Review of Listener/Speaker Behavior

- Skinner’s (1957) analysis of verbal behavior offered an alternative to the prevailing structural conceptions of language in which words and sentences (i.e. formal properties of language) were considered the important units of analysis.

- Whereas structural accounts emphasized the topography of language (e.g. syntax, grammar, morphemes, mean length of utterance, etc.), Skinner’s behavior analytic account identified the functional relation between a response and its controlling variables, or the verbal operant, as the important unit of analysis.

- This behavior analytic account of language suggests important implications for the treatment of children with autism and other developmental disabilities (Sundberg & Michael, 2001) and a growing body of clinical work and research has documented the value of including this taxonomy in language training programs (see Sautter & LeBlanc, 2006 for a review).
• Much of this literature, however, has focused the application of Skinner’s analysis to teaching **speaker behavior**, with less work dedicated to a thorough analysis of the contingencies operating on the **behavior of the listener** (Schlinger, 2008).

• Possibly due to this lack of attention, cognitive explanations that describe the listener as a “passive receptacle” (Schlinger, 2008, p. 149), “recipient” (Lowenkron, 1998, p.339), or “processor” of information (Sidner, 2006) have persisted.

• Although Skinner’s (1957) analysis emphasized speaker behavior, he did not ignore the listener. Skinner suggested that the control exerted by verbal stimuli was at least partially dependent upon the **listener having an existing verbal repertoire of speaker behavior**.

• He stated, “…some of the behavior of listening resembles the behavior of speaking, particularly when the listener understands what is said” (Skinner, 1957, p. 10).

• Schlinger (2008) extended Skinner’s analysis of listener behavior and refined the difference between listener behavior **as a repertoire of discriminated operants** (i.e., mediation of reinforcement for a speaker) and “listening.”

• Schlinger asserted that listening is behaving verbally. He stated, “…the behavior of listeners and speakers may be inseparable, especially when we say the listener listens, pays attention to, or understands the speaker” (p.148).
Schlinger argued that, in fact, listening and speaking may not be functionally different, "In other words, the listener also behaves verbally when he or she is said to be listening" (Schlinger, 2008, p.150).

All of this suggests that listening may be predicated upon a complex verbal repertoire that mediates listener responses.

### Joint Control


Lowenkron (1998) defined joint control as “the effect of two (discriminative stimuli) S’s acting jointly to exert stimulus control over a common response topography” (p.328-329).

Lowenkron (1998) stated:

“Joint control occurs when the currently rehearsed topography of a verbal operant, as evoked by one stimulus, is simultaneously evoked by another stimulus. This event, the onset of joint stimulus control by two stimuli over a common response topography, then sets the occasion for a response appropriate to this special relation between the stimuli” (p.327).

In other words, one verbal response is simultaneously emitted under two distinct sources of stimulus control. For example, two possible sources of control are: (1) a verbal stimulus that evokes an echoic or self echoic and (2) a nonverbal antecedent S^D that evokes a tact.
MULTIPLE CONTROL

• The emission of a single response under two joint sources of stimulus control is a unique event that then exerts control over a third response, typically a selection response which is mediated by the verbal responses.

• Michael et. al. (2011) identified joint control as a special case of convergent multiple control, defined as “the convergent control of a response of a particular topography by two concurrent variables” (p,21)

• Palmer (2006) refers to joint control as the saltation in response strength when two or more concurrent S^D_s control a response of a common topography. It is an example of multiple control.

Multiple Control EXAMPLE

JC Activity
Steps to Selecting the Correct Response

LISTENER is shown the sample non-verbal stimulus

LISTENER/SPEAKER describes/names the sample non-verbal stimulus: “horizontal oval, space, down arrow, space, horizontal rectangle” *(TACT)*

LISTENER/SPEAKER rehearses the TACT during the delay period: “horizontal oval, space, down arrow, space, horizontal rectangle”…”horizontal oval, space, down arrow, space, horizontal rectangle”…”horizontal oval, space, down arrow, space, horizontal rectangle” *(SELF-ECHOIC)*

LISTENER/SPEAKER scans the array of comparison non-verbal stimuli and describes/names each:

A. “horizontal rectangle, space, down arrow, space, horizontal oval” *(TACT)*
B. “horizontal oval, space, up arrow, space, rectangle” *(TACT)*
C. “horizontal oval, space, down arrow, space, horizontal rectangle” *(TACT) + (SELF-ECHOIC)*
D. “horizontal oval touches down arrow touches horizontal rectangle” *(TACT)*

*TACT + SELF-ECHOIC* jointly controls selection response of comparison stimulus C.

Multiple Step Instructions

Verbal Stimulus
“Get bread, milk, and butter”

Listener/Speaker
Echoes
“Bread, milk, butter...”

Listener/ Speaker
Rehearses
(Self-Echo)
“Bread, milk, butter”

Listener/ Speaker
Echoes in Same Order *(Intraverbal)*

Listener/ Speaker Tact
Non-verbal Stimulus & Echo
Simultaneously (see item and echo at same time)

Jointly Controls
Selection Response

Circle over square EX
VERBAL MEDIATION

• Through this analysis, it is easily seen that the listener response of selecting the correct comparison stimulus was dependent upon speaker behavior, specifically tact and self-echoic responses.

• The listener selection responses were mediated by speaker behavior

• A verbal repertoire and the mediating effects of joint control make learning untaught discriminations possible.

• This suggests that complex listener behavior is dependent upon a speaker repertoire (Schlinger, 2008).

• Blough (1959) demonstrated something very similar to this with pigeons in a delayed match to sample experimental preparation.
Pigeon Analogue Experiment

- Blough (1959) demonstrated something very similar to this with pigeons in a delayed match to sample experimental preparation.

- During the delay period the pigeons which engaged in differentiated stereotypical behavior (analogous to invented gestural signs) were more likely to emit correct matching responses than those which failed to engage in specific topographical responses during the delay.


**EXPERIMENTAL PREPARATION**

1. **SAMPLE** ON - 1 sec (flicker or steady)
2. **DELAY** - e.g. 0-5 sec (all stimulus lights off)
3. **CHOICE** (side keys on) Bird pecks stimulus that appeared in 1
4. **REINFORCEMENT** (keys red) Bird eats if peck in was correct
5. **REST** - 5 sec (keys red)

Vary from trial to trial:
- sample stimulus (flicker or steady)
- matching key (left or right)
- delay (typically 0, 1, 2, or 5 sec)

Figure 1. The sequence of events in a single delayed matching trial.
Visual observations during these sessions revealed that during the delay interval the bird was performing stereotyped behavior similar to the “superstitious” behavior described by Skinner (1948). Figure 2 (inset) illustrates this behavior, which consisted of two repetitive chains of quite different topography. When the sample flickered, the bird backed quickly away from the keys and waved its head slowly back and forth throughout the delay interval. Following a steady sample, the bird spent the delay pecking rapidly at the top of the vertical sample bar. Sometimes, Bird 5 did not maintain its head-waving response following a flickering sample through a long delay, but began pecking at the sample bar. When this happened, the bird almost always pecked the steady (incorrect) stimulus when the key lights appeared. Thus, these responses in the delay interval seemed to mediate the discrimination in the sense that they took the place of the sample as stimuli controlling the choice of keys. Other observations which support this notion are described below.
Value of a Joint Control Analysis

- By analyzing how speaker behavior mediates and evokes listener behavior, an analysis of joint control provides an evidence-based and conceptually systematic explanation of listener behavior, without reliance on cognitive processes and structures.

- Furthermore, an explanation of joint stimulus control falls within the confines of Skinner’s (1957) analysis of verbal behavior, not only with relation to his descriptions of the elementary verbal operants, but also with relation to his descriptions of multiple causation (multiple control) and descriptive autoclitics.

Typical Development of Joint Control


1. **Before the age of 3 children learn echoic behavior and acquire a number of tacts and unmediated listener selection responses.**

2. The emission of echoic and self-echoic behavior, after a caregiver’s instruction to find or retrieve an item, would be reinforced by improved accuracy in locating the named item.

3. If the child then searches for a nonverbal stimulus after a caregiver’s instruction that evokes a tact response of the same topography as the simultaneously emitted self-echoic, joint control occurs.

4. The child may select that nonverbal stimulus due to previously acquired unmediated listener behavior, not joint control, however, responding in the presence of the onset of joint stimulus control, (echoic and tact emitted to same object simultaneously) would be adventitiously reinforced.

5. Repeated occurrences of this arrangement would lead to generalized responding to joint control events and consequently lead to the performance of various complex behaviors.  

JL Video of Selection
Stimuli Produced by the Task

- The distinction between unmediated and mediated stimulus selection accounts present important implications for the arrangement of language training programs for children with autism.

- For example, if a child with autism was to be taught to select two items from a larger field (e.g., “Give me the crayon and the ball” when presented with a field of 10 items), an unmediated stimulus selection account would require that each set of two items be specifically trained and reinforced.

- Conversely, according to the [joint control] account, ... the child’s responses may be brought under the control of the stimuli produced by the task itself and not the specific sample and comparison stimuli used, thus facilitating generalized responding.

---Causin, Albert, Carbone & Sweeney-Kerwin (2013, p. 999)

Joint Control Research with Children with Autism

- This analysis provides the basis from which potential teaching procedures for children with autism can be derived.

- Presently, there are only a couple of published studies and one unpublished applied study on the benefits of joint control training for children with autism.

- Tu (2006) examined the importance of joint control when teaching responses to experimenter vocal requests to both vocal and non-vocal children.

- She found that tact and echoic training were insufficient to produce listener selection responses.

- Only after joint control training did the participants improve their selection response.

- degli Espinosa (2014) demonstrated how selection responses and intraverbal behavior can come under joint control.
METHOD

Participants and Setting

• There were three participants in this study.

• All participants demonstrated echoic/mimetic, tact and intraverbal repertoires that fell within the 18-30 month level of the VB-MAPP (Sundberg, 2008).

• All participants were enrolled at a private clinic that provides one-on-one instruction that was guided by the principles of applied behavior analysis and incorporated Skinner’s (1957) analysis of verbal behavior.
• Bobby
  – Six-year-old male diagnosed with autism who was enrolled for about 15 hours per week.
  – Non-vocal learner who used manual sign language as his primary means of communication.

• Connor
  – Fourteen-year-old male diagnosed with Pervasive Developmental Disorder (PDD) and Attention Deficit Hyperactive Disorder (ADHD) who was enrolled at the clinic for about 8 hours per week.
  – Vocal learner

• Andre
  – Seventeen-year-old male diagnosed with autism who was enrolled for about 15 hours per week.
  – Vocal learner

Stimulus Sets

• Selection of pictures of items was the dependent variable in this study. Therefore, a pool of 12 previously mastered tacts and listener selection responses were combined to form 50 stimulus sets containing three or four pictured items in each set. The number of pictured items within each set varied for each participant based on pre-baseline assessment of the echoic repertoire.

Experimental Design

• A multiple probe design across participants was used to examine the effectiveness of joint control training on teaching listener responding (Horner & Baer, 1978).
Response Definitions and Data Collection

- Two dependent variables in this study:
  - Cumulative number of untrained stimulus set selections acquired (baseline and generalization).
  - Cumulative number of trained stimulus set selections acquired (based on daily first trial probes in the training condition).

- Correct response: Selecting all pictured items that correspond to the spoken items named by the instructor (i.e., vocal stimulus), in the same order in which they were presented by the instructor; the response was completed within 20 seconds of the presentation of the vocal stimulus and included a full 1 second pause following the selection and handing over of the final item in a set.

- For example, the experimenter said “Give me A, B and C”. A correct response was the child handing A, B and C to the teacher in that order within 20 secs that included no attempt to hand over another stimulus for 1 sec after the response.
• **Incorrect response:** Selecting pictured items that did not correspond to the vocal stimulus OR selecting the incorrect number of pictured items OR selecting pictured items that correspond with the vocal stimulus in a different order than which they were presented OR emitting a response beyond the established time criteria (20 seconds) OR initiating a response before the completion of the vocal stimulus OR failing to respond or attempting to hand over a picture during the final one second time delay before the experimenter removed her hand.

• IOA and treatment fidelity measures were all within acceptable ranges

---

**PROCEDURES**

Experimental Conditions

1. **Baseline** – Twelve (12) pictures of objects were configured into 50 sets of 3 or 4 pictures each. Probes of all 50 sets were conducted during each day of baseline according to the probe procedures described in the next slide. A correct response during any probe during baseline was the criterion for acquisition and the set was recorded as untrained and removed from the group of 50.

2. Probes for trained sets occurred each day during treatment. During training probes acquisition required two consecutive correct daily probes to meet acquisition criterion. Once a set met acquisition criteria the remaining untrained sets were probed for generalized responding.
Trained and Untrained Probe Procedures

- Presents vocal stimulus (e.g., Give me the A, B, and C) with flat hand up, palm facing participant
- Drops hand so that palm is facing upwards (i.e., if to receive picture card)

Correct response
Incorrect response

Keeps hand in position for 30 s after presentation of vocal stimulus or for 1 s past the delivery of the test picture card required

Presents 3 previously mastered skills (deemed probes), or presents previously mastered skills, the next untrained probe trial, or waits 30 s then clears the field (untrained probes)

Delivers reinforcer

Joint Control Training Procedures

Shuffles 12 nonverbal stimuli and presents in noisy field or table

Presents vocal stimulus (e.g., Give me the A, B, and C) with flat hand up, palm facing participant

Initiates vocal reinforcer response

Correct reinforcer
Incorrect reinforcer

1-2 s pause then re-present the vocal stimulus (e.g., Give me the A, B, and C) with flat hand up, palm facing participant

Incorrect selection
Correct selection

Kneels in position for 5 s after the presentation of the vocal stimulus or for 1 s past the delivery of the test picture card required

Delivers reinforcer
General Procedures

• Vocal and gestural prompts for the rehearsal response were systematically faded.

• Each time acquisition criteria were met for a trained stimulus set, a probe of all remaining untrained stimulus sets was conducted until all the sets were recorded as either trained or untrained.

VIDEOS OF PROCEDURES

• What follows are video illustrations of each of the phases of the experiment.

Experimental Conditions

• Baseline Conditions
  – Baseline Procedures (Bobby Video)

• Treatment Conditions
  – Joint Control Training Condition
    • Vocal Learner Teaching Procedures (Andre Video)
    • Non-Vocal Learner Teaching Procedures (Bobby Video)
    • Error Correction Procedures (Connor Video)
  – Training Rehearsal (self-echoic)
    • Vocal Learner Rehearsal Training Procedures (Andre Video)
    • Non-Vocal Learner Training Procedures (Bobby Video)
Results

• In total Billy acquired 22 trained stimulus sets and 28 untrained stimulus sets across 120 joint control training condition sessions.

• In total, Cole acquired 20 trained stimulus sets and 30 untrained stimulus sets across 96 joint control training sessions.

• Across 206 joint control training sessions, Abe acquired 26 trained stimulus sets and 24 untrained stimulus sets.
Private Nature of Responses

- The private nature of the jointly controlled responses block direct observation and therefore leads to an interpretive analysis of the role of joint control.

- In this experiment, the children were not required to emit overt tact responses and therefore, the additive effects of the tact response can only be inferred.

- In fact, one group of researchers found that overt vocal rehearsal was not necessary to produce delayed match to sample responses in typical children although covert rehearsal may have occurred. (Ratkos, Frieder, Poling, 2016)

- In prior studies however, blocking of one of the responses necessary for joint control substantially degraded correct responding (Degraff & Schlinger, 2012; Guiterrez, 2006; Lowenkron, 2006) suggesting that covert responses appear to be playing a role in the additive effects of more than one stimulus leading to listener response errors.

- In addition a more recent study demonstrated that the blocking effect appears to be the result of interference with covert responding and not just interference with completion of the task. (Clough, Meyer & Miguel, 2016)

- Frequently during both daily first trial probes and untrained stimulus set probes, Bobby was observed to respond intraverbally to the teacher's vocal stimulus and presence of the stimulus through self-mimetic behavior even when he was not explicitly required to do so. Bobby Example (Bobby Video- one rehearsal)

- During baseline and before joint control training Connor did not emit an overt self-echoic response. Following training with rehearsal, Connor always engaged in a self-echoic rehearsal, even when he was not required to do so by the experimental contingency (i.e. during untrained probes). It appears he learned to emit the “strategy” that had been selected by more effective outcomes (i.e., correct selection of multiple items). (Connor Video)

- Andre engaged in a self-echoic rehearsal during both training and untrained probe conditions. When Andre engaged in the correct self-echoic rehearsal he almost always selected the correct stimulus set. When his rehearsal was incorrect or he failed to rehearse he frequently selected the incorrect array. (Andre Video)
Clinical Applications

- In this experiment the emission of a single response topography occurring under two different sources of control (i.e. echoic and tact or mimetic and tact) occasioned selection responses.

- Given this analysis, the onset of joint control was a generic event consisting of the simultaneous control of two discriminative stimuli over a single response.

- The results of this study indicated that joint control training was effective in increasing trained and untrained listener responses for the three participants involved.

- Typical children may acquire this repertoire through exposure to every day contingencies, however, children with autism may require precise teaching to acquire jointly controlled responses.

- A number of authors have described the advantages of a joint control analysis, not only as an explanation for complex human behavior (Lowenkron, 1998), but as a means by which to design language training programs for individuals with language deficits and delays. (Causin, Albert, Carbone, Sweeney-Kerwin, 2013; delgi Espinosa, 2011; Michael et al., 2011; Sidener, 2006; Tu 2006).

- As an example of mediated stimulus selection joint control training provides an efficient method of teaching generalized responding to children with autism that would require a virtually impossible number of trials to achieve the same outcome. (Sidener, 2006).
Within autism treatment programs, skills that are often acquired under the title of “auditory and visual memory” or cognitive skills may actually be acquired through the unwitting effects of the type of verbal mediation that was explicitly taught in this study.

The list of skills that may be taught using methods derived from a joint control analysis include:
- delayed match to sample
- completing a complex pattern of items,
- finding a previously displayed item within a large array,
- identifying what is missing from a previously displayed array of items,
- following multiple step instructions,
- answering yes or no,
- counting out a specific number of items from a larger set.

Videos of Clinical Applications

In general, when mediating responses (self-echoic, self-mimetic and tact responses) were overt, correct selection of the stimulus set was more likely. Similar to the studies performed by Gutierrez (2006), Lowenkron, (2006b), DeGraaf and Schlinger (2012), future research should experimentally investigate the individual roles of echoic, self-echoic, and tact responses to provide additional empirical evidence in favor of a joint control analysis.

**Primacy of Topography-Based Verbal Behavior**

- For one participant the response form was manual sign language, suggesting the applicability of these procedures to non-vocal children for whom alternative communication systems are necessary.

- An important point, however, is that responding to joint control events depends upon topography-based verbal behavior (e.g., vocal, manual sign language, writing) (Lowenkron, 1991).

- Consequently, selection-based methods of communication such as the Picture Exchange Communication System (Bondy & Frost, 2012) or icon selection using a touch screen device may preclude the occurrence of responding under joint stimulus control.

Finally, Palmer (2006, p.214) discusses the important role joint control plays in the control of human behavior and notes the general lack of recognition it has previously been given by behavior analysts:

- “Joint control is a tool in the workshop of the behavior analyst who would understand complex behavior. It is not a new phenomenon, nor does an analysis of joint control invoke new principles. It has been lying in the toolbox all along, but we are only beginning to appreciate its role in the control of human behavior. I believe that it will have a distinguished future.

References


---


Dave Palmer on Joint Control
[http://autism.outreach.psu.edu/archive/conference-schedule-2013](http://autism.outreach.psu.edu/archive/conference-schedule-2013)
Find Presentation # 9 by Palmer and Select the title
Download the ppt and then select Dave Palmer to view the video

Francesca degli Espinoza on Joint Control
[http://autism.outreach.psu.edu/archive/conference-schedule-2014](http://autism.outreach.psu.edu/archive/conference-schedule-2014)
Find Presentation # 44 and select the title
Download the ppt and then select Advanced and then select the paper on “Teaching Generalized Multiply Controlled Verbal Behavior”.

Vincent Carbone on Joint Control
[http://legacy.wpsu.org/live/archive/](http://legacy.wpsu.org/live/archive/)
Presentation # 37
The ppt can be downloaded from [http://autism.outreach.psu.edu/webcasting](http://autism.outreach.psu.edu/webcasting)
Scroll down this page and select presentation # 37
To Obtain a Copy of This Power Point Go To

CarboneClinic.com
Resources Tab
(Available in One Week)