Stimulus Control & Procedures to Facilitate Visual Discriminations

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Agenda

Visual Discrimination
Stimulus Control
Review procedures to transfer stimulus control
Brief review of comparison studies
Study: Procedures to facilitate discrimination
Summary
Questions

Visual Discrimination

- Discrimination: differentially responding in the presence of different stimuli
- Critical for learning
- Discrimination among complex stimuli
Visual Discrimination

- Students must discriminate academic materials:
  - Colors & Shapes

- Numbers & Letters

- Words & Pictures
Visual Discrimination

- Other discriminations:

Visual Discrimination

- Individuals with Intellectual/Developmental Disabilities (I/DD) and/or Autism may not acquire visual discriminations under standard teaching conditions
- A variety of procedures have been described to facilitate learning visual discriminations

*Let’s Review the Basics*

Stimulus Control

- Change in property of stimulus produces change in rate or probability of a response (Rilling, 1977)
  - Responding differently to different stimuli
- Established via differential reinforcement (e.g., Reynolds, 1960; Eckerman, 1969)
  - $S+$: stimuli correlated with reinforcement
  - $S-$: stimuli correlated with no reinforcement
Differential Reinforcement can be effective to establish stimulus control

Limitations:
- Errors (responses to S-) occur during teaching
- Prolonged teaching sessions
- Learners may never acquire the correct responses

Alternative teaching methods must be considered
Errorless Learning

- Errorless learning or Errorless discrimination
  Training involves the use of a fading procedure to establish a discrimination so that no errors occur.
- Fading involves the gradual removal of:
  - Stimulus prompts
  - Response prompts

Transfer of Stimulus Control

- Transfer of Stimulus Control:
  - Procedures to fade prompts
  - Transfer stimulus control from a prompt to a feature of the target stimulus

- 2 Categories:
  1. Stimulus-prompt procedures
  2. Response-prompt procedures
Stimulus-Prompt Procedures

Stimulus Fading:
- Adding stimuli to, or enhancing teaching stimuli
  - Size
  - Color
  - Position
  - Texture
- Gradually remove (fade) enhancements
- End with target teaching stimuli

Stimulus Fading

Letter Discrimination:

Target stimuli: A B
Step 1: A B
Step 2: A B
Step 3: A B

Stimulus Shaping:
- Manipulating the topography (shape) of teaching stimuli
- Gradually fade, or change the shape, the enhanced stimuli
- End with the target teaching stimuli
**Stimulus Shaping**

- **Advantages:**
  - Enhancements are made to the actual target stimuli
  - Facilitates transfer to relevant stimulus features

- **Disadvantage:**
  - Making enhanced stimuli takes time
  - Teaching time may be extended

**Stimulus-Prompt Procedures**

- **Advantages:**
  - Enhancements are made to the actual target stimuli
  - Facilitates transfer to relevant stimulus features

- **Disadvantage:**
  - Making enhanced stimuli takes time
  - Teaching time may be extended

**Response-Prompt Procedures**

- **Extra-stimulus prompt:**
  - Not related to the discrimination task
  - Point prompt
  - Most-to-least prompting
  - Least-to-most prompting
  - Verbal prompt
Prompt Delay

- Prompt Delay:
  - Incorporated into extra-stimulus prompt procedures
  - Inserts a delay between target stimuli presentation and extra-stimulus prompt
  - Reinforcement arranged to favor responses before the prompt

Response-Prompt Procedures

- "Touch A"

Advantages:
- Most-to-least produces fewer errors, rapid acquisition
- Least-to-most allows for independent responding

Disadvantages:
- Extra-stimulus prompts are not relevant to target stimuli
- May be difficult to fade

Response-Prompt Procedures
What procedure works best?

It depends…..

Summary of Comparison Studies

- Stimulus-prompt superior to reinforcement-ext:
  - Egeland and Winer (1974)
  - Egeland (1975)
  - Schilmoeller, Etzel, and LeBlanc (1979)
- Stimulus-prompt superior to response-prompt:
  - Schreibman (1975)
  - Repp, Karsh, and Lenz (1990)
- Fade along dimensions of the S+ rather than S-:
  - Schreibman and Charlop (1981)
  - Strand (1989)

Other Considerations

Does the procedure lead to the stimuli that “should” control behavior?

- Number of fading steps
- Conducting probe trials (presenting target stimuli)
- Criterion for advancing/revisiting steps
- Fading along multiple dimensions
- Combining fading procedures
Other Considerations

- **Restricted Stimulus Control** (aka stimulus overselectivity)
  - Possible feature of autism
  - Responding under control of irrelevant feature of a complex stimulus
    - Position
    - Specific therapist/teacher
    - Tear in the left hand corner of an instructional stimulus

Other Considerations

- **Addressing restricted stimulus control**
  - Eliminate irrelevant feature (if possible)
  - Transfer control to relevant feature of target stimulus
  - Alternate between teaching trials of target stimulus with problem stimulus

Examination of Procedures to Facilitate Discrimination of Picture-Communication Cards

*Wilson, D.M., Iwata, B.A.*

* &

*Bloom, S.E.*
PECS (Bondy & Frost, 1994, 2001)
- Augmentative communication system
- Utilizes picture cards containing communicative referents
- 6 Training Phases (1-3 critical):
  - Phase 1: Requesting
  - Phase 2: Generalization
  - Phase 3: Discrimination

PECS Curriculum (Frost & Bondy, 1994, 2001)

PECS
- PECS usage is rapidly acquired:
  - Bondy and Frost (1994, 2001)
- Increases vocal communication:
  - Charlop-Christy, Carpenter, LeBlanc, & Kellet (2002)
- Decrease inappropriate behaviors:
  - Charlop-Christy, Carpenter, LeBlanc, & Kellet (2002)
- What about participants who have difficulty acquiring PECS usage?
Purpose

- Study 1: compare methods for facilitating discrimination during picture-card communication training
  - Antecedent: stimulus fading
  - Consequence: enhanced (magnitude/quality)
- Study 2: evaluate the effects of stimulus fading combined with enhanced consequences to train discrimination between two picture cards

Study 1: Methods

- Participants and Setting:
  - 3 participants with developmental disabilities
  - Sessions conducted at sheltered workshop
- General sequence:
  - Preference assessment
  - Single-card training
  - Discrimination baseline
  - Multielement comparison of stimulus fading vs. enhanced consequences
  - Multiple-baseline across participants

Preference Assessments

- Paired-stimulus method (Fisher et al., 1992):
  - Selection $\geq 80\% \rightarrow S^+$
  - Selection $\leq 20\% \rightarrow S^-$
- Single-stimulus method (Pace et al., 1985):
  - Selection = 0% $\rightarrow S^-$
Discrimination Baseline
- S+ & S- presented:
  - S+ → access to corresponding stimulus
  - S- → access to corresponding stimulus
  - No response → next trial
- S+/S- positions alternated
- Criterion for continuation: failure to meet criterion of 90% unprompted correct responses for 3 consecutive sessions

Comparison Methodology
- One S+/S- pair taught via stimulus fading
- Another S+/S- pair taught via enhanced consequences
- Training sessions alternated
- Criterion: 90% responding to S+ for 3 consecutive sessions under original S+/S- conditions

Stimulus Fading
- Enhanced S+ card:
  - Distance
  - Size
- Fading steps:
  - Fading criterion: S+ responding 90% or higher for 3 consecutive sessions
  - Distance: 10 cm, 20 cm, 30 cm
  - Size of card: 10 cm², 7.5 cm², 5 cm², 2.5 cm²
Enhanced Consequences

- Rate, delay, magnitude, quality:
  - Magnitude (Hoch, McComas, Johnson, Faranda, & Guenther, 2002)
  - Quality (Mace, Neef, Shade, & Mauro, 1996)

- Magnitude:
  - Response to S+: larger quantity of reinforcers (e.g., 3 jellybeans)
  - Thinning: S+ responding 90% or higher for 3 consecutive sessions

- Quality:
  - S- replaced with stimulus never selected during the single-stimulus preference assessment
Paired-Stimulus Preference Assessment

Single-Stimulus Preference Assessment

Discrimination Training
Summary of Results

- Stimulus fading:
  - Victor acquired 1 S+/S- discrimination
  - Perry acquired 3 S+/S- discriminations
- Enhanced Consequences:
  - Victor acquired 1 S+/S- discrimination
  - Al acquired 2 S+/S- discriminations

Conclusions

- Stimulus fading and enhanced consequences will facilitate visual discrimination
- Enhanced consequences establishes stimulus control
- Stimulus fading assumes stimulus control

Study 2

- Purpose: evaluate the effects of stimulus fading combined with enhanced consequences to train discrimination between two picture cards
Study 2: Methods

- Participants and Setting:
  - 5 participants w/ developmental disabilities
  - Sheltered workshop or Special-Education School
- Procedures identical to Study 1 (except training)
- Multiple baseline
- Criterion: 90% responding to S+ for 3 consecutive sessions

Stimulus Fading & Enhanced Consequences

- Enhanced S+ card
- Magnitude/Quality enhancement
- Fading steps:
  - Fading criterion: S+ responding 90% or higher for 3 consecutive sessions
  - Distance: 10 cm, 20 cm, 30 cm
  - Size of card: 10 cm², 7.5 cm², 5 cm², 2.5 cm²; Reinforcer Magnitude: 3, 2, 1

Discrimination Training

[Graph showing data]
Summary of Results

• Stimulus Fading and Enhanced Consequences:
  – Andrew & Billy acquired 2 S+/S- discriminations
  – David & Donald acquired 3 S+/S- discriminations
  – Kevin acquired 1 S+/S- discrimination
• Average # of sessions for acquisition = 23

Conclusions

• Study 1: Stimulus Fading and Enhanced Consequences were effective, but variability in results across participants
  – Discrimination failures during baseline resulted from different problems:
    • Indifference to consequences
    • Failure to attend to visual enhancements
• Study 2: Stimulus Fading plus Enhanced Consequences was effective in preventing discrimination failures

Strengths

• Contributes to literature on picture-card communication and stimulus control:
  – Empirically assessed procedures
  – Individual data analyzed
  – Empirically identified S+/S-
  – Combined procedure addressed possible sources of discrimination failures
Limitations

- Training time
  - Study 1: avg. 30 sessions
  - Study 2: avg. 23 sessions
- Number of fading steps
- Picture card preparation time
- Used only edible stimuli

Thank You

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