Introduction

People with aphasia (PWAs) have demonstrated the ability to learn augmentative and alternative communication (AAC) devices that employ traditional grid layouts to enhance their communication; however, the process is typically lengthy and yields limited generalization (Fox & Fried-Oken, 2001; Koul & Harding, 1998). In response, researchers have begun to investigate the use of visual scene displays (VSDs) to support the communication interactions of PWAs by capitalizing on their relatively intact episodic memory (Beukelman, Dietz, McKelvey, Hux, & Weissling, in press; Dietz, Beukelman, & McKelvey, 2006a; Dietz, McKelvey, Beukelman, Weissling, & Hux, 2006b; McKelvey, Dietz, Hux, Weissling, & Beukelman, 2007). High-technology VSDs may include various combinations of photographs, text boxes and speak buttons (see Figure 1); however, the specific elements of VSDs that best support the communication of PWAs is unknown. Therefore, the purpose of this investigation was to compare the impact of personally relevant (PR) photographs and line drawings (LDs) as well as the presence of text on four AAC interfaces, on the communication of PWAs during a personal narrative retell task.

Method

Participants

The participants included four people with chronic (greater than 12 months) Broca's aphasia; three of whom displayed concomitant apraxia/dysarthria (see Table 1). Additionally, one listener was recruited for the narrative retell sessions.

Materials

Equipment and software. The Visual Scene Displays software on the DynaVox VMax™ (DynaVox™-Mayer Johnson, 2010) was used as the AAC device. Six narratives were co-constructed for each participant and paired with PR photographs or LDs (see narrative development). Each story was limited to one screen to avoid navigation challenges (i.e., locating target stories on the device). The narrative retell sessions were recorded with three digital video cameras to capture facial expressions and gestures, the DynaVox VMax™ screen, and all written/drawn communication.

Procedures

Step 1: Assessment. Each participant completed an aphasia assessment battery.

Step 2: Narrative Development. After the assessment, the participants took part in two co-construction sessions (Dietz et al., 2006b), to create six narratives. Afterwards, the researchers selected four narratives for use during the experimental session and two narratives for the familiarization process. The four experimental VSD interfaces included (a) PR photographs with text boxes (PR + TB), (b) PR photographs without text boxes (PR NO TB), (c) LDs with text boxes (LD + TB) and (d) LDs without text boxes (LD NO TB) (see Figure 2).

Step 3: Narrative Retell Session. The first author familiarized each participant with the various VSD interfaces using two personal stories. Next, the participants retold their narratives to a naïve listener. The participants were informed that a computer would display speak buttons, PR photographs, LDs, and text boxes. Each had the opportunity to practice using the device displaying each experimental condition.

Step 4: Transcription and Data Analysis. A trained research assistant transcribed the retells, including all references to the device and written/drawn output. The transcripts were divided into six types of expressive modality units (EMUs), which included: (1) spoken (SEMUs), (2) photograph (PEMUs), (3) text box (TBEMUs), (4) speak button (SBEMUs), (5) written (WEMUs), and (6) drawn (DEMUs). The transcripts were also evaluated for trouble sources (TS) (i.e., communication breakdowns) and trajectory lengths (i.e., average duration of repair sequence). See Appendix for operational definitions. Two researchers coded the transcripts and reached a minimum of 80% agreement on each dependent measure. The transcripts will be crosschecked for procedural integrity.

Research Design

This study employed a case series design to isolate and describe the effect of four AAC interfaces on the communicative behaviors of four PWA.

Results

A number of communicative patterns emerged within and across participants during each narrative retell condition. Due to space limitations, only notable patterns that emerged across the participants for the types of EMUs utilized as well as trouble sources and repairs are presented.

Spoken Modality Units (SEMUs)

Most notably, the PWAs expressed themselves predominately through verbal communication (*M* = 68% of total EMUs; *Range* = 62.5-85%), despite the presence of the high-tech AAC device (Table 2).

Text box expressive modality units (TBEMUs)

In the TB conditions, all participants utilized the text to facilitate exchange of information (*M* = 12.8% of total EMUs; *Range* = 1-21%) (Table 3). On average, the participants demonstrated a higher number of successfully repaired TS in the TB conditions (*M* = 77%; *Range* = 25-100%) (Table 4) when compared to the 'NO TB' conditions (*M* = 61%; *Range* =37.5-100%) (Table 5).

Written Expressive Modality Units (WEMUs)

Each participant wrote during at least one story retell (*M* = 2.4% of total EMUs; *Range* = 2-14%). More specifically, the PWAs wrote almost exclusively during conditions in which text was not present (Table 6).

Drawing Expressive Modality Units (DEMUs)

Only two participants drew during their narrative retells (i.e., B.D. and N.S.). Intriguingly both of these participants exhibited opposite patterns of use. In particular, B.D. spent an average of 12% of EMUs drawing when text was not available, whereas N.S. spent an average of 2.75% of EMUs drawing in the presence of text (Table 7).

Picture Expressive Modality Units (PEMUs)

All the participants utilized PEMUs with PR photographs to facilitate communication (*M*

= 13% of total EMUs, *Range* =1-38%) to a greater degree than LDs (*M* = 5% of total EMUs, *Range* = 0-14%). Also, all of the participants tended to reference the photographs more often to support their narrative retells in the NO TB conditions (*M* = 11.8%, *Range* = 4-28%) when compared to the TB conditions (TB = 6.3% of EMUs; *Range* = 1-14%) (Table 8).

Discussion

The findings suggest that the participants used SEMUs most often and employed other types of EMUs during communicative breakdowns; or when they expanded upon their spoken production. Also, the presence of text seemed to foster an effective communicative environment by providing a shared communication space (Hux, Buechter, Wallace & Weissling, 2010) in which the participants could refer to the text during breakdowns. Furthermore, the presence of text had a positive influence on the number of repaired trouble sources. Additionally, increased rates of WEMU and DEMU usage in the NO TB conditions suggests that PWAs may rely on text to help effectively facilitate communication. The analyses also revealed that PWAs relied on PR photographs more often than LDs to facilitate information transfer during their narrative retells. This seems logical since the PR photographs may stimulate the episodic memory of PWAs to enhance their communicative performance (Dietz, Weissling, Griffith, & McKelvey, 2012). In summary, this case series study offers anecdotal data that stresses the importance of assessing the impact of using various types of visual (i.e., PR photographs vs. LDs) and linguistic supports (i.e., text) when designing AAC systems for PWAs.

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Table 1

Participant Demographic and Language Measures

Participant	Age	Gender	Months Post Onset	Aphasia Type	WAB-R AQ^	WAB-R Reading Comprehension of Sentences*
B.D.	64	Female	55	Broca's	32.1[a]	30
J.D.	57	Male	48	Broca's	61.8	28
N.S.	42	Female	81	Broca's	53.9[b]	2
M.B.	70	Female	42	Broca's	64.9[b]	40

Note. ^WAB-R AQ = Western Aphasia Battery – Aphasia Quotient, maximum score = 100, * WAB-R = Western Aphasia Battery Reading Comprehension of Sentences, maximum score = 40, [a] concomitant dysarthria, [b] concomitant apraxia of speech

Table 2

Spoken Expressive Modality Units (SEMUs) by Participant and AAC Condition

Participant	PR + TB[a]	PR NO TB[b]	LD + TB[c]	LD NO TB[d]
B.D.	64(64%)	90(68%)	59(77%)	134(72%)
J.D.	66(85%)	64(69%)	24(75%)	36(80%)
N.S.	46(69%)	51(73%)	53(69%)	68(74%)
M.B.	45(62.5%)	81(64%)	63(67%)	80(82%)

Note: [a] PR photographs with text boxes (PR + TB), [b] PR photographs without text boxes (PR NO TB), [c] LDs with text boxes (LD + TB) and [d] LDs without text boxes (LD NO TB); all percentages were calculated out of the total number of EMUs for each condition

Table 3

Text Box References (TBEMUs) by Participant and AAC Condition

Participant	PR + TB[a]	LD + TB[b]
B.D.	21(21%)	10(13%)
J.D.	1(1%)	2(6%)
N.S.	11(16%)	11(14%)
M.B.	11(15%)	16(17%)

Note: [a] PR photographs with text boxes (PR + TB) and [b] LDs with text boxes (LD + TB); all percentages were calculated out of the total number of EMUs for each condition

Table 4

Trouble Sources Repaired and Abandoned by Participant and AAC Conditions PR +TB and LD + TB

	PR + TB[a]					LD + TB[b]				
Participant	Trouble Sources	Total EMUs	Repaired	Abandoned	Trajectory^	Trouble Sources	Total EMUs	Repaired	Abandoned	Trajectory^
B.D.	10(10%)	100	8(80%)	2(20%)	6.5	7(9%)	77	6(86%)	1(14%)	5.7
J.D.	4(5%)	78	1(25%)	3(75%)	4.75	3(9%)	32	3(100%)	0	2.6
N.S.	3(4%)	67	2(66.6%)	1(33.3%)	6.3	5(6%)	77	3(60%)	2(40%)	11.8
M.B.	2(3%)	72	2(100%)	0(0%)	4.5	5(5%)	94	5(100%)	0	5.6

Note: [a] PR photographs with text boxes (PR + TB), [b] LDs with text boxes (LD + TB); all percentages were calculated out of the total number of EMUs for each condition, ^ Mean number of EMUs to resolve or abandon breakdowns

Table 5

Trouble Sources Repaired and Abandoned by Participant and AAC Conditions PR NO TB and LD NO TB

	PR NO TB[a]					LD NO TB[b]				
Participant	Trouble Sources	Total EMUs	Repaired	Abandoned	Trajectory^	Trouble Sources	Total EMUs	Repaired	Abandoned	Trajectory^
B.D.	12(9%)	133	6(50%)	6(50%)	10.3	16(8.5%)	188	7(44%)	9(56%)	10.3
J.D.	8(9%)	93	4(50%)	4(50%)	6.62	6(13%)	45	3(50%)	3(50%)	3
N.S.	6(9%)	70	4(66.6%)	2(33.3%)	6.3	6(6.5%)	92	6(100%)	0	6.1
M.B.	8(6%)	126	3(37.5%)	5(62.5%)	4.5	9(9%)	98	8(89%)	1(11%)	5.3

Note: [a] PR photographs without text boxes (PR + TB), [b] LDs without text boxes (LD + TB); all percentages were calculated out of the total number of EMUs for each condition, ^ Mean number of EMUs to resolve or abandon breakdowns

Table 6

Written Expressive Modality Units (WEMUs) by Participant and AAC Condition

Participant	PR + TB[a]	PR NO TB[b]	LD + TB[c]	LD NO TB[d]
B.D.	0	0	0	10(5%)
J.D.	3(4%)	4(4%)	0	0
N.S.	0	3(4%)	0	13(14%)
M.B.	0	3(2%)	0	5(5%)

Note: [a] PR photographs with text boxes (PR + TB), [b] PR photographs without text boxes (PR NO TB), [c] LDs with text boxes (LD + TB) and [d] LDs without text boxes (LD NO TB); all percentages were calculated out of the total number of EMUs for each condition

Table 7

Drawing Expressive Modality Unit (DEMUS) by Participant and AAC Condition

Participant	PR + TB[a]	PR NO TB[b]	LD + TB[c]	LD NO TB[d]
B.D.	0	19(14%)	0	19(10%)
J.D.	0	0	0	0
N.S.	2(3%)	0	2(2.5%)	0
M.B.	0	0	0	0

Note: [a] PR photographs with text boxes (PR + TB), [b] PR photographs without text boxes (PR NO TB), [c] LDs with text boxes (LD + TB) and [d] LDs without text boxes (LD NO TB); all percentages were calculated out of the total number of EMUs for each condition

Table 8

Picture Expressive Modality Units (PEMUs) by Participant and AAC Condition

Participant	PR + TB[a]	PR NO TB[b]	LD + TB[c]	LD NO TB[d]
B.D.	12(12%)	14(11%)	0	17(9%)
J.D.	1(1%)	18(19%)	0	2(4%)
N.S.	7(11%)	8(11.5%)	2(2.5%)	4(4%)
M.B.	7(10%)	35(28%)	13(14%)	8(8%)

Note: [a] PR photographs with text boxes (PR + TB), [b] PR photographs without text boxes (PR NO TB), [c] LDs with text boxes (LD + TB) and [d] LDs without text boxes (LD NO TB); all percentages were calculated out of the total number of EMUs for each condition

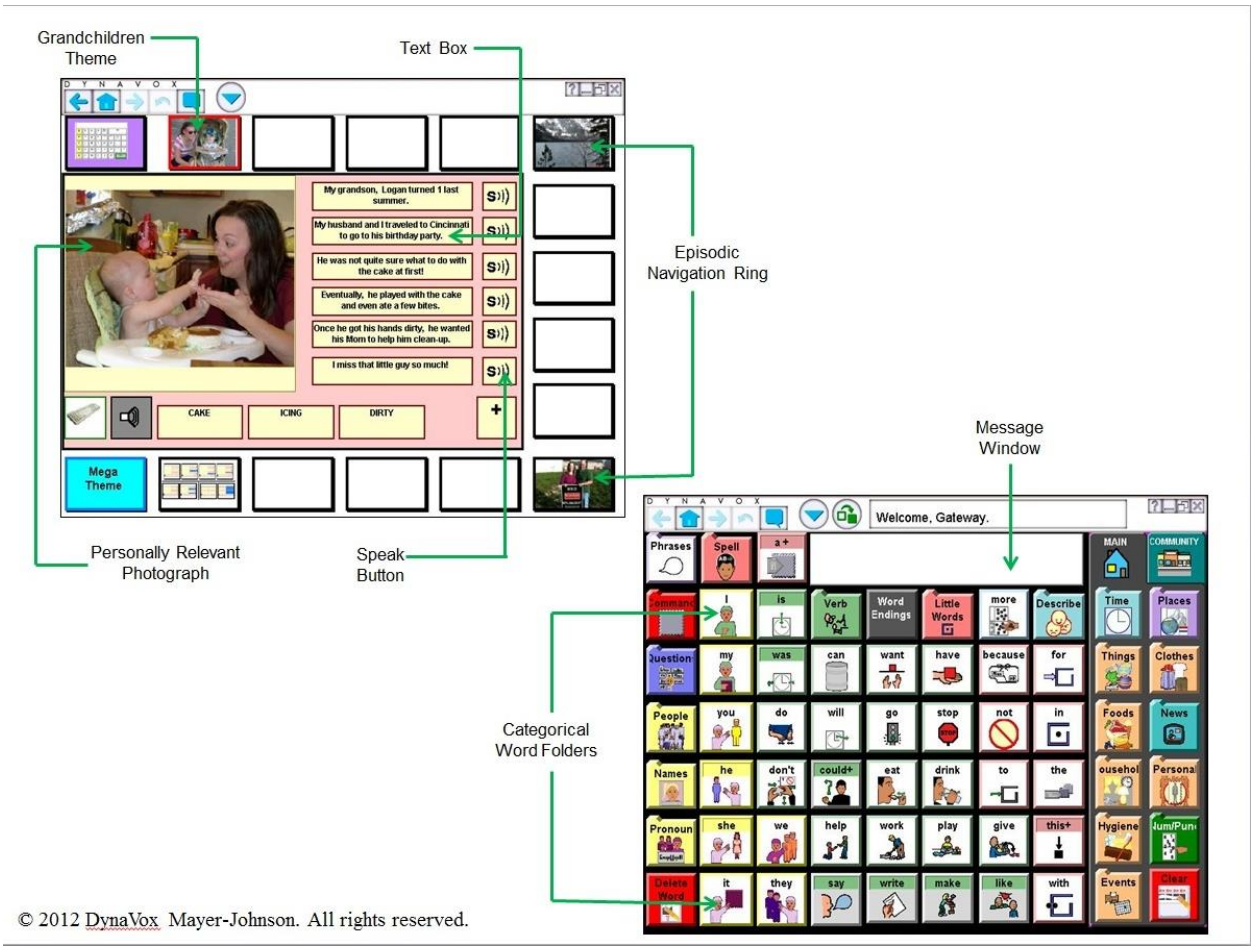

Figure 1. A comparison of a personalized visual scenes display (VSD and a traditional grid layout. (Dietz, Weissling, Griffith, & McKelvey, 2012).

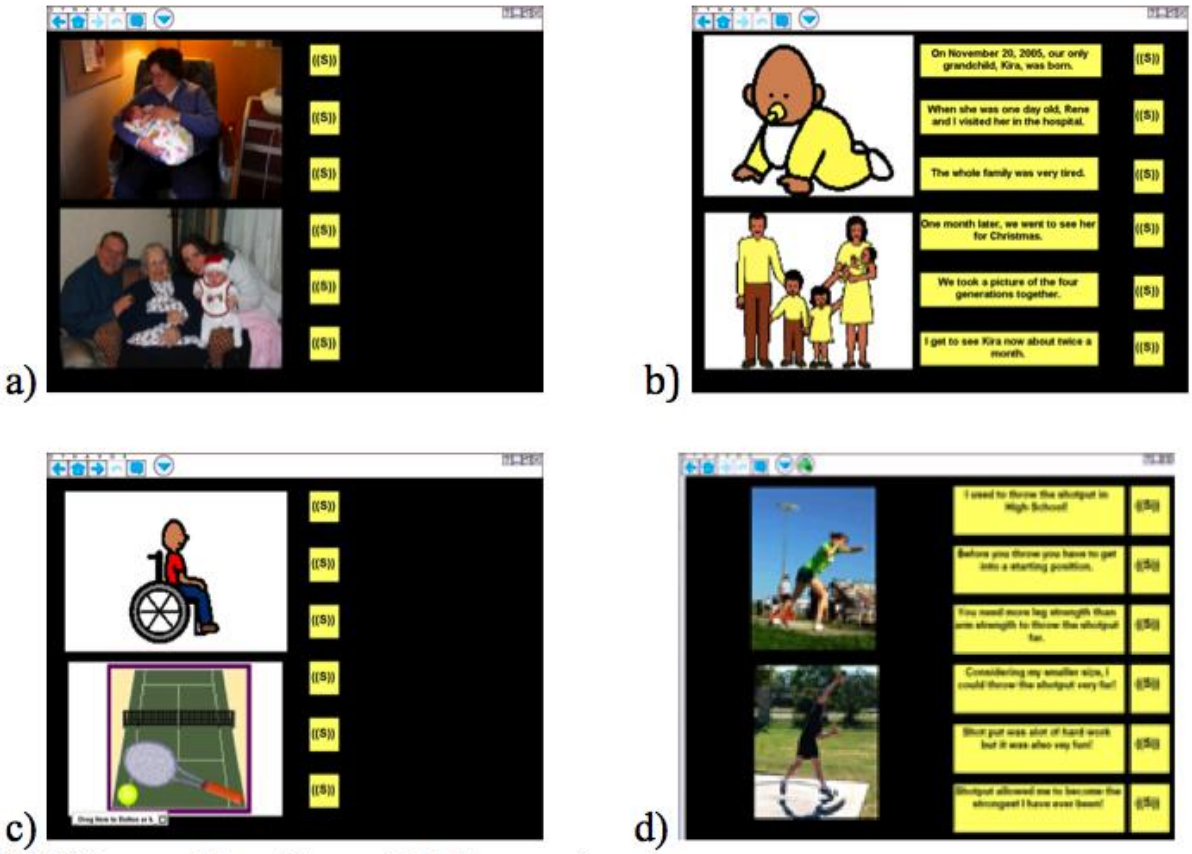

Figure 2. Examples of the four experimental Visual Scene Displays. (a) personally relevant photographs with text boxes (PR + TB), (b) personally relevant photographs without text boxes (PR NO TB), (c) line drawings with text boxes (LD + TB) and (d) line drawings without text boxes (LD NO TB)

Appendix*

Glossary of Acronyms & Operational Definitions of the Dependent Measures

Acronyms

EMUs: expressive modality unit

DEMUs: EMUs conveyed through drawing

LD: line drawing

PEMUs: EMUs conveyed through photographs

PR: personally relevant photographs

SB: speak button

SBEMUs: EMUs conveyed through speak buttons

SEMUs: spoken EMUs

TB: text box

TS: trouble source

TBEMUs: EMUs conveyed through text boxes

WEMUs: EMUs conveyed through writing

Operational Definitions

EMUs: a piece of information conveyed through various modalities (i.e., spoken (SEMU), written (WEMU), drawn (DEMU), text boxes (TBEMU), photographs (PEMUs), speak buttons (SBEMUs)).

SEMUs: a thought combined under a single, coherent intonation contour; usually, but not always preceded by a pause. A coherent intonation contour contains a single thought or idea. A new SEMU begins after a pause greater than 2 seconds. Stereotypical utterances are coded as separate SEMUs. Lastly, a pause lasting longer than 5 seconds constitutes a separate 'SEMU' (adapted from Mentis & Prutting, 583-595).

WEMUs: occurs when the PWA exhibits a pause of 2 seconds or more in spoken production while writing and/or points/refers to their written text. If a person writes while speaking, 1 SEMU and 1 WEMU is coded on the same row (i.e., does not increase the trajectory—see below).

DEMUs: occurs when the PWA exhibits a pause of 2 seconds or more in spoken production while drawing and/or points/refers to their drawing. If a person draws while speaking, 1 SEMU and 1 DEMU is coded on the same row (i.e., does not increase the trajectory—see below).

TBEMUs: occur when the person references words located in a textbox. If the person demonstrates a TBEMU while talking, it occurs on the same row (i.e., does not increase the trajectory—see below). Non meaningful references to the text boxes, which do not carry information and have no 'intent', are not coded (i.e., random pointing to text).

PEMUs: occur when the person references a picture, or part of a picture. If the person demonstrates a PEMU while talking, it occurs on the same row (i.e., does not increase the trajectory—see below). Non-meaningful references to the photographs, which do not carry information and have no 'intent', are not coded (i.e., random pointing to a picture).

SBEMUs: occur when the person activates a SB. If the person demonstrates a SBEMU while talking, it occurs on the same row (i.e., does not increase the trajectory—see below). Non-meaningful activations of the speak buttons are not coded (i.e., accidental activation of the SB).

TS: A lack of information provided in the EMU that impeded the transition or flow of the interaction, which prompts the listener to request more information/clarification (adapted from Cunningham & Ward, 2003).

Repaired TS: The TS was successfully resolved/clarified (adapted from Cunningham & Ward, 2003).

Abandoned TS: The TS was resolved by the PWAs and the listener mutually agreeing to move onto a new topic (adapted from Cunningham & Ward, 2003).

Trajectory: The average number of EMUs required for the PWAs to repair the breakdown (adapted from Cunningham & Ward, 2003).

*Appendix adapted from Dietz, Weissling, Griffith, & McKelvey, (2012).