Update on Research on Verbal Behavior and Autism

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Purpose: To summarize and synthesize recently published findings on teaching verbal behavior to individuals with ASD.

The goal is for you to become aware of recent studies that may be relevant to what you do in your practice.

You won't get all the information here, but you will know where to find articles that may be useful to you.

B. F. Skinner's (1957) analysis of the elementary verbal operants will be used as a framework for classification and discussion

Mands, tacts, intraverbals, echoics

VB Research: Recent Developments

Sautter & LeBlanc (2006):

[Figure 1 from Sautter & LeBlanc, 2006]

Over 30 research articles per year in 2013 and 2014!

A great resource you should know about!

Analysis Verbal Behav (2015) 31:3–9
DOI 10.1007/s40616-015-0029-z

CONCEPTUAL ARTICLE

An Annotated Bibliography of Verbal Behavior Scholarship Published Outside of *The Analysis of Verbal Behavior*: 2014

James E. Carr · Melissa R. Nosik · Sarah A. Lechago · Lauren Phillips

Studies Included in Review

PsycINFO search + manual search of several journals

Initial search included:

- Original empirical research only (no review/discussion papers)
- Studies published in 2014 and 2015 (before July)
- Studies in which one or more participants were diagnosed with ASD
- Behavior-analytic studies that addressed similar topics as recent VB studies, but without using VB terminology

The search excluded:

- Studies in which no participants had ASD diagnoses
- Studies in which the primary focus was reduction of problem behavior (e.g., functional communication training)
- Studies that focused on listener behavior exclusively
- Studies that focused on textual behavior exclusively

PRESENTATION OVERVIEW

Teaching Manding (8)

Emergent Speaker and Listener Behavior (7)

Increasing Vocalizations of Minimally Verbal Children (3)

Teaching Tacts and Simple Intraverbals (8)

Teaching Complex Verbal Behavior (3)

+ brief update on other topics if time permits

Teaching Manding (8)

Teaching mands for information (3)

Selecting mand modality (3)

Other (2)

Mand: "[v]erbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (Skinner, 1957, pp. 35-36)

↓

ESTABLISHING OPERATIONS (EO)
(Michael, 1993)

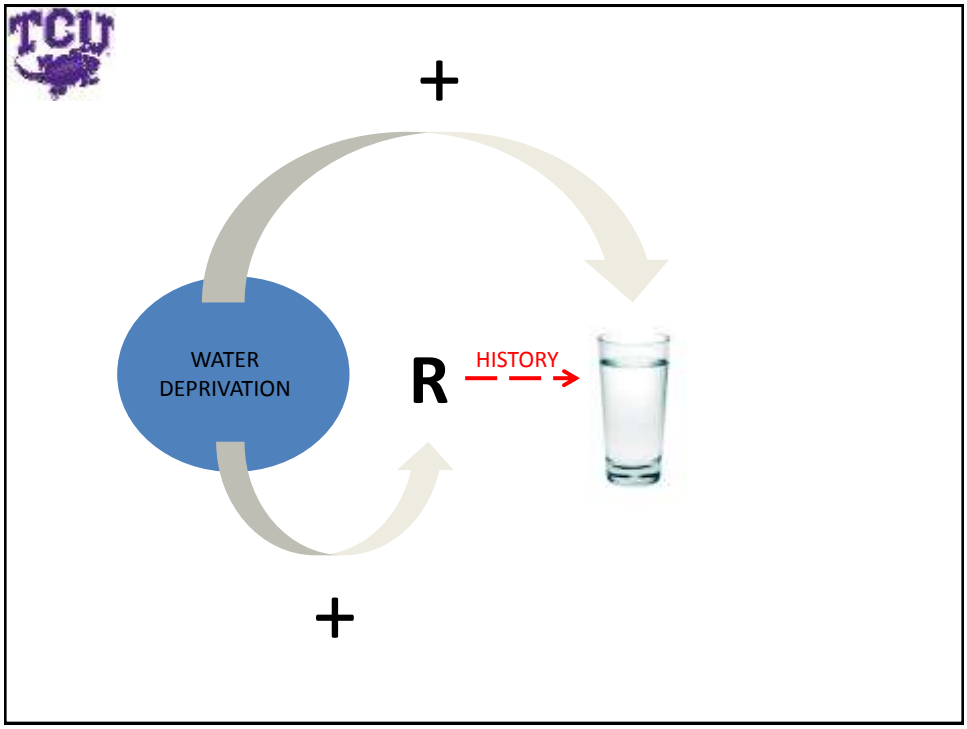
A subclass of MOTIVATING OPERATIONS
(Laraway, Snycerski, Michael, & Poling, 2003)

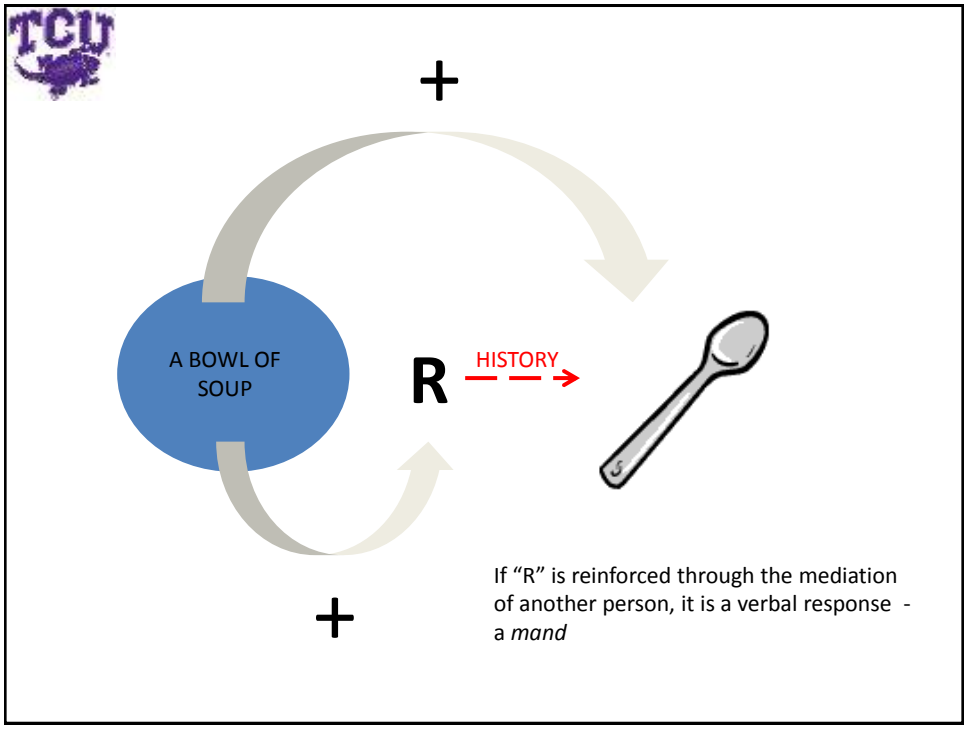
→ **EO**

→ **Abolishing Operation (AO)**

Motivating Operations

A variable that (a) increases or decreases the reinforcing value of stimulus or event X, and (b) evokes or suppresses responses that have produced X in the past (e.g., Laraway et al., 2003; Michael, 1982, 1993)





If "R" is reinforced through the mediation of another person, it is a verbal response - a *mand*

Question

If this child says "spoon" right now, is it likely to be a mand?

If a response is equally likely to occur in the presence and the absence of the EO, then it is probably not a mand!

Studies on teaching mands for information:

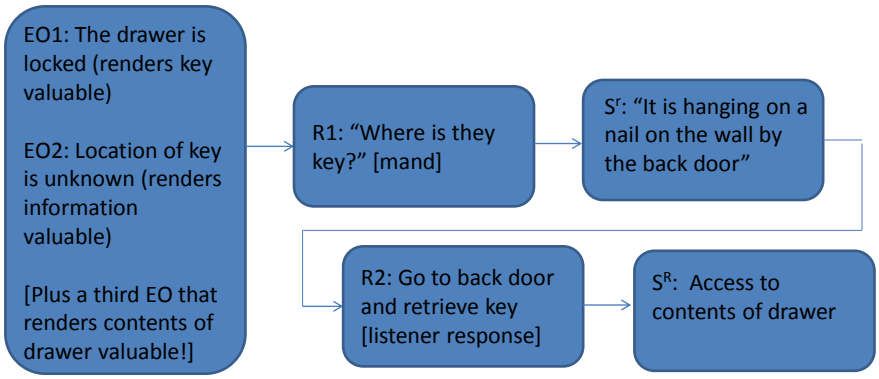
Shillingsburg, M. A., Bowen, C. N., Valentino, A. L., & Pierce, L. E. (2014). Mands for information using "who?" and "which?" in the presence of establishing and abolishing operations. *Journal of Applied Behavior Analysis, 47*, 136-150.

Shillingsburg, M. A., Bowen, C. N., & Valentino, A. L. (2014). Mands for information using "How" under EO-Absent and EO-Present conditions. *The Analysis of Verbal Behavior, 30*, 54-61.

Somers, A., Sidener, T. M., DeBar, R. M., & Sidener, D. W. (2014). Establishing concurrent mands for items and mands for information about location in children with autism. *The Analysis of Verbal Behavior, 30*, 29-35.

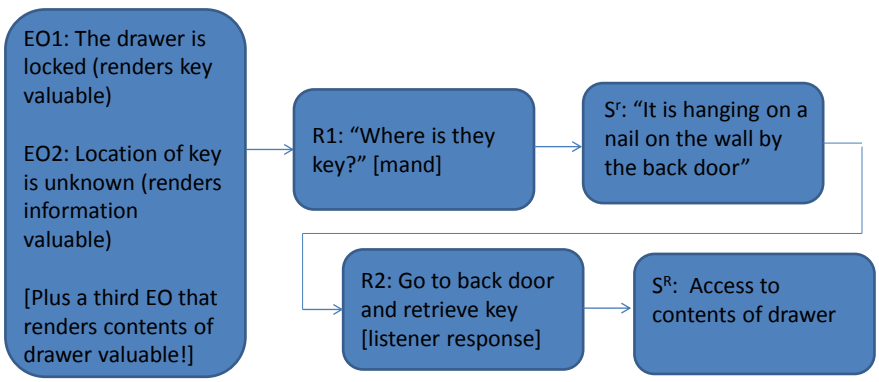
What is a mand for information (MFI)?

A mand under the functional control of a condition (EO) that renders *information* valuable (because in the presence of the information, effective action is possible)



What if you have no need for the content of the drawer? What if the drawer is unlocked? What if you already know where the key is? These *abolishing operations* should decrease the probability of manding for information.

To verify that you have truly taught an *MFI*, you need to demonstrate that it occurs more under EO than AO conditions (missing from some earlier studies)



Shillingsburg, Bowen, Valentino, & Pierce (2014)

Target MFIs: “Which . . .?” and “Who . . .?”

Three children diagnosed with ASD; 6, 8, and 12 years old

Approximately 100 tacts, a number of intraverbal fill-in responses, could *respond* to “What. . .?” and “Where . . .? ” questions

Two types of trials for each MFI: EO and AO

- AO trials served to provide evidence that the response that was taught functioned as a mand for information

Shillingsburg, Bowen, Valentino, & Pierce (2014)

EO trial for “Which”:

Participant: “I want a Skittle”

Shillingsburg, Bowen, Valentino, & Pierce (2014)

EO trial for "Which":

Experimenter: "It is under one of these cups"

Shillingsburg, Bowen, Valentino, & Pierce (2014)

EO trial for "Which":

Participant: "Which cup?" [target response]

Shillingsburg, Bowen, Valentino, & Pierce (2014)

EO trial for "Which":

Experimenter: "The yellow cup"

Shillingsburg, Bowen, Valentino, & Pierce (2014)

EO trial for "Which":

Participant: Looks under yellow cup [secondary measure]

Shillingsburg, Bowen, Valentino, & Pierce (2014)

AO trial for "Which":

Participant: "I want a Skittle"

Shillingsburg, Bowen, Valentino, & Pierce (2014)

AO trial for "Which":

Experimenter: "It is under the yellow cup"

Shillingsburg, Bowen, Valentino, & Pierce (2014)

In both EO and AO trials, the participant could look under one cup before the trial was terminated.

Guesses that occurred prior to mands for information were *not* blocked in EO trials.

During instruction, MFIs were prompted vocally using a constant prompt delay (0-s for the first 8 trials, then 2-s) in EO trials. Both prompted and independent responses produced the information.

In AO trials, no consequences were provided if an MFI was emitted.

Shillingsburg, Bowen, Valentino, & Pierce (2014)

[Figure 1 from Shillingsburg, Bowen, Valentino, & Pierce, 2014]

Shillingsburg, Bowen, Valentino, & Pierce (2014)

"Who" mands were taught in a similar manner and results were similar.

[Figure 5 from Shillingsburg, Bowen, Valentino, & Pierce, 2014]

Participants continued to perform well when "Which" and "Who" trials were alternated:

Shillingsburg, Bowen, Valentino, & Pierce (2014)

Extensive generalization probes conducted for "Which" MFIs.

Immediate generalization to novel containers obtained for two participants.

The third participant required training with multiple exemplars before generalization was observed.

Shillingsburg, Bowen, & Valentino (2014)

"How" MFIs

Two boys diagnosed with ASD

- Josh: 7 years old, 100 tacts, 90 intraverbals, mand repertoire
- Doug: 3 years old, 50 tacts, 50 intraverbals (answers to wh- questions), high rates of multiple-word phrase manding

EO (EO-present) and AO (EO-absent) trials

Shillingsburg, Bowen, & Valentino (2014)

[Table 1 from Shillingsburg, Bowen, & Valentino, 2014]

Activities were selected based on a pretraining assessment indicating that all activities were preferred, and that the participant either could (EO-present) or could not (EO-absent) complete them independently.

Shillingsburg, Bowen, & Valentino (2014)

[Table 2 from Shillingsburg, Bowen, & Valentino, 2014]

EO-present teaching activities that Doug learned to complete independently during teaching were re-classified as EO-absent activities from that point on.

Shillingsburg, Bowen, & Valentino (2014)

Trials were interspersed within regular language programming; 10 trials per day on the average

A trial began with the therapist asking the participant if he or she wanted to engage in the target activity, and conducted only if the participant indicated yes.

EO present trial: The therapist delivered an instruction to complete an unknown activity ("Spell Bugati" or "Plug in the mouse")

EO absent trial: The therapist delivered an instruction to complete a known activity ("Spell Ferrari" or "Press play")

Shillingsburg, Bowen, & Valentino (2014)

Teaching procedures similar to previous study.

In EO-present trials, prompted and unprompted "How?" responses produced information on how to complete the task. Upon task completion, the therapist provided verbal praised and joined the participant in the activity.

In EO-absent trials, participant was permitted to complete the task independently, but the trial was terminated if the participant asked "How?"

Shillingsburg, Bowen, & Valentino (2014)

[Figure 1 from Shillingsburg, Bowen, & Valentino, 2014]

Shillingsburg, Bowen, & Valentino (2014)

[Figure 2 from Shillingsburg, Bowen, & Valentino, 2014]

Somers et al. (2014)

"Where . . .?" MFIs

Participants:

- Two boys diagnosed with ASD, 8 and 9 years old
- Could mand for at least 20 items using the phrase "I want [item]" but did not mand for information about location

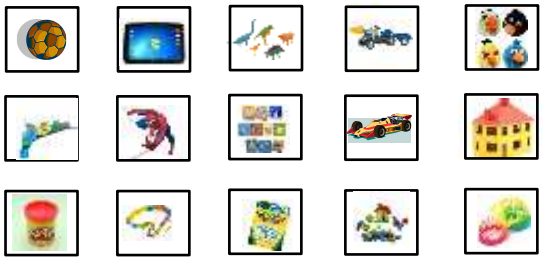
Importance of differentiating "I want . . ." from "Where is . . ." !

Three types of trials:

- Item present (AO) trials
- "I want" trials: Item visible but inaccessible
- "Where" trials: Item not visible

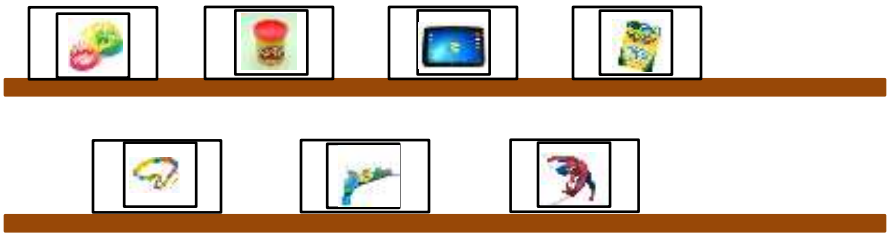
Somers et al. (2014)

At the beginning of a trial, the participant had access to a choice board with 15 photographs of preferred toys:



Somers et al. (2014)

After selecting a picture, the participant took it to a toy shelf that held 15 clear containers with the same photographs, matched the two photographs, and looked inside the container.



Somers et al. (2014)

Item present trials: Item inside container; participant plays with item for 2-3 min

"I want" trials: Items not in container but visible in teacher's hands; "I want" mand required to play with item.

"Where" trials: Item not in container and not visible. "Where is . . .?" MFI resulted in being told the location of the item and having an opportunity to retrieve and play with it.

Generalization probes included novel instructor, novel setting, novel items, and two natural situations involving activities in participant's daily routine.

Somers et al. (2014)

[Figure 1 from Somers et al., 2014]

Studies on selecting mand modality:

Couper, L., van der Meer, L., Schafer, M. C. M., McKenzie, E., McLay, L., O'Reilly, M. F., Lancioni, G. E., Marschik, P. B., Sigafoos, J., & Sutherland, D. (2014). Comparing acquisition of and preference for manual signs, picture exchange, and speech-generating devices in nine children with autism spectrum disorder. *Developmental Neurorehabilitation, 17*, 99-109.

McLay, L., van der Meer, L., Schafer, M. C. M., Couper, L., McKenzie, E., O'Reilly, M. F., Lancioni, G. E., Marschik, P. B., Green, V. A., Sigafoos, J., & Sutherland, D. (2015). Comparing acquisition, generalization, maintenance, and preference across three AAC options in four children with autism spectrum disorder. *Journal of Developmental and Physical Disabilities, 27*, 323-339.

Roche, L., Sigafoos, J., Lancioni, G. E., O'Reilly, M. F., van der Meer, L., Achmadi, D., Green, V. A., Kagohara, D., Sutherland, D., Rayner, C., & Marschik, P. B. (2014). Comparing tangible symbols, picture exchange, and a direct selection response for enabling two boys with developmental disabilities to access preferred stimuli. *Journal of Developmental and Physical Disabilities, 26*, 249-261.

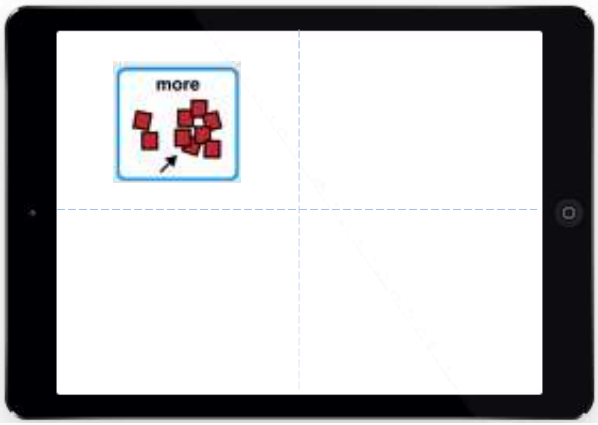
Mand Modality Studies

All three studies addressed alternative communication systems for establishing mands/requests in children diagnosed with ASD who had severe communication impairments

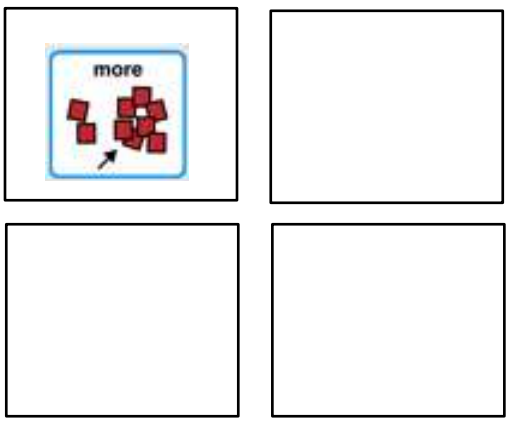
Two studies (Couper et al., 2014; McLay et al., 2015) compared acquisition and preference for picture exchange, manual signing, and an iPad® speech-generation app (Proloquo2Go™; Sennott & Bowker, 2009) with a total of 13 participants.

Participants were taught to request "more" when preferred toys were removed, using a 10-s delay to physical prompt involving the least amount of assistance needed to produce the response.

Mand Modality Studies



Mand Modality Studies



Mand Modality Studies

Source: The Online Dictionary of New Zealand Sign Language, http://nzsl.vuw.ac.nz/

Mand Modality Studies

A comparison of trials to criterion in the three conditions yielded variable results across participants.

McLay et al. tested generalization across settings and people; results varied across participants.

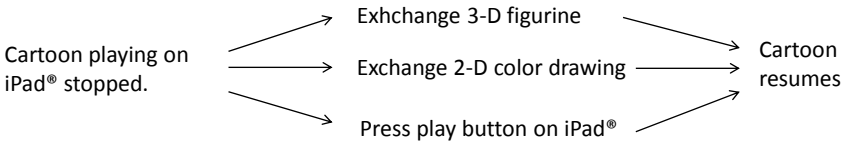
Preference probes conducted throughout all conditions revealed a preference for using the iPad for 12 of 13 participants.

In conclusion, children with ASD tend to show a preference for using iPad®-based speech output over other options, but this is not necessarily reflected in faster acquisition.

Limitation: Only one response taught

Mand Modality Studies

The third study (Roche et al., 2014) compared acquisition and preference for 3-D symbol *vs*. 2-D picture exchange; a third condition was direct access to the reinforcer without a listener's mediation.



Six cartoons used for each participant.

No consistent acquisition differences, but both participants preferred 3-D symbol exchange to the other options

Other studies on teaching mands:

Groskreutz, N. C., Groskreutz, M. P., Bloom, S. E., & Slocum, T. A. (2014). Generalization of negatively reinforced mands in children with autism. *Journal of Applied Behavior Analysis, 47*, 560-579.

Lorah, E. R., Gilroy, S. P., & Hineline, P. N. (2014). Acquisition of peer manding and listener responding in young children with autism. *Research in Autism Spectrum Disorders, 8*, 61-67.

Groskreutz et al. (2014)

In the context of Functional Communication Training, children are often taught to mand for the removal of aversive stimuli that otherwise may evoke problem behavior.

But shouldn't children also learn to mand for aversive stimuli, even if they have not developed problem behavior?

- May prevent problem behavior
- May improve quality of life

Groskreutz et al. (2014) developed an assessment to identify aversive stimuli or activities in daily environment; then taught the participants to sign "stop" or "finished" to escape the stimulus or activity.

Groskreutz et al. (2014)

Two boys diagnosed with ASD; 7 and 9 years old. Jared had no vocal communication; Brian spoke in 3-4 word utterances but rarely initiated communication.

[Figure 3 from Groskreutz et al., 2014]

Lorah et al. (2014)

Peer manding: A peer, rather than an adult, serves as the listener who reinforces a mand

Previous studies in which both participants and peers were children with ASD did not provide data on the peer's listener behavior

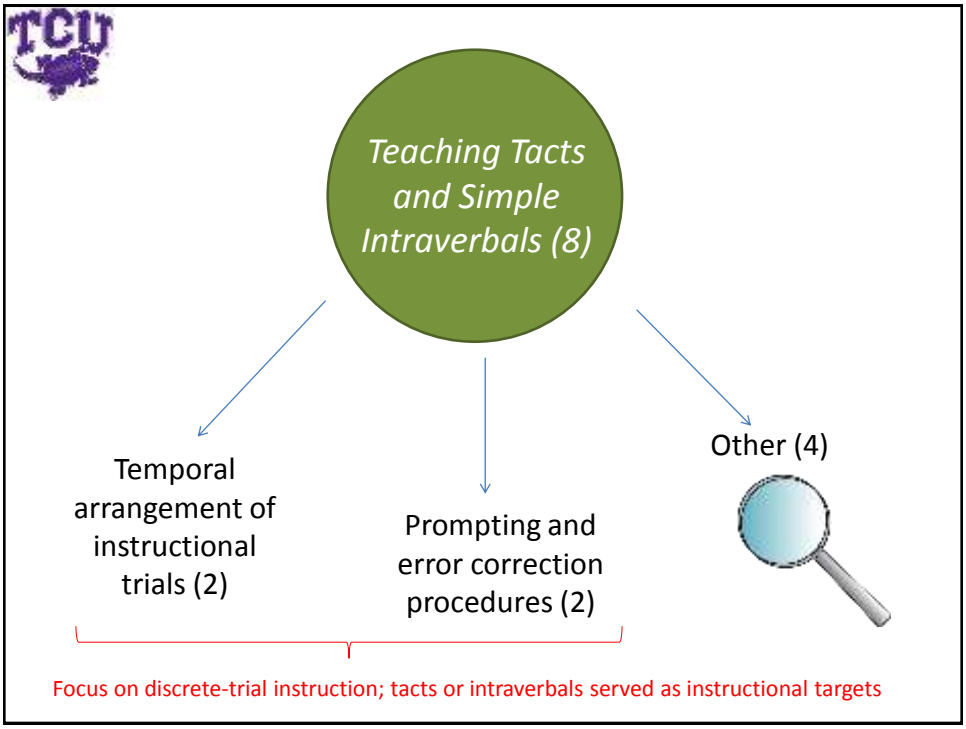
Lorah et al. (2014) taught some participants to direct mands toward a peer, and other participants to accurately reinforce the mands of peers

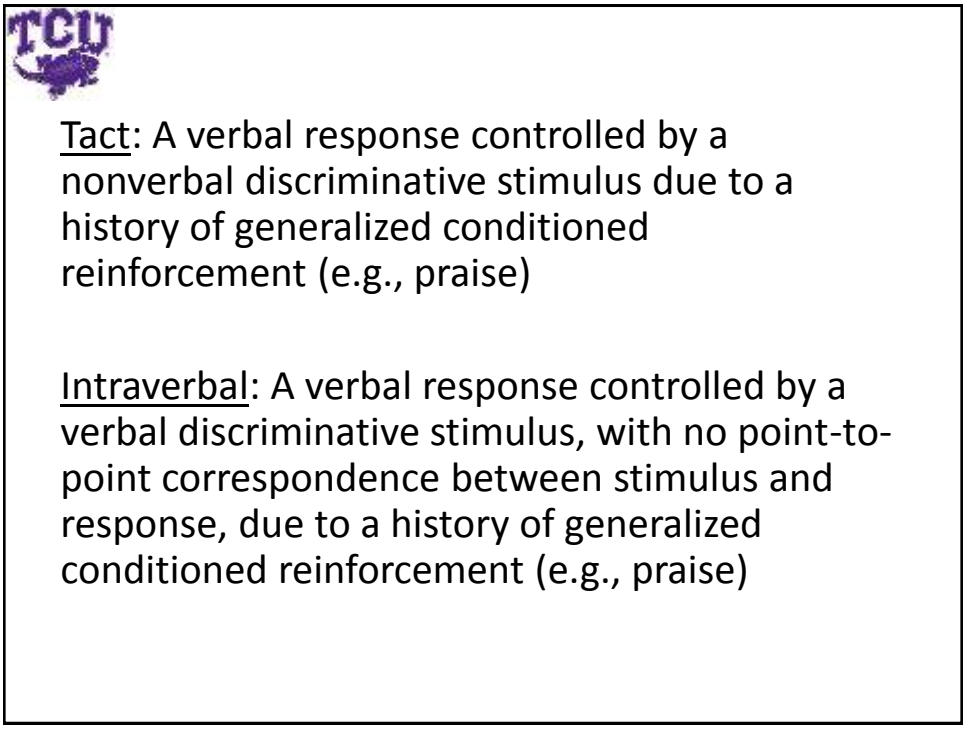
Participants: Six 4- and 5-year-old children with ASD diagnoses; mands weak or absent according to VB-MAPP

Lorah et al. (2014)

Participants were taught to (a) mand for missing puzzle pieces, or (b) deliver missing puzzle pieces upon reuqest, using a variety of age-appropriate puzzles

Through prompting and reinforcement, each participant acquired his or her target response, and generalization was observed to novel peers.


Teaching Tacts and Simple Intraverbals (8)
Temporal arrangement of instructional trials (2)
Prompting and error correction procedures (2)
Other (4)
Focus on discrete-trial instruction; tacts or intraverbals served as instructional targets


Tact: A verbal response controlled by a nonverbal discriminative stimulus due to a history of generalized conditioned reinforcement (e.g., praise)
Intraverbal: A verbal response controlled by a verbal discriminative stimulus, with no point-to-point correspondence between stimulus and response, due to a history of generalized conditioned reinforcement (e.g., praise)

Studies on discrete-trial instruction with tacts or intraverbals as instructional targets

Temporal arrangement of instructional trials:

Haq, S. S., Kodak, T., Kurtz-Nelson, E., Porritt, M., Rush, K., & Cariveau, T. (2015). Comparing the effects of massed and distributed practice on skill acquisition for children with autism. *Journal of Applied Behavior Analysis, 4*8, 454-459.

Majdalany, L. M., Wilder, D. A., Greif, A., Mathisen, D., & Saini (2014). Comparing massed-trial instruction, distributed-trial instruction, and task interspersal to teach tacts to children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 47*, 657-662.

Prompting and error-correction procedures:

Carroll, R. A., Joachim, B. T., St. Peter, C. C., & Robinson, N. (2015). A comparison of error-correction procedures on skill acquisition during discrete-trial instruction. *Journal of Applied Behavior Analysis, 48*, 257-273.

Leaf, J. B., Leaf, R., Taubman, M., McEachin, J., & Delmolino, L. (2014). Comparison of flexible prompt fading to error correction for children with autism spectrum disorder. *Journal of Developmental and Physical Disabilities, 26*, 203-224.

Haq et al. (2015)

Massed Practice:	Distributed Practice:	Control:
80 training trials in a single training session 1 day/week	20-trial training sessions 4 days/week	No instruction

Three children with ASD diagnoses; 4, 5, and 10 years old; verbal and spoke in full sentences.

Distributed practice was more efficient than massed practice. No participant reached mastery in the massed practice condition, even after many more trials, weeks, and minutes than it took to reach mastery in the distributed practice condition.

Majdalany et al. (2014)

Massed Trials*:	Distributed Trials*:	Task Interspersal:
20 trials alternated across five new tact targets; 1-2 s ITI	20 trials alternated across five new tact targets; 10 s ITI	Identical to distributed trials except three mastered targets presented during ITI

*Refers here to the length of the inter-trial interval (ITI)

Six children with ASD diagnoses; Level 2 learners on VB-MAPP

Five participants acquired the target responses fastest in the massed-trial condition; results of follow-up probes varied across participants.

Carroll et al. (2015)

Single-response repetition:
Contingent on incorrect responses and failures to respond, the participant was required to echo a vocal model.

Multiple-response repetition:
Contingent on both incorrect responses and failures to respond, participant was required to echo vocal model repeatedly until 5 correct echoic responses.

Remove and represent:
Contingent on incorrect responses, the instructor turned away for 2 s, then re-presented the trial. Consequences for failures to respond were the same as in single-response repetition

Represent until independent:
Contingent on both incorrect responses and failures to respond, the participant was required to echo a vocal model; the trial was then re-presented until a correct, independent response was obtained or 20 error correction trials had been conducted.

Carroll et al. (2015)

Five 5- to 8-year-old children; 3 diagnosed with ASD and 2 with ADHD. Participants with ASD communicated vocally in one- to five-word utterances.

Target responses for participants with ASD were tacting features or functions of items, or reading sight words.

One or more correction procedures were generally effective for all participants, but relative efficiency varied across participants.

Fewest trials and minutes to criterion in the "represent until independent" condition for the two participants with ADHD and one participant with ASD.

Results underscore need for individualized assessment to select the most effective error correction procedure.

Leaf et al. (2014)

Flexible prompt-fading:
In each trial, the experimenter had the autonomy to decide whether to provide an immediate prompt or first allow an independent opportunity to respond, which type of prompt (how intrusive) to provide, and whether or not to implement a remedial trial following errors.

Error correction:
All trials began with an independent opportunity to respond. Error responses were followed by the experimenter providing the answer and a remedial trial with another independent opportunity to respond.

Leaf et al. (2014)

Four boys with ASD, 4-6 years old, IQ ranging from 86 to 128; three participants had a prior history of flexible prompt-fading procedures.

Dependent measures included trials, sessions, and instructional time to criterion.

Results varied across participants but generally favored the flexible prompt-fading procedure.

Other studies on teaching tacts and intraverbals:

Kelly, L., & Holloway, J. (2015). An investigation of the effectiveness of behavioral momentum on the acquisition and fluency outcomes of tacts in three children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 9*, 182-192.

Perez-Gonzalez, L. A., Pastor, A., & Carnerero, J. J. (2014). Observing tacting increases uninstructed tacts in children with autism. *The Analysis of Verbal Behavior, 30*, 62-68.

Koehler, K. T., & Malott, R. W. (2014). Matrix training and verbal generativity in children with autism. *The Analysis of Verbal Behavior, 30*, 170-177.

Lorah, E. R., Karnes, A., & Speight, D. R. (2015). The acquisition of intraverbal responding using a speech generating device in school aged children with autism. *Journal of Developmental and Physical Disabilities, 27*, 557-568.

Kelly & Holloway (2015)

Used a *behavioral momentum* procedure to teach new tacts to a fluency (instead of an accuracy) criterion.

Three children with ASD diagnoses, 3-4 years old; Preschool Language Scale age equivalent scores of 2.1 to 3.6 years.

Participants were first taught to independently tact pictures on flashcards, controlling their own rate of presentation.

Kelly & Holloway (2015)

High-*p* tacts: Already mastered
Low-*p* tacts: Non-mastered

During intervention sessions, the participants first went through 20 flash cards of high-*p* stimuli followed by one minute of flashcards containing a set of four low-*p* tact stimuli.

The fluency goal was 30-35 correct tacts per min for low-*p* stimuli for 2 participants; 20-25 per min for one participant.

No reinforcement, prompts, or error correction delivered during timing, but corrective feedback was delivered after the session for stimuli tacted incorrectly during timing.

Kelly & Holloway (2015)

[Figure 1 from Kelly & Holloway, 2015]

Kelly & Holloway (2015)

[Figure 3 from Kelly & Holloway, 2015]

Kelly & Holloway (2015)

[Figure 5 from Kelly & Holloway, 2015]

Kelly & Holloway (2015)

[Figures 2, 4, and 6 from Kelly & Holloway, 2015]

Kelly & Holloway (2015)

In summary, all participants demonstrated fluent performance, and the number of sessions to fluency decreased across stimulus sets.

Positive results of retention, endurance, stability, and application checks.

Error rates?

Contribution of the high-*p* sequence?

Benefits of fluent tacting for individuals with ASD?

Perez-Gonzalez et al.(2014)

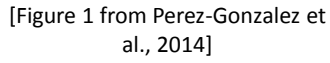
The goal was to increase rates of uninstructed ("spontaneous") tacts in natural settings by having the teacher model spontaneous tacting.

Condition 1:
In each session, the teacher conducted 20 tact trials for mastered tacts with the participant

Condition 2:
In each session, the teacher conducted 20 tact trials for mastered tacts with the participant. In addition, the teacher herself emitted 20 tacts.

Perez-Gonzalez et al.(2014)

Three children with ASD diagnoses, 4-5 years old; 150-250 tacts; demonstrated emergence of tacts or mands following listener training



[Figure 1 from Perez-Gonzalez et al., 2014]

Koehler & Malott (2014)

Effects of *matrix training* on novel tacts in the form of subject-verb-object (S-V-O) sentences, e.g., "Jessica eats banana."

- Recombinative generalization

Two five-year-old children with ASD diagnoses; had already mastered the single-word action and object tacts used in the study, but did not emit S-V-O sentences.

Stimuli presented via video (e.g., a familiar person named Jessica eating a banana).

Koehler & Malott (2014)

Vocal prompting (0-s, then 3-s delay) and reinforcement used to teach three diagonally ordered responses in a single matrix, then tested generalization to other cells and trained as needed.

[Figure 3 from Kohler & Malott, 2014]

Koehler & Malott (2014)

Next, tested three diagonal cells in each remaining matrix.

If less than 2/3 correct, provided training with that matrix in the same manner

If at least 2/3 correct, tested remainder of that matrix, trained as needed (if needed)

[Figure 3 from Kohler & Malott, 2014]

Koehler & Malott (2014)

Both participants mastered all 162 sentences

One participant required explicit training on only 14 sentences and required no training with 3 of 6 matrixes.

The other required explicit training with 72 sentences and no training with 2 of 6 matrixes.

[Figure 3 from Kohler & Malott, 2014]

Lorah et al. (2015)

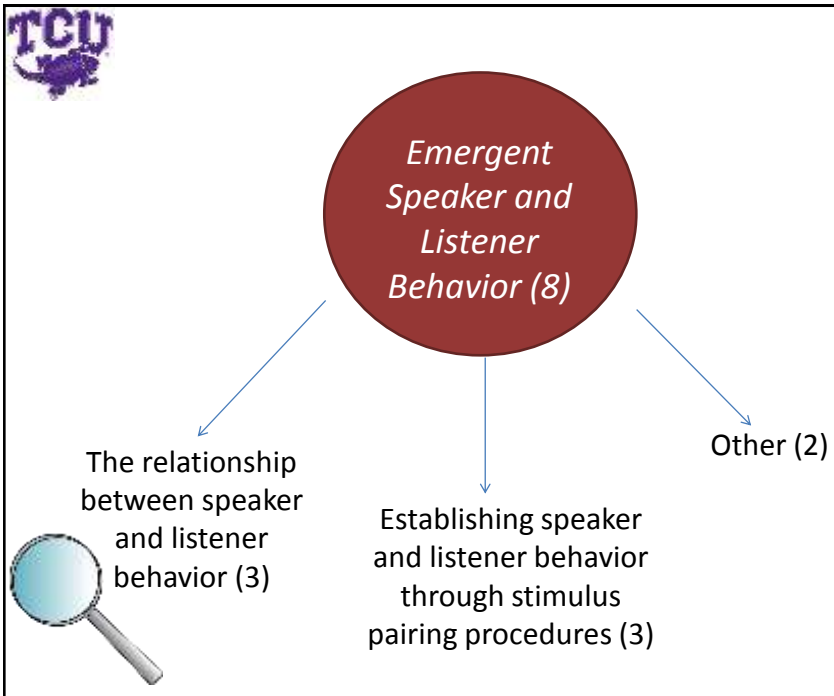
Evaluated use of the Proloqu2Go™ app combined with 5-s time delay to physical prompt to teach intraverbal responses to a social questions.

Two participants diagnosed with ASD, 8 and 12 years old, minimal or no vocal communication, intraverbal repertoire weak or absent (Level 3-4 on VB-MAPP Barriers Assessment).

Experimenter asked questions (e.g., “What is your favorite toy?”) and participants responded by selecting one of five pictures on iPad screen, producing the spoken word.

Lorah et al. (2015)

[Figures 1 and 2 from Lorah et al., 2015]



The relationship between speaker and listener behavior:

Delfs, C. H., Conine, D. E., Frampton, S. E., Shillingsburg, M. A., & Robinson, H. C. (2014). Evaluation of the efficiency of listener and tact instruction for children with autism. *Journal of Applied Behavior Analysis, 47*, 793-809.

Kodak, T., & Paden, A. R. (2015). A comparison of intraverbal and listener training for children with autism spectrum disorder. *The Analysis of Verbal Behavior, 31*, 137-144.

Kobari-Wright, V. V., & Miguel, C. F. (2014). The effects of listener training on the emergence of categorization and speaker behavior in children with autism. *Journal of Applied Behavior Analysis, 47*, 431–436.

Should we always teach listener behavior before teaching corresponding speaker behavior (receptive-before-expressive) or is it better to go straight to teaching speaker behavior (expressive-before-receptive)?

Petursdottir and Carr (2011) reviewed the literature that has addressed this question:

- Most studies suggested that it was more efficient to teach tacts before listener behavior than listener behavior before tacts (at least for individuals who had already acquired some tacts and listener behavior).
- However, most of the literature was dated and most studies did not include individuals with ASD.
- No studies had addressed the question for intraverbal speaker behavior except with typically developing children.

Delfs et al. (2014)

Four boys diagnosed with ASD, 3-8 years old, at different levels of language functioning. All had existing tact and listener repertoires; scored at levels 1-3 on VB-MAPP.

[Table 1 from Delfs et al, 2014]

Delfs et al. (2014)

[Figure 4 from Delfs et al., 2014]

Delfs et al. (2014)

[Table 2 from Kohler & Malott, 2014]

Training trials to criterion were similar for tact and listener training.

Kodak & Paden (2015)

Function, feature, and class (FFC): Listener behavior (RFFC) and intraverbal responding

Sundberg & Partington (1998) recommend teaching the listener repertoire first

Purpose of study (similar to Delfs et al., 2014): To compare trials to criterion in listener vs. intraverbal FFC instruction, as well as emergence of the untrained repertoire, and unsolicited tacting during listener training.

Two children diagnosed with ASD, 2-3 years old; extensive tact repertoires and 50 intraverbals

Kodak & Paden (2015)

[Table 1 from Kodak & Paden, 2015]

Kodak & Paden (2015)

[Figure 1 from Kodak & Paden, 2015]

Kodak & Paden (2015)

[Figure 1 from Kodak & Paden, 2015]

Together, Delfs et al. (2014) and Kodak and Paden (2015) found that

- Teaching tacts or intraverbals consistently resulted in the emergence of listener behavior
  - Not always the case in previous research (e.g., Wynn & Smith, 2003)
- Teaching listener behavior did not consistently produce tacts or intraverbals
- Teaching speaker behavior did not require more instructional trials than teaching listener behavior

Consistent with previous literature (Petursdottir & Carr, 2011) but further research needed to determine for whom tact and intraverbal instruction produces listener behavior.

Kobari-Wright & Miguel (2014)

Can children with ASD categorize stimuli nonverbally after receiving listener training with their category names?

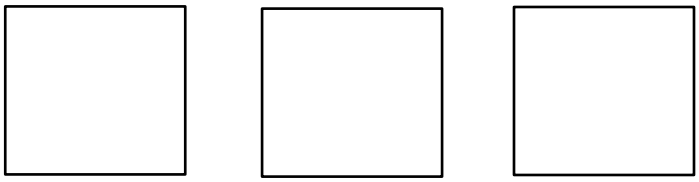
Studies with typically developing children suggest that this happens only if listener training produces emergent tacts (e.g., Horne, Lowe, Harris, & Randle, 2004; Miguel, Petursdottir, Carr, & Michael, 2008)

"Naming" repertoire (Horne & Lowe, 1996)

Kobari-Wright & Miguel (2014)

Listener Training

"Give me the hound dog"

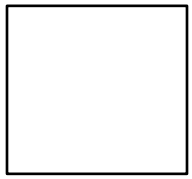


[Not the actual stimuli used in the study]

Kobari-Wright & Miguel (2014)

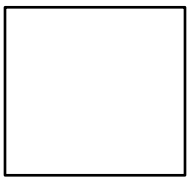
Tact Test 1

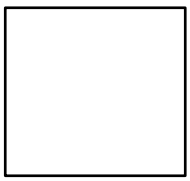
"What is it?"

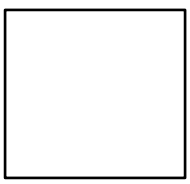


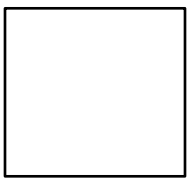
Kobari-Wright & Miguel (2014)

Categorization Test









Kobari-Wright & Miguel (2014)

[Figure 1 from Kobari-Wright & Miguel, 2014]

Kobari-Wright & Miguel (2014)

[Figure 1 from Kobari-Wright & Miguel, 2014]

Kobari-Wright & Miguel (2014)

Children are said to have a "naming" repertoire when the listener behavior emerges as a result of speaker training and vice versa.

Results suggest that children with naming repertoires may show increased emergence of untrained skills (see also Miguel & Kobari-Wright, 2013)

Some early intervention curricula (e.g., Leaf & McEachin, 1999; Taylor & McDonough, 1996) suggest teaching category sorting or matching before teaching category labeling (listener/tact). This may not be necessary if the student has a naming repertoire.

Establishing speaker and listener behavior through stimulus pairing procedures:

Byrne, B. L., Rehfeldt, R. A., & Aguirre, A. A. (2014). Evaluating the effectiveness of the stimulus pairing observation procedure and multiple exemplar instruction on tact and listener responses in children with autism. *The Analysis of Verbal Behavior, 30*, 160-169.

Longano, J. M., & Greer, R. D. (2015). Is the source of reinforcement for naming multiple conditioned reinforcers for observing responses? *The Analysis of Verbal Behavior, 31*, 96-117.

Vallinger-Brown, M., & Rosales, R. (2014). An investigation of stimulus pairing and listener training to establish emergent intraverbals in children with autism. *The Analysis of Verbal Behavior, 30*, 148-159.

Early in language programming, we teach speaker and listener behavior through prompting and reinforcement.

Ultimately, we want our students to be able to pick up new speaker and listener behavior from the natural environment without formal instruction; perhaps as a result of simple exposure to word-object pairings.

The next set of studies aimed to assess the extent to which students with ASD acquired new speaker and listener behavior as a result of observing word-object pairings or observing others tact objects, without requiring a response from the student.

"SPOP": Stimulus Pairing Observation Procedure

Byrne et al. (2014)

Three 7-year-old children with ASD diagnoses; VB-MAPP Level 1.

A single SPOP session (3 stimuli, 45 trials) initially produced limited increases in correct tacts and listener behavior.

Multiple-exemplar training was conducted with new sets of stimuli for multiple sessions until participants met criterion for emergent tacts and listener behavior (55-115 trial blocks).

One participant then demonstrated criterion performance with the original stimulus set; smaller increases were observed for the other two.

Longano & Greer (2014)

How can we get children to acquire tacts and listener behavior from exposure to word-object pairings if they do not do so already?

Byrne et al.'s (2014) data suggested that multiple-exemplar training with repeated probes will improve performance.

Longano & Greer's (2014) approach: Strengthen participants' preference for looking at pictures and listening to words through a conditioning procedure.

Three 5- to 7-year-old children; two diagnosed with ASD. Had mands, tacts, listener behavior, echoics, etc., but did not have strong naming repertoires.

Longano & Greer (2014)

Phase 1: Paired a set of 4 visual [auditory] stimuli with edible and social reinforcers until participants reliably engaged in observation of the stimuli

Phase 2: Paired auditory [visual] stimuli with the visual [auditory] stimuli

Pre-test: Participants showed some emergent listener behavior following
(a) identity-matching trials during which they heard the relevant spoken word (joint attention condition), and to a lesser extent
(b) after observing experimenter tacting stimuli (incidental condition).
Did not demonstrate emergent tacts or intraverbals.

Post-tests: After experiencing Phase 1 and Phase 2 with multiple (2-4) stimulus sets, all participants showed emergent tacts under both conditions.

Vallinger-Brown & Rosales (2014)

Compared the effects of SPOP and listener training on emergent intraverbal responding

Three boys with ASD diagnoses, 4-7 years old, Level 2 on intraverbal subsection of VB-MAPP; Levels 2-3 for mands and tacts.

[Table 1 from Vallinger-Brown & Rosales, 2014]

Vallinger-Brown & Rosales (2014)

Listener Training:

"Point to the one you use to tell time"

SPOP:

"A dime is worth 10 cents"

Vallinger-Brown & Rosales (2014)

One participant demonstrated all emergent intraverbals in both conditions with the minimum amount of training.

The other two participants did better in the listener training than in the SPOP condition but did not acquire all of the target intraverbals until they were trained directly.

Although SPOP does not necessarily produce tacts, intraverbals, or listener behavior to criterion, it often produces an increase in these behaviors.

A low-effort way to jump start instructional programs?

Other research on emergent verbal behavior:

Allan, A. C., Vladescu, J. C., Kisamore, A. N., Reeve, S. A., & Sidener, T. M. (2015). Evaluating the emergence of reverse intraverbals. *The Analysis of Verbal Behavior, 31*, 59-75.

Allan et al. (2015)

Four males with ASD, 9-18 years old; three scored at Level 3 on most VB-MAPP subtests and the fourth at Levels 1-2

30 intraverbal training trials per session; 3 per target

Audio recorded vocal prompt

[Table 1 from Allan et al., 2015]

Allan et al. (2015)

[Figure 1 from Allan et al., 2015]

Studies on teaching complex verbal behavior:

Valentino, A. L., Conine, D. E., Delfs, C. H., & Furlow, C. M. (2015). Use of a modified chaining procedure with textual prompts to establish intraverbal storytelling. *The Analysis of Verbal Behavior, 31*, 39-58.

O'Neill, J., & Rehfeldt, R. A. (2014). Selection-based instruction and the emergence of topography-based responses to interview questions. The Analysis of Verbal Behavior, 30, 178-183.

Mason, L. L., Davis, D., & Andrews, A. (2015). Token reinforcement of verbal responses controlled by temporally removed verbal stimuli. The Analysis of Verbal Behavior, 31, 145-152.

Valentino et al. (2015)

Used backward chaining with leaps ahead to teach children with ASD to re-tell simple stories.

For example, if a participant had mastered segments 9 and 10, and also produced non-targeted segment 8 in two consecutive probes, that segment was not included

Valentino et al. (2015)

Three boys with ASD, 4 to 8 years old, with fairly extensive verbal repertoires

Three trials per session:

1. Probe trial ("Tell me the story about . . .")
2. Prompted trial: Participant reads all segments
3. Transfer trial: Target segment and later segments are covered with blank pages

Correct Response → Praise and next blank page

Incorrect Response → Prompt by showing text and picture, then return to blank page, repeat max. 5 times

Valentino et al. (2015)

[Figure 2 from Valentino et al., 2015]

Valentino et al. (2015)

The other two participants also acquired storytelling, but various modifications to the procedure were required (e.g., book prompts).

O'Neill & Rehfeldt (2014)

Taught two young adults (one of whom was diagnosed with ASD) to answer job interview questions through computerized selection-based instruction in combination with a Lag 1 reinforcement schedule.

Protocol resulted in an increase in accurate vocal-verbal responses to interview questions.

A second study extended these findings by evaluate components of the instructional program separately (O'Neill, Blowers, Henson, & Rehfeldt, 2015), but participants were not diagnosed with ASD.

Mason et al. (2015)

Three boys with ASD diagnoses, 8, 15, and 17 years old

Target response: Reporting information provided by a person the participant has just met (e.g., “She likes Taylor Swift”)

During the intervention, the participant received a token contingent on each fact about the visitor that they reported accurately.

Token reinforcement produced increases in accurate verbal reporting

Studies on increasing vocalizations of minimally verbal children:

Rader, L., Sidener, T. M., Reeve, K. E., Sidener, D. W., Delmolino, L., Miliotis, A., & Carbone, V. (2014). Stimulus-stimulus pairing of vocalizations: A systematic replication. *The Analysis of Verbal Behavior, 30*, 69-74.

Greenberg, A. L., Tomaino, M. E., & Charlop, M. H. (2014). Adapting the Picture Exchange Communication System to Elicit Vocalizations in children with autism. *Journal of Developmental and Physical Disabilities, 26*, 35-51.

Schreibman, L., & Stahmer, A. C. (2014). A randomized trial comparison of the effects of verbal and pictorial naturalistic communication strategies on spoken language for young children with autism. *Journal of Autism and Developmental Disorders, 44*, 1244-1251.

Rader et al. (2014)

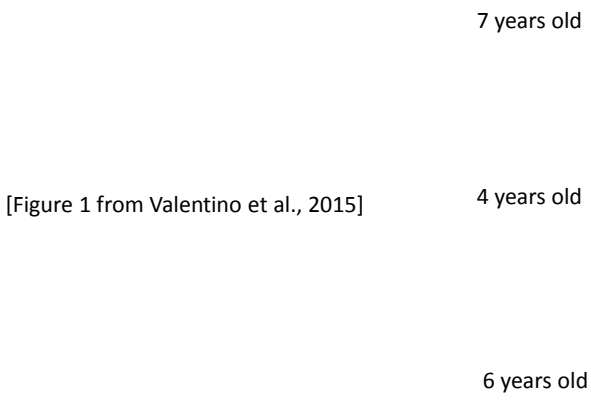
Replication of a previous study by Esch, Carr, & Grow (2009) that used an enhanced *stimulus-stimulus pairing* procedure to increase vocalizations of children with ASD.

Adult speech sounds are paired with reinforcers; no response requirement by the child

Esch et al.'s (2009) enhanced procedure included

- Interspersed target (S+) and nontarget (S-) trials
- Observing prompt
- Motherese speech
- Measurement of vocalizations during the ITI instead of post-session

Rader et al. (2014)



[Figure 1 from Valentino et al., 2015]

Rader et al. (2014)

[Figure 2 from Valentino et al., 2015]

Greenberg et al. (2014)

Study 1 assessed the effects of PECS instruction on the vocalizations of 4 minimally children with ASD (4-8 years old) who were minimally verbal and did not communicate vocally.

One participant failed to vocalize throughout the study; the others showed no change or decrease in vocalizations throughout the study, but an increase at follow-up.

Study 2 included two participants from Study 1, at which time they were able to imitate consonant-vowel combinations.

Time delay and prompting during PECS exchanges increased vocalizations.

Schreibman & Stahmer (2014)

Compared the effects of PECS and Pivotal Response Training on vocal language acquisition by minimally verbal children

39 children with ASD diagnoses, 2-4 years old, did not speak or spoke under 10 words; randomly assigned to conditions.

PRT targeted vocal responding directly, whereas PECS targeted picture exchange.

Both groups' spoken language skills improved (over 23 weeks) but no difference between conditions.

Parents found PECS more difficult to implement.

Brief Update: Parent and Staff Training

Barnes, Mellor, & Rehfeldt (2014): Used Behavioral Skills Training to teach school psychologists to administer the VB-MAPP.

Homlitas, Rosales, & Candel (2014): Used Behavioral Skills Training to teach teachers to implement phases 1, 2, and 3A of PECS.

Loughrey et al. (2014): Used Behavioral Skills Training to teach mand training procedures to caregivers of children with autism.

Brief Update: More on PECS

Smith, Hand, & Dowrick (2014): Used video self-modeling to teach PECS to children and an adult diagnosed with ASD.

Lerna, Esposito, Conson, & Massagli (2014): Compared long-term effects of PECS and conventional language therapy at 12-month follow up

Chien et al. (2015): Evaluated a tablet-based PECS application (iCAN), 11 children with ASD successfully learned to use it, and content-preparation time reduced compared to traditional PECS

Brief Update: PEAK

Dixon, Belisle, Whiting, & Rowsey (2014): Compared PEAK scores of children with autism and a normative sample. PEAK scores for children with autism were lower than for typcially developing children, and not correlated with age, unlike scores of typically developing children.

Dixon et al. (2015): Evaluated relationship between PEAK and VB-MAPP; scores on the two assessments were highly correlated; a ceiling effect observed for VB-MAPP but not for PEAK.

Brief Update: PEAK

McKeel, Rowsey, Dixon, & Daar (2015): PEAK correlated strongly with commonly used one-word vocabulary assessments (ROWPVT-4 and EOWPVT-4)

Dixon et al. (2014): Positive correlation between PEAK and PPVT scores and Illinois Early Learning Standards Test.

Dixon, Whiting, Rowsey, & Belisle (2014): Strong correlation between PEAK scores and IQ scores

Rowsey, Belisle, & Dixon (2015): Principal Component Analysis of PEAK; yielded four factors.

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