MossTalk Training for Word Retrieval: Generalization Across Semantic Categories

Introduction

Many studies have examined effects of training for word retrieval impairments in aphasia (e.g., Nickels, 2002). Improvements are usually greatest for trained words, although recent findings indicate that generalization to some untrained words can be seen for words within the same semantic category (Kiran, 2007). Training effects are largest after intensive clinician-supported training. Techniques are needed that patients can implement independently to improve functional vocabulary. One means of supporting independent practice is the use of computers (Petheram, 2004; Fink et al., 2005; Wallesch & Johannsen-Horbach, 2004).

MossTalk Words (Fink et al., 2001) is an experimental computerized word retrieval training program designed to provide cues and feedback as patients participate in one of two training modules, cued naming or multi-mode matching exercises (MMME). Fink and colleagues (2002; 2005) reported that the MossTalk Words cued naming module (computer presented cueing hierarchies) completed with only partial clinician assistance led to improved word retrieval in individuals with phonologic-based word retrieval impairments. The MMME modules, in contrast, are patterned after studies reporting word retrieval improvements following semantic training in which patients complete word/picture matching tasks (e.g., Pring et al., 1990; Nickels, 1996). Raymer et al. (2006) reported that five patients with aphasia benefited from training using the MMME module when paired with spoken production as assisted by a clinician.

The purpose of this study was to evaluate the effects of the MossTalk MMME module when working independently without the clinician present. Further, we examined effects of training for untrained words within the same semantic category and across untrained semantic categories.

Participants

The study included four right handed individuals with aphasia subsequent to left hemisphere stroke, 1 man and 3 women. They ranged 47-71 years of age, and were 12-54 months post onset of aphasia. Testing with the Western Aphasia Battery (Kertesz, 1982) and the Boston Naming Test (Kaplan et al., 2001) indicated that all presented a pattern of Broca's aphasia with pronounced word retrieval impairments (Table 1). Further testing with an experimental lexical battery (Zingeser & Berndt, 1990) indicated that P1 and P4 had impaired word comprehension and retrieval performance indicative of semantically-based word retrieval impairments, whereas P2 and P3 had more intact comprehension and impaired word retrieval, as in phonologically-based word retrieval impairment. All provided written consent to participate in this treatment study.

Treatment Design and Methods

The study incorporated a single-participant multiple baseline design. The daily probe task required picture naming for 58-60 nouns. The naming sets varied across participants. P1 & P2: Set 1 - 20 phase 1 training pictures representing items from 4 different

semantic categories; Set 2 – 20 phase 2 training pictures from the *same* 4 semantic categories used in treatment phase 1; Set 3 – an untrained generalization set of 10 pictures from the four trained semantic categories; Set 4 – an untrained control set of 10 pictures from two untrained semantic categories. P3 & P4: Set 1 – 16 phase 1 training pictures representing items from 2 semantic categories; Set 2 – 16 phase 2 training pictures representing items from 2 *different* semantic categories; Set 3 – 16 generalization probes representing pictures from the trained categories in Set 1 and 2; Set 4 – an untrained control set of 10 pictures from two untrained semantic categories. The dependent variable in all sets was percent correct. Probes were administered for 3-4 baseline sessions and throughout the training phases 2-3 times per week. A final probe was administered at one month post training completion.

During daily independent training phases, the participants completed three MossTalk Multimode Matching Exercises: 1) spoken+written word/picture matching; 2) spoken word/picture matching; 3) written word/picture matching. Each exercise was implemented for each of the 16-20 target words presented with three semantically related distractors. If incorrect in matching, the participant re-attempted matching until the computer program indicated a correct match. The participant then attempted to say the name of the target picture as modeled by the computer program. No feedback was available on the accuracy of the spoken production. Participants practiced with the computer program 5 days per week for two weeks, during which they were seen 1-2 sessions per week to probe for progress. Treatment ended when performance reached 90% accuracy in 2 sessions or after two weeks (10 sessions) of training on a given treatment set. Results were graphed and effect sizes (d) were calculated comparing means in treatment and baseline relative to the baseline standard deviation (Busk & Marascuilo, 1992). An effect size >2.5 was considered a significant effect.

Results

Effect sizes are reported in Table 2. Improvements in picture naming were evident for 3 of 4 participants. Only P2 improved naming of trained words during both training phases. Little change was evident for the untrained generalization sets for the same semantic categories, however. P1 and P3 improved for trained words only during the first training phase. During phase 1, P3 also improved for one untrained set representing words of two untrained semantic categories. She did not improve for the generalization set of words from the trained semantic categories, however. Improvements were largely maintained at one month. Finally, P4 did not demonstrate improvements in her naming abilities across all phases of the experiment.

Standardized testing at the completion of training indicated some improvements beyond the standard error of measurement for 3 of 4 participants (Table 1). P2, P3, and P4 all improved on the WAB AQ, and P3 improved on the BNT.

Discussion

Independent training with the MossTalk Words MMME module led to modest language improvements in all four individuals with aphasia. Although P4 did not demonstrate increases on the probe naming task, but she did improve on the WAB subtests. Effect sizes for picture naming in this study were not as large as those observed in an earlier study in which computer training was provided with clinician assistance (Raymer et al., 2006). These observations are reminiscent of Drew and Thompson (1999) where participants showed greater treatment gains when spoken production of words was paired with performance of semantic matching exercises.

Generalization to untrained items within the same semantic category was limited in this study, as training items available within the MossTalk program largely represent typical exemplars of the semantic categories implemented. In contrast, Kiran (2007) has shown greater generalization effects when atypical category exemplars are trained. The only generalized naming improvements in this study came from P3 as she improved for some sets of unrelated words. The basis for that improvement is not clear.

An examination of participant test profiles sheds light on the different treatment responses across participants. P4, who responded poorly in the experiment had the most severe aphasia at baseline. P3, whose semantic processing abilities were better than the other three had greater improvements. These observations hint that semantic impairment may be an important factor in word retrieval treatment response, as has been noted in the naming treatment literature.

Whereas the MossTalk cueing exercises might be used independently with some success (Fink et al., 2005), the matching modules may require more clinician assistance to have a greater impact on word retrieval abilities. Although effects were fairly modest in this exploratory trial, all individuals were enthusiastic about the computer training and expressed the desire to continue the program once the experiment ended.

Table 1: Experimental and standardized test results

	P1		P2		P3		P4	
Western Aphasia Battery	*Pre*	*Post*	*Pre*	*Post*	Pre	Post	Pre	Post
Fluency (max 10)	2	3	3	0	5.0	6.0	1.0	4.0
Comprehension (max 10)	4.5	5.2	5.7	7.4	7.2	7.7	5.45	5.95
Repetition (max 10)	2.2	1.2	3.4	1.2	7.0	8.2	3.0	3.0
Naming (max 10)	2.3	2.2	5.1	4.8	5.2	6.0	2.3	2.3
Total AQ (max 100)	35.9	33.2	36.4	48.8	62.8	69.8	29.5	36.1
Boston Naming Test (max 60)	2	5	8	12	19	26	4	6
Experimental Lexical Battery								
% Noun Verification (n=60)	60.0		83.3		90.0		71.7	
% Picture Naming (n=60)	21.7		65.0		63.3		5.0	

Table 2: Treatment effect sizes (d) (*estimated due to stable baseline)

Training Phase 1	P1	P 2	P3	P4
Set 1 (trained)	**4.0**	**3.0***	**2.88**	0
Set 2 (untrained phase 2 set)	-.57	1.19	**10.34**	0
Set 3 (untrained generalization)	.14	1.29	1.73	0
			1.55	0
Set 4 (untrained control)	.25	.86	2.34	0
Training Phase 2				
Set 1 (maintenance)	1.07	.46	.53	1.0
Set 2 (trained - replication)	1.01	**2.97**	-.71	0
Set 3 (untrained generalization)	.65	1.36	-1.4	0
			1.41	0
Set 4 (untrained control)	.48	2.16	1.04*	0