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# Personalizing AAC for People with Aphasia: The Role of Text and Pictures

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## Introduction

Over time, and with intensive instruction, people with aphasia (PWAs) can learn to use grid-based, categorically organized, high-technology AAC layouts during structured tasks (e.g., Hough & Johnson, 2009). In an effort to reduce the training intensity required to teach PWAs to use AAC; researchers developed visual scene displays (VSDs), designed to complement the residual cognitive and linguistic abilities of PWAs by tapping their intact episodic memory. VSD interfaces incorporate personally relevant (PR) photos, text, and speech output (Dietz, McKelvey, & Beukelman, 2006; Weissling & Beukelman, 2006). VSDs appear to facilitate improved communication success (e.g., McKelvey, Dietz, Hux, Weissling, & Beukelman, 2007) as well as relatively efficient learning of system navigation with less instruction than reported for traditional grid layouts (McKelvey et al., 2007; Wallace & Hux, 2012). Figure 1 contrasts VSD and grid interfaces. The success of VSDs is frequently attributed to the PR photographs; however, investigators have not examined the impact of the various VSD elements on communication behaviors. Therefore, the purpose of this study was to examine the influence of PR photographs and the presence of text on a VSD interface on the communication behaviors of PWAs during a narrative retell task.

## Method

### Research Design

A case series design was used to examine the impact of four high-technology VSD interfaces on the narrative retells of two people with chronic, nonfluent aphasia. The four interfaces included speak buttons and: (a) PR photographs + text boxes (PR + TB), (b) non-personally relevant (NPR) photographs + text boxes (NPR + TB), (c) PR photographs without text boxes (PR No TB), and (d) NPR without text boxes (NPR No TB) (see Figure 1 for an example VSD).

### Participants

The participants included two people with chronic (i.e., greater than 12 months), nonfluent aphasia—Phil and Anna. Participation in this study was their first experience with high-technology AAC (Table 1.).

### Materials

**Equipment and software.** The researchers used the Visual Scene Displays software on the DynaVox VMax<sup>TM</sup> (DynaVox-Mayer Johnson<sup>TM</sup>, 2010). Three digital video cameras captured facial expressions, gestures, written/drawn communication, and the screen of the DynaVox VMax<sup>TM</sup>.

**Story development.** Six stories were co-constructed with participant (Dietz et al., 2006). The researchers randomly selected four stories, for the experimental session; two included PR photographs and two included NPR photographs. The researchers programmed six text boxes and speak buttons using information provided by the PWAs.

## Procedures

**Assessment.** Participants completed an assessment battery to determine their aphasia type and reading level (Table 1).

**Familiarization of high-technology VSDs.** Prior to the retell, the PWAs were familiarized with and explored each AAC interface design, using two non-experimental stories.

**Narrative Retell Sessions.** The participants shared four stories with a single listener, who was instructed not to use vocabulary related to the conversation topic unless initiated by the participant. Sessions were transcribed and cross-checked for accuracy.

**Procedural integrity.** Procedural integrity analyses revealed that the listener followed the guidelines with 99.25% accuracy and the researcher followed 100% of the script during the familiarization session.

## Data Analysis

Transcribed narratives were analyzed for expressive modality units (EMUs) which included various subcategories: (1) spoken (SEMUs), (2) written (WEMUs), and (3) drawn (DEMUs), (4) photograph (PEMUs), (5) text box (TBEMUs), and (6) speak button (SBEMUs). Further, researchers analyzed trouble sources, repairs of trouble sources, abandonment of repair attempts, and NPR photograph talk time. See Appendix for operational definitions. Coding reliability checks yielded at least 80% agreement on each measure.

## Results

Tables 2 & 3 outline Phil and Anna's expressive modality units, trouble sources and repairs. A summary of observed patterns are provided below.

### Trouble Sources

Phil and Anna benefitted from the combination of PR photographs and supporting text, by exhibiting no trouble sources in the PR + TB condition. Both participants exhibited similar percentages of trouble sources across the NPR conditions. In particular, Phil's trouble sources made-up, on average, 4.3 % of his total EMUs (*Range* = 4-5%). Similarly, Anna's trouble sources accounted for 6.67% of her total EMUs (*Range* = 5-10%).

### Expressive Modality Units (EMUs)

**Spoken expressive modality units (SEMUs).** Across conditions, Phil (76% of all EMUs) and Anna (79.25% of all EMUs) relied primarily on the spoken modality to share their narratives.

**Written expressive modality units (WEMUs).** The participants exhibited differing patterns of use for WEMUs. Phil wrote in only the PR NO TB (12% of all EMUs) and NPR conditions ( $M = 8.5\%$  of all EMUs), whereas Anna attempted to write only once (NPR + TB).

**Drawn expressive modality units (DEMUs).** Phil used DEMUs in the PR NO TB (5% of all EMUs) and NPR + TB (7% of all EMUs) conditions. In contrast, Anna did not use DEMUs to supplement her communication.

**Photograph expressive modality units (PEMUs).** Phil referenced pictures most frequently in the PR + No TB condition (13% of all EMUs). Anna referenced pictures slightly more in NPR conditions ( $M = 8\%$  of all EMUs,  $Range = 6-10\%$ ) compared to PR conditions ( $M = 4\%$  of all EMUs,  $Range = 1-7\%$ ). Closer examination is necessary to understand the full impact of NPR photographs on Phil and Anna's communication effectiveness. Instead of helping Phil and Anna retell their narratives, the NPR photographs elicited off topic conversation. Specifically, Phil generated off-topic talk regarding the photos on average 2.7% of the retell duration ( $Range = 1\% - 4.4\%$ ), creating an average of 22.5% of his trouble sources (Table 4). Similarly, Anna demonstrated the same off-task behavior on average 18.55% of the retell duration ( $Range = 11.1\% - 26\%$ ), causing 18.35% of her trouble sources.

**TB expressive modality units (TBEMUs).** Phil and Anna each referenced the text boxes 11% of all EMUs in the NPR + TB condition; and not at all in the PR+TB condition.

**Speak button expressive modality units (SBEMUs).** Phil only used the speak buttons in the PR + TB condition (19% of all EMUs). In contrast, Anna used speak buttons in every condition ( $M = 9.3\%$  of all EMUs,  $Range = 7-11\%$ ); and the most during the NPR No TB condition (18% of all EMUs).

## Discussion

These results suggest that, compared to the NPR interface, the PR interface facilitated more effective and efficient narrative retells. The PWAs demonstrated no trouble sources in the PR + TB condition. The photographs contributed to a high percentage of trouble sources in the NPR conditions. Perhaps the PR photographs activated the PWAs episodic memory, thereby facilitating more effective communication exchanges. Another finding revealed that text, when paired with PR photographs, appeared beneficial. The activation of the PWAs' episodic memory may have facilitated access to the linguistic system, thus improving functional use of text in the PR+TB condition. The role of speak buttons on the VSD is less clear and no clear patterns emerged regarding how the PWAs used WEMUs/DEMUs to supplement the VSD content. Perhaps formal instruction is necessary to effectively integrate these EMUs into narrative retells. In closing, it is notable that both participants exhibited higher levels of spoken expression compared to any other modality during the narrative retells using an AAC system. Although limited by the case series design, this study supports the notion that PWAs demonstrate increased communication effectiveness with AAC systems that incorporate PR visual materials.

## References

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Table 1  
*Demographic and Language Measures*

<b>Participant</b>	<b>Age</b>	<b>Gender</b>	<b>Months Post Onset</b>	<b>High-Tech AAC Experience</b>	<b>WAB-R AQ<sup>a</sup></b>	<b>Aphasia Type</b>	<b>RCBA-2 Total Score<sup>b</sup></b>
<b>Phil</b>	57	Male	>36	No	72.4	TCM <sup>c</sup>	92
<b>Anna</b>	72	Female	252	No	61.1	Broca's*	81

<sup>a</sup>WAB-R AQ = Western Aphasia Battery – Aphasia Quotient, maximum score = 100, <sup>b</sup>RCBA-2 = Reading Comprehension Battery for Aphasia, maximum score = 100, <sup>c</sup>TCM = Transcortical Motor, \* Apraxia of Speech present.

Table 2  
*Phil's Communication Behaviors Across Conditions*

	<b>Total EMUs</b>	<b>SEMUs</b>	<b>WEMUs</b>	<b>DEMUs</b>	<b>PEMUs</b>	<b>TBEMUs</b>	<b>SBEMUs</b>	<b>Trouble Sources</b>	<b>Repairs</b>	<b>Abandoned Repairs</b>	<b>Trajectory<sup>c</sup></b>
<b>PR+TB<sup>a</sup></b>	32	24(75%)	0(0%)	0(0%)	2(6%)	0(0%)	6(19%)	0(0%)	NA	NA	NA
<b>PR No TB<sup>b</sup></b>	43	98(70%)	16(12%)	7(5%)	18(13%)	Na	0(0%)	5(4%)	5(100%)	0(0%)	8.8
<b>NPR+TB<sup>c</sup></b>	89	65(73%)	7(8%)	6(7%)	1(1%)	10(11%)	0(0%)	4(4%)	3(75%)	1(25%)	5.75
<b>NPR No TB<sup>d</sup></b>	76	65(86%)	7(9%)	0(0%)	4(5%)	Na	0(0%)	5(5%)	2(40%)	3(60%)	9

<sup>a</sup> Personally relevant photographs + text boxes + speak buttons (PR+TB), <sup>b</sup> Personally relevant photographs + speak buttons (PR No TB), <sup>c</sup> Non-personally relevant photographs + text boxes + speak buttons (NPR+TB), <sup>d</sup> Non-personally relevant photographs + speak buttons (NPR No TB), <sup>e</sup> measured in average number of EMUs.

Table 3  
*Anna's Communication Behaviors Across Conditions*

	<b>Total EMUs</b>	<b>SEMUs</b>	<b>WEMUs</b>	<b>DEMUs</b>	<b>PEMUs</b>	<b>TBEMUs</b>	<b>SBEMUs</b>	<b>Trouble Sources</b>	<b>Repairs</b>	<b>Abandoned Repairs</b>	<b>Trajectory<sup>e</sup></b>
<b>PR+TB<sup>a</sup></b>	60	50(83%)	0(0%)	0(0%)	4(7%)	0(0%)	6(10%)	0(0%)	NA	NA	NA
<b>PR No TB<sup>b</sup></b>	103	91(88%)	0(0%)	0(0%)	1(1%)	Na	11(11%)	5(5%)	4(80%)	1(20%)	5.4
<b>NPR+TB<sup>c</sup></b>	115	85(74%)	2(2%)	0(0%)	7(6%)	13(11%)	8(7%)	6(5%)	5(83%)	1(17%)	12.5
<b>NPR No TB<sup>d</sup></b>	49	35(72%)	0(0%)	0(0%)	5(10%)	na	9(18%)	5(10%)	4(80%)	1(20%)	8

<sup>a</sup> Personally relevant photographs + text boxes + speak buttons (PR+TB), <sup>b</sup> Personally relevant photographs + speak buttons (PR No TB), <sup>c</sup> Non-personally relevant photographs + text boxes + speak buttons (NPR+TB), <sup>d</sup> Non-personally relevant photographs + speak buttons (NPR No TB), <sup>e</sup> measured in average number of EMUs.



Table 4

*Total Duration of Narrative Retells and Percentage of NPR Talk Time for All Participants*

	<b>Phil</b>			<b>Anna</b>		
	<b>Total Duration</b>	<b>NPR Talk Time</b>	<b>Percentage of Trouble Sources</b>	<b>Total Duration</b>	<b>NPR Talk Time</b>	<b>Percentage of Trouble Sources</b>
<b>PR+ TB</b>	1:29	NA	NA	4:09	NA	NA
<b>PR NO TB</b>	7:01	NA	NA	7:50	NA	NA
<b>NPR + TB</b>	4:38	00:03(1%)	25%	10:20	1:09 (11.1%)	11%
<b>NPR NO TB</b>	5:02	00:16(4.4%)	20%	3:54	1:01 (26%)	26%

\* *Note.* Time reported in minutes:seconds (percentage of total talk time)

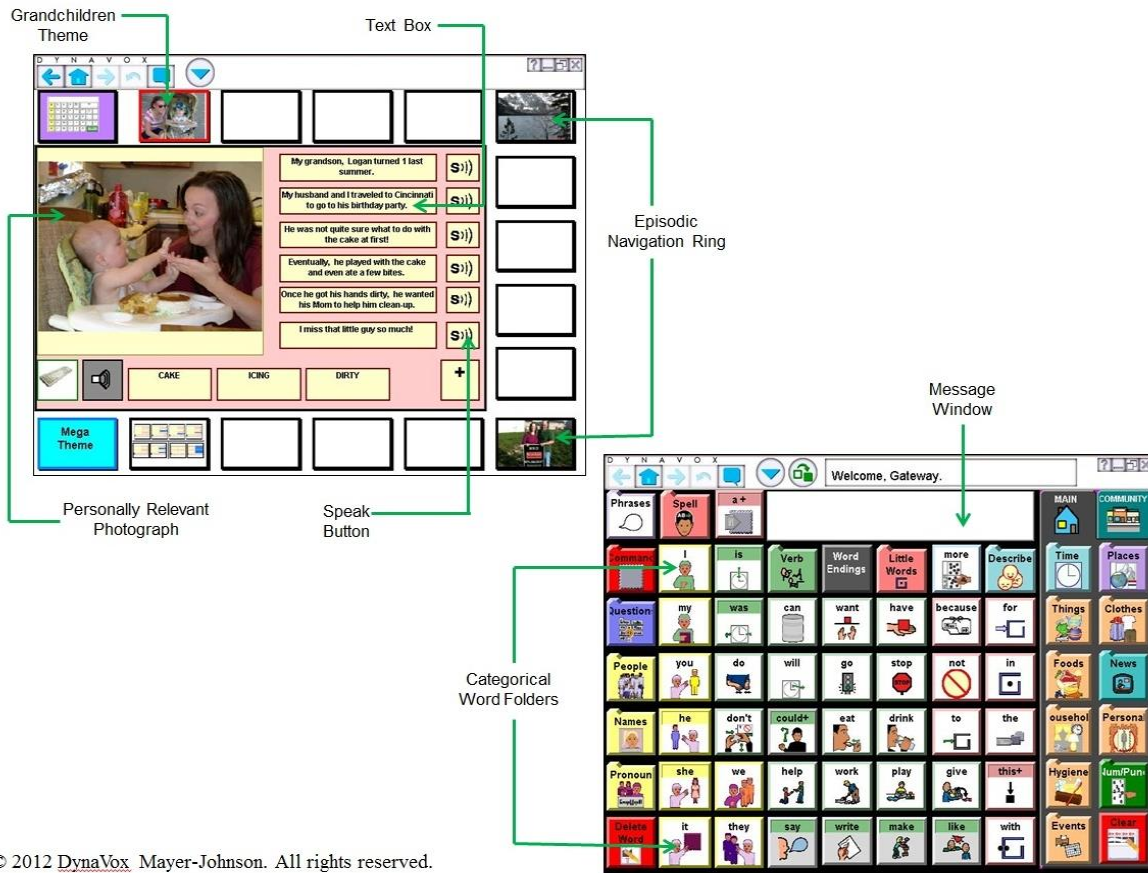


Figure 1. A comparison of a personalized visual scenes display (VSD) and a traditional grid layout.

## Appendix\*

### Glossary of Acronyms & Operational Definitions of the Dependent Measures

#### Acronyms

**EMUs:** expressive modality unit

**PR:** personally relevant pictures

**TB:** text box

**DEMUs:** EMUs conveyed through drawing

**SB:** speak button

**TS:** trouble source

**NPR:** non-personally relevant pictures

**SBEMUs:** EMUs conveyed through speak buttons

**TBEMUs:** EMUs conveyed through text boxes

**PEMUs:** EMUs conveyed through pictures

**SEMUs:** spoken EMUs

**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), pictures (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 ‘SEMUs’ (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 pictures, 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).

**Total Duration of Retell:** The start-time was subtracted from the end-time. The start-time was determined by the first EMU of the PWAs in each story. The end-time was calculated immediately after the last EMU of the PWAs in each story.

**NPR Photograph Talk Time:** The amount of time spent trying to convey that the NPR images did not belong to them or questioning why they PR pictures were not programmed into the device. The start-time was determined by the first EMU of NPR talk. The end-time was calculated immediately after the last EMU of NPR talk.

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