

Introduction

Individuals with aphasia are reported to communicate better than they talk (Holland, 1982). Although oral expressive language and written language are impaired, many individuals with aphasia are able to compensate by utilizing other response modalities. These observations have been used to support aphasia treatments that encourage aphasic individuals to communicate using any means available, including speaking, writing, pantomime, and drawing (see Davis & Wilcox, 1985). While there is evidence that pantomime and drawing may be used to compensate for deficits in spoken and written responses, deficits in the ability to communicate through gesture and drawing have also been observed in aphasic individuals (Duffy & Duffy, 1990; Lyon, 1995). Models of lexical access for spoken and written output (Caramazza & Hillis, 1990) and models of gestural (Raymer & Rothi, 2000) and drawing production (vanSommer, 1989) have proposed a common semantic system for both verbal (spoken and written) and nonverbal (gestural and drawing) response modalities. Moreover, these models suggest performance in each response modality may be influenced by stimulus input modality, e.g. auditory, visual-printed, or visual-picture. Thus, performance in each response modality may be impaired relative to the performance of non-aphasic individuals, and performance in each response modality may differ within stimulus modalities. However, the degree to which each modality is impaired and the influence of the stimulus mode on the accuracy of a response is unclear.

To date, only a few investigators (Sacchett, Byng, Marshall, & Pound, 1999) have systematically examined aphasic verbal and nonverbal responses on the same elicitation tasks. And, no investigator has systematically examined the influence of different stimulus modes on performance in each response modality. Empirical study of the speaking, writing, pantomime, and drawing responses of individuals with aphasia on elicitation tasks that utilize different stimulus modes may improve understanding of the underlying mechanisms involved in performance in each modality and may provide information to plan treatment.

Methods

Twelve participants with aphasia (PWA) and twelve participants without aphasia (PWNA) were recruited for the study. The selection criteria for all participants are shown in Table 1. Additional criteria for individuals with aphasia are shown in Table 2. The demographic data for participants with aphasia are shown in Table 3.

All participants were administered the *Western Aphasia Battery* (WAB) (Kertesz, 1982), the *Test of Adolescent/Adult Word Finding* (TAWF) (German, 1990), the *Pyramids and Palm Trees Test* (PPT) (Howard & Patterson, 1992), the *Limb Apraxia Test* (LAT) (Duffy & Duffy, 1990), the *Token Test* (Spreen & Benton, 1969), and the *Reading Comprehension Battery for Aphasia* (RCBA) (LaPointe & Horner, 1979). Participant performance on these measures is shown in Table 4. All participants completed twelve experimental conditions. In each condition, twenty stimuli were presented through one of three stimulus presentation modes (pictorial, auditory, and printed) and required a response in one of four response modalities (speaking, writing, pantomime, or drawing). The same twenty targets were used in each condition. The presentation of the conditions was counterbalanced across subjects.

In the pictorial stimulus mode, the stimuli consisted of individual black line drawings of the 20 target items from Snodgrass and Vanderwart (1980). In the auditory stimulus mode, the stimuli consisted of single sentence descriptions for each of the 20 target items (e.g., "This is an

object that has a handle and a metal head and is used to pound nails”). In the printed stimulus mode, the stimuli consisted of the same 20 single sentence descriptions of the target items used in the auditory task. In the speaking task, the participant was asked to say the name of the target item. In the writing task, the individual was asked to write the name of the target item. In the pantomime task, the participant was asked to demonstrate how to use the target item. Finally, in the drawing task, the participant was asked to draw a picture of the target item. Performance in each condition was scored using the 16-point multidimensional scoring system from the *Porch Index of Communicative Abilities* (Porch, 1981).

Results

The PWNA performed significantly better than the PWA in each response modality (speaking, writing, gesturing, drawing) within and across stimulus modes (pictorial, auditory, printed) (See Table 5).

The data for PWA in each condition are shown in Table 6. In the speaking modality, PWA performed significantly better in the pictorial condition than the printed condition. In the writing modality, there was no significant difference in performance among the three stimulus conditions. In the pantomime modality, performance was significantly better in the pictorial condition compared to the auditory condition and the printed condition. Finally, in the drawing modality, there were no significant differences in performance among the three stimulus conditions.

For PWA, in the pictorial condition, performance in the speaking modality was significantly better than performance in the writing and drawing modalities. Performance in the pantomime modality was significantly better than performance in the speaking, writing, and drawing modalities.

For PWA, in the auditory condition, performance in the speaking modality was significantly better than performance in the writing and drawing modalities. Performance in the pantomime modality was significantly better than performance in the writing and drawing modalities.

For PWA, in the printed condition, there was no significant difference in performance between any of the response modalities.

Discussion

The results of the present investigation provide potential implications for the management of aphasia. First, the results confirm the need to examine performance in all response modalities, because deficits in both verbal and nonverbal response modalities are likely, although they may not be equally impaired in all modalities. In the current investigation, PWA tended to perform better in pantomime and speaking compared to writing and drawing. It was hypothesized that performance in pantomime and drawing would be significantly better than performance in speaking and writing. Both pantomime and drawing provide a means of communication that does not require the use of linguistically coded forms (i.e., phonemes and graphemes), which are often impaired in aphasia. Instead, the results suggest performance in the non-graphic response modalities (speaking and pantomime) may be superior to performance in the graphic response modalities (writing and drawing). This does not indicate that written naming performance cannot be equal or superior to spoken naming in individuals with aphasia--

cases of superior written naming to spoken naming performance have been reported (Bub and Kertesz, 1982; Caramazza and Hillis, 1990). However, it suggests that, in general, aphasic individuals are often more impaired in writing, and it implies that writing may be more susceptible to the effects of aphasia.

Performance in each response modality may differ depending upon the mode of stimulus presentation. For example, pantomime performance may be more accurate when pictorial stimuli are used, compared to auditory or printed stimuli. This is consistent with predictions of Raymer and Rothi's (2000) model of pantomime production, which suggests information from a pictorial stimulus may by-pass the semantic system and directly activate the production of a pantomime. Moreover, speaking performance appears to be more accurate with pictorial stimuli compared to printed stimuli. Thus, stimuli may differ in adequacy. The adequacy of the stimuli in a treatment protocol is important, because it may influence an aphasic individual's level of success. Therefore, the adequacy of the stimuli used during treatment should be evaluated and reevaluated as treatment continues.

References

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Tables

Table 1. Selection criteria for all participants

1. Able to provide informed consent
2. 85 years of age or younger
3. Literate or premorbidly literate in English
4. No history of psychiatric disorders or any coexisting major medical disorders
5. At least 9 years of formal education
6. Auditory sensitivity no worse than an estimated 40 dB speech reception threshold in the better ear using the Carhart Method
7. Visual acuity no worse than 20/100 corrected, in the poorer eye, determined by a pocket-sized Snellen chart
8. Ability to use at least one upper extremity to write, gesture, and draw
9. Right-handed, or in the aphasic participants, premorbidly right-handed

Table 2. Selection criteria for individuals with aphasia

1. Aphasic subsequent to a first left hemisphere cerebrovascular accident
2. More than 3 months postonset from stroke at initial testing
3. Severity of aphasia indicated by an Aphasia Quotient score from 15 through 90 on the *Western Aphasia Battery* (WAB)

Table 3. Demographic data for normal (N=12) and aphasic (N=12) participants.

Variable	Mean	Range	<u>SD</u>
Age (Years)			
Aphasic participants	63.83	53-79	10.19
Non-aphasic participants	65.08	55-75	8.58
Educational Level (Years)			
Aphasic participants	13.42	9-18	2.57
Non-aphasic participants	13.25	9-18	2.77
Time Poststroke (Months)			
Aphasic participants	77.08	6-144	59.53

Table 4. Aphasic performance on language, praxis, and drawing measures.

	Age	Sex	WAB AQ	Aphasia Type	WAB Write	WAB Draw	TAWF	LAT	Token Test	PPT	RCBA
1	57	m	72.2	Broca	41.0	22.0	35	20.49	139	49	64
2	53	m	75.8	Cond.	19.5	13.0	26	18.15	18	43	28
3	76	f	84.8	Anomic	87.0	17.5	80	17.16	129	48	95
4	64	m	24.2	Wernicke	0.0	5.5	0	16.58	36	20	26
5	71	m	84.4	Anomic	85.5	23.0	77	20.67	132	47	90
6	70	m	26.5	Broca	0.0	11.0	0	19.42	79	44	35
7	59	m	18.5	Global	0.0	8.5	0	15.66	48	34	22
8	60	f	72.6	Conduct.	38.0	25.0	15	20.10	99	42	50
9	43	f	88.0	Anomic	98.0	20.0	80	19.70	152	45	86
10	70	f	17.7	Broca	0.0	7.0	0	13.53	74	40	37
11	64	m	70.4	Conduct.	74.0	18.0	43	19.06	155	50	90
12	79	m	43.4	Broca	0.0	7.5	1	17.72	61	42	19

Table 5. Aphasic and non-aphasic performance in each response modality across stimulus conditions.

Response Modality	Mean	Range	SD
Speaking*			
Aphasic participants	9.25	3.13-14.80	4.32
Non-aphasic participants	14.90	14.57-15.02	0.17
Writing*			
Aphasic participants	7.90	3.83-14.18	3.65
Non-aphasic participants	13.92	12.13-15.00	1.11
Pantomime*			
Aphasic participants	9.92	4.95-14.35	3.45
Non-aphasic participants	14.41	14.05-14.92	0.32
Drawing*			
Aphasic participants	8.19	4.58-13.78	3.38
Non-aphasic participants	12.79	9.03-14.60	1.45

*significant at $p < .001$

Table 6. Aphasic performance in each response modality in each stimulus condition.

Response Modality	Pictorial	Auditory	Printed
Speaking			
Mean	9.83	9.31	8.62
SD	4.61	4.45	4.44
Range	3.00-14.85	3.00-14.95	3.40-14.80
Writing			
Mean	8.12	7.82	7.76
SD	3.64	3.81	3.58
Range	4.00-14.05	3.00-13.80	4.50-14.70
Pantomime			
Mean	11.04	9.87	8.85
SD	3.17	3.69	4.25
Range	5.85-14.25	4.00-14.20	5.00-15.03
Drawing			
Mean	8.44	8.10	8.03
SD	3.23	3.44	3.70
Range	4.85-13.10	4.10-13.75	4.70-14.75