

Teaching verbal conditional discrimination: a framework for organising language curricula to establish generalised question-answering in children with autism

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National Autism Conference
Penn State, 5th & 6th August 2015

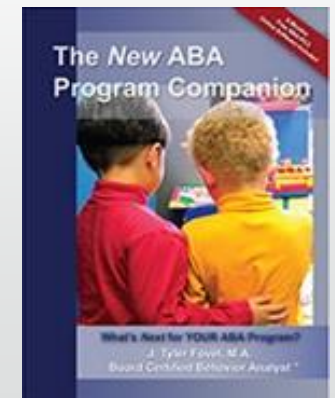
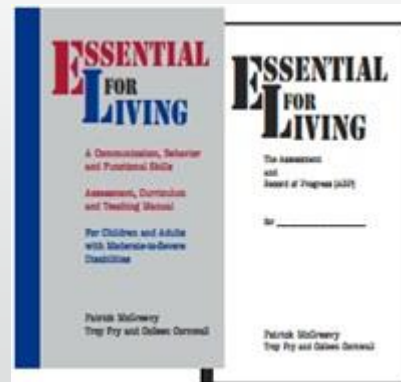
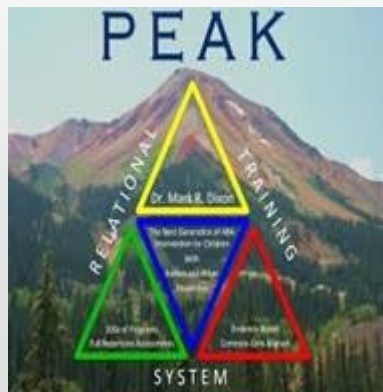
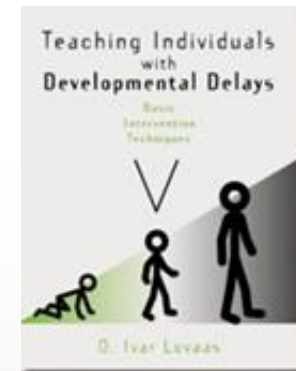
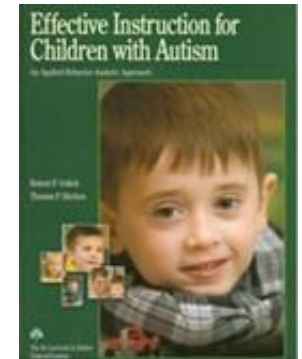
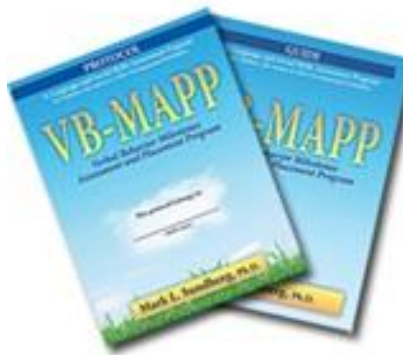
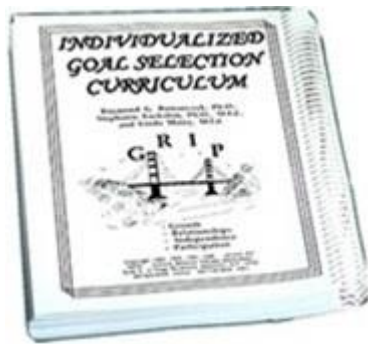
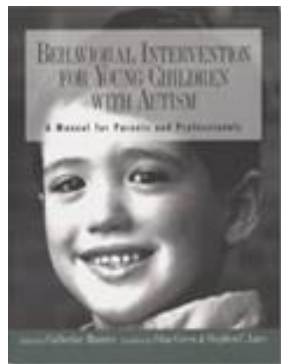
Learning objectives

To understand

- Applied procedures based on the analysis of multiply controlled verbal behaviour in relation to tact and intraverbal conditional discriminations
- Applied procedures that evoke transfer of stimulus control from tact to intraverbal repertoires without direct teaching of specific individual responses
- Learner progression across three levels of stimulus complexity, from acquisition of basic vocabulary (Beginner), to acquisition of generalised verbal conditional discriminations (Intermediate), to answering novel questions about past events (Advanced)

Basic concepts

- Curricular organisation:
 - Hierarchical organisation of “programmes” or “skills”
 - Differentiation of “generalised” and “cumulative” skills
 - Differentiation of “responses” and “skills”
- Autoclitic frames
- Verbal conditional discriminations
- Pure and multiply controlled intraverbal responding



A general framework: overall objectives

	Beginner	Intermediate	Advanced
Social	People need to become S ^D s for delivery of S ^R s: Eye-contact as CMO-T and joint attention	Attention and shared activities as S ^R s: reciprocal commenting and comment extensions	Verbal interaction as the S ^R : conversation
Verbal: function & structure	Conditional discriminations: visual and unmediated selection (receptive)	Tact and intraverbal conditional discriminations: objects and ongoing events	Tact and intraverbal conditional discriminations: general topics and past events
	Communication: mands	Listener (mediated selection, jointly controlled responding)	Descriptions of past events (remembering)
	Establishing basic noun and action vocabulary: tacts and receptive	Relations between nouns: and classes (categories), and actions (functions), and nouns (parts), properties (adjectives)	Abstract reasoning: predictions, inferences, temporal relations/sequences
	Generalised imitation		Problem solving and tacting
	Naming	Descriptions (tacts of compound stimuli): events and objects	private events of others (Theory of Mind)
	Structure: single words	Structure: basic utterance (SVO, articles, and agreements)	Structure: Multi-clause, connected sentences (discourse)
Academic	Drawing imitation and colouring	Textual (decoding), taking dictation, number/quantity relations	Story comprehension and story writing, maths, word problems, sums

Beginner tact objectives

- The initial aim of many EIBI programmes is to establish a basic single-word repertoire in the primary operants and receptive discriminations
- Tacting: Saying the names of things visually presented under non-verbal stimulus control (i.e., the item)
- Content: common objects, animals, names of familiar people, rooms of the house, locations, actions, colours
- Debate about the sequence of acquisition of tacts and receptive discrimination

Beginner tact progression

Objective		Description	Absent Emergent Achieved
1	Tacting reinforcers: CMO-Transitive	Tacts common objects s/he has learned to mand for under CMO-T conditions (e.g., spoon, cup, keys)	
1	Tacting common objects	Tacts common objects following the question "What is it?" and presentation of visual stimulus	
1	Tacting animals	Tacts animals following the question "What is it?" or "What animal?" and presentation of visual stimulus	
2	Tacting actions in 2D	Tacts 2D actions following the question "What is she/he doing?" and presentation of visual stimulus	
2	Tacting shapes	Tacts shapes following the question "What shape?" and presentation of visual stimulus	
2	Tacting colours	Tacts colours following the question "What colour?" Many neutral stimuli of different colours (cards, pegs, cards) can be used	
2	Tacting locations	Tacts locations following the question "Where is it?" "What room is it?" and presentation of visual stimulus	

Objective		Description	Absent Emergent Achieved
3	Tacting people in vivo	The adult points to a person present in the environment and asks "Who is it?" – the student responds with the name of that person	
3	Tacting actions in vivo performed by a third person	Tacts what people are doing: "What is mummy doing?" while the adult points to the mother who performs the actions	
3	Naming	Generalised to tact, labels that were only reinforced in receptive discrimination (without formal receptive to tact transfer)	
3	Tacting multiple examples of the same stimulus	Tacts different examples of the same stimulus (see non-identical matching)	
3	Non-identical matching	Matches non-identical stimuli that she/he knows the tact of (see Naming - beginning of classification)	
3	Tacting stimuli from different sources	Tacts mastered stimuli when presented in different formats: from a picture book or video.	
3	Tacting locations in vivo	Tacts the place in which s/he is following the question "where is it here?" or "which room is this?"	
3	Tacting own actions (*autoclitic)	Labels her/his own actions following the question "What are you doing?", using the correct subject and verb ("I am ____ing")	

“Why” and “how”

“My child has hundreds of tacts (nouns, colours, people, actions, animals) but doesn’t seem to understand the question, even though he knows the answer”

- What does it mean to teach “understanding the question?”
- Why is it important?
- How could we do it?
- Teaching individual responses vs. understanding

Early tact conditional discrimination problems: objects and their properties

- **Colour vs. noun**

- “*What colour is it?*” - “*Apple*”



- **Function vs. noun**

- “*What do you do with it?*” - “*Apple*”

- **Sound vs. noun**

- “*What does it say?*” - “*Cat*”



- **Category vs. sound**

- “*What does a cat say?*” vs. “*What is a cat?*”

Early tact conditional discrimination problems: events

- **Agent vs. action**
“Who is it?” - “Drinking”
- **Object vs. function**
*“What is he drinking?” - “Straw”, or
“What is he drinking with?” - “Juice”*
- **Agent vs. object**
*“Who is drinking?” - “Juice”, or
“What is he drinking?” - “Boy” or “Straw”*



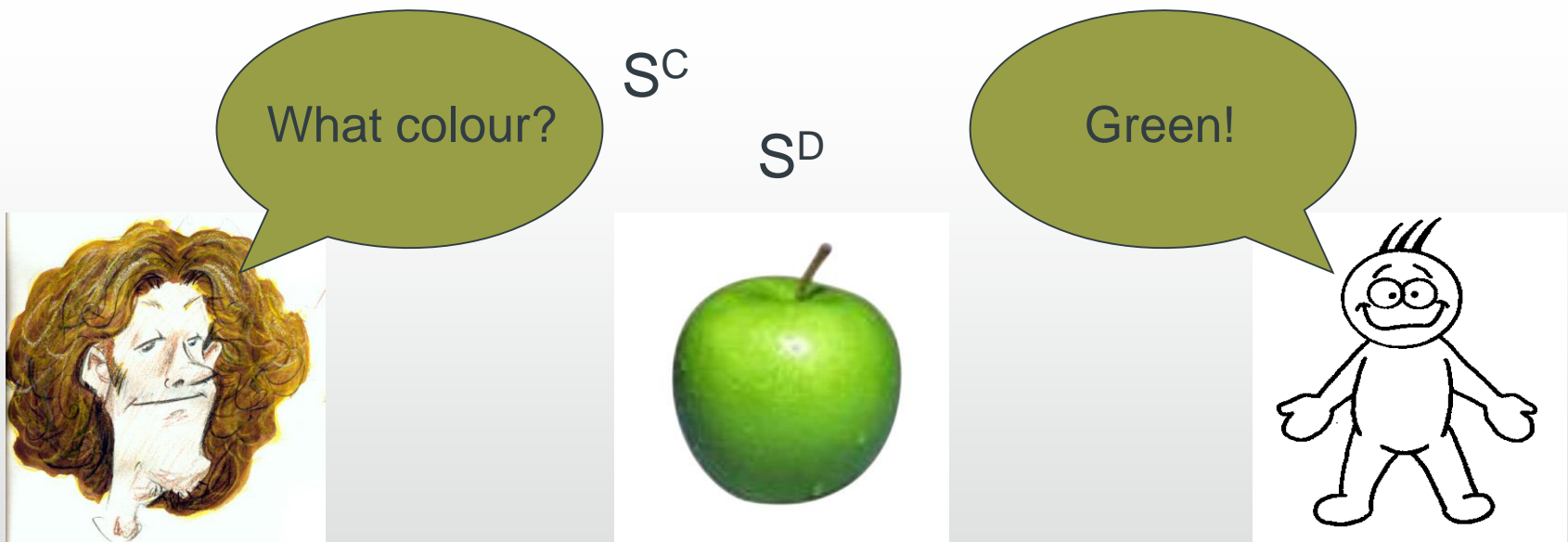
A quest....

- As soon as a basic verbal behaviour repertoire has been established, further explanations (and procedures) become necessary to account for (and teach) the interactions of its parts
- As interventionists, our quest must be to identify the sources of stimulus control (i.e., the controlling variables) in the natural environment and to recreate those contingencies in our teaching—only from procedures derived from such a molecular analysis can we move beyond teaching specific responses under very restricted stimulus control

Conditional discrimination in verbal behaviour

- Inherent in all verbal operants as probabilities of verbal responses vary with the presence of conditional and discriminative stimuli

Catania (1998)



Adapted from Axe (2008)

Conditional discriminations

- “The nature or extent of operant control by a stimulus condition depends on some other stimulus condition”

Michael (2004, p. 64)

- “That is, one discriminative stimulus (S^D) alters the evocative effect of a second stimulus in the same antecedent event (or vice versa), and they collectively evoke a response”

Sundberg and Sundberg (2011, p. 25)

An analysis of multiple control

- An adult shows a green apple to a child and asks “*What colour is it?*”
- The auditory verbal stimulus colour strengthens a variety of intraverbal responses related to colours (blue, yellow, red, and green) and the non-verbal stimulus strengthens related tacts (round, small, you eat it, sweet, and **green**). The response green is under the control of both antecedent variables.

Michael, Palmer, and Sundberg (2011)

Autoclitic frames

- Intraverbal frames, grammatical frames, sentence frames
- Strings, repeatedly heard and echoed in a context, with some elements fixed and some variable. The fixed elements are the frame, and each element exerts intraverbal control over subsequent elements of the frame
- Autoclitic frames are intraverbals, and, unlike other verbal operants, intraverbals have a formal structure: One can't substitute other forms. The functional feature is the structure.
- Verbs as dominant form and nouns as variable elements

Palmer (2007)

Teaching children with autism to answer novel wh-questions by utilizing a multiple-exemplar strategy (Jahr, 2001)

Table 2

Examples of questions and appropriate answers within each of the question categories

Question	Answer
What	
1. What do you like to eat?	I like to eat pizza
2. What do you like to drink?	I like to drink coke
3. What do you like to play with?	I like to play with cars
Who	
1. Who do you like to play with?	I like to play with Peter
2. Who do you live with?	I live with mom and dad
3. Who do you sing with?	I sing with the other children
Where	
1. Where do you buy a snack?	I buy a snack at the grocery
2. Where do you play football?	I play football in the garden
3. Where do you swim?	I swim in the pool
Why	
1. Why do you wash your hands?	I wash my hands because they are dirty
2. Why do you eat?	I eat because I am hungry
3. Why do you drink?	I drink because I am thirsty

Autoclitic acquisition

Three important variables

1. Intraverbal control of the autoclitic frame
2. Discriminative control of the auditory properties of the verbal behaviour of the speaker as he or she hears himself or herself speak (the speaker as his or her own listener)
3. Automatic shaping of verbal responses to achieve parity with the verbal practices of the verbal community

Palmer (1998)

Teaching question discrimination to children with autism

- Procedure based on manipulating relevant conditions to evoke intraverbal control between the word “colour” and a colour name (i.e., the example being presented) and the word “number” and a number name (i.e., the example being presented).
- By training responding to single elements using autoclitic frames it may be possible to bring responding under multiple echoic, intraverbal, and tact control in a tact conditional discrimination without specifically teaching each response.

degli Espinosa and Brocchin (2015)

Procedure: teaching steps (run concurrently)

1. **Echoic priming**

“Colour green”, “colour red”, “colour blue”, etc., and “number 3”, “number 5”, “number 4”, etc., to increase intraverbal control of the verbal stimulus
“Colour” and the name of a colour, “Number” and the name of a number

2. **Establish tacting of numbers with the autoclitic frame “Number [X]”**

Stimuli are black numbers on white paper. Ask “What number?” in each presentation. Response is partly an echoic, partly intraverbally controlled, and partly a tact (specific sample), thus establishing multiply controlled responding

3. **Establish tacting of colour swatches with the autoclitic frame “Colour [X]” (in separate trial blocks from Step 2)**

Ask “What colour?” in each presentation. The response is partly an echoic, partly intraverbally controlled, and partly a tact (specific sample), thus establishing multiply controlled responding

Procedure: testing step

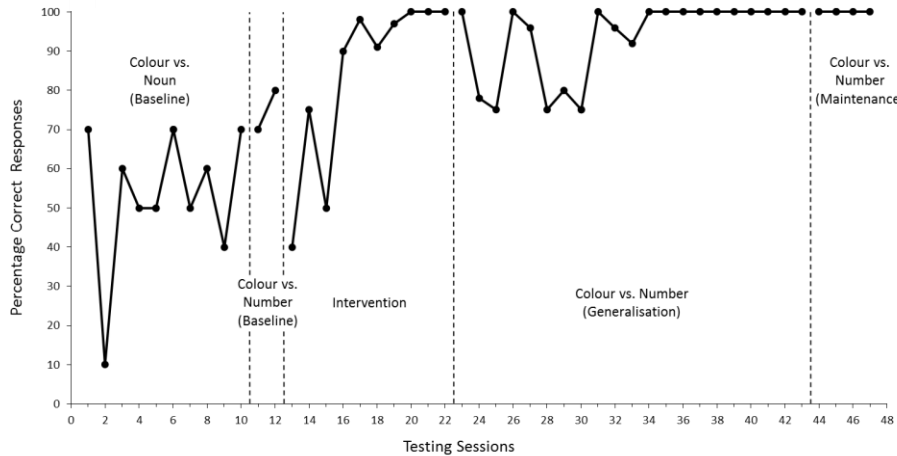
4. Testing

When the above groups of tacts have been established (Steps 1 to 3), begin testing for tact conditional discriminations using a continuous schedule of reinforcement for each correct response

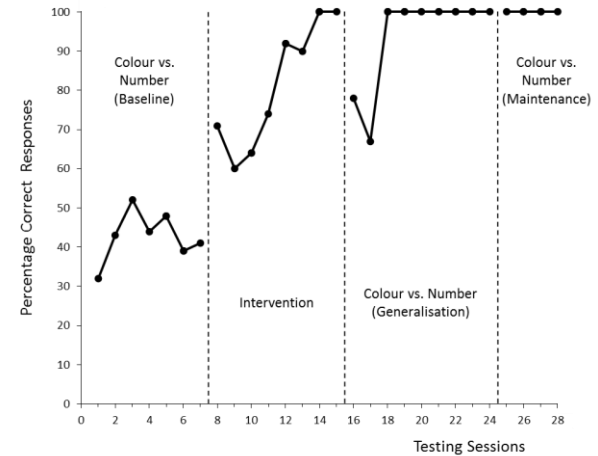
- a) Run echoic trials as a priming session
- b) Present five coloured numbers on the table and randomly ask one of the two questions about a single stimulus (i.e., do not ask two questions about the same stimulus). Use an intraverbal filler, so when you point to the relevant sample and ask “What number?”, say “Number...”. The child should then say “Number” and the number name together (e.g., “Number three”). *Note.* The intraverbal filler is used to establish intraverbal control over the whole class with the tact as the specific sample, so it does not function as a prompt for the tact. Use the same procedure for the “What colour?” question

Four children: colour vs. number

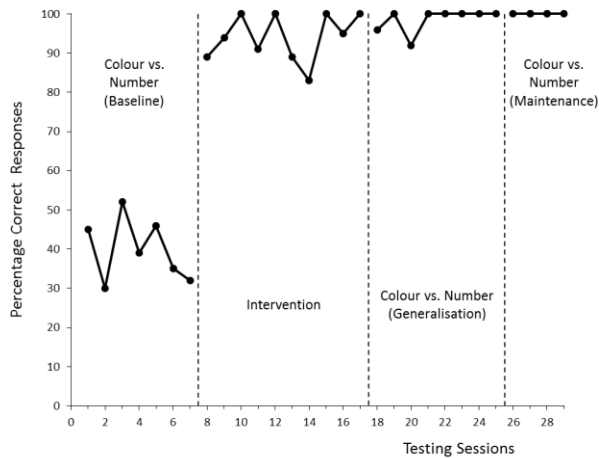
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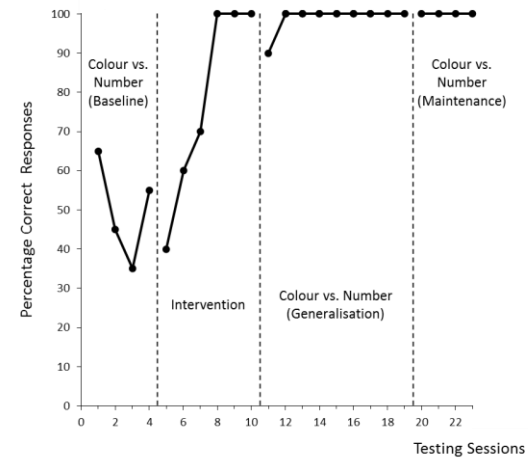
John



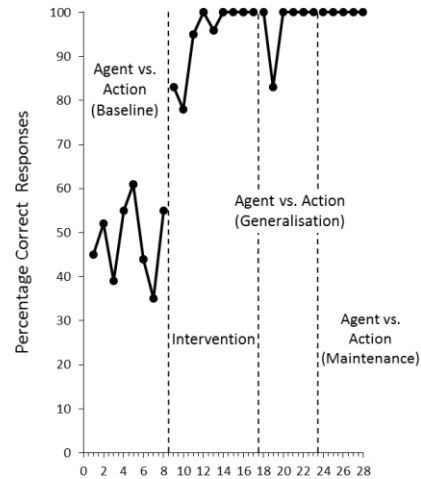
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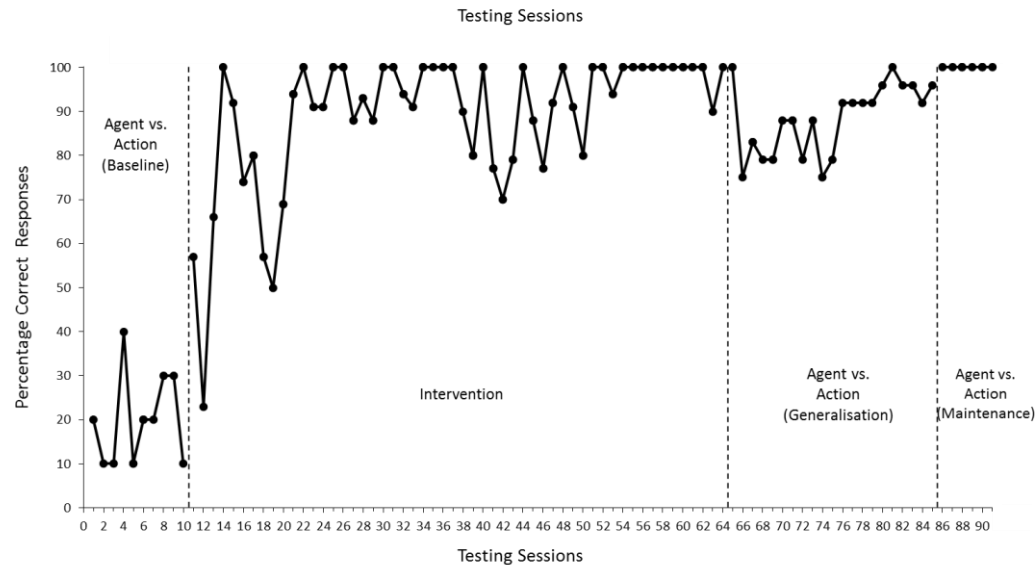
Richard



Two children: agent vs. action



John



Matthew

Intraverbal and tact control via autoclitic frames: some examples

- “What number?” – “Number [number name]”
- “What is it?” – “It’s a [object name]”
- “What colour?” – “Colour [colour name]”
- “What animal?” – “It’s a cat”
- “What does it say?” – “It says meow”
- “Who is it?” – “It’s mummy”
- “What is **she doing**?” – “She is swimming”
- “What do you **eat**?” – “Eat spaghetti”
- “What do you eat **with**?” – “With fork”
- “When do you eat breakfast?” – “When it’s morning”

Objects vs. events: general knowledge vs. experiences

Object

- Non-variable “vocabulary” regarding a given item
- All there is to know about a cat vs. “this” cat



Event

- Variable “vocabulary” about a changing event
- All there is to see about the cat in the picture



Beyond tacting of visible properties

Learning relations between words

- **Function**
 - Action and object
- **Categorisation**
 - Members and their belonging class
- **Features**
 - Parts: visible characteristics specific and defining of certain items (e.g., stripes for a zebra, a handle for a door)
 - Adjectives

Functions, features, and classes: Searching for intraverbal stimulus control

- The majority of research on the subject has focused on establishing discrete responses (e.g., members of a category) and investigated the effects of prior listener and tact training
- Typically a tact/echoic to intraverbal transfer procedure is used, item by item
- See “*Teaching Intraverbals: the difference between ‘rote’ and ‘meaningful’*” (Petursdottir, 2013) for a review of the literature

Teaching sequence: an example

	Listener and tact (vocabulary)	Tact & intraverbal conditional discrimination	Listing	Multiple conditional discrimination (compound)
Categorisation	Physically sorts members into a class (e.g., cat to dog and horse for "animal" class: $A+B=C$). Points to the class, tells the name of the class when asked question and shown member (e.g., what is a cat?). Also categorisation by function, feature, materials, contexts (things you find in places)	"What is it?"; "What colour is it?"; "What is a cat?"	"Tell me some animals"; "... some foods"; "... some furniture"; "... things that you build"	
Functions	Points to and says the name of the item used to carry out a known action (A-B). Says function when shown object (B-A). Also functions of places, people (professions)	"What is it?"; "What is X for?"/"what do you do with it?"/"X?"; "What colour is it?"; "What is a/an X?"; "What do you do with X?"; "What do you [<i>verb</i>]?"	"Tell me some things that you eat with"; "... drink with"; "... write with"	
Features (parts and adjectives)	Points to and says the name of the item that has that particular feature. Parts are specific to the whole (e.g., stripes on a zebra)	"Which one has stripes?"; "What does the zebra have?"; "Which is dirty?"; Conditional question ("Is the glass clean or dirty?"); Yes/no ("Is it clean?")	"Tell me some big things"; "Tell me some things that have stripes"	"Tell me a big animal"; "... a small animal"; "... a small vehicle"; "... a cold drink"; "... green food"

Intermediate curricular objectives

Content

- Vocabulary that defines properties and relations between items
- Features
- Functions
- Classes
- Prepositions

Verbal antecedents

- Direct questions
- Yes and No
- Conditional questions (“Is it X or Y?”)
- Listing
- Verbal multiple discrimination (compound)

Skill	Description	Example
<i>Simple tacts (non verbal control) – beginner objective</i>	<i>Says the name of the item presented: noun, colour, number, animal</i>	<i>Picture of car “car”. Red colour swatch “red”.</i>
Tact question discrimination: colour/noun, sound/noun (single object)	Answers two to three questions about a visible single item: colour, noun, number, animal	“What is it?”; “What colour?”; “What number?”; “What does it say?”
Tact Yes and No and conditional questions (single object)	Answers direct questions, yes and no, conditional questions about a single visible item: colour, noun, number, animal	“Is it a car?”; “Is it a car or a chair?”; “Is it green?”; “Is it red or green?”
Tact question discrimination feature (part), function, class (single object)	Answers direct questions about single visible item: noun, colour, function, class, feature (part), sound	“What is it?”; “What colour?”; “What is a car?”; “What do you with a car/it?”; “What does it/a car have?”
Tact question discrimination feature (part/adjective), function, class: direct questions, yes and no, conditional questions (single object)	Answers direct questions, yes and no, conditional questions: colour, function, class, feature (part), sound	“What is it?”; “What is a car?”; “Does it have wings?”; “Is the car blue?”; “Is it transport or an animal?”; “What do you do with it?”
Tact two-element questions (multiple objects): all question formats	Answers direct questions, yes and no, conditional questions about function, class, feature, adjective when presented with multiple objects in the same visual field	“What does the pen have?”; “Is the chair made of wood?”; “Is the cup empty or full?”; “Where do you find the cup?”; “What do you do with a toothbrush?”; “What colour is the cup?”; “Which is the big animal?”; “Is the dog dirty?”

Considerations

- The trap of teaching intraverbal responses through an echoic/tact to intraverbal transfer **before** a repertoire of tact conditional discriminations has been established
 - “What do you **eat**?” - “Fork” (“What do you eat with?”)
 - “What is a **cat**?” - “Miao” (“What does a cat say?”)
 - “What do you do with **food**?” - “Pizza” (“What is a type of food?”)
- Using such procedures risks turning a response that should occur under multiple control (i.e., a conditional discrimination) into one that occurs under simple discriminative control alone (i.e., a pure intraverbal). Because it has temporal contiguity, by definition, a pure intraverbal cannot be a variable response.

The problem with directly training intraverbal responses

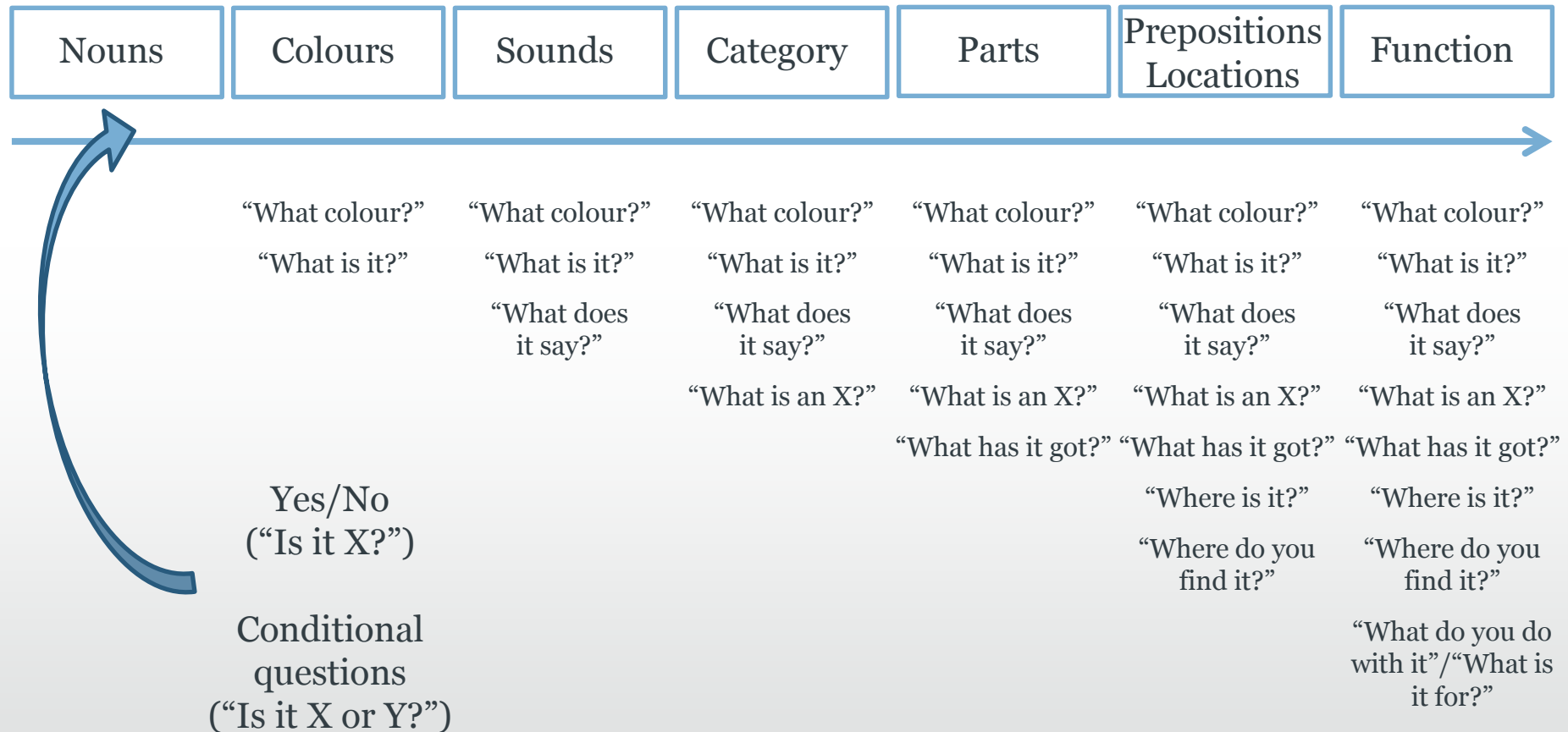
- “[...] researchers are able to establish small and somewhat restricted categorization repertoires by directly training the responses using stimulus control transfer procedures. However, some have suggested that the resulting responses may differ from how most verbally competent individuals answer categorization questions”

D. C. Palmer (personal communication, September 12, 2006, as cited in Sautter, Leblanc, Jay, Goldsmith, & Carr, 2011, p. 228)

Learning how to learn

- Because EIBI aims to equip children with autism with skills necessary for independent functioning across a wide range of real-world contexts:
 - Interventions that focus on teaching every single requisite response for a given situation cannot be optimal, or, indeed, often even efficient
 - Instead, clinicians must focus on developing procedures for intervention that enable children to acquire novel responses in the absence of any teaching subsequent to intervention

Continuum: tact and intraverbally controlled conditional discrimination - object



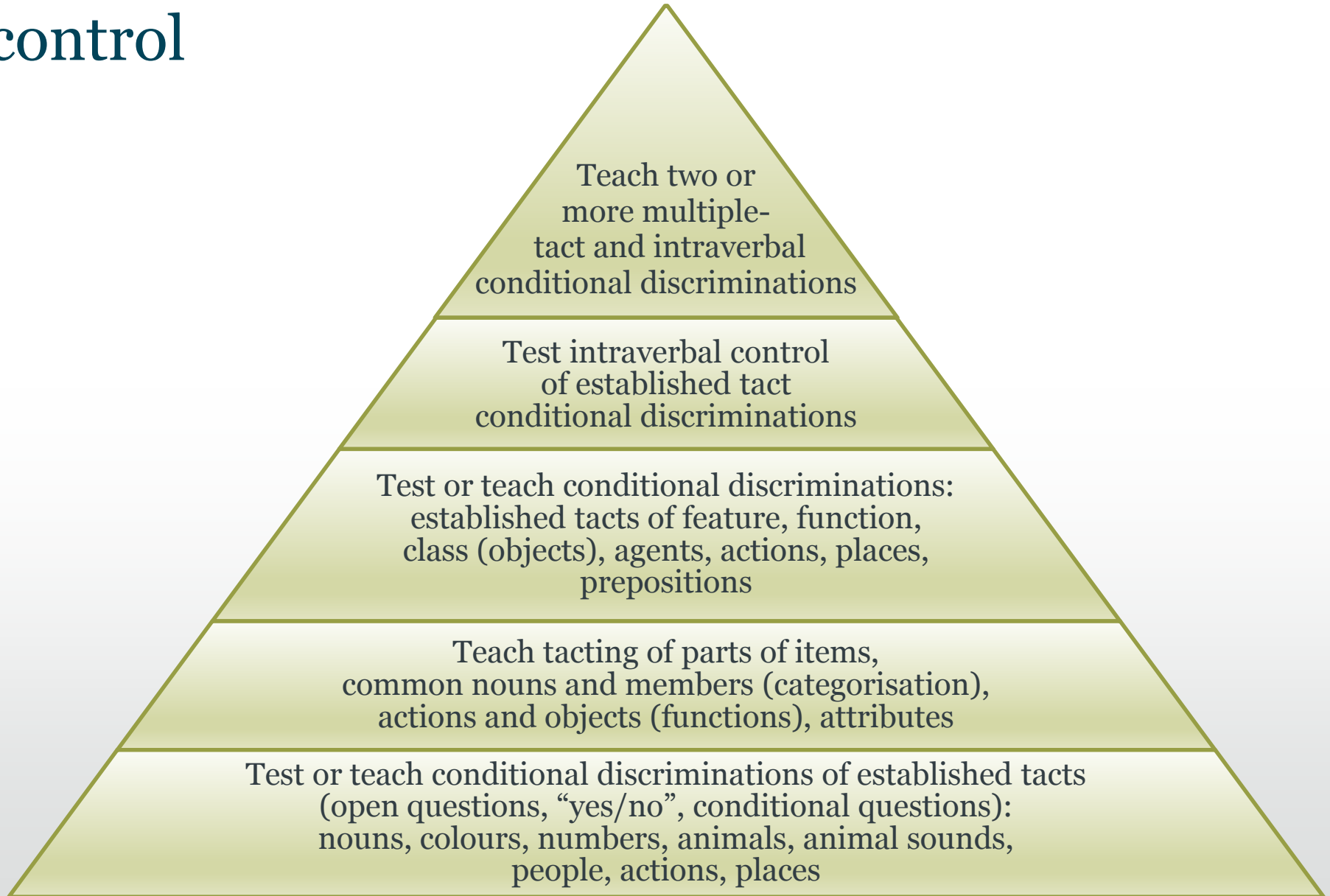
Intraverbal

- Our daily verbal behaviour often occurs in response to the verbal behaviour of another person
- Verbal behaviour in which the form of the response (i.e., what is said, signed, written, etc.) is under the functional control of an antecedent verbal discriminative stimulus (S^D) and some type of generalised conditioned reinforcement (Skinner, 1957)

Are these all intraverbal responses?

Example	
“Where did you go this morning?”; “Who taught the class?”; “Who were you next to?”; “How did you get to the museum?”; “What did you talk about?”; “What is a cat?”; “What are some other felines?”	Past event recall: Remembering (problem solving and conditional discriminations)
“What is a cat?”; “What does a cat have?”; “What does a cat drink?”; “Tell me some animals?”; “Tell me some animals that live in a house?”	Conditional discrimination (multiple control)
“One, two, ____?” “A cat says ____?”	Pure intraverbal

Curricular sequence: Teach tact, test intraverbal control



Skill	Description	Example
Intraverbal questions feature (part), function, class (single object): direct questions	Answers direct questions about non-visible single item: colour, function, class, feature (part and specific colour), sound	“What is a car?”; “What do you with a car/it?”; “What does it/a car have?”
Intraverbal questions feature (part), function, class (single object): all question formats	Multiple questions about single item: Direct questions, yes and no, conditional questions about feature, function, class, adjective	“Is a lemon red?”; “Is a lemon furniture?”; “Is a lemon food or transport?”; “What is a lemon?”; “What shape is a lemon?”; “What colour is a lemon?”
Says members of a category/class (verbal divergent control)	Lists members of a verbal class	“Tell me some animals”; “Name some foods”; “Tell me some red things”
Intraverbal Object vs function: what vs with	Discriminates between the object and the function of the object in transitive verbs	“What do you eat?”; “What do you eat with?”; “What do you drink with?”; “What do you drink?”
Intraverbal questions rotation: all formats	Answers direct questions, yes and no, conditional questions, and lists: feature, function, class, adjective	“Which is food - a lemon or a car?”; “What is something you drink?”; “Where do you swim?”; “What do you use for swimming?”; “Which is red; a strawberry or a banana?”; “Say some red things”
Single-element intraverbal questions about a single class	Multiple questions about a single class	“Tell me an animal”; “Tell me a big animal”; “... a yellow animal”; “... an animal that lives in a house”
Two or more element intraverbal questions	Multiple questions about multiple classes in consecutive arrangement	“Tell me a big animal”; “... a big vehicle”; “... a vehicle that flies”; “... an animal that flies”; “... an animal that lives in a house”; “... a room of the house”; “... a room in a school”

Continuum: tact and intraverbally controlled conditional discrimination - event

People	Actions	Locations	Features	Prepositions	Functions	Past events
 <p>“Who is it?”</p> <p>“What is he doing?”</p> <p>“Where is he?”</p> <p>“What colour is his top?”</p> <p>“What colour is his hair?”</p> <p>“Where is the juice?”</p> <p>“What is he drinking?”</p> <p>“What is he drinking with?”</p> <p>Yes/No (“Is it X?”)</p> <p>Conditional questions (“Is it X or Y?”)</p>	“Who is it?”	“Who is it?”	“Who is it?”	“Who is it?”	“Who is it?”	“Who was it?”
	“What is he doing?”	“What is he doing?”	“What is he doing?”	“What is he doing?”	“What is he doing?”	“What was he doing?”
	“Where is he?”	“Where is he?”	“Where is he?”	“Where is he?”	“Where is he?”	“Where was he?”
	“What colour is his top?”	“What colour is his top?”	“What colour is his top?”	“What colour is his top?”	“What colour was his top?”	
	“What colour is his hair?”	“What colour is his hair?”	“What colour is his hair?”	“What colour is his hair?”	“What colour was his hair?”	
	“Where is the juice?”	“Where is the juice?”	“Where is the juice?”	“Where is the juice?”	“Where was the juice?”	
	“What is he drinking?”	“Who is drinking?”	“Who was drinking?”			
	“What is he drinking with?”	“What is he drinking?”	“What was he drinking?”			
	“What is he drinking with?”	“What was he drinking with?”				
	“What is he drinking with?”	“What was he drinking with?”				

Skill	Description	Example
<i>Simple tacts (non verbal control) – beginner object</i>	<i>Says the name of the item presented: person, action</i>	<i>Picture of familiar person: “Mummy”. Action card “reading”</i>
Event Question discrimination agent/action/location (picture and in vivo)	Answers two to three questions about an ongoing event with one agent, one action and one location (simple event)	“Who is it?”; “What is s/he doing?”; “Where is Mummy?”
Event Yes and No and conditional questions (picture and in vivo)	Answers direct questions, yes and no, conditional questions about an ongoing event with one agent, one action and one location (simple event)	“Who is it?”; “Is Mummy reading?”; “Is Mummy in the kitchen or in the garden?”; “What is she doing?”; “Is it Daddy?”
Event 2-part questions what colour/action	Answers 2-part What questions related to properties of items/person in the event (simple event) e.g., colour and action	“What colour is the cup?”; “What colour is Mummy's top?”; “What is Mummy holding?”
Event 2-part questions where location vs preposition	Answers 2-part Where questions related to position and location of items/person in the event (simple event)	“Where is “Mummy?”; “Where is the teapot?”; “Who is it?”; “What is on the table?”; “What is she doing?”; “What colour is her top?”
Event question discrimination: who/what/with	Answers direct questions about the person (boy/girl/man/woman) engaging in the action, the object and related function	“Who is drinking?”; “What is she drinking?”; “What is she drinking with?”
Event question discrimination: personal and possessive pronouns	Answers direct questions about an ongoing event with multiple agent including himself and the other speaker (in vivo)	“Who is drinking?”: <i>I am</i> ; “Who is eating?”: <i>You are</i> ; “What are you drinking?”

Advanced Objectives

- Smaller changes in verbal antecedents
- Beyond public events and intraverbal responses
- The role of verbal mediation in the behaviour of remembering
- Temporal concepts
- Problem solving and abstract reasoning

Skill	Description	Example
Tact and intraverbal negation	Answers questions in the presence and absence of visual stimuli involving negation	“Which one does not live in the sea?”; “Which isn’t green?”; “Which is big?”; “Which isn’t big?”; “Which one lives on a farm?”; “Tell me a big animal?”; “Tell me a vehicle that isn’t big”
Two or more element intraverbal questions with and without negation	Questions involving two or more S ^D s	“Something white that you eat”; “Something white that you drink”; “Something sharp you find in the kitchen”; “Something hot in the bathroom”; “Something white you do not eat”
Associative intraverbal questions	Multiple questions about a single item, single questions about multiple items	“What colour is grass?” <i>Green</i> . “A green animal?”: <i>Frog</i> . “What does a frog do?”: <i>Jumps</i> . “Where do you jump in the garden?”: <i>Trampoline</i> . “What does a trampoline have?”: <i>Springs</i> . “What are springs made of?”: <i>Metal</i> . “What do you cut your food with that is made of metal?”: <i>Knife</i>
Complex listing (divergent multiple control)	Lists members of a verbal class: by function, part, feature, context (things you do in, things you see in, people you see at..) and multiple-element	“Tell me things that have a zipper”; “Say some yellow things”; “Name some cold things”; “Tell me things you do at the beach”; “Tell me things you see at the beach”; “Who do you see in a hospital?”; “Say some cold things but not food”
Topic based intraverbal questions (Wh)	Answers questions about a topic (personal information, e.g. school) or general knowledge: e.g., the cinema): who, what, where, when, why, which, how, listing	“When do you go to school?”; “What’s your school called?”; “Who works in a school?”; “What is your teacher at school called?”; “What is your teacher at Sunday school called?”; “Who takes you to school?”; “How do you get to school?”; “What do you wear at school?”; “What do you do at school?”; “Who do you see at school?”

Skill	Description	Example
Differences and similarities (tact)	Adult presents two items that share some similarity and difference. Properties are initially visible (e.g. same colour different items, same items different colours) and the relation becomes progressively more arbitrary.	How are these two things similar? How are they different?
Differences and similarities (intraverbal)	As above, but the information is presented verbally only	How are a light and a candle similar? How are they different?
Tacting absurdities	Describes absurdities and provides coherent explanation (tact)	Shown a picture of a pig that flies amongst other things in the picture. Child identifies the flying pig as absurdity. Explains why. Pig cannot fly, it has no wings, just legs.
Tacting problems	Describes what is wrong and provides coherent explanation (tact)	Child is shown a picture of someone doing something incorrectly: The ice-cream cannot go in the microwave because it would melt there.
Tact the odd one out/what doesn't belong	Identifies what doesn't belong/odd one out and provides explanation (tact)	The fly doesn't belong because the other animals all make food and the fly doesn't (cow, bee, fly)
Identifies what doesn't belong/odd one out from verbal description (intraverbal)	Identifies what doesn't belong/odd one out when information is given verbally and provides explanation	Which is the odd one out and why between a car, a bike and a truck.
Rule-based perspective taking: family members	Answers questions about changes in perspectives within family roles (reading skills required)	Anne and Mark are married and they have a child called Juliet: "Who is Juliet for Mark?"; "Who is Mark for Anne?"; "Who is Anne for Mark?"; "Who is Mark for Juliet?"; "Who is Juliet for Anne?"; "Who is Anne for Juliet?"; "Tell me who Mark is": <i>Anne's husband and Juliet's father</i>

The behaviour of remembering

- “When we ask about yesterday’s breakfast, a crucial controlling variable is missing: the eggs. Not only are the eggs not present, they no longer even exist. We cannot invoke a non-existent stimulus as current source of control”
- “If representations of events are stored, like books in a library, how are they indexed and how does a particular volume get summoned?”
- “There is no such thing as memory as a thing to be studied. [We can only study] the behaviour we engage in when ‘try to remember’”

Palmer (1991, pp. 263-264)

Being there, understanding, and remembering

- Understanding the question (conditional discrimination)
 - “*What did you do at school today?*” – “*Nothing*”
 - “*What did you do at school today?*” – “*Monday 2nd of June*”
- Engaging in remembering
 - Being physically present vs. being verbally present (engaging in matching verbal behaviour to the ongoing event)
 - Problem solving

The relation between understanding the question and remembering



When we move to past event remembering, question discrimination must be present

Skill	Description	Example
Past event recall: static scene	After observing a picture of a scene for 20 to 30 seconds, answers questions regarding the event (yes/no, conditional and some open questions)	“Was the ball stripy?”; “How many ball were there?”; “Where was it?”. <i>The more open the questions the more complex the task is</i>
Past event recall: video	After watching a brief video, answers questions about concrete information	“Who was in the vide?”; “What was Peppa doing?”; “What colour was her car?”; “What was she holding?”
Past event recall: experience	After a salient event, answers concrete questions related to it (varying latencies - within the day)	“What did you do?”; “What did you use to make cookies?”; “What colour icing did you use?”
Event question discrimination (complex event)	Answers multiple-part questions about an ongoing event. Questions are presented from general to specific (whole scene to details), no pointing involved	“Where is this place?”; “Who is in it?”; “What is the blond boy doing?”; “What is the girl with the red top holding?”; “Where is the girl drawing?”; “Is the person sitting on the brown chair a boy?”
Past verbal event recall: story comprehension	After listening to a story, answers concrete questions related to it.	“Who was in the story?”; “What were their names?”; “Where did they go?”; “What did they do?”; “Where did she hide?”. <i>The longer the story the fewer concrete details (e.g., colours, names of people) can be recalled.</i>
Past event recall: experience (long latency) and time concepts	Answers questions regarding a past personal event or contacted experience. Questions include temporal concepts such as before and after, times of day (morning, afternoon, evening) and days of the week	“Where did we go?”; “How did we get there?”; “Before we went to the get ice-cream, where did we go?”; “Who did we see at the cinema?”; “What did we see at the cinema?”
Abstract reasoning (tact and past event)	Answers questions regarding private events of others: emotions, inferences, why questions, predictions, generating solutions	“How did she feel when...?”; “Why did she feel that way?”; “Where were they?”; “How do you know?”; “Why did they go there?”; “What should they do?”; “What could they have done?”

Differentiating between a tact and an intraverbal response

- Intraverbal control is involved in most verbal interactions: Direct transfer procedures across individual responses between tact to intraverbal may not be required if we teach children to respond under the multiple sources of stimulus control involved in those kinds of verbal interactions
- Differentiating between tact and intraverbal responses may not be so crucial once we consider the role of intraverbal control

Conclusions

- We must consider the role of conditional discriminations and mediating behaviour, particularly in relation to answering questions about past events
- Ultimately, we want children to be able to answer questions about their personal experiences and what they know about the world, and to engage in meaningful ever-changing verbal interactions

Thank you!

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