

Generative Language Learning in Severe Autism: Experimental Evaluation of a Mobile Application

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Background

- About 50% of individuals with autism spectrum disorder have severe speech and language impairments (Lord, Risi, & Pickles, 2004)
- Increasing use of augmentative and alternative communication (AAC), particularly speech-generating devices including mobile technologies
- Messages generated through AAC or minimal speech are mostly limited to one-word utterances (Schlosser & Wendt, 2008)
- Challenge to move minimally verbal learners from single-word requests to conventional language systems

Matrix Training

- Language intervention to systematically build up vocabulary and teach longer word combinations
- Generative approach to instruction, words are arranged in matrix format, some multiword phrases are taught and others develop without direct instruction
- Linguistic elements (e.g., nouns, verbs, etc.) are presented in systematic combination matrices, which are arranged to induce generalized rule-like behavior
- Example for a 6x6, action-object matrix:

		OBJECT					
		ball	cup	spoon	fork	apple	car
ACTION	point to	1	2	3	4	5	6
	drop	7	8	9	10	11	12
	take out	13	14	15	16	17	18
	put in	19	20	21	22	23	24
	shake	25	26	27	28	29	30
	wipe	31	32	33	34	35	36

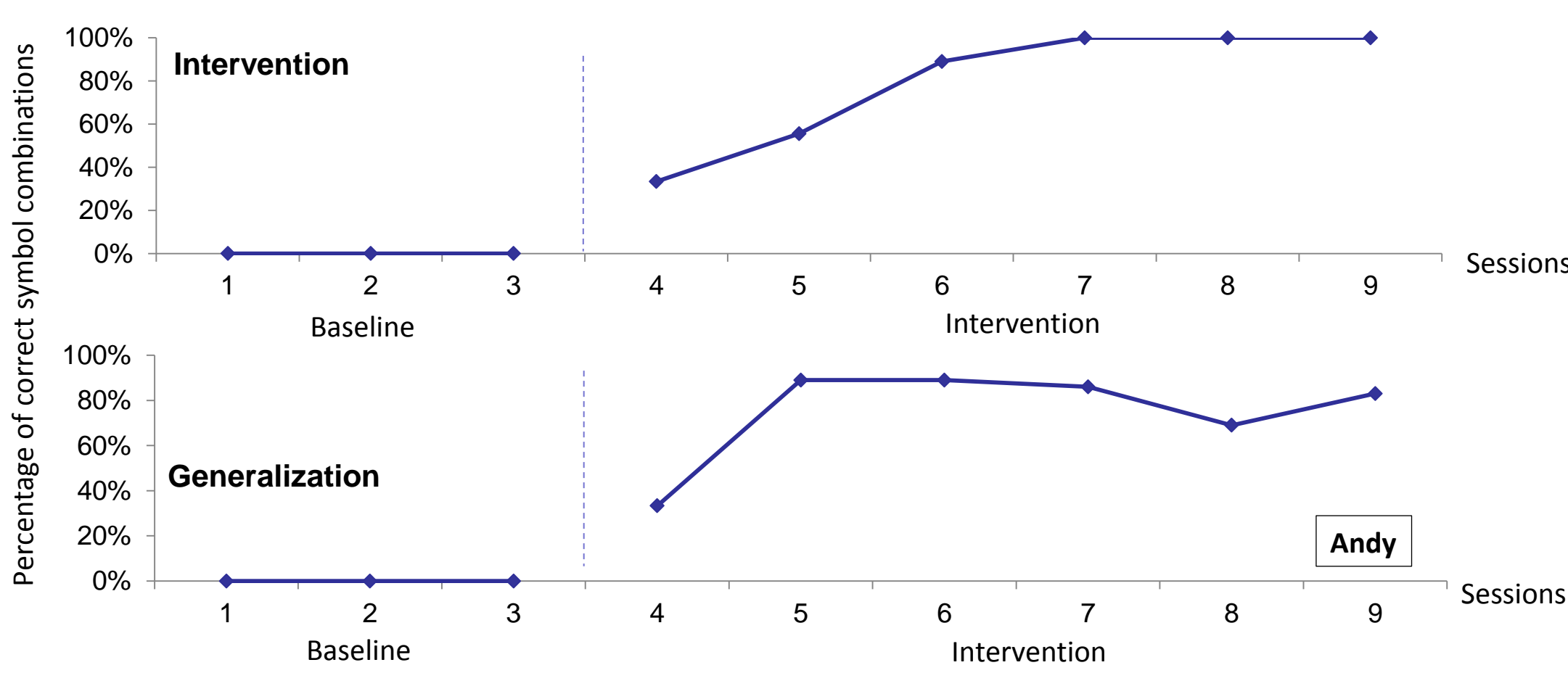
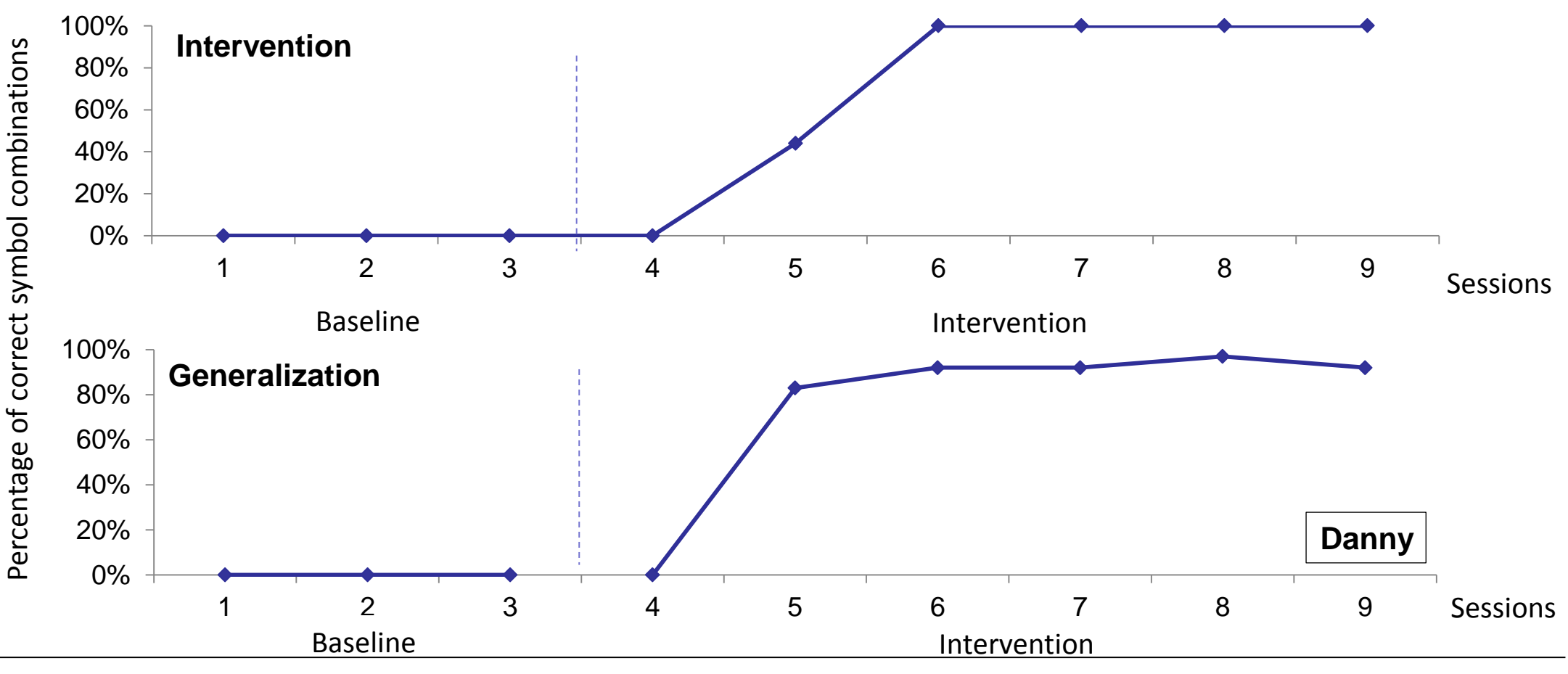
Objectives

A mobile application, *SPEAKmore!*TM was developed to carry out matrix training on a tablet device. Initial proof-of-concept data were collected to investigate:

1. Does language training with *SPEAKmore!*TM facilitate production of action-object combinations on a tablet device?
2. Do newly learned skills generalize to untrained action-object combinations?

Proof-of-Concept Data

- Series of pre-experimental A-B single case designs were completed across sets of action-object combinations with generalization probes of untrained combinations
- Two students were taught action-object combinations on a 6x6 matrix with *SPEAKmore!*TM: From total pool of 36 possible symbol combinations, the researcher created four different sets of three symbol combinations each that were actively taught
- Remaining 24 combinations were tested for generalization effects



- Participants demonstrated similar pattern of successful acquisition of symbol combinations during the intervention condition and subsequent generalization to untrained stimuli
- Magnitude of intervention effect was estimated using the Non-overlap of all Pairs (NAP) Index (Parker & Vannest, 2009):
 - Score from 0 – 65% indicates weak effects
 - Score from 66 – 92% indicates medium effects
 - Score from 93 – 100% indicates large or strong effects

iPad with *SPEAKmore!*TM App



- Video model delivers visual stimuli and prompts for response
- Expressive and receptive language assessment to determine current skill level
- Intervention mode: Instruction and error-correction on new symbol combinations
- Generalization mode: Testing generalization to untrained stimuli

Participants (Based on ADOS-2 and CARS-2 Scores)

Danny: Male, 12 yrs.	severe autism	highly echolalic, jargon, no functional, meaningful words
Andy: Male, 12 yrs.	severe autism	limited speech – vocalizations, gestures

Results and Discussion

Participant	Intervention NAP Effect	Generalization NAP Effect
Danny	92% (medium-strong effect)	92% (medium-strong effect)
Andy	100% (strong effect)	100% (strong effect)

- Results suggest matrix training through a mobile application may be a promising approach to teach new vocabulary, enhance semantic relationships and their generalization, and increase complexity of utterances for AAC users with severe autism
- To further investigate the robustness of this technology intervention, findings need to be replicated using (a) different language targets (e.g., agent-action, adjective-object combinations), (b) expansions from two-term to three-term semantic relations (e.g., agent-action-object), and (c) qualitatively different stimuli (e.g., animated icons vs. human video clip)
- Implementation of an experimental single-subject research design is the logical next step to generate evidence of a causal relationship
 - Generalization probes should investigate language generation without prompting through the application
- Future research may expand matrix training on mobile technologies to
 - Play skills and social skills training
 - Early literacy instruction
 - Teaching initial math skills