This case study presents a treatment approach with innovative software for an individual with apraxia of speech and global aphasia from a severe anoxic injury. This paper proposes that aspects of the ability to communicate are available even when core capacities of the language system are dysfunctional (Willems, Benn, Hagoort, Toni, & Varley, 2011). Most of the literature reports that prognosis is bleak for individuals diagnosed as globally aphasic and remain so at one month post. The expected course of recovery is improved comprehension but little functional speech (Sarno, Silverman & Sands, 1970). As such, this treatment was designed to use non-lexical routes toward communication and thereby achieve a better outcome.

Participant

SM is a 26 year- old, right-handed female with a college education who coded at home from a suspected pulmonary embolus associated with birth control pill use. Her extensive hospitalization included multiple CPRs, tracheostomy, and MRI/MRAs acquired 10 days after the event. She was discharged home at seven weeks in a "vegetative state." Her family began a course of rehabilitation in the home, teaching her to walk. Four months after the event, SM was admitted to a university rehabilitation hospital where formal rehabilitation began.

Parental consent was obtained prior to participation in this study. Initial testing revealed that SM was completely nonverbal, scoring 0/10 on naming common objects, unable to respond to simple auditory commands or one-unit yes/no questions with gestures or head nods. She did copy letters and match objects and pictures when given visual directions.

Repeat brain MRI scan obtained at 8 months after the initial event revealed "obliteration of bilateral temporal and frontal lobes, as well as amygdala and hippocampus, with relative sparing of occipital, posterior parietal lobes, the cortico spinal tracts and brain stem" (see Figure 1). One area of sparing was Brodmann area 19, which is part of the occipital lobe cortex. Along with area 18, it comprises the extrastriate (or peristriate) cortex. The extrastriate cortex is a visual association area, with feature-extracting, shape recognition, attentional, and multimodal integrating functions. These spared regions and multiple bilateral regions are involved in semantic associations and, therefore, we speculated that these regions could be exploited for the purpose of developing a visually-based communication system (Harrington, Farias, Davis, & Buonocore, 2007).

Method

A treatment protocol was developed in light of her spared functions, primarily visual-spatial abilities. This treatment approach was guided by two considerations: 1. Tasks sufficiently easy for SM to understand and follow, and 2. Presented hierarchically to build on skills for the purposes of communication. This method was based on previous work of Alexander and Loverso (1993). Alexander and Loverso used everyday common objects in their protocol, whereas this method utilized personal objects, family and home photographs to make the training tasks meaningful and relevant to the participant. Twelve treatment levels were presented in hierarchical order adapted from Alexander and Loverso (1993). Data was collected on the following levels:

1. Object-to-object, picture-to-picture match in a field of one to establish basic understanding of concept. This established 3 baselines.
2. Object-to-object and picture-to-picture match in a field of 2.
3. Categorizing/grouping objects and pictures that matched by color, size or other features in a field of 2.
4. Object-to-object and picture-to-picture match in a field of 4.
5. Match actual object to picture in a field of 2.
6. Match single to plural objects/pictures in a field of 2.
7. Match pictures differing in size only in a field of 2.
8. Match photographs by category, (e.g,, match various photographs of herself versus pictures of her brother, mother or pets).
9. Demonstrate that photographs matched actual rooms, people, pets, and objects of relevance (e. g., pointing to the person or walking to the room when shown a photograph of that person or room).
10. Introduce pictures that signal "stop" or "more/go" to indicate wanting to do more of a task versus stop a task.
11. Demonstrate use photographs as a means of communicating intent, (e.g., "I want to go to my bedroom" when pointing to a photograph of her bedroom).
12. Match semantically related pictures in a field of 2, (e.g., spoon to a bowl).

Procedures

A multi-baseline design was implemented. Three baselines were obtained of simple object and picture matching in a field of one to ensure that SM understood the expected response. SM was advanced from level 1 to the next level of tasks when she achieved 90% over two consecutive sessions. Data were obtained on the levels presented at each training session 2-3 times a week, one hour each session. The task complexity increased by the demands of the association or categorization and by the numbers of foils. Training responses required hand-over-hand direction and blocking incorrect responses.

Development of Treatment tasks

Web-based software, Bink ™, was developed to offer highly individualized and flexible treatment templates that presented a target for a match in a field of 2-4 (See Figure 2). This software was designed to facilitate easy upload of personal photographs for the creation of templates for teaching conceptual skills. Photographs of her family, friends, rooms in her home and objects/pets were used in the templates. These templates moved from simple matching of exact photos to one another in a field of 1 to a more complex field of 4 along the treatment levels. The computerized templates ensured treatment fidelity across treatment sites and therapists. Additionally, the web-based system assisted SM in learning how to operate a touch screen; a skill that would eventually be useful for an augmentative communication device.

Results

SM is currently able to complete up to treatment level 8, levels 9 and 10 have been introduced (see Table 1). Her performance varies by her attention to task, which appears to fluctuate with her level of pain and any distraction in the room. She matches photographs by category in a field of 2 consistently and 3-4 inconsistently. She also shows some sparing of semantic relationships when matching singular with plural pictures and of super ordinate association by grouping members of a like category by color, shape or design. Towards the end goal of communication, SM is learning to use symbols of “stop” and “more” on a touch screen communication system with hand-over-hand direction. The “stop” and “more” touch screen is presented alongside treatment tasks to provide a way for her to signal that she wants to do” more” of a task or to “stop” a task. This communication skill is emerging as she is beginning to use the “more” button, however her performance is below chance level.

Conclusion

Despite profound language and cognitive deficits and the absence of brain regions typically associated with language, this participant was able to learn and show improvement in basic cognitive skills directed towards use of a communication system. In light of her progress we propose that spared brain regions and a life-time of forming semantic associations support learning a visually-based system as a mode of functional communication. In this case, innovative software individualized an approach towards a non-lexical method of communication.

References

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Figure 1 Diffusion Tensor imaging shows sparing of occipital parietal regions.

Figure 2 Web-based software, Bink ™, for individualized treatments

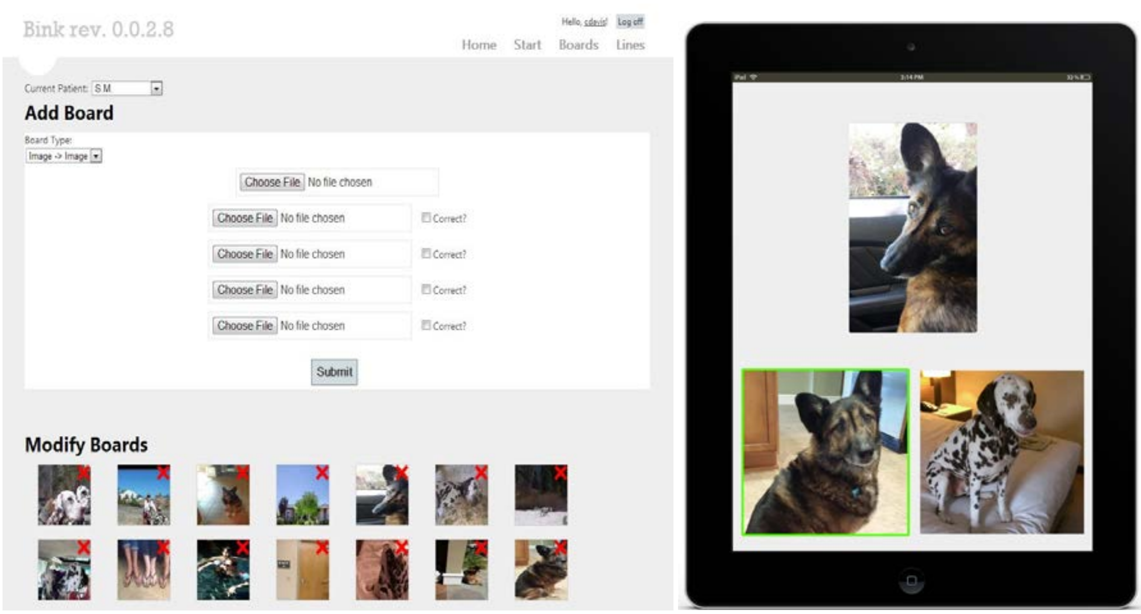

Table 1 Response accuracy along treatment levels