Many treatment conducted to improve naming in aphasia have focused on retrieval of nouns (e.g., Kiran & Thompson, 2003). However, some researchers reported that some aphasic individuals show greater difficulty retrieving verbs than nouns (e.g., Berndt et al., 1997). Furthermore, some suggested that the verb retrieval failure in some aphasic individuals may underlie their sentence construction deficits (e.g., Marshall et al., 1998). This study examined the effect of a verb naming treatment on verb retrieval and sentence production of two non-fluent aphasic individuals. On the basis of the previous studies examining the influence of verb's semantic properties on aphasic verb retrieval (e.g., Kim & Thompson, 2004), the treatment approach focused on exploiting the association between a verb and its noun arguments to enhance aphasic participants' verb retrieval.

METHOD

Participant. Two individuals with Broca's aphasia participated. Table 1 presents the participants' demographic data. Table 2 shows the results of selected subtests administered to the participants. Both participants demonstrated more impaired verb naming than noun naming.

Materials. An unpublished verb battery developed by the author was administered twice. The battery depicted 169 action verbs in 4 x 6" color photographs, all of which elicited over 80% naming accuracy from twenty control adult participants. Verbs that each participant missed across both trials were used to select stimuli. For Participant 1 (P1), 15 training and 15 control verbs were selected. For Participant 2 (P2), smaller-sized verb sets (10 training and 10 control verbs) were selected due to his more severe motor speech difficulty. For both participants, verbs in the two sets were closely matched in frequency, number of syllables, and argument structure complexity. Finally, to control for effects of spontaneous recovery and repeated measures, a naming of abstract nouns to definition task was used (N=15 for P1 and N = 10 for P2).

Experimental design. The treatment protocol modeled after a single-subject A-B-A withdrawl with a multiple baseline across subjects design, to evaluate the effects of the verb treatment and to examine generalization to control verbs and sentence production. However, no true withdrawal phase was employed; instead, maintenance data were collected during the second A phase. Therefore, the design involved three phases: (1) baseline; (2) application of treatment; (3) maintenance.

Baseline procedures. Naming of verbs from the training and control sets, and naming of abstract nouns to definition were assessed for three consecutive sessions. The participants were given 20 seconds to respond. P1's naming to definition was not assessed during the first baseline session due to time constraints.

Treatment. Following the baseline phase, the treatment was applied to the training set. The treatment took participants through a series of steps that emphasized the association between verbs and their noun arguments. The specific treatment steps for each target were: (1) naming of the action picture; (2) naming in response to a three-sentence story presented with the picture depicting the action; (3) naming in response to a noun argument introduced in step (2), with no picture stimuli; (4) naming in response to an auditorily-presented three-sentence story with no picture stimuli; (5) naming of the action picture again. In all steps, failure to name led to an alternative step of pointing to the target verb out of four word choices. If pointing was incorrect, the examiner pointed to the correct choice while naming the verb, and then proceeded to the next step. The treatment was conducted twice a week for an hour-long session.

Treatment probes. Performance on the trained verbs, control verbs, sentence production of successfully retrieved trained and control verbs, and naming to definition were examined once a week. For sentence production, a sentence that included the appropriate verb occurring in a grammatically and semantically correct context for the given picture was scored as correct.

Data analysis. During treatment, the data were graphed. The criterion for treatment was 80% correct naming of the trained verbs over two consecutive sessions or a total of 20 sessions. Generalization was considered to have occurred when behaviors increased at least 40% above baseline performance.

Maintenance and post-treatment testing. All probe test items were repeated five weeks after the termination of the treatment to examine maintenance of the treatment effect. In addition, narrative language samples were collected during pre-treatment and maintenance testing to examine the effect of the treatment on the participants' spontaneous speech.

RESULTS AND DISCUSSIONS

Participant 1

Verb naming. As shown in Figure 1, P1 reached the criterion of 80% accuracy across two consecutive sessions by Probe session 7, demonstrating over 50% increase in accuracy from the best baseline performance. No generalization was noted on the naming of untrained (i.e., control) verbs. As expected, noun naming-to-definition did not improve.

Sentence production. Generalization to sentence production involving trained verbs was noted. During the first probe session, P1 produced one grammatical sentence out of four correctly named trained verbs. During the last probe session, he produced nine grammatical sentences out of 13 correctly retrieved verbs. On the contrary, he produced at most one grammatical sentence out of the small number of correctly retrieved control verbs throughout all probe sessions, showing no generalization.

Maintenance. P1's accuracy in naming trained verbs was decreased from the last probe session but was maintained at a level which was still 40% higher than the best baseline performance. However, his production of the sentences involving trained verbs decreased to 4 grammatical sentences out of 10 retrieved verbs. There was no change in the retrieval of either control verbs or the sentence production involving the control verbs.

Narrative production. Values reported in the Table 3 indicate that, following the treatment, P1's spontaneous speech has improved in the measures that are closely related to the nature of the verb treatment approach such as % grammatical sentences and % verbs used with correct argument structure. Overall, these values suggest generalization of the treatment effect to his spontaneous speech.

Participant 2

Verb naming. Figure 2 shows that P2 rapidly acquired the trained verbs once the treatment was applied. However, he reached a plateau during the last four probe sessions. Due to his lack of motivation as a result of the plateau, the treatment was terminated after 10 treatment sessions, without reaching the criterion. However, his last probe data show accuracy level which is 40% higher than the best baseline performance, indicating that the treatment was effective in facilitating his verb retrieval of some trained verbs. No generalization was noted on the naming of either untrained (i.e., control) verbs or noun naming-to-definition.

Sentence production. P2's sentence production did not improve. When prompted, he often produced a stereo-typed sentence structure ("verb-ing it" such as "pouring it"). It is likely that his moderate motor speech difficulty posed too great a challenge for him to attempt an utterance any longer than two words at a time.

Maintenance. P2's naming of trained verbs was maintained at the level of the last probe session. Naming of control verbs and naming nouns-to-definition remained low. P2 produced no grammatical sentence during the maintenance probe.

Narrative production. As shown in Table 3, P2's narratives showed improvement in the proportion of verbs produced with correct argument structure. It appears that, following the treatment, P2 has become more aware of the need of argument structures around the verbs and was able to produce them more frequently than pre-treatment, although not in a completely grammatical sentence. Overall, P2's spontaneous speech showed limited generalization of the verb treatment to sentence production.

CONCLUSION

Results indicate that treatment focusing on the association between the verb and its noun arguments was effective in facilitating retrieval of verbs. As predicted, there was no generalization to control verbs, however, generalization to sentence production was demonstrated in the treatment context in one and spontaneous speech in both participants. Overall, the results of this study confirm the theory behind the verb treatment approach in that training verbs along with its noun arguments improve not only single verb retrieval but also sentence production in some individuals with aphasia. The results also suggest that individuals with moderate motor speech difficulty may not significantly benefit from this treatment approach.

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Table 1

Participants' demographic data

Variables	Participant 1	Participant 2
Age	50	41
Education	16 years	16 years
Language	Monolingual, native English	Monolilngual, native English
Handedness	Right	Right
Time post-onset	17 months	46 months
Etiology	Left CVA	Left CVA
Motor speech difficulty	Mild apraxia of speech (AOS)	Moderate AOS and dysarthria

Table 2

Participants' pre-treatment language test data

Test	Participant 1	Participant 2
Western Aphasia Battery (WAB)		
Aphasia Quotient	69.3	56.8
Fluency	5	2
Auditory Comprehension	6.65	7.9
Repetition	7.4	4.9
Naming	6.6	6.6
Test of Adult/Adolescent Word Finding (TAWF)		
Picture Naming: Nouns	25/37 (67.6%)	26/37 (70.3%)
Picture Naming: Verbs	12/21 (57.1%)	11/21 (52.4%)
Noun Comprehension	30/37 (81.1%)	34/37 (91.9%)
Verb Comprehension	21/21 (100%)	19/21 (90.5%)
Unpublished Verb Battery (Northwestern Verb Test)		
Verb Naming	18/36 (50%)	14/36 (38.9%)
Noun Naming	31/36 (86.1%)	33/36 (91.7%)/

Table 3

Comparison of selected values of linguistic variables derived from narrative language samples pre- and post-treatment

Variables	Participant 1		Participant 2	
	Pre-	Post-	Pre-	Post-
Total utterances	28	52	29	25
MLU	4.68	4.21	1.87	2.35
% grammatical sentence	33%	49%	0%	0%
% verbs in open class words	54%	40%	15%	10%
% verbs with correct argument structure	77%	95%	17%	60%
% correct verb morphology	77%	93%	67%	40%

Figure 1

Participant 1's accuracy for verb naming and control noun naming-to-definition.

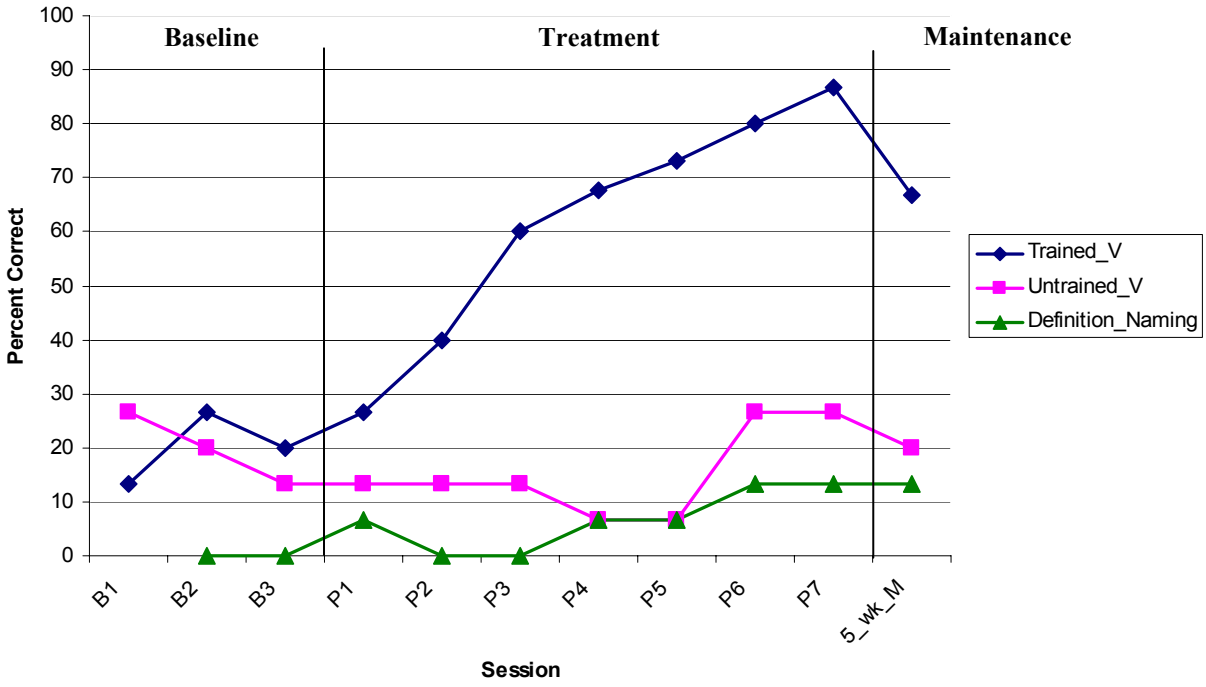

Figure 2

Participant 2's accuracy for verb naming and control noun naming-to-definition.