Previous studies aimed at training compensatory strategies for language deficits in aphasia have met with limited success. Purdy et al. (1994) trained 15 individuals with aphasia to acquire multiple communication strategies for specific concepts (verbal, gestural, pictorial) and examined use of these strategies on a referential communication task. Participants typically attempted a verbal response initially; however, when this failed, they spontaneously switched to an alternative modality only 37% of the time.

Yoshihata et al. (1998) studied mode interchange skills of three individuals with aphasia. They first trained participants to provide a gesture or drawing to represent 18 concepts. The acquisition phase was followed by a usage phase during which participants were required to request an object using the trained modes. Results were inconsistent and participants required additional training for generalization.

Each mode of response (gesture, verbal, pictorial) may be viewed as a specific extension of the semantic representation of a concept. Use of the varied modalities requires the ability to shift between different mental sets, one of the three primary components of executive functioning (Miyake, et al., 2000). Research with aphasic individuals has shown normal-range shifting ability when working memory demands are reduced (Allen & Martin, 2008). Consequently, it seems likely that difficulties with adopting non-verbal compensatory responses relate to the nature of patients' semantic representation. Here, we focus on the possibility that alternative methods of expression are not salient enough to enable shifting to succeed.

The limited success noted in the Purdy et al. (1994) and Yoshihata et al. (1998) studies may be because these studies trained concepts one modality at a time, which may not be sufficient to produce an integrated multi-modal representation. We investigated the possibility that training these modalities simultaneously would increase the availability of alternative modes of expression by creating a more tightly integrated multi-modal conceptual unit. The purpose of this pilot study was to determine whether such training would improve aphasic individuals' use of multiple modalities in a functional communication task.

Method

Participants

Two men with moderate aphasia participated in this project. BW is 56-year-old man, four years post left-hemisphere stroke. His speech was non-fluent, and was further compromised by a moderate-severe apraxia of speech. His verbal output was characterized by one and two word approximations. Intelligibility was fair-good, depending on the listener's knowledge of the topic or context. He could comprehend conversation, respond reliably to concrete yes/no questions, and follow directions in context.

LK is a 73-year-old man, eight years post left-hemisphere stroke. His verbal output was characterized by word-finding problems and paraphasic errors, with islands of fluent, appropriate phrases and short sentences. He comprehended familiar conversation, responded reliably to yes/no questions, and followed directions in context. (See Table 1).

Assessment

Communicative Activities in Daily Living-2 (CADL-2) (Holland Frattali, & Fromm, 1999). The CADL-2 was administered to assess overall functional communication and to determine a baseline cognitive flexibility score (Purdy & Koch, 2006).

Referential Communication Task. This task was carried out in a barrier format. Participants were required to describe 15 action pictures to their communication partner who was blinded to the target picture. The partner was asked to select the appropriate picture from four semantically similar choices, based on information provided by the participant. Participants were instructed to use whatever means necessary to describe the picture. The cognitive flexibility score was calculated.

Treatment

Interchanging Modalities. Multiple graphic representations of 20 concepts were used for training to emphasize that a single concept could be represented many ways. Participants were instructed to convey the target concept by verbalizing, gesturing, writing, and/or drawing. Direct input and feedback were provided to elicit a correct production in each modality. Following practice with all modalities for a single concept, a new concept was introduced. Feedback was faded and participants were probed to utilize another modality. The 20 concepts were drilled 2-4 times per session. Participants were seen in a university clinic for one to two, one-hour sessions per week over a period of five weeks.

Results

BW spontaneously provided a minimum of three different modalities for 19/20 concepts by the end of training. Post-training, his cognitive flexibility score increased from 28% to 71% on the CADL-2 and from 37% to 62% on the referential communication task (See Table 2).

LK spontaneously switched modalities for 11/20 concepts during training. His cognitive flexibility score increased from 6% to 45% on the CADL-2 and from 5% to 28% on the referential communication task (See Table 3). However, although LK demonstrated some improvement, his overall scores remained poor. His poor performance on the Pyramid and Palm Trees test, a test that requires participants to match pictures according to different semantic features, suggests that his improvement may have been limited by generally poor semantic representations. Therefore, a semantic treatment program was initiated, which aimed at increasing the salience of relevant features.

Semantic Treatment. LK was provided with six picture cards that could be sorted into two groups of three, based on a variety of concrete and abstract semantic features. He was asked to sort the picture cards in as many groups as possible. A semantic feature analysis chart was jointly completed by LK and the clinician for each picture. Once features were identified, similarities and differences among the objects were discussed, and then the sorting task proceeded. Initially, specific guidance was provided, then cueing.

Results

During baseline, LK spontaneously completed one sort (category- fruits/vegetables). Over the course of treatment, he completed up to three different sorts (category, color, size). Improvement on the Pyramids and Palm Trees test was noted, as well as on the referential communication task (See Table 3). A reduction in the number of opportunities to switch modalities was seen as a result of more accurate verbalizations. In addition, a slight increase in cognitive flexibility was observed.

Discussion

Results of this pilot study suggest that simultaneous multi-modal training may enhance communication in at least some individuals with aphasia, particularly those with relatively intact semantic representations. We interpret these results within the context of the interactive activation (IA) model of lexical access (Dell, et al. 1997), which suggests that brain damage reduces the ability to transmit activation between semantic and verbal representations. While the (IA) model has been limited to considerations of verbal communication, our results can be explained if this model were extended to include non-verbal modes of communication. We believe that our training serves to increase the weighting of links between alternative communication methods and the semantic representation, thereby increasing the likelihood that individuals will use them.

It is understood that little can be concluded on the basis of a single case study; however, the fact that after only 8 training sessions BW’s performance exceeded that of all participants in Purdy’s (1992) study is encouraging and suggests that simultaneous, or integrated conceptual training, may be a more efficient treatment approach.

Individuals with impaired semantic knowledge may not benefit as much from this approach, which is not surprising. When semantic information is missing, holes are created in the semantic network, decreasing the probability of accessing the concept. When LK’s semantic system was directly addressed, gains in both semantic knowledge and communicative flexibility were evident.

Theoretical and clinical implications will be discussed.

Table 1. Subject characteristics.

	BW	LK
WAB AQ	34.5	25.8
Pyramid & Palm trees	46/52 (89%)	35/52 (67%)
Age and gender	56 year old male	73 year old male
Time post stroke	4 years	8 years
Co-morbitities	Moderate-severe verbal apraxia	Moderate limb apraxia
Motor status	Right hemiparesis	Decreased right hand sensation
Ambulation	Wheel chair bound	Ambulatory
Education	High school graduate	High school education
Occupation	Transfer operator	Retired electrician

Table 2. Results for BW: Number of opportunities to switch, number of successful modality switches, and cognitive flexibility score (percent of successful switches).

	CADL			Referential Communication Task		
	# of opp. to switch	# of succ. switch	Cognitive flexibility	# of opp. switch	# of succ. switch	Cognitive flexibility
Pre-training	14	4	28	27	10	37
Post-training	14	10	71	24	15	62

Table 3. Results LK: Number of opportunities to switch, number of successful modality switches, and cognitive flexibility score (percent of successful switches).

	CADL			Referential Communication Task			Pyramids & Palm Trees
	# of opp. to switch	# of succ. switch	Cognitive flexibility	# of opp. switch	# of succ. switch	Cognitive flexibility	
Pre- cognitive flexibility training	15	1	6	19	1	5	34/52 (65%)
Post- cognitive flexibility training	11	5	45	21	6	28	35/52 (67%)
Post-semantic training				12	4	33	46/52 (89%)

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