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

Ruth Fink, MA

Moss Rehabilitation Research Institute

Elizabeth Rochon, PhD

University of Toronto and Toronto Rehabilitation Institute

Gail Ramsberger,ScD.

University of Colorado

Anastasia Raymer, PhD

Old Dominion U., Norfolk, VA

ASHA, November, 2010, Philadelphia, PA

Contact: rfink@einstein.edu

Todays Talk

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
- ORLA: Cherney, Halper, Holland, & Cole, 2008
- 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.

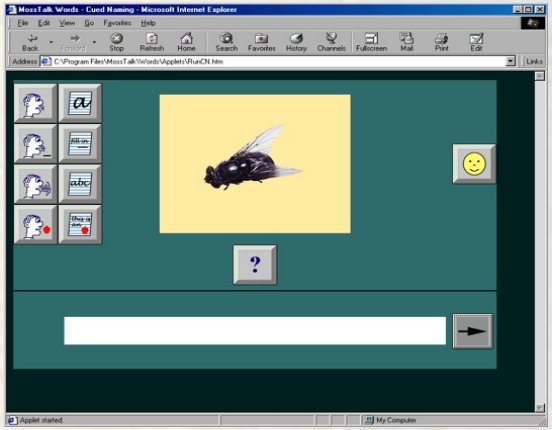
- Important to inform clinicians about the evidence available for treatment technology they may recommend.

What is MossTalk Words® (MTW)

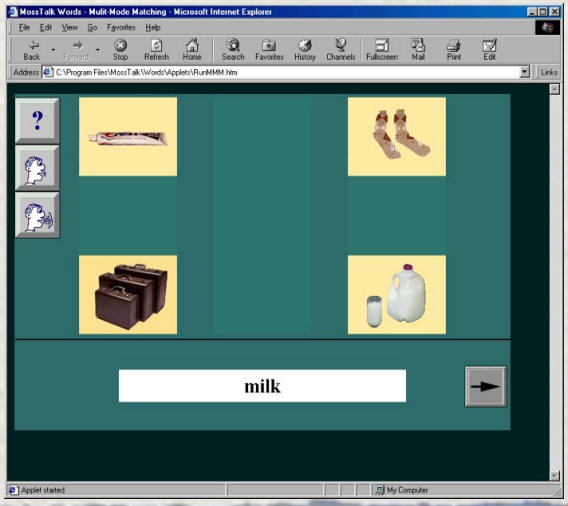
- A computerized therapy system for aphasic adults with word retrieval deficits
- Provides extensive practice in word comprehension and production using multimodality cues and feedback
- Treatment modules
  - Theoretically motivated
  - based on effective treatments
  - routinely employed by clinicians

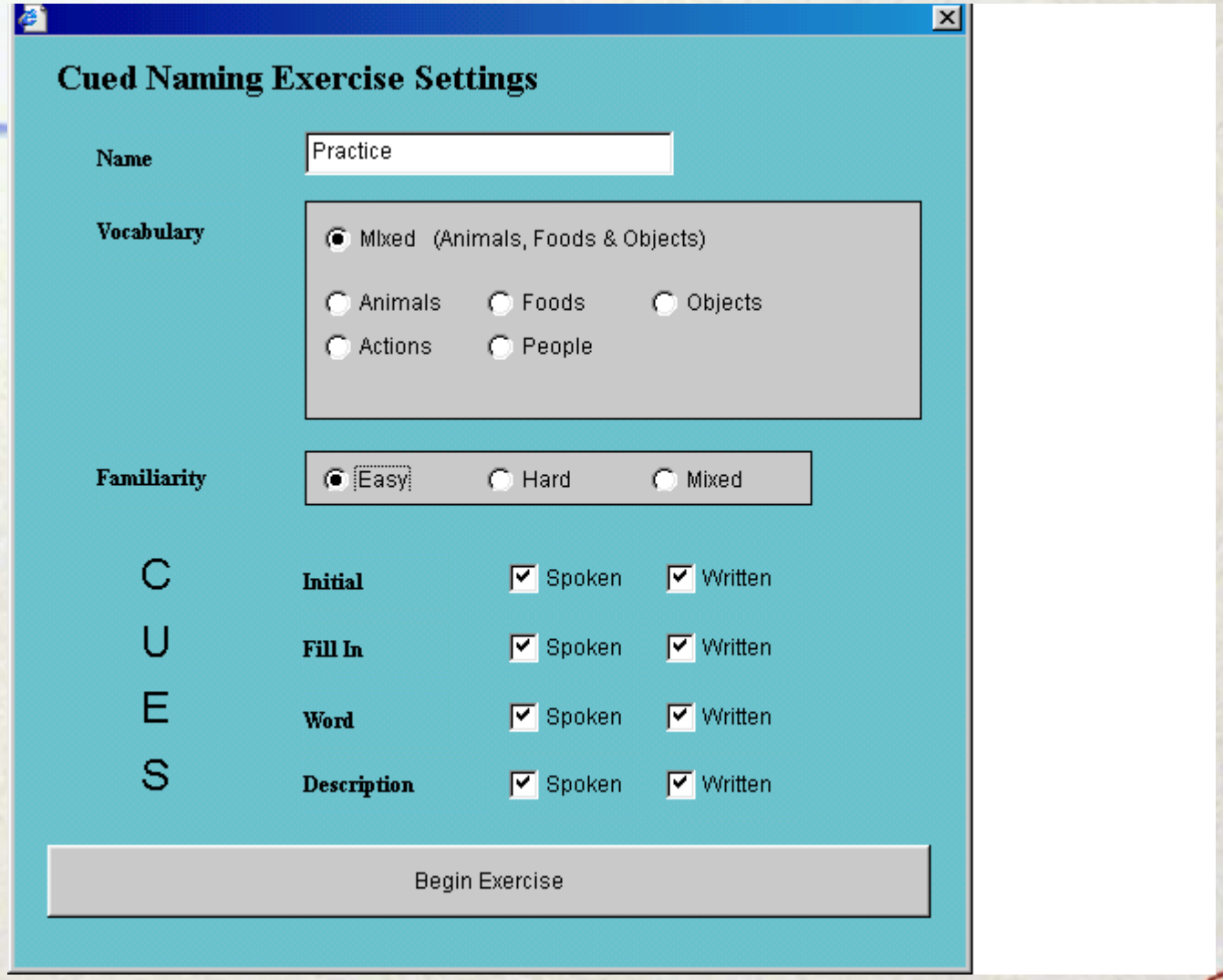
Two Modules

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
C
U
E
S
Initial
Spoken
Written
Fill In
Spoken
Written
Word
Spoken
Written
Description
Spoken
Written
Begin Exercise

MossTalk Words - Cued Naming - Microsoft Internet Explorer

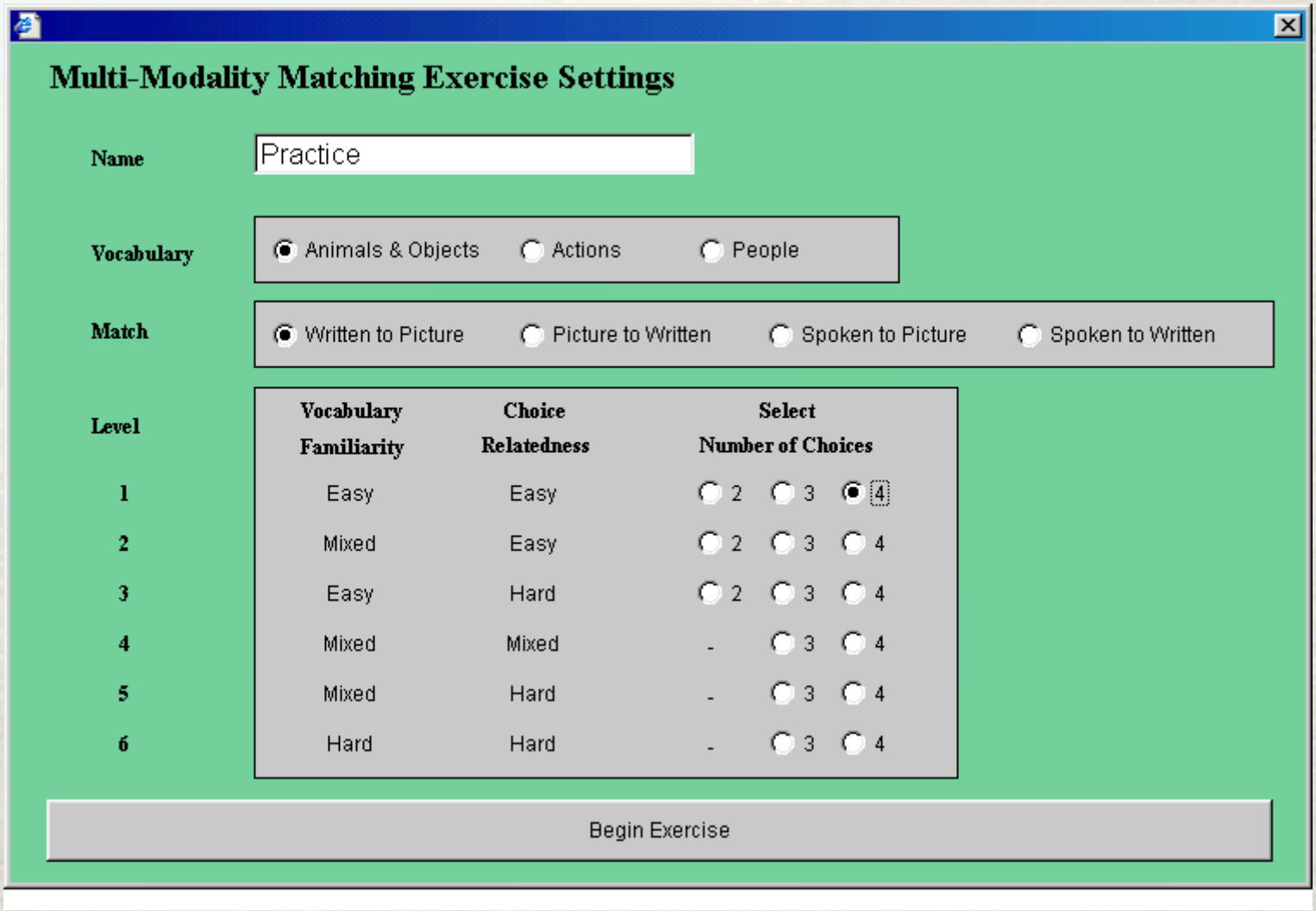
File Edit View Go Favorites Help

Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit

Address C:\Program Files\MossTalk\Words\Applets\RunCN.htm Links

Applet started

My Computer


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
Level
Vocabulary Familiarity
Choice Relatedness
Select Number of Choices
1 Easy Easy 2 3 4
2 Mixed Easy 2 3 4
3 Easy Hard 2 3 4
4 Mixed Mixed - 3 4
5 Mixed Hard - 3 4
6 Hard Hard - 3 4
Begin Exercise

MossTalk Words - Mulit-Mode Matching - Microsoft Internet Explorer

File Edit View Go Favorites Help

Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit

Address C:\Program Files\MossTalk\Words\Applets\RunMMM.htm Links

milk

Applet started.

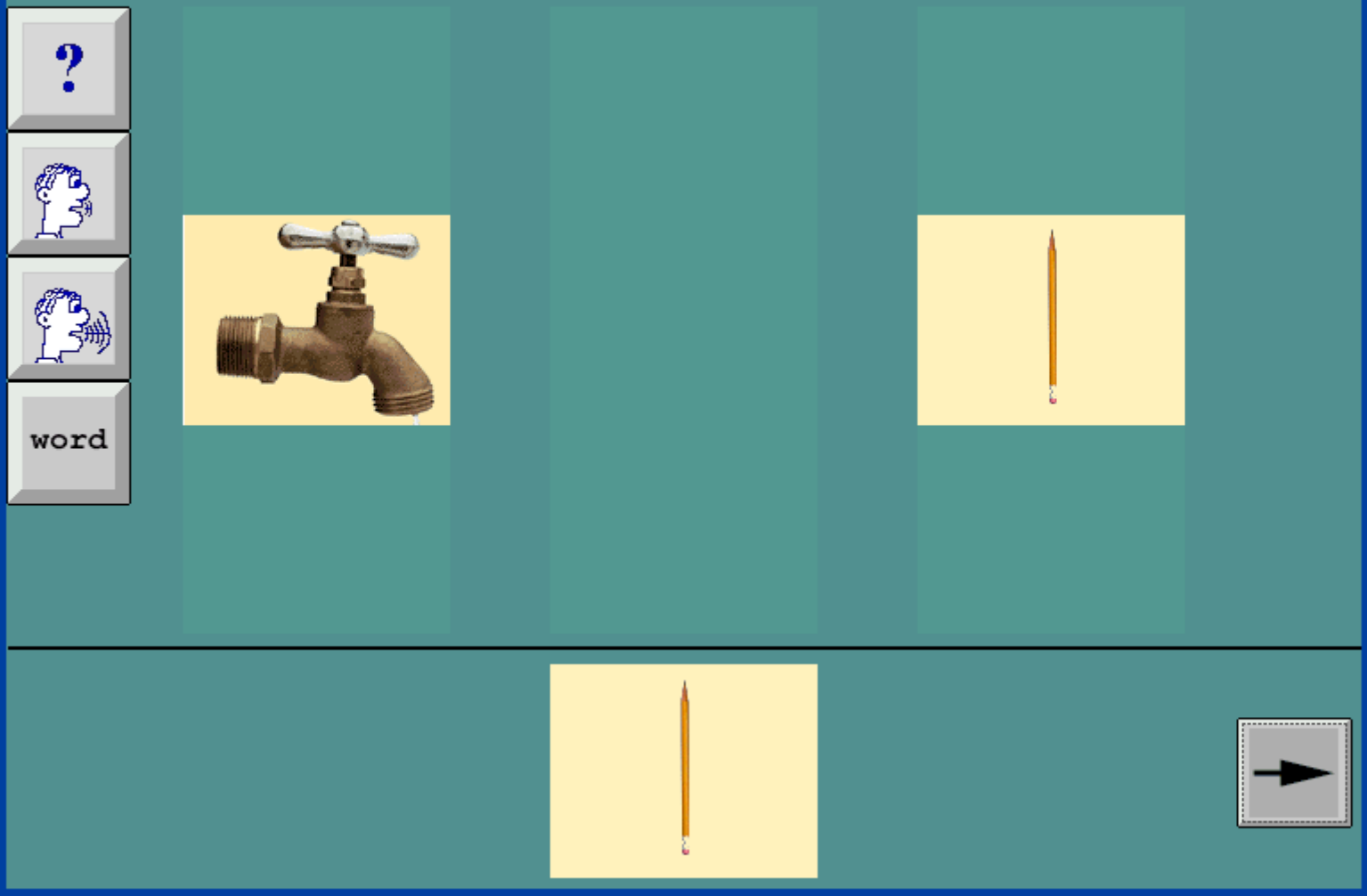
My Computer

MossTalk Words - Mulit-Mode Matching - Microsoft Internet Explorer

File Edit View Go Favorites Help

Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit

Address C:\Program Files\MossTalk\Words\Applets\RunMMMCV.htm Links



Applet started

My Computer

Additional features

- Customize vocabulary
- Create homework assignments
- Track results

Fink, Brecher, Schwartz & Robey (2002) 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.

	Clinician Guided			Partially Self Guided		
	GM	AS	BM	EL	EG	RH
Age-(rounded year)	54	64	60	59	63	63
Gender	M	M	M	F	M	M
Handedness	R	R	L	R	R	L
Time Post Onset (mos.)	92	40	28	34	40	61
Prior Language Therapy	12	9	9	5	8	11
Aphasia Subtype	Conduction	Broca	Anomic	Conduction	Conduction	Anomic
BDAE severity level	4	2	2	3	2	2

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)

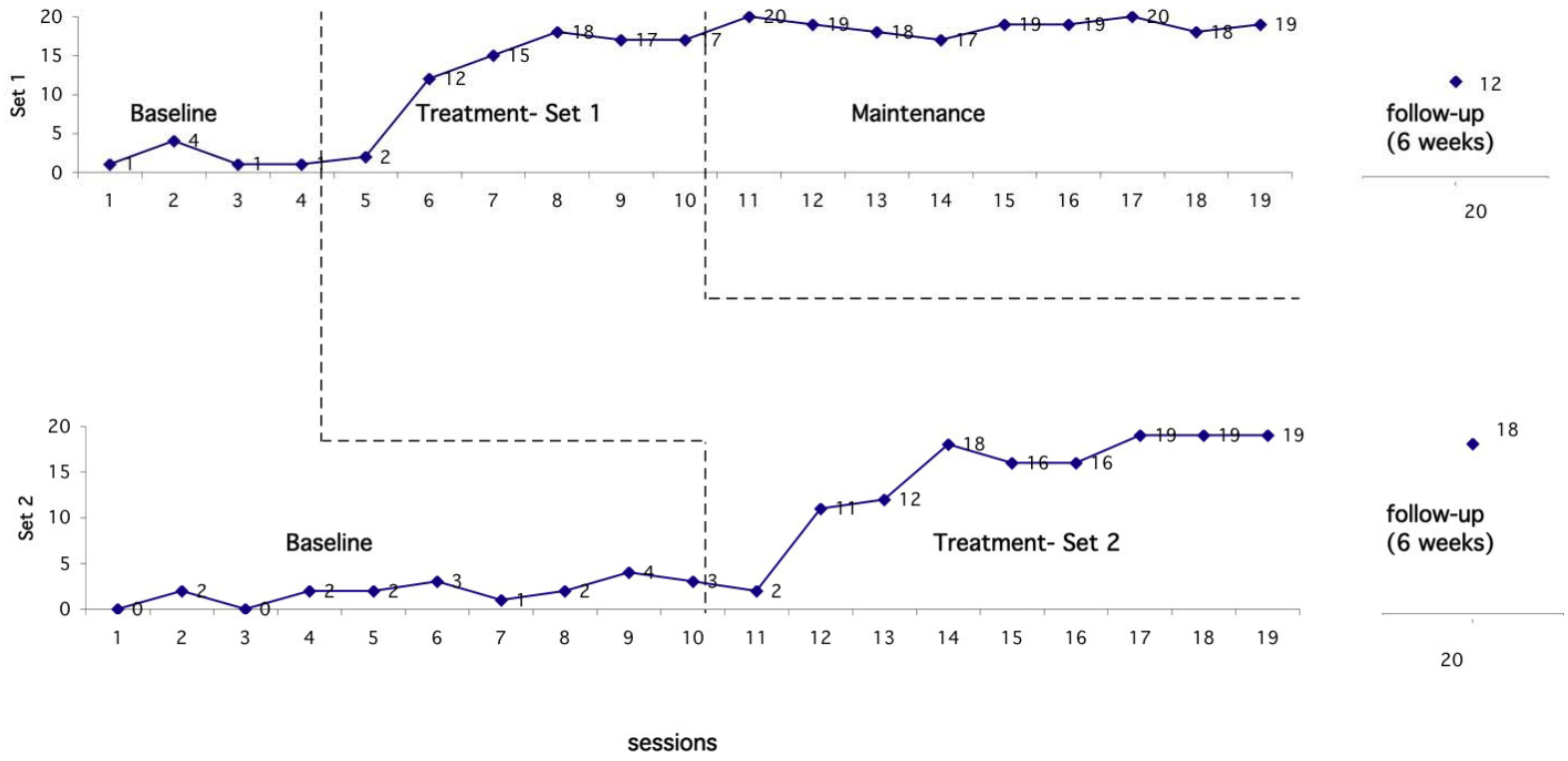


Figure 2. Subject AS (CG)

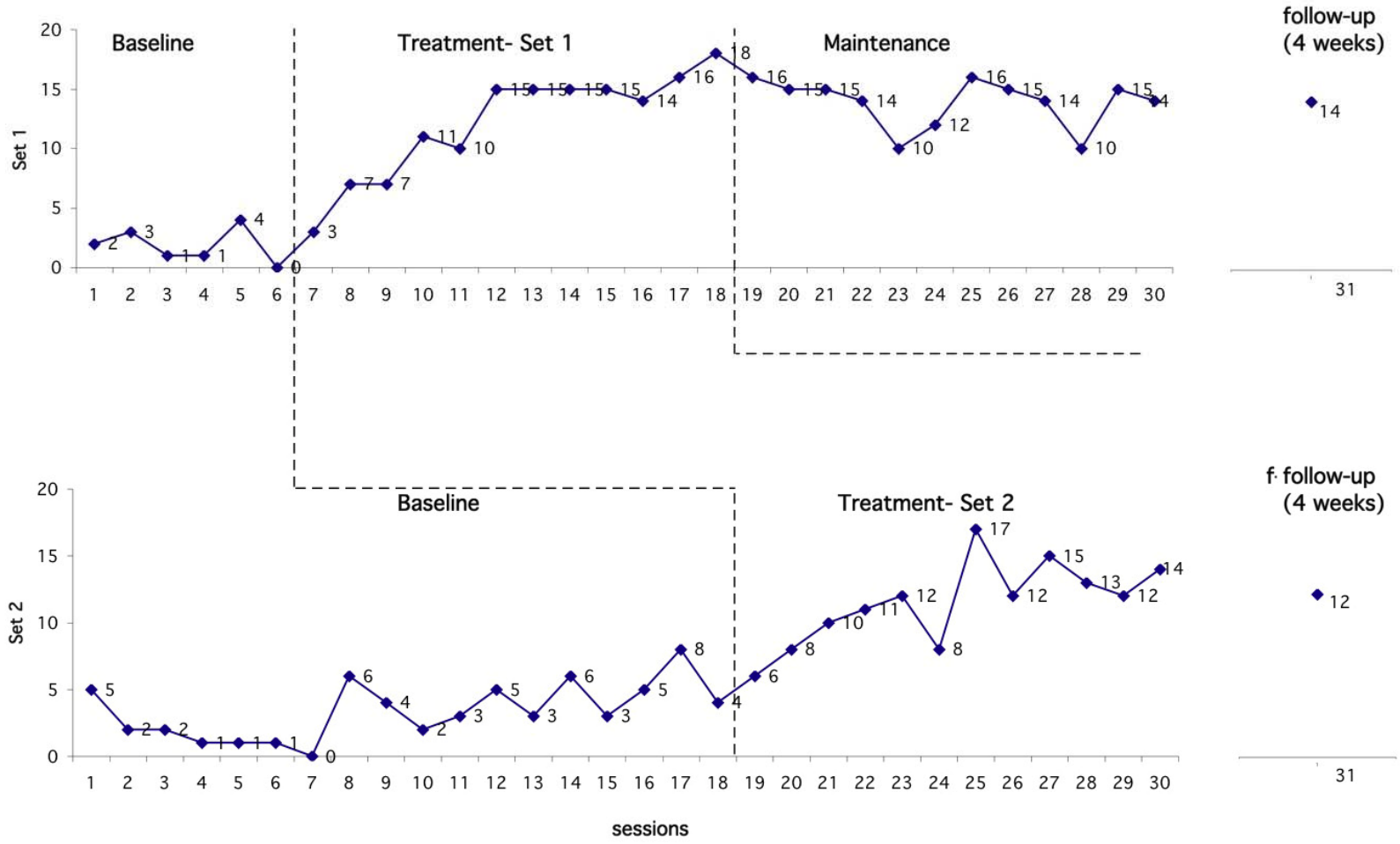


Figure 3. Subject BM (CG)

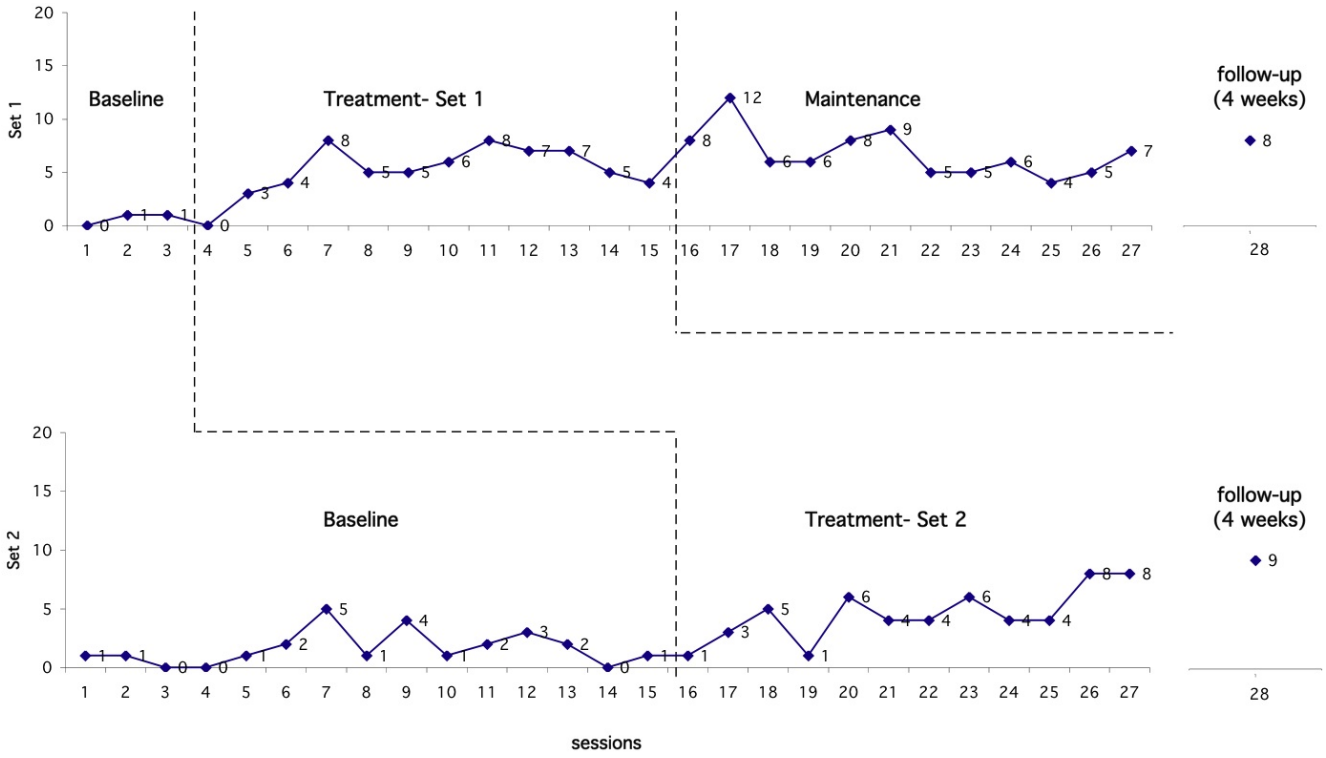


Figure 4. Subject EL (PSG)

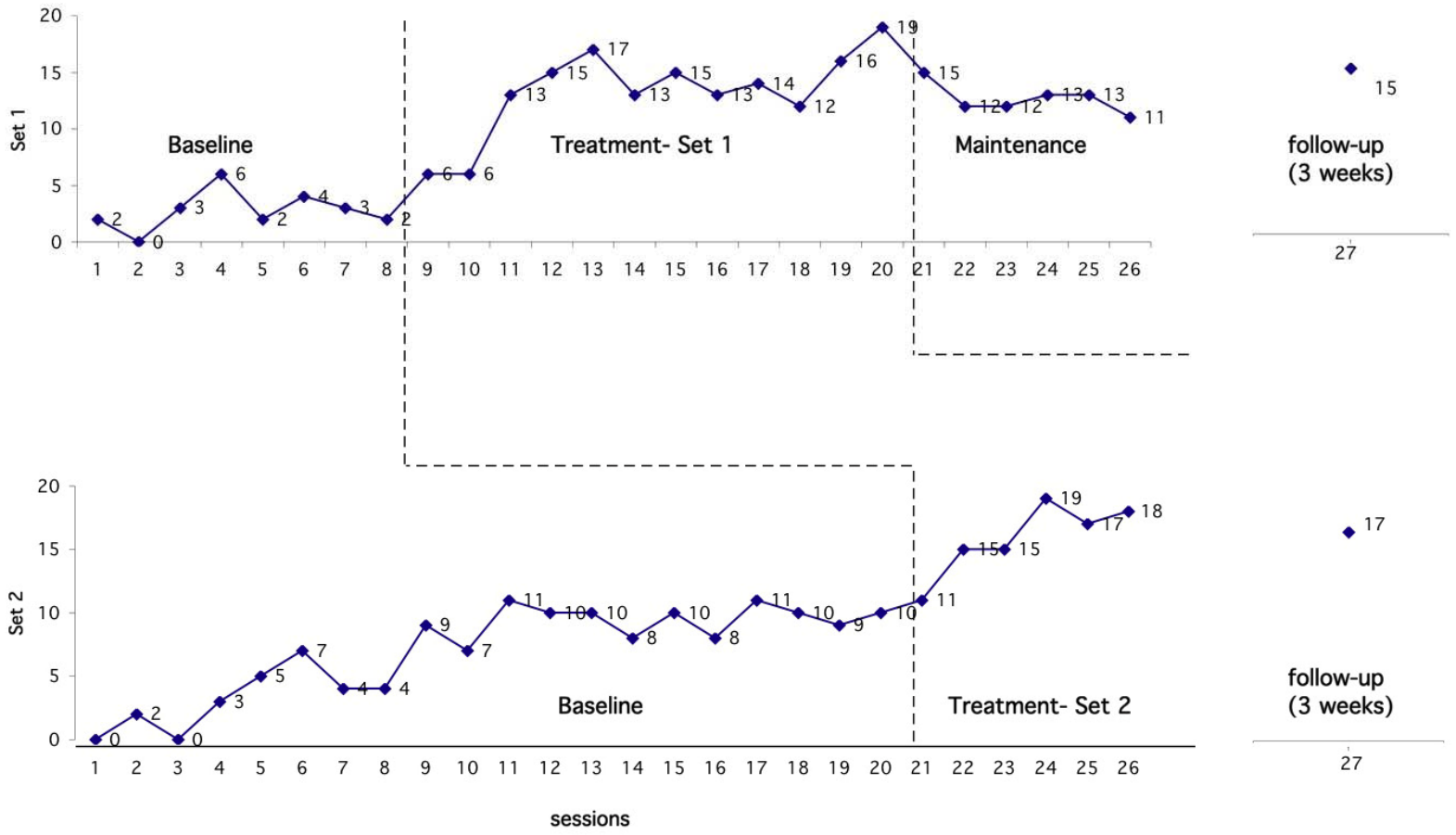


Figure 5. Subject EG (PSG)

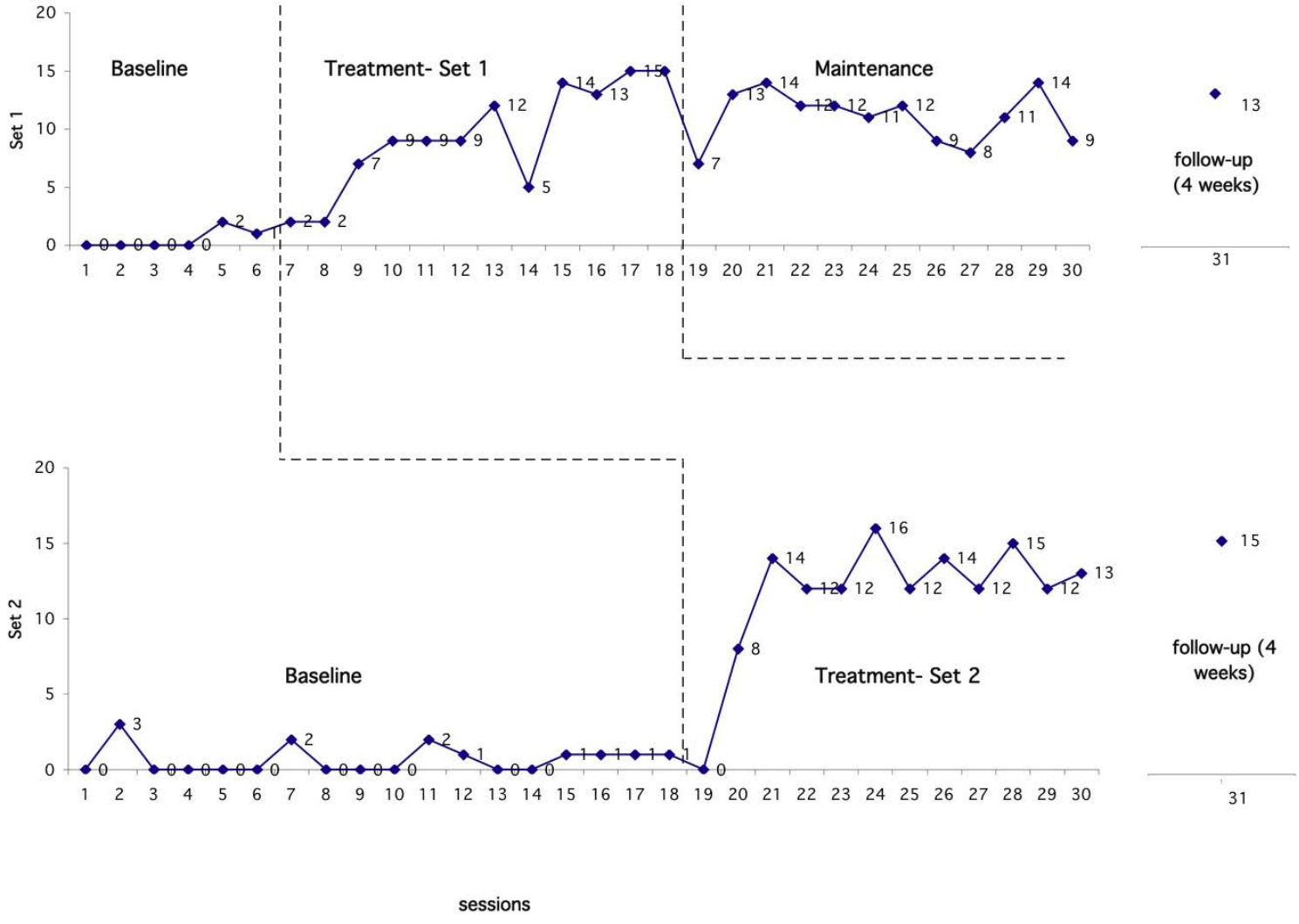
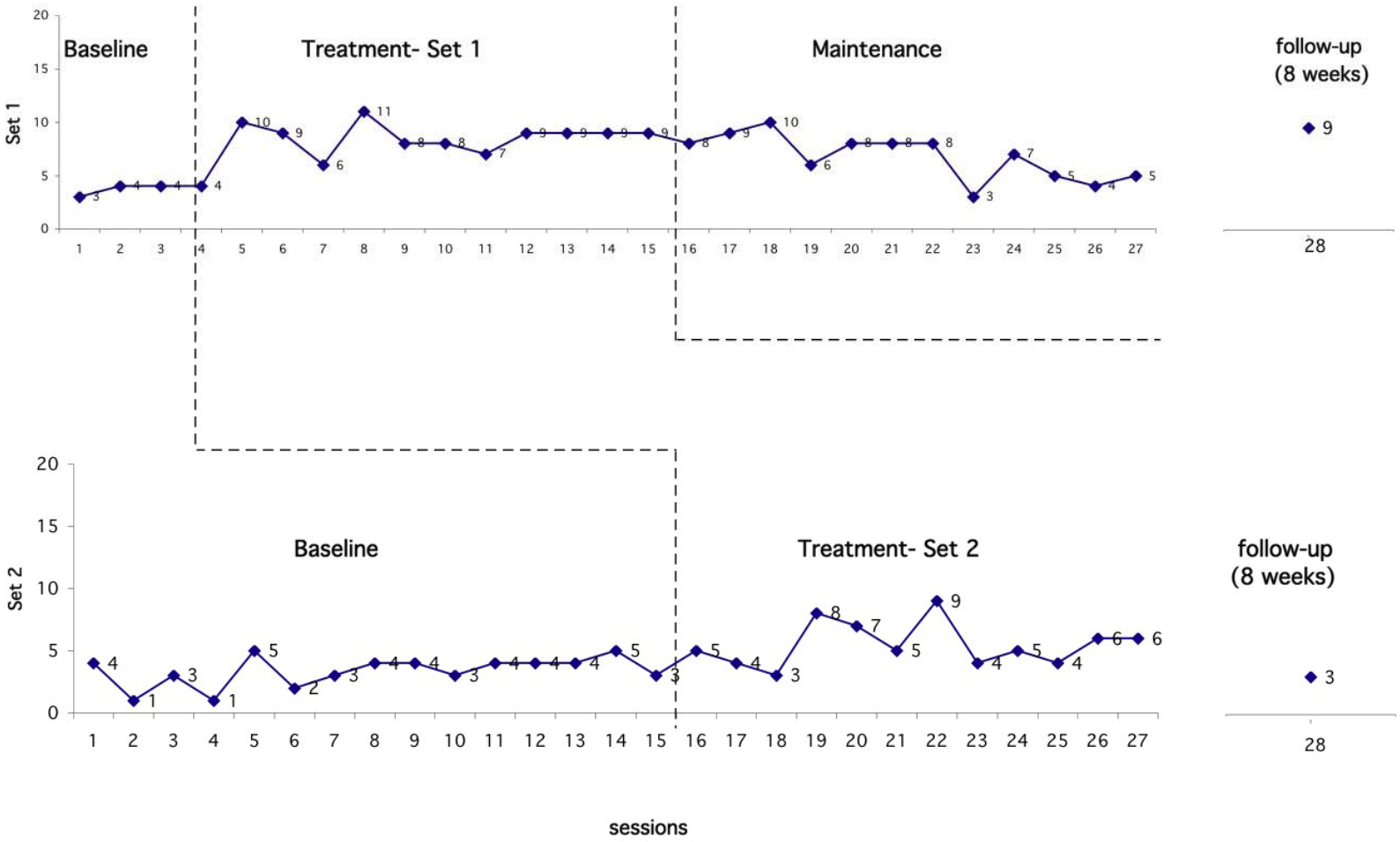


Figure 6. Subject RH (PSG)



		Set 1			Set 2	
		Baseline vs. Treatment	Baseline vs. Maintenance	4-week Follow-up	Baseline vs. Treatment	4-week Follow-up
Group	Subject					
	GM	10.74	13.02	7.82	11.74	13.18
CG	AS	7.78	8.37	8.49	3.91	3.91
	BM	8.9	10.83	12.99	2.3	5.26
	EL	5.5	4.86	6.05	2.67	2.73
PSG	EG	9.76	10.81	12.92	13.51	16.05
	RH	8.14	6	10.5	1.67	-0.35

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 impairements
* 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

Research Group	Module Used	Number of participants	Clinically Relevant Factors Studied		
			Etiologies & language impairment	Effectiveness when self-administered	Impact of therapy intensity
Jokel & Rochon (2009)	CN	2	NPA (P)		√
Jokel & Rochon (2010)	CN	1	SD (P)		
Raymer, et al (2006)	MMM	5	CVA 2(S) 3(P)		√
Raymer, et al (2009)	MMM	4	CVA (S)	√	
Ramsberger & Marie (2007)	CN	4	CVA 1(S) 3 (P)	√	√
Fink, et al (2002)	CN	6	CVA (P)	√	

CN=Cued Naming; MMM=Multimodality Matching;
NPA=Nonfluent Progressive Aphasia; SD=Semantic 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.
- IINDEPENDENT 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

Aftonomos,L.B., Steele,R., & Wertz,R. (1997). Promoting recovery in chronic aphasia with an interactive technology. *Archives of Physical Medicine and Rehabilitation, 78 (8),* 841-846.

Beeson, P. & Robey, R.R. (2006). Evaluating single-subject treatment research: lessons Learned from the aphasia literature. Neuropsychological Review. 16 (4), 161-169.

Cherney, L. R., Halper, A. S., Holland, A. L., & Cole, R. (2008). Computerized script training for aphasia: Preliminary results. *American Journal of Speech-Language Pathology, 17,* 19-34.

Choy, J., Holland, A., Cole, R., & Thompson, C. (2009). Sentactics: A virtual treatment of underlying forms. *Clinical Aphasiology Conference,* Keystone, CO.

Fink, R. B., Brecher, A., Schwartz, M. F., & Robey, R. R. (2002). A computer implemented protocol for treatment of naming disorders: Evaluation of clinician-guided and partially self-guided instruction. *Aphasiology, 16*(10-11), 1061-1086.

Jokel, R., Cupit, J., Rochon, E., & Leonard, C. (2009). Relearning lost vocabulary in nonfluent progressive aphasia with MossTalk Words. *Aphasiology, 23*(2), 175-191.

Jokel, R., Rochon, E., & Anderson, N. D. (2010). Errorless learning of computer-generated words in a patient with semantic dementia. *Neuropsychological Rehabilitation, 20*(1), 16-41.

Ramsberger, G., & Marie, B. (2007). Self-administered cued naming therapy: A single-participant investigation of a computer-based therapy program replicated in four cases. *American Journal of Speech-Language Pathology, 16,* 343-358.

Raymer, A., Carwile, K., Matthews, M., Johnson, T., & Todd, T. (2009). MossTalk training for word retrieval: Generalization across semantic categories. *Aphasiology,*

Raymer, A., Kohen, F., & Saffel, D. (2006). Computerized training for impairments of word comprehension and retrieval in aphasia. *Aphasiology, 20*(2), 257-268

Sobel, P., Fink, R., & Schwartz, M.F. (2000). The impact of computer-asssitsted aphasia therapy in the outpatient aphasia clinical setting: Report on a study funded by the McLean Contributionship. Unpublished manuscript.