Introduction

People with aphasia generally experience better reading comprehension of material formatted in aphasia-friendly manners (e.g., Rose Worrall, & McKenna, 2003) than material formatted in other ways. Aphasia-friendly principles include linguistic-based text modifications (i.e., increased white space, simplified syntax and vocabulary) and visual supports (i.e., relevant images) (Howe, Worrall, & Hickson, 2004). However, conflicting reports exist in the literature regarding the helpfulness of pairing visual supports with text (Brennan, Worrall, & McKenna, 2005; Dietz, Hux, McKelvey, & Beukelman, 2009; Rose, Worrall, Hickson, & Hoffman, 2011). Also, linguistically-based supports may bolster the reading comprehension of people with aphasia in the same way these supports help children understand written materials. Linguistic supports include the use of topic setters (e.g., organizational headings) and keywords alerting a reader to the topic and activating prior knowledge. To date, investigators have performed only preliminary explorations about the effects of linguistic and visual supports on the reading comprehension of people with aphasia. Therefore, the purpose of this study was to compare the individual and combined effect of linguistic and photographic supports on the reading comprehension of narratives by people with aphasia.

Method

Participants

Participants included 17 people with aphasia (12 with nonfluent aphasia and 5 with fluent aphasia) who were at least 12 months post-stroke. The researchers used the *Western Aphasia Battery-Revised* (*WAB-R*) (Kertesz, 2007) to classify aphasia type and severity. No significant differences emerged between the groups for age, educational attainment, or reading performance on the *Reading Comprehension Battery for Aphasia (RCBA-2)* (LaPointe & Horner, 1998) (see Table 1 for demographic information).

Materials

Narratives. The researchers developed six narratives. Each story conveyed a problem and its resolution. The narratives were balanced for number of words (Range = 74-75 words) and Flesch-Kincaid Grade Level (Range = 5.2-5.5) (Flesch, 1948). The researchers calculated a passage dependency index (*M* = .93) (Tuinman, 1974) establishing that people could not respond to questions at better-than-chance levels without reading the narratives.

Photographic and Linguistic Supports. Two linguistic supports (i.e., topic setters and keywords) and one visual support supplemented each narrative. For the topic setters, the researchers developed a 2-3 word story title for each narrative. The topic setters provided information about the primary setting or situation without revealing the solution to the story's central problem. For the keywords, the authors independently identified 15 keywords that conveyed critical content regarding major story events. For the visual support, the researchers developed one high-context photograph that captured the meaning conveyed at the beginning of each story. The Appendix contains a sample narrative and the corresponding supports. For presentation purposes, the supports appeared on the front and inside left-hand portions of a

manila folder; the narratives appeared on the inside right-hand portion of the folders. All text was double-spaced and appeared in 18-point bold-faced font.

Comprehension assessments. The researchers developed 15 multiple-choice questions to assess participants' comprehension of each narrative. Answer choices included the correct response plus three foils presented in a Written Choice format (Garrett & Beukelman, 1992).

Procedures

The experimental tasks included reading the six narratives—each in a condition using none, one, or two of the reading supports—and completing the associated comprehension assessment. The participants viewed the reading supports on the front of the folder for 30 seconds prior to the researcher opening the folder to display both the supports and the narrative. Stimuli were left in view of participants while they responded to questions. The researchers systematically alternated the pairing of stories across the various conditions.

Data Analysis

The researchers employed a mixed ANOVA ($p \leq .05$) to determine whether significant differences existed between the participants with fluent versus nonfluent aphasia across the six reading support conditions. As appropriate, computation of Fisher's Protected LSD procedure (Rosner, 2005) ($p \leq .05$; critical LSD value = 7.212) provided a means of further evaluating differences among the support conditions.

Results

Computation of a mixed ANOVA revealed no main effects for aphasia type ($F_{(1, 15)} = .342$, $p = .568$, $MSE = 2881.664$) or reading support condition ($F_{(5, 75)} = 1.427$, $p = .224$, $MSE = 108.890$). However, a significant interaction effect occurred between aphasia type and reading supports ($F_{(5, 75)} = 2.702$, $p = .027$, $MSE = 189.890$) (see Figure 1). The post-hoc analyses revealed that the participants with fluent aphasia attained significantly higher reading comprehension accuracy scores in the No Support (LSD = 11.36), Keywords (LSD = 15.60), and Photograph (LSD = 15.94) conditions than the participants with nonfluent aphasia; the two groups performed comparably in the other reading support conditions. Table 2 provides individual performance data.

Fluent Aphasia

For the participants with fluent aphasia, reading with the support of a photograph produced significantly higher comprehension scores than any of the other conditions (Photograph vs. No Support: LSD = 8.75; Photograph vs. Topic Setter: LSD = 15.00; Photograph vs. Keywords: LSD = 8.25; Photograph vs. Photograph + Topic Setter: LSD = 13.75; Photograph vs. Photograph + Keywords: LSD = 20.00). The participants with fluent aphasia also demonstrated significantly higher reading comprehension scores in the No Support condition than the Photograph + Keywords condition (LSD = 11.25) and in the Keywords condition than the Photograph + Keywords condition (LSD = 11.75). Overall, this group exhibited higher levels

of reading comprehension accuracy given photographic supports than given linguistic supports or a combination of linguistic and photographic supports. The combination of Photographs + Keywords was especially harmful to the reading comprehension of participants with fluent aphasia.

Nonfluent Aphasia

The participants with nonfluent aphasia achieved significantly higher reading comprehension scores when passages appeared with a combination of photographic and linguistic supports than when they appeared with only one type of support. Their reading comprehension in the Photograph condition was equivalent to that achieved in the Topic Setters condition (LSD = 3.12) and in the No Support condition (LSD = 4.17); they achieved significantly higher reading comprehension scores in the Photograph + Topic Setter (LSD = 8.95) and the Photograph + Keywords (LSD= 11.04) conditions than in the Keyword condition. Hence, the participants with nonfluent aphasia differed from their fluent counterparts in that the former benefitted from having multiple rather than single supports.

Discussion

The results of this study suggest that visual supports positively affect the reading comprehension of people with aphasia. In particular, it appears that photographs bolster the reading comprehension of people with aphasia when paired with narrative text. These findings also highlight that differences exist regarding how people with fluent and nonfluent aphasia respond to the presence of reading supports. More specifically, people with fluent aphasia appear to benefit the most from photographic supports provided in isolation, whereas people with nonfluent aphasia benefit most from a combination of photographic and linguistic supports. These varied performance patterns may be due to unique cognitive processing deficits and preserved skills not reflected in *WAB-R* (Kertesz, 2007) or *RCBA-2* (LaPointe & Horner) scores. However, the small sample size—especially for the participants with fluent aphasia ($N = 5$)—is a study limitation that may have confounded the results. Overall, reading supports appear to facilitate comprehension in some instances and with some individuals with aphasia; however, decisions about which types of supports to present and in what combination(s) to present them require careful consideration of residual language and cognitive skills.

References

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Table 1
Participant Demographic and Assessment Data

Participant number	Age (years)	Gender	Time post-stroke (months)	Education (years)	*WAB-R* aphasia type	*WAB-R* aphasia quotient	*RCBA-2* total score
1	--[a]	F	35	13	Broca's	72.0	86
2	73	F	268	12	Broca's	61.1	84
3	42	F	47	16	Broca's	63.3	84
4	66	F	156	18	Broca's	52.1	88
5	70	F	73	18	Global	20.9	43
6	64	M	264	12	Broca's	59.4	58
7	54	F	58	14	Global	34.4	49
8	64	M	27	16	Broca's	33.4	55
9	59	M	71	16	Transcortical motor	72.4	92
10	59	M	66	16	Broca's	61.8	68
11	64	M	15	16	Global	25.1	64
12	50	M	14	12	Broca's	16.6	66
13	57	F	156	12	Conduction	78.1	91
14	82	F	29	12	Anomic	88.7	86
15	85	M	78	18	Transcortical sensory	62.7	45
16	56	F	48	18	Anomic	60.9	51
17	79	M	86	12	Wernicke's	73.6	90

[a]Participant refused to provide age.

Table 2

Individual Participant's Reading Comprehension Percent Correct Scores in Each Condition

Aphasia type	No support	Topic setter	Keywords	Photograph	Photograph + Topic setter	Photograph + Keywords
Nonfluent						
1	75.00	68.75	80.00	75.00	93.75	81.25
2	87.50	100.00	75.00	75.00	75.00	93.75
3	93.75	87.50	93.75	87.50	100.00	81.25
4	81.25	75.00	93.75	93.75	62.50	100.00
5	50.00	43.75	25.00	43.75	37.50	68.75
6	37.50	37.50	31.25	37.50	31.25	50.00
7	56.25	68.75	43.75	68.75	87.50	62.50
8	43.75	37.50	25.00	43.75	62.50	31.25
9	68.75	68.75	75.00	100.00	81.25	68.75
10	37.50	37.50	31.25	43.75	62.50	43.75
11	50.00	56.25	56.25	62.50	43.75	62.50
12	37.50	50.00	43.705	37.50	43.75	62.50
Fluent						
13	93.75	87.50	81.25	100.00	62.50	81.25
14	87.50	93.75	81.25	93.75	93.75	87.50
15	31.25	6.25	40.00	31.25	25.00	6.25
16	62.50	68.75	68.75	81.25	75.00	62.50
17	81.25	68.75	87.50	93.75	75.00	62.50
Grand Mean	63.24	62.13	60.73	68.75	65.44	65.07
Standard Dev	21.86	24.45	24.88	24.61	22.87	23.29
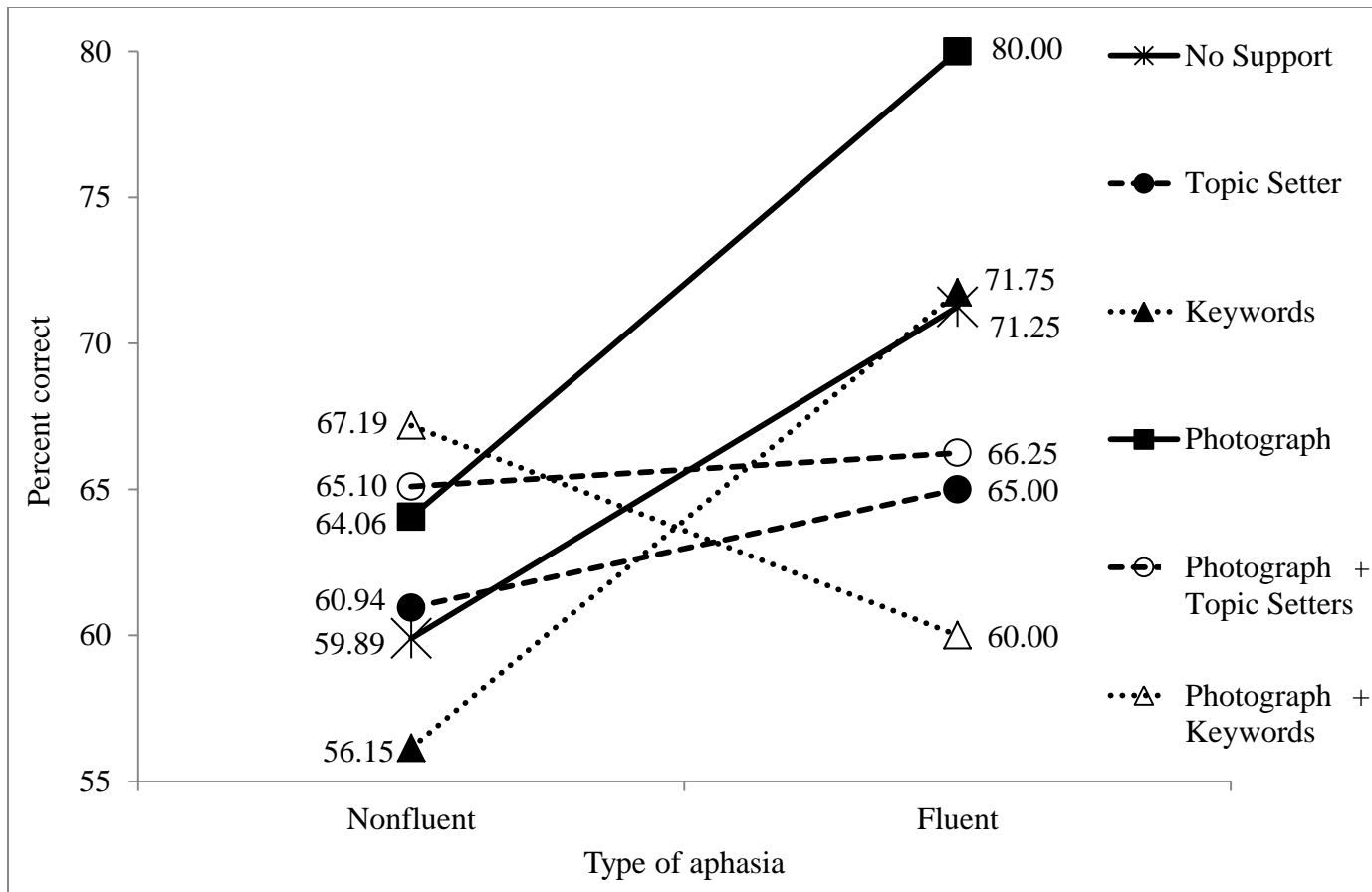
Figure 1. The average percentage comprehension questions correct across six types of pre-reading support between people with nonfluent and fluent aphasia.

Example Narrative Topic Setter, Key words and Photographic Supports

Narrative

Betty walked to the kitchen early one morning to make her first cup of coffee. Heading to the living room, she noticed a young man sprawled on the couch. Disoriented, the man stood, took a few shaky steps, and then fell back onto the couch. Betty debated whether she should confront the man or telephone the police. She decided to call for assistance. An officer arrived and approached the stranger. The man said he was visiting a friend nearby and had attended a party the previous night. Leaving at 3:00am, he lost his way and thought Betty's house was his friend's. In an attempt to not wake anyone, he climbed in an open window and curled up on the couch to sleep. The officer escorted him out to the police car and charged him with trespassing.

Topic Setter

Home Break-In

Keywords

Betty	morning	coffee	living room	man
couch	police	Call	Officer	party
3:00am	lost	window	Charged	trespassing

Photograph

Note: Due to space limitations, materials are not formatted as described in the materials section.