

Stimulus Control, Differential Reinforcement and RIRD Interventions for the Reduction of Vocal and Motor Stereotypy

Discussant: Claire Egan

Stereotypy

- Invariant and repetitive
- Movement or vocalizations
- Absence of socially mediated consequences
 - Functional analysis or functional behaviour assessment
- Key diagnostic criterion for autism

Rapp & Vollmer, 2005

Stereotypy

- Engagement in stereotypy may:
 - Block the effects of social reinforcers
 - Lovaas, 2003
 - Block acquisition of new skills
 - Lovaas, Newsom & Hickman, 1987; Koegel Covert, 1972; Morrison & Rosales-Ruiz, 1997; Epstein, Doke, Sajwaj, Sorrell & Rimmer, 1974

Challenges in Treating Stereotypy

- Automatically reinforced
- We often don't have access to the maintaining variables
- Potent automatic reinforcers
- Multiple maintaining variables

Time and Place

- Complete elimination of stereotypy?
- We all engage in some stereotypy
- Alternative: time and place

Stimulus Control

- Responding increases or decreases
 - In the presence of an antecedent stimulus
 - Due to a history of reinforcement or punishment
 - In the presence of that stimulus
- Antecedent stimulus = Discriminative stimulus

Cooper, Heron, Heward, 2007

Stimulus Control

- Examples
 - Phone rings - hello
 - Hello in the absence of the phone ringing?
 - Dual languages
 - Speak the language of those around you

Stimulus control - Stereotypy

- Stimulus signals a specific contingency is in place
- Stimuli commonly used
 - Wristbands, lanyards
 - Poster board, cards
- Considerations
 - Salient/Clear
 - Portable?
 - Discreet?

References

- Cooper, J.O., Heron, T.E. & Heward, W.L. (2007). *Applied Behavior Analysis*. Upper Saddle River, New Jersey: Pearson Education.
- Epstein, L. H., Doke, Larry A., Sajwaj, Thomas E., Sorrell, Sue & Rimmer, Betty (1974). Generality and side effects of overcorrection. *Journal of Applied Behavior Analysis*, 7, 385-390.
- Koegel, R.L. & Covert, A. (1972). The relationship of self-stimulation to learning in autistic children. *Journal of Applied Behavior Analysis*, 5, 381-387.
- Lovaas, O. I. (2003). *Teaching individuals with developmental delays: Basic intervention techniques*. Austin, Texas: Pro-Ed.
- Lovaas, I., Newsom, C. & Hickman, C. (1987). Self-stimulatory behavior and perceptual reinforcement. *Journal of Applied Behavior Analysis*, 20, 45-68.
- Morrison, K. & Rosales-Ruiz, J. (1997). The effect of object preferences on task performance and stereotypy in a child with autism. *Research in Developmental Disabilities*, 18), 127-137.
- Rapp, J. T. & Vollmer, T. R. (2005). Stereotypy I: A review of behavioral assessment and treatment. *Research in Developmental Disabilities*, 26, 527-547.

Decreasing Motor and Vocal Stereotypy Using a Stimulus Control and Response Interruption and Redirection Procedure

Sharon Baxter
Semiahmoo Behaviour Analysts, Inc.

Sarah Pastrana
University of British Columbia &
Semiahmoo Behaviour Analysts, Inc.

Current Research - Interventions

- Non-contingent reinforcement
- Matched/preferred stimulation
- Differential reinforcement
- Sensory extinction
- Response blocking
- Treatment packages

Response Blocking

- Response blocking
 - Response blocking alone (sensory extinction)
 - Response interruption and redirection (RIRD)

RIRD

- Interrupt target behaviour
- Provide prompt for (incompatible) alternative behaviour

Ahearn et al. (2007)

- Effects of RIRD on vocal stereotypy
 - RIRD = prompted language use
 - ABAB design
- Results
 - Decreased vocal stereotypy
 - Increased use of appropriate language

Ahrens et al. (2011)

- Vocal and motor RIRD
- Vocal and motor stereotypies
 - Vocal = prompted language use
 - Motor = motor response (e.g., stand up)
- Results
 - Decreases in motor and vocal stereotypy
 - Increases in appropriate vocalizations

Schumacher & Rapp (2012)

- Three-component multiple schedule
- RIRD
 - Effects on vocal stereotypy
- Results
 - Immediate decrease in vocal stereotypy
 - No effect on subsequent stereotypy
- Pastrana et al. (2013)
 - Immediate increase, decrease in untargeted stereotypy
 - No effect on subsequent stereotypy

Case Study

- **Participant**

- 21 year-old male
- Resides in 24-hour residential ABA teaching home
- Focus on self-management, life skills, leisure skills, and community-based programming
- Engages in loud vocalizations and intense hand flapping

- **Settings**

- Residential home
- Community

Target Behaviours

- **Hand stereotypy**

- Repetitive (2x or more)
- Non-functional motor movements
- Occurrence ends when no motor stereotypy for 2 seconds

- **Vocal stereotypy**

- All vocalizations that are not words or statements directed towards a staff member

Long Term Objective

- Two or fewer occurrences of motor stereotypy
- Per 15 minute interval
- Wearing the stimulus control wristband
- Criterion = 20 consecutive intervals
 - 1) House
 - 2) Indoor track

Baseline

- Scored by team leader
- 1:1 instruction and indoor track
- 5 minute observation
- 10-s partial interval recording
- Current behaviour plan procedures implemented

Intervention

- General procedure:
 - Staff place wristband on student's wrist
 - "Talk nicely and have nice hands"
 - Set timer for target interval
 - When stereotypy occurs, interval paused + RIRD implemented:
 - Hand flapping = "Calm down" + model prompt + count to 10
 - Vocal stereotypy = 8-10 consecutive echoic antecedents
 - Hand flapping + vocal stereotypy = procedure for hand flapping
- Following RIRD, interval resumed (not restarted)
- Wristband removed at end of target interval

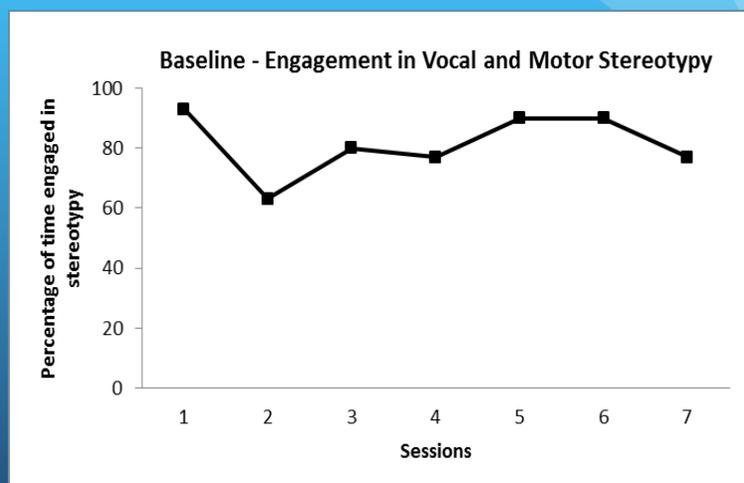
Intervention (continued)

- Long-term objectives broken into series of short-term objectives (STOs)
 - MC = 5 consecutive intervals with 1 event of stereotypy or less
- STO B:
 - Stimulus control with elastic wristband
 - 1:1 instruction desk; no instructional tasks or activities
 - 30-s interval; no more than 3 consecutive intervals
 - Same intervention for both motor and vocal stereotypy
- STO C:
 - 45-s interval + instructional tasks
- STO D:
 - 45-s interval + no instructional tasks or activities

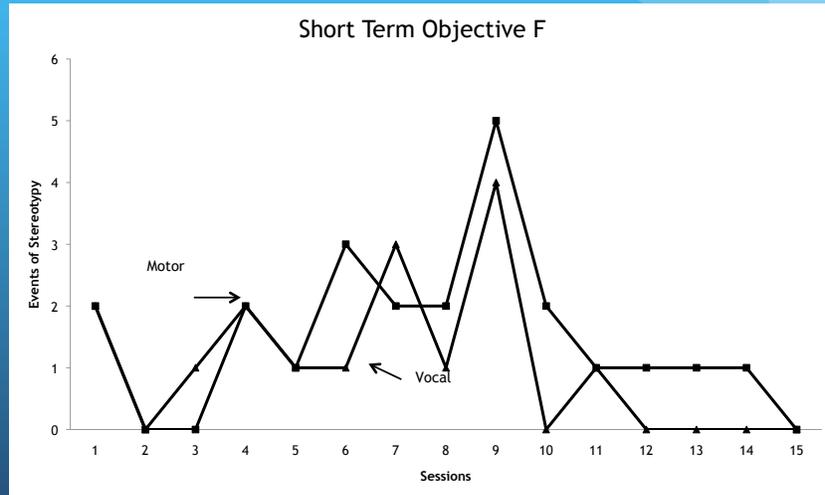
Intervention (continued)

- STO E:
 - 45-s interval
 - No instructional tasks or activities
 - Second intervention introduced - vocal RIRD for vocal stereotypy
- STO F:
 - As per STO E; 60-s interval
- STO G:
 - 30-s interval
 - Interactive activity, instructional task, or chore
- STO H:
 - As per STO G; 45 -s interval
- STO I (current):
 - As per STO G; 60 -s interval

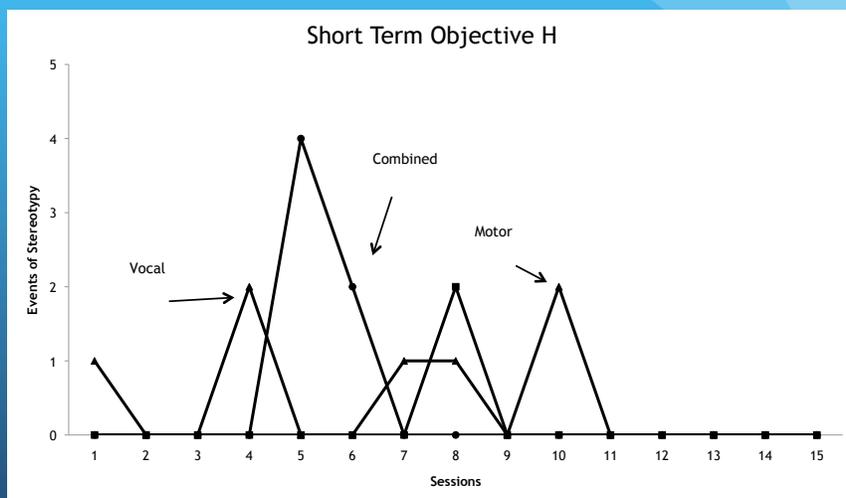
Results



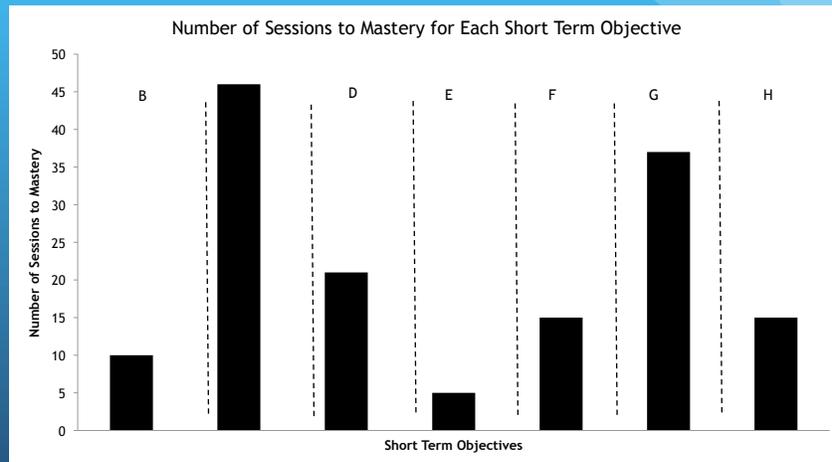
Results



Results



Results



Results

- Baseline
 - Mean = 81% of 5-min interval
 - Range = 63%-93% of 5-min interval
- Intervention
 - LTO has not yet been met
 - Absence of or low rates of stereotypy for 60-s intervals

Limitations

- Non-experimental case study
- Experimental functional analysis not conducted
 - Limited resources; results of FBA identified function
- Did not measure subsequent stereotypy
 - Increase/decrease possible
- Role of bracelet unclear (was stimulus control established?)
 - Previous interventions involving stimulus control
 - Similar outcome without bracelet?

Limitations

- Variable number of sessions each day/week
 - Quicker progress with more frequent sessions
- Different data collection systems
 - Baseline versus intervention
 - Not possible for staff to collect PIR data while presenting instructional trials
 - Will run baseline probes using PIR when the LTO has been met

Conclusions

- In the current case study, RIRD decreased immediate engagement in vocal and motor stereotypy
- Replicated, in part, previous RIRD research
 - Ahearn et al. (2007)
 - Ahrens et al. (2011)
- Need additional research about subsequent changes in stereotypy
 - Unclear in current case study
- When possible, include teaching of new skills in RIRD
 - Need additional research

References

- Ahearn, W.H., Clark, K.M., MacDonald, R.P.F., & Chung, B.I. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 42*, 263-275.
- Ahrens, E., Lerman, D., Kodak, T., Worsdell, A., & Keegan, C. (2011). Further evaluation of response interruption and redirection as treatment for stereotypy. *Journal of Applied Behavior Analysis, 44*, 95-108.
- Pastrana, S. J., Rapp, J. T., & Frewing, T. M. (2013). Immediate and subsequent effects of response interruption and redirection on targeted and untargeted forms of stereotypy. *Behavior Modification, 37*, 591-610.
- Schumacher, B., & Rapp, J. (2011). Evaluation of the immediate and subsequent effects of response interruption and redirection on vocal stereotypy. *Journal of Applied Behavior Analysis, 44*, 681-685.

Questions?

- Sharon Baxter - sharonbaxteraba@yahoo.ca
- Sarah Pastrana - sarahpastrana@hotmail.com

Using stimulus control and response interruption and redirection to decrease motor and vocal stereotypy

Amy Tanner
Florida Institute of Technology
Tyla Frewing and Andrew Bonner
University of British Columbia
Sharon Baxter
Semiahmoo Behaviour Analysts Inc.

Introduction

- RIRD is one common intervention for stereotypy
 - Interrupt the current behavior
 - Provide a prompt to engage in a new (incompatible) behavior
- Demonstrated effectiveness in reducing stereotypy
 - Ahearn et al. (2007)
 - Ahrens et al. (2011)
 - Schumacher & Rapp (2012)
 - Pastrana et al. (2013)

Three Component Analysis

- Recent research has investigated methods of identifying:
 - Effects of interventions while they are in place (immediate effects)
 - Effects of interventions immediately after they are removed (subsequent effects).
 - Increases, decreases or no change in stereotypy post-intervention?
 - Lanovaz et al. (2009); Lanovaz et al. (2010); Schumacher & Rapp (2013); Pastrana et al. (2013).
- The three component analysis has been used to evaluate:
 - Immediate and subsequent effects of interventions on stereotypy

Three Component Analysis

- Consists of two separate sequences
 - Baseline Sequence
 - Test Sequence
- Each sequence is comprised of three, 10-minute components
 - Baseline: All three components are procedurally identical
 - Test: 1st and 3rd component are procedurally identical
 - 2nd component consists of intervention procedures
- Sequences alternate between baseline and test

Three Component Analysis Cont.

<u>1st Component</u> BL	Baseline Sequence <u>2nd Component</u> BL	<u>3rd Component</u> BL
<u>1st Component</u> BL	Test Sequence <u>2nd Component</u> Treatment	<u>3rd Component</u> BL

Background

- Student “John” is 19 year old boy with autism
- In intensive ABA home program since age of 4
- Currently residing in ABA teaching home

Background

- John's history of stereotypy
- Access to stereotypy and problem behaviour
 - Precursor to aggression and property destruction
- Motor stereotypy
 - caused physical damage to property
- Interferes with skill acquisition
- Adverse social consequences

Background

- Program History
- Program began as a DRO
 - 21 different STO's
 - DRL, increasing reinforcement, return to DRO
- Procedures were unsuccessful in producing reductions in stereotypy for longer than 2 minutes at a time.
- RIRD implemented
 - 3 minute interval, increasing by 15 second increments

Target Behaviors and Operational Definitions

- Vocal Stereotypy
 - Positive exemplars
 - Laughing, whispering, humming, moaning, talking aloud to himself, palilalia, echolalia
 - Negative exemplars
 - Functional and contextual language in response to instructor antecedents

Target Behaviors and Operational Definitions

- Gross Motor Stereotypy
 - Positive exemplars
 - Rocking in chair, bouncing on chair, flaring of arms in the air, belly slapping
 - Negative exemplars
 - Reaching for instructor recruiting tactile reinforcement, controlled movements away from or to the table

Target Behaviors and Operational Definitions

- Fine Motor Stereotypy
 - Positive exemplar
 - Hand flapping, face rubbing, finger flicking, leg or belly rubbing, covering and uncovering of ears
 - Negative Exemplar
 - Fidgeting with objects in reach (pen, binder, clipboard), functional scratching of arms, head and face

Heart Rate

- Why?
 - Concerns
 - After SC & RIRD removed - belief of profound increase of stereotypy
 - Physiological Effects
 - To examine possible physiological effects of intervention
 - To address concerns that the intervention may increase distress
 - To assess immediate and subsequent physiological effects

Heart Rate

- Heart Rate was collected throughout Phase 2 (BPM)
- Digital wrist watch, every 2.5 minutes.
- 4 measurements per 10 minutes - average of 4
- John was trained to collect own heart rate data

Design

- Phase 1: Alternating treatments design
 - Compared baseline with stimulus control & RIRD
 - Evaluate the effectiveness of stimulus control & RIRD
 - Additional baseline sessions conducted in error
- Phase 2: Three component analysis
 - Determine subsequent effects of treatment
 - Increases, decreases or no change
 - Immediately after treatment sessions

Data Collection

- Data were scored from video
- 5-s partial interval recording was used
- Vocal and motor stereotypy were recorded separately

Setting Description

Therapy Room



Session Description

- All Sessions
 - Same time each day
 - Variety of previously mastered DTT table programs
 - Conducted by John's primary instructor
 - Videotaped and scored from video by two observers
 - Partial interval recording with 5 second intervals

RIRD Procedures

- Procedures as in baseline except:
 - RIRD with stimulus control implemented
- Presented wristband to student
 - Abbreviated Antecedent issued 'Hand's, Body, Noises'
 - Calm Hands, Calm Body, No Noises

RIRD Procedures Cont.

- Vocal Stereotypy
 - Directed student to engage in an incompatible vocalization
 - Counting from 100 to 200
 - Interval was paused while student was counting
- Gross and Fine Motor Stereotypy
 - Directed student to engage a motor movement incompatible with stereotypy
 - Hands in pockets
 - Interval not paused during correction

Materials

- Wrist Band
 - Discriminative stimulus
 - When worn, RIRD was in effect
 - Worn on right wrist during treatment components



Materials Cont.

Heart Rate monitor

- Digital wrist watch worn on left wrist of student



Procedures - Phase 1

- Alternating treatment design
- All sessions
 - 5 minutes in length intervals
 - Rapidly alternating baseline, treatment, baseline

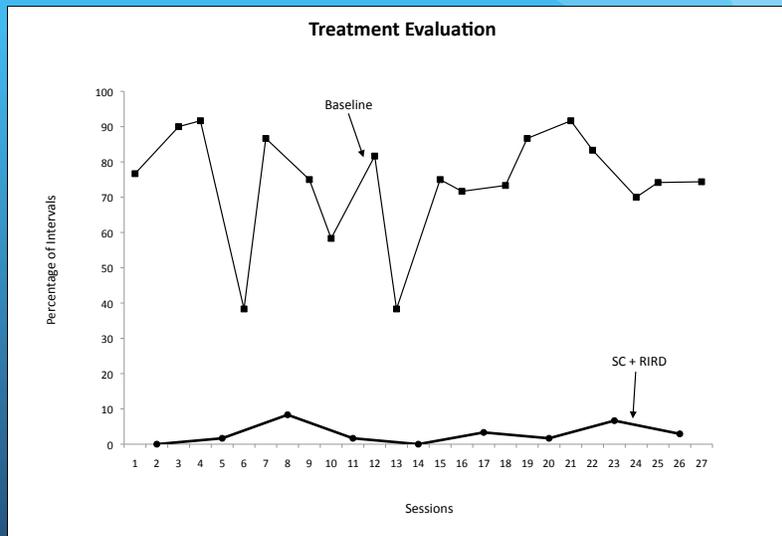
Procedures - Phase 1 Cont.

- Baseline Condition
 - Staff implemented students regular educational curriculum
 - One-to-one discrete trial teaching
 - No planned consequences for motor and vocal stereotypy
- Treatment Condition- as in baseline except:
 - Stimulus control wristband was worn
 - RIRD implemented for all events of motor or vocal stereotypy

Results - Phase 1

- Alternating Treatment
 - Motor and Vocal Stereotypy combined

Phase 1 - Alternating Treatments



Procedures - Phase 2

- Three Component Analysis
- All sessions
 - 10 minutes in length
 - Each sequence contained three consecutive sessions
- Baseline Sequence
 - Baseline conditions as in Phase 1
 - No planned consequences for motor and vocal stereotypy
 - Procedures remained the same throughout all three components

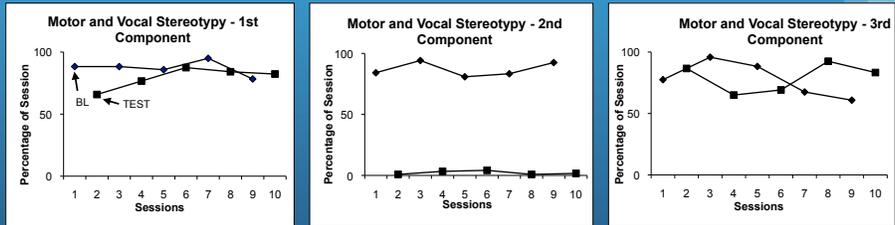
Procedures - Phase 2 Cont.

- Test Sequence
 - 1st and 3rd components- baseline conditions as in Phase 1
 - No planned consequences for motor and vocal stereotypy
 - 2nd component - test (RIRD + SC), procedures as in Phase 1
 - Stimulus control wristband was worn
 - RIRD for all events of motor or vocal stereotypy

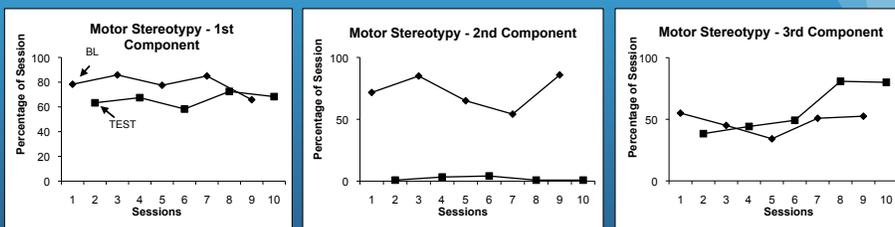
Results - Phase 2

- Three Component Analysis
 - Motor and Vocal Stereotypy combined
 - Motor and Vocal Stereotypy separated
 - Resting Heart Rate throughout all conditions

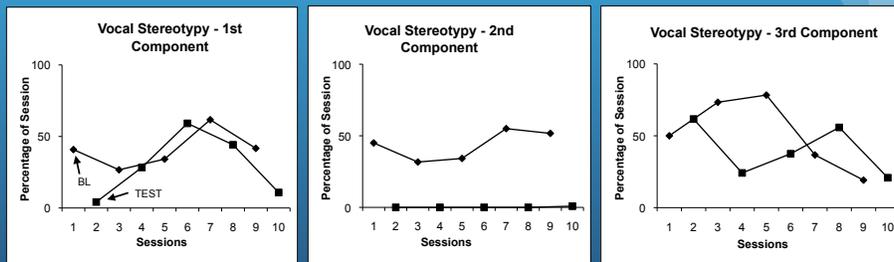
Between Sequence Analysis Motor and Vocal Stereotypy



Between Sequence Analysis Motor Stereotypy



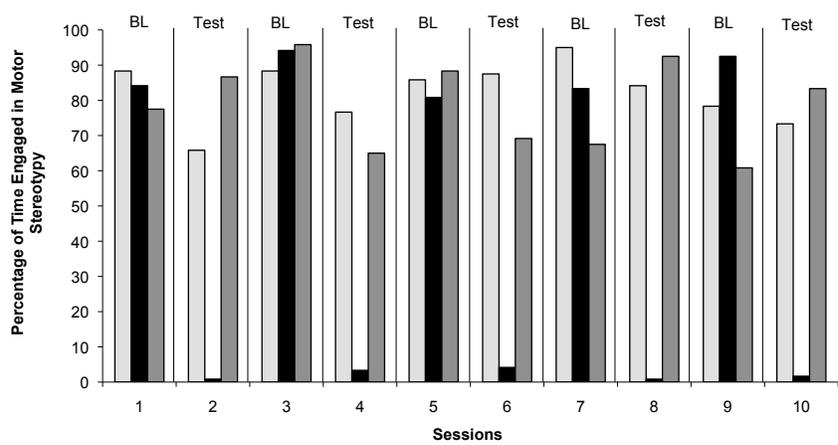
Between Sequence Analysis Vocal Stereotypy



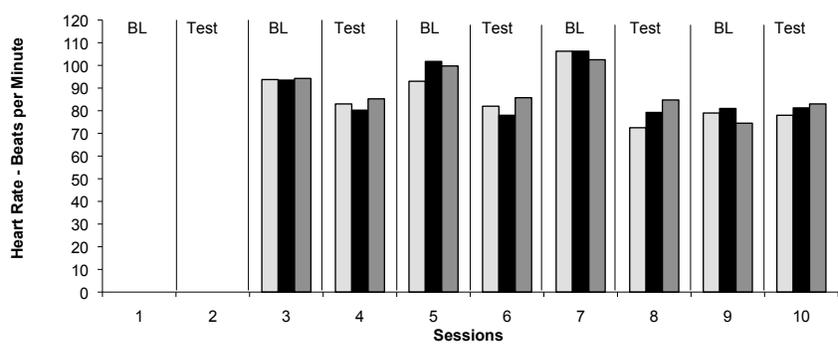
Results Summary Percentage of Motor and Vocal Stereotypy

- Baseline Sequence
 - 1st component: 87%
 - 2nd Component: 87%
 - 3rd Component: 78%
- Test Sequence
 - 1st component: 79%
 - 2nd component: 2.16%
 - 3rd component: 79%

Within Sequence Analysis



Heart Rate



*Heart Rate monitor error during session 1 & 2

Results Summary

- Phase 1:
 - Stereotypy was consistently low during treatment sessions and high during baseline sessions
- Phase 2:
 - Between sequence analysis
 - Levels of stereotypy similar in first and third components
 - In the second component
 - High stable levels of stereotypy in baseline sequence
 - Low stable levels of stereotypy in treatment sequence

Results Summary Cont.

- Within Sequence Analysis
 - Baseline sequences
 - Levels of stereotypy similar in all three components
 - Test sequences
 - Levels of stereotypy were similar in the 1st and 3rd component and similar to all three baseline components
 - During treatment sequence levels of stereotypy were significantly reduced with no overlap

Generalization Probes

	Baseline	Treatment
IPOD (With prior training)	95.0%	8.3%
Eating (With prior training)	43.3%	0.0%
Toy Room (Probe- no prior training)	48.3%	0%

Discussion

- RIRD + stimulus control successfully decreased stereotypy
 - Motor and vocal
- Results generalized to three additional settings
- Stable heart rate data may provide preliminary indication of little or no physiological distress when RIRD implemented

Discussion

- Explanation for findings
 - High level of instructional control and compliance
 - Reside in residential teaching home staffed 24 hours per day
 - Slowly and systematically increased intervals
 - Negative Reinforcement - removal of the stimulus is reinforcing

Discussion Cont.

- Limitations
 - Treatment effects were not lasting
 - Stereotypy did not increase over baseline levels when intervention was removed.
 - Response effort in implementing RIRD
 - Significant time required to score data for Phase 1 and 2

References

- Ahearn, W.H., Clark, K.M., MacDonald, R.P.F., & Chung, B.I. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 42*, 263-275.
- Ahrens, E., Lerman, D., Kodak, T., Worsdell, A., & Keegan, C. (2011). Further evaluation of response interruption and redirection as treatment for stereotypy. *Journal of Applied Behavior Analysis, 44*, 95-108.
- Lanovaz, M., Fletcher, S., & Rapp, J. (2009). Identifying stimuli that alter immediate and subsequent levels of vocal stereotypy: A further analysis of functionally matched stimulation. *Behavior Modification, 33*, 682-704.
- Lanovaz, M., Rapp, J., & Fletcher, S. (2010). Expanding functional analysis of automatically reinforced behavior using a three-component multiple schedule. *European Journal of Behavior Analysis, 11*, 17-27.
- Pastrana, S. J., Rapp, J. T., & Frewing, T. M. (2013). Immediate and subsequent effects of response interruption and redirection on targeted and untargeted forms of stereotypy. *Behavior Modification, 37*, 591-610.
- Schumacher, B., & Rapp, J. (2011). Evaluation of the immediate and subsequent effects of response interruption and redirection on vocal stereotypy. *Journal of Applied Behavior Analysis, 44*, 681-685.

The effects of differential reinforcement of low rates of behavior (DRL) and stimulus control procedures on motor and vocal stereotypy

Sara Boisselle
 Tyla Frewing, M.Sc., BCBA
 Sara White, Ph.D. BCBA

Introduction

- Stereotypy (Rapp & Vollmer, 2005)
 - Invariant movement of a body part
 - Persists in the absence of social reinforcement

Differential Reinforcement

- Successful in decreasing stereotypy
- Most commonly used - Differential reinforcement of other behavior (DRO)
 - Shabani, Wilder & Flood (2001)
 - Taylor, Hoch & Weissman (2005)

Differential Reinforcement

- Differential reinforcement of low rates of behavior (DRL)
 - Singh, Dawson & Manning (1981)
 - Spaced-responding DRL
 - Stereotypy decreased, appropriate behavior increased

Stereotypy as Reinforcement

- Charlop et al (1990)
 - Access to stereotypy
 - More effective than primary reinforcers
 - Increasing correct responding
 - Academic tasks

Stereotypy as Reinforcement

- Potter, Hanley, Augustine, Clay & Phelps (2013)
 - Access to stereotypy
 - Package intervention
 - Differential reinforcement
 - Response blocking
 - Prompts to engage in appropriate responses
 - Increased complexity of alternative behaviors
 - Social validity assessment

Purpose

- Evaluate the effects of
 - Differential reinforcement of low rates of behavior (DRL) and stimulus control procedures
 - On the occurrence motor and vocal stereotypy
 - Stereotypy as reinforcement

Participant

- Nine year old boy with ASD and ADHD.
- Attended elementary school
 - Grade 4
 - Part time ABA Support Worker (First author)
 - Participates in the daily routine for part of the day
 - 1:1 ABA instruction for 1-2 hours per day.
- Engaged in high frequency motor and vocal stereotypy throughout the school day.

Materials

- Clicker - frequency data
- Timer - time intervals
- Linking cubes - visual representation opportunities to engage in stereotypy during DRL.

Design

- ABA reversal design
- Evaluated across two settings

Target Behaviors

- Gross Motor Stereotypy
 - Reaching for, touching or staring at perseverative objects (e.g. door knobs) in the hallway or classroom
- Vocal Stereotypy
 - Repetitive, non-functional vocalizations including (but not limited to) perseverative discussion of specific objects, over-enunciation of syllables within spoken words.

Measurement

- Event recording
 - Events of stereotypy per intervention interval
 - 10 minute interval in classroom
 - 2 minute interval during hallway transitions
 - Each event recorded on a clicker
- Events discrete and short duration
- New event recorded
 - 1s with no stereotypy

Measurement

- Inter-observer agreement data
 - Recorded by an integration support teacher
- Calculations:
 - Smaller number/larger number, X 100
 - Percent agreement averaged across observations
- Results:
 - Baseline: 100%
 - Intervention: 100%

General Procedures

- Sessions at a consistent time each day
- All sessions run by ABA support worker
- Student had one to one support throughout
- Student participated in ongoing events
 - E.g., transitioning between locations (hallway)
 - E.g., completing assigned classroom work

General Procedures

- Baseline commenced simultaneously in
 - Hallway
 - Classroom
- Informal preference assessment
 - 3-5 items/activities presented verbally
 - immediately prior to each interval
 - Participant chose on every occasion
 - opportunity to engage in stereotypy

Baseline

- General instruction related to ongoing events
 - to transition (hallway) or
 - to begin or continue work on a task (classroom)
- Timer was started
- ABA Support Worker continued with ongoing daily events.
- No planned consequences for stereotypy
- At the end of the interval
 - Continued with ongoing events

Intervention

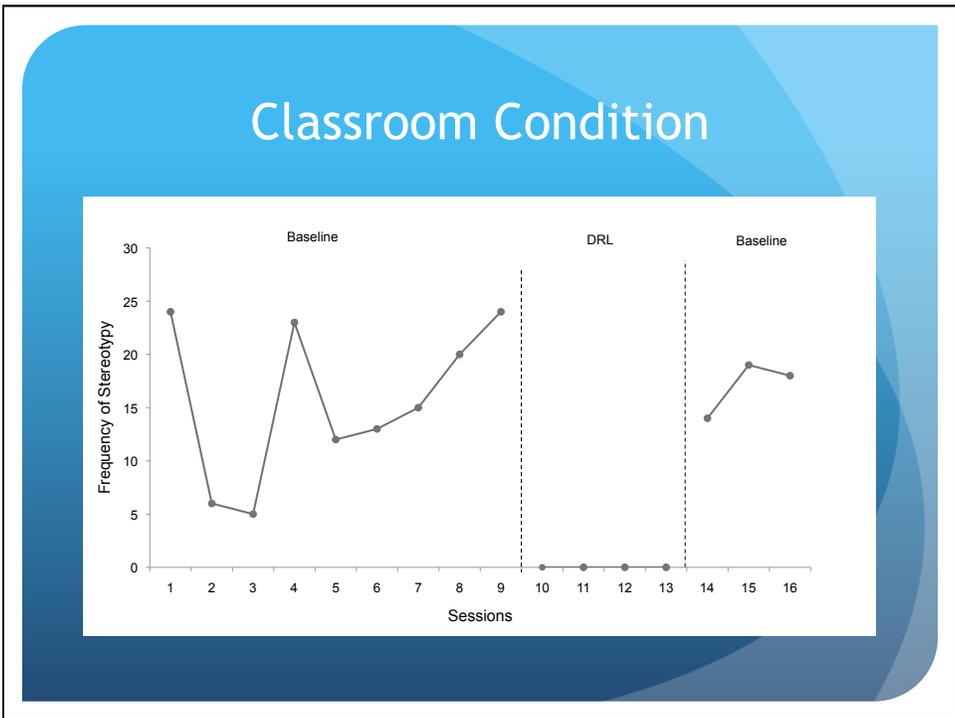
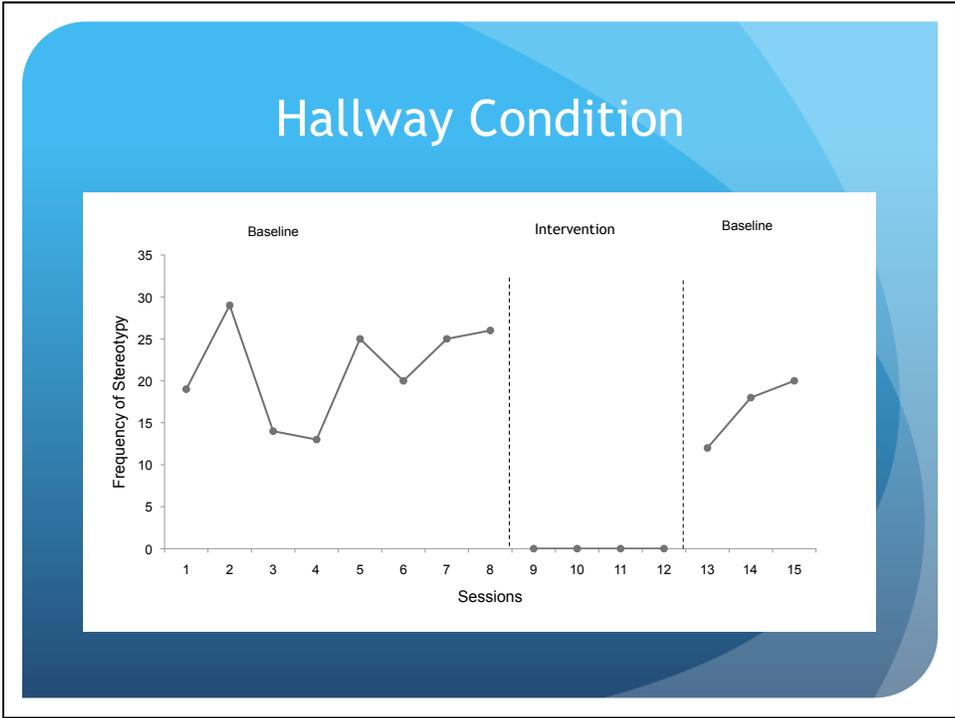
- At the start of the interval:
 - Vocal S^D - "You need to have nice hands and nice talking"
 - Participant was presented ten linking cubes
 - Target behaviors reviewed
 - Examples and non-examples provided.
 - Contingency reviewed
 - Target behavior = one block removed.
 - At least one block left = access reinforcer

Intervention

- If a target behavior occurred:
 - Behavior specific feedback:
 - E.g., “That was silly talk.”
 - Block removed from stick
 - Vocal S^D represented
- If last block was removed
 - Participant informed he could try again
 - Interval allowed to elapse
 - New interval initiated

Intervention

- At the end of the interval
 - At least one block remaining
 - Reinforcer presented (brief access to stereotypy)



Results-Summary

- High levels of stereotypy in baseline
- Immediate reduction to zero rates
 - With DRL with stimulus control
- Immediate increase
 - With return to baseline

Discussion

- DRL with stimulus control decreased stereotypy
 - In a 9 year old boy with autism
 - In two different settings in the school environment
- Preliminary support for
 - Access to stereotypy as a reinforcer
 - No experimental evaluation
 - Functional relationship was not established.

Discussion

- Establishing initial DRL response requirements
 - 10 blocks were chosen without consideration of baseline data
 - Mean occurrences in baseline
 - Baseline may have indicated a higher DRL number

Discussion

- Effects of DRL procedure not clear
 - Immediate decrease to zero - no events in intervention
 - Functioned as a DRO
 - Removal of block - response-cost?
 - Avoidance of removal of block

Discussion

- Study conducted in a natural environment
 - During ongoing events (e.g., classroom activities)
 - Increased likelihood procedure will generalize
 - Anecdotally, generalization has occurred outside of procedure.
- Since study completion
 - Procedure now run across multiple settings
 - e.g., gym class
 - Data indicates
 - participant continues to be successful
 - Future plans - systematically transition to DRO

Discussion

- Future research
 - Self-management of procedure
 - Discriminating appropriate and inappropriate times