

TEACHING INTRAVERBALS: THE DIFFERENCE BETWEEN "ROTE" AND "MEANINGFUL"

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Overview

- WHAT IS AN INTRAVERBAL?
- INTRAVERBALS IN EARLY INTERVENTION FOR ASD
- "ROTE" VS. "MEANINGFUL" INTRAVERBALS
- SOME ISSUES TO ADDRESS:
 - DIVERGENT MULTIPLE STIMULUS CONTROL
 - CONVERGENT MULTIPLE STIMULUS CONTROL
 - APPROPRIATE LISTENER BEHAVIOR
 - DERIVED INTRAVERBAL RELATIONS
- SUMMARY AND QUESTIONS

What is an intraverbal?

What is an intraverbal?

One of the primary verbal operants described by Skinner (1957)

Verbal operant: A verbal response and its relation to antecedents and consequences that influence its occurrence

Verbal does not necessarily mean *vocal*

Verbal means that the response is reinforced by the actions of a listener, due to that listener's reinforcement history

Mand
Tact
Echoic
Intraverbal
Textual Behavior
Transcription

What is an intraverbal?

A verbal response that is evoked by a *verbal discriminative stimulus*, with which the response has "*no point-to-point correspondence*" (Skinner, 1957, p. 71), due to a history of *generalized conditioned reinforcement*

Verbal discriminative stimulus:

Point-to-point correspondence:

Generalized conditioned reinforcement:

Examples

Reciting the alphabet

Singing songs

Answering factual questions

Having conversations

Intraverbals in Early Language Intervention for Children with Autism Spectrum Disorder (ASD)

The complexity of intraverbals

"The intraverbal relations in any adult repertoire are the result of hundreds of thousands of reinforcements under a great variety of inconsistent and often conflicting contingencies. Many different responses are brought under the control of a given stimulus word, and many different stimulus words are placed in control of a single response."
(Skinner, 1957, p. 74)

Intraverbals and ASD

Many children with ASD fail to acquire strong intraverbal repertoires

Size and complexity of repertoires

Lack of awareness (at least outside of applied behavior analysis) that intraverbals need to be taught explicitly

Behavior analysts have developed a variety of curriculum items that involve intraverbals

Examples of intraverbal milestones from the VB-MAPP (Sundberg, 2008)

- Completing fill-in-the blank phrases or songs (e.g., "A cat says . . .", "Head, shoulders, knees and . . .")
- Stating name when asked; answering questions about names of family members
- Answering questions about the functions, features, and category membership of objects, without these objects being visually present
- Answering "who" and "where" questions
- Making intraverbal comments
- Answering questions after hearing a story
- Describing past events

"Rote" vs. "Meaningful" Intraverbals

Rote learning: Dictionary definitions

"A memorizing process using routine or repetition, often without full attention or comprehension" (www.thefreedictionary.com)

"The use of memory usually with little intelligence" and "mechanical or unthinking routine or repetition" (www.m-w.com)

"From memory, without thought of the meaning; in a mechanical way" (www.dictionary.com)

The Meaning of Meaning?

"The weakness of current theories of language may be traced to the fact that an objective conception of human behavior is still incomplete. The doctrine that words are used to express or convey meanings . . . is incompatible with modern psychological conceptions of the organism." (Skinner, 1945, p. 270)

"What we want to know in the case of many traditional psychological terms is, first, the specific stimulating conditions under which they are emitted . . . and second . . . why each response is controlled by its corresponding condition." (Skinner, 1945, p. 272)

Under what specific conditions will people emit the responses "rote" and "meaningful" or "with comprehension?"

Some possibilities...

Lack of divergent multiple stimulus control

Lack of convergent multiple stimulus control

Lack of appropriate listener behavior

All intraverbals have been taught directly; novel intraverbals are not derived from other speaker and listener relations in the child's repertoire

Do ABA-based interventions produce rote responding, including intraverbals?

Yes, they can and often do . . .

. . . *any* method of instruction can and often does produce rote intraverbals

. . . typically developing (TD) children's language acquisition in the natural environment results in many rote intraverbals

Rote intraverbals may be a natural step toward acquiring functional intraverbal repertoires

Case in Point #1

From Sundberg and Sundberg (2011; Table 1):

- "What do you smell with?" "Poopies," "A skunk"
- "What grows on your head?" "Shoulders," "Plants," "Hat"
- "Where do you eat?" "Food"
- "What is your last name?" "Noah"

Case in Point #2

Teaching new intraverbals to young TD children does not necessarily result in appropriate listener behavior

Example: Petursdottir, Carr, Lechago, & Almason (2008)

- After learning to tact a variety of stimuli such as outline maps of foreign countries and characters from foreign writing systems, children learned to intraverbally answer questions about their category membership (e.g., "Rho is Greek")
- But most failed to demonstrate appropriate listener behavior (e.g., when asked "Which one is Greek?")

Case in Point #3

"I led the pigeons to the flag . . ."

"I pledge a lesion to the flag and to the public witches' stand . . ."



(Petursdottir, Carp, Peterson, & Lepper (in progress))

A stimuli

psi mu rho

B stimuli

kibi taka doso

(Petursdottir, Carp, Peterson, & Lepper, in progress)

Intraverbal Training

Experimenter: Correct Response:

“Psi goes with...” → “Kibi”

“Rho goes with...” → “Doso”

“Mu goes with...” → “Taka”

A-Names B-Names

(Petursdottir, Carp, Peterson, & Lepper, in progress) VVCD-1 Test

Experimenter: “Look”

A-B Trial

Experimenter: (holds out open hand)

(Petursdottir, Carp, Peterson, & Lepper (in progress) VVCD-1 Test

Experimenter: “Look”

B-A Trial

Experimenter: (holds out open hand)

(Petursdottir, Carp, Peterson, & Lepper (in progress))

No participants passed this match-to-sample test

Sounds like maybe they learned “rote” intraverbals instead of “meaningful” intraverbals?

However, we gave them a second version of the test...

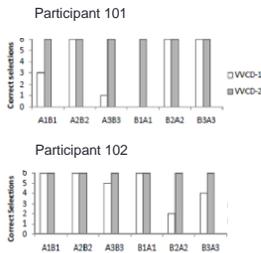
(Petursdottir, Carp, Peterson, & Lepper (in progress) VVCD-2 Test

Experimenter: “Look. What is this?”

Correct Response: “Mu”

Experimenter: (holds out open hand)

This time, two participants passed the test:



Reverse Intraverbal Test

Experimenter: Correct Response:

“Kibi goes with...” → “Psi”

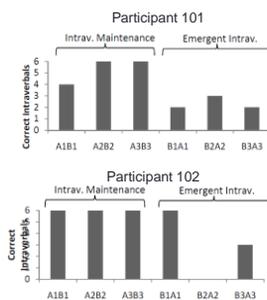
“Doso goes with...” → “Rho”

“Taka goes with...” → “Mu”

B-Names

A-Names

They couldn't do it!



“Meaning” or “comprehension” are not something you either have or do not have

The participants' match-to-sample performance suggests that they “comprehended”

Their reverse intraverbal test performance suggests that they did not

Different conclusions regarding “rote” and “meaningful” depending on which behavior was being observed

Bottom line . . .

The appearance of “rote intraverbals” is developmentally normal

TD children acquire intraverbals in a predictable sequence, as a function of stimulus control complexity (Poon & Butler, 1972; Sundberg & Sundberg, 2011)

Sundberg (2008) recommends fill in the blanks phrases and songs as the first intraverbals you teach to children with ASD. These types of intraverbals will likely be rote, and that's fine.

For more complex intraverbals, starting intraverbal training too early may increase risk of rote responding

Procedures for preventing or intervening on rote responding may depend on the stimulus control problem at hand

Divergent Multiple Stimulus Control

Definition

A single stimulus controls many different response topographies (Michael, Palmer, & Sundberg, 2011)

Hearing the word "car" may bring to strength a variety of intraverbal responses: "Vroom," "drive," "wheels," "vehicle," "garage," "Chevy"

What are some car makes? "Toyota, Dodge, Subaru, Ford, Honda, Cadillac, Lincoln, Volvo, Kia"

Illustrating the problem:

Tell me the name something that you wear: "Pants"
What is something else that you wear? "Pants"

MON: What did you do at school today? "Eat lunch"
TUE: What did you do at school today? "Eat lunch"
WED: What did you do at school today? "Eat lunch"

Establishing divergent stimulus control

Transfer of stimulus control procedures, plus differential reinforcement, have been used to establish multiple intraverbal responses to questions about categories

Braam and Poling (1983) taught children with developmental disabilities to vocalize the names of various items given questions such as "What are some animals?" using (a) tact prompts, and (b) echoic prompts that were subsequently faded (see also Goldsmith, Sautter, & LeBlanc, 2007; Luciano, 1986)

But does this type of training result in behavior under the same kind of stimulus control you would see in competent speakers?

Establishing divergent stimulus control

Recent studies with TD children have examined the use of problem-solving strategies to establish multiple intraverbal responses to questions about categories:

Sautter, LeBlanc, Jay, Goldsmith, & Carr (2011): Taught children to self-prompt a series of shorter intraverbal chains

Kisamore, Carr, & LeBlanc (2011): Taught children to use visual imagining strategy and state a rule regarding the use of that strategy

Possible solutions

Lag schedules of reinforcement may be another way to strengthen divergent stimulus control over intraverbal responses

In a lag schedule, the delivery of a reinforcer is contingent on a response that differs from the previous X responses

- Lag 1: To be reinforced, a response must differ from the last response made
- Lag 2: To be reinforced, a response must differ from the last two responses made

Possible solutions

Lag schedules have been found to successfully increase the variability of intraverbal responses to social questions (Lee, McComas, & Jawor, 2002; Susa & Schlinger, 2012)

Use of lag schedules to expand divergent stimulus control for a wider range of intraverbal curriculum items might be investigated further

Convergent Multiple Stimulus Control

Definition

Two or more stimuli contribute to the strength of a single response topography

One type of convergent multiple stimulus control has been referred to as verbal *conditional* (e.g., Axe, 2008; Sundberg & Sundberg, 2011) or *compound* (Eikeseth & Smith, 2013) stimulus control

- What do you eat that's red?
 - What do you eat that's yellow?
 - What do you drink that's red?
 - What do you drink that's yellow?
- (Axe, 2008)

Possible solutions

For TD children, this type of stimulus over intraverbal behavior is not fully evident until 4-5 years of age (Sundberg & Sundberg, 2011)

Suggested prerequisite skills (Eikeseth & Smith, 2013; Pérez-González & Alfonso-Alvarez, 2008; Sundberg & Sundberg, 2001):

- Tacts and listener behavior with respect to each element (e.g., eat, drink, yellow, red)
- Each element has divergent intraverbal control over multiple responses (e.g., can give many different responses to "What do you eat?" "Name something that's red" etc.)
- Listener discriminations involving all elements (e.g., "Point to something you eat that's red")

Possible solutions

Must be taught using appropriate discrimination training procedures (see Braam & Poling, 1983, Experiment 3)

- Don't teach "What do you eat that's red?" unless you are also teaching "What do you eat that's [some other color]?" and "What _____ that's red?"

Matrix training procedures? (Axe, 2008)

	Red	Yellow	Green	White
Eat				
Drink				
Play with				
See at school				

Possible solutions

Possible interventions if difficulties are encountered during training:

- Differential observing responses (Kisamore, Karsten, Mann, & Conde, 2013)
 - Echo the verbal stimulus before giving the intraverbal response
 - "What is the opposite of cold?" "The opposite of cold is hot"
- Blocked-trials procedures?

Blocked-Trials Procedure

Einarsson, Macias, Koelker, Carp, & Petursdottir (in preparation)

- Participants: 6 boys with ASD, age 6 to 8 years
- Question pairs that required discrimination of verb alone vs. verb + "with"

What do you sweep?
What do you sweep with?

What do you eat?
What do you eat with?

Ingvarsson, Macias, Koelker, Carp, & Petursdottir (in preparation)

Blocked-Trials Procedure

Step 3 (Always presented first):

- First question until 5 consecutive correct
- Second question asked until 5 consecutive correct
- Advancement criterion: four consecutive errorless trial blocks

Step 4: Questions asked in counterbalanced blocks of 2 and 3 trials

- Advancement criterion: 15 consecutive correct responses

Step 5: Semi-random presentation

- Mastery criterion: 15 consecutive correct responses

Ingvarsson, Macias, Koelker, Carp, & Petursdottir (in preparation)

Blocked-Trials Procedure

Steps 1 and 2 conducted only if no success in Step 3

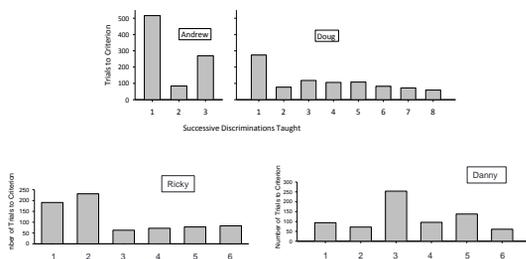
Step 1: Each question asked until 10 consecutive correct responses

- Advancement criterion: Four consecutive trials blocks with no more than 2 errors

Step 2: Each question asked until 8 consecutive correct responses

- Advancement criterion: Four consecutive trials blocks with no more than 1 error

Ingvarsson, Macias, Koelker, Carp, & Petursdottir (in preparation)



Appropriate Listener Behavior

Definition

Responding to verbal stimuli in ways that are not necessarily verbal "in any special sense" (Skinner, 1957, p. 2)

Following instructions: "Clap your hands," "Wave bye-bye," "Go brush your teeth."

Looking at, touching or picking up items named by another person: "Where is the car?" "Show me the dog," "Show me the one that says woof"

- "Receptive identification"
- Auditory-visual conditional discriminations

Illustrating the problem

A child can answer the questions "What is your mom's name?" ("Linda") and "What is your dad's name?" ("Jeff") but does not point to or look at mom or dad when asked "Where is Linda?" or "Whose name is Jeff?"

A child can answer questions about animal sounds, but cannot point to the correct animal given the sounds

When asked to name some animals, a child responds "cow, horse, pig," but does not point to cow, horse or pig in a picture book when asked to find the animals

Possible solutions

One way to ensure intraverbals are accompanied by relevant listener behavior, when applicable, is to teach the listener behavior first (Eikeseth & Smith, 2013; Sundberg, 2008; Sundberg & Sundberg, 2011; Sundberg & Partington, 1998)

For example, "receptive by function, feature, and class" (RFFC):

- "Point to what you drive/what you drink from/what you eat with/what you sweep with"
- "Which one has wheels/buttons/a handle/a tail?"
- "Touch the animal/vehicle/furniture/food"

Possible solutions

By itself, listener training tends not to generate highly accurate intraverbals in young TD children or children with ASD (more on this later!). So, following listener training, the intraverbals must be trained directly.

If you train the relevant listener behavior directly, and then you train the intraverbals directly, the intraverbals are necessarily accompanied by relevant listener behavior. But could they still be "rote?"

You may not satisfy a critic until you demonstrate that when you teach a new intraverbal, *untaught* listener behavior emerges

- "Truly verbal" vs. rote responding (e.g., Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000).

Possible solutions

In fact, intraverbal training may often lead to the acquisition of listener relations that have *not* been previously trained (Ingvarsson, Cammilleri, & Macias, 2012; Luciano, 1986; Petursdottir & Haflióadóttir, 2009; Sundberg & Sundberg, 1990)

For example, Ingvarsson et al. (2012) first taught children with ASD to tact pictures of state birds

Following intraverbal training that included questions such as "What is the state bird of Idaho?" the participants demonstrated novel listener behavior by pointing to the correct bird given the name of its state (e.g., "Point to the state bird of Idaho").

Possible solutions

Tentative recommendation: (1) Teach the relevant listener behavior first, as typically recommended; then teach the related intraverbals

- For some curriculum items, you may also teach relevant *tacts* along the way

(2) every once in a while, try teaching new intraverbals *without* teaching the relevant listener behavior first

- If the listener behavior emerges, the intraverbals cannot be "rote"
- Future targets: How long does it take to teach listener-then-intraverbal sequence vs. intraverbals only?

Possible solutions

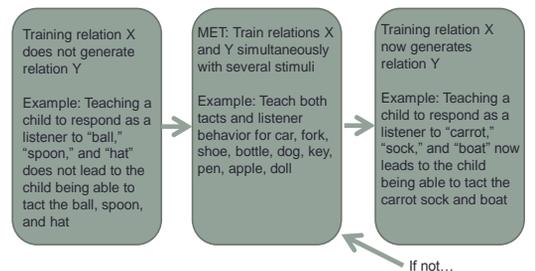
Alternatively, could an intervention, such as multiple-exemplar training (MET), help a child to acquire new listener behavior along with new intraverbals?

In general, MET refers to training that incorporates multiple exemplars of the stimulus intended to control the target behavior, for the purpose of promoting generalization (Stokes & Baer, 1977)

In recent years, researchers have investigated the effects of a type of MET to promote the emergence of untrained listener and speaker relations

Multiple-exemplar training

The basic idea:



Possible solutions

Numerous variations of MET can be found on the literature

- Specific implementation guidelines have been proposed (Greer & Ross, 2008) but implementation varies across studies/labs

A number of MET studies have found positive effects on tact emergence following listener training or object-word pairings (e.g., Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005; Greer, Stolfi, & Pistoljevic, 2007; Gilic & Greer, 2011; Rosales, Rehfeldt, & Lovett, 2011)

Emergence of appropriate listener responding following intraverbal training might be addressed in future research

Derived Intraverbal Relations

Definition

A *derived* intraverbal may be defined as one that has not been taught explicitly

Instead, it arises from other relations in the person's repertoire – listener relations, speaker relations (e.g., tacts, existing intraverbals), or stimulus-stimulus relations



"dog"

"perro"

Derived intraverbal: "Perro means dog"

More on derived intraverbals

Intraverbals following listener training (e.g., RFFC):
Learning to respond as a listener to "What do you read?" by pointing to a book, and later being able to respond to that same question with "Book" (derived intraverbal) when no visual stimuli are present

Being able to state "cold is the opposite of hot" (derived intraverbal) after learning to state that "hot is the opposite of cold" (trained intraverbal)

More on derived intraverbals

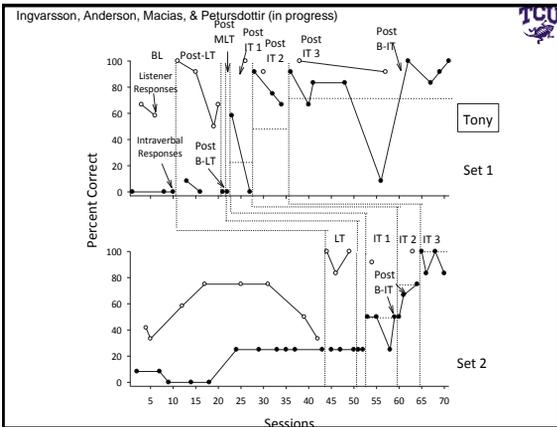
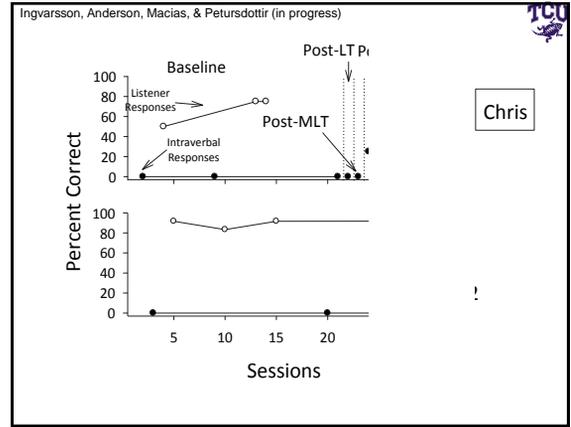
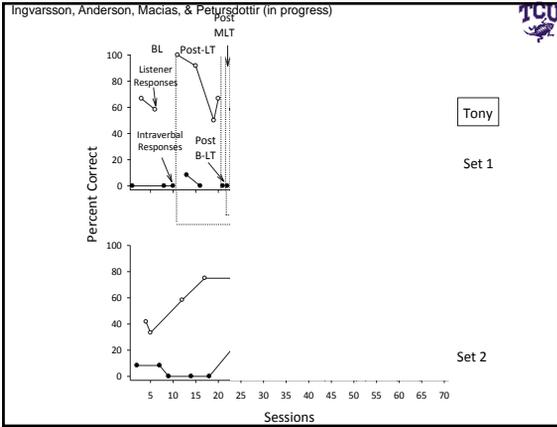
Many of competent speakers' intraverbals are probably derived rather than directly reinforced

A child who never "says anything new" (intraverbally) may be quite different from his or her typically developing peers

Intraverbals derived from listener behavior

Young TD children typically show limited or no emergence of derived intraverbals following listener training alone (e.g., Kisamore et al., 2011; Miguel et al. 2005; Petursdottir, Carr, et al., 2008; Petursdottir & Hafliðadóttir, 2009; Petursdottir, Olafsdottir, & Aradottir, 2008; Sautter et al., 2011)

The same is likely often true of children with ASD (Ingvarsson, Anderson, Macias, & Petursdottir, in progress)



Intraverbals derived from listener behavior

Are there any interventions?

Multiple exemplar training?

- Did not produce an effect on derived intraverbals for typically developing children in a study by Lechago (2010)

Recent evaluation of the effects of *collateral response requirements* on TD children's derived tacts and intraverbals following listener training:

- Petursdottir, Lepper, & Peterson (under review)
- Informed by Horne and Lowe's (1996) Naming Hypothesis

Petursdottir, Lepper, & Peterson (under review)

Stimuli

VISUAL STIMULI			AUDITORY STIMULI
			"kisha"
			"inu"
			"hana"
			"ushi"
			"ringo"
			"ninjin"

Petursdottir, Lepper, & Peterson (under review)

Standard Listener Training

Experimenter: "Inu"

Correct Response: (Point)

Consequence: Praise + Token / Prompt + Repeat

Petursdottir, Lepper, & Peterson (under review)

Collateral Response Training 1

Experimenter: "Inu"
 Correct Response 1: "Inu" ← Collateral echoic response

Correct Response 2: (Point)
 Consequence: Praise + Token / Prompt + Repeat

Petursdottir, Lepper, & Peterson (under review)

Collateral Response Training 2

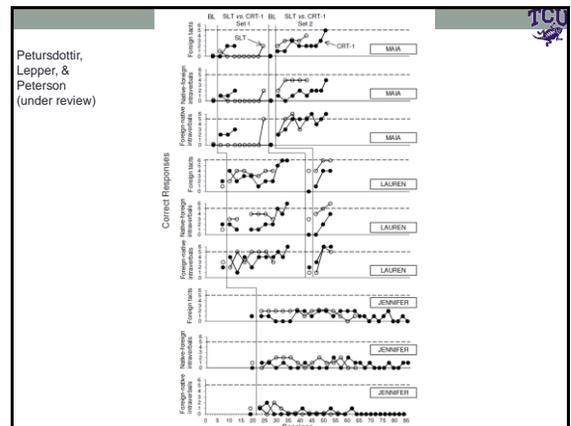
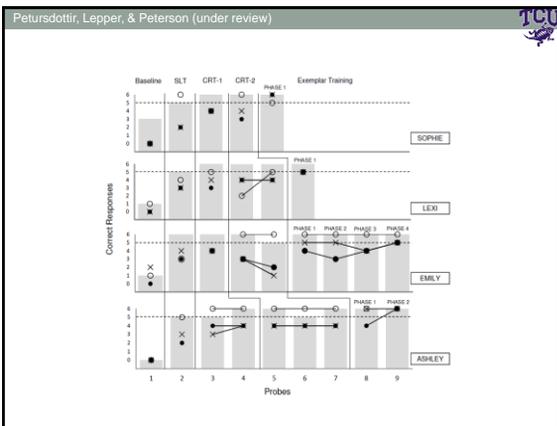
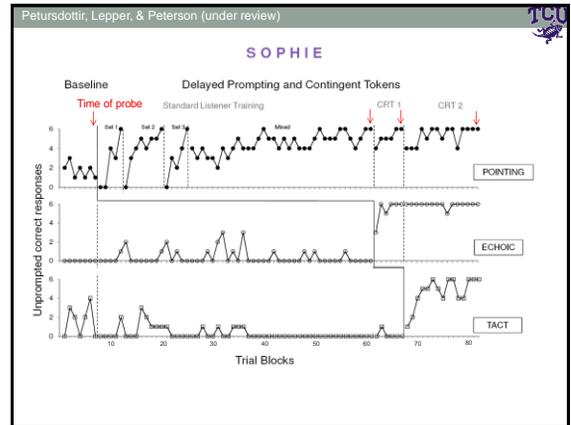
Experimenter: "Inu"
 Correct Response 1: "Inu"

Correct Response 2: (Point) + "Dog" ← Collateral native tact
 Consequence: Praise + Token / Prompt + Repeat

Petursdottir, Lepper, & Peterson (under review)

Verbal Relation Probes

Verbal Relation	Antecedent Stimuli	Correct Response
Foreign Tact	"What is this in Japanese?" +	"Inu"
Native-Foreign Intraverbal (N-F)	"What's Japanese for dog?"	"Inu"
Foreign-Native Intraverbal (F-N)	"What is inu?"	"Dog"



Petursdottir, Lepper, & Peterson (under review)

Intraverbals derived from listener behavior

Collateral response training did not generate derived intraverbals

However, the participants already demonstrated some derived intraverbals following standard listener training

- Previous studies suggest an effect on derived tacts for children who have language impairments due to developmental disabilities (Ezell & Goldstein, 1989; Hawkins, Kingsdorf, Charnock, Szabo, & Gautreaux, 2009)

Further research may be warranted on potential interventions

Intraverbals derived from stimulus-stimulus relations

Stimulus equivalence and derived intraverbals following visual-visual MTS training (Carp & Petursdottir, in preparation)

Six 5- to 7-year-old TD children

Carp & Petursdottir (in preparation)

Stimuli

			a1 – “Virginia”
			b1 – “cardinal”
			c1 – “dogwood”
A1	A2	A3	a2 – “Alabama”
B1	B2	B3	a3 – “California”
C1	C2	C3	b1 – “cardinal”
			b2 – “yellowhammer”
			b3 – “quail”
			c1 – “dogwood”
			c2 – “camellia”
			c3 – “poppy”

Carp & Petursdottir (in preparation)

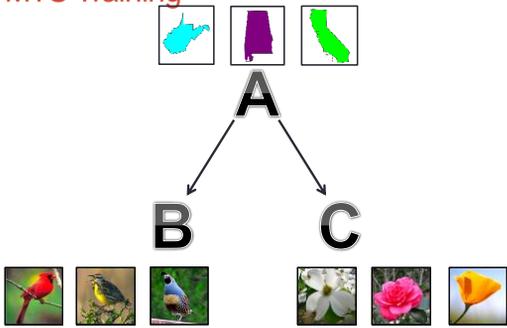
Tact Training

Experimenter: “What is this?”

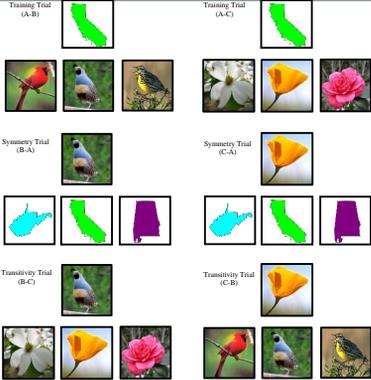


Carp & Petursdottir (in preparation)

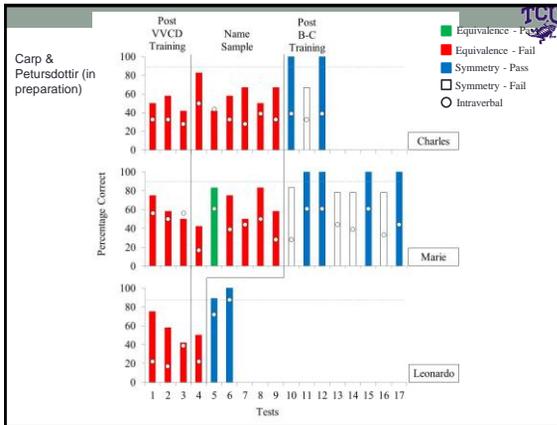
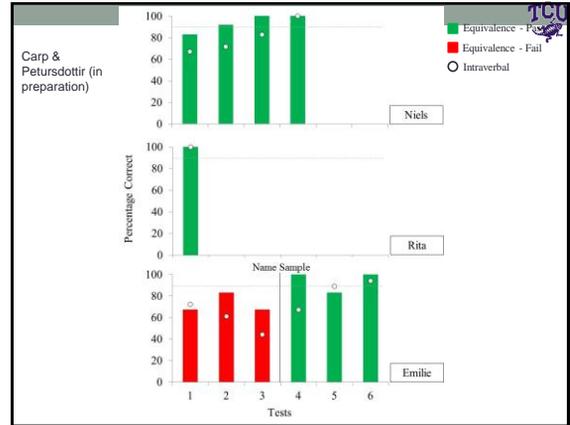
MTS Training



Carp & Petursdottir (in preparation)



Relation	Stimuli	Response
a-b	(a1) Virginia goes with which bird?	(b1) Cardinal
a-b	(a2) Alabama goes with which bird?	(b2) Yellowhammer
a-b	(a3) California goes with which bird?	(b3) Quail
a-c	(a1) Virginia goes with which flower?	(c1) Dogwood
a-c	(a1) Alabama goes with which flower?	(c2) Camellia
a-c	(a1) California goes with which flower?	(c3) Poppy
b-a	(b1) Cardinal goes with which state?	(a1) Virginia
b-a	(b2) Yellowhammer goes with which state?	(a2) Alabama
b-a	(b3) Quail goes with which state?	(a3) California
c-a	(c1) Dogwood goes with which state?	(a1) Virginia
c-a	(c2) Camellia goes with which state?	(a2) Alabama
c-a	(c3) Poppy goes with which state?	(a3) California
b-c	(b1) Cardinal goes with which flower?	(c1) Dogwood
b-c	(b2) Yellowhammer goes with which flower?	(c2) Camellia
b-c	(b3) Quail goes with which flower?	(c3) Poppy
c-b	(c1) Dogwood goes with which bird?	(b1) Cardinal
c-b	(c2) Camellia goes with which bird?	(b2) Yellowhammer
c-b	(c3) Poppy goes with which bird?	(b3) Quail



Carp & Petursdottir (in preparation)

Intraverbals derived from stimulus-stimulus relations

Match-to-sample training produced derived intraverbals when and only when it also resulted in stimulus equivalence

Why was this the case? Are there any practical implications?

Intraverbals derived from tacts

Tact training may be more likely than listener training to generate derived intraverbals (Miguel, Petursdottir, & Carr, 2005; Petursdottir, Olafsdottir, & Aradottir, 2008)

May, Hawkins, & Dymond (2013):

- Participants with ASD were able to answer questions such as "What food does Simon eat?" and "Which monster eats chips?" following relevant tact training alone

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    graph TD
      A[Picture of monster] --> B["Simon"]
      A --> C["Chips"]
  
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Intraverbals derived from tacts

Variability across studies

- One vs. multiple correct responses per verbal stimulus
- Overlap between training and testing instructions

If the objective is to teach an individual to derive intraverbals from other relations, the tact might be a good one to start with (i.e., high likelihood of success)

- But may not be applicable to all curriculum items

Intraverbals derived from intraverbals

Bidirectional intraverbal: Teaching an intraverbal response to "What do you drink from?" ("Cup") also generates the reverse intraverbal ("What do you do with a cup?" "Drink")

Intraverbal training often fails to generate bidirectional intraverbals in young TD children and children with ASD (e.g., Pérez-González, García-Ansenjo, Williams, & Carnerero, 2007; Petursdottir, Carr et al., 2008; Petursdottir & Hafliöadóttir, 2009)

However, may improve with repeated experience (Pérez-González et al., 2007)

- I.e., training with multiple exemplars

Intraverbals derived from intraverbals

More complex instances (Pérez-González, Herslikowicz, & Williams, 2008):

- Name a city in Argentina
- Name a park in Buenos Aires

How many novel intraverbals it is possible to derive?

Convergent stimulus control – important to ensure that all elements of the verbal stimulus exert control over the response (Carp & Petursdottir, 2008; Pérez-González et al., 2008)

Summary

A variety of stimulus control issues can lead a person to tact a child's intraverbal behavior as "rote."

Most of them are commonly seen in TD children as well

Different stimulus control issues may call for different instructional strategies

May be informed by the existing literature, but additional research is needed

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