

From Stereotypic to Appropriate Vocalizations: A Practical Review of Effective Procedures

William Ahearn, Ph.D., BCBA

Using research to inform best practice

- Research into teaching procedures
 - What works
 - The best procedure?
- Stages of best practice
 - What do we know
 - How many things work?
 - Comparative studies!
 - Prediction of effective practice
 - Identifying crucial “pre-requisites”



EIBI: Best Practice!

- Lovaas, 1987; McEachin, Smith, & Lovaas, 1993
- Meta-analyses
(e.g., Eldevik, Hastings, Hughes, Jahr, Eikseth, and Cross, 2009)
- Cochrane review
(Reichow, Barton, Boyd, & Hume, 2013)
- AAP (2001); NIMH (2007); Surgeon General (1999)

Common elements of effective programs (Dawson & Osterling, 1997)

- **Curricula focus in major deficit areas**

 - Becoming aware of world around them**

 - Imitation**

 - Communication**

 - Play skills**

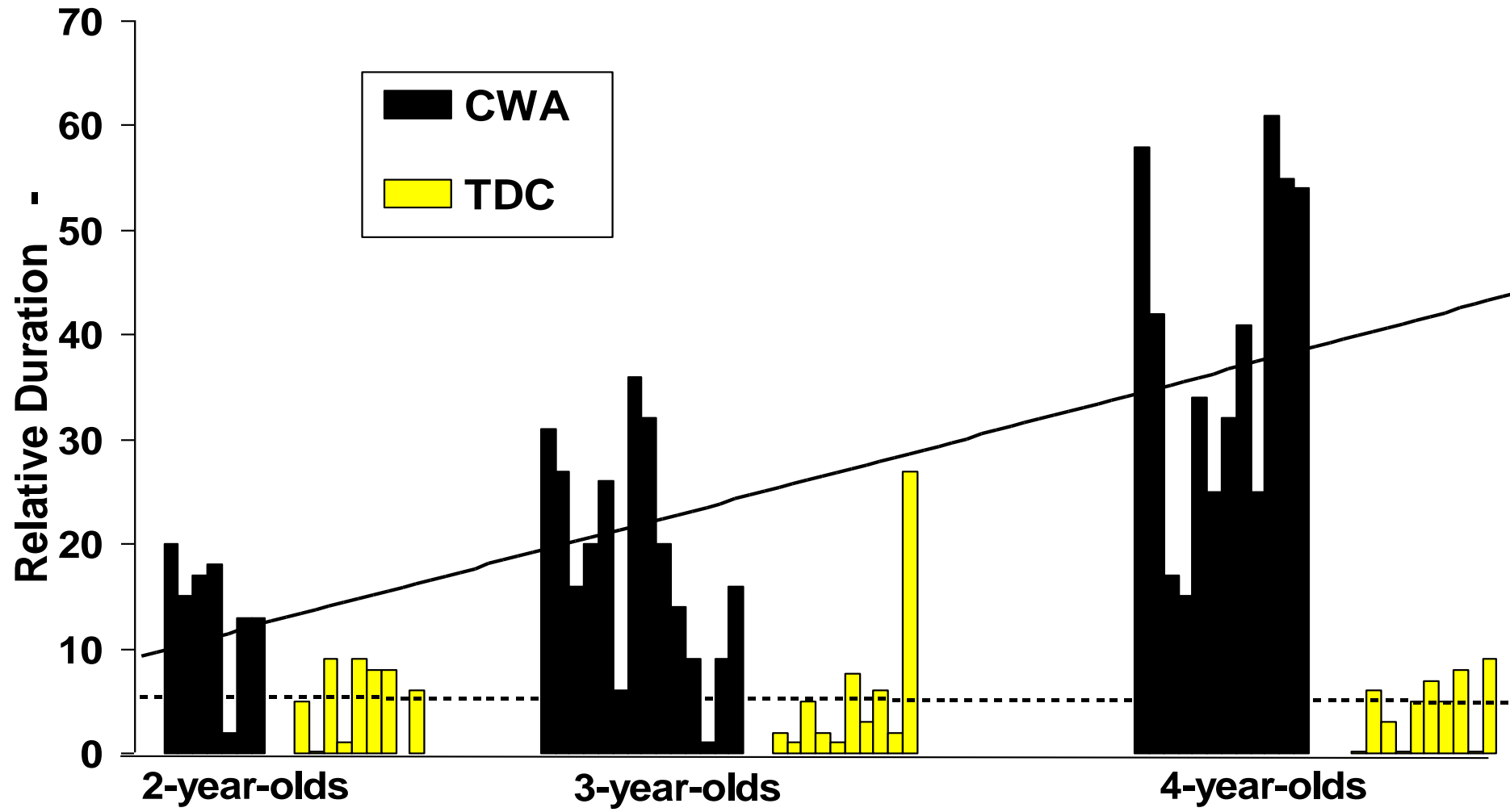
 - Social interaction**

- **Establish/generalize these skills**

- **Functional Tx of problem behavior**

 - Self-injury/Stereotypy/Aggression/Etc.**

MacDonald et al. (2007)

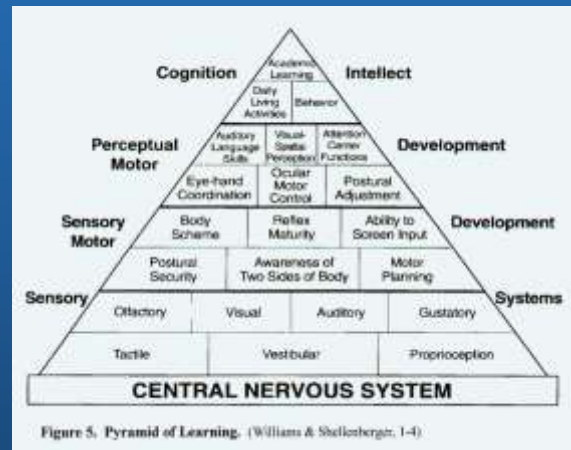


A Case History in Best Practice

- Stereotypic behavior circa 2000
 - Function-based TX?

Stereotypy: Etiology

- Sensory processing problem
(e.g., Ringman & Janovic, 2000)



Sensory Integration

- “Sensory diet” (Wilbarger, 1993)
 - Therapeutic use of sensation in daily contexts
 - Brushing and Deep Pressure Therapy (DPT)
- Behavioral Perspective
 - Use with automatically reinforced behavior
 - SD performing an abolishing operation
 - Global/Local effects



Moore, Cividini-Motta, Clark, & Ahearn (2015; BIN)

- Experimental analysis of Sensory Integration
 - If SI effective, should reduce automatically maintained motor stereotypy
- Expose participants to sensory diet of competing items and/or brushing hourly
 - Measure stereotypy at specific times during day

Method

- Participants
 - 5 adolescents with ASDs
 - All attended school for children with autism
 - Automatically maintained vocal/motor stereotypy with no treatment or ineffective treatment in place
- Setting
 - Assessments in 1.5 m x 3 m research room
 - Treatments in students' classrooms

Procedure

- Materials
 - Consulted with OT and trained SI therapist
- Staff Training
 - All direct care staff in Experiment 3 trained in brushing protocol



Pre-intervention Assessments

- Functional Analysis of motor/vocal stereotypy (Iwata et al., 1982/1994)
 - All indicated automatic reinforcement
- Competing Items Assessment with sensory diet items (Piazza et al., 2000)



Experiment 1

- Purpose: to examine whether access to the SD during school hours would effect stereotypy across the day
- Dependent Variable: motor stereotypy
- Independent Variable: SI treatments
- Design
 - Pat: ABABA
 - Luke: ABAB'A

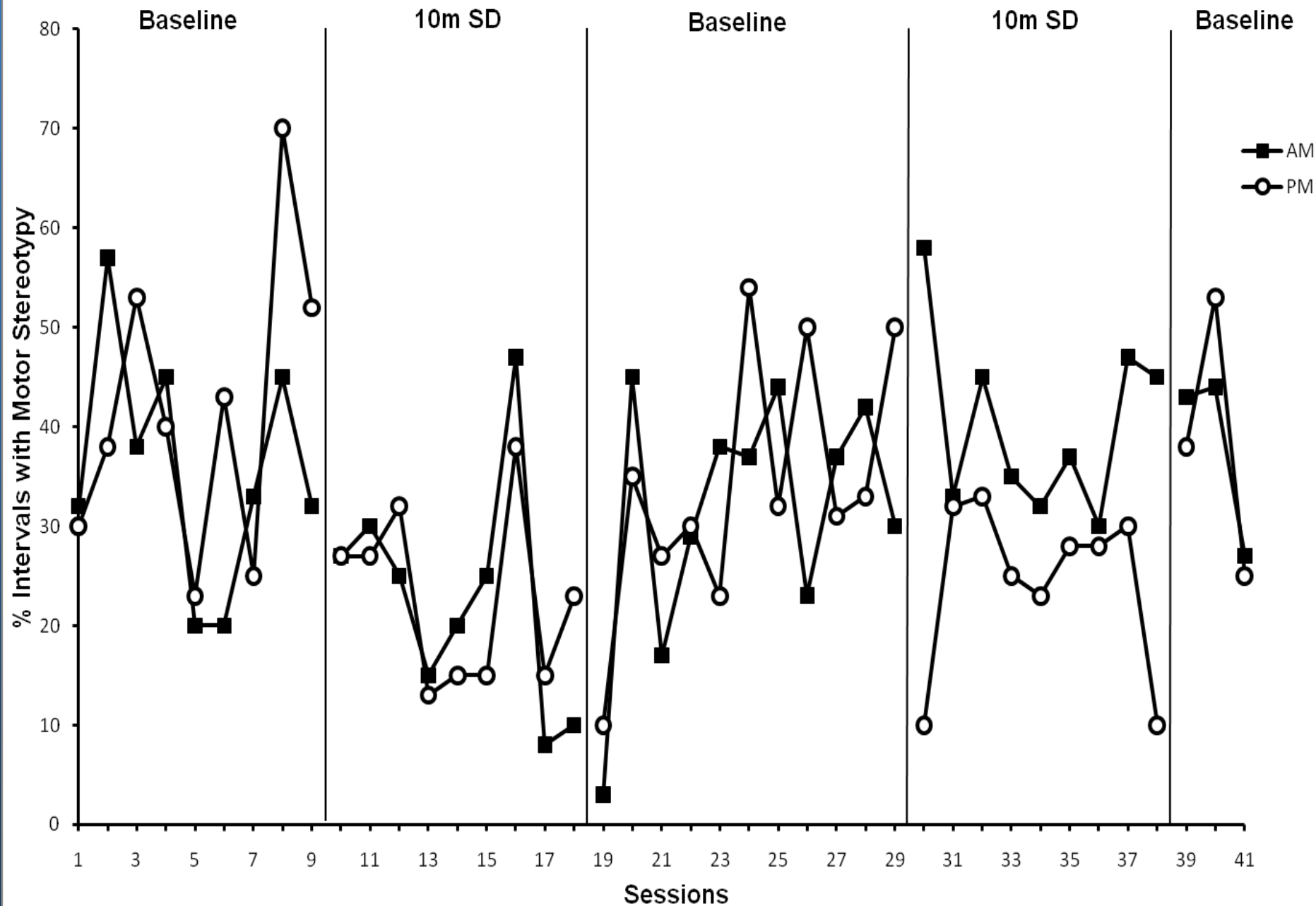
Sensory Diet Treatment Analysis

- Baseline sessions
 - 2-3 times per week
 - 10 min alone sessions in AM and PM
 - Measure motor stereotypy
 - No consequences for target behavior

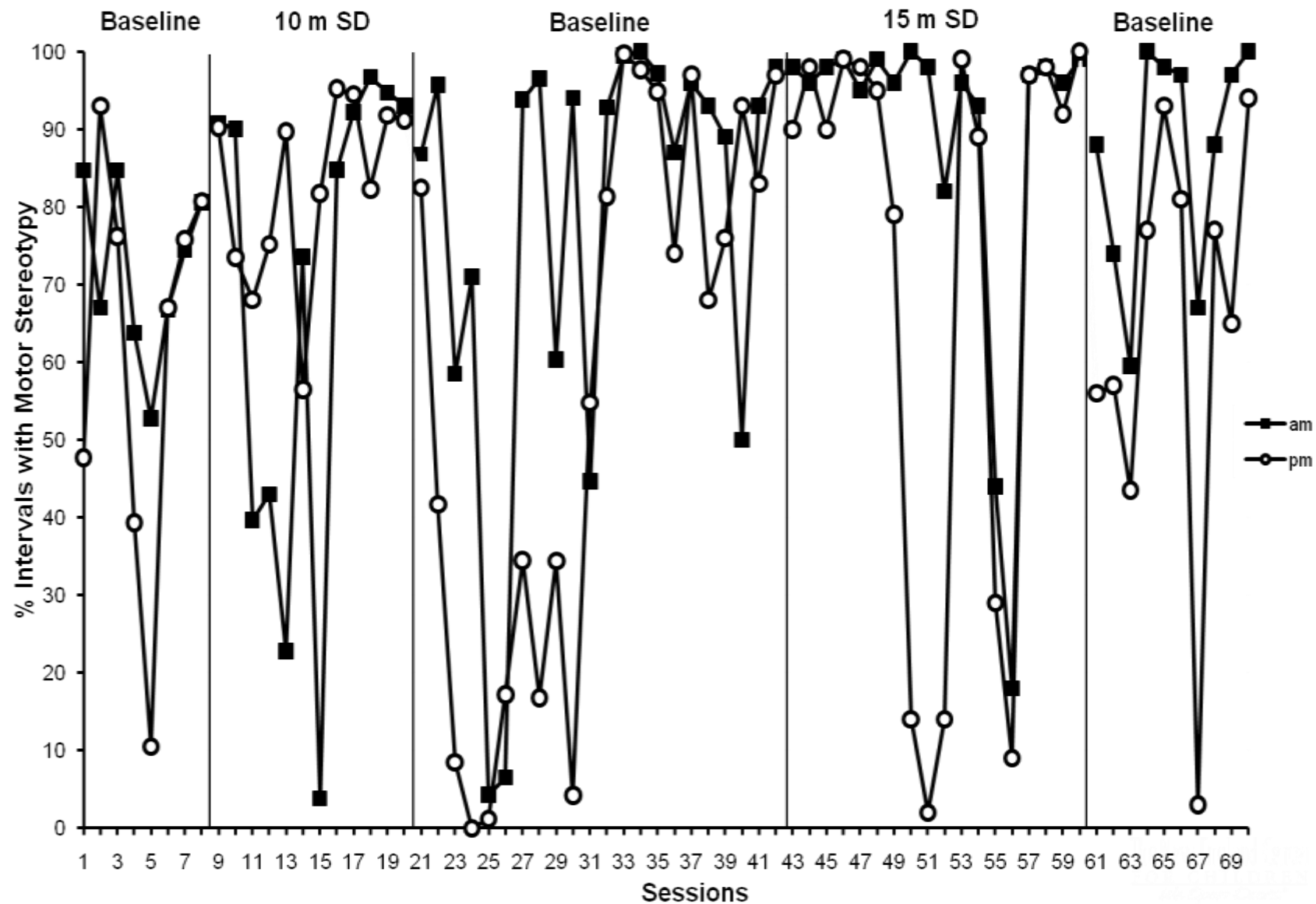
Treatment Analysis

- Treatment (sensory diet)
 - Access to competing sensory items first 10 min (or 15 for one participant) of every hour in school
 - No consequence for stereotypy
 - 10 min alone sessions in AM and PM to measure stereotypy

Sensory Diet Only- Pat



Sensory Diet Only- Luke



Discussion

- No global effect with sensory diet as treatment
 - Ineffective at reducing motor stereotypy when participants given access to sensory diet items throughout the day

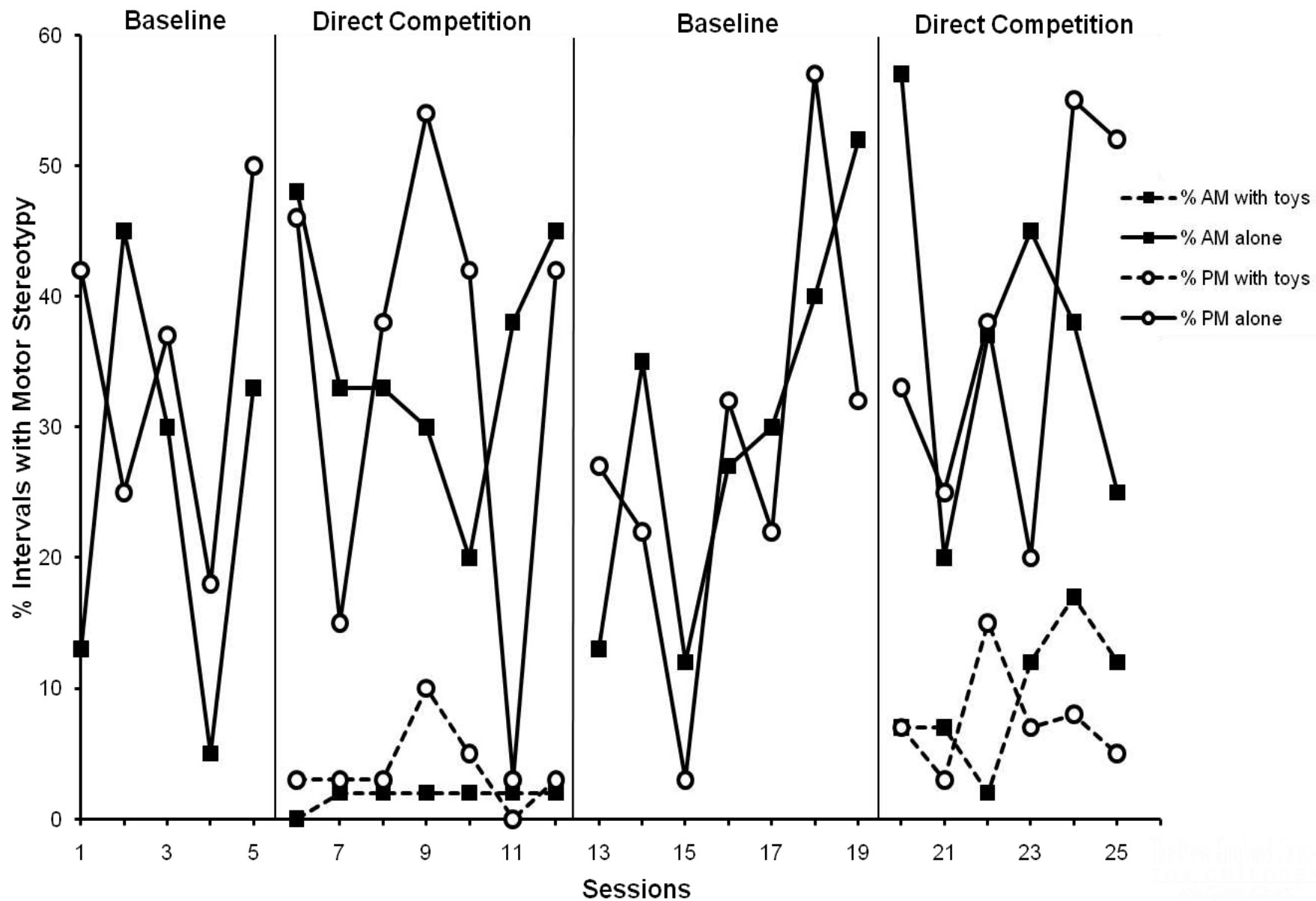
Strike 1!



Experiment 2

- Purpose: to determine if SI has any local effects on stereotypy
- Direct response competition assessment (Piazza et al., 1998)
 - 10 min session with toys, followed by 10 min session alone
 - Measure stereotypy during direct competition and immediately after

Direct Competition- Pat



Discussion

- No local effect on stereotypy
- SD items only worked when participant in direct contact
- Stereotypy resumed baseline levels immediately after SD items removed
- Effects of SD items waned quickly

Strike 2!

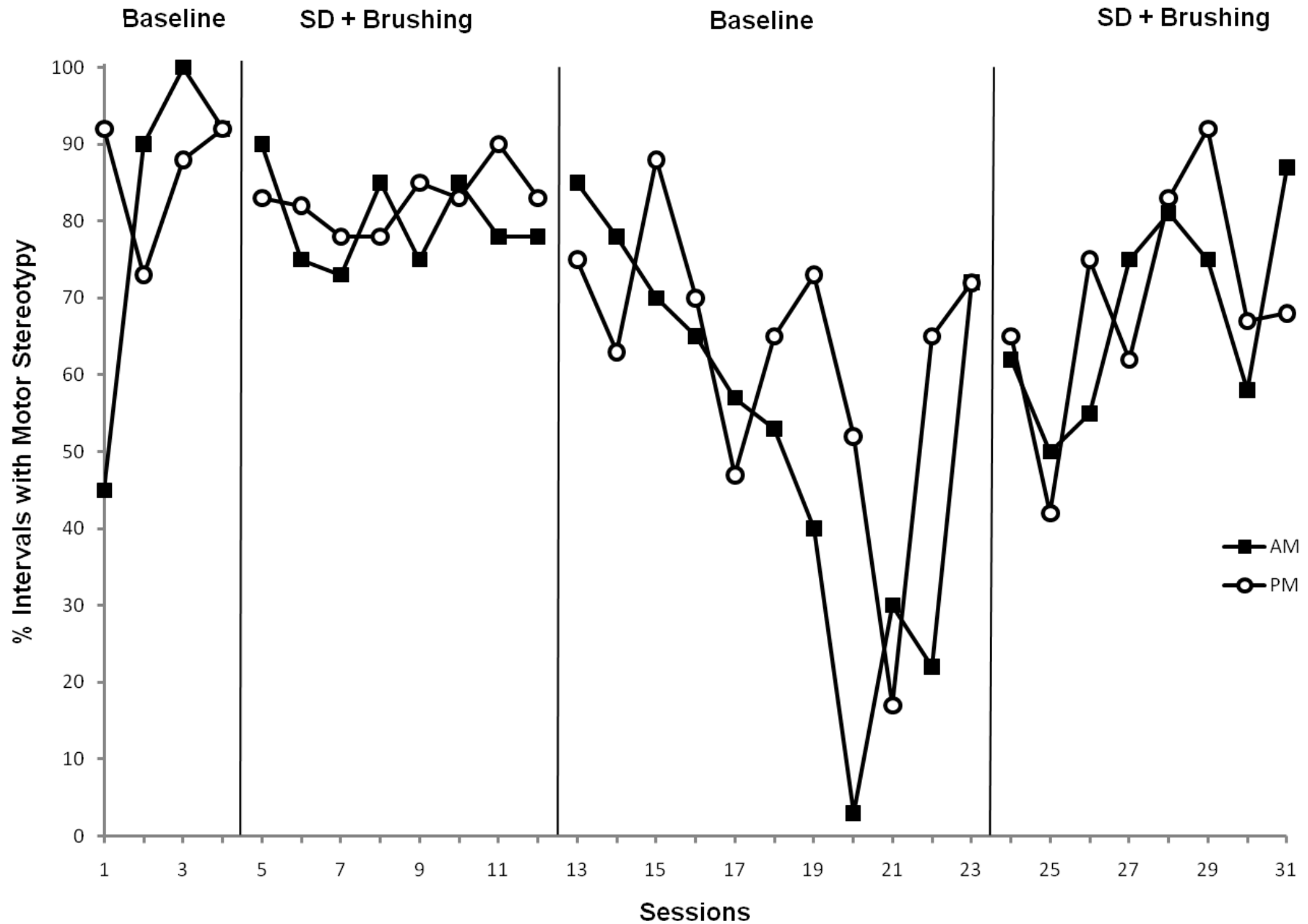


Experiment 3

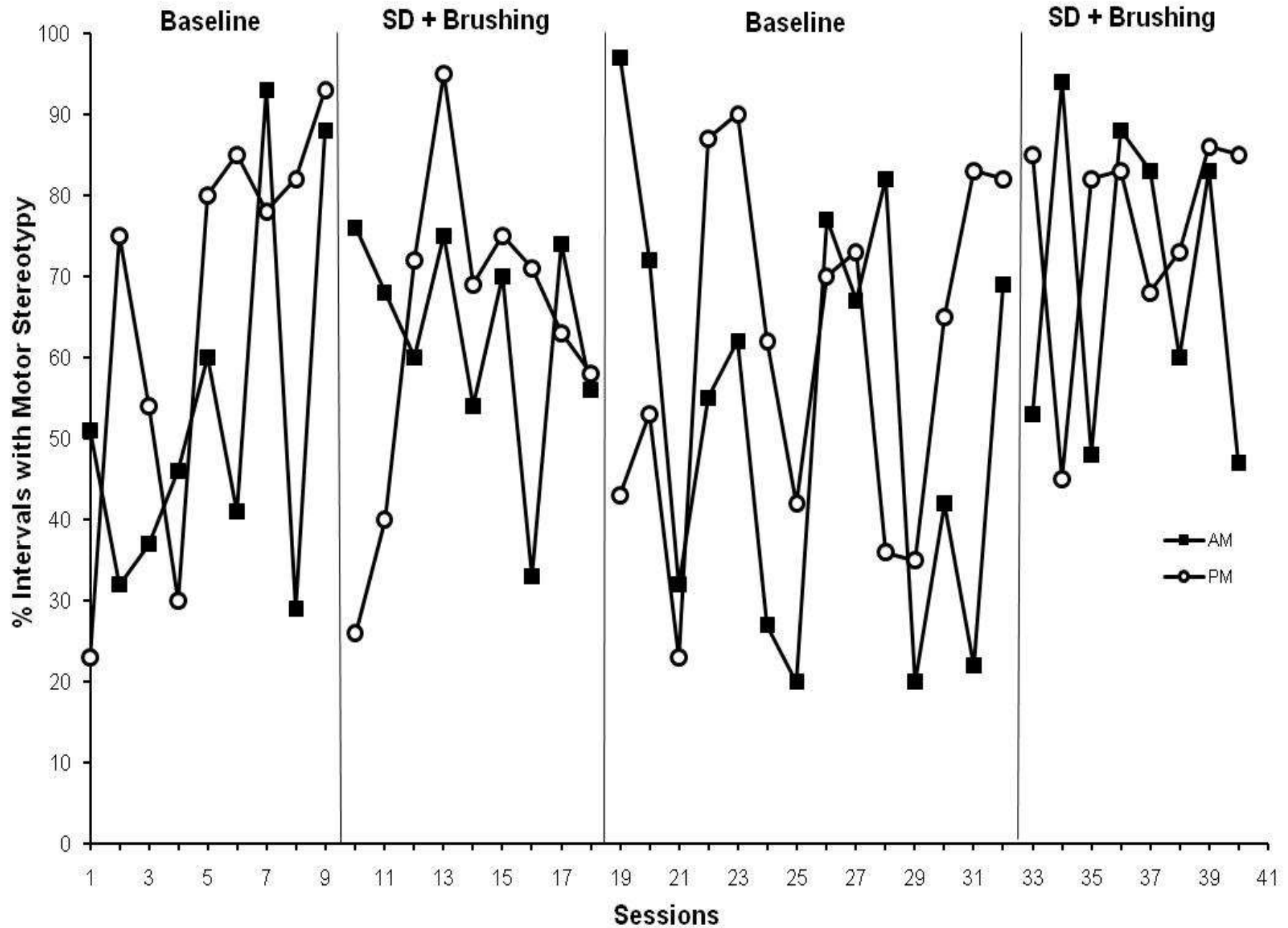
- Purpose: to determine whether brushing and DPT alone or in combination with the sensory diet would decrease stereotypy
- Procedure same as Experiment 1 with addition of brushing and DPT



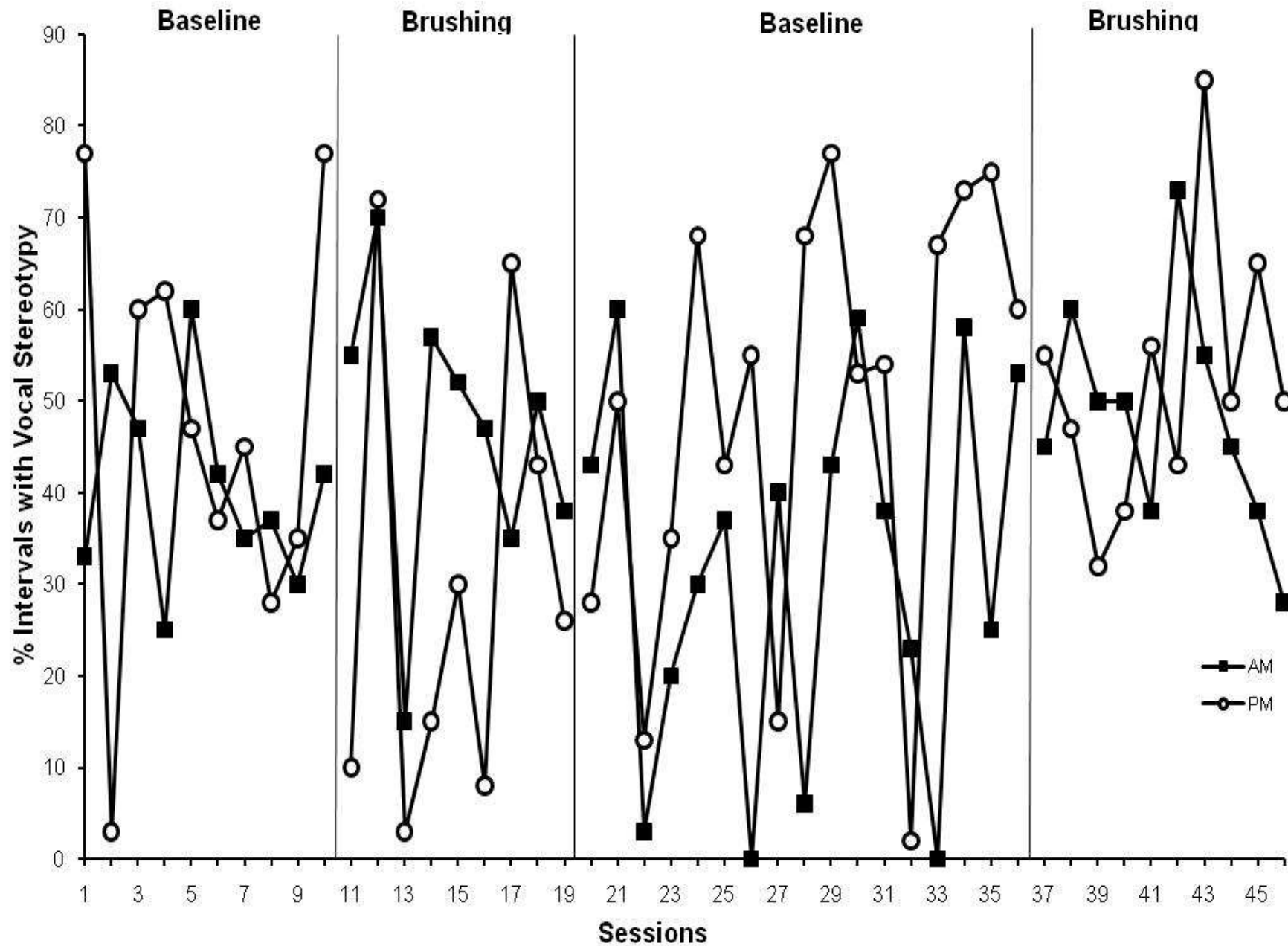
Sensory Diet + Brushing- Dave



Sensory Diet + Brushing- Matt



Brushing Only- Erin



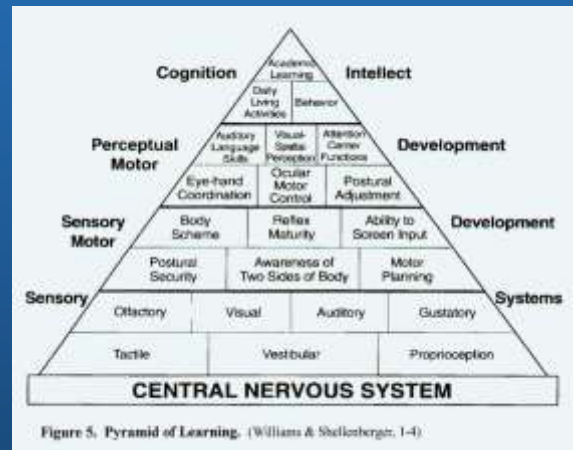
Discussion

- SI ineffective in all three studies
 - May increase stereotypy
 - Even when implemented more rigorously than standard treatments
- Concerns about time
- Social validity concerns
- Further research
 - Validate ineffectiveness



Stereotypy: Etiology

- Sensory processing problem
(e.g., Ringman & Janovic, 2000)



- Operant behavior (Ahearn et al., 2003)
- Impoverished environment
(e.g., Berkson, 1983)

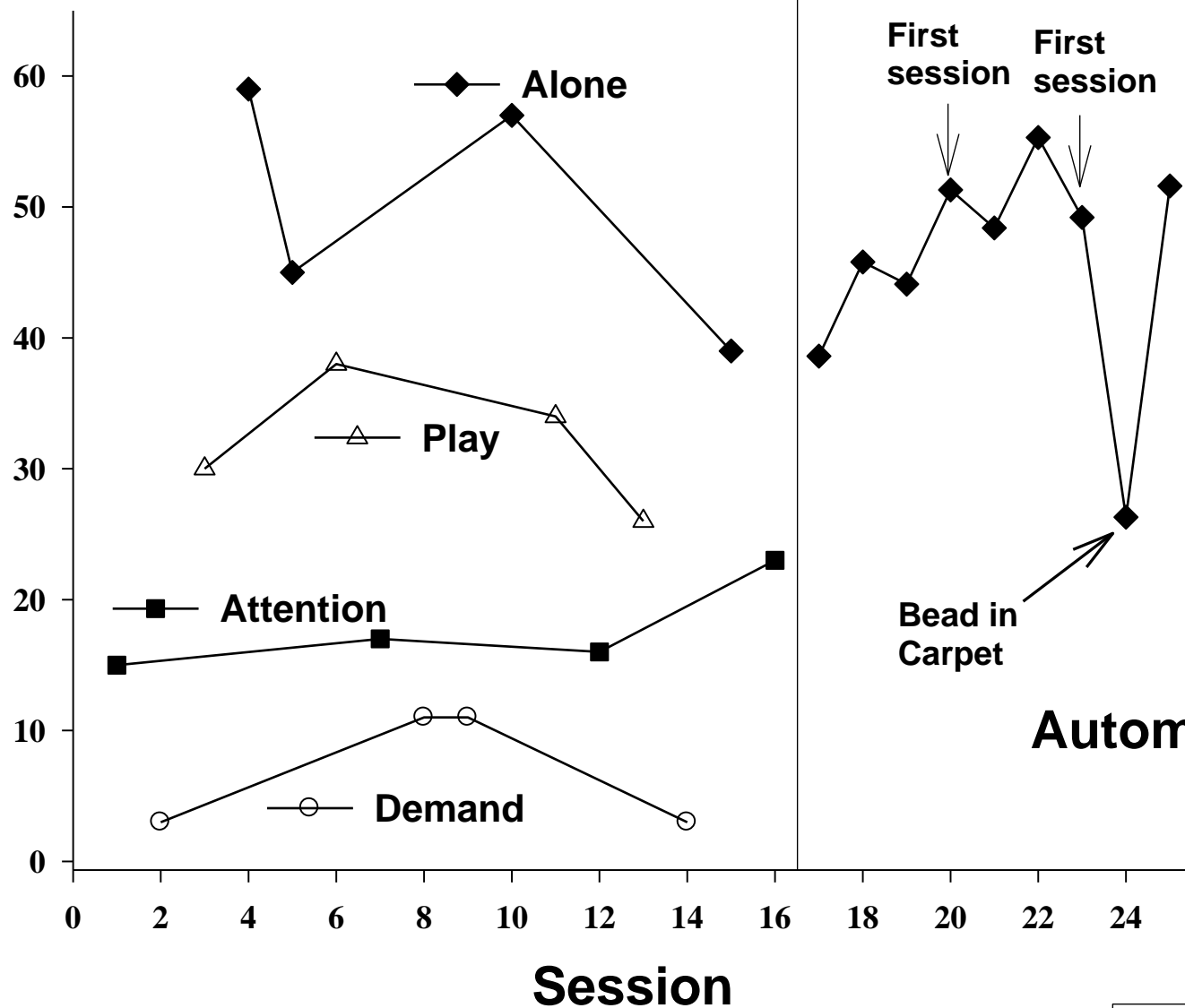
Functional Hypotheses

- ⇒ **Automatically-reinforced response**
(Lovaas, Newsom, & Hickman, 1987)
- ⇒ **Related to demand**
(Mace et al., 1987)
- ⇒ **Suppressed by contingent isolation**
(Pendergrass, 1972)
- ⇒ **Multiply-controlled response**
(Kennedy et al., 2000)

Percentage of intervals with Vocal Stereotypy

Multi-element

Blocked Alone



Automatic SR+

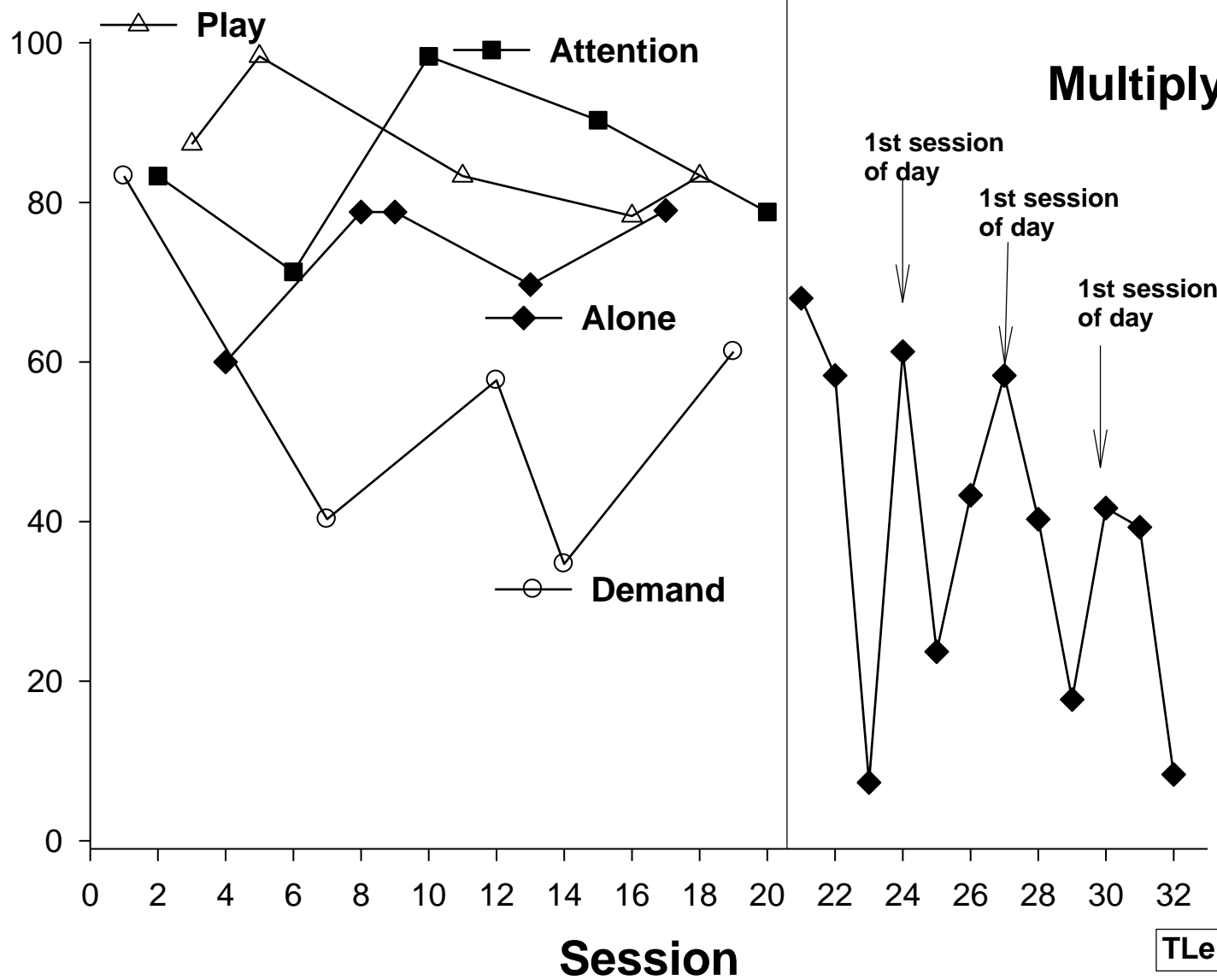
Mark

Percentage Occurrence - Vocal Stereotypy

Multi-element

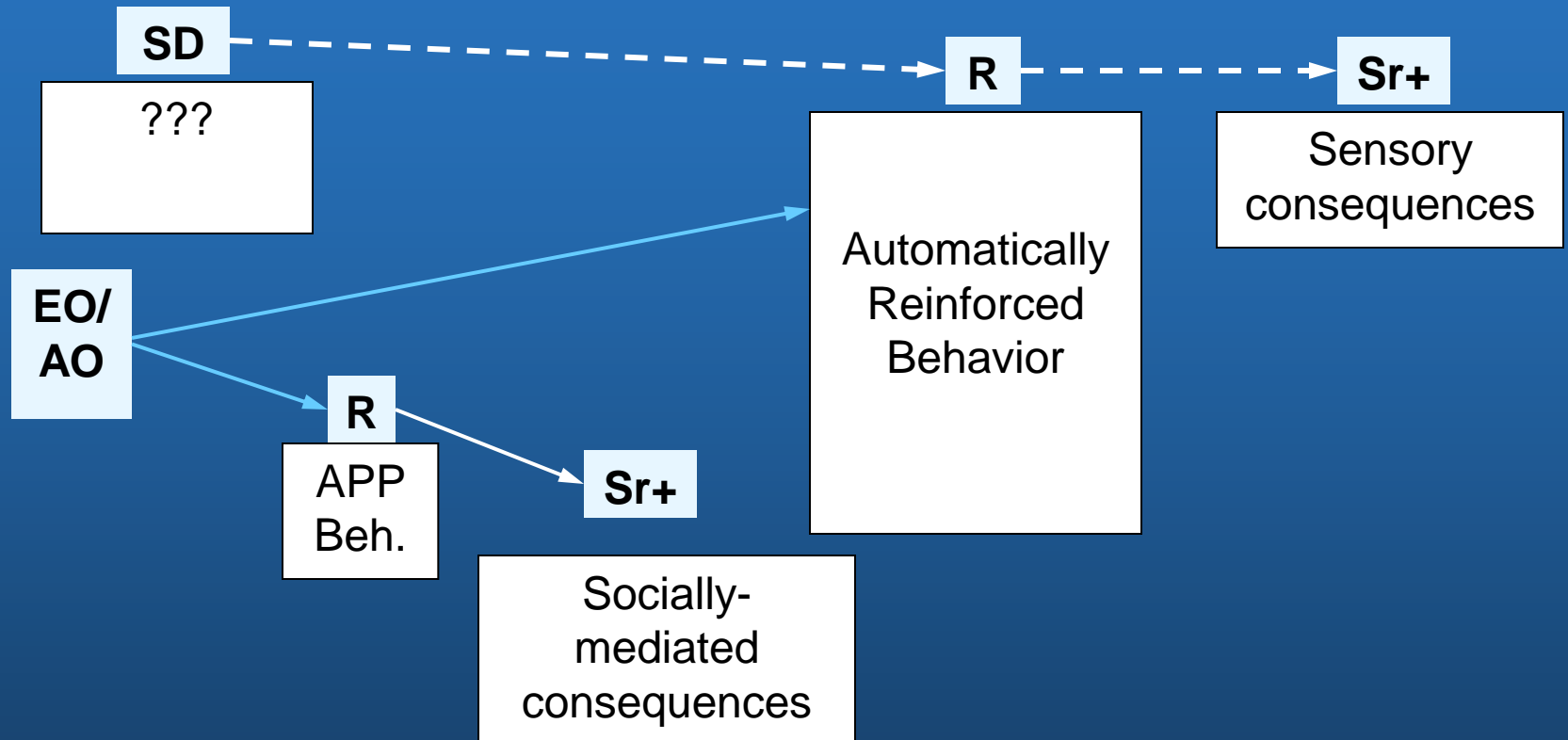
Blocked Alone

Multiply Controlled



TLe

Context: Presence of others



An aside on vocal stereotypy

- VS observed to increase after vocal imitation trg
(Lovaas et al., 1977/1987)
- Developmentally appropriate
(Nakanishi & Kenjiro, 1973)
- Interfering, stigmatizing, communicative?
(Schreibman & Carr, 1978)
- Elimination or control
(Charlop, 1983; Luce & Dyer, 1996)

A Case History in Best Practice

- Stereotypic behavior circa 2000
 - Status as functional operant class
 - Manualized recommendations
 - Status of evidence
- Establish competing behavior! How?
- RB for Auto SIB (N=1-2)...
- NCR (Piazza et al. 1998/2000)?
 - Ahearn et al. (2003/2005)
- DRO! (but does not foster CB!)
- DRA?

Response Interruption + RD – Ahearn et al. (2007)

- **5-minute sessions**
 - No interaction baseline**
 - Reinforce requesting/app speech**
- **Contingent upon vocal stereotypy**
 - Establish attention (eye contact)**
 - Ask social questions (hi-p compliance)**
 - Reinforce requesting/app speech**

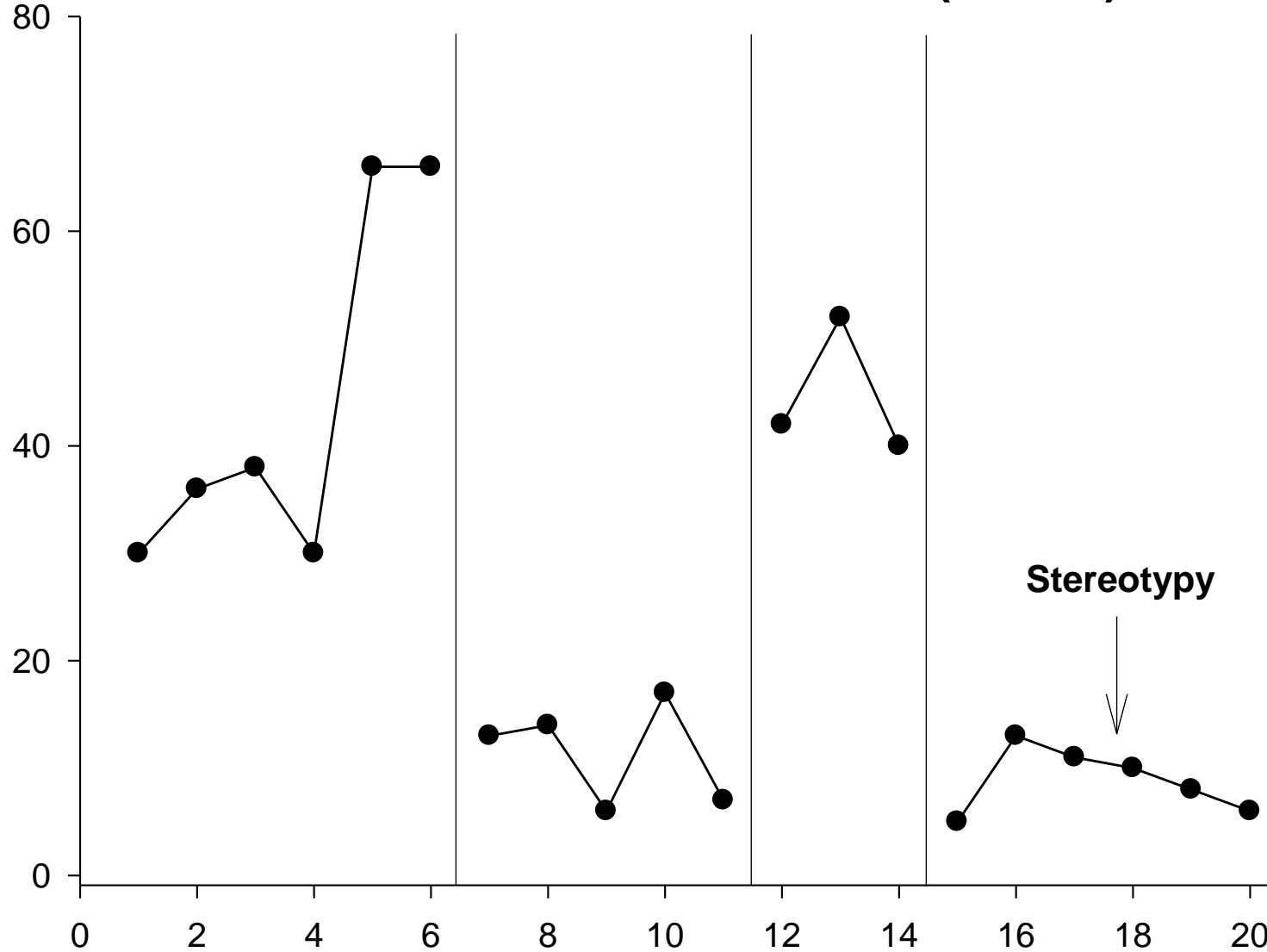
Percentage of intervals - Vocal Stereotypy

BL

RI+RD

BL

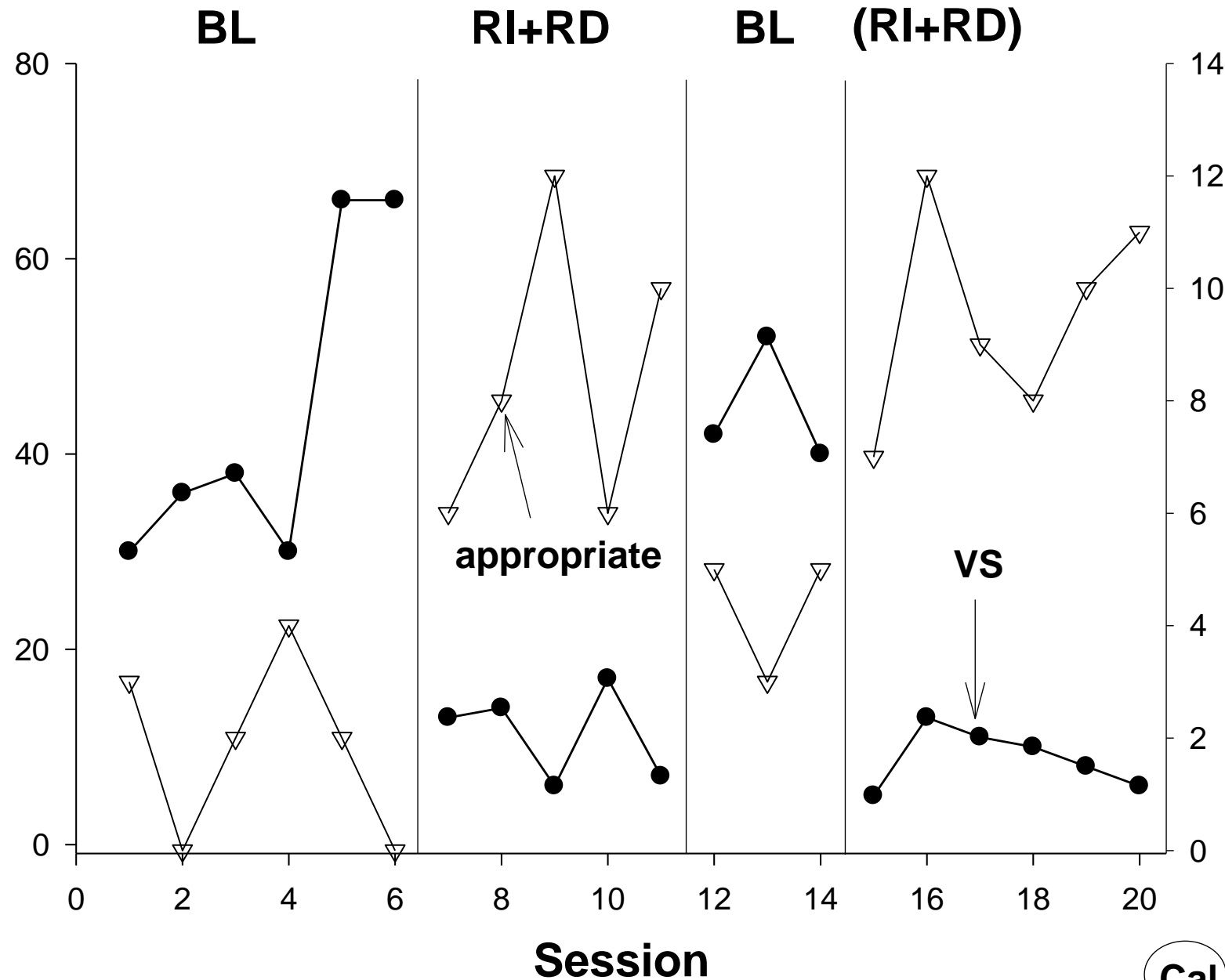
Response interrupt
+ redirect
(RI+RD)



Session

Cal

Percentage of intervals - Vocal Stereotypy



Cal

A Best Practice Revealed

- Spurred a flurry of studies on this technique
 - Martinez & Betz (2013)
- Several variants of RIRD effective
- TX comparisons have favored RIRD (however!)
- Added components that target supporting adaptive skills likely superior to RIRD alone
 - Colon, Ahearn et al. (2012)
- Vanderkerken et al. (2013)
 - Meta-analysis of SCE for VCB (N=74)
 - Large TX effect (e.g., RIRD – VS+)

RIRD video

Clip 4 - BL

Clip 5 – RIRD 1st session

Best Practice is not RIRD

Clip 6 – Teaching social reciprocity

Clip 7 – Generalization

Establish Appropriate Behavior

- **Social interaction (via prompting)**
(e.g., Odom & Strain, 1986; MacDonald et al., 2009)
- **Play skills (via prompting & whatever)**
(e.g., Libby et al., 2009; Tereshko et al., 2011)
- **Collateral effects → Less stereotypy**

VM videos

Clip 1 - BL

Clip 2 - Trg

Stereotypy: Prevalence

- During typical development
 - Children
 - Adults (e.g., Rojahn et al., 2000)
- Sensory impairment
 - Blind (e.g., Fazzi et al., 1999)
- IDD/MR
 - (Berkson et al., 1999)
- ASD
 - (Lewis & Bodfish, 1998)
 - (Cuccaro et al., 2003)

Why is it important?

- Occurs in typical development
- Skill acquisition
(e.g., Dunlap et al., 1983)
- Socially unacceptable
(e.g., Wolery et al., 1985)
(e.g., Jones et al., 1990)

Behavioral interventions for Auto SR+

- **Establish appropriate behavior**

(Schreibman & Carr, 1978; Matson et al., 1993)

- **Differential consequences**

(Palyo et al., '79; Steege et al., '89)

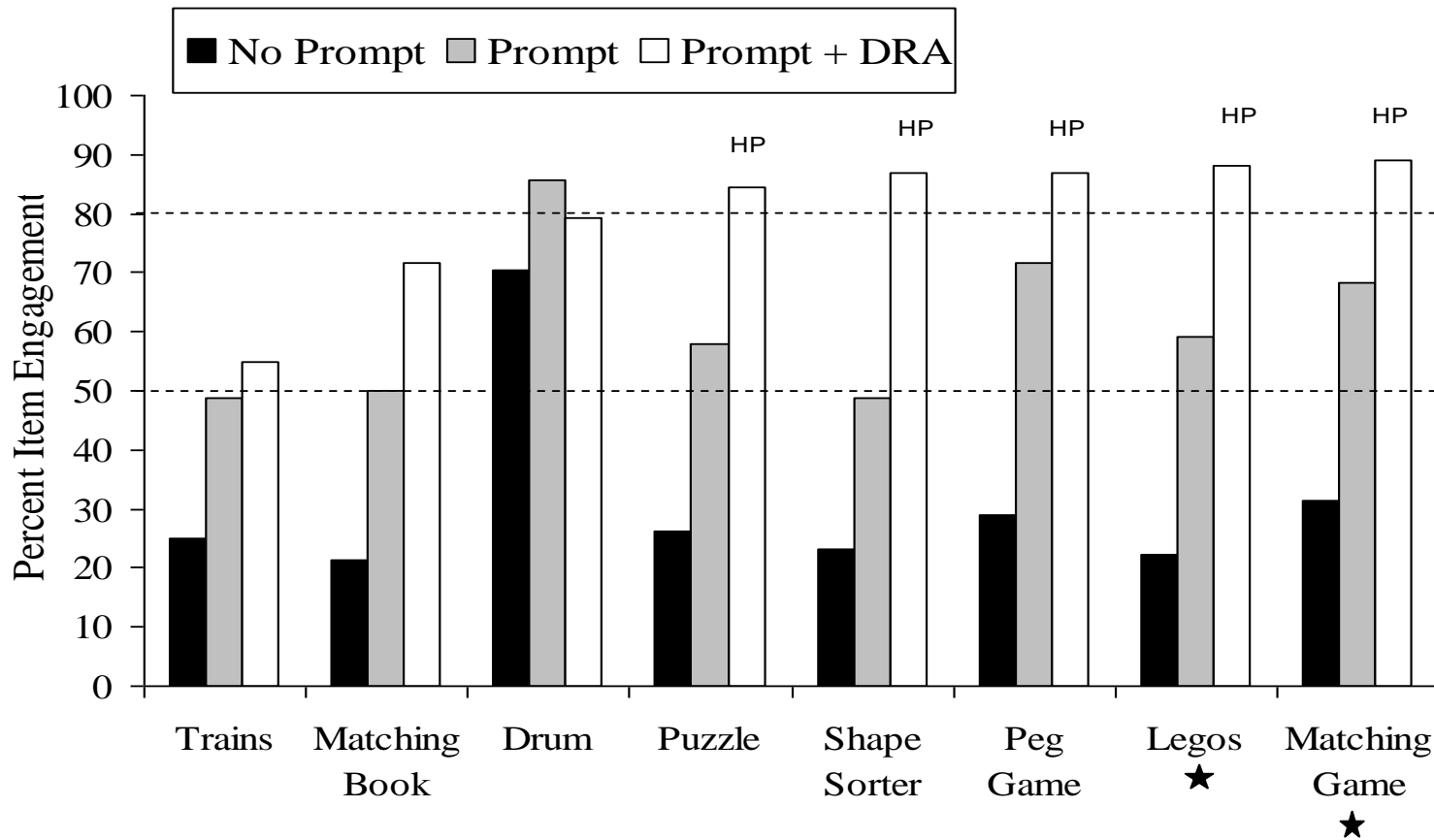
- **Response competition**

(Vollmer et al., '94; Piazza et al., '98/00)

- **Response blocking (interruption)**

(Ahearn et al., '07; Reid et al., '93)

Prompt + DRA Results - Doug



Move to response competition

- **Matching sensory consequence**
(Piazza et al., 1998/2000)
- **The role of preference**
(Ahearn et al., 2005; Vollmer et al., 1994)

Competing Items Assessment

Piazza et al. (1998/2000)

- Response competition is common approach for automatically maintained problem behavior
- Compared matched and unmatched stimuli effect on automatically maintained problem behavior
- Hypothesized that automatically reinforced problem behavior is less probable when levels of environmental stimulation are enriched

Responses Per Minute

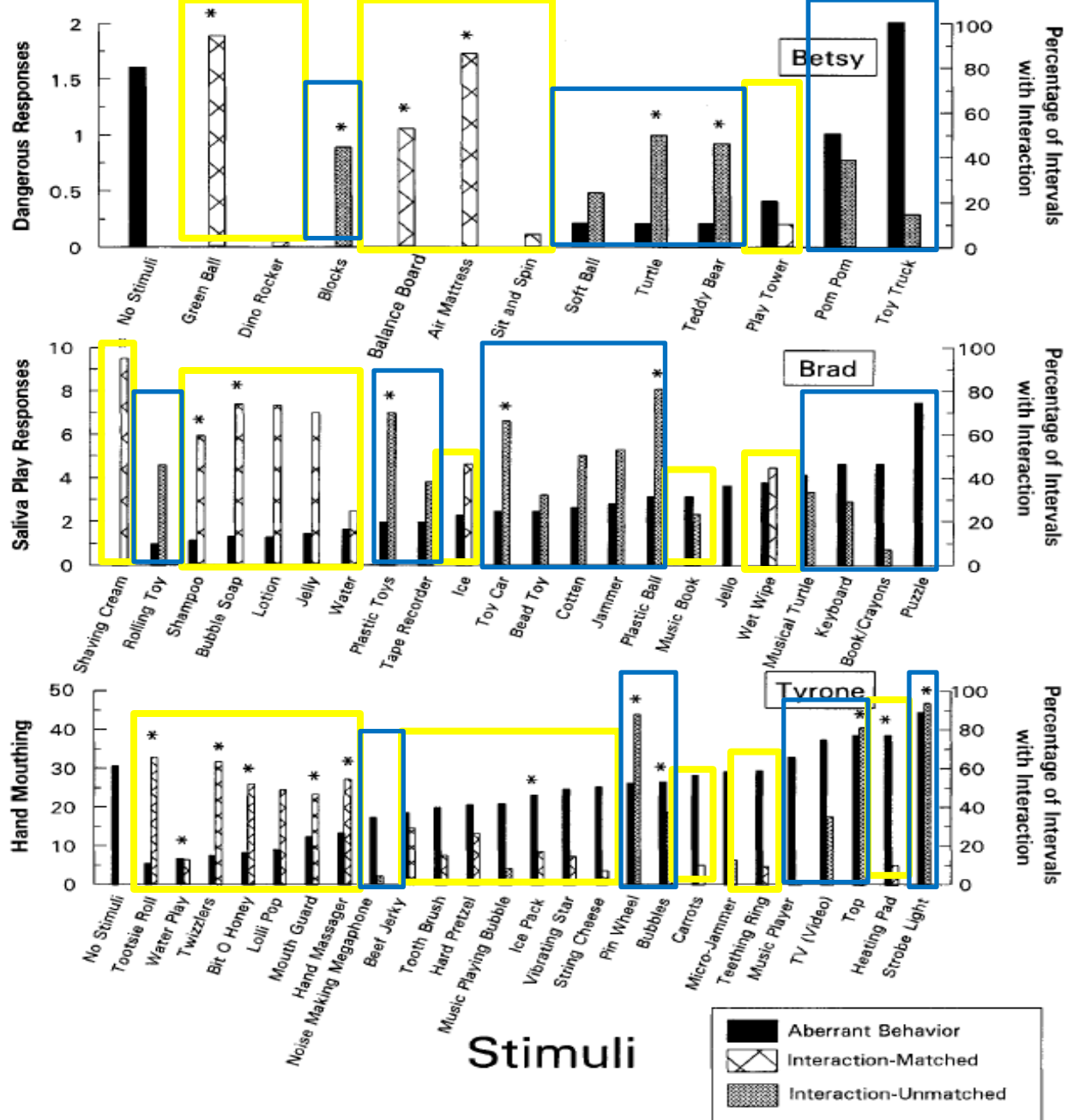
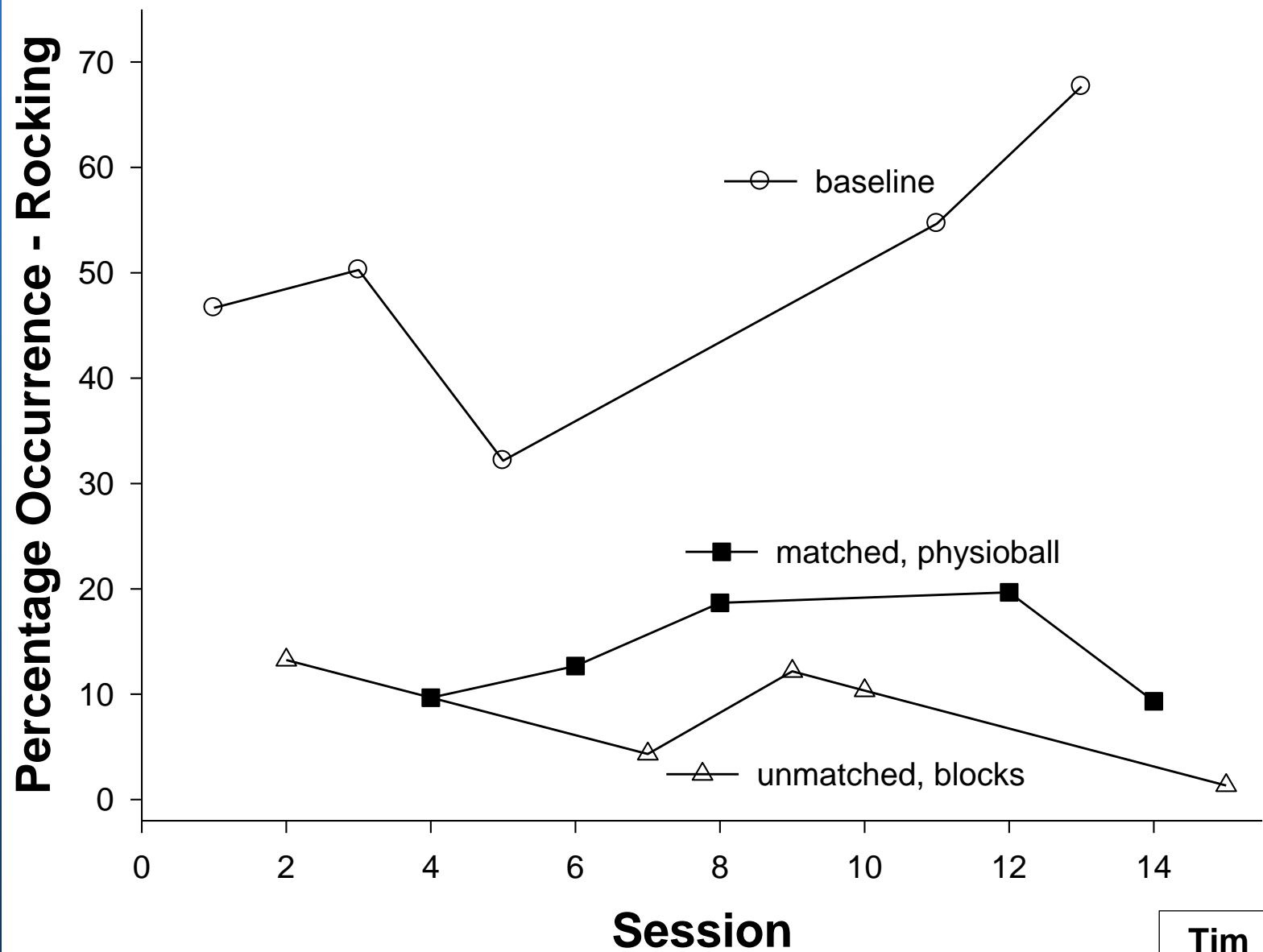


Figure 2. Aberrant behaviors per minute (solid bars), duration of item interaction with matched stimuli (hatched bars), and duration of item interaction with unmatched stimuli (dotted gray bars) during the stimulus preference assessments for Betsy (top panel), Brad (middle panel), and Tyrone (bottom panel). The items denoted with asterisks were used in the evaluation of matched and unmatched stimuli.

**Ahearn, W.H., Clark, K.M., DeBar, R.,
& Florentino, C. (2005).**

- **Duration of engagement assessment**
 - 8 min sessions**
 - Continuous access**
 - Matched/Unmatched items**
- **Measure engagement/stereotypy**
- **Items w/ high engagement in CIA typically compete**



Tim

Problems with competition

- Engagement not incompatible w/ stereotype
- Engagement not always functionally appropriate
- Appropriate speech and other app. behavior not addressed

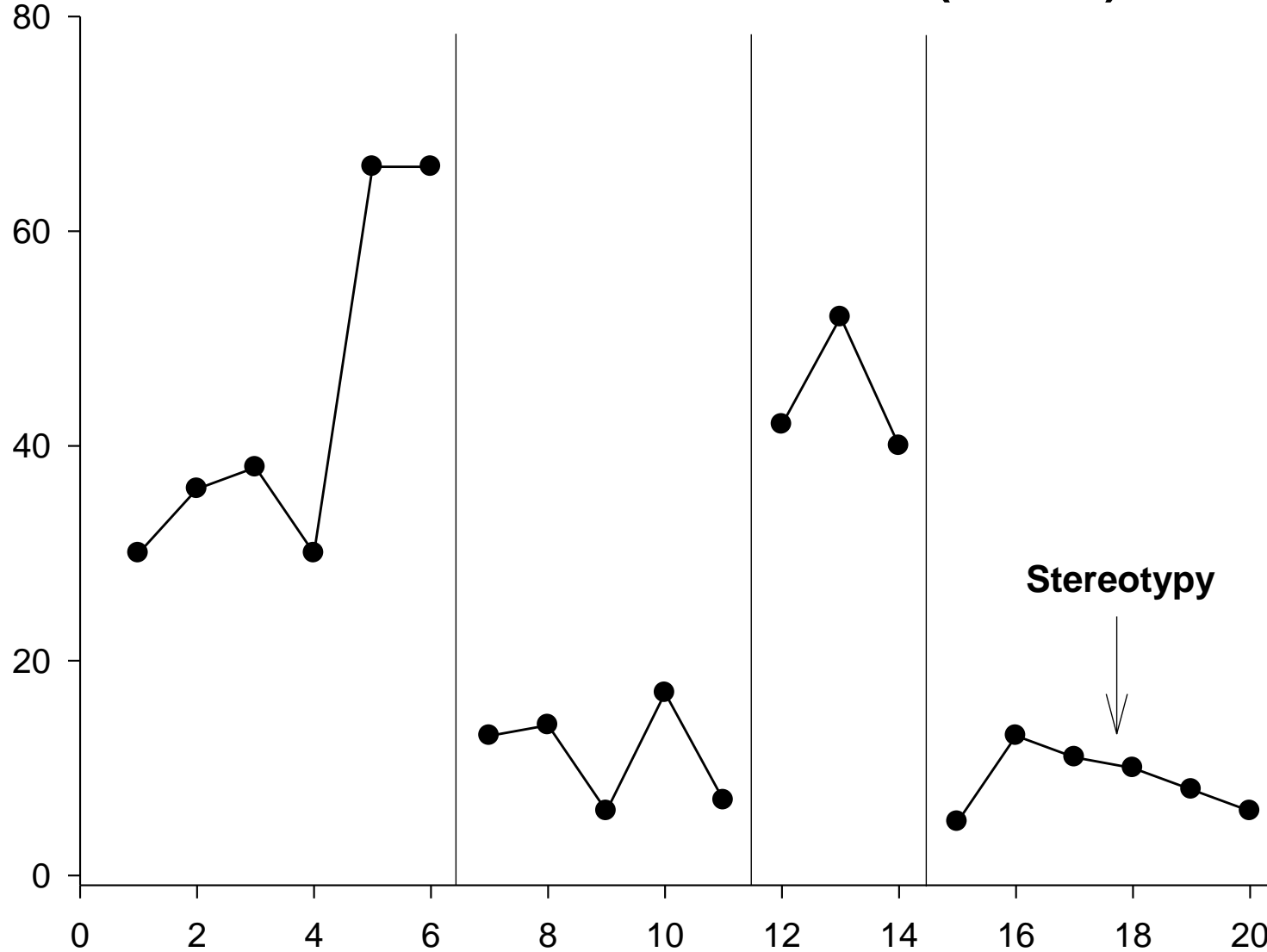
Percentage of intervals - Vocal Stereotypy

BL

RI+RD

BL

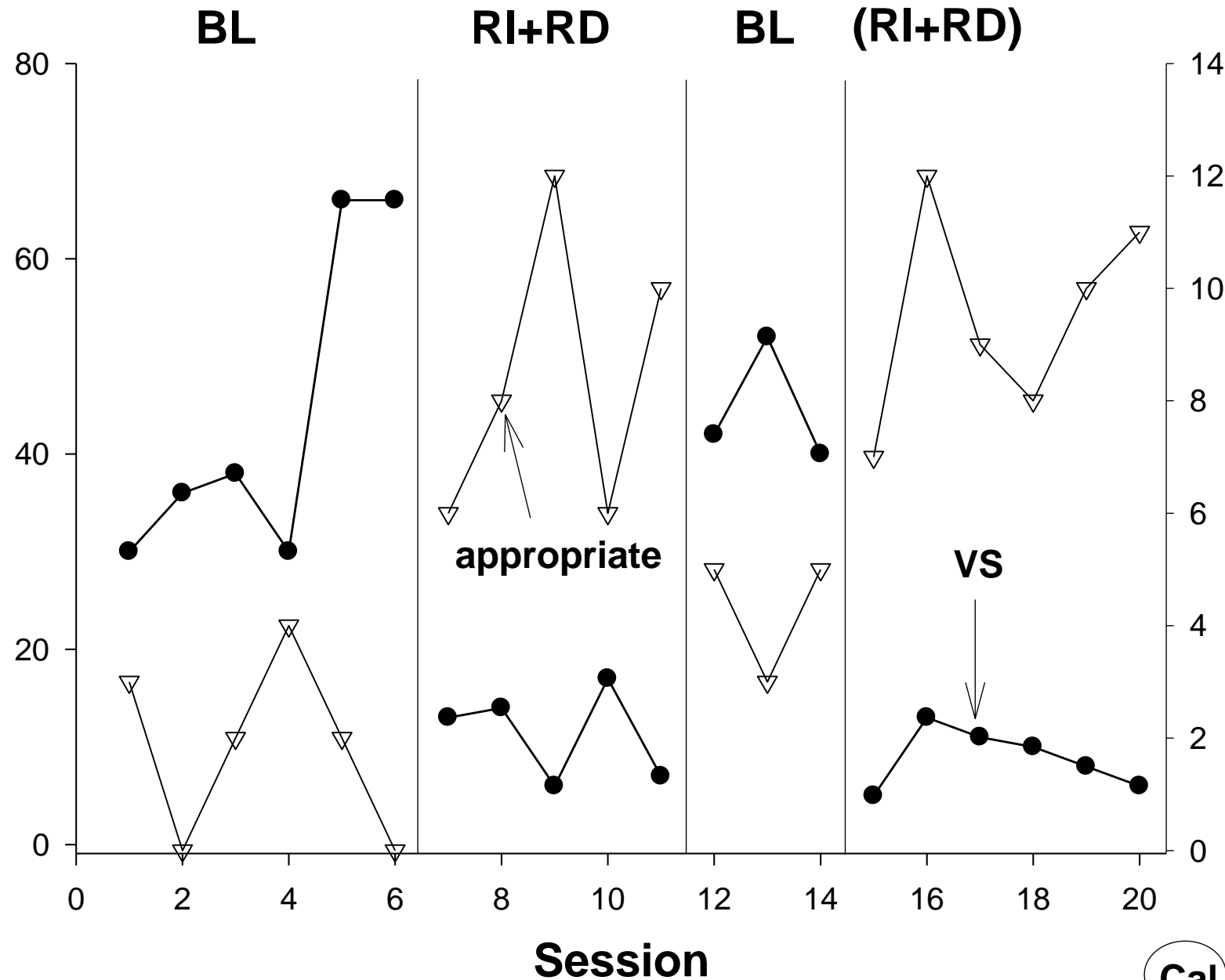
Response interrupt
+ redirect
(RI+RD)



Session

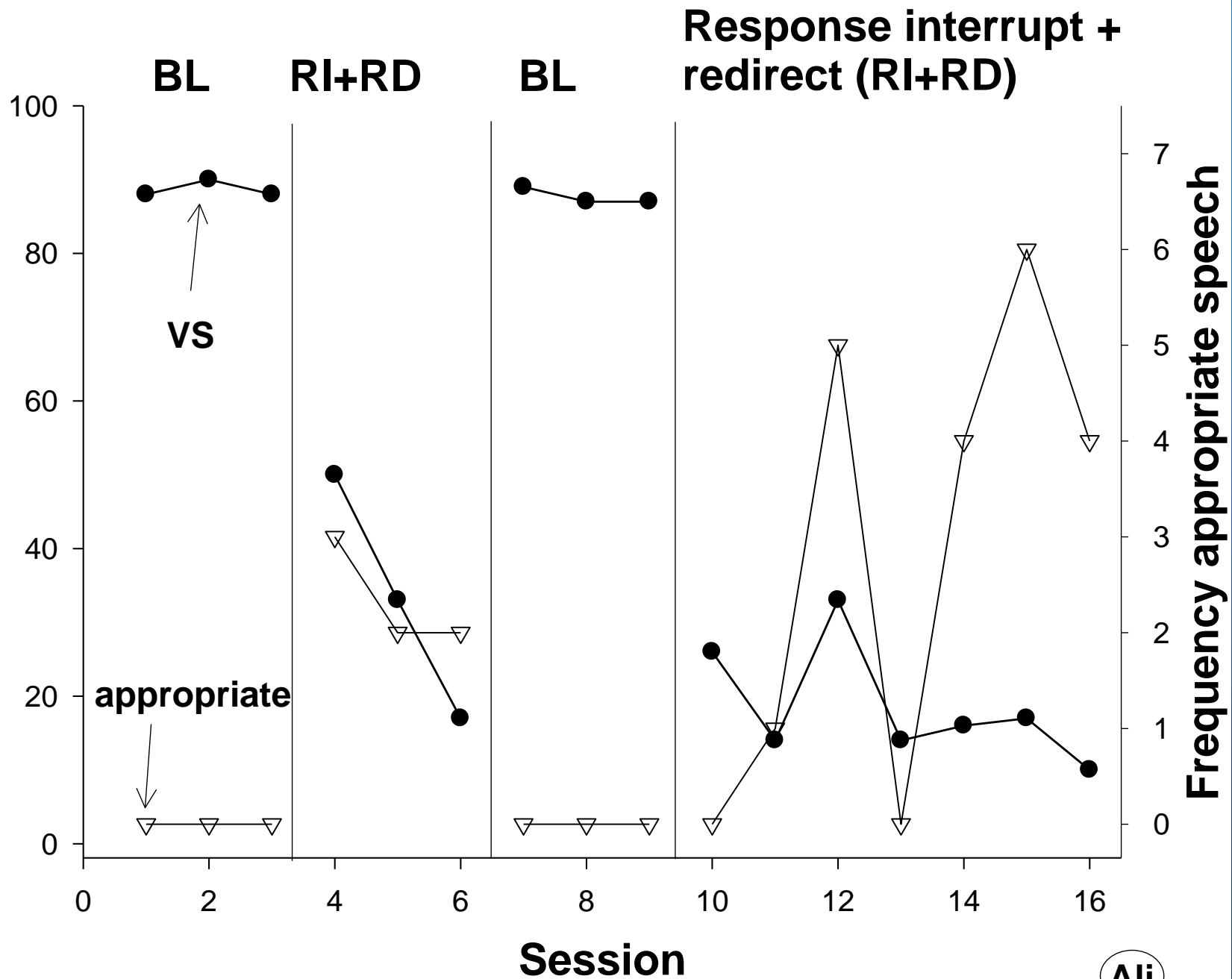
Cal

Percentage of intervals - Vocal Stereotypy



Cal

Percentage of intervals - Vocal Stereotypy



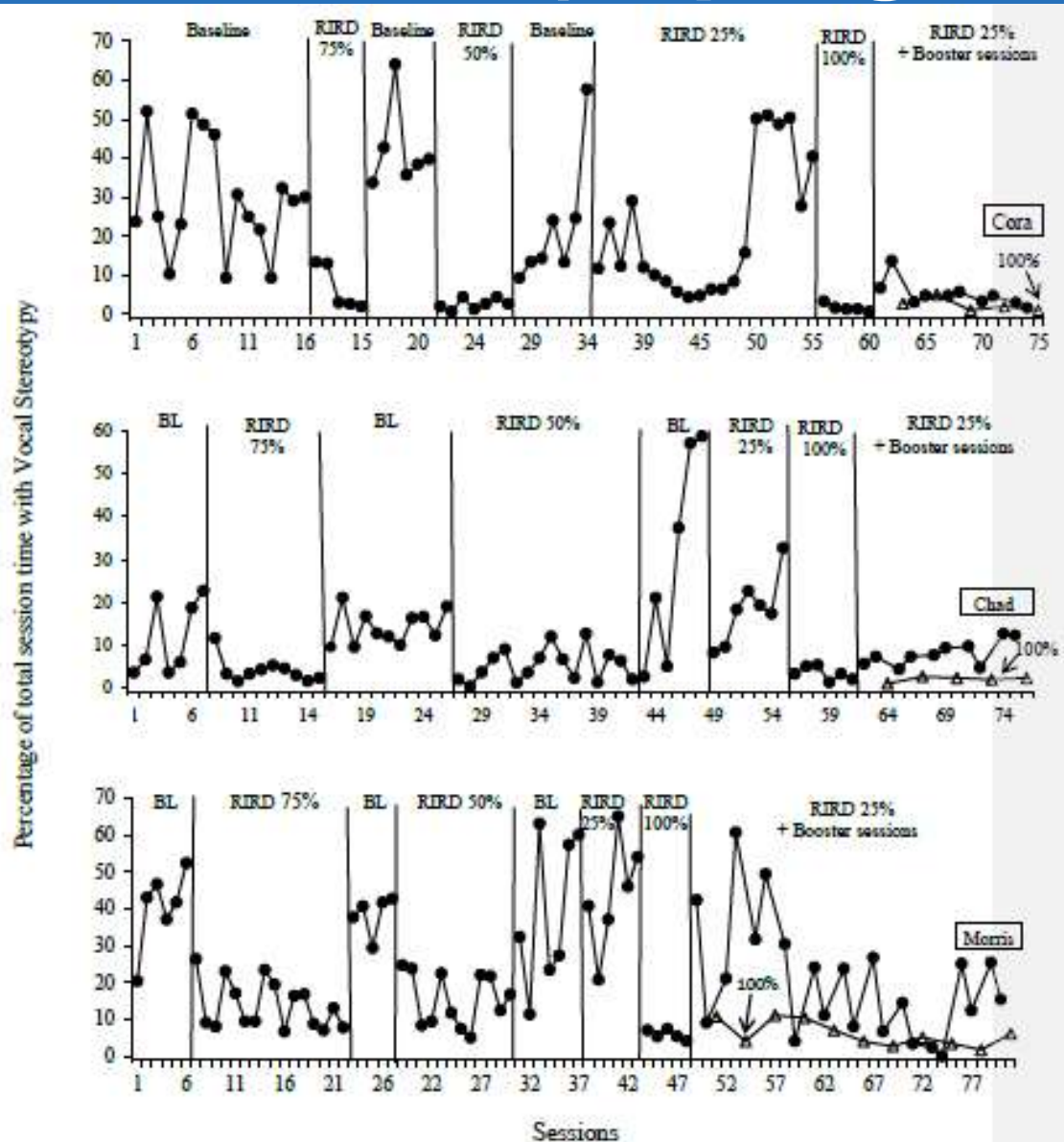
Findings

- Interruption - quick decrease in VS
- Appropriate speech more probable
- Adding materials may be necessary to increase requesting
- Intervention requires 1:1 staffing

Requires high integrity

Effortful

Colon & Ahearn (in progress)



Response Blocking

- Ahrens, Lerman, Kodak, Worsdell, & Keegan (2011)
 - RIRD-v may not be a possible treatment option for students that are noncompliant or have a limited vocal verbal repertoire
 - RIRD-v vs. RIRD-m (with prompting)

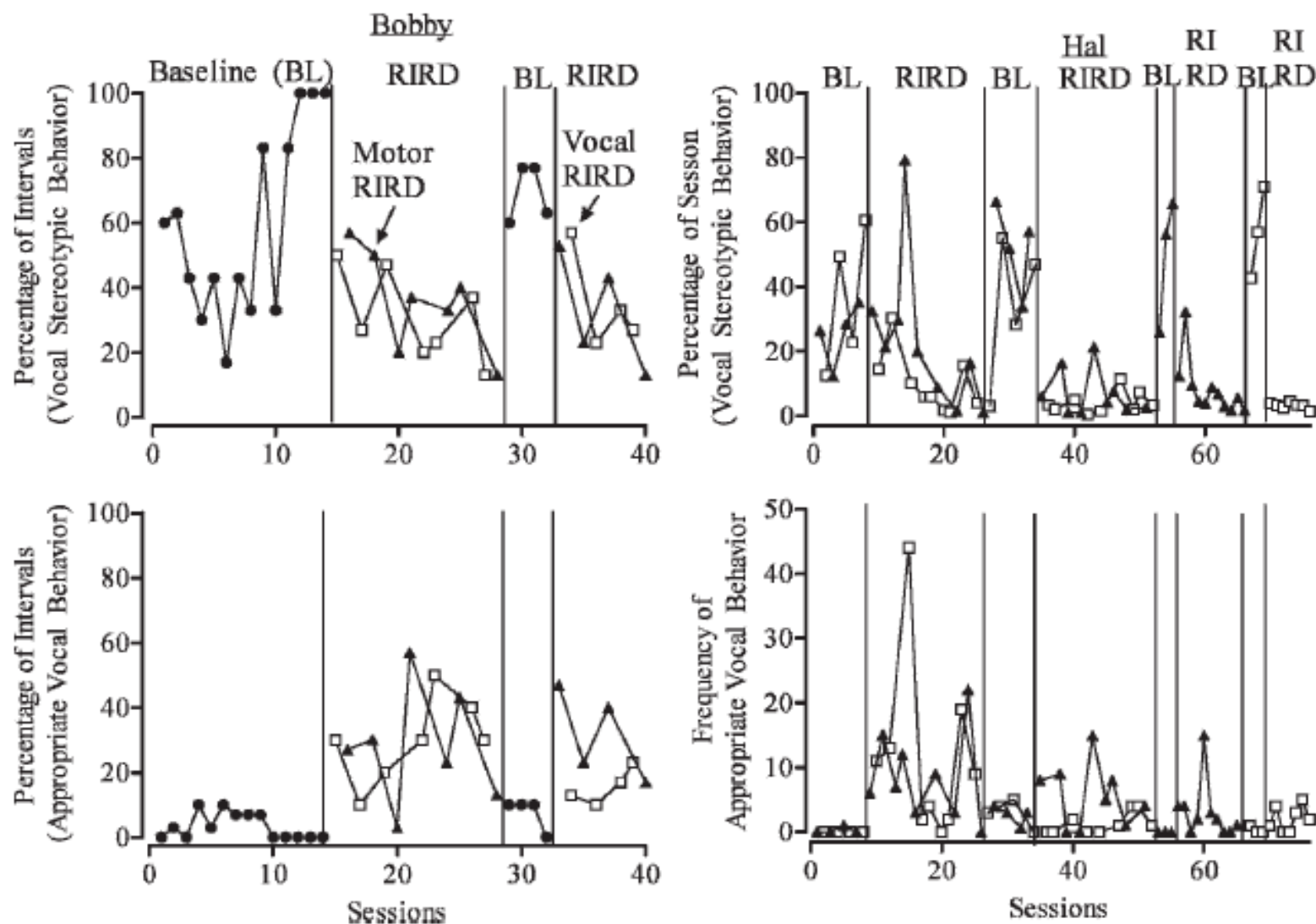
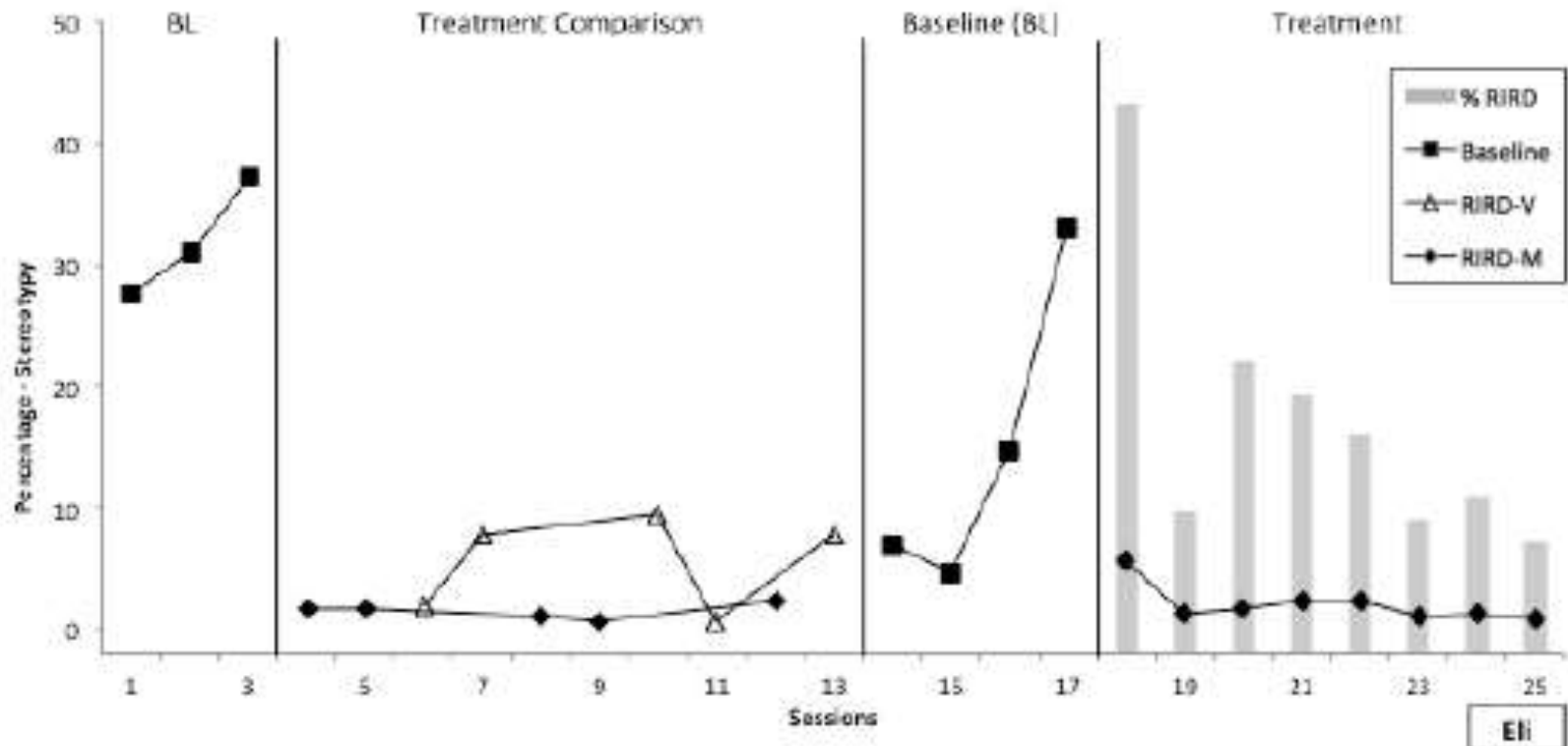


Figure 1. Percentage of intervals with vocal stereotypy (top left) and appropriate vocalizations (bottom left) for Bobby during the treatment comparison. Percentage of session time with vocal stereotypy (top right) and frequency of appropriate vocalizations (bottom right) for Hal during the treatment comparison.

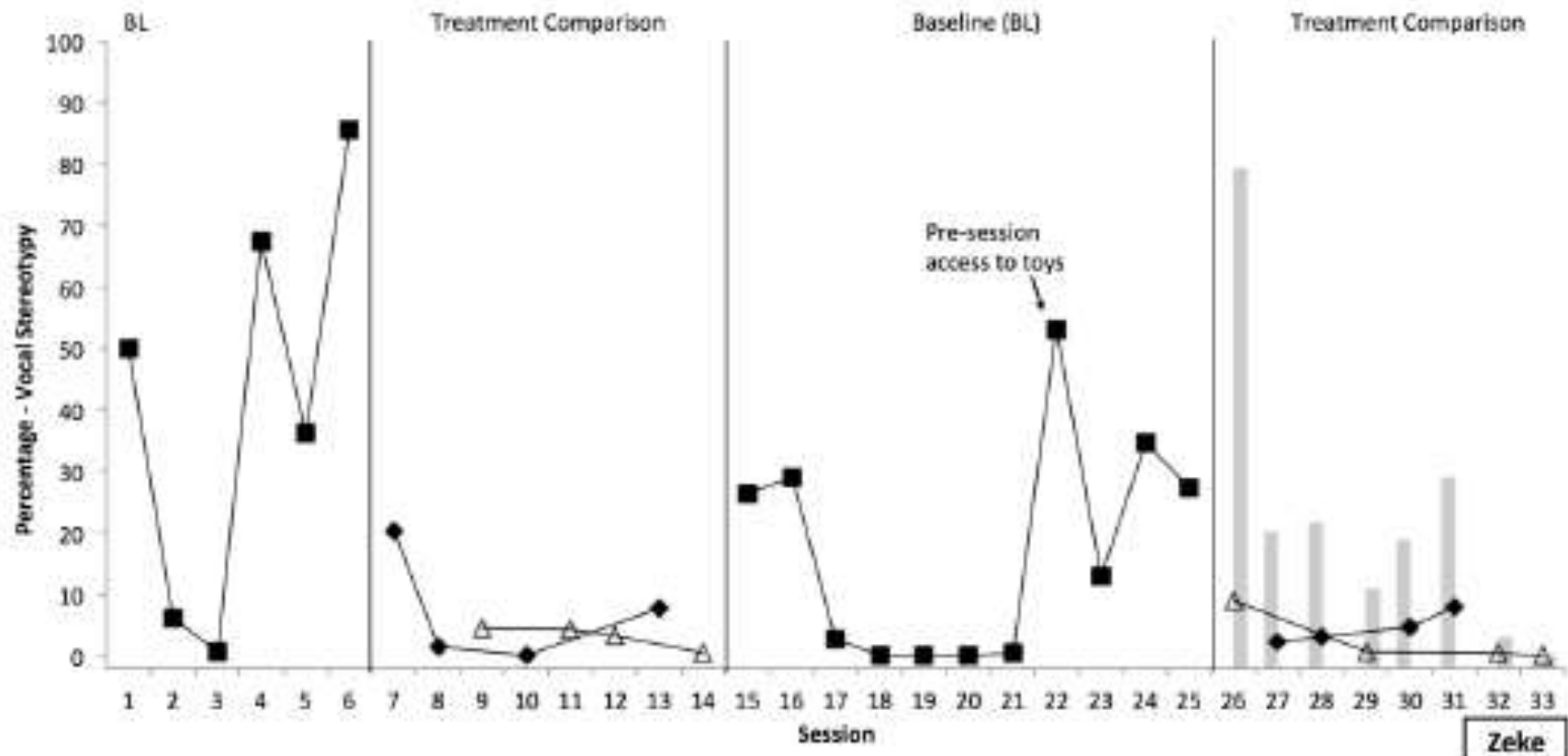
Steinhauser & Ahearn (in prep)

Figure 5. Percentage of each session with motor stereotypy for Eli during the treatment comparison. Percentage of session implementing RIRD indicated with bars.



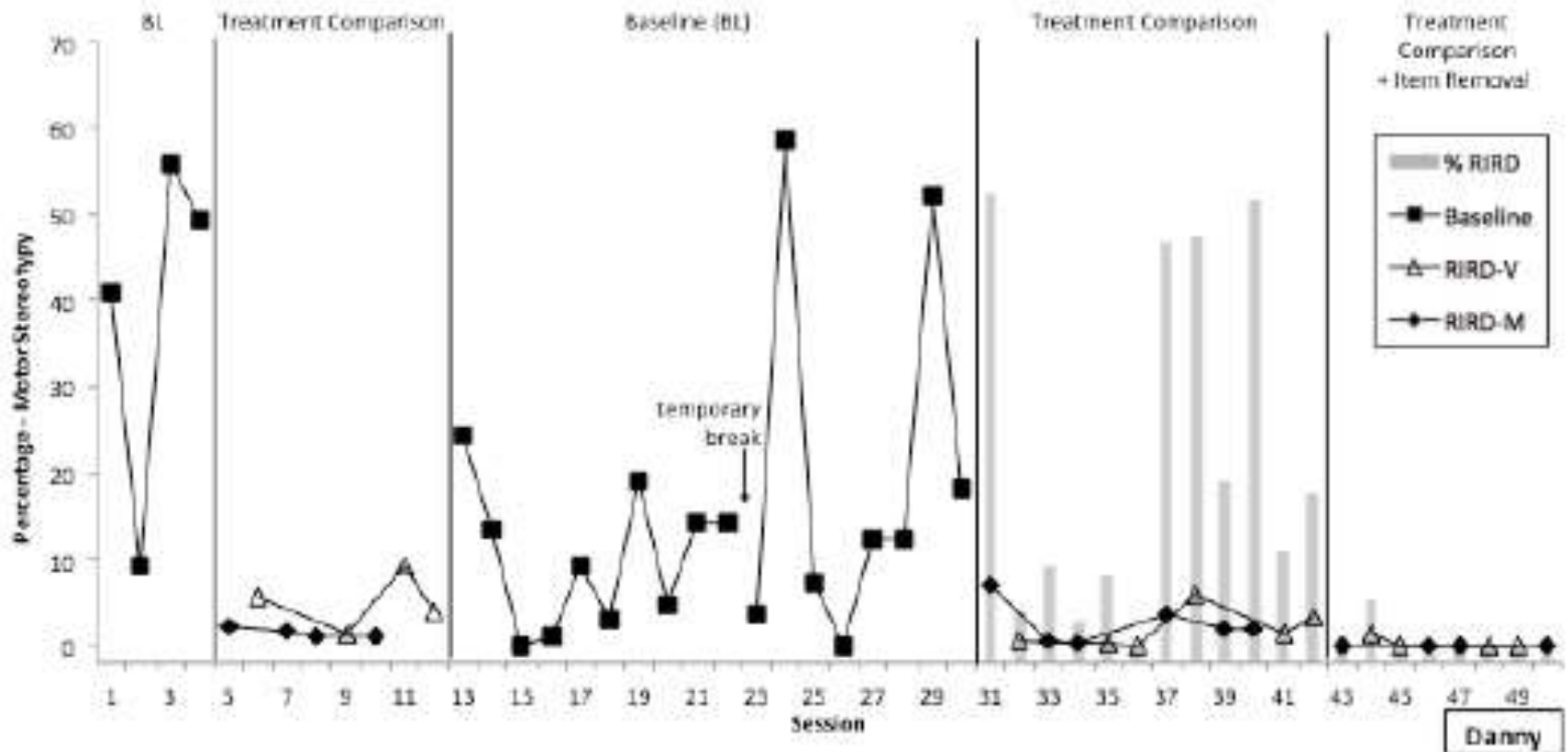
Steinhauser & Ahearn (in prep)

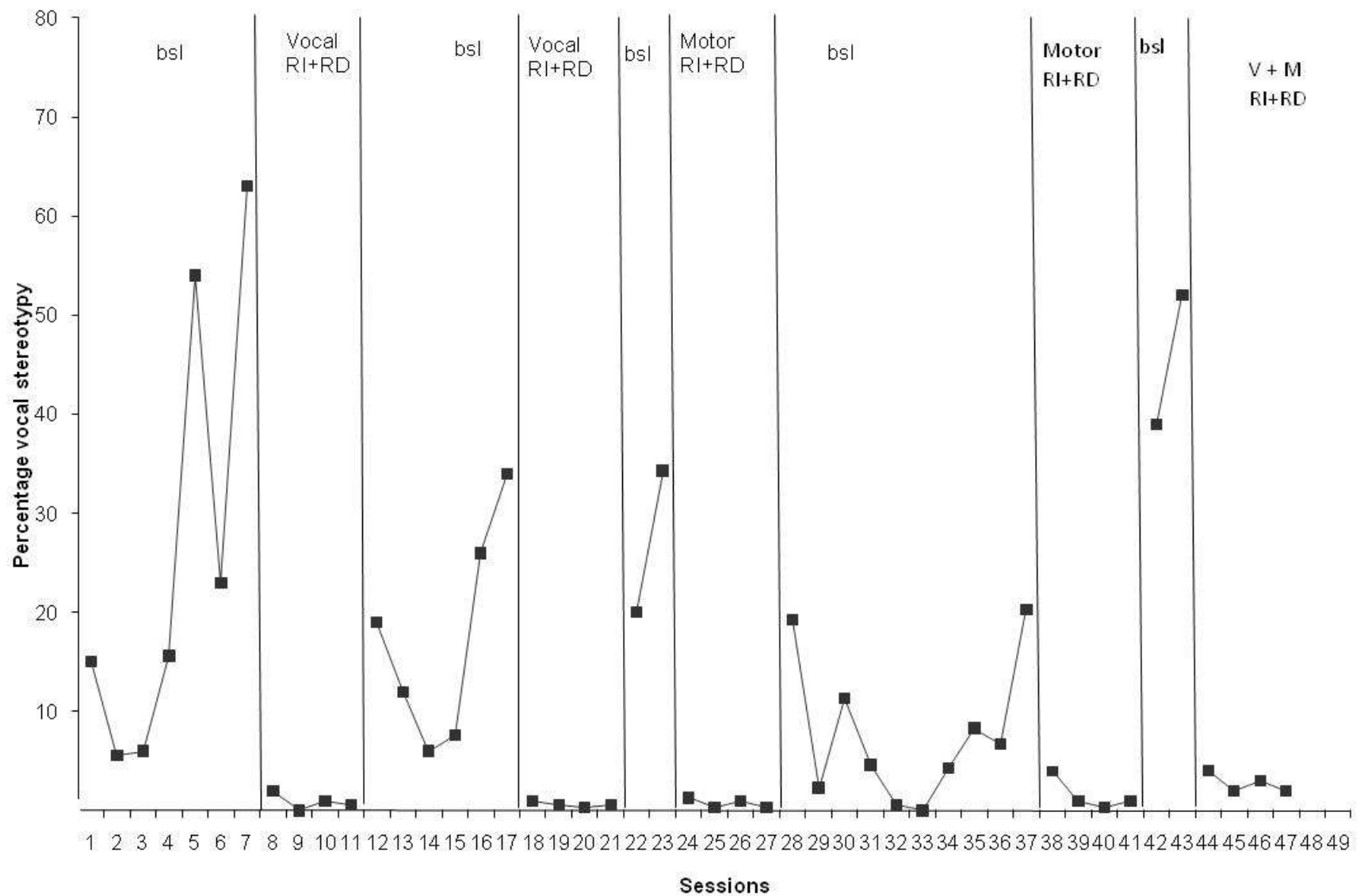
Figure 6. Percentage of each session with motor stereotypy for Zeke during the treatment comparison. Percentage of session implementing RIRD indicated with bars.



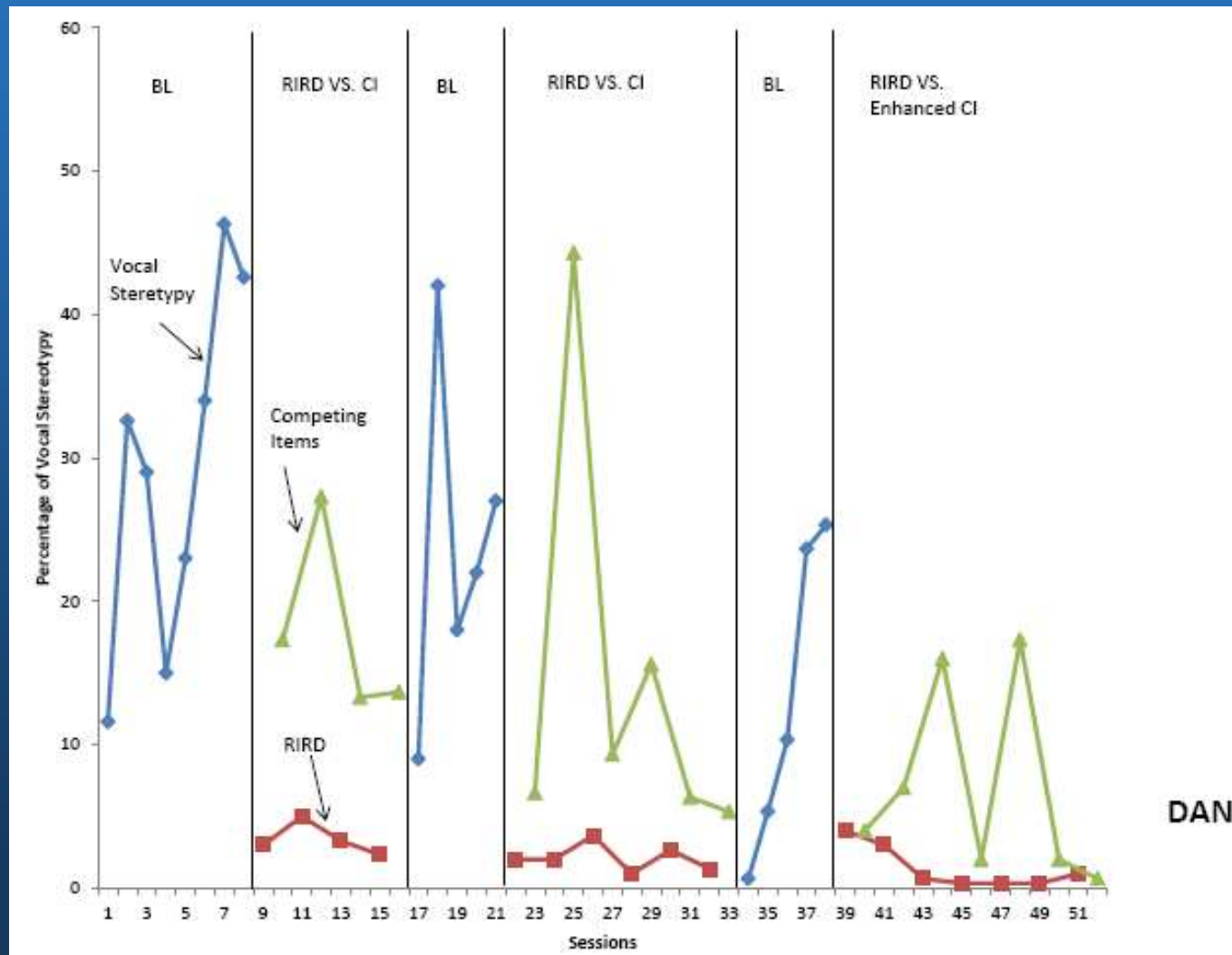
Steinhauser & Ahearn (in prep)

Figure 7. Percentage of each session with motor stereotypy for Danny during the treatment comparison. Percentage of session implementing RIRD indicated with bars.





RIRD variations



Procedural concerns - RIRD

Table 2

RIRD Percentage of Time Spent in Treatment

Column1	Session	RIRD	Phase average	Overall Average
Phase1	1	17.12		
	2	28.74		
	3	21.46		
	4	10.71	20.05	
Phase2	5	12.53		
	6	11.76		
	7	10.97		
	8	6.25		
	9	10.97		
	10	17.12	11.72	
Phase 3	11	6.25		
	12	8.81		
	13	3.53		
	14	1.63		
	15	3.53		
	16	1.63		
	17	5.06	4.41	10.47

Procedural concerns - CI

Table 1

Competing Items Percentage of Engagement

Column1	Session	Engagement	Phase average	Overall average
Phase 1	1	100		
	2	98.35		
	3	100		
	4	98.33	99.17	
Phase 2	5	100		
	6	100		
	7	100		
	8	100		
	9	100		
	10	100	100	
Phase 3	11	100		
	12	100		
	13	97.66		
	14	100		
	15	100		
	16	100		
	17	100	99.66	99.66

Verbal Operant Training

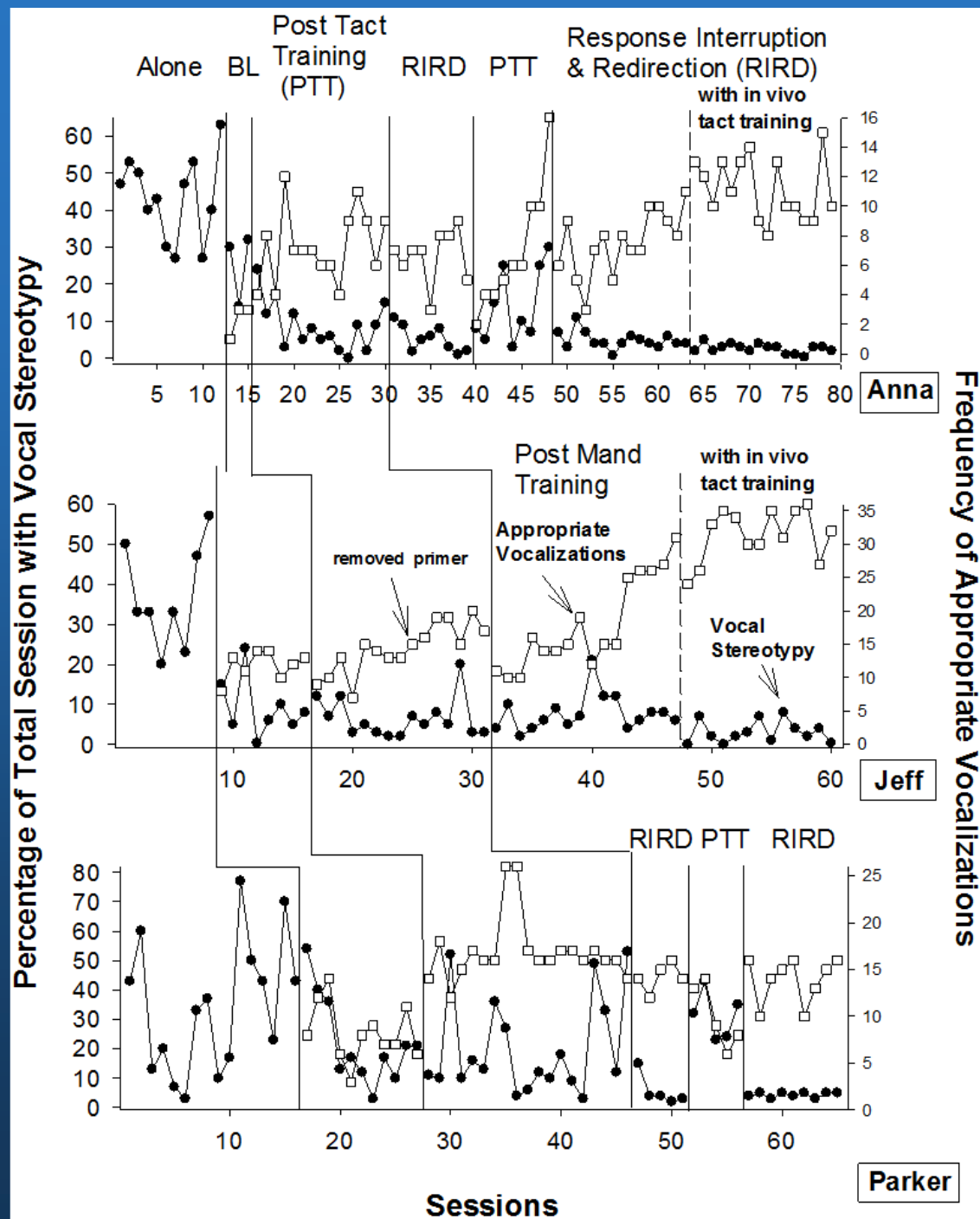
Colon, Ahearn et al. (2012)

- Produce decreased levels of vocal stereotypy and increased levels of appropriate vocalizations
 - Evaluate effect of tact training on occurrence of appropriate vocalizations & vocal stereotypy
 - Evaluate effect of a response interruption/redirection procedure on vocal stereotypy

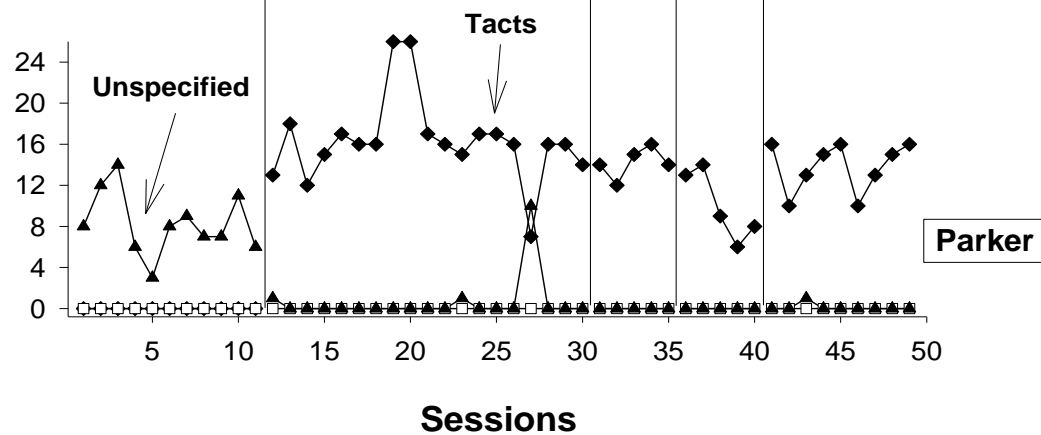
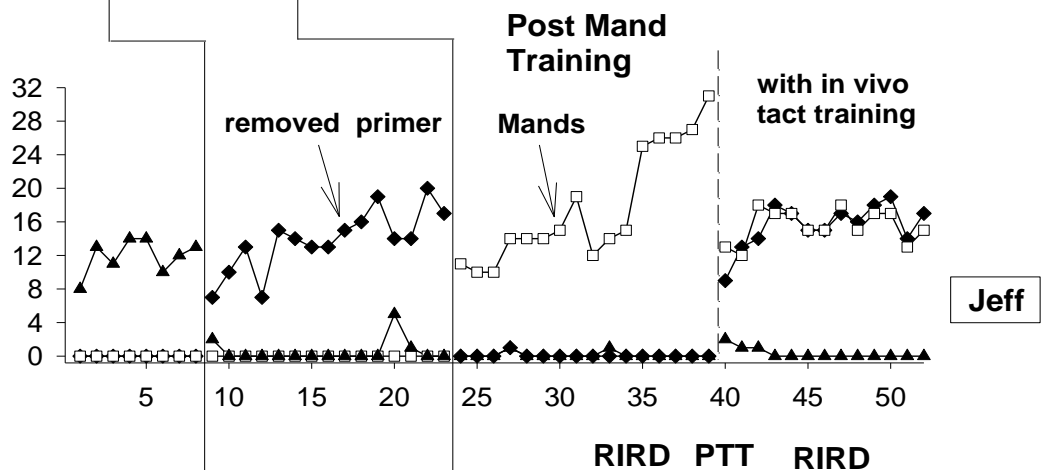
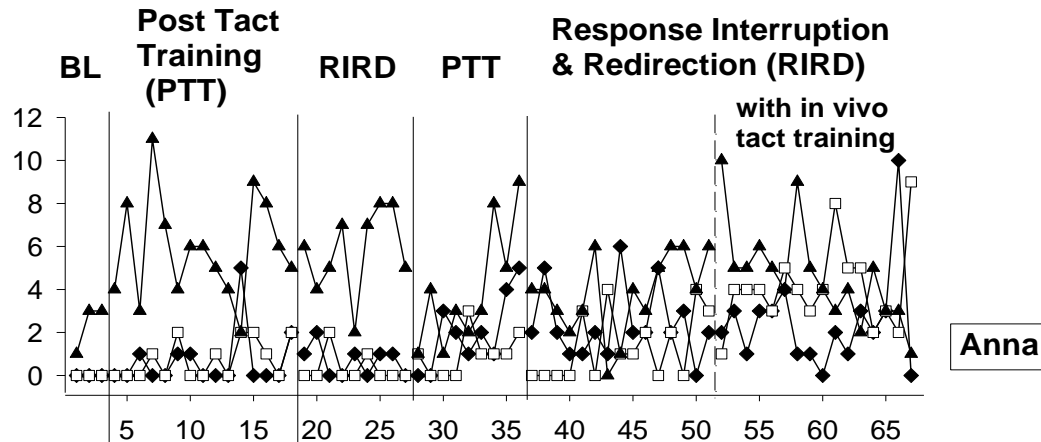


Tact Training

- 4 stimuli trained (2 high preference items from preference assessment & 2 contextually relevant items)
- Progressive prompt delay w/ echoic prompt
- Response modeled, “I see chip”
- Appropriate student response→social praise & tokens exchanged for edible
- Tact training until 90% accuracy

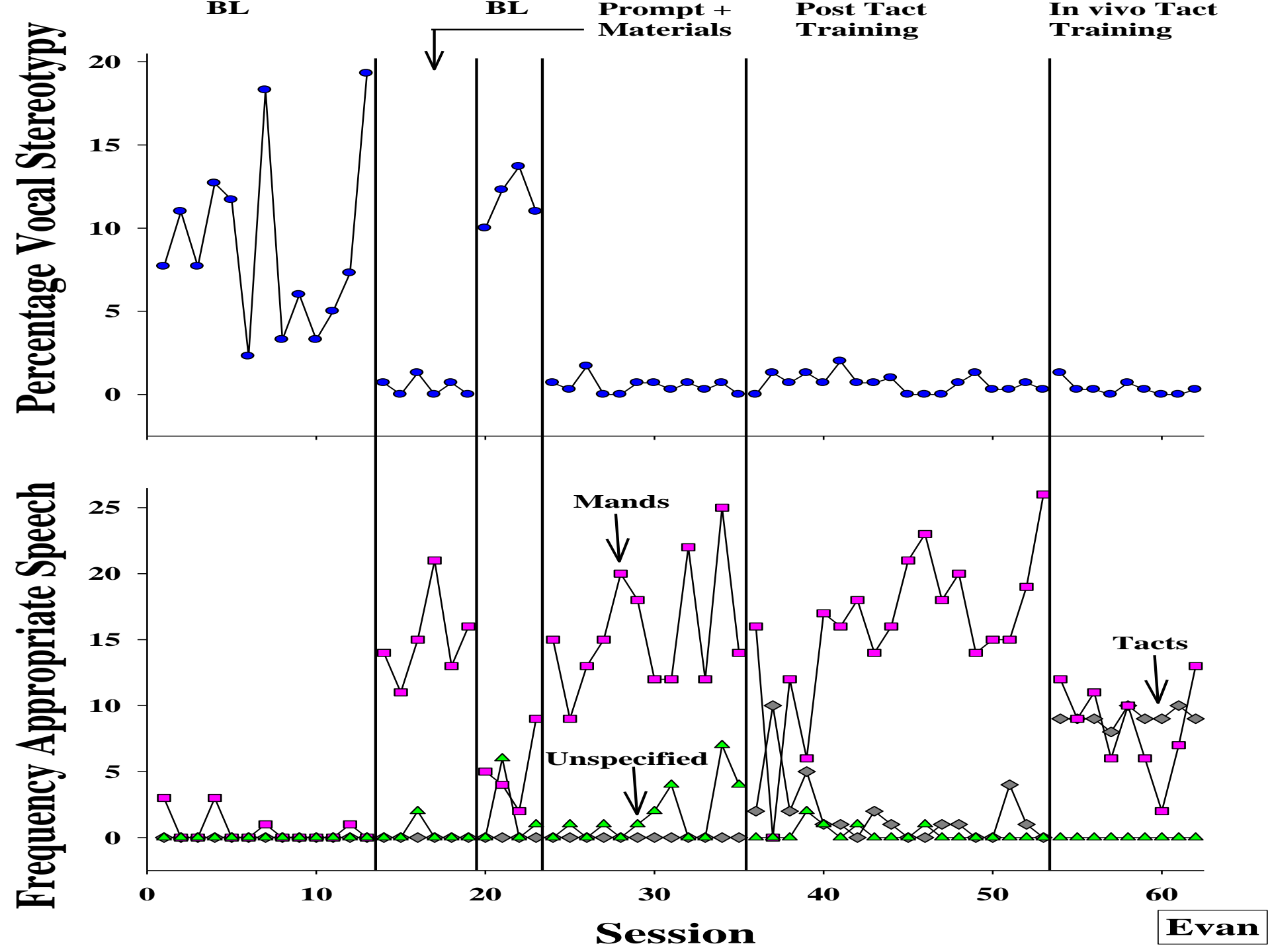


Frequency of Appropriate Vocals



Results-Summary

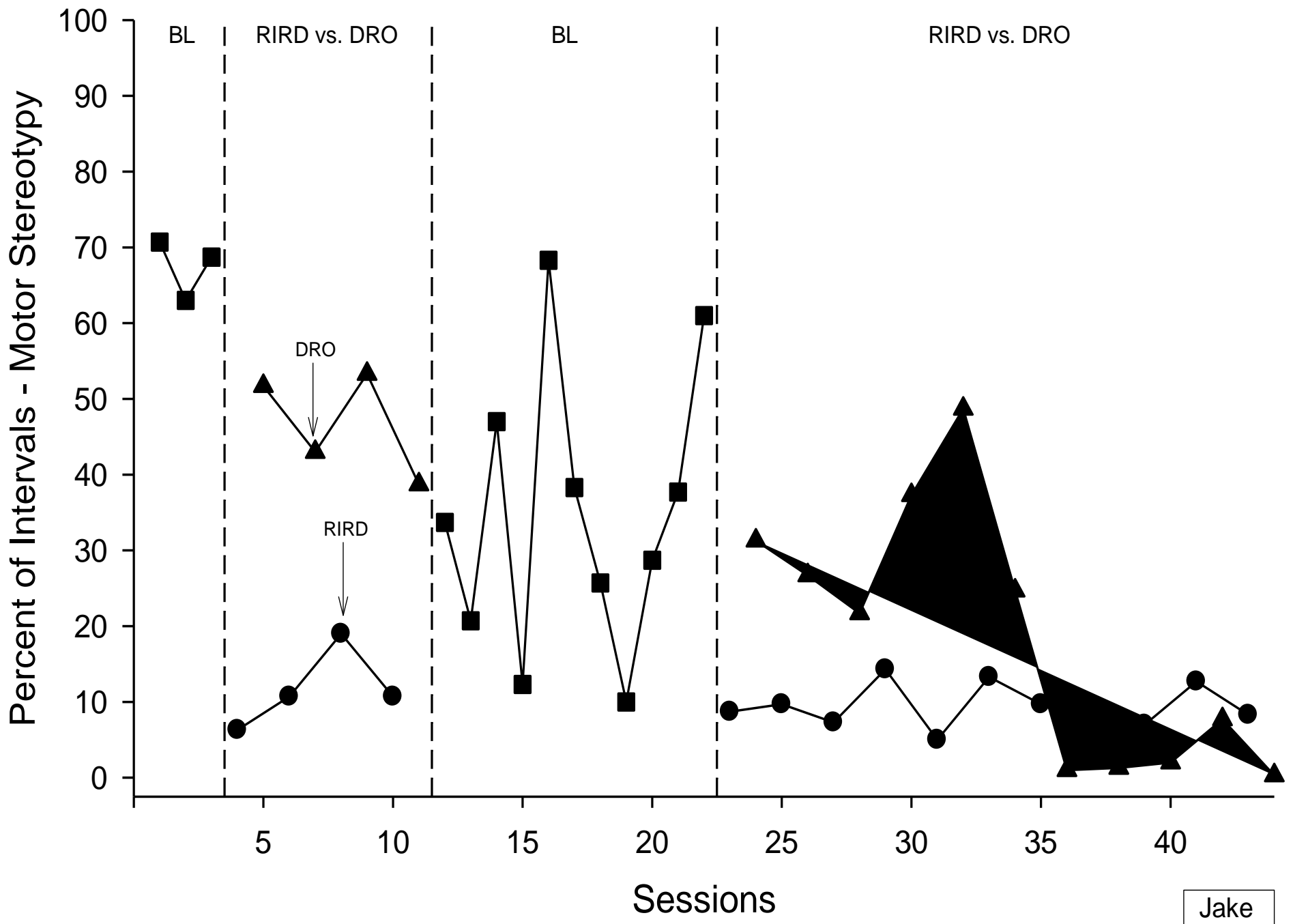
- VOT effective in increasing VB, decreasing vocal stereotypy
- RIRD decreased vocal stereotypy further
- Some mands seen in Post-tact Training and RIRD sessions



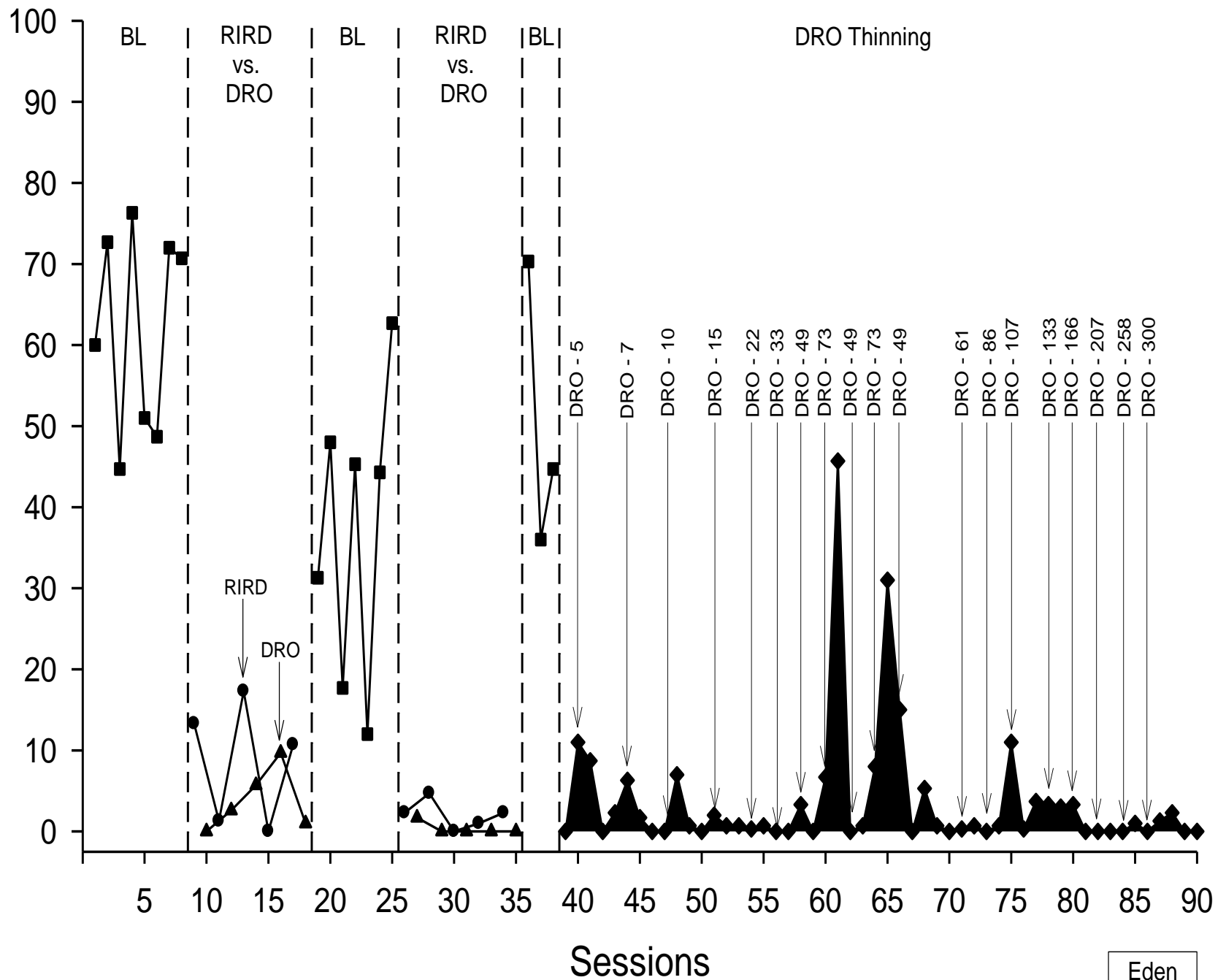
DRO/Negative Punishment

Farber, Ahearn et al.

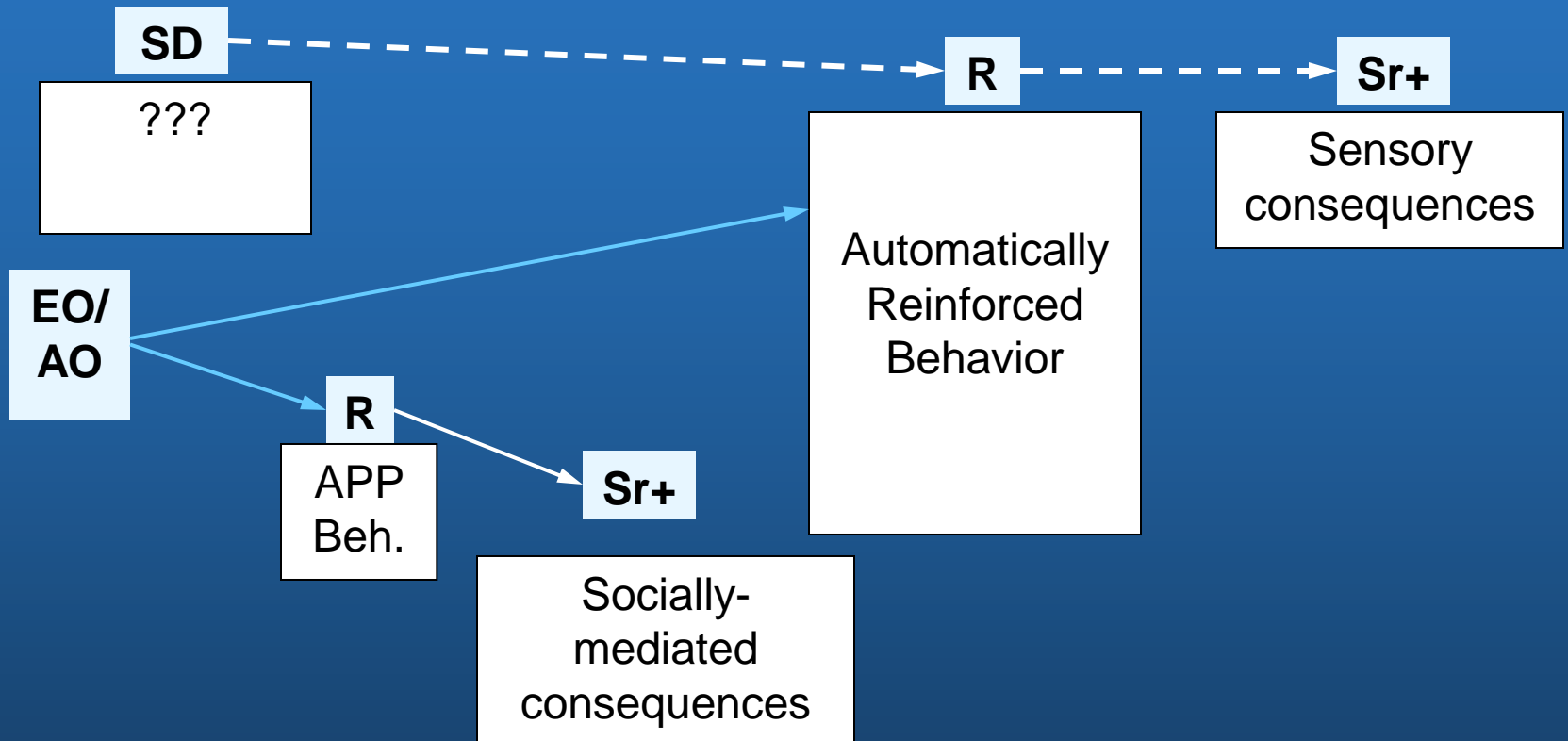
- Identify high preference item (edible/activity-must engage 80%+)
 - Fellner, LaRoche, & Sulzer-Azaroff (1984)
 - DRO + DRI ineffective → added interruption procedure decreased behavior
 - However, when effective DRO is much less resource intense
 - Easy to thin
 - May work well in combination with other Ps



Percent of Intervals - Motor Stereotypy



Context: Presence of others



Automatic Contingencies

```
graph TD; AC[Automatic Contingencies] --> R[Reinforcement]; AC --> P[Punishment]; R --> RP[Positive]; R --> RN[Negative]; P --> PP[Positive]; P --> PN[Negative]; RP --- RP_desc[add appetitive stimulus]; RN --- RN_esc[Escape]; RN --- RN_av[Avoidance]; RN_esc --- RN_esc_desc[Terminate aversive stimulus]; RN_av --- RN_av_desc[Avoids/delays aversive S]; PP --- PP_desc[Add aversive stimulus]; PN --- PN_desc[Terminate appetitive stimulus];
```

Reinforcement

Bx. ↑

Positive

add appetitive stimulus

Negative

Escape

Terminate aversive stimulus

Avoidance

Avoids/delays aversive S

Punishment

Bx. ↓

Positive

Add aversive stimulus

Negative

Terminate appetitive stimulus

Wither Automatic Reinforcement?



- **Skinner (e.g., 1957)**

Technical term? Concept!

- **Vaughan & Michael (1982)**

Perceiving

Producing

Problem solving

Why is it important?

- **Because BFS says so?**
- **Acquisition vs. maintenance**
CRF vs. INT
- **Complex behavior**
An echoic without an audience
Consequences not always apparent




Does it actually exist?




What is it exactly?

- **Conceptual & applied phenomenon**
- **Does it have pragmatic value?**
Are we further along acting on it?
- **What kind of behavior is it?**
Vollmer (RIDD; 1994)
Operant?


Automatic Reinforced Behavior

- Iwata et al. (1982/1994)
 - Higher in alone sessions
 - Persists in repeated alone sessions
 - Alternative explanations (Vollmer, 1994)
 - Elicitation
 - Lean schedule of SR+
- 


Is it operant?

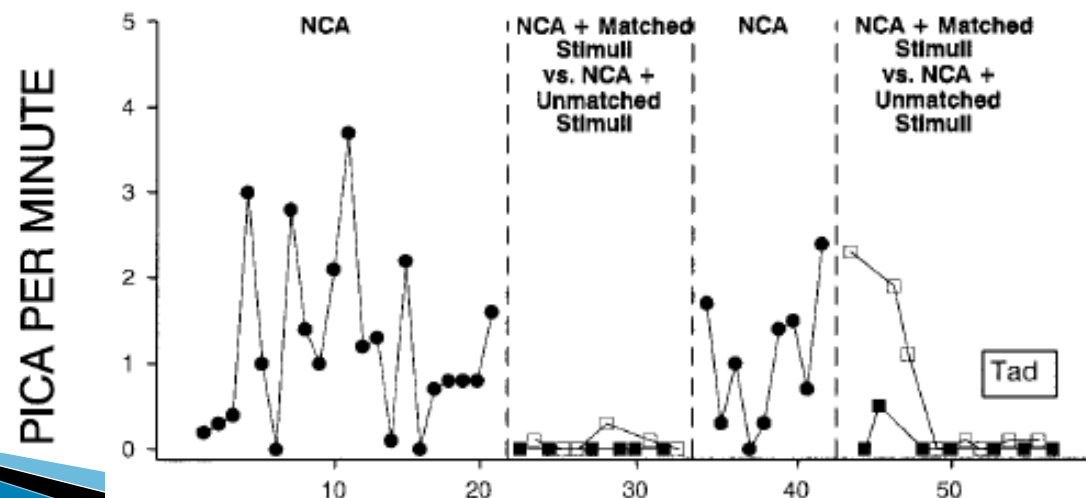
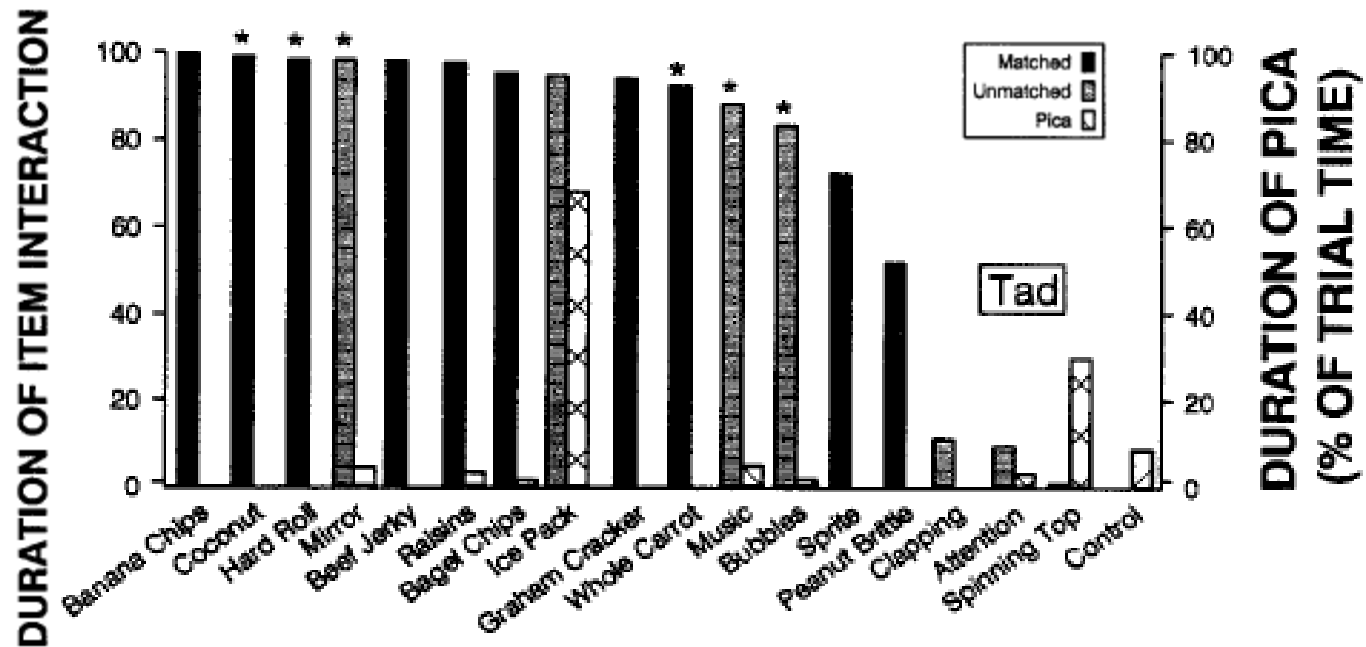
- **Conditioned seeing → Respondent**
 - **Empirical demonstration difficult**
Lack of access to consequence
 - **Indirect evidence**
Convergent or divergent?
- 

Contingent Access

- Reinforcing contingency in effect if alternative behavior increases
 - Charlop, Kurtz, & Casey (1990)
 - Edible, stereotypy, or both
 - Hanley, Iwata, Thompson, & Lindberg (2000)
 - Response blocking and/or contingent stereotypy
 - Potter, Hanley, Augustine, Clay, & Phelps (2013)
 - Shaped complex leisure skills
- 

Environmental Enrichment


- Competing reinforcer
 - Piazza et al. (1998)
 - Substitutable reinforcer
 - Piazza et al. (2000)
 - Consequences not socially mediated
 - Similar appetitive sensory consequences
 - Members of the same operant class
- 



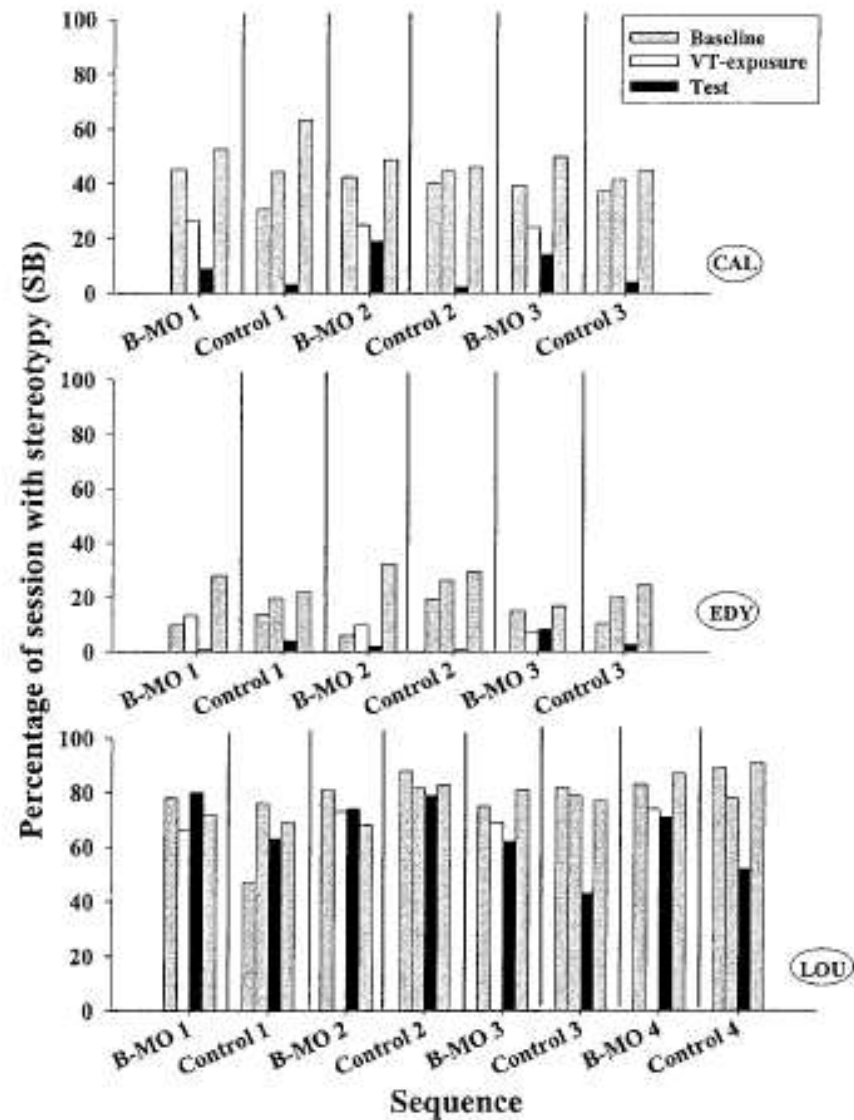
Response Deprivation Hypothesis

- Deprivation increases value of reinforcer (Timberlake & Allison, 1974)
- Satiation decreases value?
 - McComas, Thompson, & Johnson (2003)
 - Rapp, Vollmer, Dozier, St. Peter, & Cotnoir (2004)

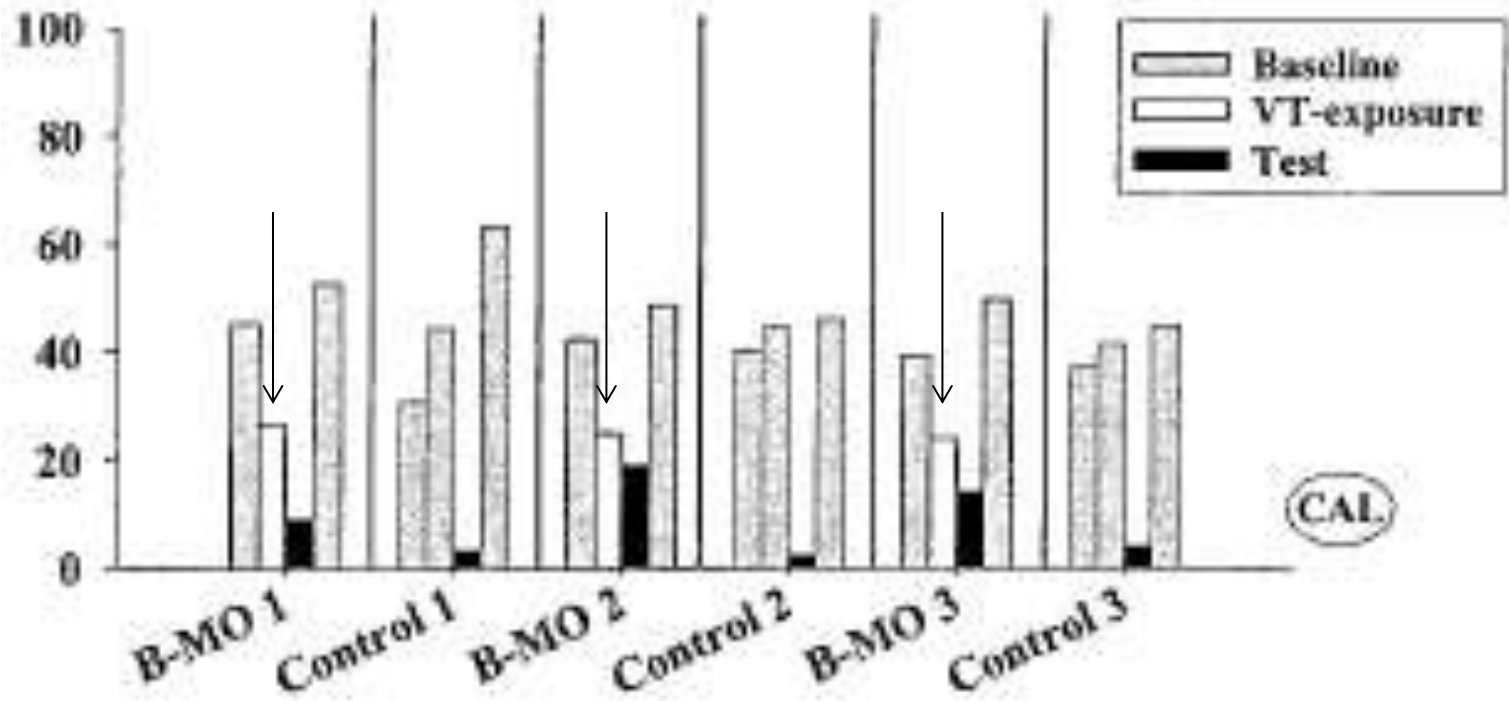
Behavior Momentum

- Environmental variables (contextual stimuli; reinforcer delivery) related to resistance to change of discriminated operant behavior (Nevin, 1984, 1988, & 1992)
 - Rate: response–reinforcer relation
 - Resistance: stimulus–reinforcer relation (Pavlovian)
 - Added reinforcers = more persistence to disruption
 - Dube & McIlvane (2001)
 - Mace, Lalli, Shea, Lalli, West, Roberts, & Nevin (1990)
- 

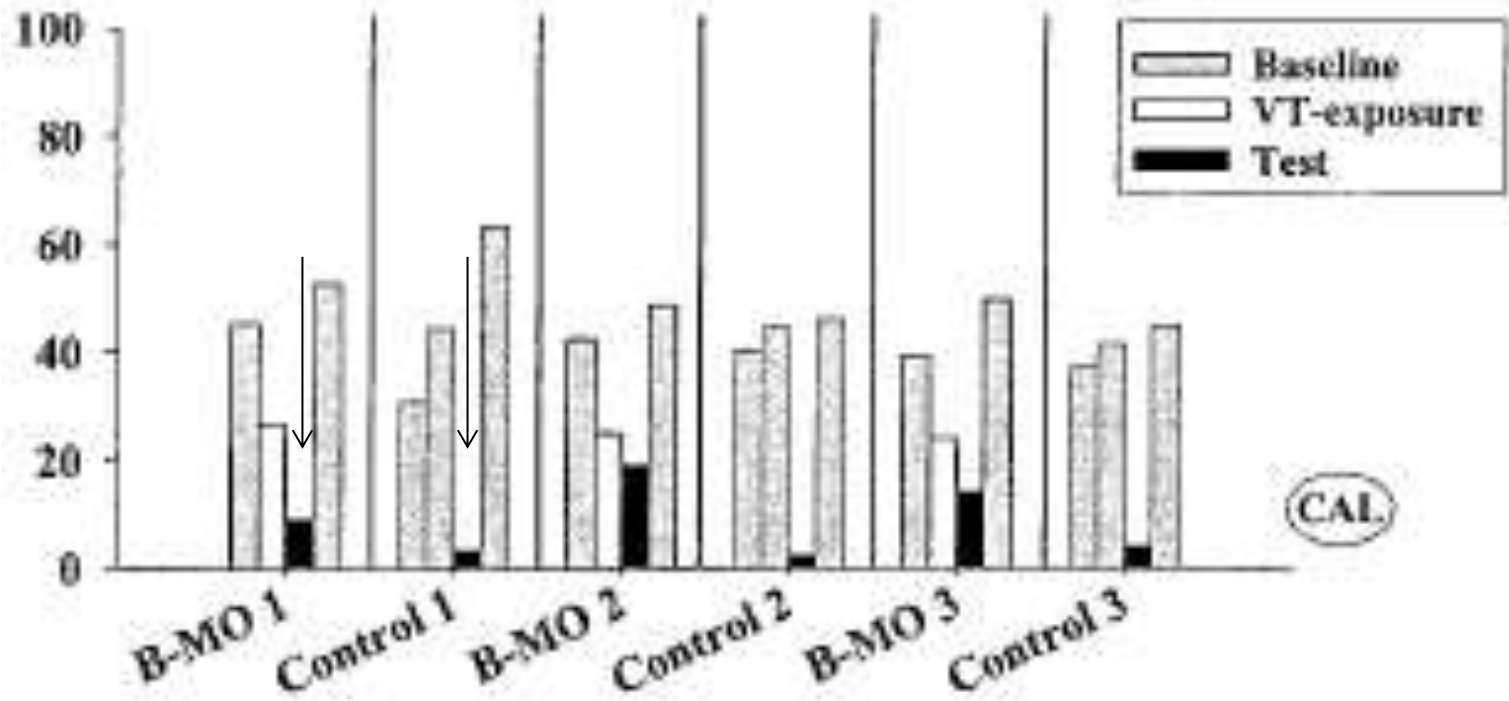
Ahearn et al. (2003)



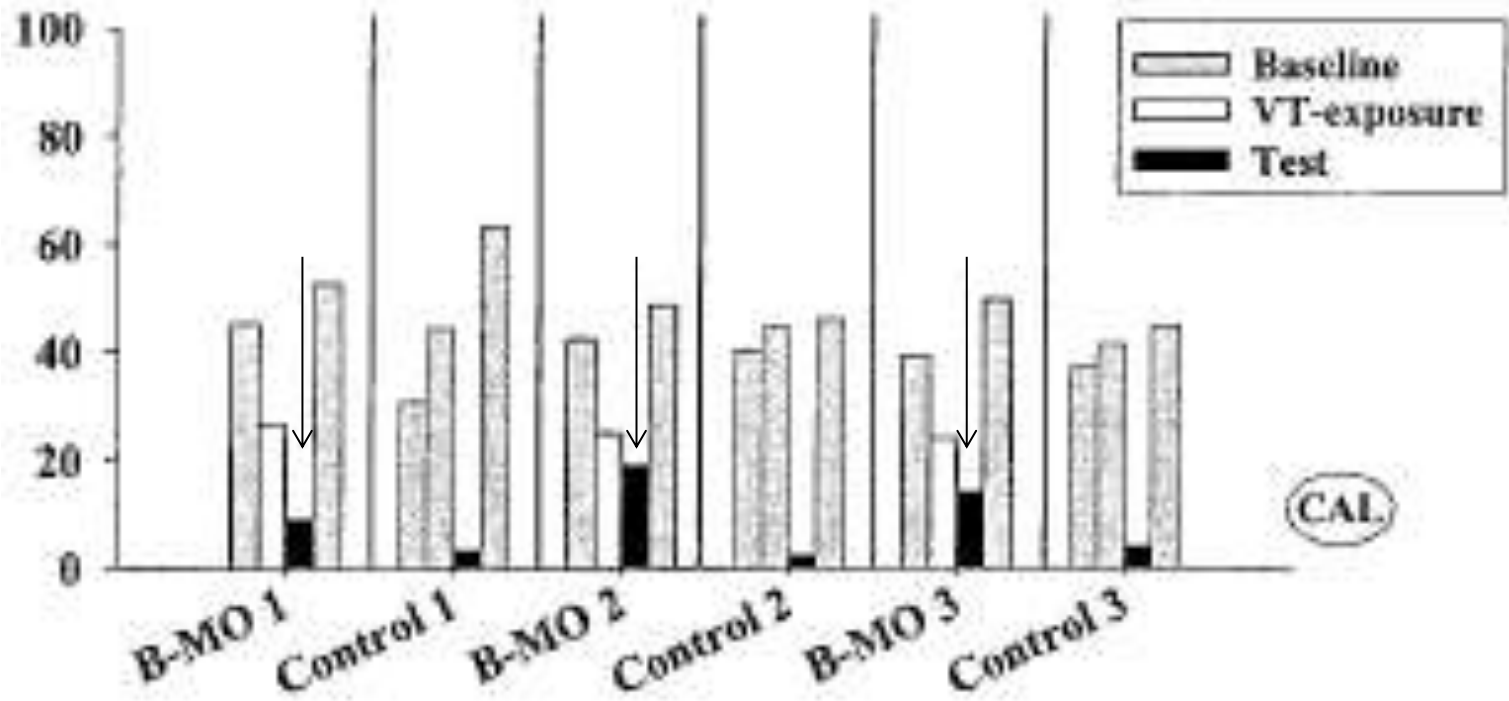
Ahearn et al. (2003)



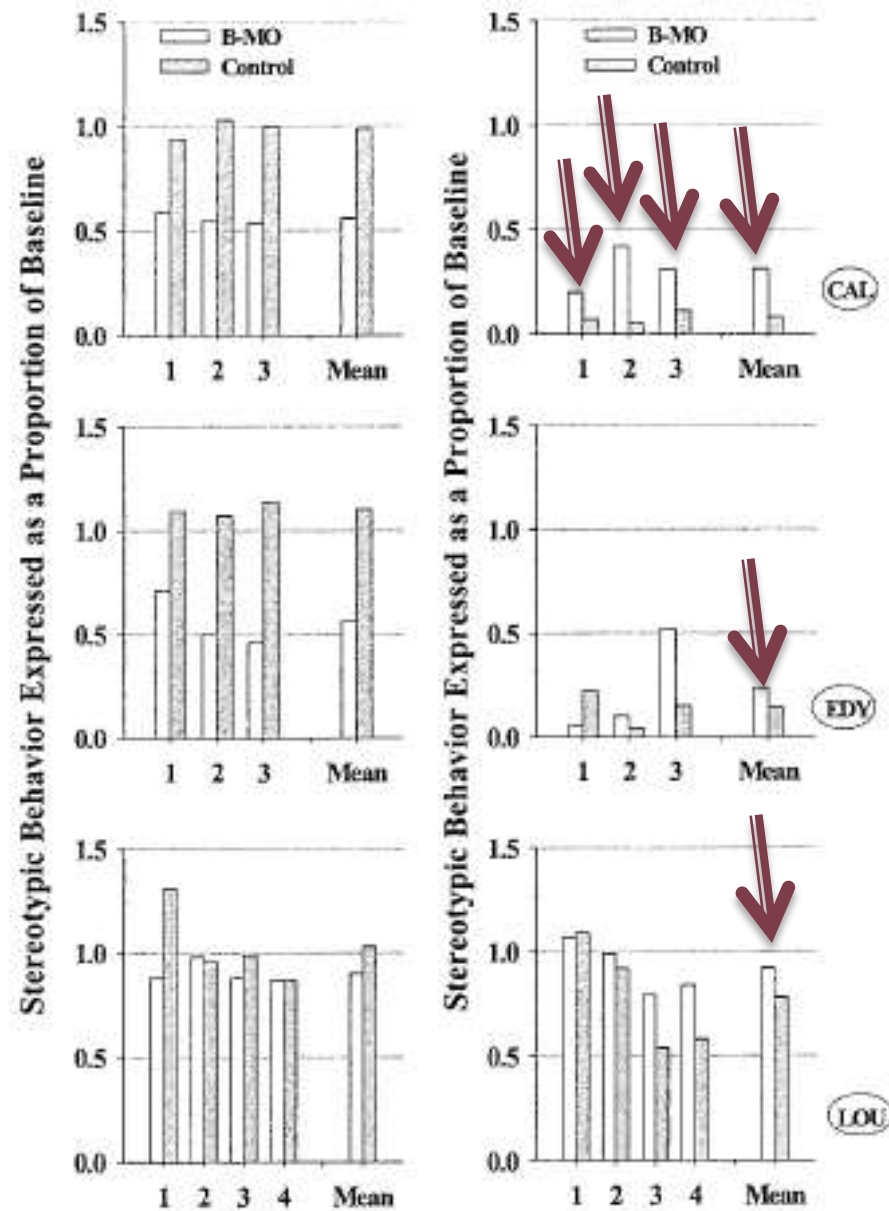
Ahearn et al. (2003)



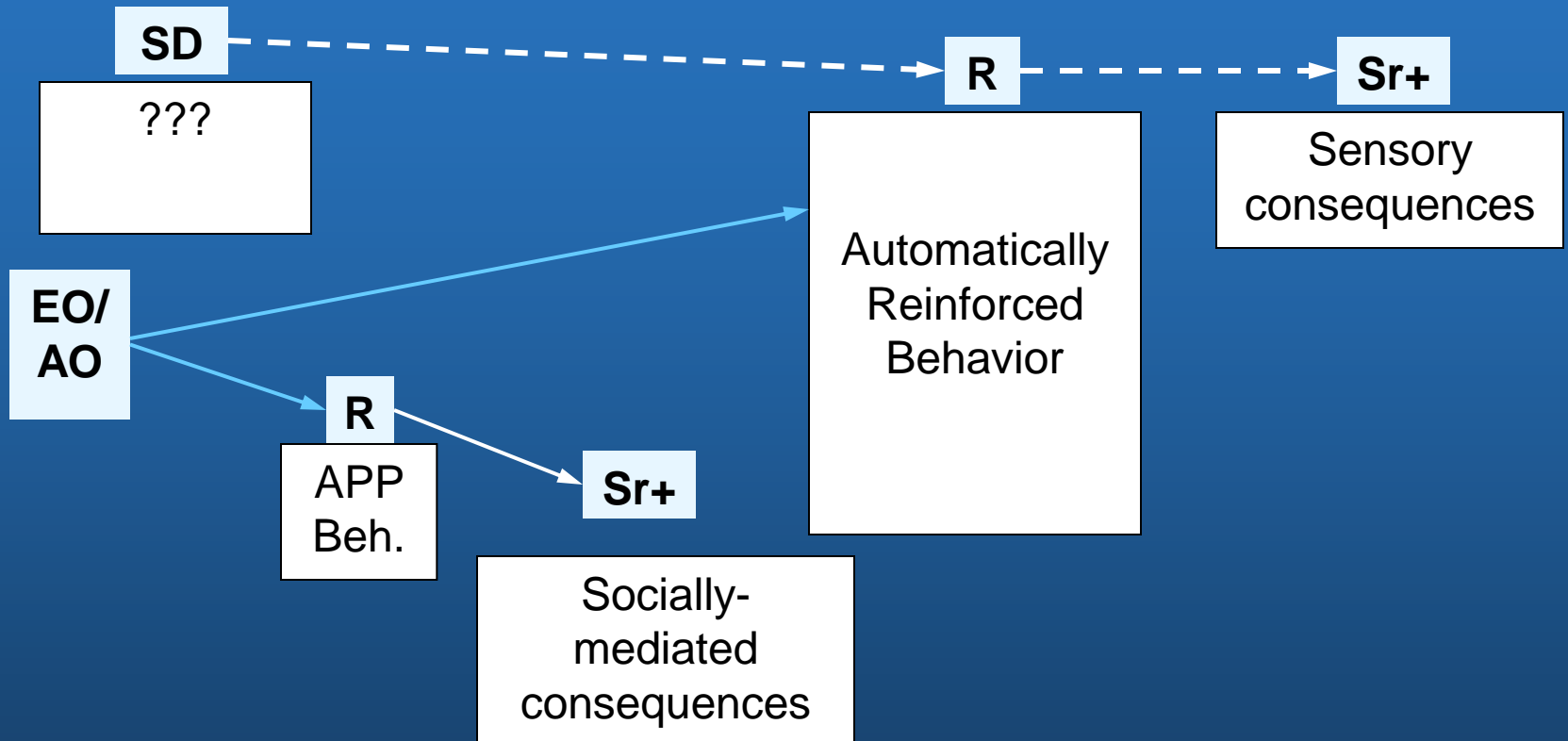
Ahearn et al. (2003)



PERSISTENCE OF STEREOTYPIC BEHAVIOR



Context: Presence of others



Thank you!



bahearn@necc.org