Strategies to Promote Maintenance and Generalization of Skills for Children with Autism
OBJECTIVES

- Understand the importance of programming for maintenance and generalization
- Define maintenance
- Describe strategies to promote maintenance
  - Fading prompts
  - Thinning reinforcement schedule
  - Naturally occurring reinforcers
  - Additional considerations
- Define generalization
- Describe strategies to promote generalization
  - Recommendations from Stokes & Baer (1977)
  - General case case programming
Some content of this presentation was adapted from chapter 8 in:

Goal of instruction is to produce behavior change outside the training context
- Over time
- Across persons, settings, stimuli, etc.
- Spread to related behaviors (Stokes & Baer, 1977)

Once a child learns a skill, it is important they
- Maintain the skill over time (maintenance)
- Perform the skill in different contexts (generalization)
Maintenance & generalization often occur without explicit training for typically developing children.

Young children with autism
- Have a propensity for repetitive behaviors, predictability, & routine
- Often have difficulty maintaining skills & generalizing to new contexts (National Autism Center, 2009)

Generalization & maintenance should be an essential aspect of the curriculum for children with autism (Dawson & Osterling, 1997; National Research Council, 2001)
The child can “perform a response over time, even after systematic applied behavior procedures have been withdrawn” (Alberto & Troutman, 2013, p. 405)

Cannot be assumed

- Particularly true for children with autism, who often display deficits in maintaining previously acquired skills (Harris & Weiss, 2007)
STRATEGIES TO PROMOTE MAINTENANCE: FADING PROMPTS

- Prompting is commonly used to teach children with developmental disabilities

- 3 main prompting methods
  - physical, visual, and verbal
  - A continuum of support

- Prompts must be systematically faded as efficiently as possible
  - Temporary teaching tool, not end result

- Prompt dependency
  - When a child becomes dependent on the prompt for correct responding (Maurice, Green, & Luce, 1997)
  - Not uncommon for children with autism
  - When stimulus control from the prompt to the naturally occurring cue does not occur
**FADING PROMPTS, CONT’D**

- **Most-to-least prompting**
  - Begin with a more supportive/intrusive prompt, and fade to a less supportive one
  - Fade in a *gradual* & *systematic* manner
  - E.g., full physical ➔ partial physical ➔ gestural ➔ verbal

- **Least-to-most prompting**
  - Begin with less supportive prompt & increase support as needed
  - E.g., verbal ➔ gestural ➔ physical
  - One child responds correctly with prompt, fade support over time (begin most-to-least)
  - Disadvantage: high number of errors
FADING PROMPTS, CONT’D

- **Stimulus shaping** *(LeBlanc & Etzel, 1979)*
- **Extra-stimulus & within-stimulus prompting** *(Schreibman, 1975)*

- **Extra-stimulus**
  - An additional cue is presented
  - Child attends to 2 stimuli: prompt & training stimulus
  - Fading procedure: most-to-least

- **Within-stimulus**
  - “exaggeration of the relevant component of the training stimulus” *(p. 91)*
  - Child attends to 1 stimulus: the training stimulus
  - Fading procedure: gradually fade exaggerated feature
FADING PROMPTS: EXAMPLES

- Least-to-most prompting
  - TBD

- Extra-stimulus prompting
  - TBD

- Within-stimulus prompting
  - TBD
Positive reinforcement (S\textsuperscript{R+}): presentation of a stimulus after a response that increases the future probability of that response

Continuous schedule of reinforcement (CRF)
- Every response is reinforced
- Useful when:
  - Teaching a new skill
  - A behavior occurs at low frequency
- Limitations:
  - Increases likelihood of satiation
  - Does not promote maintenance
SCHEDULES OF REINFORCEMENT, CONT’D

- **Ratio Schedule**
  - Reinforcer delivered after a certain number of responses
    - *Fixed*: After a specific number of responses (FR)
    - *Variable*: After an average number of responses (VR)

- **Interval Schedule**
  - Reinforcer contingent on the first response after a certain amount of time as passed
    - *Fixed*: First response after a specific number of minutes (or seconds, etc.) have passed (FI)
    - *Variable*: First response after an average number of minutes (or seconds, etc.) have passed (VI)
### Schedules of Reinforcement, Cont’d

<table>
<thead>
<tr>
<th>Time</th>
<th>Response</th>
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<tbody>
<tr>
<td>Fixed interval</td>
<td>Fixed ratio</td>
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<tr>
<td>Variable interval</td>
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SCHEDULES OF REINFORCEMENT: EXAMPLES

1. Students get 1 point for each correct math problem.

2. Students get to go to recess after a correct group response at the end of a 90 min. period.

3. A student receives verbal praise about every 5 responses (range 2-7).

4. A student receives peer attention for talking out about every 5 min (range 3-8 min).

5. Sally receives money about every 35th time she pulls a lever on a slot machine (range 1-50).

Horner, 2011
When teaching a new skill, it is often necessary to *initially* reinforce behavior more frequently than what would be typical in the natural environment.

- In teaching situations, a CRF may be used.
- But in the natural environment, a VR schedule may be in place.

Need to “bridge the gap” between teaching situation & natural environment.

- Dense (teaching situation) → Thin (natural environment)

Otherwise, EXT will occur when the behavior is emitted in natural environment.

- Extinction (EXT): when a previously reinforced behavior is no longer reinforced & subsequently, the occurrence of that behavior decreases.

Pinkelman & Barton (2012)
Thinning schedule of $S^{R+}$

- $S^{R+}$ gradually becomes available less often (Alberto & Troutman, 2013)
- $S^{R+}$ contingent on greater amounts of responding
- $S^{R+}$ must be *gradually & systematically* thinned
  - E.g., CRF $\rightarrow$ VR 2 $\rightarrow$ VR 4...
TBD
STRATEGIES TO PROMOTE MAINTENANCE: NATURALLY OCCURRING REINFORCERS

- It is sometimes necessary to *initially* use reinforcers that don’t occur in the natural environment.

- Once the child acquires the skill, reinforcers should be introduced that will maintain the behavior in the natural environment.

- Extrinsic reinforcers fulfill two objectives:
  - To initially teach the skill
  - Condition natural consequences as reinforcers (Horcones, 1992)
NATURALLY OCCURRING REINFORCERS: EXAMPLES

- TBD
STRATEGIES TO PROMOTE MAINTENANCE: OTHER CONSIDERATIONS

- Frequency of skill
  - How often does the student have the opportunity to perform the skill?

- Naturally occurring cues
  - Cue in teaching situation should resemble cue in natural context

- Maintenance checks
  - Build into part of child’s program
  - Probe performance every 2 days, week, 2 weeks, etc.

Pinkelman & Barton (2012)
GENERALIZATION

- **Stimulus generalization**
  - Train a response under 1 set of stimuli
  - The response occurs in the presence of *different* (but similar) *stimuli*

- **Response generalization**
  - Train a response under 1 set of stimuli
  - In the presence of the training stimuli, if the trained response is no longer reinforced, the student engages in a *new response*

- **Common description of generalization**
  - When a skill “it is taught under one set of conditions and the child is able to apply the same skill with different people, in a new place, and using other materials” (Anderson, Jablonski, Thomeer, & Knapp, 2007)
  - *Is this stimulus or response generalization?*
EXAMPLES

- Stimulus generalization
  - TBD

- Response generalization
  - TBD
Generalization cannot be assumed
- Children with autism have difficulty generalizing newly learned skills to settings that differ from training conditions (Maurice, Green, & Luce, 1996)

Stokes and Baer (1977)
- “Train and hope” versus explicitly programming for generalization
- Sequential modification
- Naturally maintaining contingencies
- Train sufficient exemplars
- Train loosely
- Use indiscriminable contingencies
- Program common stimuli
- Mediate generalization
- Train to generalize

General case programming (Horner, McDonnell, & Bellamy, 1986)
Teach under conditions in which generalization is desired

Training settings are generalization settings

Teach in the natural environment

E.g., teaching hand-washing
NATURALLY OCCURRING CONTINGENCIES

- Use reinforcers that occur in the natural environment
  - In natural settings, what reinforcer is contingent on the behavior?

- Perhaps the “most dependable of all generalization programming mechanisms” (Stokes & Baer, 1977, p. 353)

- Previously mentioned in programming for maintenance

- Increases likelihood the skill will generalize to other settings, where that reinforcer is available
MULTIPLE EXEMPLARS

- Provide multiple examples of the concept you are teaching

- Without an adequate array of examples
  - The child may stipulate on irrelevant features of the training stimuli
  - Concept will not generalize to other stimuli

- E.g., teaching the color red
Arrange the training setting to resemble natural environment

Increases likelihood of generalization from training to natural setting

E.g., teaching hand-washing
MEDIATE GENERALIZATION

- Student provides report of their attempts to generalize
- Might need to teach students how to accurately self-monitor and report on their behavior
- Reinforcement contingent on student reporting that they engaged in the generalized response
- E.g., teaching a student to join in a conversation with a group of peers
When a generalized response occurs throughout the school day, reinforce it!
  - Especially when unprompted, or not instructed to do so

Reinforcement contingent on generalized response
  - Only generalized response

E.g.,
  - Teaching play
  - Teaching requests for attention
Teach behaviors that (Horner, McDonnell, & Bellamy, 1986)

1. Are “performed across the full range of appropriate stimulus conditions encountered by the student” (p. 290)
2. Are not performed in conditions when the behavior is inappropriate
3. Endure over time

Stimulus condition: everything a student is exposed to at a given point in time (e.g., objects, sounds, colors, movements, etc.)

- Instructional universe (Becker, Engelman, & Thomas, 1975)

Select and sequence teaching examples so students learn to perform skill across all appropriate stimulus conditions
1. Define instructional universe
2. Select teaching and test examples
3. Sequence teaching examples
4. Teach
5. Test

(Horner, McDonnell, & Bellamy, 1986)
1. Define instructional universe

- Operationally define stimulus conditions where the skill needs to be performed
- Will vary depending on skill, student, & environment
- Capture the *range of variation* of stimulus conditions

(Horner, McDonnell, & Bellamy, 1986)
2. Select teaching and test examples

- Select set of examples that sample the range of variation in stimulus conditions
  - Define stimulus that should occasion response
  - Examine how that stimulus changes across different stimulus conditions

- Criteria for example selection:
  1. Positive examples are similar *only* with respect to relevant stimuli. Irrelevant stimuli should be as different as possible.
  2. Positive examples sample the range of stimulus variation in which the learner is expected to respond.
  3. Negative examples should include those that are maximally similar to the positive examples

(Horner, McDonnell, & Bellamy, 1986)
3. Sequence teaching examples

- Use multiple examples within a teaching session.

- Don’t train *easy-to-hard*. Student will likely learn generalization errors.

- Within a teaching set: 60% easy, 20% intermediate, 20% hard examples.

- Juxtapose maximally similar positive & negative examples.
  - Aids in teaching fine discriminations

- Review examples used in previous teaching session

(Horner, McDonnell, & Bellamy, 1986)
4: TEACH

4. Teach!

- Teach following the lesson plan you carefully planned!

- Incorporate effective teaching techniques that you typically use
  - Reinforcement, prompting, fading, pacing, etc.

(Horner, McDonnell, & Bellamy, 1986)
5. Test

- Test with a new set of examples
  - Probe student performance in a novel situation, with new materials, etc.

- To see if student responds correctly in generalization-type situations

- Provides information for how to adjust additional instruction

(Horner, McDonnell, & Bellamy, 1986)
GENERAL CASE PROGRAMMING: EXAMPLES

- TBD
 Educating children with autism can be complex!

Often, the goal of instruction is to produce behavior change outside the training context.

Programming to ensure maintenance and generalization of skills is an essential component to a student’s curriculum.

Explicitly teaching maintenance and generalization requires additional planning.
Research provides some guidance on how to increase the likelihood of skills:

- **Maintain over time**
  - Fading prompts
  - Thinning reinforcement schedule
  - Use naturally occurring reinforcers
  - Consider: frequency of skill use, naturally occurring cues, maintenance checks

- **Generalize to stimulus conditions other than the training setting**
  - Train in generalization setting
  - Incorporate naturally occurring contingencies
  - Train sufficient exemplars
  - Use stimuli present in generalization setting
  - Self-monitor & report on generalized attempts
  - Reinforce generalized responses
  - Use general case programming


Please complete and return evaluations to me before you leave.

Thank you! 😊