(neart)	(Dail)	(kine)	/4	
			(Phone)	(Hand)	(Door)	(Church)	14	
Bell Plane D	og Clo	ck		<u> </u>	<u> </u>		/4	
			(Bell)	(Plane)	(Dog)	(Clock)		
Key Train M	loon Ai	rm					/4	
			(Key)	(Train)	(Moon)	(Arm)		

Picture Span Forward- Updated 5/21/14

Pre-Treatment Assessment

Subtest	Pı	Р2	P3
WAB AQ	71.2	74.7	89.1
Aphasia Type	Conduction	Anomic	Anomic
Boston Naming Test	38/60	39/60	47/60
SAQOL-39	NA	3.74	3.13
ABA-2 or Duffy Motor Speech Exam	Moderate AoS	None-Mild	None-Mild

Pre-Treatment Assessment

Subtest	Group Comparison Mean (SD)		P1	P2	Р3
	NC	PwA			
Modified Listening Span Process Storage	.99 (01) .92 (.07)	.72 (.2) .75 (.1)	.74 .63	.71 .39	.83 .71
Picture Span Forward Span Correct	NA NA	NA 37.6 (8.6)	2.5 39	2.5 38	3.5 52
Picture Span Backward Span Correct	NA NA	NA 45.7 (13.1)	2 48	2 48	2 47
Digit Span Forward	NA	NA	3.75	4	4.75
Digit Span Backward	NA	NA	.5	3.75	3.75

Probe Schedule

- Probes were obtained prior to treatment (B1, B2, B3)
- Probe were also obtained once a week during the treatment phase at the start of the session prior to treatment.
- Probes were finally obtained after treatment was completed at one-month follow up (FU1, Fu2, Fu3).

Multiple Baseline Single Subject Design

- Assess the effects of treatment on treatment lists
 - Probes (testing) of all three lists were conducted prior to treatment to ensure stable baselines. Three baseline probes were obtained.
 - Probes were then conducted every week to insure that the treated list was improving while the untreated lists maintained a stable baseline
- Sequential Manipulation
 - List 1 was treated initially
 - List 2 was treated next
 - List 3 was never treated
- Cause & Effect
 - By recording initial behaviors, then successively administering a manipulation to those behaviors, this design allows for inferences about the effect of the intervention

Multiple Baseline Design



Treatment Procedure

- Participants were seen on a twice weekly schedule
- Pictures that were treated on any given day were randomly selected until all pictures had been used in treatment five (5) times
- Reliability checks were conducted on 20% of sessions

Treatment Steps

• Step 1. Naming the Picture

• What is this?

• Step 2. Selecting Appropriate Semantic Features.

- What can you say about _____?
- What does it remind you of?
- What does it have?
- Where is it found?

Step 3 Repeating the features

• Please repeat the words you chose three times.

Treatment Steps

• Step 4. Listening Span

- Listen carefully to the question and answer yes or no.
- Try to remember the last word of each question because I'll ask you to tell me what they were after I finish asking the yes/no questions.

• Step 5. Recall of Semantic Features

• Let's go back to your 3 words. What were the 3 words you used to describe the picture?

Step 6. Word Span Backward

• I'll say the 3 words to you. Repeat them back to me but in reverse order.

Step 7. Picture Naming

- Review of semantic features
- What is this?

Video Clip P1



Video Clip P3



RESULTS

Results

- Q1: Was the current treatment protocol feasible for PwA?
 - All participants were able to complete the steps with at least 50% or higher accuracy by the end of treatment.

	List 1					
	Step 4	Step 5	Step 6	Step 4	Step 5	Step 6
P1	64%	81%	51%	69%	85%	60%
P2	87%	90%	47%	87%	87%	50%
P3	46%	66%	68%	64%	67%	72%

Results

• Q2: Did the treatment protocol result in meaningful treatment effect sizes using *d* statistics for single subject experimental designs?

	List 1 WM-SFA	List 2 WM-SFA	List 3 Control (Untreated)			
P1	4.04*	9.81**	6.9*			
P2	3.46	6.17*	1.51			
P3	9.33**	12.12***	8.66*			
* = small ES; ** = medium ES; ***= large ES						



Pre- & Post-Treatment Assessment

Subtest	Pı		P	2	P3		
	Pre-Tx	Post-Tx	Pre-Tx	Post-Tx	Pre-Tx	Post-Tx	
WAB AQ	71.2	76.1	74.7	81.3	89.1	94.2	
Aphasia Type	Conduction	Conduction	Anomic	Anomic	Anomic	Anomic	
Boston Naming Test	38/60	36/60	39/60	38/60	47/60	52/60	
SAQOL-39	NA	NA	3.74	3.82	3.13	3.72	

Pre- & Post-Treatment Assessment

Subtest	Group Compa	rison Mean (SD)	P1 Pre	P1 Post	P2 Pre	P2 Post	P3 Pre	P3 Post
	NC	PwA						
Modified Listening Span Process Storage	.99 (01) .92 (.07)	.72 (.2) .75 (.1)	74 63	79 58	71.25 38.75	58.75 68.75	82.5 71.25	77.5 81.25
Picture Span Forward Span Correct	NA NA	NA 37.6 (8.6)	2.5 39	2 38	2.5 38	2.5 52	3.5 52	3.5 66
Picture Span Backward Span Correct	NA NA	NA 45.7 (13.1)	2 48	2 48	2 48	2 51	2 47	2.5 46
Digit Span Forward	NA	NA	3.75	3.25	4	3.5	4.75	4.5
Digit Span Backward	NA	NA	.5	.5	3.75	3.5	3.75	3.5

DISCUSSION

Discussion

- Proposed protocol was largely "do-able" for all 3 participants.
 - Step 6 (Word Span Backward) was most difficult for P1 & P2, while Step 4 (Listening Span) was most difficult for P3.
 - Anecdotally, all three participants expressed frustration at times over their performance, but none of them were too frustrated to stop a session or stop participating in the study.

Discussion

- Protocol, to date, has improved naming (i.e., obtained meaningful ESs) in at least one of the trained lists across all 3 participants.
 - Nature of linguistic tasks used in the approach (Sze et al., 2021)
 - Feedback about naming accuracy (Steps 1 & 7: Picture Naming)
 - Generation of semantic features (Step 2: Generation of Features)
 - WM tasks reinforced some of the same skill sets needed for successful word retrieval while using an array of presented cues.
 - Manipulation & Temporary Storage of Items (Steps 4: Listening Span; Step 5: Recall of Semantic Features; Step 6: Word Span Backward).

Discussion

- Surprisingly, naming performance on untreated (control) lists improved for 2 of the 3 participants.
 - WM is considered a central and fundamental construct of cognition.
 - Improved WM would be expected to lead to improved linguistic performance.

HOWEVER

 Post-treatment WM assessments did not lead to across-theboard improvements in WM

Limitations & Future Directions

• Initial results are promising but there are still outstanding questions to be addressed:

- To what extent did the WM tasks contribute to the improved naming performance? Outcomes (improved naming of trained items, maintenance of gains) were similar to what has been reported in previous SFA studies (Efstratiadou et al., 2018; Maddy et al., 2014; Quique et al., 2019)
 - Was it the combined SFA-WM tasks?
 - Or just the SFA tasks alone?

Limitations & Future Directions

- When improved WM performance was noted (or when WM performance remained the same or declined) what was the reason?
 - Attention?
 - Inhibition ?
- Who benefits the most from this type of approach in terms of aphasia performance profile and severity?
- How can the present protocol be modified to accommodate as many PwA as possible?

An Appeal for Participants!

• This is where the clinicians out in the field can help!

• We are still actively recruiting PwA to enroll in the study.

• If you know of someone who may be interested, please provide my contact information!

THANKYOU!

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