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A Proposed Method for Determining Trajectory of Learning Language on an AAC System for Individuals with Functional Blindness

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DOCUMENT ABSTRACT

INDIVIDUALS WITH VISUAL AND COMMUNICATION IMPAIRMENTS TYPICALLY RECEIVE AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC) INTERVENTION USING CUSTOM LOW-TECHNOLOGY OR LIGHT-TECHNOLOGY SYSTEMS, NOT HIGH-TECHNOLOGY SPEECH GENERATING DEVICES (SGDs). HOWEVER, PRE-INTERVENTION ASSESSMENTS TO IDENTIFY VIABLE AAC OPTIONS FOR THESE INDIVIDUALS ARE NOT REPORTED IN THE LITERATURE. THE OPTION TO USE AN SGD MAY BE WITHHELD BASED ON AUTHORITATIVE MODELS, RATHER THAN EMPIRICAL EVIDENCE. SOME SYSTEMS HAVE KEYBOARDS OR KEYGUARDS THAT HELP USERS ISOLATE LOCATIONS. THESE SYSTEMS MAY BE LEARNED USING MOTOR PLANNING. OTHERS CAN BE MODIFIED TO SUPPORT A STATIC DISPLAY OF CUSTOM TACTILE SYMBOLS. THESE MODIFIED SYSTEMS CAN BE LEARNED USING BOTH MOTOR PLANNING AND SYMBOLIC REPRESENTATION. AN EXPERIMENTAL DESIGN COMPARING THE TRAJECTORY OF LEARNING WORDS ON AN AAC SYSTEM USING MOTOR PLANNING ALONE TO THE TRAJECTORY OF LEARNING WORDS ON AN AAC SYSTEM USING SYMBOLS + MOTOR PLANNING IS DESCRIBED. FEEDBACK FROM CONFERENCE PARTICIPANTS WILL BE CONSIDERED IN REFINING THIS METHODOLOGY.

RESEARCH DESCRIPTION

BACKGROUND

INDIVIDUALS WITH VISUAL AND COMMUNICATION IMPAIRMENTS OFTEN DO NOT RECEIVE AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC) INTERVENTION USING HIGH-TECHNOLOGY SPEECH GENERATING DEVICES (SGDs). A REVIEW OF AAC INTERVENTIONS FOR INDIVIDUALS WHO ARE DEAFBLIND (SIGAFOOS, ET AL., 2008) REPORTED UNAIDED AND LOW-TECH STRATEGIES FOR BASIC COMMUNICATION USED ACROSS STUDIES. ALL AAC SYSTEMS ACROSS REVIEWED STUDIES WERE CUSTOM-MADE. ANOTHER REVIEW INCLUDING STUDIES WITH SUBJECTS WITH NORMAL HEARING (KOVACS & HILL, SUBMITTED) FOUND SIMILAR USE OF CUSTOM SYMBOLS. HOWEVER, SUBJECTS WITH NORMAL HEARING HAD MORE ADVANCED SPEECH OUTPUT SYSTEMS AND MORE COMPLEX EXPRESSIVE LANGUAGE GOALS. RATIONALES FOR GOALS, AND CHOICES OF AAC SYSTEMS WERE NOT SPECIFIED IN SOURCE DOCUMENTS.

ONE POSSIBLE EXPLANATION FOR USING LOW OR LIGHT-TECHNOLOGY AAC SYSTEMS WITH MINIMAL SPEECH OUTPUT IS THAT AVAILABLE TECHNOLOGIES ARE INACCESSIBLE TO INDIVIDUALS WITH FUNCTIONAL BLINDNESS, OR THOSE WHO RELY PRIMARILY ON AUDITORY OR TACTILE INPUT TO PROCESS THEIR ENVIRONMENT (CORN, 1996). THIS THEORY MAY NOT HAVE BEEN TESTED EMPIRICALLY. THE REVIEW BY SIGAFOOS, ET AL (2008) FOUND THAT 0/17 STUDIES REPORTED PRE-INTERVENTION ASSESSMENT TO IDENTIFY VIABLE AAC OPTIONS. THE OPTION TO USE AN SGD MAY BE WITHHELD BASED ON AN AUTHORITATIVE MODEL, PARTICULARLY, WHAT THE TEAM BELIEVES WILL BE EFFECTIVE. RESEARCH IS NEEDED TO ESTABLISH HOW INDIVIDUALS WITH FUNCTIONAL BLINDNESS CAN ACCESS THE LANGUAGE AVAILABLE ON SGDS, AND DETERMINE WHAT ADAPTATIONS MAY BE NECESSARY FOR THESE POPULATIONS.

COMMERCIAL SGDS REPRESENT LANGUAGE CONTENT USING VISUAL (GRAPHIC) STRATEGIES. THIS IS TRUE FOR ALL THREE LANGUAGE REPRESENTATION METHODS (HILL, 2001). GRAPHIC SYMBOL SYSTEMS MAY BE INACCESSIBLE TO INDIVIDUALS WITH FUNCTIONAL BLINDNESS. LANGUAGE CONTENT MAY NEED TO BE REPRESENTED IN ALTERNATIVE SENSORY MODALITIES. TACTILE REPRESENTATION IS OFTEN THE PREFERRED MODALITY WHEN VISION IS INSUFFICIENT, AS EVIDENCED BY MANY INDIVIDUALS WITH BRAILLE LITERACY SKILLS.

IN A REVIEW OF SENSORY CHARACTERISTICS OF USER INTERFACES ON 21 COMMERCIAL AAC DEVICES FROM SEVEN MANUFACTURERS, KOVACS & LIGHTNER (2007) FOUND NO SYSTEMS WITH PRE-FABRICATED TACTILE SYMBOL SETS. HOWEVER, SOME OVERLAY-BASED SYSTEMS COULD BE MODIFIED BY END-USERS TO SUPPORT CUSTOM TACTILE SYMBOL SETS. THIS STRATEGY IS COMMONLY REPORTED ANECDOTALLY, AND AT LEAST ONCE IN THE LITERATURE (LOCKE & MIRENDA, 1988). OTHER SYSTEMS FEATURED HARDWARE KEYBOARDS OR KEYGUARDS THAT ALLOW USERS TO ISOLATE TARGET LOCATIONS, BUT PROVIDE NO TACTILE FEEDBACK TO CONVEY THE MEANING OF LANGUAGE CONTENT STORED IN INDIVIDUAL LOCATIONS (KOVACS & LIGHTNER, 2007). IT MAY BE POSSIBLE FOR SOME USERS TO LEARN TO USE THESE SYSTEMS USING MOTOR PLANNING STRATEGIES. THE LEARNING PROCESS MAY BE SCAFFOLDED WITH TACTILE SYMBOLS.

AAC INSTRUCTIONAL STRATEGIES FOCUSING ON LEARNING UNIQUE MOTOR PLANS FOR SELECTING EACH WORD RATHER THAN LEARNING THE COMBINATIONS OF SYMBOLS USED TO REPRESENT EACH WORD HAVE BEEN DESCRIBED. THE LANGUAGE ACQUISITION THROUGH MOTOR PLANNING PROGRAM (LAMP) IS AN INSTRUCTIONAL STRATEGY FOCUSED ON MOTOR PLANNING THAT IS USED WITH CHILDREN WITH AUTISM (HALLORAN & EMERSON, 2006). IN LAMP, CHILDREN LEARN CONSISTENT AND UNIQUE MOTOR PATTERNS TO SELECT WORDS AND PRACTICE THESE PATTERNS IN SPONTANEOUS INTERACTION. AUTOMATICITY DEVELOPS THROUGH CONSISTENT, REPEATED EXPOSURE.

THERE MAY BE A DIFFERENCE BETWEEN THE TRAJECTORY OF LEARNING TO USE A SYSTEM USING MOTOR PLANNING ALONE, AND THE TRAJECTORY OF LEARNING TO USE A SYSTEM WITH A TACTILE SYMBOL BASE. ALTHOUGH INSTRUCTIONAL STRATEGIES TO

SUPPORT THE DEVELOPMENT OF MOTOR PLANS ARE FREQUENTLY RECOMMENDED, THE CONTRIBUTION OF MOTOR PLANS TO AAC LANGUAGE LEARNING HAS NOT BEEN DIRECTLY MEASURED. STUDYING INITIAL LEARNING OF AAC LANGUAGE FOR INDIVIDUALS WITH FUNCTIONAL BLINDNESS MAY PROVIDE A UNIQUE OPPORTUNITY TO DIRECTLY MEASURE LEARNING BASED ON MOTOR PLANNING. COMPARING THE TRAJECTORY OF LEARNING WITH AND WITHOUT TACTILE SYMBOLS CAN HELP DETERMINE IF THE ADDED APPLICATION OF TACTILE LANGUAGE REPRESENTATION IMPROVES USER PERFORMANCE.

PURPOSE

THE PURPOSE OF THIS PAPER IS TO DESCRIBE A METHODOLOGY FOR A PLANNED EXPERIMENT COMPARING THE TRAJECTORY OF LEARNING A SET OF WORDS REPRESENTED BY:

- A. PHYSICAL LOCATION ALONE, WHERE PHYSICAL LOCATIONS ARE SEPARATED BY A KEYGUARD BUT NO SYMBOLS PROVIDED (MOTOR PLANNING ONLY CONDITION), AND
- B. PHYSICAL LOCATION AND TACTILE SYMBOLS, WHERE PHYSICAL LOCATIONS ARE SEPARATED BY A KEYGUARD AND CUSTOM TACTILE SYMBOLS ARE POSITIONED IN EACH BUTTON LOCATION (SYMBOLS + MOTOR PLANNING CONDITION).

CONVERSATION GENERATED WITH CONFERENCE PARTICIPANTS WILL BE CONSIDERED IN IMPROVING THIS EXPERIMENTAL DESIGN.

HYPOTHESES:

- NULL: THERE IS NO DIFFERENCE BETWEEN THE TRAJECTORY FOR LEARNING AN AAC SYSTEM USING SYMBOLS + MOTOR PLANNING AND FOR LEARNING AN AAC SYSTEM USING MOTOR PLANNING ONLY
- ALTERNATIVE: THERE IS A DIFFERENCE BETWEEN THE TRAJECTORY FOR LEARNING AN AAC SYSTEM USING SYMBOLS + MOTOR PLANNING AND FOR LEARNING AN AAC SYSTEM USING MOTOR PLANNING ONLY

SUBJECTS:

FOUR ADULTS WITH NORMAL COGNITION, LANGUAGE, AND HEARING WILL PARTICIPATE. ALL SUBJECTS WILL BE BLINDFOLDED TO SIMULATE VISUAL IMPAIRMENTS.

INDEPENDENT VARIABLES

AAC SYSTEMS:

THE AAC SYSTEMS IN BOTH CONDITIONS WILL BE 15-LOCATION SGDS WITH STATIC DISPLAYS, AUTOMATED LANGUAGE ACTIVITY MONITORING, AND A HIGH FREQUENCY CORE VOCABULARY WORD AT EACH LOCATION. TWO COMMUNICATION BOARDS WITH SIMILAR VOCABULARY WILL BE USED. COMMUNICATION BOARD A INCLUDES VOCABULARY THAT ALLOWS SENTENCES TO BE GENERATED IN AGREEMENT WITH FIRST AND SECOND PERSON

PRONOUNS, AND COMMUNICATION BOARD B INCLUDES VOCABULARY THAT ALLOWS SENTENCES TO BE GENERATED IN AGREEMENT WITH THIRD PERSON PRONOUNS.

TRAINING TASKS:

DURING TRAINING SESSIONS, SUBJECTS WILL PRACTICE USING THE AAC SYSTEM TO PRODUCE SINGLE WORDS NAMED BY THE RESEARCHER IN RANDOM SEQUENCE. DIRECT INSTRUCTION WILL BE PROVIDED WITH INTERMITTENT REINFORCEMENT. SUBJECTS WILL BE REQUIRED TO ACCURATELY ACQUIRE OR IDENTIFY EACH OF THE 15 TARGET WORDS ON THE AAC SYSTEM TWICE IN EACH TRAINING SESSION.

METHODS

AN ALTERNATING TREATMENTS SINGLE SUBJECT DESIGN WILL BE USED. SUBJECTS WILL BE TRAINED TO USE TWO AAC SYSTEMS, ONE IN EACH CONDITION.

SUBJECTS WILL BE TRAINED TO USE THE AAC SYSTEM AT THE SINGLE WORD LEVEL. GENERALIZATION TO PRODUCTION OF LONGER, MORE COMPLEX UTTERANCES WILL BE MEASURED DURING PROBE TASKS (SENTENCE COPYING, AND SPONTANEOUS NOVEL UTTERANCE GENERATION) ADMINISTERED BETWEEN TRAINING SESSIONS. SESSIONS WILL CONTINUE UNTIL EITHER 95% ACCURACY ON THE SENTENCE COPYING TASK IS ACHIEVED ACROSS THREE CONSECUTIVE SESSIONS, OR ASYMPTOTIC PERFORMANCE IS DEMONSTRATED FOR BOTH CONDITIONS.

ONE TRAINING SESSION AND ONE PROBE SESSION FOR EACH CONDITION WILL BE COMPLETED DURING EACH DAY OF DATA COLLECTION. THE ORDER OF PRESENTATION OF CONDITIONS AND COMMUNICATION BOARDS WILL BE COUNTERBALANCED. TWO SUBJECTS WILL BE TRAINED TO USE COMMUNICATION BOARD A IN THE SYMBOLS + MOTOR PLANNING CONDITION AND COMMUNICATION BOARD B IN THE MOTOR PLANNING ONLY CONDITION, AND VICE VERSA.

DEPENDENT VARIABLES:

DEPENDENT VARIABLES WILL BE MEASURED IN THE FOLLOWING PROBE TASKS, ADMINISTERED AFTER EACH TRAINING SESSION:

- SENTENCE COPYING; SUBJECTS WILL REPEAT SENTENCES USING THE AAC SYSTEM. SENTENCES WILL BE PRESENTED VERBALLY.
- SPONTANEOUS NOVEL UTTERANCE GENERATION; SUBJECTS WILL ANSWER QUESTIONS BY GENERATING SENTENCES WITH THE WORDS AVAILABLE ON THE COMMUNICATION DEVICE.

DEPENDENT VARIABLES ON BOTH TASKS WILL INCLUDE: ACCURACY, AVERAGE COMMUNICATION RATE (WORDS/MINUTE), SELECTION RATE (BITS/SECOND), AND BIT RATE (WORDS/BIT). ON THE SPONTANEOUS NOVEL UTTERANCE GENERATION TASK, MEAN LENGTH OF UTTERANCE IN WORDS WILL ALSO BE MEASURED.

DATA ANALYSIS:

DATA WILL BE GATHERED, PLOTTED AND REPORTED FOLLOWING ATD PROCEDURES BASED ON AN INTERVENTION PHASE PROBES WITH PRE AND POST PHASE TESTING. A VISUAL ANALYSIS AND THE PERCENT OF NON-OVER LAPPING DATA WILL BE USED TO IDENTIFY THE METHOD THAT ACHIEVED THE BEST PERFORMANCE FOR THE INDIVIDUAL. THE DATA FROM THIS PILOT STUDY WILL SUPPORT FUTURE WORK IN A LARGER STUDY.

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