# Maximizing Stimulus Control:
# Best Practice Guidelines for Receptive Language Instruction

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# Importance of Effective Teaching

- **Use the most effective and efficient teaching strategies because**
  - Even under optimal conditions we don't get 40hr/wk for 2-6 years!!
  - Practice <u>doesn't</u> make perfect!!
    - **Perfect practice makes perfect**
    - **Practicing errors creates entrenched <u>faulty stimulus control</u> and PROBLEM BEHAVIOR**

# Markers to Evaluate Your Teaching

## Effective teaching

- Leads to independent and accurate responding

- Leads to rapid acquisition

- Results in a high probability of reinforcement

- Results in minimal problem behavior

Stereotypy may persist

## Ineffective Teaching

- Leads to high error rates

- Leads to prompt dependence and passivity

- Results in a low rate of reinforcement

- Results in increasing trends in problem behavior

Escape function

# Stimulus Control and Autism

- **Stimulus control:** a stimulus readily evokes or alters some dimension of a behavior

- **Failed/Faulty stimulus control is the norm**

- **Teaching is about manipulating antecedent stimuli to establish <u>stimulus control</u>**
  - Stimuli that accompany or precede responses that are reinforced can come to influence those responses in important and complex ways (Skinner)

# Incorporating Advances in Stimulus Control Technology

- **Many aspects of DTT are based on the original "ME book" protocols**

- **We have learned <u>so much</u> about stimulus control that suggests other procedures for optimal instructional programming!**
  - Murray Sidman
  - Shriver Center and NECC!
  - Green (2001)

Teaching Receptive Language Skills:
Recommendations for Instructors

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TRUMPET
SM
BEHAVIORAL HEALTH

Behavior Analysis in Practice, 6, 56-75

# Why this paper?

- **Synthesize the literature in a consumable form**

- **Generate best practice guidelines and tools**

- **Publish in a behavior analysis journal for practitioners**



Teaching Receptive Language Skills:
Recommendations for Instructors
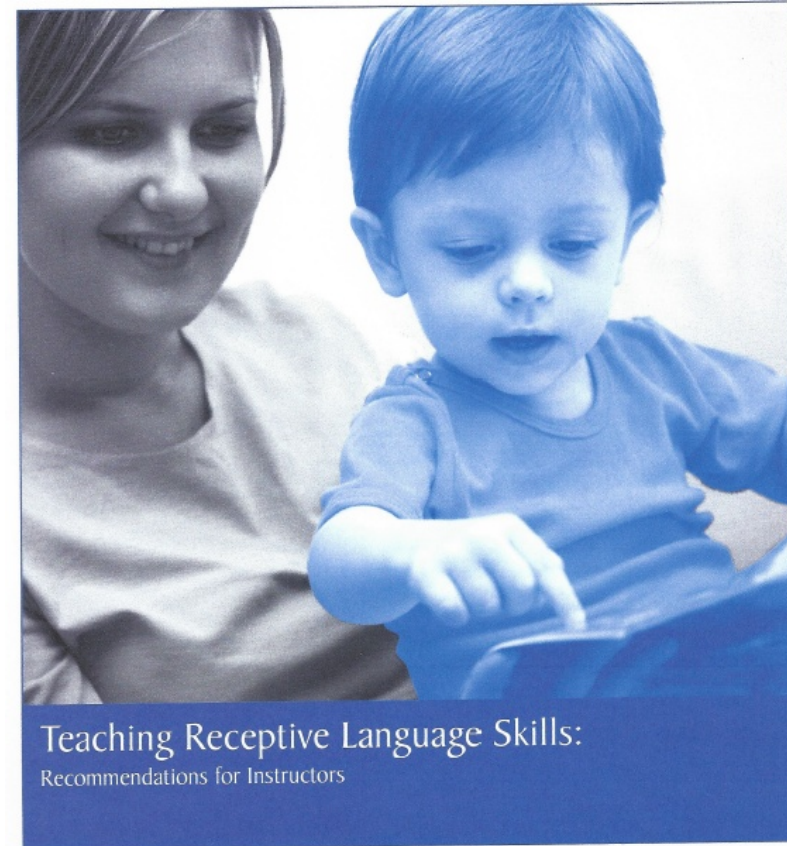
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# Scope of Use

- **Listener responding – both simple and conditional discriminations**

- **Other types of conditional discriminations – V-V matching, picture-based mand training**

- **MOST important with early learners who are just beginning discrimination training – start right to prevent future problems!!!**

# Types of Discriminations

- **Simple Discriminations**
  - Discrimination that has three elements:
    - **Sd, Bx, Sr+**
    - **E.g., Oral Naming (tact), Instruction Following, Imitation**
- **Conditional Discriminations**
  - <u>Matching</u> is basis for many of these responses
  - Require multiple simple discriminations and <u>conditionality</u>
    - **Reinforce response <u>if and only if</u> there is a specific additional stimulus**

# Recommendations

- **Require an observing response**
- **Minimize unintentional instructor cues**
- **Arrange the antecedent stimuli and required behaviors**
  - Select the appropriate auditory instruction
  - Plan the required behaviors
  - Select the features of the stimuli and behaviors carefully
  - Introduce and teach the targets simultaneously
  - Counterbalance antecedent stimuli
- **Use effective prompting and differential reinforcement procedures**
- **Troubleshoot stimulus control problems**

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# Require an observing response

- **Observing responses (OR)**
  - Learner emits a response that results in sensory contact with the stimuli
- **Differential observing responses (DOR)**
  - Same as OR except learner response varies depending on stimulus

# Require an observing response

- **The OR or DOR should match the program and learner skills**
  - Motor Imitation
    - **"Look at me"**
  - V-V Matching Trials
    - **Scan the array, touch the sample, touch each comparison**
  - Listener Responding (A-V)
    - **Respond after the stimulus, echo the target**
- **Only reinforce responses that occur after the antecedents are presented**
  - Did not attend to stimulus if it didn't exist before response

# Example of DOR Procedure



Say, "Blue"

Child says, "Blue"

"Blue"

# Recommendations

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# Minimize Unintentional Cues

- **Instructors may unintentionally provide prompts for correct answer**

- **Examples:**
  - Looking at the correct item in the array
  - Placing the correct item in the array first
  - Minor body mannerisms during instruction-following tasks (e.g., posture for stand up)
  - Placing hand near the incorrect ones to block
  - Tone or pitch of voice

# Minimize Unintentional Cues

- Stimuli that accompany or precede responses that are reinforced can influence responses in important and complex ways (Skinner)

  - EVEN WHEN WE DIDN'T MEAN FOR IT TO HAPPEN!!

- Increases the likelihood that irrelevant features of the environment will control responding instead of the programmed stimuli

# Minimize Unintentional Cues

- **Return hand and body to neutral, keep face at neutral, keep eyes on learner, same tone**
  - Practice until fluent without unintentional cues
  - Teach instructors to recognize in others (video)

- **Periodically check for drift**

- **Prepare materials out of view – printed arrays in a binder or PowerPoint presentation**

# Recommendations

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- **Troubleshoot stimulus control problems**

# Provide Clear and Concise Instructions

- **Instructions should:**
  - Be brief and clear
  - Contain the relevant information
- **Unnecessary information may lead to faulty stimulus control (Green, 2001; Tarbox, Tarbox, & O'Hora, 2009)**
  - Example
    - **Show me the <u>red</u> one, show me the <u>green</u> one, show me the <u>blue</u> one**

# **Provide Clear and Concise Instructions**

| Program | Avoid | Ideal |
|---|---|---|
| Following instructions | "Ok, let's stand up" | "Stand" |
| Receptive ID: objects | "I'd like you to point to red" or "Point to the truck for me" | "Red" |
| Receptive ID: abstract features | "Show me the big one" | "Big" |

# Arrange the Antecedents and Required Behaviors Carefully

- **Carefully program the behaviors and stimuli for the set with care– remember you are discriminating these things FROM each other**
  - Start with easier (snake, bird, dog) then move to harder (horse, cow, dog)
- **Avoid opposite actions in instruction following target sets – status may evoke the other behavior rather than your instruction**
  - Stand up, sit down
  - Arms up, arms down
  - Light on, light off

# Arrange the Antecedents and Required Behaviors Carefully

- **Introduce multiple targets simultaneously – NO MASS TRIALS!!!**
  - Introduce a **minimum of three** targets at the onset of training and exit them together
    - **following 3 different directions**
    - **identifying common objects from an array of 3 cards**
- **Minimizes the likelihood of**

  - correct responding and reinforcement for "doing what you just did" without listening to the auditory stimulus

  - control by "reject relation" or switching

# Arrange the Antecedents and Required Behaviors Carefully

- **Faulty stimulus control is so common when you use massed trials that Lovaas (2003) has multiple pages describing the most common error patterns**
  - E.g., scrolling, win-stay, lose-shift, side bias

- **Absolutely critical that <u>the conditional and discriminative stimuli</u> control responding on every single trial**
  - Conditional stimulus must vary every trial with a different required response that is uniquely associated with that auditory stimulus

# Sequential vs. Simultaneous Methods

- **Sequential Method (simple to conditional)**
  - Lovaas (2003)
  - Blocked-trial procedure (Saunders & Spradlin,1989)

- **Simultaneous Method (conditional only)**
  - Green (2001); Grow, Carr, Kodak, Jostad & Kisamore (2011); Grow, Kodak, & Carr (2014)

# Step 1: Sequential Method
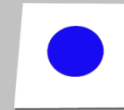
# Step 2: Sequential Method

# Step 3: Sequential Method

# Step 4: Sequential Method

# Step 5: Sequential Method

# Step 6: Sequential Method
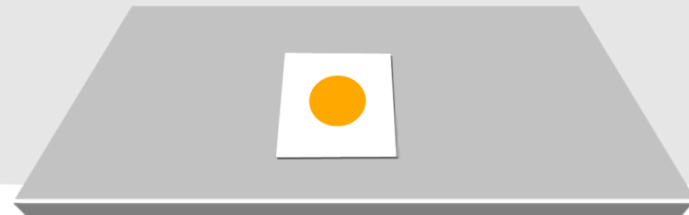
# Step 7: Sequential Method

# Step 8: Sequential Method
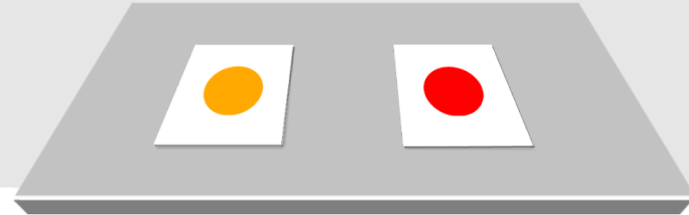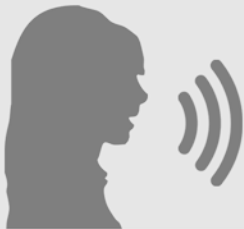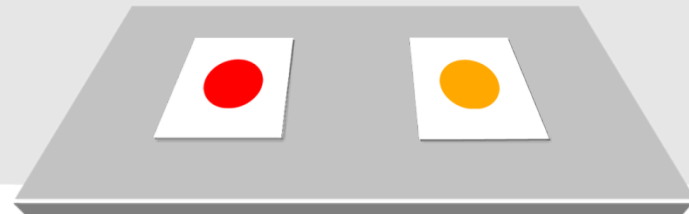
# Step 9: Sequential Method
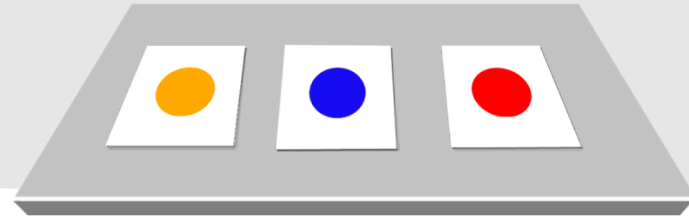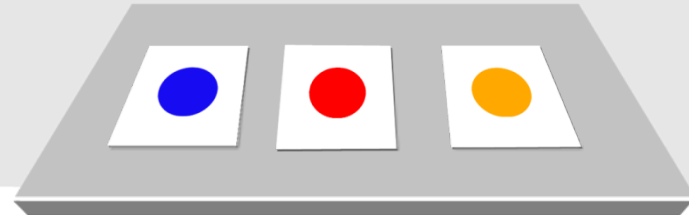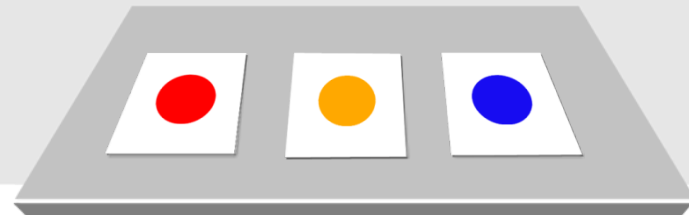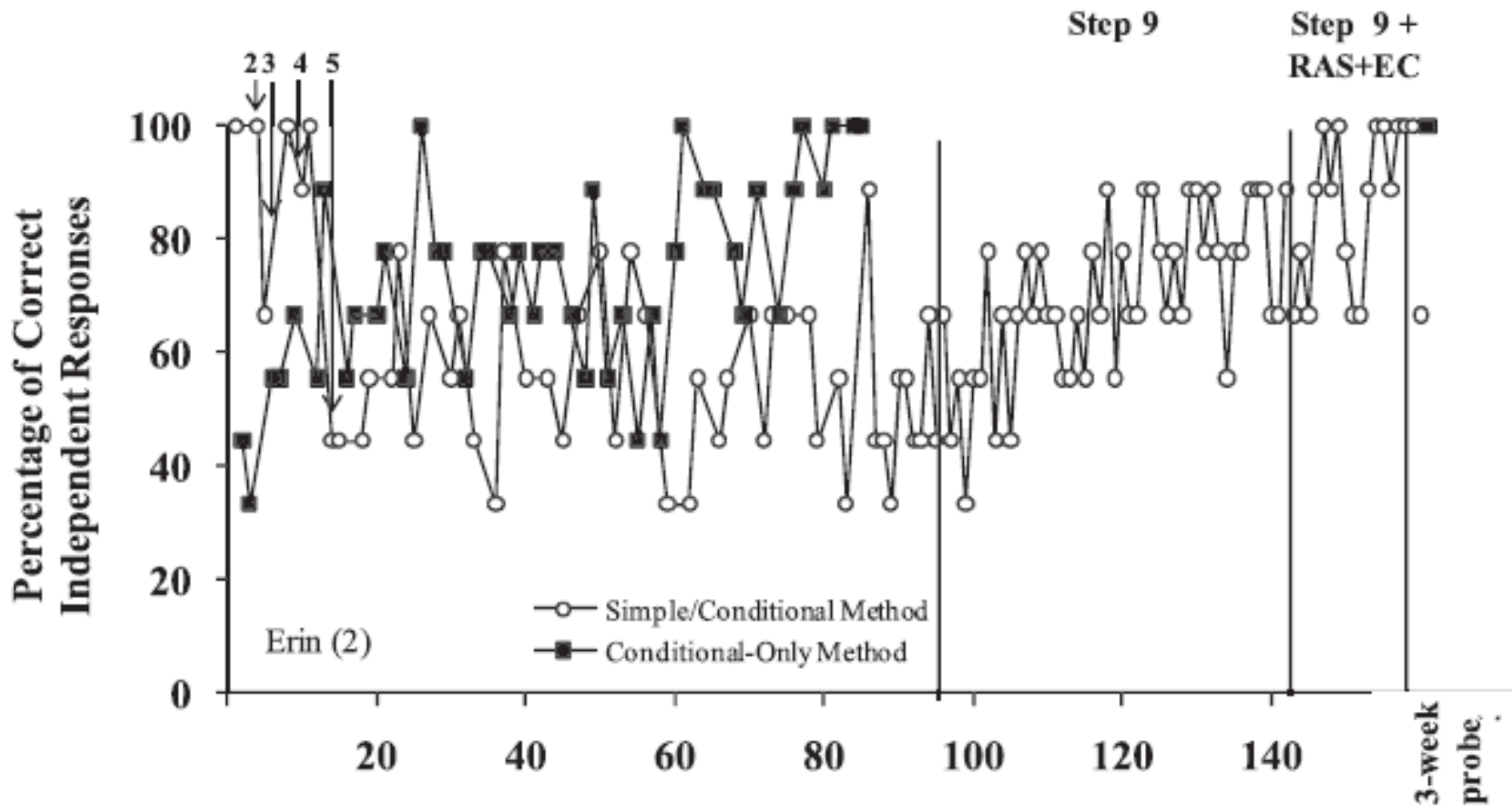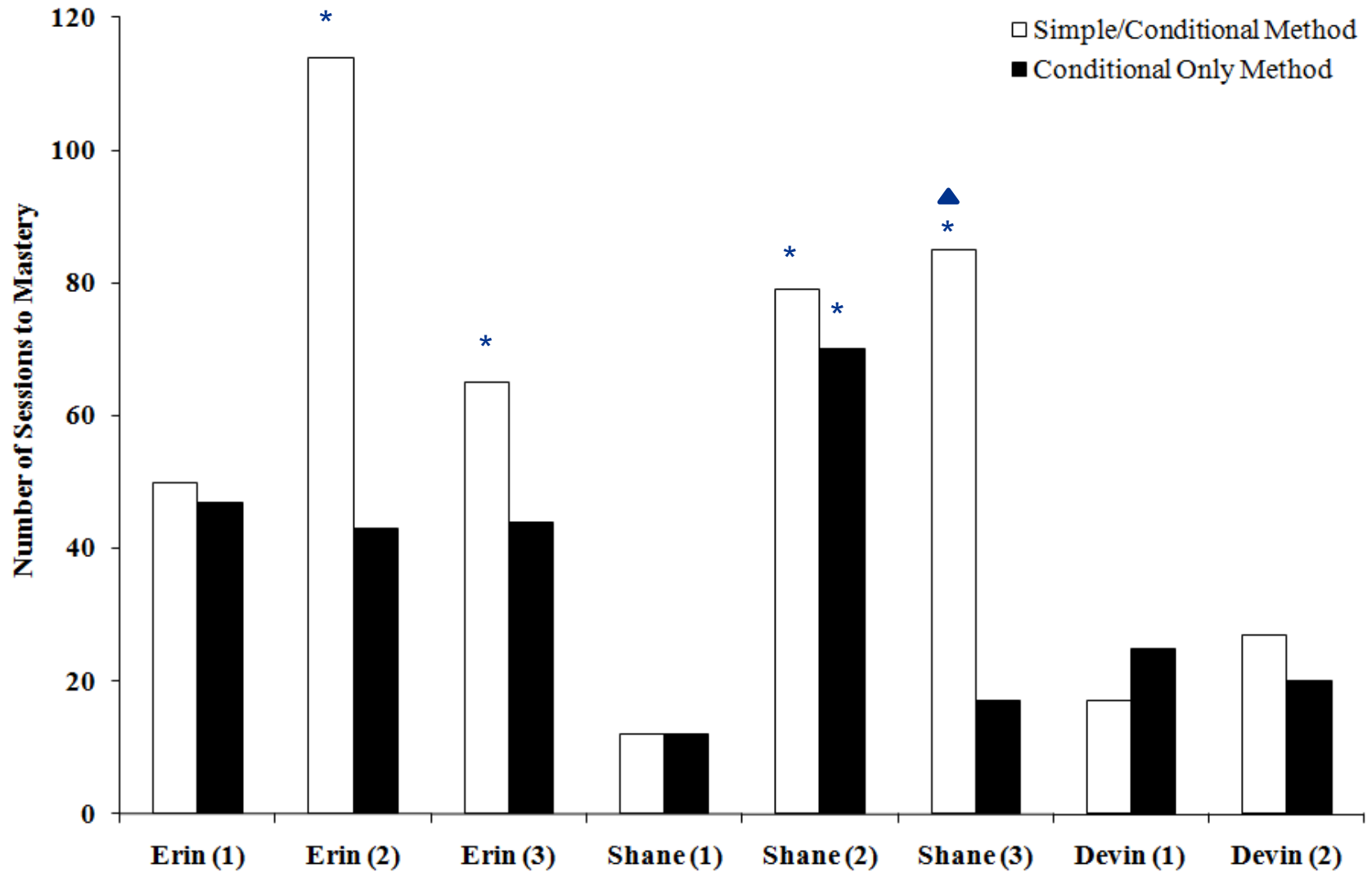
# Simultaneous Method
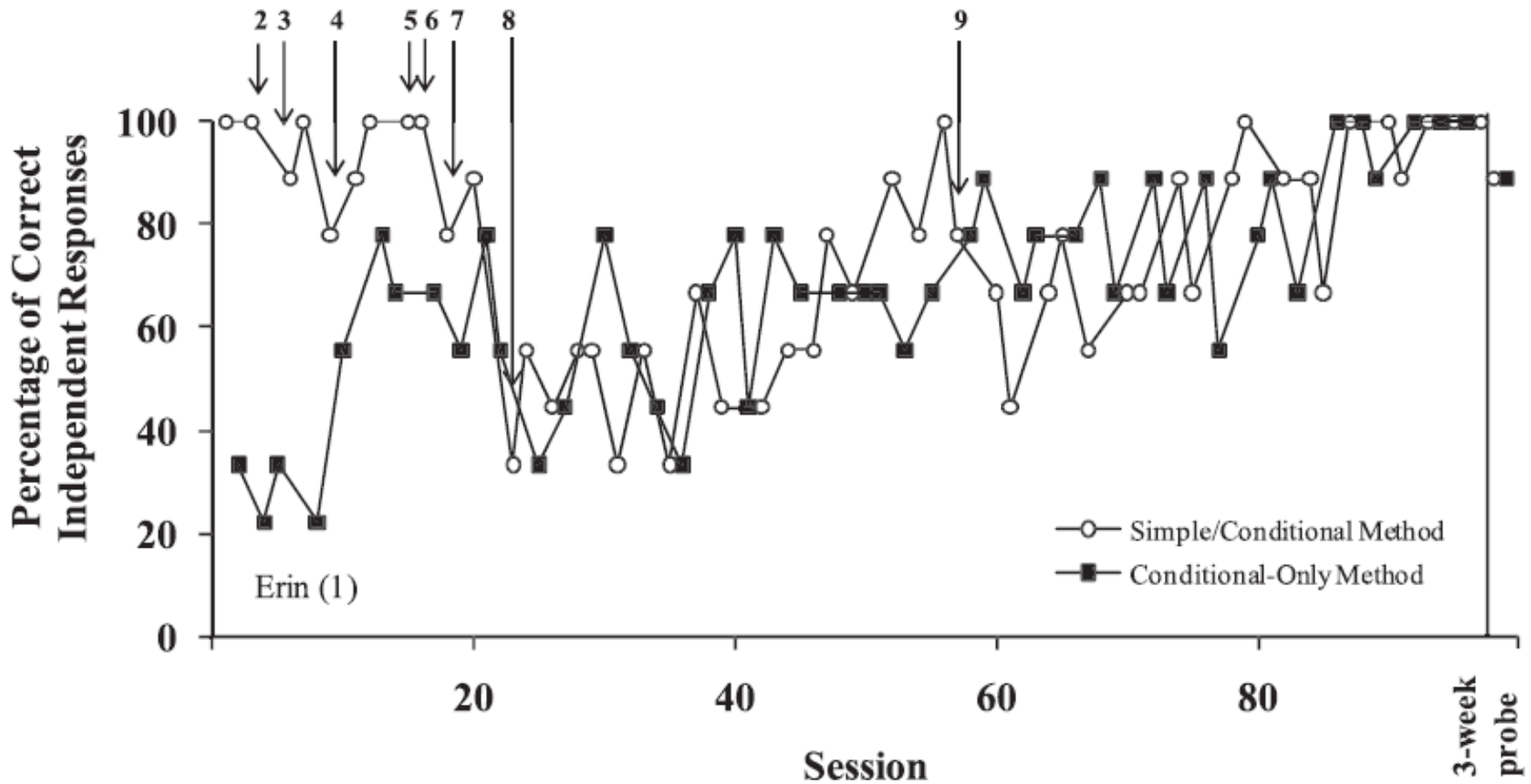
# Grow et al (2011)



Figure 2. Percentage of correct independent correct responses during Erin's first evaluation. The numbered arrows represent steps in the simple-conditional method.
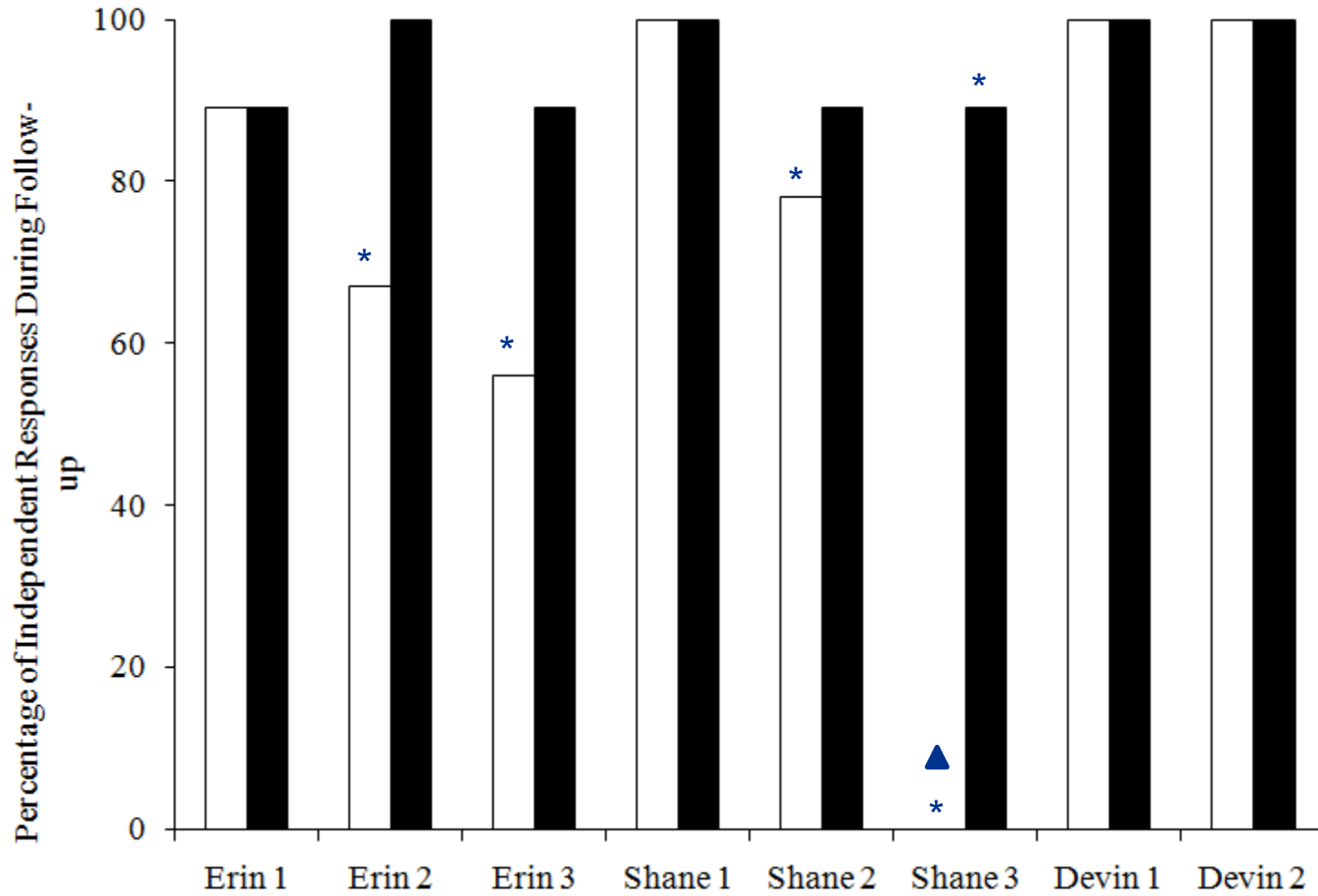
LAURA L. GROW et al.

# Grow et al., 2011

# Follow-up

# Green (2001)

- **Vary sample equally within the block but keep the comparisons the same**
  - Minimizes responding to or away from novel distracter
- **At least 3 comparisons on every conditional discrimination trial**
  - Early mass trials which are simple discriminations can interfere with subsequent conditional discriminations and minimize attending to the auditory stimulus
- **Random variation in order of sample presentation within block**
- **Random variation in placement of comparison stimuli within the block**
  - Positional bias

# Counterbalance Array

- **Without planning, an instructor is likely to present the stimuli in a way that promotes faulty stimulus control**

  – Placing the correct item in a particular position disproportionately may result in a side bias

- **Create a system to ensure therapists rotate the stimuli correctly**

# Counterbalancing

| Trial | Session Type A | | |
|-------|------|------|------|
| 1 | Coloring | **Bathing** | Dancing |
| 2 | Bathing | Dancing | **Coloring** |
| 3 | **Dancing** | Coloring | Bathing |
| 4 | **Coloring** | Bathing | Dancing |
| 5 | Bathing | **Dancing** | Coloring |
| 6 | Dancing | Coloring | **Bathing** |
| 7 | Coloring | Bathing | **Dancing** |
| 8 | **Bathing** | Dancing | Coloring |
| 9 | Dancing | **Coloring** | Bathing |

# Counterbalancing

| Trial | Session Type A | | |
|-------|------|------|------|
| 1 | Coloring | **Bathing** | Dancing |
| 2 | Bathing | Dancing | **Coloring** |
| 3 | **Dancing** | Coloring | Bathing |
| 4 | **Coloring** | Bathing | Dancing |
| 5 | Bathing | **Dancing** | Coloring |
| 6 | Dancing | Coloring | **Bathing** |
| 7 | Coloring | Bathing | **Dancing** |
| 8 | **Bathing** | Dancing | Coloring |
| 9 | Dancing | **Coloring** | Bathing |

# Counterbalancing

| Trial | Session Type A | | |
|-------|----------|----------|----------|
| 1 | Coloring | **Bathing** | Dancing |
| 2 | Bathing | Dancing | **Coloring** |
| 3 | **Dancing** | Coloring | Bathing |
| 4 | **Coloring** | Bathing | Dancing |
| 5 | Bathing | **Dancing** | Coloring |
| 6 | Dancing | Coloring | **Bathing** |
| 7 | Coloring | Bathing | **Dancing** |
| 8 | **Bathing** | Dancing | Coloring |
| 9 | Dancing | **Coloring** | Bathing |

| Trial | Session Type B | | |
|-------|----------|----------|----------|
| 1 | Bathing | Dancing | **Coloring** |
| 2 | **Dancing** | Coloring | Bathing |
| 3 | Coloring | **Bathing** | Dancing |
| 4 | Bathing | **Dancing** | Coloring |
| 5 | Dancing | Coloring | **Bathing** |
| 6 | **Coloring** | Bathing | Dancing |
| 7 | **Bathing** | Dancing | Coloring |
| 8 | Dancing | **Coloring** | Bathing |
| 9 | Coloring | Bathing | **Dancing** |

| Trial | Session Type C | | |
|-------|----------|----------|----------|
| 1 | **Dancing** | Coloring | Bathing |
| 2 | Coloring | **Bathing** | Dancing |
| 3 | Bathing | Dancing | **Coloring** |
| 4 | Dancing | Coloring | **Bathing** |
| 5 | **Coloring** | Bathing | Dancing |
| 6 | Bathing | **Dancing** | Coloring |
| 7 | Dancing | **Coloring** | Bathing |
| 8 | Coloring | Bathing | **Dancing** |
| 9 | **Bathing** | Dancing | Coloring |

# Recommendations

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- **Minimize unintentional instructor cues**
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  - Select the appropriate auditory instruction
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  - Counterbalance antecedent stimuli
- **<u>Use effective prompting and differential reinforcement procedures</u>**
- **Troubleshoot stimulus control problems**

# Use Effective Prompts and Fading Procedures

- **Response prompts: Additional behavior by the teacher that increases the likelihood that the correct behavior will occur**
  - Verbal (instruction)
  - Gestural or Model (pointing)
  - Physical (physical guidance)

- **Can go in sequence either way:**
  - Increasing assistance (LTM)
    - **Verbal, Gestural/Model, Physical Guidance**
  - Decreasing assistance (MTL)
    - **Guidance, model, gestural, verbal**

# Use Effective Prompts and Fading Procedures

- ## Increasing assistance (LTM):
  - Each trial provides an opportunity to respond at each level of prompting
  - Implement higher-level prompt only if no correct response
  - Potential drawbacks: Frequent errors, prompt dependence

- ## Decreasing assistance (MTL)
  - Amount of assistance gradually decreased across trials
  - Fewer errors, more efficient (more rapid learning) than least-to-most prompts -  sometimes called "errorless"
  - High rate of reinforcement means you DON'T NEED TO INTERSPERSE maintenance tasks

- ## General recommendation (MacDuff et al)
  - Assess skill level with least-to-most probes
  - Teach with most-to-least trials

# Use Effective Prompts and Fading Procedures

- "Errorless" learning procedures rather than trial and error

- Fade prompts quickly and effectively
  - Probe and teach
  - Time-delay (Touchette & Howard, 1984)
  - DON'T USE POSITIONAL PROMPTS!!

- Benefits
  - Reduces or eliminate errors
  - Decreases overall instruction time
  - Prevents or reduces escape-maintained problem behavior

# Grow, Kodak, & Carr (2014) Errorless Teaching
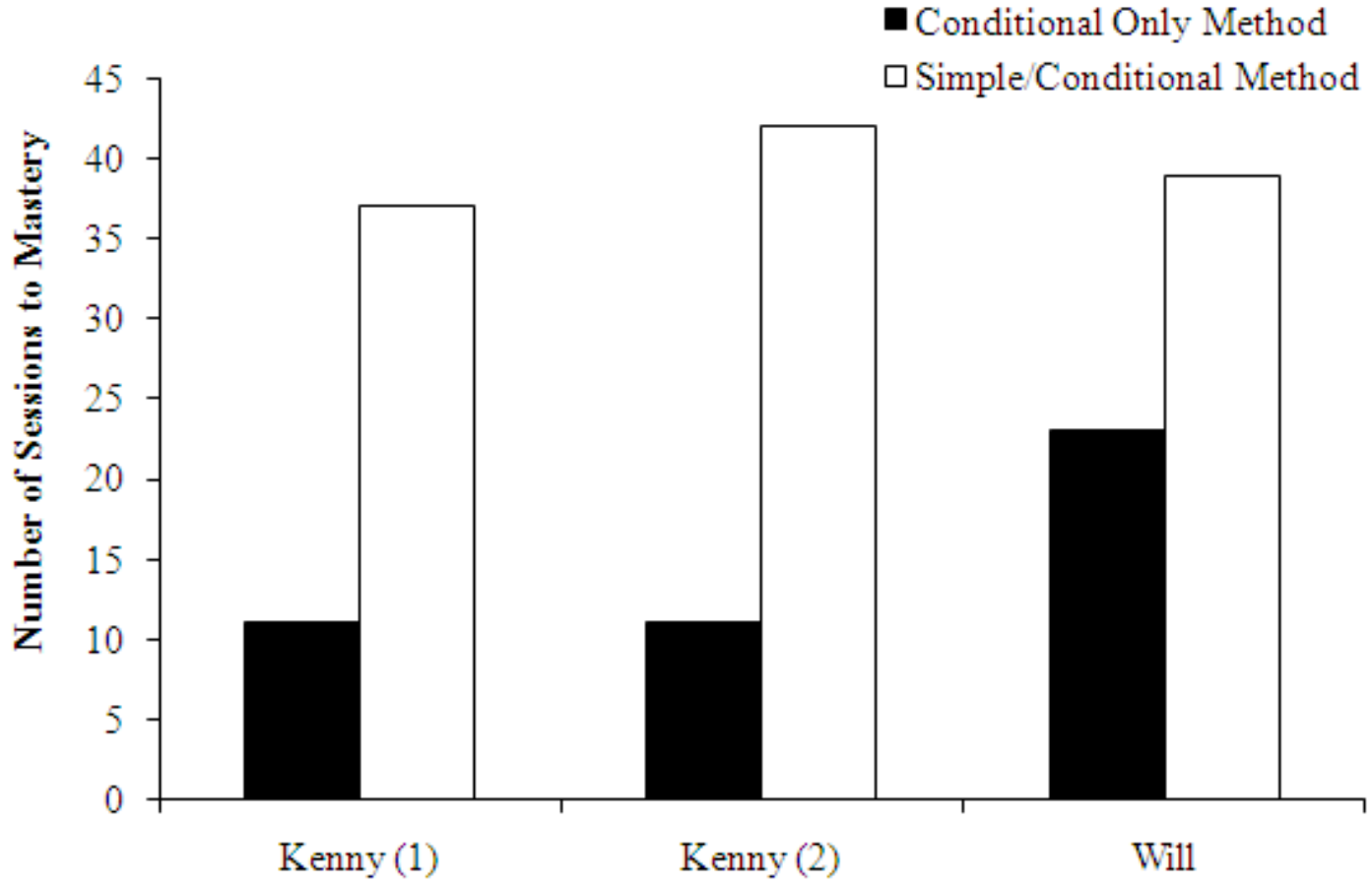
# Probe and Teach Session

| Probe | Session Type A | | | Prompt Req | | | |
|---|---|---|---|---|---|---|---|
| 1 | dog | (cat) | horse | (I) | G | P | F |
| 2 | (cat) | horse | **dog** | I | (G) | P | F |
| 3 | **horse** | dog | (cat) | I | (G) | P | F |

| Trial | Session Type A | | | Correct / Error | |
|---|---|---|---|---|---|
| 1 | dog | **cat** | horse | C | E |
| 2 | cat | horse | **dog** | C | E |
| 3 | **horse** | dog | cat | C | E |
| 4 | **dog** | cat | horse | C | E |
| 5 | cat | **horse** | dog | C | E |
| 6 | horse | dog | **cat** | C | E |
| 7 | dog | cat | **horse** | C | E |
| 8 | **cat** | horse | dog | C | E |
| 9 | horse | **dog** | cat | C | E |

# ____

_____ %

_____ %

# Use Effective Reinforcement

- **Use preference assessment to identify effective reinforcers**

- **Provide <u>higher magnitude</u> reinforcers, <u>higher quality</u> reinforcers or <u>denser schedules</u> of reinforcement for independent responses than for prompted responses**
  - Karsten & Carr (2009)
  - Olenick & Pear (1980)
  - Vladescu & Kodak (2010)

# Data Analysis and Maintenance

- **Analyze for the set!!**
  - 100% independent accuracy for probes
  - Also track responding on trial blocks to do error analysis and detect trends once errors can occur
- **Combine known sets to new mastery criterion prior to moving into final maintenance**
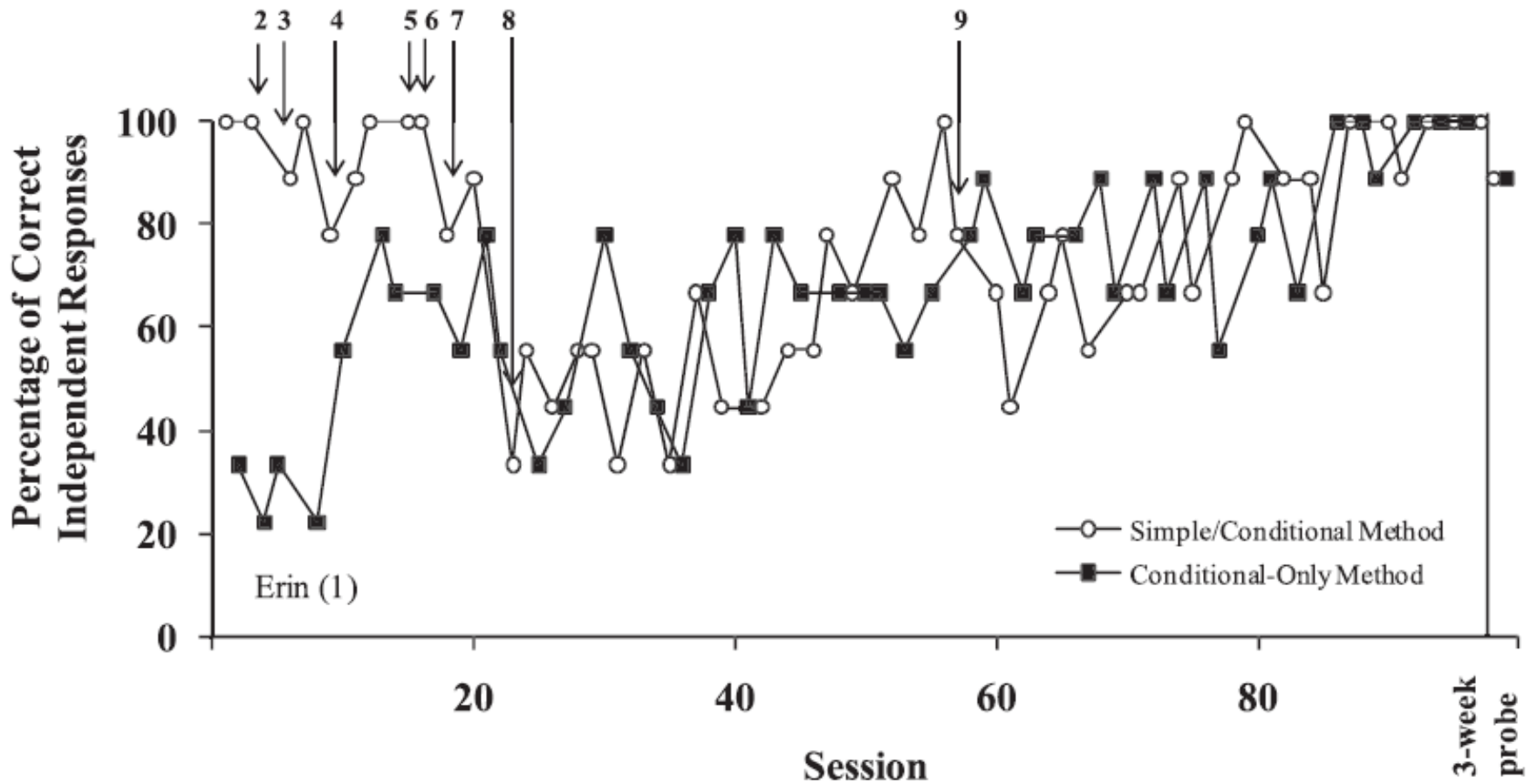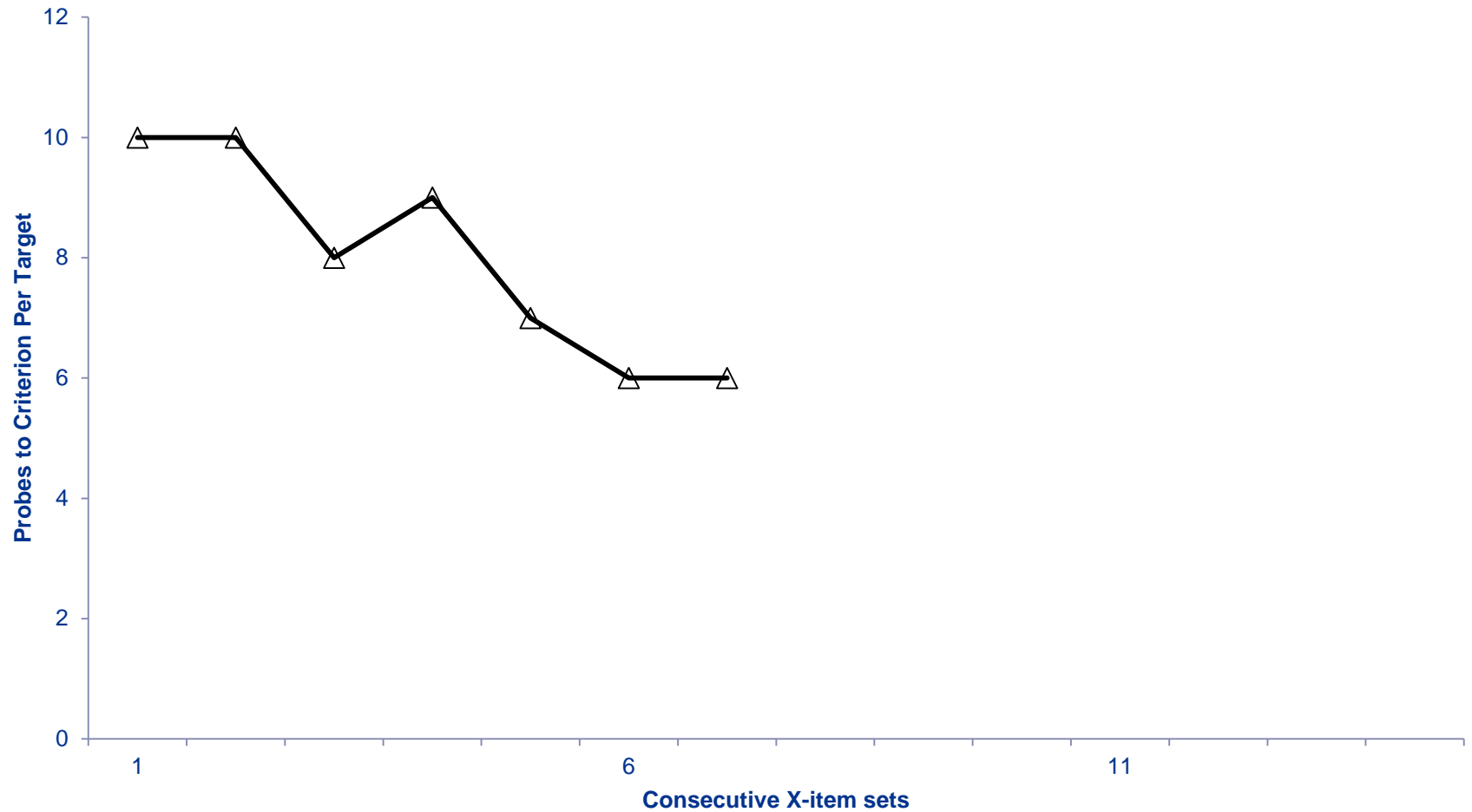
# Grow et al (2011)



Figure 2. Percentage of correct independent correct responses during Erin's first evaluation. The numbered arrows represent steps in the simple-conditional method.

# Larger Analysis



Receptive Targets — line chart. Y-axis: Probes to Criterion Per Target (0 to 12). X-axis: Consecutive X-item sets (1 to 11). Data points descend from 10, 10, 8, 9, 7, 6, 6.

# Recommendations

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- **Troubleshoot stimulus control problems**

# Uh Oh!!! Did I teach a strategy?

- **Faulty stimulus control can be established by**
  - An instructional history of massed trials
  - Unintentional instructor cues
  - Failing to counterbalance the stimuli
- **Error patterns may worsen over time and/or bleed over into other programs**

# Troubleshoot problems

- **Discard corrupt targets unless THAT is the critical stimulus – not just learning to learn**

- **Add in DOR to ensure attending**

- **Eliminate instructor cues and maybe even instructor (if SD for attending to other than essential features)**

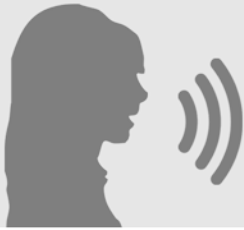- **Conduct error analyses to detect stimulus control issues**

# Right Side Bias

# Error Analysis-Side Bias

- Calculate the percentage of responses that are allocated to each position in the array
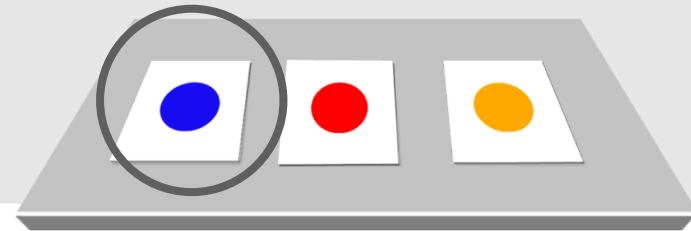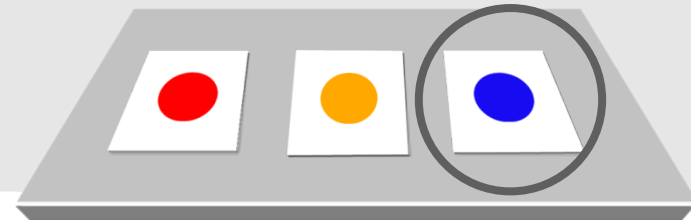
# Stimulus Bias
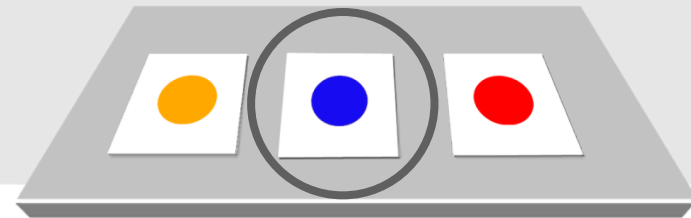
# Error Analysis-Stimulus Bias

- Calculate the percentage of responses that are allocated to each stimulus in the array

# Troubleshoot Problems

Table 2. Examples of Issues That Might Arise During Receptive Language Instruction and Some Potential Solutions

| Issue | Potential solution |
|---|---|
| Learner displays a side bias during receptive langauge programs | Increase the array size |
| Learner responses are influenced by the instructor's behavior | Identify and eliminate the instructor behavior (e.g., looking at the correct visual comparison stimulus) |
| Learner engages in switching responses when two targets are similar | Separate targets into two training sets and ensure that the new training sets contain distinction targets |
| Learner responds prior to the delivery of the antecedent stimuli | Prevent or block responding prior to the delivery of the relevant antecedents; require a differential observing response; place premature responses on extinction |

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- **Use effective prompting and differential reinforcement procedures**
- **Troubleshoot stimulus control problems**

# Last words . . .

- **Design it well**

- **Make it easy to present the trials optimally**

- **Stay on top of the data**

- **Fix it quickly if it goes off of the rails**

# Contact me:

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