APPLICATIONS OF THE DERIVED STIMULUS RELATIONS RESEARCH PROGRAM TO INDIVIDUALS WITH ASD AND OTHER DEVELOPMENTAL DISORDERS

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Objectives:

- Discuss experimental investigations that have been inspired by Skinner’s (1957) *Verbal Behavior* in conjunction with derived stimulus relations

- Explore the potential role of participants’ own mediating behaviors in controlling their experimental performance
On the Limitations of *Verbal Behavior’s* Impact:

- “The interpretation…conforms to basic scientific principles, but only those…available up to 1957” (Dymond & Alonso-Alvarez, 2010)
- “Research…has focused mainly on individuals with developmental disabilities and on the verbal operants from the introductory chapters of Skinner’s book” (Dixon et al., 2007, p. 197)
Support for the Impact of *Verbal Behavior*:

- “….nor do I believe that empirical research is necessary to confirm Skinner’s interpretation” (Schlinger, 2010, p. 362)
- “The value of *Verbal Behavior* is ultimately determined by its ability to generate empirical and practical applications” (Schlinger, 2008a, p. 331)
- *Verbal Behavior* has generated enormous practical applications, but the “approach” is in need of outcome research (Carr & Firth, 2005)
On Balance:

  - Does the increase in research on derived stimulus relations really serve as a rejection of Skinner’s account?
  - “At the very least, (RFT) promises to supplement Skinner’s early work on language by helping to integrate it with the study of equivalence classes and derived stimulus relations....achieving such an integration must surely be a worthwhile objective” (p. 72)
  - “...a clear and useful research agenda for the behavior analytic study of human language and cognition” (p. 69).
My own Chronology of Research on this Topic:

- *Byrne, Rehfeldt, & Aguirre. (2014). Emergent Naming (Listener & Tacts)*
- *De Souza, A., & Rehfeldt, R. A. (2013). Emergent Intraverbals*
The Naming Hypothesis: (Horne & Lowe, 1996)

What is the Name Relation?

The Components of Naming:

1. Listener Behavior: verbal community establishes as discriminative a speaker’s (caregiver) vocal stimulus and socially appropriate (listener) behavior (i.e., orienting, using conventionally) evoked in the listener (child).

2. Echoic Behavior:
   - Reproduction of the verbal responses of others are differentially reinforced
   - Caregiver imitate child; child imitates caregiver
   - *Child eventually responds as listener to own verbal utterance – now speaker-listener within same skin
   - Vocal behavior recedes to covert level; may have automatic conditioned reinforcing properties (Skinner 1957)
Components of the Name Relation, cont.

3: Naming as a Higher Order Operant

- Objects develop functional control over behavior
- **Tacting**: response that shares a point-to-point correspondence with the antecedent stimulus and is maintained by generalized conditioned rft (Skinner, 1957).
- **Naming**: Objects are then discriminative for tacting AND listener behavior – a bidirectional relation between objects & speaker-listener behavior that they occasion (Horne & Lowe, 1999)
- After so many exemplars in which listener, echoic, and tacting behaviors are reinforced, a child need only hear a caregiver name a novel object a few times before the name relation emerges (Horne & Lowe, 1996)
Stimulus Pairing Observation Procedure (SPOP):

Rosales, Rehfeldt, & Huffman (2012; *JABA*):
SPOP: a procedure to teach stimulus equivalence relations that requires no overt selection response during instruction

Participants are simply exposed to pairings of stimuli separated by an ITI.

Vocal names accompanied by visual stimuli mirror naturally occurring opportunities (i.e., observing adults and peers manipulating and tacting items).

Rosales et al. found that some untaught listener and tact skills emerged after SPOP instruction for preschool children; but tact instruction with other stimuli was necessary for other tact and listener relations to emerge.
Byrne, B., Rehfeldt, R. A., & Aguirre, A. (2014). Evaluating the Effectiveness of Stimulus Pairing Observation Procedure (SPOP) and Multiple Exemplar Instruction (SPOP): Establishing Listener and Tact Relations with Children with Autism (TAVB)

**Purpose:**

- Evaluate the efficacy of SPOP and MEI/SPOP in producing untaught listener and tact skills
- Explore the role of participants’ echoic behavior (echoing of stimulus names) on their performance
- Horne & Lowe (1998): participants’ echoing of names during SPOP may facilitate their performance during listener posttests, as though responding as a speaker and listener within the same skin.

**Participants:**

- Three 7-year olds with autism and severe language delays (VM-MAPP Level 1)
Procedure Overview:

- **Pretest Probes** (in 9-trial blocks; 3 visual stimuli):
  - Tact Probes (“what is it?)
  - Listener Probes (“where is the ______”)  

- **SPOP Instruction:**
  - Trial consisted of 2 s presentation of picture and its dictated name (5 9-trial blocks), with 2-3 s ITI

- **Posttest Probes 1**

- **MEI/SPOP:**
  - Identical to SPOP instruction but performed with 2 novel sets of 3 stimuli

- **Remedial SPOP w/ Original Stimuli**

- **Posttest Probes 2**
<table>
<thead>
<tr>
<th>Participants</th>
<th>Original Set</th>
<th>MEI Set 1</th>
<th>MEI Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jackson</td>
<td>Ladle</td>
<td>Tambourine</td>
<td>Clarinet</td>
</tr>
<tr>
<td></td>
<td>Vase</td>
<td>Kiwi</td>
<td>Valve</td>
</tr>
<tr>
<td></td>
<td>Bush</td>
<td>Parachute</td>
<td>Pastry</td>
</tr>
<tr>
<td>Jenna</td>
<td>Rice</td>
<td>Taxi</td>
<td>Pepper</td>
</tr>
<tr>
<td></td>
<td>Paint</td>
<td>Kiwi</td>
<td>Fountain</td>
</tr>
<tr>
<td></td>
<td>Gum</td>
<td>Ax</td>
<td>Globe</td>
</tr>
<tr>
<td>Sophia</td>
<td>Cucumber</td>
<td>Washer</td>
<td>Pliers</td>
</tr>
<tr>
<td></td>
<td>Colt</td>
<td>Freckles</td>
<td>Wreath</td>
</tr>
<tr>
<td></td>
<td>Canoe</td>
<td>Ground</td>
<td>Plantain</td>
</tr>
</tbody>
</table>
Measures:

- Performance on
  - 1. Tact Probes
  - 2. Listener Probes

as a function of SPOP

Proportion of trials with echoic behavior emitted during

1. Listener pre and posttests trials (“where is the ___”)
2. SPOP Instruction (pairings of dictated names with visual stimuli)
Only Jackson showed untaught listener and tact skills with original instructional stimuli following multiple exemplar instruction with SPOP and novel stimuli.

Jenna showed untaught listener skills.

Sophia showed improvement in tact and listener skills following SPOP and MEI/SPOP but none were at criterion.
**Echoic Results**

*Mean percentage of echoed trials for the original stimulus sets and MEI stimuli sets for Jackson.*

<table>
<thead>
<tr>
<th></th>
<th>Original Set</th>
<th>MEI Set 1</th>
<th>MEI Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>25.93%</td>
<td>18.52%</td>
<td>66.66%</td>
</tr>
<tr>
<td>SPOP</td>
<td>96.67%</td>
<td>94.07%</td>
<td>92.78%</td>
</tr>
<tr>
<td>Posttest</td>
<td>34.72%</td>
<td>66.67%</td>
<td>44.44%</td>
</tr>
</tbody>
</table>

Jackson, who showed untaught tactual and listener skills, echoed names on high proportion of trials during all SPOP phases, but on few trials during pre and posttests.
Echoic Results

Mean percentage of echoed trials for the original stimulus sets and MEI stimuli sets for Jenna.

<table>
<thead>
<tr>
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<th>MEI Set 1</th>
<th>MEI Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>63.49%</td>
<td>33.33%</td>
<td>22.22%</td>
</tr>
<tr>
<td>SPOP</td>
<td>96.3%</td>
<td>91.11%</td>
<td>98.3%</td>
</tr>
<tr>
<td>Posttest</td>
<td>81.81%</td>
<td>73.61%</td>
<td>92.98%</td>
</tr>
</tbody>
</table>

Jenna, who showed untaught listener skills following SPOP & MEI, echoed names on high proportion of trials during all SPOP phases, and on a high proportion of posttest trials relative to pretests.
## Echoic Results

*Mean percentage of echoed trials for the original stimulus sets and MEI stimuli sets for Sophia.*

<table>
<thead>
<tr>
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<th>MEI Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pretest</strong></td>
<td>83.33%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>SPOP</strong></td>
<td>97.04%</td>
<td>94.07%</td>
<td>92.54%</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>97.78%</td>
<td>93.65%</td>
<td>79.09%</td>
</tr>
</tbody>
</table>

Sophia, who made minor improvements in tact and listener skills, named stimuli on a high proportion of SPOP trials and pre and posttest trials.
Implications

- SPOP effective in promoting development of listener skills
- Tact skills at criterion levels following SPOP for one participant only
- Interestingly, that is the participant who engaged in the least echoic behavior
- All participants echoed frequently during SPOP instruction
- Echoic behavior only corollary
Speaker and Listener within the Same Skin

- Thinking (Ch. 19 of 1957) may be LEAST subjected to empirical investigation:
  - Thinking conceptualized as covert verbal behavior for which speaker mediates his or her own reinforcement (serves as his or her own listener)
  - Efficient and convenient (reduced response effort; avoidance of punishment)
Speaker and Listener within the Same Skin,

- **The speaker’s own verbal behavior automatically supplies stimuli for echoic, textual, or intraverbal behavior, and these in turn generate stimuli (which occasion) further responses”** (1957; p. 439)

- Speaker’s covert (and overt) verbal behavior affects his/her behavior as a listener
  
  Opening a Lock example
  
  Playing the Piano example

- Covert verbal responses may be automatically reinforced by the practical consequences they produce for the speaker – automatic practical consequences may supply the necessary contingencies (1957; p. 442); *problem-solving* (Palmer, 1991)
EXPERIMENT 1:

- Would teaching written spelling (i.e., taking dictation) facilitate the induction of vocal spelling (intraverbal)?

*Skinner (1957): Writing and speaking are separately acquired and conditioned; a change in one repertoire may produce changes in the other repertoire – what “bridges the gap” between spoken and written behavior? (MEI?)

Greer et al. (2005) demonstrated improvements in vocal spelling following instruction in written spelling only after multiple exemplar instruction for both written and spelling repertoires was conducted.

*Would we observe corollary indicators of covert textual spelling?
Participants

- 3 young adults with intellectual disability
- Ages 18 – 20 years old
- Residents at a developmental center
- Followed instructions without difficulties, participated in conversations with others, and could identify and name letters
- Had participated in special education in high school and had graduated within the last 1-2 years
- Used multiple baseline design across participants
Instructional Stimuli
(from SAT prep book)

Textual Stimuli:
Verify
Confirm
Demonstrate

Expand
Distend
Increase

Negate
Disprove
Invalidate
Procedure, cont.:

- **Pretests/Posttests**
  - Evaluated nontargeted vocal spelling responses → 3 x each word
  - “Spell ___”
  - No reinforcement or error correction

- **Dictation Instruction**
  - “Write ___”
  - Correct response → verbal praise
  - Incorrect response → error correction

- **Remedial Instruction**
  - Same as dictation instruction
Implications:

- All participants vocally spelled the words they had been directly taught to write following dictation instruction.
- Participants may have emitted covert textual spelling in the presence of the tested auditory stimuli, which then controlled their subsequent behavior.
- **Corollary Behaviors:** One participant traced letters during posttests; all echoed experimenter’s dictation of word on vocal spelling test trials.
Experiment 2 (de Souza & Rehfeldt, 2013):

- With same participants from Exp. 1, would learning stimulus equivalence relations between printed words that are synonyms facilitate 2 forms of nontargeted intraverbals:
  - Vocal spelling of words (when asked, “Spell 2 words that mean the same as ______”)
  - List 2 words that mean the same as ____ “
  - Would we observe corollary indicators of covert verbal behavior?
Participants were taught the meaning of the “A” words beforehand.
Experiment 2 – Match-to-Sample

Pretests
- Derived relations $\rightarrow$ symmetry and equivalence
- Listing and Spelling:
  - “List two words that mean the same as $\underline{\text{___}}$”
  - “Spell two words that mean the same as $\underline{\text{___}}$”

Conditional Discrimination Training
- Trained to conditionally relate synonyms
  - A to B and A to C

Posttests
Identical to pretests

How to conditionally relate, and then list and spell textual stimuli WITHOUT mediating verbal behavior or problem solving strategy?
No indicators of covert mediating or corollary responses in Experiment 2, but only Bob engaged in finger spelling in Experiment 1.

According to Palmer (1991), such mediating behaviors may eventually occur covertly.
Implications:

- Emergent intraverbals in the form of listing stimuli that were synonyms was observed; intraverbal spelling of synonyms observed for one participant but close to criterion for the other two.

- A repertoire of relating stimuli may facilitate “indirect induction” of intraverbals (Lee & Pegler, 1982; Grannan & Rehfeldt, 2012).
Conclusions

- Synthesis of Verbal Behavior with derived stimulus relations may be a good framework for studying complex behavior.
- Need for further research on control by participants’ own overt or covert mediating behavior (Aguirre & Rehfeldt, in press).
- Skinner’s (1957) interpretation can be used to guide research, and much of human behavior would be baffling if we did not consider the role of private events (Palmer, 2011).
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