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# Some musings on automatic reinforcement: Central concept, controversial status

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**Director of Research**

# Automatic Reinforcement



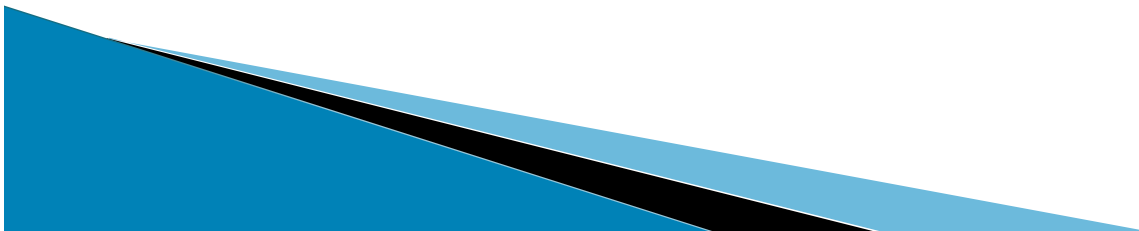
- Controversial topic
- Not requiring mediation by another person
- Crucial concept?



# On automatic reinforcement

There are occasions upon which we say that the speaker “needs a verbal response.” The circumstances may be incomplete, as when variables which strengthen behavior without respect to form need supplementary sources of strength. Thus...we cast about for a stimulus...and respond to it.

–Skinner (1957; p. 403)



# Wither Automatic Reinforcement?



- **Skinner (e.g., 1957)**
  - Not a technical term
  - Verbal and non verbal behavior
- **Vaughan & Michael (1982)**
  - Perceiving
  - Producing
  - Problem solving



# Perceiving



- **Stimuli**  
Sensory apparatus
- **Reflexive**  
“Conditioned seeing”

A man may see or hear "stimuli which are not present" on the pattern of the conditioned reflex: he may see X, not only when X is present, but when any stimulus which has frequently accompanied X is present.

Skinner (1953/2005; p. 266)



# Producing

- Emitted behavior
  - Sensory consequences
- Operant
  - Active seeing



# Problem solving

...we have to ask how contingencies of reinforcement are arranged. When is a numerical operation reinforced as “right”? Eventually, of course, the pupil may be able to check his own answers and achieve some sort of automatic reinforcement, but in the early stages the reinforcement of being right is usually accorded by the teacher.

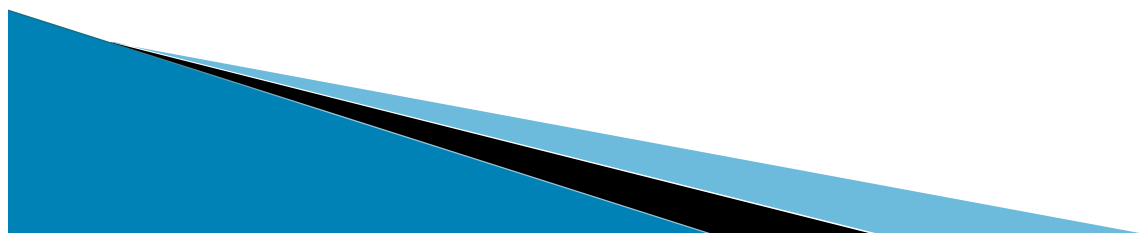
–Skinner (1954/1999; p. 184)



# Problem solving



- **Historied behavior**
  - Stimulus control
  - The discriminative stimulus
- **Operant & respondent**
  - Complex behavior





# Higher order behavior

Thinking is more productive when verbal responses lead to specific consequences *and are reinforced because they do so...* The verbal fantasy, whether overt or covert, is automatically reinforcing to the speaker as listener. Just as the musician plays or composes what he is reinforced by hearing, or as the artist paints what reinforces him visually, so the speaker engaged in verbal fantasy says what he is reinforced by hearing or writes what he is reinforced by reading.

-Skinner (1957; p. 438)



# Why is it important?

- Because BFS says so?
- Implications for acquisition and maintenance of behavior
- Behavior → no obvious consequence
  - An explanatory fiction
  - Or a pragmatic



# Does it actually exist?



# An applied phenomenon

- Producing → Analogue FA  
(Iwata et al., 1982/1994)  
Higher in alone sessions/UNDiff  
Persists in repeated alone sessions
- Vollmer (RIDDD; 1994)  
Operant? Elicited? Lean schedule of SR+?



# 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

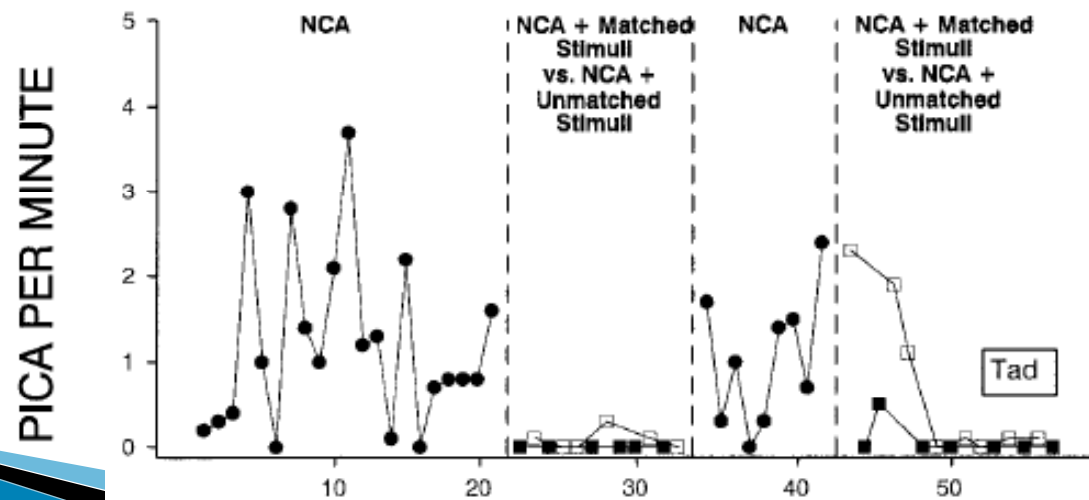
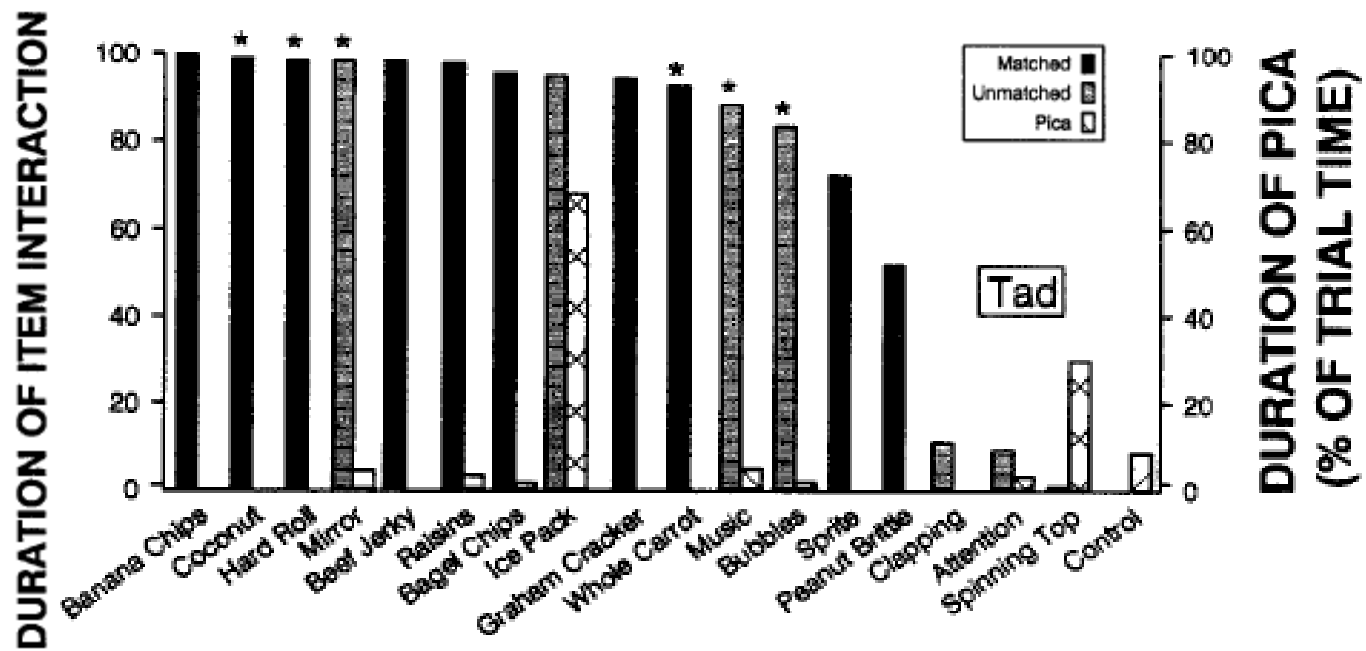


# Environmental Enrichment

- 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







Piazza et al. (1998)- Figures 3 & 4

# 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)

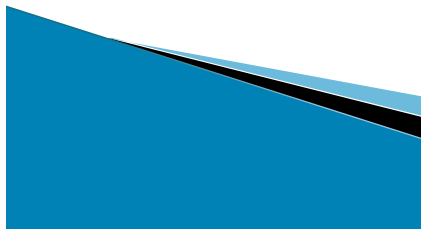
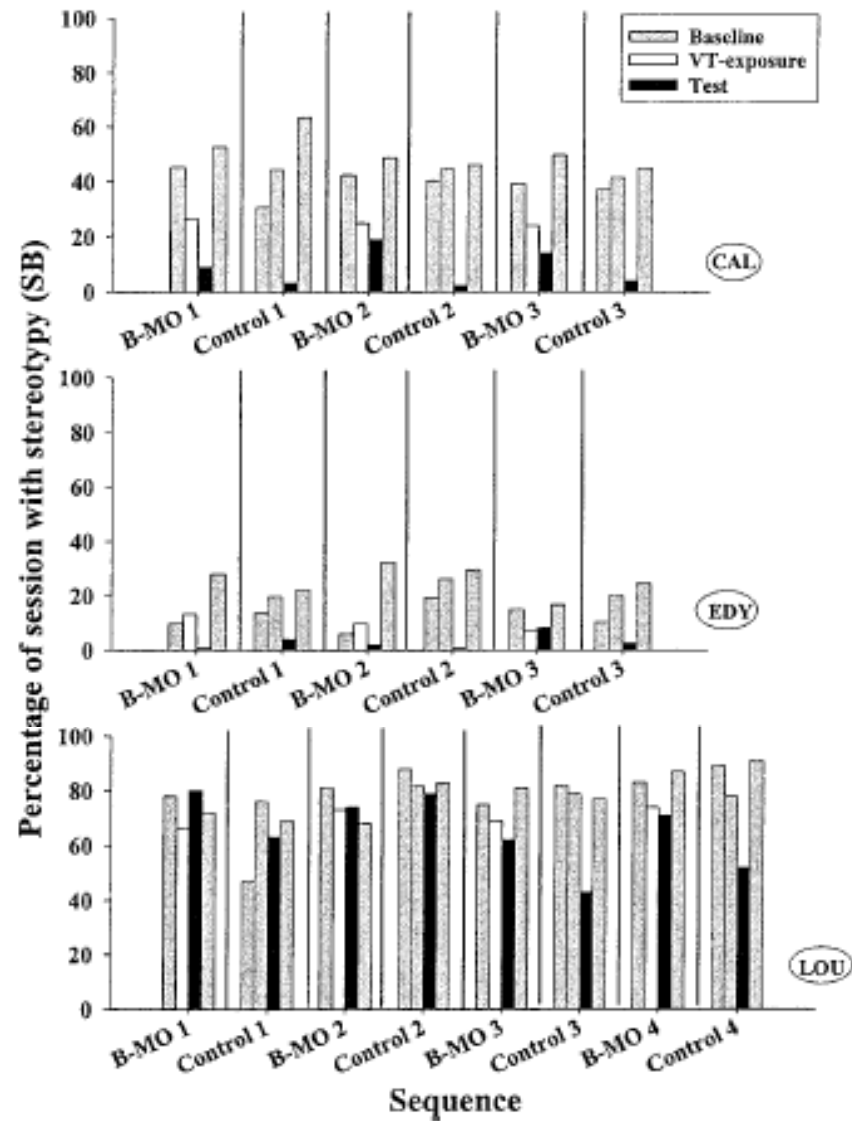


# Behavior Momentum

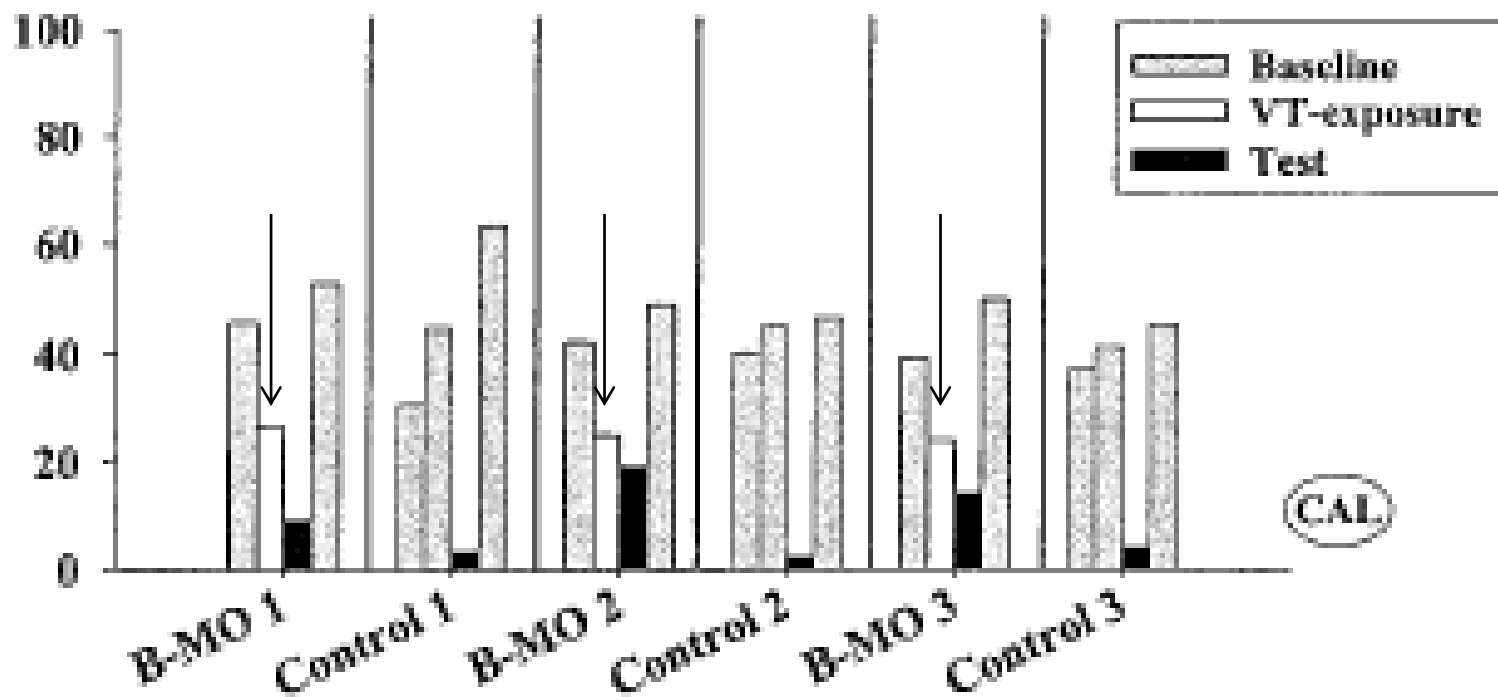
- Environmental variables (contextual stimuli; reinforcer delivery) related to resistance to change of discriminated operant behavior (Nevin, 1984, 1988, & 1992)
  - Rate: response–reinforcer relation
  - Resistance: stimulus–reinforcer relation (Pavlovian)
- Added reinforcers = more persistence to disruption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



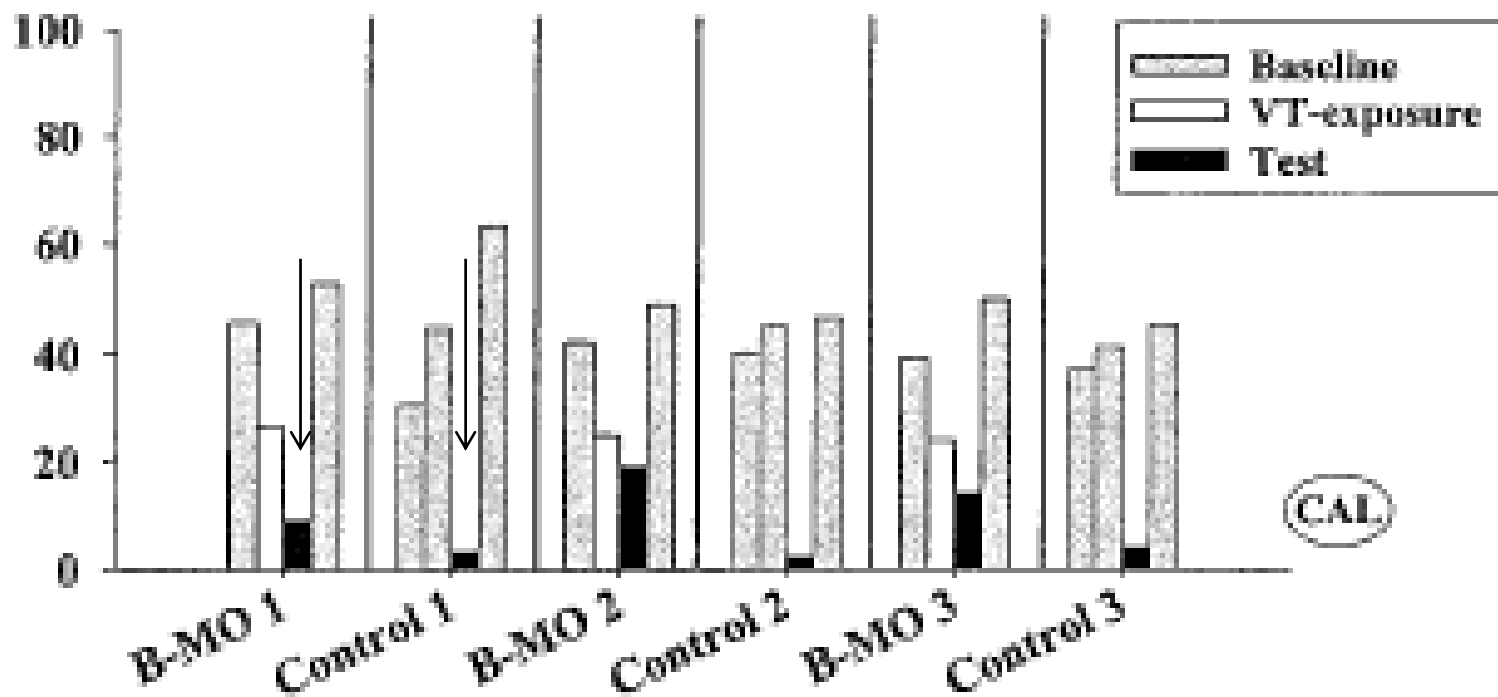
# Ahearn et al. (2003)



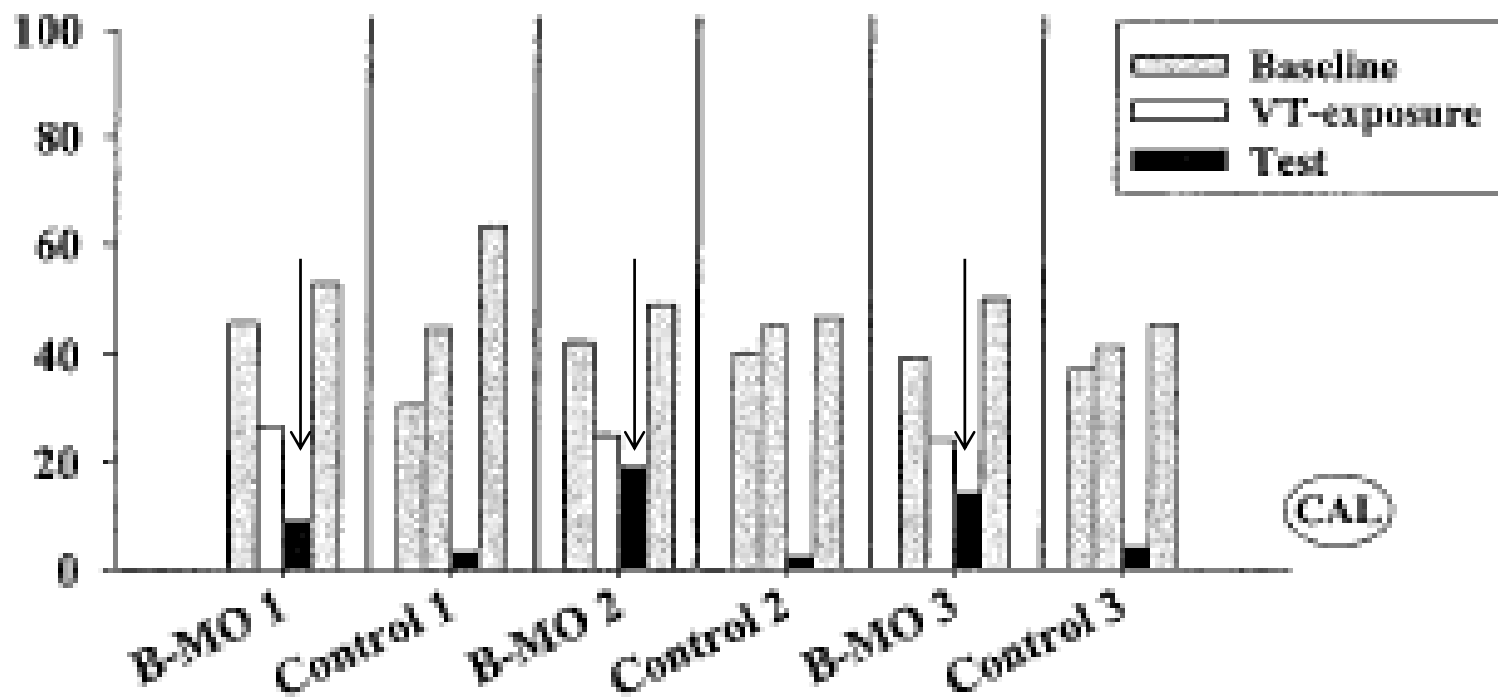
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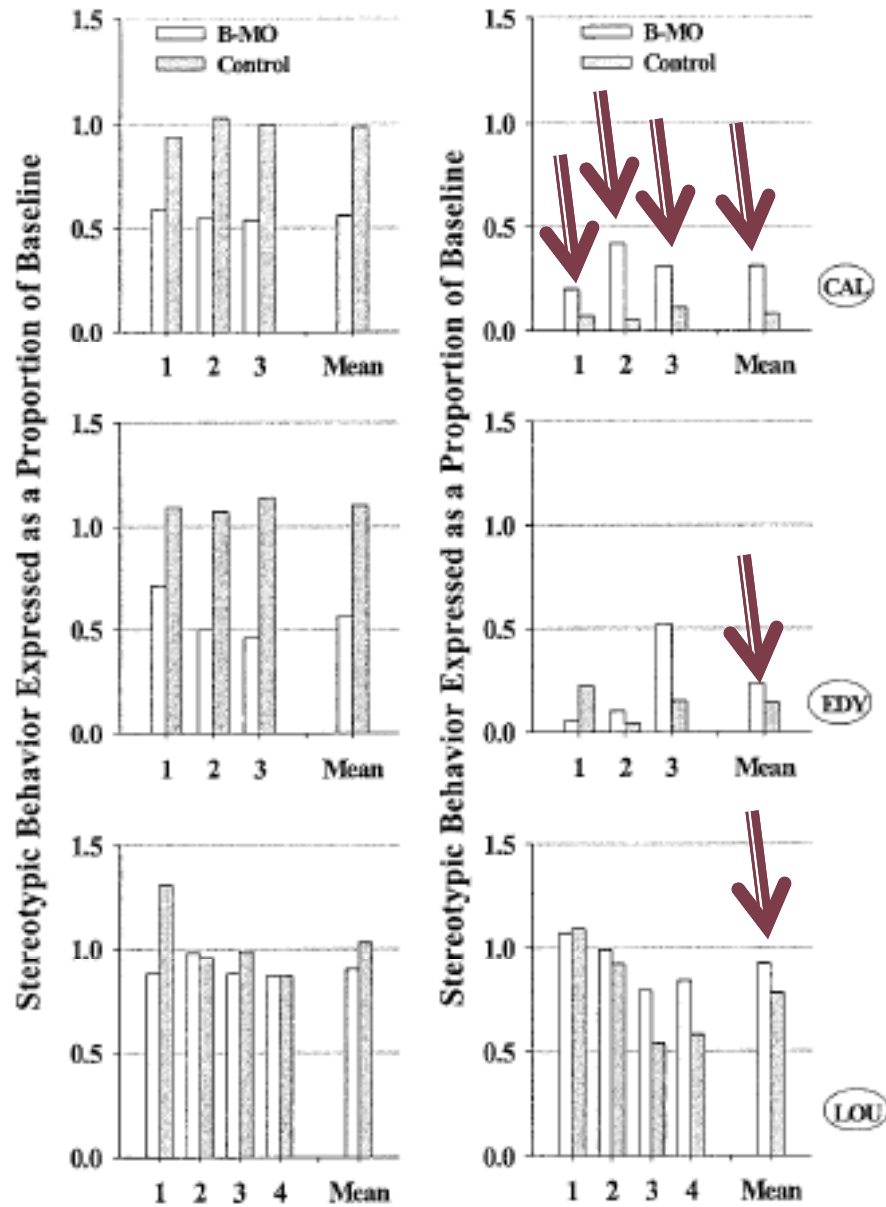
# Ahearn et al. (2003)



# Ahearn et al. (2003)



PERSISTENCE OF STEREOTYPIC BEHAVIOR



Ahearn, W. H., Clark, K. M., & Sigafoos, J. D. (1997). Persistence of stereotypy: Examining the effects of extended extinction. *Journal of Applied Behavior Analysis, 24*, 439-447.



# Does it actually exist?



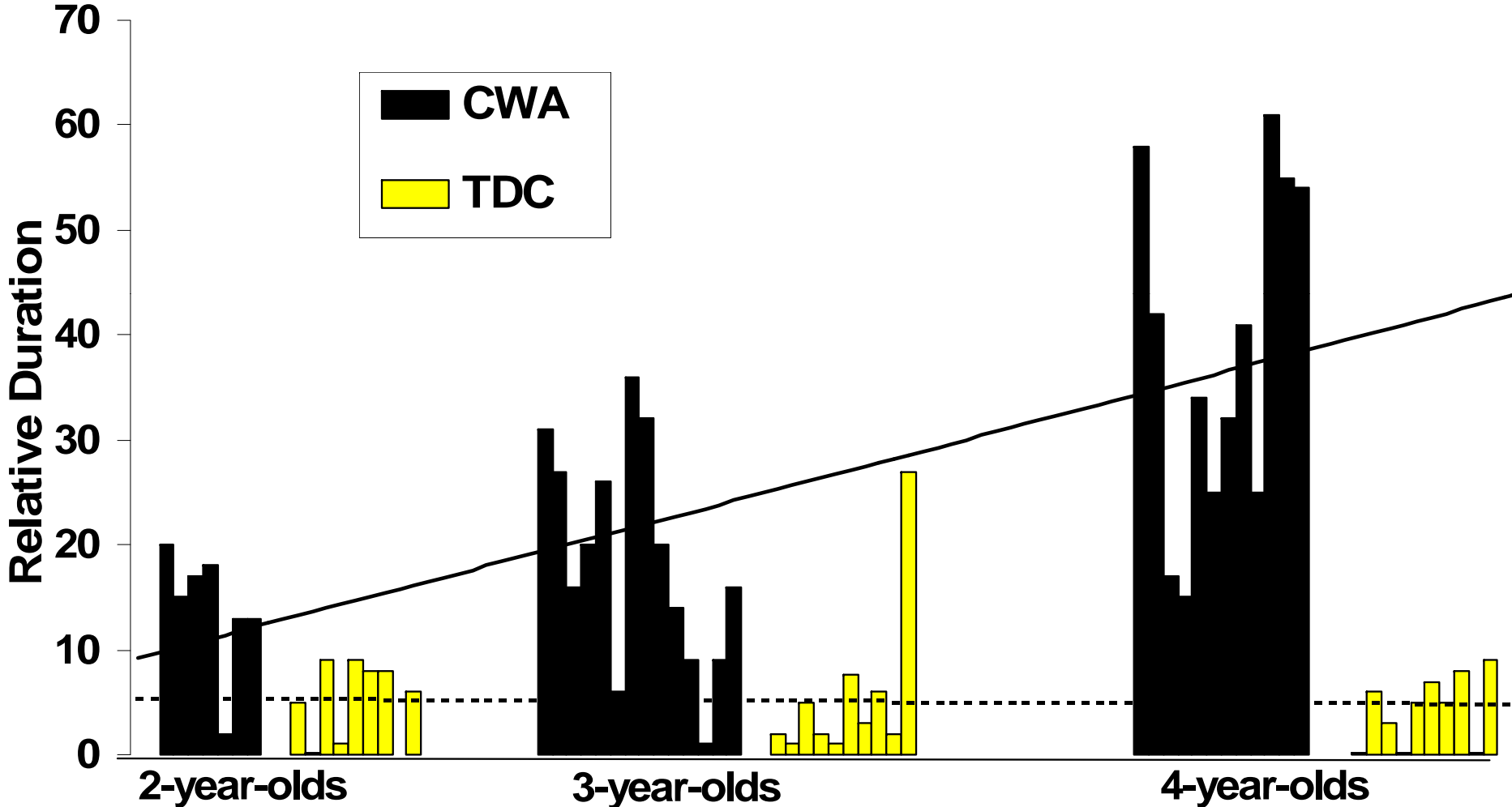
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# Response Redirection: Treating repetitive behavior

William Ahearn, Ph.D., BCBA

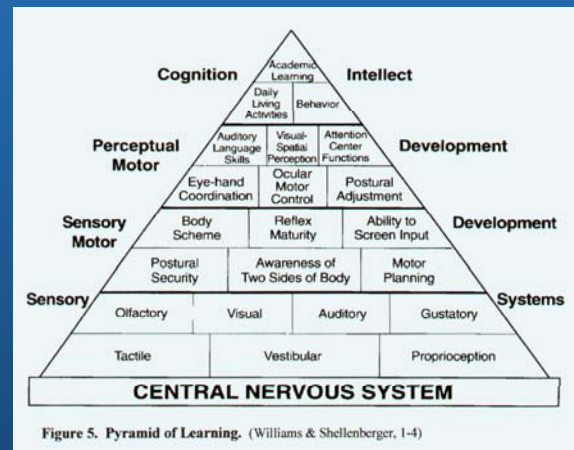


# MacDonald et al. (2007)



# Stereotypy: Etiology

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

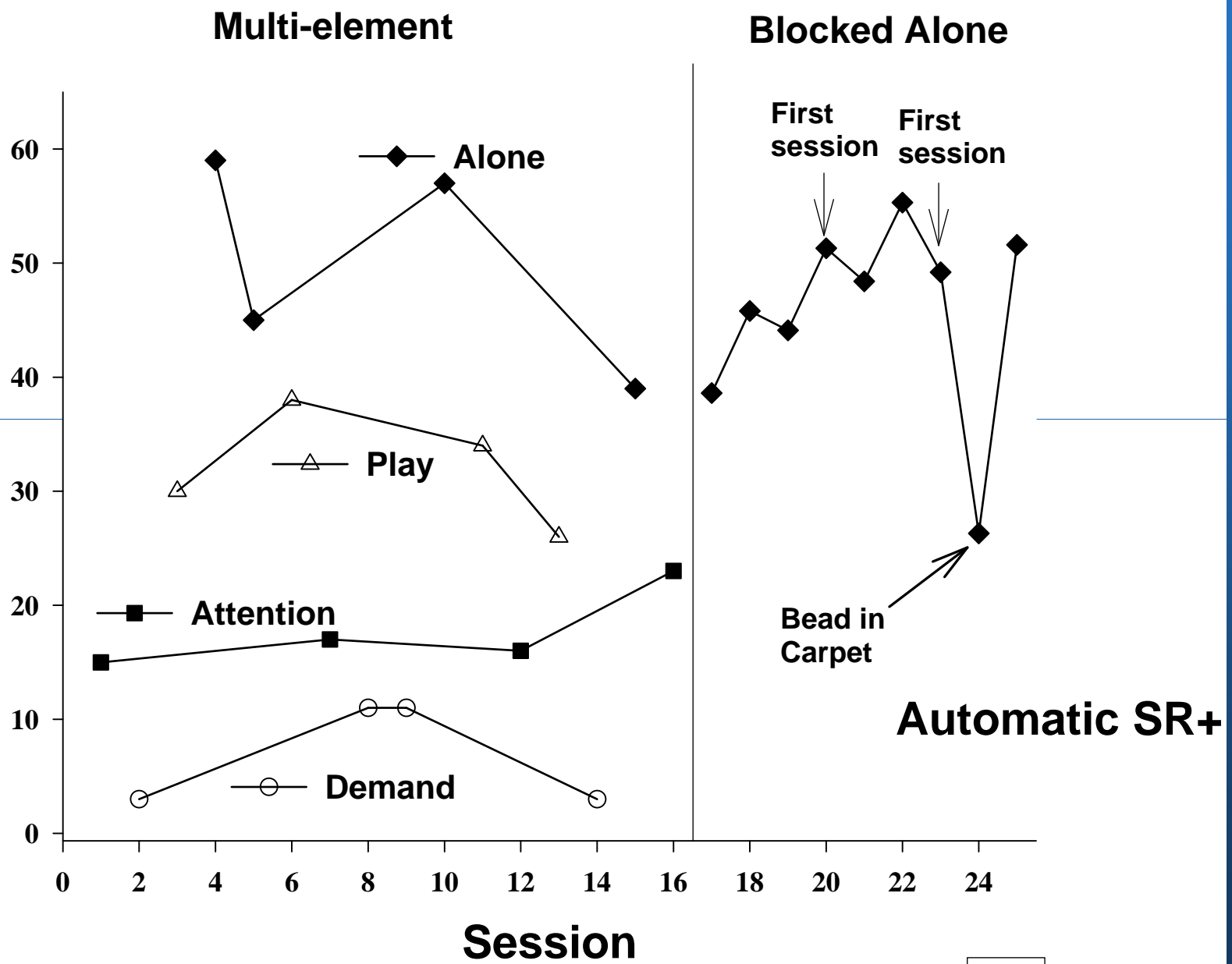


- Operant behavior (Ahearn et al., 2003)
- Impoverished environment  
(e.g., Berkson, 1983)

# Functional Hypotheses

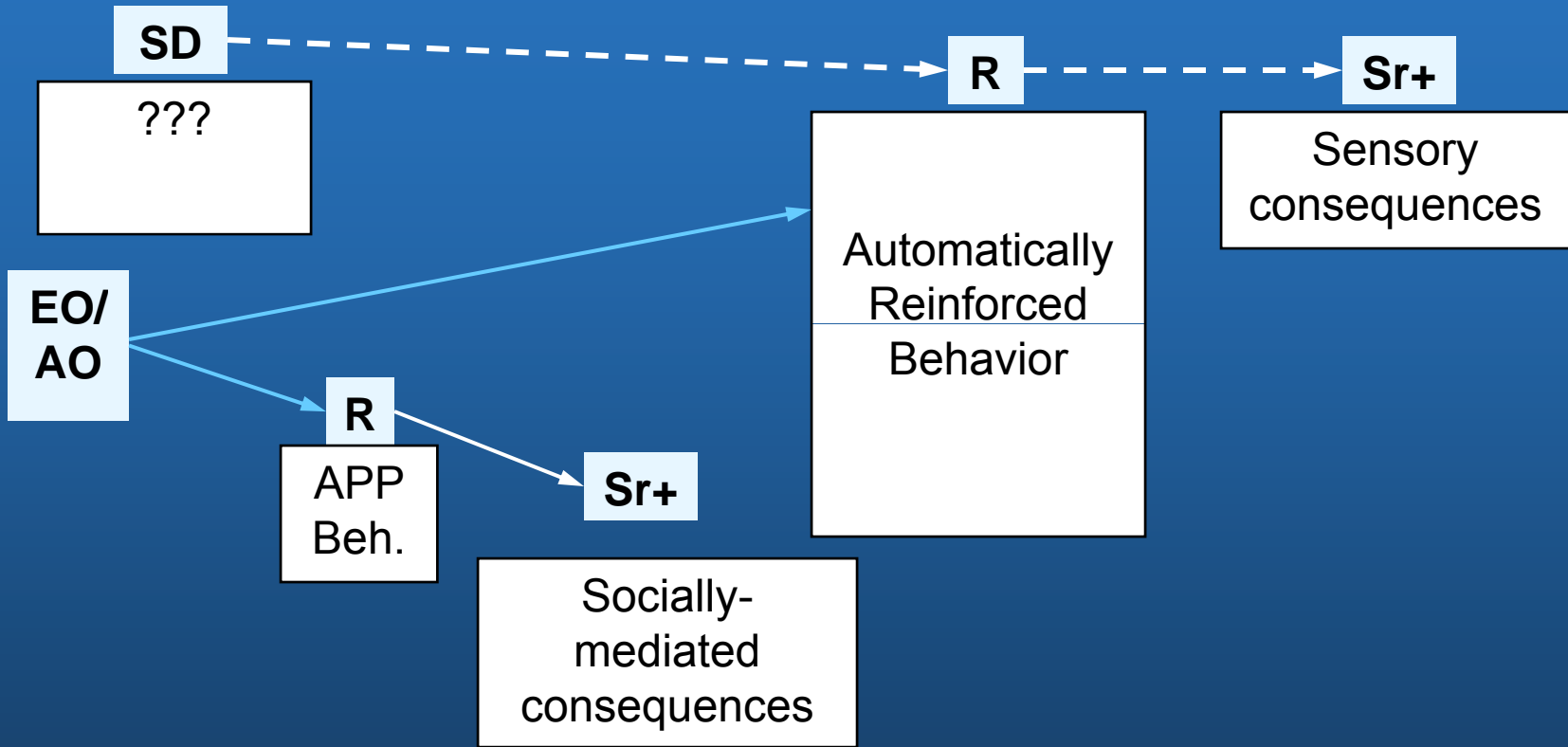
- ⇒ **Automatically-reinforced response**  
(Lovaas, Newsom, & Hickman, 1987)
- ⇒ **Related to demand**  
(Mace et al., 1987)
- ⇒ **Suppressed by contingent isolation**  
(Pendergrass, 1972)
- ⇒ **Multiply-controlled response**  
(Kennedy et al., 2000)

Percentage of intervals with Vocal Stereotypy



Mark

# 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)



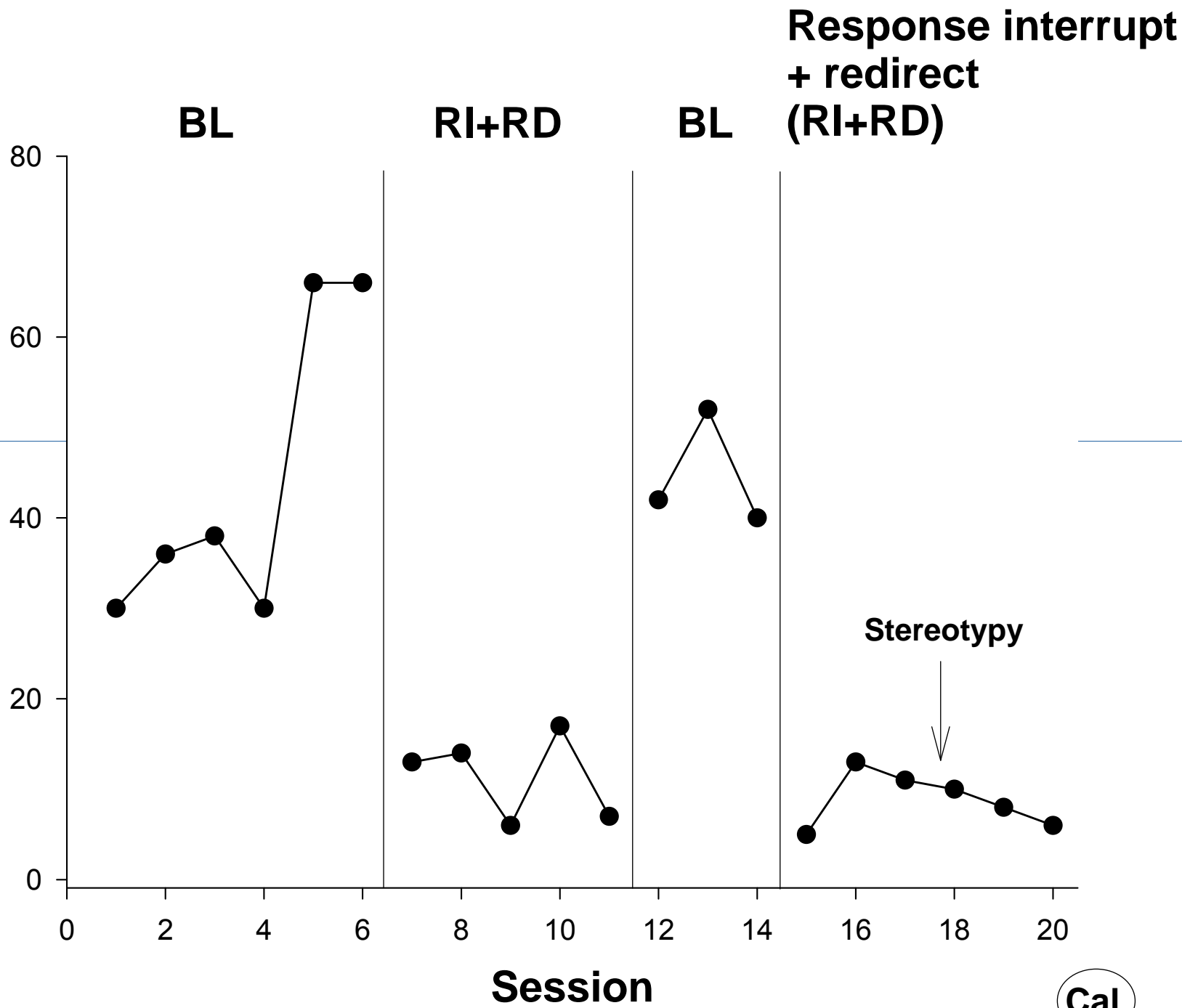
# A Case History in Best Practice

- 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)

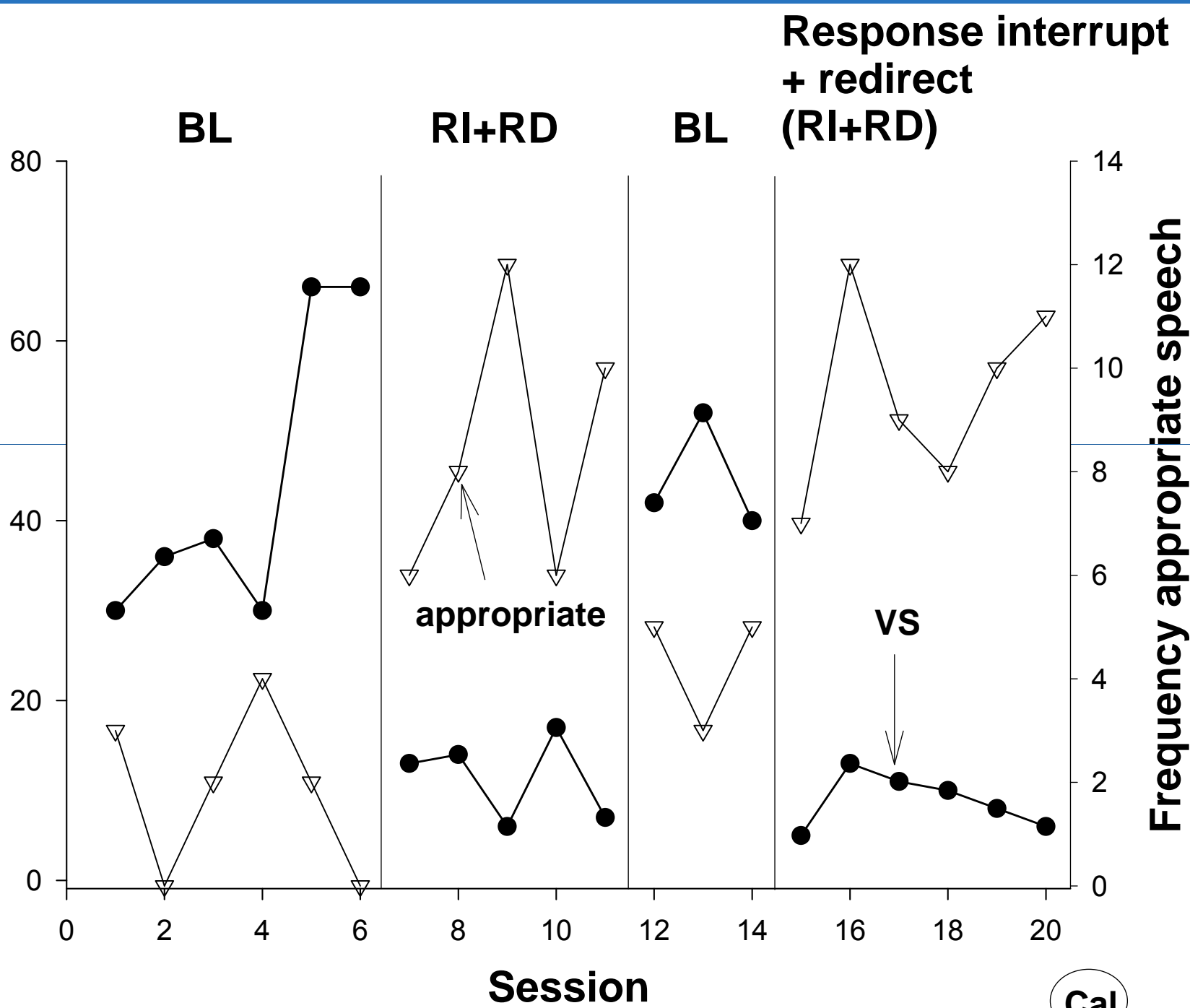
- **5-minute sessions**
  - No interaction baseline
  - Reinforce requesting/app speech
- **Contingent upon vocal stereotypy**
  - Establish attention (eye contact)
  - Ask social questions (hi-p compliance)
  - Reinforce requesting/app speech

Percentage of intervals - Vocal Stereotypy



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 1<sup>st</sup> session

# Moving on past 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)**

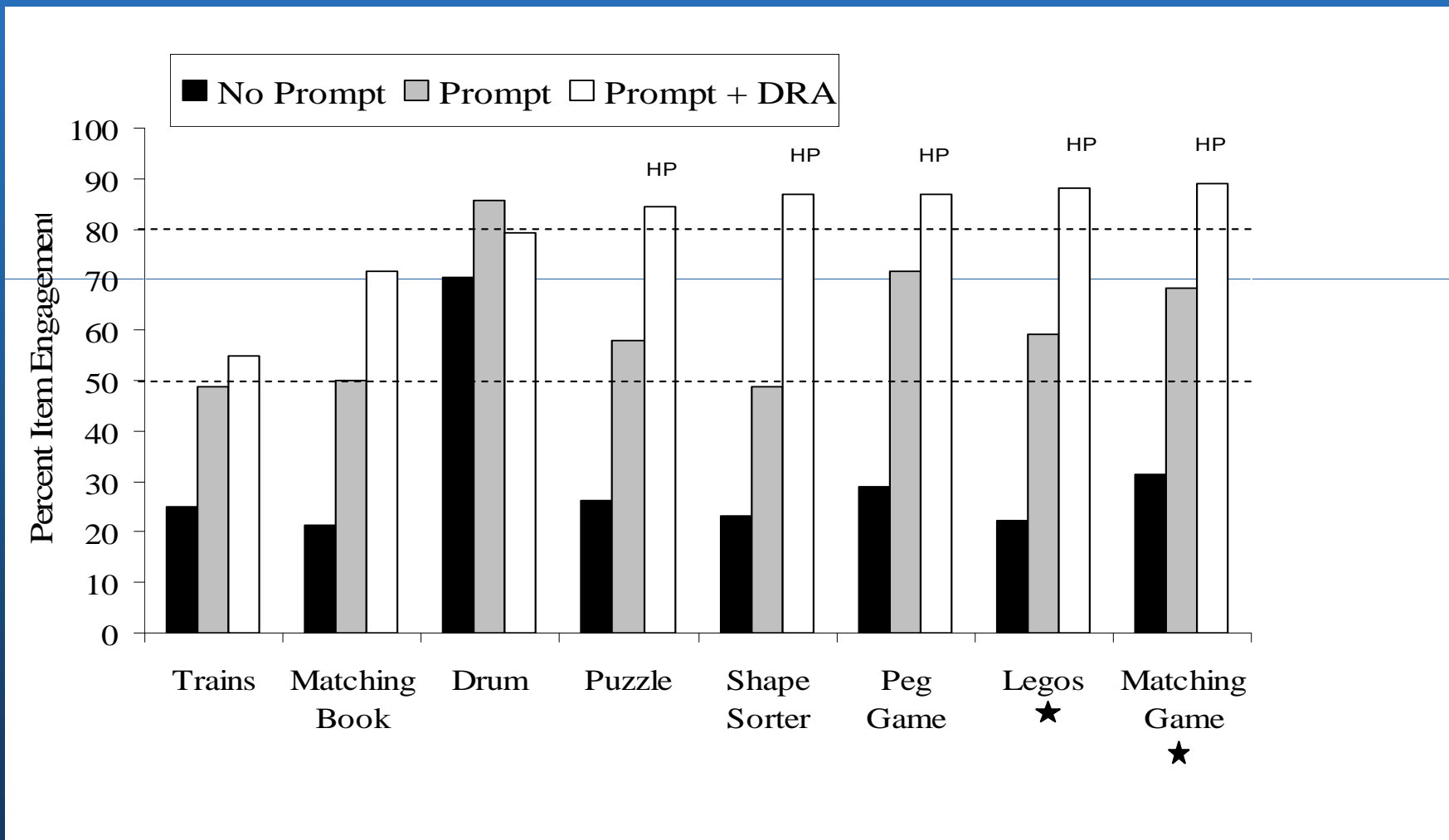
# Why is it important?

- 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



Leif, E., Roscoe, E.M., Morrison, H., & Ahearn, W.H. (in review).

# 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

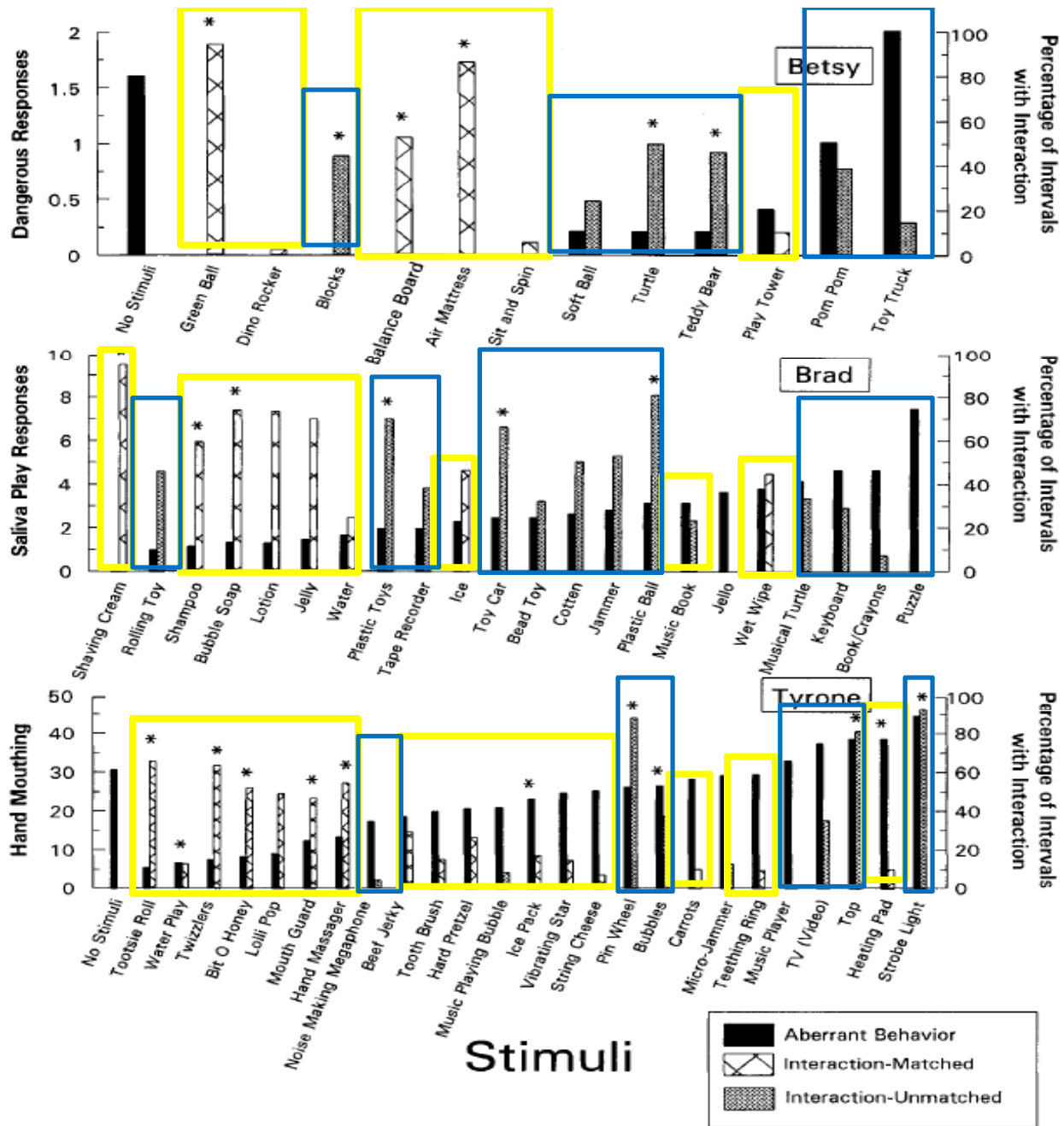
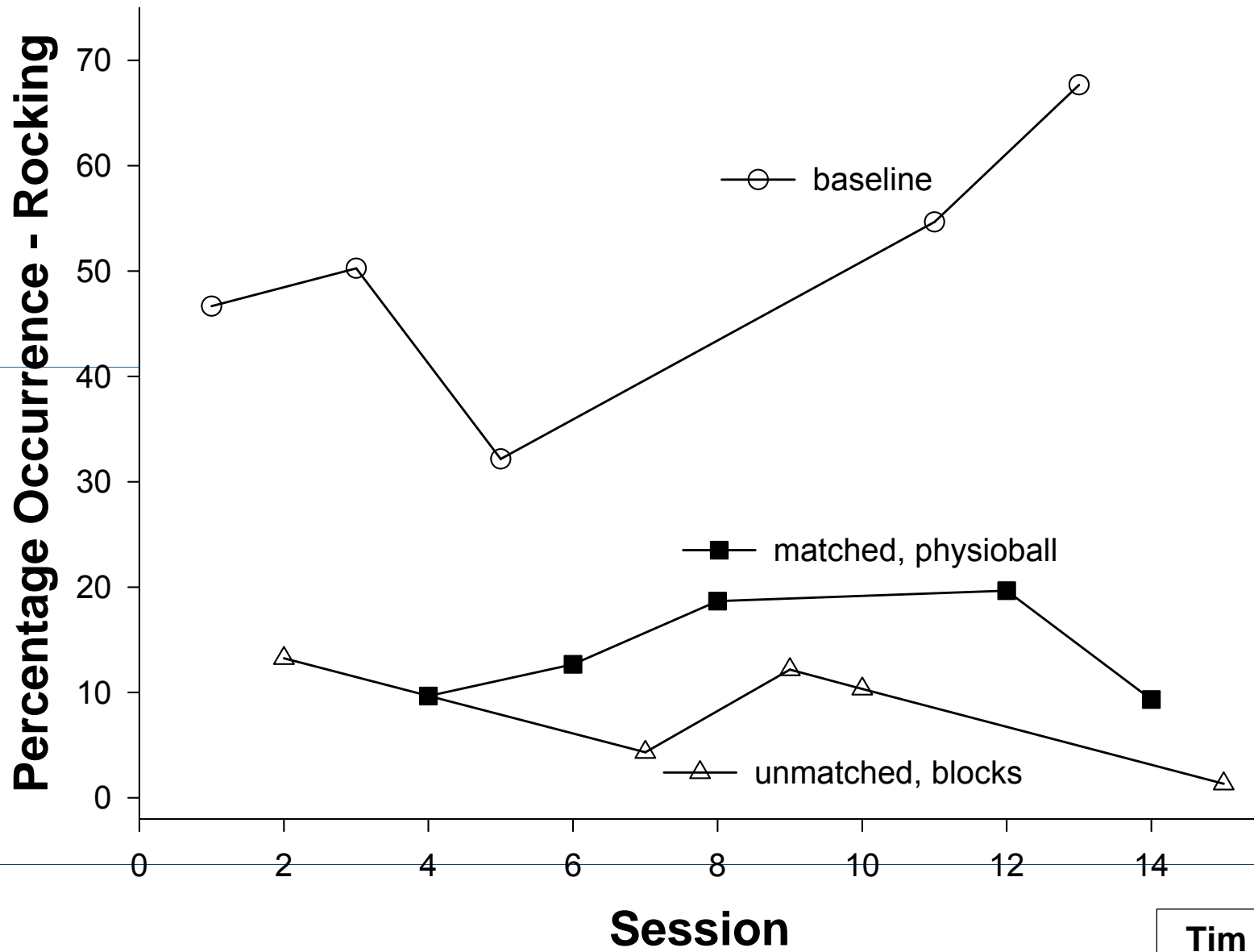


Figure 2. Aberrant behaviors per minute (solid bars), duration of item interaction with matched stimuli (hatched bars), and duration of item interaction with unmatched stimuli (dotted gray bars) during the stimulus preference assessments for Betsy (top panel), Brad (middle panel), and Tyrone (bottom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

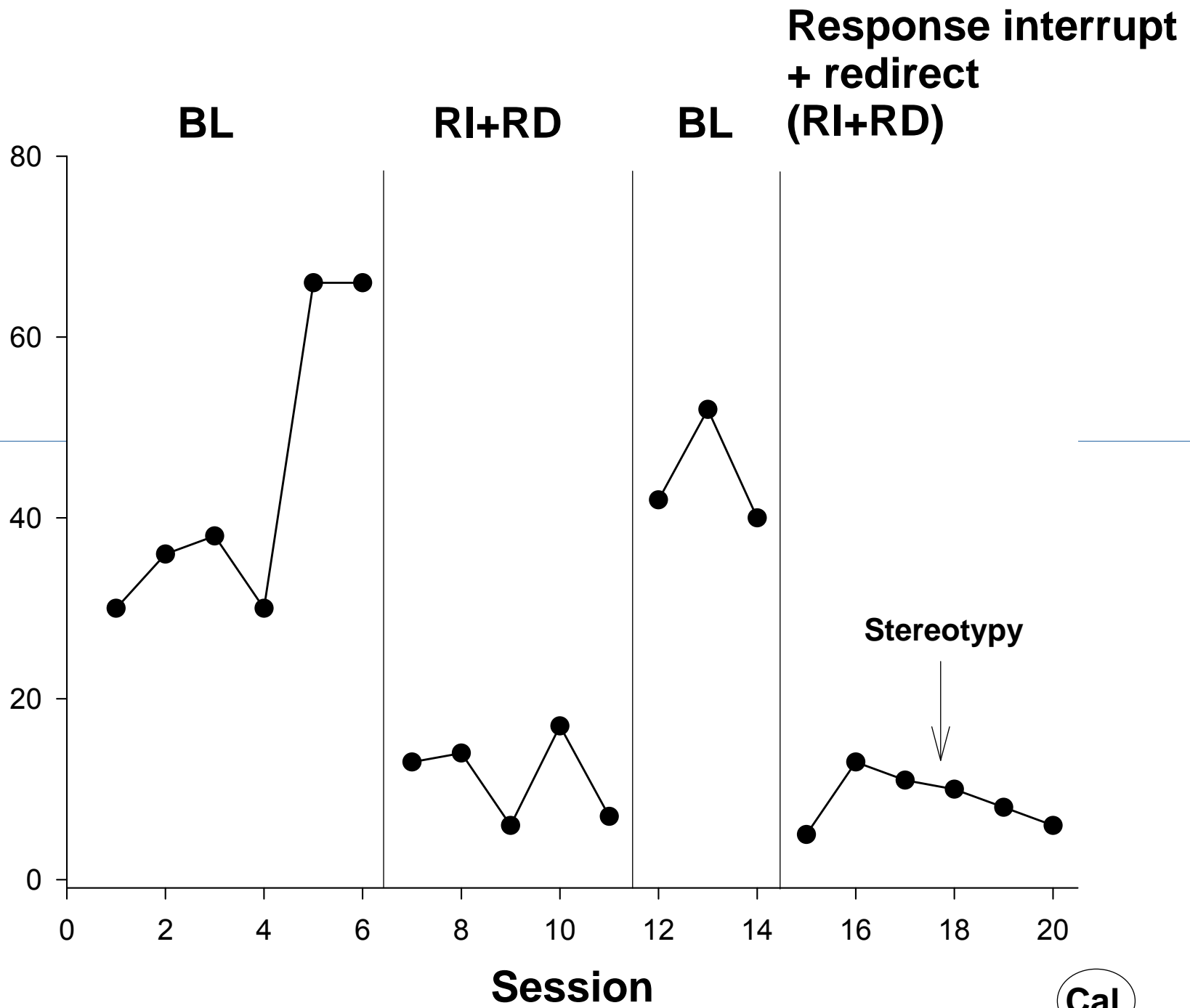
# Problems with competition

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

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

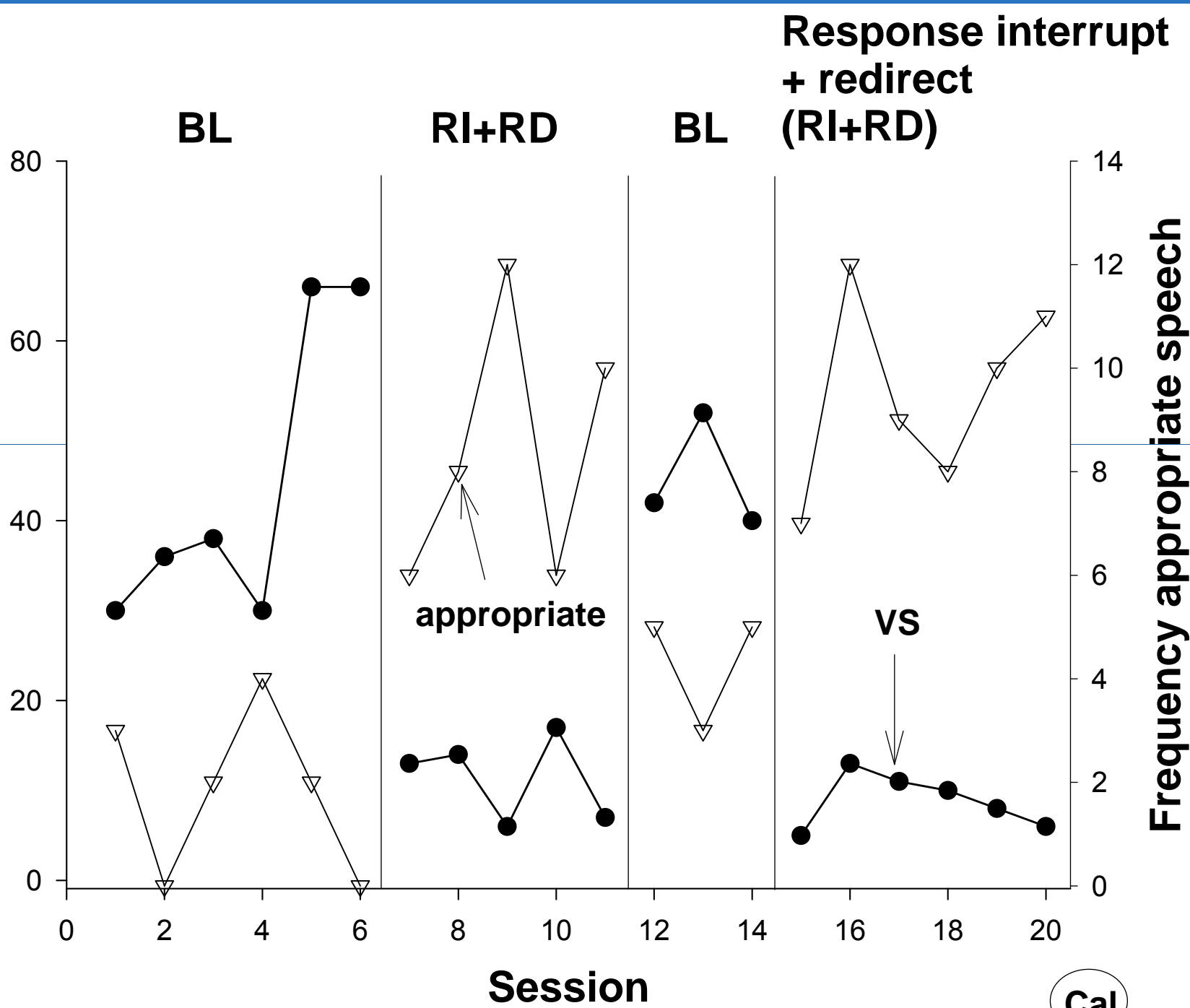
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- **Contingent upon vocal stereotypy**
  - Establish attention (eye contact)
  - Ask social questions (hi-p compliance)
  - Reinforce requesting/app speech
- **TX session extended to obtain 5-min w/out intervention application**

Percentage of intervals - Vocal Stereotypy

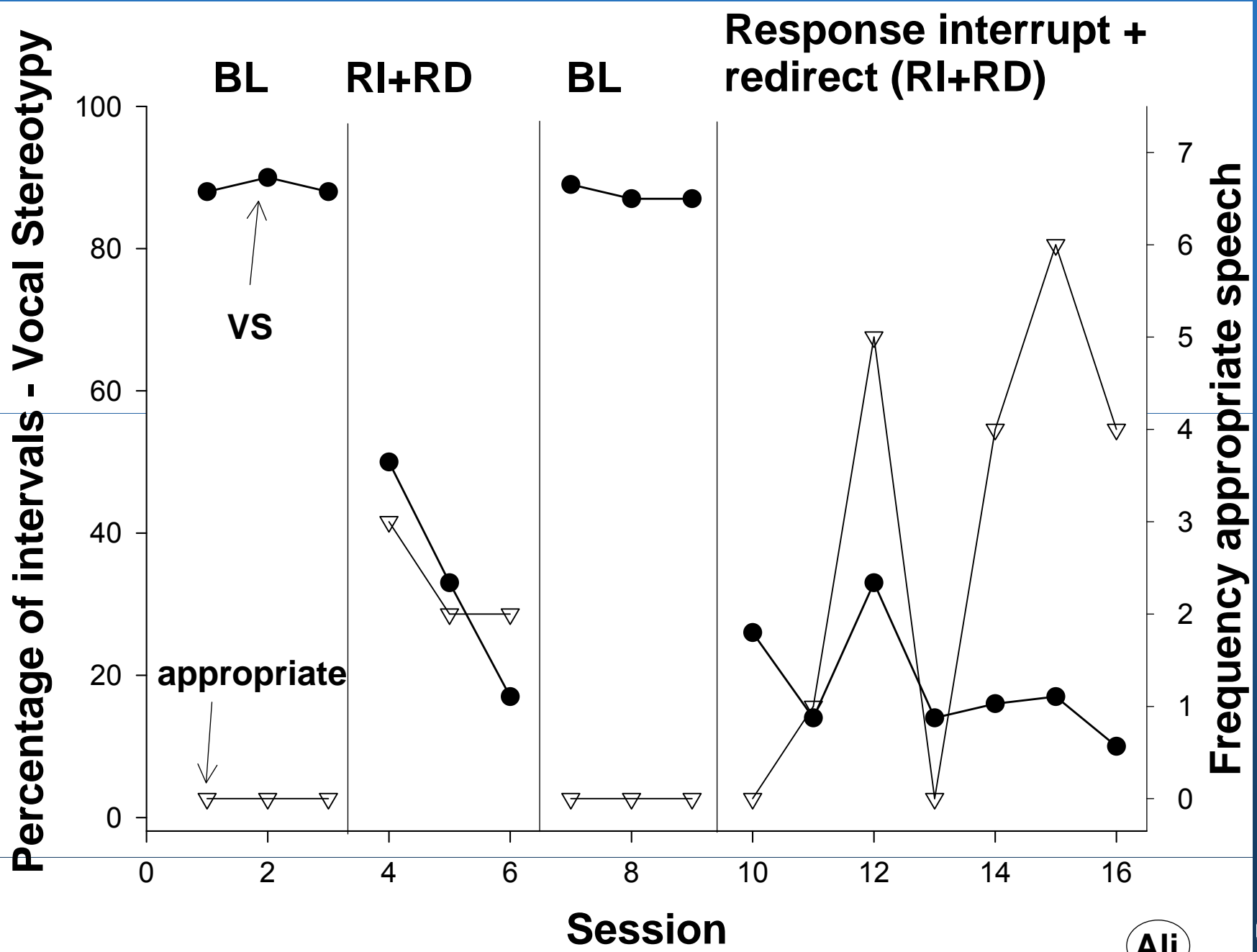


Cal

Percentage of intervals - Vocal Stereotypy



Cal



# 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



# 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

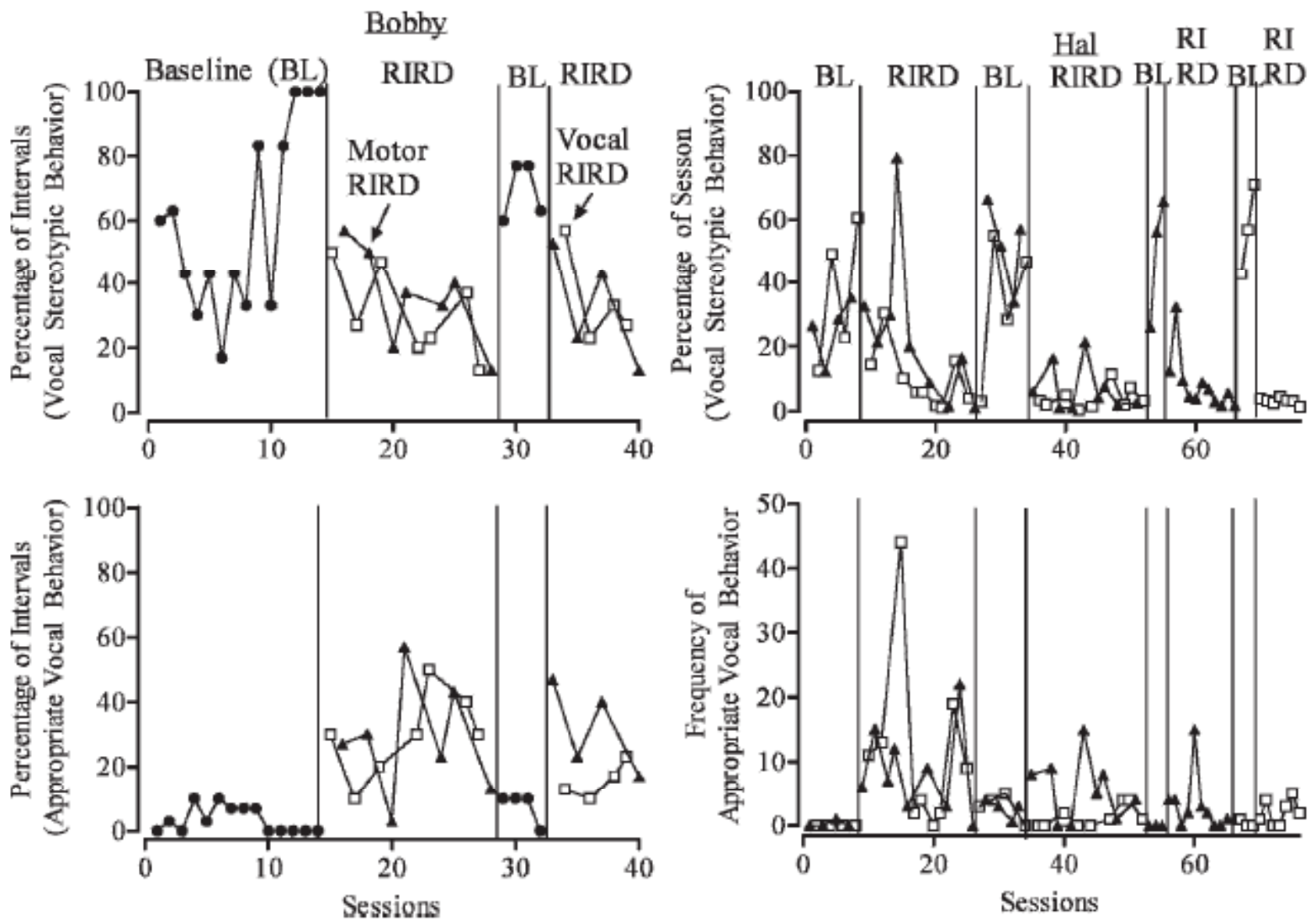
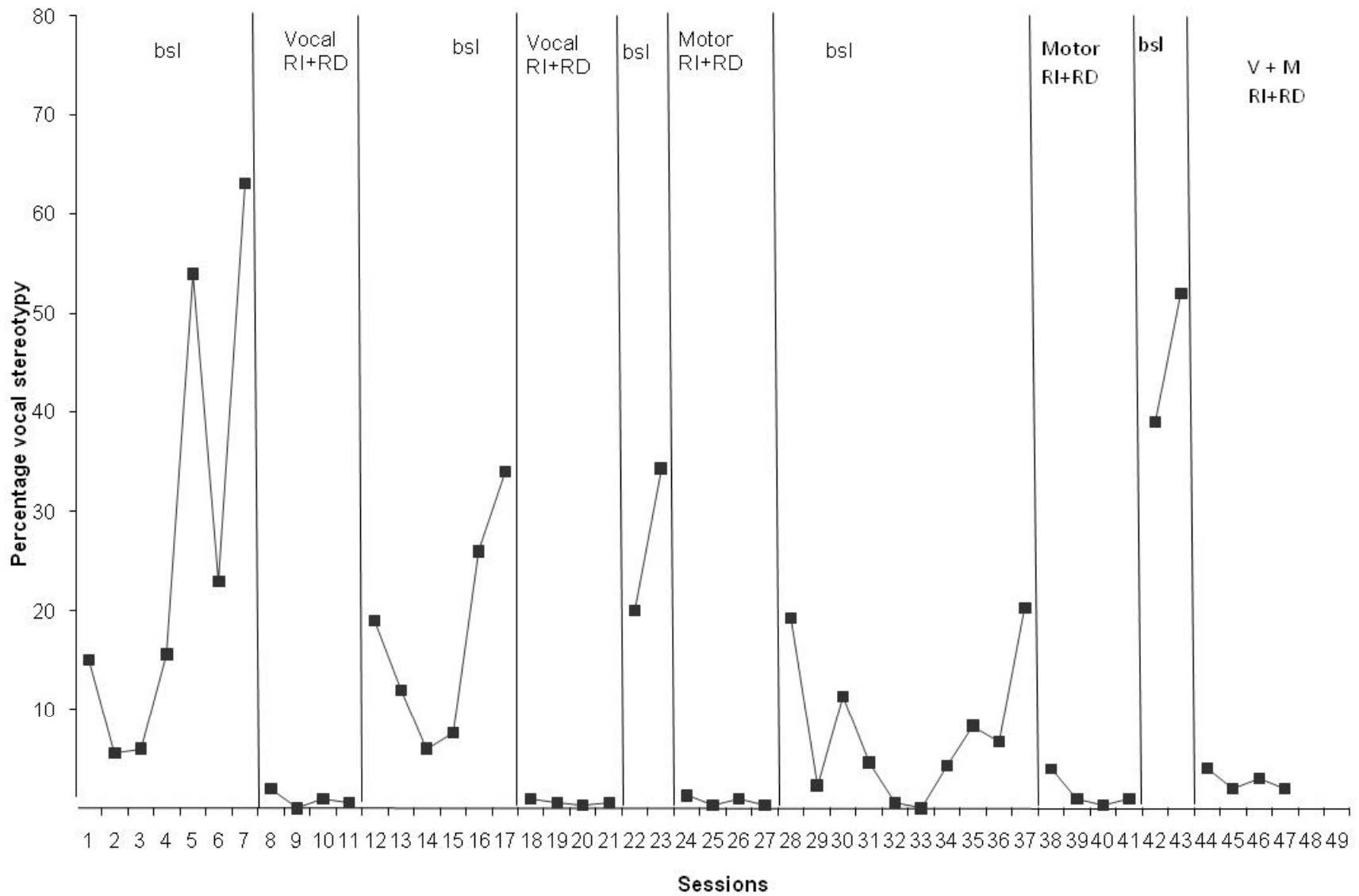
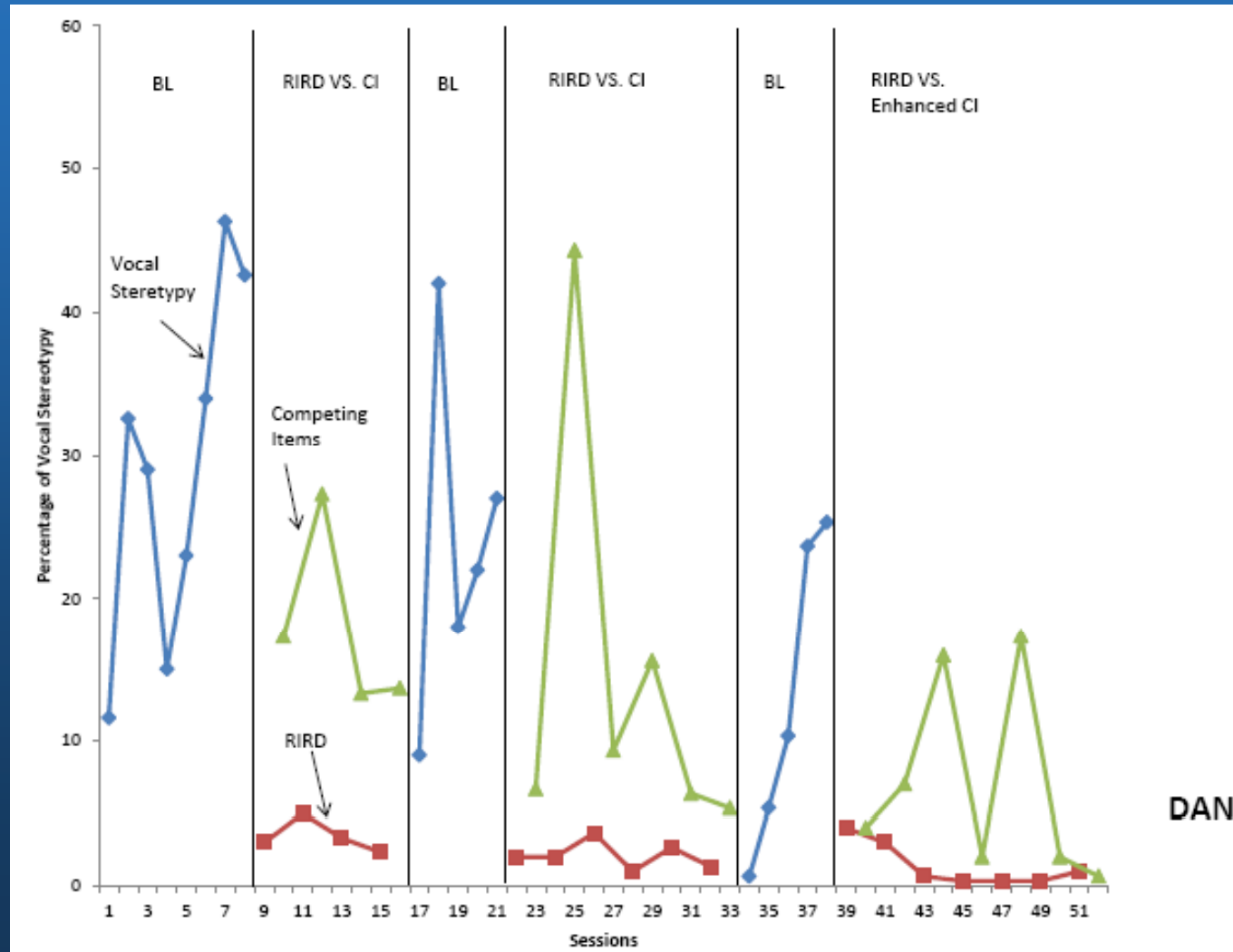


Figure 1. Percentage of intervals with vocal stereotypy (top left) and appropriate vocalizations (bottom left) for Bobby during the treatment comparison. Percentage of session time with vocal stereotypy (top right) and frequency of appropriate vocalizations (bottom right) for Hal during the treatment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



# RIRD variations



DAN

# 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)

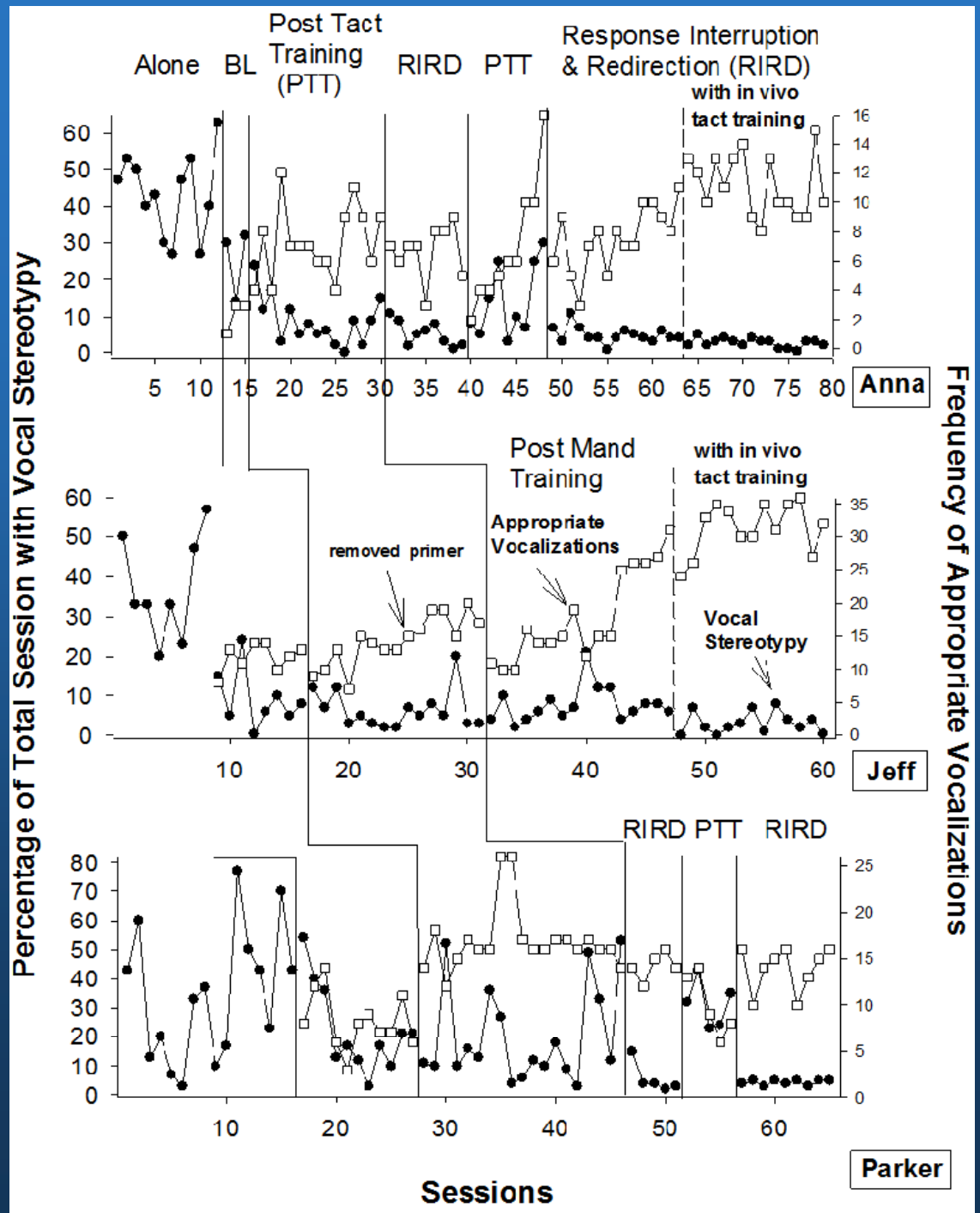
- Produce decreased levels of vocal stereotypy and increased levels of appropriate vocalizations
  - Evaluate effect of tact training on occurrence of appropriate vocalizations & vocal stereotypy
  - Evaluate effect of a response interruption/redirection procedure on vocal stereotypy





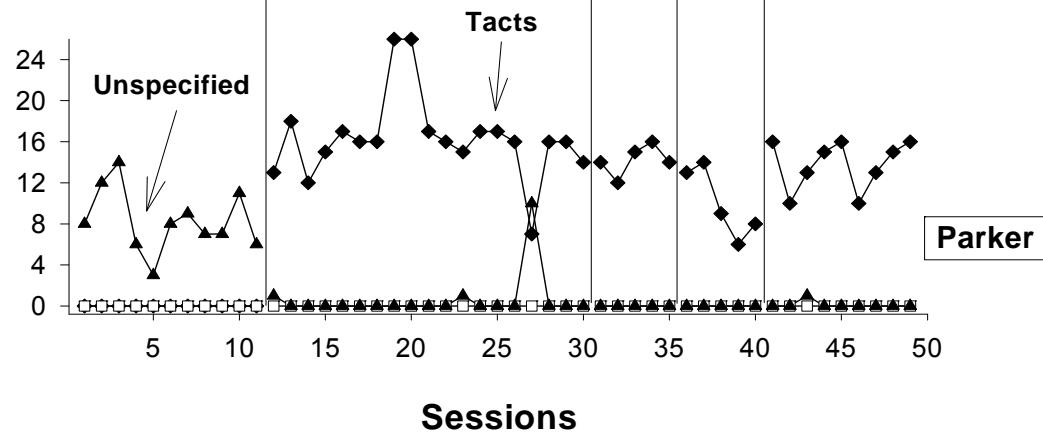
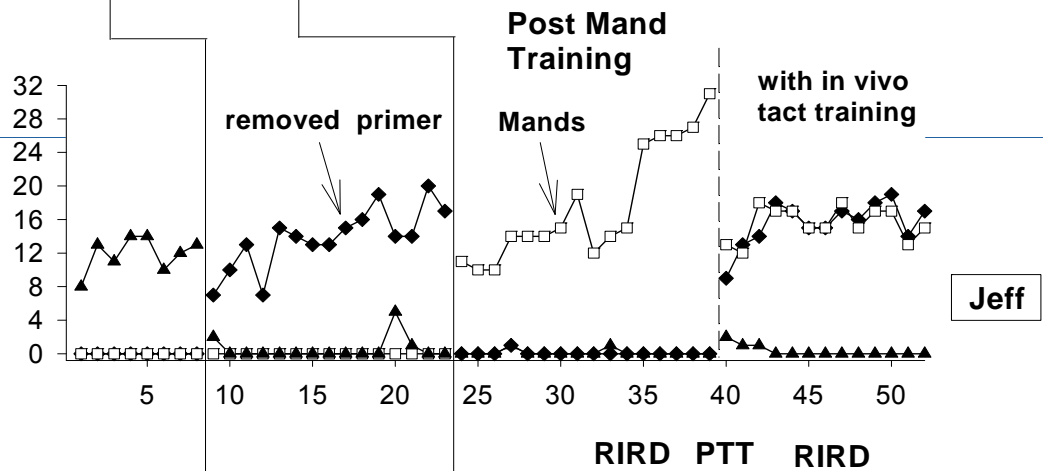
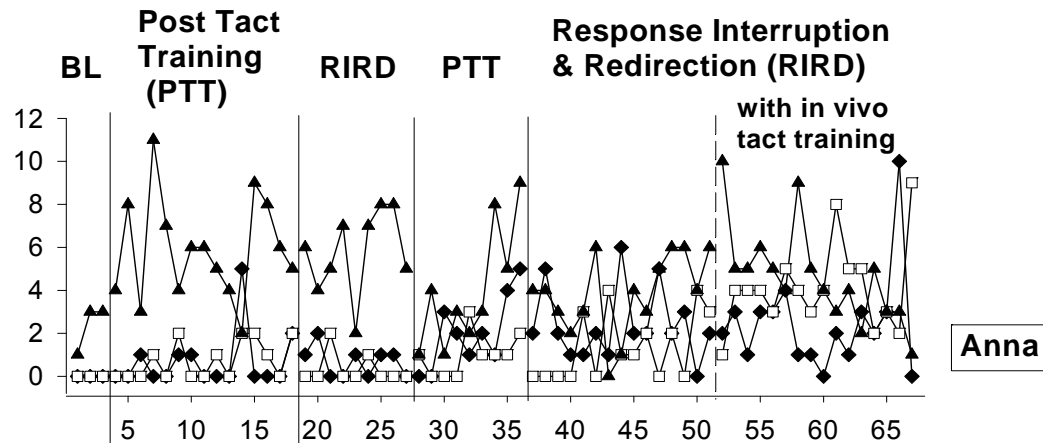
# Tact Training

- 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



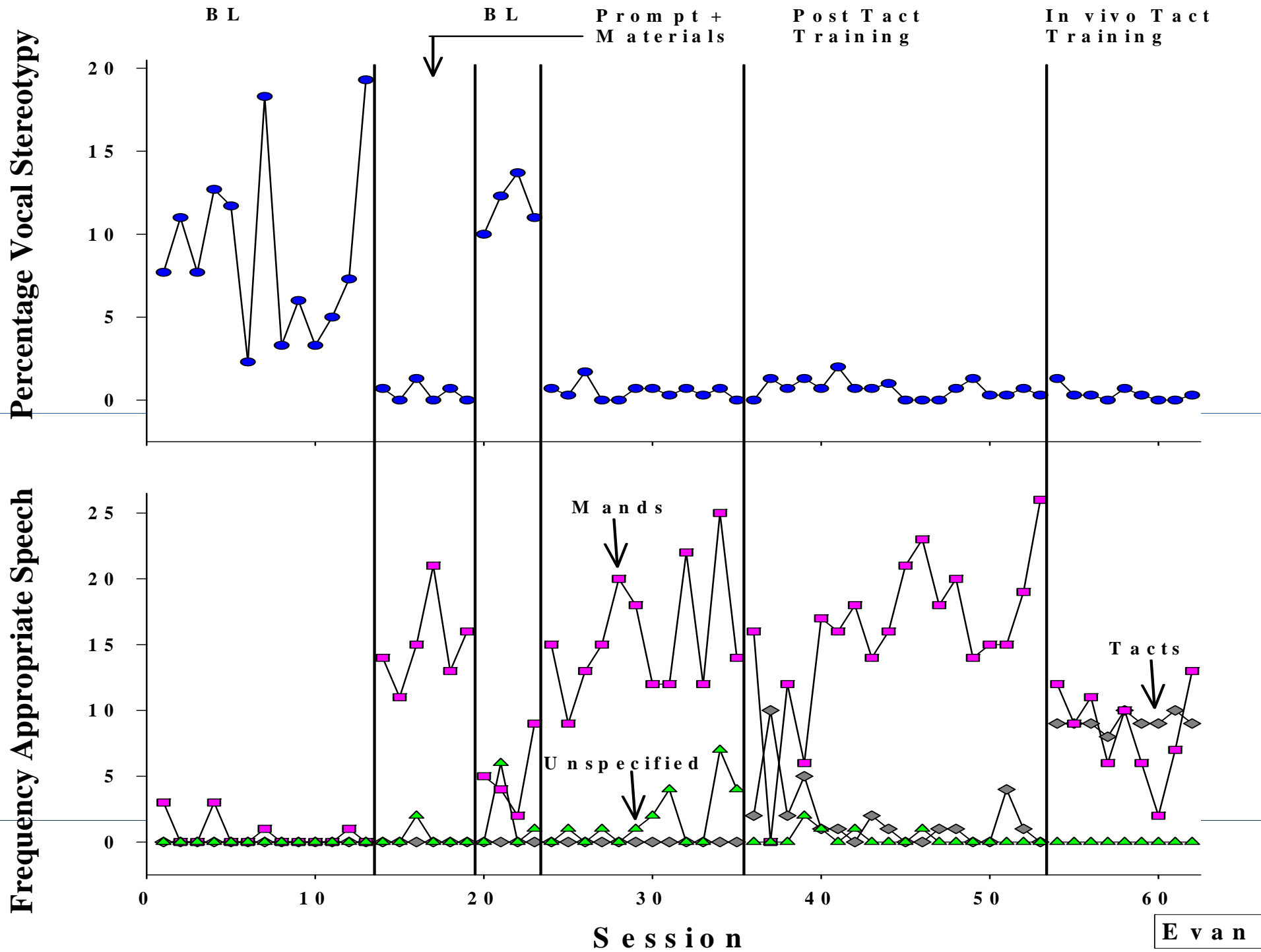
Frequency of Appropriate Vocalizations

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



# Torres-Viso, Sloman, & Schulman (Douglass Developmental Disabilities Center)

- Negative Reinforcement Assessment
  - Five minute sessions
  - Five conditions (“I see” program, singing tasks, motor tasks, vocal tasks, play condition)
  - Demands presented until Amy requested to stop, then removed for 20 seconds
- Dependent Measures:
  - Rate of “stop” requests
  - Inappropriate behavior (aggression, SIB, crying)
  - Latency to first “stop” response or instance of problem behavior

# DRO

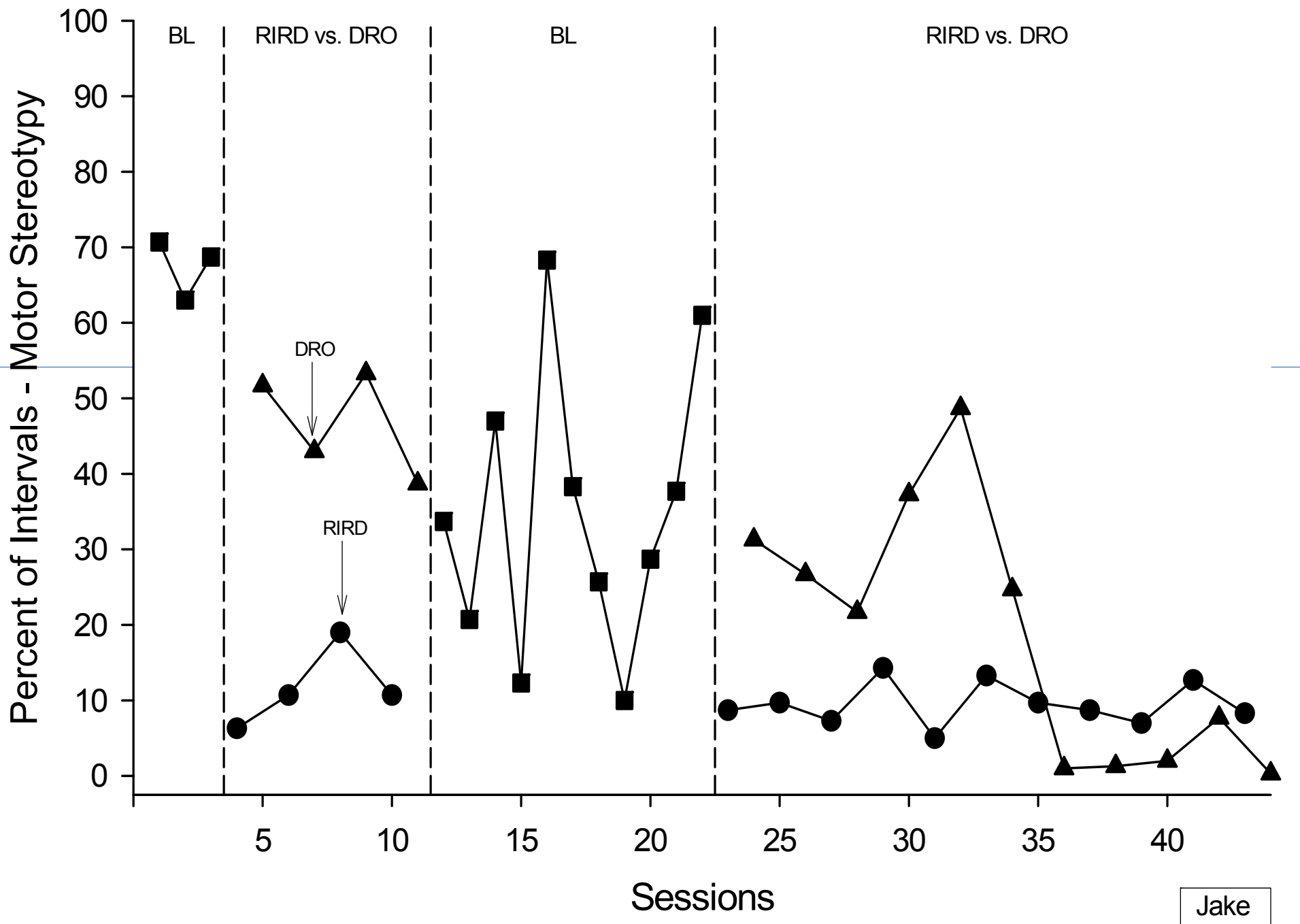
- Most commonly used treatment for aberrant behavior (Marcus & Vollmer, 1996)
- Effective treatment
  - e.g., Wacker et al. (1990); Taylor et al., (2005)
- **Resetting vs. non-resetting** (e.g., Himle, Woods, & Bunaciu, 2008; Roane, Falcomata, & Fisher, 2007).
- Effective in combination
  - Fellner, Laroche, & Sulzer-Azaroff (1984)
- Adventitious reinforcement (Repp & Deitz, 1974)
- Satiation (Egel, 1981)

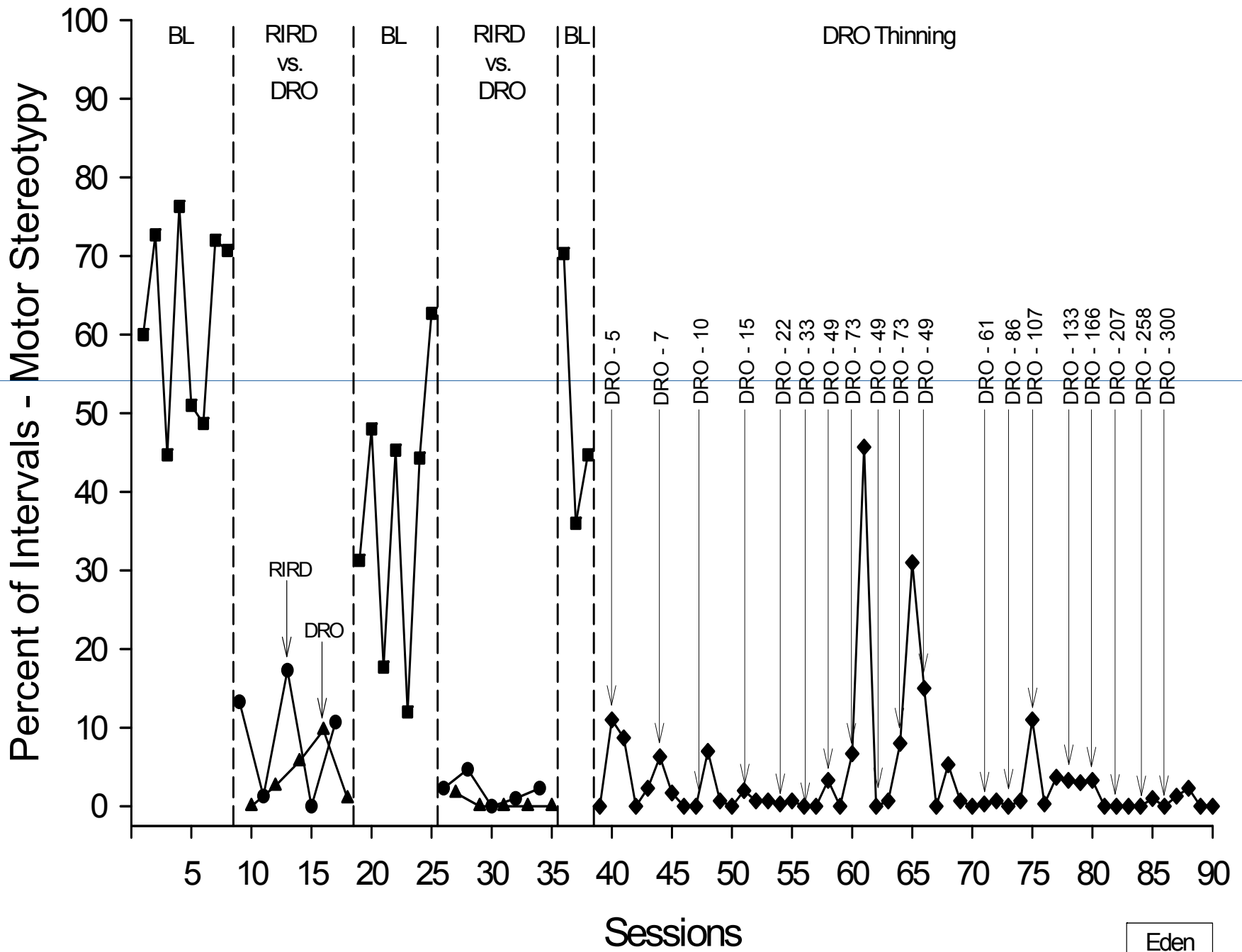
# DRO/Negative Punishment

## 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







# Context: Presence of others

