Evaluating Computer-based Treatment of Anomia: Results of Phase I Trials

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ASHA, November, 2010, Philadelphia, PA  Contact: rfink@einstein.edu
1. Present a model for facilitating programmatic research to advance the state of evidence on a computer-assisted treatment (MTW).

2. Present and summarize the data that emerged from this project.

3. Discuss clinical implications
Learner Outcomes

Participants will be able to:

• Describe MossTalk’s two main treatment modules and rationale for using each

• Summarize the evidence on efficacy including:
  – impact of therapy intensity
  – effectiveness when self administered
  – characteristics of patients who may benefit from MTW

• Identify factors to consider (e.g., barriers and facilitators) before using CAT
What treatment approaches are empirically supported?

What is the level of evidence?
Phases of Research

• Pre-efficacy studies (Phase 1 and 2)
• Efficacy studies (Phase 3)
• Effectiveness (Phase 4 and 5)
Pre- efficacy Studies

Phase I
- examines new treatments
- tests for therapeutic effect
- small, single subject designs

Phase II
- optimizes procedures
- determines appropriate candidates
- dosage (intensity)
- further explores potential efficacy
Efficacy studies

• Phase III: Clinical trial
  – Controlled large group design
  – Tests the efficacy of the treatment under ideal conditions
Effectiveness studies

• Phase IV
  – Potency under typical clinical conditions

• Phase V
  – Practical considerations (e.g., Cost-benefit analysis, consumer satisfaction)
Computer-Assisted Treatments: a popular movement

Computer-assisted treatments have potential to:

- Increase the intensity of therapy
- Improve outcome and efficiency of therapy
- Extend the period of rehabilitation
State of the evidence

A growing body of experimental literature attests to the benefits of this approach, for example:

- Lingraphica: Aftonomos, Steele, & Wertz, 1997
- Sentactics: Choy, Holland, Cole, & Thompson, 2009
- MossTalk Words: Fink, Brecher, Schwartz, & Robey, 2002
Large-scale (Phase 3) clinical trials, a level of evidence critical for establishing treatment efficacy are lacking

- Preliminary research (Phase I and II trials) needed to shape factors (patient selection criteria, intensity of administration, etc.) that are prerequisite to a Phase 3 clinical trial.

- Important to inform clinicians about the evidence available for treatment technology they may recommend.
What is MossTalk Words® (MTW)

- A computerized therapy system for aphasic adults with word retrieval deficits

- Provides extensive practice in word comprehension and production using multimodality cues and feedback

- Treatment modules
  - Theoretically motivated
  - Based on effective treatments
  - Routinely employed by clinicians
Two Modules

Cued Naming (CN):
Provides visual and auditory cues that can be systematically applied in a hierarchy to promote retrieval (Linebaugh & Lehner, 1977)

Multimodality Matching (MMM):
Encourages semantic processing to strengthening the association between words and pictures (Howard, Patterson, Franklin, Orchard-Lisle, & Morton, 1985a,b)
Cued Naming Exercise Settings

Name: Practice

Vocabulary:
- Mixed (Animals, Foods & Objects)
- Animals
- Foods
- Objects
- Actions
- People

Familiarity:
- Easy
- Hard
- Mixed

CUES:
- Initial: Spoken, Written
- Fill In: Spoken, Written
- Word: Spoken, Written
- Description: Spoken, Written

Begin Exercise
**Multi-Modality Matching Exercise Settings**

**Name**: Practice

**Vocabulary**
- Animals & Objects
- Actions
- People

**Match**
- Written to Picture
- Picture to Written
- Spoken to Picture
- Spoken to Written

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<th>Vocabulary Familiarity</th>
<th>Choice Relatedness</th>
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<td>Easy</td>
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<td>5</td>
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</tr>
<tr>
<td>6</td>
<td>Hard</td>
<td>Hard</td>
<td>3 4</td>
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</table>

**Begin Exercise**
milk
Additional features

• Customize vocabulary
• Create homework assignments
• Track results
Phase 1 Study

• Investigated effects of CN Module: a hierarchical phonological cueing procedure

• Two conditions of instruction:
  – clinician guided (CG) condition
  – Partially self-guided (PSG)

• 6 subjects with primarily phonologically based deficits, 3 in each instruction condition
Conditions of instruction

• Clinician guided (CG)
  – worked on computer exercises with clinician 3 times/week

• Partially self-guided (PSG)
  – Worked on computer exercises 3 times/week
    • 1 day with clinician
    • 2 days independently
Prior Studies

Our study draws on prior studies without replicating any of them.

➢ From Linebaugh and Lehner we took the idea of individuating the cueing hierarchy—moving up and down hierarchy on each trial.
➢ From Howard et al., Raymer et al. and Thompson et al., we limited cues to phonological type.
➢ To provide maximum support for all severity levels, we included both written and spoken cues.
Study Aims

To assess acquisition, generalization and maintenance effects associated with computer-assisted hierarchical cueing.
Design

- Single Subject (replicated)

- Multiple Baseline Across Behaviors

- Two conditions:
  - Partially self-guided (PSG)
  - Clinician-guided (CG).
Participants

- 6 chronic aphasic subjects
  - 5 M; 1 F
  - 54-64 yrs (mn= 60 yrs)
  - 2.3-7.5 yrs post onset (mn=4 yrs)

- Moderate-severe naming deficits
  - Naming severity: 17.8 - 77.4 % (PNT)
  - Aphasia Severity: 2 - 4 (BNT)

- Primarily phonological in nature
  - Phonological retrieval and/or
  - Phonological encoding

- Patients with central semantic deficits excluded
  - Mild semantic (2)
Table 1. Demographic information and language classification.

<table>
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<th></th>
<th>Clinician Guided</th>
<th>Partially Self Guided</th>
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<td></td>
<td>GM</td>
<td>AS</td>
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<tr>
<td>Age-(rounded year)</td>
<td>54</td>
<td>64</td>
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<tr>
<td>Gender</td>
<td>M</td>
<td>M</td>
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<tr>
<td>Handedness</td>
<td>R</td>
<td>R</td>
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<td>Time Post Onset (mos.)</td>
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<td>40</td>
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<td>9</td>
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<td>Aphasia Subtype</td>
<td>Conduction</td>
<td>Broca</td>
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<td>BDAE severity level</td>
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Training Procedure

• The Cued Naming module of MTW software delivered the picture stimuli, cues and feedback

• 6 of the 8 cues were used and presented in a hierarchy, individually determined for each subject
Multimodality Cues

Auditory cues
- Initial phoneme
- Sent. completion
- Word repetition

Written cues
- First letter
- Sent. completion
- Oral reading
Training conditions

- Clinician guided condition (CG)
  3 participants

- Partially self-guided condition (PSG)
  3 participants
Duration of Treatment

- Subjects were treated 3 times a week
- Treatment continued until criterion was reached or for a maximum of 4 weeks
Outcome measures: naming

• Big Naming test- pre and post

• Daily naming probes of trained and untrained items during baseline, training, maintenance and follow-up phases

• Follow-up naming probes were administered after an average of 4 weeks
Outcome measures

- Philadelphia Repetition Test (PRT)
- Philadelphia Oral Reading Test (PORT)
Results
Figure 1. Subject GM (CG)

Set 1
- Baseline
- Treatment - Set 1
- Maintenance

Set 2
- Baseline
- Treatment - Set 2
- Follow-up (6 weeks)

Sessions
Figure 2. Subject AS (CG)

Baseline

Treatment- Set 1

Maintenance

follow-up (4 weeks)

31

follow-up (4 weeks)

31

sessions

Set 1

Set 2
Figure 3. Subject BM (CG)

- Baseline
- Treatment - Set 1
- Maintenance

Follow-up (4 weeks)

Set 1

Set 2

Sessions
<table>
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<tr>
<th>Group</th>
<th>Subject</th>
<th>Set 1</th>
<th>Set 2</th>
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<td>Baseline vs. Treatment</td>
<td>Baseline vs. Maintenance</td>
<td>4-week Follow-up</td>
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<td>13.02</td>
<td>7.82</td>
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<td>CG</td>
<td>7.78</td>
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<td>BM</td>
<td>8.9</td>
<td>10.83</td>
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<td>EL</td>
<td>5.5</td>
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<td>8.14</td>
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<td>10.5</td>
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Benchmarks (Beeson & Robey, 2006): 4.0 (S); 7.0 (M); 10.1 (L)
Study Results

• Training - specific acquisition was demonstrated in both conditions for all subjects
  – 2 of 3 subjects in each group showed moderate-strong gains
  – 1 subject in each group showed weaker gains
  – Set 1 performance higher for 4 of 6 participants (2 from each group)

• Gains were maintained when treatment was withdrawn

• Small advantage for Clinician-guided group
Results: Generalization

• Limited and variable generalization patterns were noted in:
  – Naming of untrained items during training (EL and AS)
  – Oral Reading and Repetition
  – 339 item pre-post Naming test
    • All showed improved scores on trained items
    • GM and AS also showed significant improvement on untrained items
Conclusions

• Chronic aphasic subjects with moderate to severe phonologically-based naming impairments can benefit from a computerized cued naming protocol.

• Independent work on the computer can be an effective adjunct to therapy.
A model for facilitating research

Identify intervention (e.g., MossTalk Words)

Organize collaborative network

Site A  Site B  Site C

Evaluate results

Plan Phase 3 Clinical Trials
Organizing Collaborative network

Letters of invitation were sent to researchers and clinicians who work with individuals with aphasia.

Collaborators agreed to:
* Participate in a brief training program
* Complete a set of evaluation forms
* Execute a controlled experiment of their design (research sites)
* Use MTW in clinical setting (clinical sites)

Host provided ongoing training, technical assistance and support
Results of Dissemination

End of Year 1

* 3 Research groups had preliminary data on clinically relevant factors
  * Effectiveness for various etiologies and language impairments
  * Effectiveness when self administered
  * Impact of therapy intensity on outcomes

Subsequently
* Researchers presented and published several articles on clinically relevant aspects of MTW
## Overview of Research Studies

<table>
<thead>
<tr>
<th>Research Group</th>
<th>Module Used</th>
<th>Number of participants</th>
<th>Clinically Relevant Factors Studied</th>
<th>Impact of therapy intensity</th>
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<td>CVA 2(S) 3(P)</td>
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<td>CN</td>
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<td>CVA 1(S) 3(P)</td>
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</table>

CN= Cued Naming; MMM=Multimodality Matching; NPA=Nonfluent Progressive Aphasia; SD=Semanic Dementia; S=semantic impairments; P=phonological impairments
Panel Presentation

Gail Ramsberger, ScD
- University of Colorado

Elizabeth Rochon, PhD
- University of Toronto and Toronto Rehabilitation Institute

Anastasia Raymer
Old Dominion University, Norfolk, VA.
THE END OF PART 1
PART 3: Summary and Discussion
Acquisition, Maintenance & Generalization

Acquisition
Most participants demonstrated measurable acquisition of trained items, though they varied in degree of improvement

Maintenance
Most maintained gains above baseline levels when treatment was withdrawn
  maintenance phase
  1 month follow-up

Generalization
Some evidence - but limited and variable
Does Intensity Matter?

- Significant improvement noted with intensive and non-intensive schedules
- Some advantage for greater intensity (Ramsberger, Raymer)
- When asked, participants preferred non-intense condition (Ramsberger)
Effectiveness when self-administered

- Participants able to use computer independently
- Improvement noted when treatment was
  - Clinician guided
  - Partially self-guided
  - Completely self-guided
- Effect sizes somewhat favor clinician-guided group
Who benefits?

- Adults with stroke related aphasia (15 studied); NPA (2 studied) and SD (1 studied)
- Moderate-severe production deficits
- Moderate-severe comprehension deficits
- Varied aphasia subtypes (Broca, Anomia, Conduction, Wernicke*)
  *limited # of Wernicke aphasia studied)
Modules/cues used

• CN
  – Ramsberger (all written and spoken cues, individually determined)
  – Fink et al (all but description cues, individually determined)
  – Jokel & Rochon (printed and spoken cues (Study 1); written and spoken description (study 2))

• MMM
  – Raymer and colleagues
Barriers

- No computer in home or support
- Cognitive deficits
- Severe apraxia
  - need to be able to repeat or
  - respond to one of the cues provided by the computer)
Conclusions

Findings confirm and extend Fink et al data:

- CN and MMM modules were effective in improving naming of trained words (acquisition and maintenance) for individuals with moderate severe naming impairments.

- Software effective with varied population (NPA, Semantic Dementia, and moderate-severe chronic aphasia)

- INTENSITY
  - Some advantage for greater intensity, but significant improvement noted with either intensive and non-intensive schedules.

- INDEPENDENT work on computer can be an effective adjunct to clinician guided treatment

- BUT
  - Limited and variable generalization to untrained words or tasks
Future Directions

• Assess effects with new speech recognition component

• Incorporate more functional outcome measures
  – Generalization to untrained production tasks (e.g., picture description, conversational sample)

• Prepare for Phase III Trial (RCT)
Acknowledgements

MTW research was supported in part, by a grant from the NIH (NIDCD) (#RO1DC00191) and by a grant awarded by the Peer Review Committee of the MossRehabilitation Research Institute. Funded.

The dissemination project was funded, in part, by a grant from the NEC Foundation Assistance and resources were made available through the Neuro-Cognitive Rehabilitation Research Network (NCRRN) at www.ncrrn.org, supported by grant #1 R24 HD050836 from the NICHD/NIH.

MossTalk Words was developed with partial funding from McLean Contributionship and MossRehab.

* We are grateful to all the researchers and clinicians who have participated.
References


