Incorporating learning into aphasia rehabilitation

Sofia Vallila Rohter, PhD, CCC-SLP
Assistant Professor, MGH-Institute of Health Professions
Co-Director, Cognitive Neuroscience Group
Speech-Language Pathologist, Brigham and Women’s Hospital

Disclosures

I have no relevant financial or nonfinancial relationships to disclose

Overview

• Why consider learning?
• Examining principles of learning in individuals with aphasia
  – Characterizing implicit and rule-based learning
  – Examining attentional allocation
• Applying hypotheses to treatment for aphasia
  – Evaluating familiarity with technology in PWA
  – Incorporating strategy training into tablet-based therapy for aphasia
Overview

• Why consider learning?
  • Examining principles of learning in individuals with aphasia
    – Characterizing implicit and rule-based learning
    – Examining attentional allocation
  • Applying hypotheses to treatment for aphasia
    – Evaluating familiarity with technology in PWA
    – Incorporating strategy training into tablet-based therapy for aphasia

Aphasia

• Impairment in language that affects comprehension or production of language
• Problems of access or functional use of language

Typical approach to determining therapy program

Assess domains of language  
Treat impaired language domains

- Sentence construction
- Sentence comprehension
- Object naming
- Verb retrieval
Some available treatments for aphasia

<table>
<thead>
<tr>
<th>Treatment of Underlying Forms</th>
<th>Script Training &amp; SPPA</th>
<th>Agrammatism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build metalinguistic awareness of syntactic structure to improve sentence comprehension and production (TUF; Thompson &amp; Shapiro, 1995; Thompson, 2001)</td>
<td>Habilitate patients to produce grammatical sentences through production practice (Holland et al., 2002; Helm-Estabrooks &amp; Nicholas, 2000)</td>
<td></td>
</tr>
</tbody>
</table>

Treatment of Underlying Forms

- Build metalinguistic awareness of syntactic structure to improve sentence comprehension and production (TUF; Thompson & Shapiro, 1995; Thompson, 2001)

Script Training & SPPA

- Habilitate patients to produce grammatical sentences through production practice (Holland et al., 2002; Helm-Estabrooks & Nicholas, 2000)

Agrammatism

- Teach strategies to identify semantic features of a word to activate the semantic network and improve naming (SFA; Boyle & Coelho, 1995; Boyle, 2004)

Semantic Feature Analysis

- Implicitly activate the semantic or phonological system by training sets of items to improve naming (Martin, Fink, & Laine, 2004; Renvall, Laine, & Martin, 2007)

Contextual Priming

Anomia

- For Pt. 1: Receive therapy

- For Pt. 2: Comparable diagnoses

Different responses

The (big picture) problem

- Outcomes lack predictability
- Treatment is not individualized
- The mechanisms of therapy are not fully understood
### Some available treatments for aphasia

<table>
<thead>
<tr>
<th>Treatment of Underlying Forms</th>
<th>Script Training &amp; SPPA</th>
<th>Agrammatism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build metalinguistic awareness of syntactic structure to improve sentence comprehension and production (TUF; Thompson &amp; Shapiro, 1995; Thompson, 2001)</td>
<td>Habilitate patients to produce grammatical sentences through production practice (Holland et al., 2002; Helm‐Estabrooks &amp; Nicholas, 2000)</td>
<td></td>
</tr>
</tbody>
</table>

### Semantic Feature Analysis

<table>
<thead>
<tr>
<th>What is?</th>
<th>Used for?</th>
<th>In a sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>More</td>
<td>less</td>
<td></td>
</tr>
</tbody>
</table>

Teach strategies to identify semantic features of a word to activate the semantic network and improve naming (SFA; Boyle & Coelho, 1995; Boyle, 2004; 

### Contextual Priming

Implicitly activate the semantic or phonological system by training sets of items to improve naming (Martin, Fink, & Laine, 2004; Renvall, Laine, & Martin, 2007).
Some available treatments for aphasia

**Agrammatism**

**Build metalinguistic awareness of syntactic structure to improve sentence comprehension and production** (TUF; Thompson & Shapiro, 1995; Thompson, 2001)

**Script Training & SPPA**

Habituate patients to produce grammatical sentences through production practice (Holland et al., 2002; Helm-Estabrooks & Nicholas, 2000)

**Semantic Feature Analysis**

Teach strategies to identify semantic features of a word to activate the semantic network and improve naming (SFA; Boyle & Coelho, 1995; Boyle, 2004)

**Contextual Priming**

Implicitly activate the semantic or phonological system by training sets of items to improve naming (Martin, Fink, & Laine, 2004; Renvall, Laine, & Martin, 2007)

**Anomia**

**Treatment of Underlying Forms**

Habituate patients to produce grammatical sentences through production practice (Holland et al., 2002; Helm-Estabrooks & Nicholas, 2000)

**Script Training & SPPA**

Habituate patients to produce grammatical sentences through production practice (Holland et al., 2002; Helm-Estabrooks & Nicholas, 2000)

**Semantic Feature Analysis**

Teach strategies to identify semantic features of a word to activate the semantic network and improve naming (SFA; Boyle & Coelho, 1995; Boyle, 2004)

**Contextual Priming**

Implicitly activate the semantic or phonological system by training sets of items to improve naming (Martin, Fink, & Laine, 2004; Renvall, Laine, & Martin, 2007)

Language deficits determine the goals and targets of therapies, learning carries patients to achieve these

Learning is the vehicle for therapy
The field is starting to examine how learning principles might maximize gains for patients

- Training schedules
  - Revisiting memory traces (Straddon et al., 2002)
  - Spaced/Distributed practice vs. Massed practice in aphasia (Middleton, Schwartz, Rawson, Traut, & Vericullen, 2016; Haji-Ahmad, 2017)
- Errorless vs. Errorful learning in therapy
  - Errorless learning and Hebbian plasticity
  - Errorful learning and retrieval practice (Middleton, Schwartz, Rawson & Garvey, 2015)

Can we maximize gains and improve predictability by aligning an individual’s learning ability with therapy type?

Strokes that affect language are likely to affect networks related to learning. Evaluating the integrity of the learning mechanism and how therapy engages that mechanism is important to understand.

Yet researchers and clinicians are increasingly identifying the presence of nonverbal cognitive deficits in aphasia

- Attention
- Working memory
- Memory retrieval
- Cognitive flexibility
- Problem solving
- Self monitoring
- Executive functions

Overview

• Why consider learning?
• Examining principles of learning in individuals with aphasia
  – Characterizing implicit and rule-based learning
  – Examining attentional allocation
• Applying hypotheses to treatment for aphasia
  – Evaluating familiarity with technology in PWA
  – Incorporating strategy training into tablet-based therapy for aphasia

Treating agrammatism

Script Training & SPPA

- Habituate patients to produce grammatical sentences through production practice
- (Thompson & Shapiro, 1995; Thompson, 2001)

Treatment of Underlying Forms

- Build metalinguistic awareness of syntactic structure to improve sentence comprehension and production
- (Holland et al., 2002; Helm-Estabrooks & Nicholas, 2000)

Example: Treating agrammatism

• Acquire skills over time with repetition
• Below conscious awareness
• Learning is somewhat unintentional

SPPA & Script Training

- Learn facts, acquire knowledge about concepts
- Conscious
- Intentional

TUF
Multiple Learning Systems

- **Implicit**
  - Below conscious awareness
  - Unintentional
  - Examples:
    - Acquiring skills
    - Recognizing patterns or sequences

- **Explicit**
  - Conscious
  - Intentional
  - Examples:
    - Learning facts, acquiring knowledge about concepts
    - Verbal/rule-based learning

Key points

- Multiple learning and memory systems exist
- Explicit/Implicit learning differentially depend on language
  - Explicit and implicit learning are supported by neural structures that may be affected in aphasia
  - Some PWA may be better at learning via one system compared to the other
- Therapies likely draw upon different learning mechanisms
- Clinicians should be equipped with ways to evaluate learning and tailor therapy

Recent research in my lab

Can we characterize implicit and rule-based sequence learning and begin to establish a behavioral phenotype of learning?
Implicit Sequence Learning - SRT Task

- Participant looks at a dot moving around the screen
- Multiple 60-trial experimental blocks
- Saccadic response time is measured

<table>
<thead>
<tr>
<th>Block</th>
<th>Pattern</th>
<th>RT expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocks 1–7</td>
<td>12-move sequence</td>
<td>Gradual decrease in RT</td>
</tr>
<tr>
<td>Block 8</td>
<td>Pseudorandom sequence</td>
<td>RT spike</td>
</tr>
<tr>
<td>Blocks 9 &amp; 10</td>
<td>12-move sequence</td>
<td>Rapid decrease in RT</td>
</tr>
</tbody>
</table>

Implicit Sequence Learning - SRT Task

- Participant looks at a dot moving around the screen
- Multiple 60-trial experimental blocks
- Saccadic response time is measured

<table>
<thead>
<tr>
<th>Block</th>
<th>Pattern</th>
<th>RT expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocks 1–7</td>
<td>12-move sequence</td>
<td>Gradual decrease in RT</td>
</tr>
<tr>
<td>Block 8</td>
<td>Pseudorandom sequence</td>
<td>RT spike</td>
</tr>
<tr>
<td>Blocks 9 &amp; 10</td>
<td>12-move sequence</td>
<td>Rapid decrease in RT</td>
</tr>
</tbody>
</table>

Explicit, Rule Based Sequence Learning Task

- Same appearance as previous task
- Dot movement following two shapes follows rules
- Participants are taught the rules
- Rule-governed and non rule-governed trials are interspersed
- Learning = faster RTs in rule-governed than non rule-governed trials
Rule 1: After circle, always diamond:
Rule 2: After square, always triangle:
Establishing behaviors in young and older adults

62 control participants have completed the study
- Each participant completed two sequence learning tasks
  - Implicit
  - Rule based
- 31 young adults
  - Range: 18 – 30 years of age (M= 24.4, SD = 2.67)
  - 13 men, 18 women
- 31 older adults
  - Range 50 – 75 years of age (M = 62.0, SD = 6.5)
  - 10 men, 21 women

Hypotheses

- Young adults will be able to learn equally well under both implicit and rule-based conditions
- Older adults may show more preserved implicit learning than rule-based learning
  - Implicit learning is thought to be a phylogenetically older system preceding the development and emergence of conscious processing
  - May be more robust to age-related decline and neurological insult than explicit systems (Felten, 1993; Reber, Walker, & Hernstadt, 1991)
Variables of interest and data analyses

Implicit Task

- Examine reaction time per block
  - Mean and median RT
- Examine errors per block
- Using t-tests, examine RT difference between:
  - Blocks S7 & PS8
  - Blocks PS8 & S9

<table>
<thead>
<tr>
<th>Task</th>
<th>Pattern</th>
<th>RT expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocks 1–7</td>
<td>12-move sequence</td>
<td>Gradual decrease in RT</td>
</tr>
<tr>
<td>Block 8</td>
<td>Pseudorandom sequence</td>
<td>RT spike</td>
</tr>
<tr>
<td>Blocks 9 &amp; 10</td>
<td>12-move sequence</td>
<td>Rapid decrease in RT</td>
</tr>
</tbody>
</table>

Rule-based Task

- Interspersed Rule governed & non Rule governed Trials
- Learning = faster RTs in rule-governed than non-rule-governed trials

Examining behavioral phenotypes

Calculate an effect size (ES) of learning for each task
- Implicit SRT: compare S7 and PS8 divided by pooled SD
- Rule based: Compare rule governed to non rule-governed
If ES >0.2 considered a learner on that task

Four learner phenotypes arise
Revisiting Hypotheses

We had hypothesized that:

• Young adults will be able to learn equally well under both implicit and rule-based conditions
• Older adults may show more preserved implicit learning than rule-based learning

Instead, it appears that different profiles of learning may arise even in young adults.

Distributions of learner type are similar in young and older adults.

What about for PWA?

• 13 PWA
  – Mean age = 54.5, SD = 4.9
  – F=5, M=8
  – Single Left hemisphere MCA CVA
  – Premorbidly right handed

See four phenotypes with distributions similar to those of controls.
PWA07

Stronger implicit learning system than rule based?

Implicit Task ✔

Rule Based Task ✗

Evidence of implicit learning

No evidence of rule application

PWA34

Stronger implicit learning system than rule based?

Implicit Task ✔

Rule-Based Task ✗

Evidence of implicit learning

No evidence of rule application

PWA24

Stronger rule-based learning system than implicit?

Implicit Task ✗

Rule-Based Task ✔

Evidence that PWA is using rules to anticipate dot movement (using rules)

Evidence of implicit learning

No evidence of rule application
11/14/2018

Overview

- Why consider learning?
- Examining principles of learning in individuals with aphasia
  - Characterizing implicit and rule-based learning
  - Examining attentional allocation
- Applying hypotheses to treatment for aphasia
  - Evaluating familiarity with technology in PWA
  - Incorporating strategy training into tablet-based therapy for aphasia

Treating agrammatism

Are some PWA better implicit vs. explicit learners? Can identifying learner phenotype help select treatment?

- Script Training & SPPA
  - Habituate patients to produce grammatical sentences through production practice
  - Thompson, J. (2001)
- Treatment of Underlying Forms
  - Build metalinguistic awareness of syntactic structure to improve sentence comprehension and production
  - Thompson, J. (2001)

PWA04

Stronger rule-based learning system than implicit?

![Graph showing implicit vs rule-based tasks]

- Implicit Task (X)
- Rule-based Task (√)

No evidence of implicit learning

Evidence that PWA is using rules to anticipate dot movement (using rules)
Experiencing attentional allocation in PWA and age-matched controls

Many PWA did not show successful category learning

Many developed suboptimal strategies that suggest that they focused on only one feature during learning

Examining attentional allocating during learning

- 30 Participants
  - 10 R-handed PWA [3F, 7M]
    - chronic stage of recovery
    - single L-sided stroke
    - aphasia types (characterized using the Western Aphasia Battery): 9 Anomic, 1 Conduction Aphasia
  - 20 age-matched controls (+/- 5 years)
    - R-handed [10F, 10M]
Category learning task
- Replication of Rehder & Hoffman (2005)
- Classify 9 stimuli
- 21 blocks (unless 2 consecutive blocks at 100% accuracy)

1000 ms fixation cross
3000 ms to respond via button press
Auditory Feedback

Diagnosticity of features
Different features are more or less predictive of category membership

High diagnosticity feature
Low diagnosticity feature
Medium diagnosticity feature
High diagnosticity feature

Expected behaviors
- Rehder & Hoffman (2005): Through the course of learning participants learned to allocate less attention to features of low diagnosticity, i.e. the Tail and Head.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Diagnosticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing</td>
<td>High 1</td>
</tr>
<tr>
<td>Foot</td>
<td>High 2</td>
</tr>
<tr>
<td>Head</td>
<td>Medium</td>
</tr>
<tr>
<td>Tail</td>
<td>Low</td>
</tr>
</tbody>
</table>
**Results**

Controls and PWA sig. decreased observations to the low diagnosticity feature from beginning to end of Training, $F = (1, 38) = 5.05, p = .03$; $F = (1, 18) = 4.49, p = .05$.

While controls fixate each feature on nearly every trial (avg. observation $>1$), PWA do not fixate all features on each trial.

**Implications**

- PWA may, in fact, have limited abilities to process visually complex stimuli or need additional time to process all relevant features
- May be important to consider when selecting stimulus materials for therapy

**Overview**

- Why consider learning?
  - Examining principles of learning in individuals with aphasia
    - Characterizing implicit and rule-based learning
    - Examining attentional allocation
- Applying hypotheses to treatment for aphasia
  - Evaluating familiarity with technology in PWA
  - Incorporating strategy training into tablet-based therapy for aphasia
- Conclusions and Discussion
Exposure to technology

- 9/10 Americans are online using smartphones, broadband service and tablet computers
- Nearly 40% increase from the early 2000s (Smith, 2017)
- 67% of seniors are connected to and utilize the internet
- 42% of adults ages 65 and older report owning smartphones (Anderson & Perrin, 2017)

Yet users likely vary in their ability and comfort with technology.

Technology is increasingly being used in aphasia therapy.

- Adults ages 65 and older account for ¾ of those affected by stroke in the US.
- Older adults may have limited lifetime exposure to technology.

Evaluating comfort with technology

- Our lab developed:
  - iPad task battery to probe participant's abilities to perform tasks on an iPad
  - Instructional materials to teach participants to perform unfamiliar tasks

Sitren, Pittman, Pennington, & Vaillant-Rohrer (in preparation)
Aims

1. Examine individuals with aphasia and older adults in their baseline ability to perform the iPad task battery,

2. Examine whether participants can learn to successfully perform tasks that they were unable to accomplish at baseline via written, spoken and visual instruction, and

3. Examine the consistency of iPad skills and retention of learning after a delay of 3 to 10 days
### Participants

32 Participants
- 16 individuals with aphasia (PWA)
  - 37 – 71 years in age
  - Single left hemisphere stroke
  - > 6months post onset of stroke
  - English speakers
  - Premorbidly right handed
  - No history of significant psychiatric or medical disease
- 16 older adults
  - 15 – 72 years of age
  - English speakers
  - No history of significant psychiatric or medical disease

### Methods

- **Cognitive linguistic assessment battery & iPad**
- **Questionnaire**

#### Teaching and Practice
- Evaluation of learning following video models (phase 1) and step-by-step instructions (phase 2)

#### Retention evaluation
- Independent performance of iPad task battery 3 – 10 days later

#### Baseline evaluation
- Independent performance of iPad task battery

### Cognitive linguistic assessment

- Western Aphasia Battery (WAB)
  - PWA with auditory comprehension scores below 50% accuracy on the WAB were not be eligible to continue.
- Cognitive Linguistic Quick Test (CLQT)
- Mini Mental State Examination (MMSE)
IPad questionnaire

- All participants also completed a questionnaire related to their prior use of an iPad and iPhone, providing information about their exposure to and use of iPads, iPhones, and similar tablets (e.g. Samsung and Google Pixel C).
Methods

Cognitive linguistic assessment battery & iPad Questionnaire

Teaching and Practice Evaluation of learning following video models (phase 1) and step-by-step instructions (phase 2)

Retention evaluation Independent performance of iPad task battery 3 - 10 days later

Baseline evaluation Independent performance of iPad task battery

iPad task battery

1.) Turn the iPad on
2.) Find and open Notes
3.) Find and open Constant Therapy
4.) Return to the Home screen
5.) Delete the Reminders app
6.) Increase the screen brightness
7.) Turn Wi-Fi on
8.) Connect to Wi-Fi network
9.) Check an appointment in Calendar: Is there an appointment on May 16, 2018 at 2:00pm?
10.) Check an appointment in Calendar: Is there an appointment on May 7, 2018 at 2:00pm?
11.) Add an appointment in the calendar: Date: May 24, 2018, Title: Speech, Location: HUP, Time: 9:00AM
12.) Find and open the contact Sally
13.) Find your location on the map—Where are we?
14.) Find nearby ATMs
15.) Find and start navigation to nearby Citizens Bank ATM
16.) Turn the iPad off
Baseline evaluation

- 16-task iPad assessment battery on a standardized iPad loaded with 24 apps across two screens, with 12 apps on each screen
- Participants were asked to perform desired skills independently to obtain a baseline score and evaluate their familiarity with the iPad
- Instructions were programmed into a power point presentation that contained
  - Written and recorded instructions of the task
  - Picture identifying the primary goal of the task

Sample prompt

2.) Find and open Notes

Any task not performed correctly was taught in the Teaching & Practice phase

Methods

| Cognitive Linguistic Assessment Battery & iPad Questionnaire | Baseline evaluation of iPad task battery | Teaching and Practice Evaluation of learning following video models (phase 1) and step-by-step instructions (phase 2) | Retention evaluation of independent performance of iPad task battery 3–10 days later |
Teaching & Practice

Phase 1:
• Participant sees the action fluidly performed to completion one time in a video recorded demonstration
• After seeing the video, participant is provided with the task prompt and asked to perform it.

Sample Video Model

Turn Wi-Fi on

Teaching & Practice

Phase 2:
• Participant is provided with step-by-step instructions to perform the task
• Instructions are spoken, accompanied by pictures and dynamic visuals when appropriate
• After each step of instruction the participant performs the task
Look for Settings

Tap Settings to Open

You have opened Settings
Look for Wi-Fi. It's on the left side.

Tap Wi-Fi to open Wi-Fi menu.

The Wi-Fi menu is on the right. Look for the white circle.
Tap the white circle to turn on the Wi-Fi

Methods

- Cognitive linguistics assessment battery & iPad questionnaire
- Baseline evaluation
- Independent performance of iPad task battery
- Teaching and Practice Evaluation of learning following video models (phase 1) and step-by-step instructions (phase 2)

Retention evaluation

- 3 – 10 days later
- Protocol identical to the Baseline Evaluation
  - Designed to measure consistency of performance for tasks that were performed successfully on initial evaluation
  - Measures the retention of learning and efficiency of performance for tasks that required instruction
Scoring

- **Accuracy**: 1 (accurate) or 0 (inaccurate)
- **Efficiency**: number of steps taken to complete each task, compared to the minimum number of steps needed to complete the task. **Lower efficiency scores indicated better performance.**
- **Speed**: time to complete each task

---

**Baseline evaluation**

Controls and PWA produced significant differences in baseline accuracy ($t(29)=2.23, p=.033$) and average time to complete tasks ($t=.006$)
Teaching & Practice

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>PWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of tasks that had to be taught in teaching and practice</td>
<td>54</td>
<td>82</td>
</tr>
<tr>
<td>Percentage of participants who reached 100% accuracy through teaching &amp; practice</td>
<td>100%</td>
<td>69%</td>
</tr>
<tr>
<td>Percentage of tasks learned with just a video model</td>
<td>72%</td>
<td>60%</td>
</tr>
<tr>
<td>Average cycles of teaching &amp; practice needed</td>
<td>1.03 cycles</td>
<td>1.12 cycles</td>
</tr>
</tbody>
</table>

Retention

- Controls showed significant improvement in:
  - Accuracy, t(15) = -3.32, p < .01, Efficiency, t (15) = 2.63, p=.02, Speed, t(15) = 4.97, p=.008
- PWA showed significant improvement in:
  - Accuracy, t(12) = -3.94, p = .002
  - No significant changes in efficiency or speed

Conclusions

- The iPad navigation battery developed for this study was sensitive to performance differences in PWA and controls
- Instructional modules were effective in improving performance for controls and PWA, though not all PWA reached 100%
- Findings support the hypothesis that differences arise in baseline and learning ability.
- Next steps are to examine whether this relates to progress with therapy
Clinical Implications

- Clinicians should consider evaluating iPad familiarity, comfort and learning ability prior to initiating tablet-based therapy
- Instructional modules can be developed and can be effective
- Caregivers may be good resources for patients, but they too, may need training

Overview

- Why consider learning?
- Examining principles of learning in individuals with aphasia
  - Characterizing implicit and rule-based learning
  - Examining attentional allocation
- Applying hypotheses to treatment for aphasia
  - Evaluating familiarity with technology in PWA
  - Incorporating strategy training into tablet-based therapy for aphasia

Study Aims

Jeanne Gallée

Methods
Results
Gaps in knowledge

Patients often interact with tablet-based therapies independently

• How do patients engage with therapy?
• Do patients develop and use effective learning strategies?
• How do patients manage the feedback administered in therapy?

The importance of getting answers

• Many therapies incorporate feedback (Nickels, 2002), yet research probing how or whether patients are integrating and utilizing feedback effectively is lacking.

• Individuals with aphasia may have difficulty developing effective strategies during feedback-based instruction (Vallila-Rohter & Kiran, 2015)

• Effortful retrieval from long-term memory may contribute to verbal learning and retention (Middleton & Schwartz, 2013; Middleton et al., 2016; Schuchard & Middleton, 2018)

Finding the answer: A treatment study

Study Aims

Methods

Results
Study Design

• Pre-treatment assessment
• 10 weeks of therapy
  – Use Constant Therapy
  – Therapy tasks target improved naming
  – 2 hours weekly in-house therapy
  – Unlimited at-home practice (encouraged to login 1 hour/day)
• Post-treatment assessment

Pre and Post treatment assessments

• Naming battery based on items used in CT tasks
• Standardized language assessment
  – WAB
  – BNT
• Standardized assessment of cognitive skills
  – CLQT
• Motor Speech ability

Treatment tasks

• Feature Matching
• Category Matching
• Syllable Identification
• Rhyming
• Picture Naming
Treatment Groups

- **Group 1: Traditional Therapy**
  - Clinicians are present in session
  - Provide minimal instruction/input, only clarifying task instructions, observing and providing application navigation support

- **Group 2: Strategy Training Therapy**
  - Teach patients strategies to engage in a lexical retrieval attempt on every trial
  - Teach patient strategies to review responses after incorrect feedback

Strategy Training

Maximizing Naming Opportunities Within the Strategy Group

1. Clients are encouraged to retrieve names independently before initiating cue-use
2. Clients are encouraged to repeat names of pictured items after cues are heard
3. Clinicians teach clients to pause and review responses after receiving corrective feedback

Participants

- 7 PWA with chronic post-stroke aphasia have completed the study
  - 3 traditional therapy group (1 Anomic, 1 Broca’s, 1 Transcortical Motor)
  - 4 strategy training therapy group (3 Anomic, 1 Broca’s)

- Data have been collected on:
  - Pre and post-treatment assessment measures
  - Total hours spent completing therapy
  - Frequency and latency of cue use, accuracy and latency of responses throughout the course of therapy
Research Questions

1. Do behaviors of latency and cue use differ between therapy groups?
2. Do strategies taught and applied in therapy carry over to at-home practice?
3. Are there differences in overall accuracy between the traditional therapy and the strategy training group?
4. Are there specific patient factors that impact the carry-over of the strategies learned in clinic to independent home practice?

Do behaviors of latency and cue use differ between groups?

Strategy group participants have longer latencies and use fewer cues.

Do strategies taught and applied in therapy carry over to at-home practice?

Strategy group still has longer latencies and use fewer cues. Carry-over of strategies was variable across participants.
Are there differences in overall accuracy between groups?

![Graph showing task accuracy across settings with bars for Clinic and Home.

- Accuracy in %
- Bars for Traditional and Strategy.

<table>
<thead>
<tr>
<th>Accuracy in %</th>
<th>Clinic</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>40</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

Are there differences in overall accuracy between groups?

![Graph showing pre and post-treatment naming ability.

- WAB Naming and Word Finding Subscores
- Bar graph for T1, T2, T3, STR1, STR2, STR3.

Strategy group participants made significant gains on untrained lexical items.

![Graph showing number of log-ins outside of clinic.

- Home-login frequency
- Bars for T1, T2, T3, STR1, STR2, STR3.

No significant difference in the number of home-logins between groups.

Are there differences due to different rates of practice?

![Graph showing number of log-ins outside of clinic.

- Home-login frequency
- Bars for T1, T2, T3, STR1, STR2, STR3.

Number of log-ins outside of clinic:

- T1: 28
- T2: 16
- T3: 24
- STR1: 40
- STR2: 17
- STR3: 40
Summary of Findings

• PWA were able to learn and apply strategies.

• Carry-over of strategies was variable across strategy participants and differed across individual home log-ins.

• Results support the hypothesis that incorporating strategies that enhance lexical retrieval attempts can improve naming gains.

Clinical Implications

• Using a tablet-based therapy does not mean that the clinician is replaced.

• Think outside the box - there are ways to enhance therapy engagement to optimize outcomes for patients.

• In an environment where patient access to therapy can be limited, factors such as these are critical to consider.

Learning is important

Types of Aphasia

Pt 1 Receive therapy

Pt 2 Comparable diagnoses Different responses
Thank you!

Cognitive Neuroscience Group
Yael Arbel
Lauryn Zipse
Amanda Sitren
Jeannie Gallele
Megan Schliep
Emmaleigh Loyer
Jack Snowdon
Brendan Czupryna
Dani Marissa Grant

We thank patients and their families for participating in our studies
Thank you to the Christopher Norman Fund and the MGH-IHP Faculty Research Fellowship for funding support

Measures

3 Eye Tracking Measures were computed:
1) Fixation Probability:
   - binary variable encoding whether a feature was fixated at least once on a trial.
2) Average Observations:
   - average # of singular fixations to a feature
3) Log. Fixation Time:
   - log-transformed fixation time for a feature