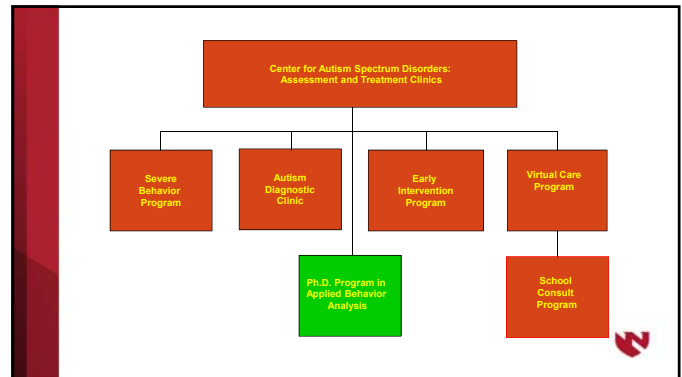


A transactional model of translational behavior analysis for increasing appropriate and decreasing problem behavior in children with autism.

Wayne W. Fisher

University of Nebraska Medical
Center's

Munroe-Meyer Institute

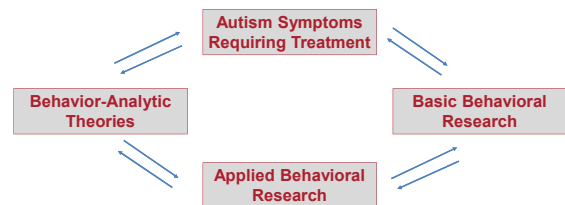


Translational Research Themes

- What are the basic behavioral processes that underlie the acquisition, maintenance, and generalization of adaptive and destructive behavior?
- How can we use our understanding of those processes to promote rapid and generalized decreases in destructive behavior and increases in adaptive behavior?



Transactional Model of Translation Behavior Analysis Applied to Autism



Extinction Component of Functioned-Based Treatments

- Almost all function-based treatments involve extinction.



Treatments involving Extinction

- “Any time you plan a crime, there are at least 50 ways you can screw up...” William Hurt to Mickey Rourke in *Body Heat*.
- Any time you plan a treatment involving extinction, there are a number of ways you can screw up.



Events that Reduce Behavior do not Erase Prior Learning

- For example, extinction does not erase the prior effects of reinforcement. Rather, extinction results in new learning (Bouton & Todd, 2014).
 - Example: Reversal learning



Evidence that Extinction Does not Erase Prior (Reinforced) Learning

- Extinction Bursts
- Reinstatement
- Renewal
- Resurgence
- Spontaneous Recovery



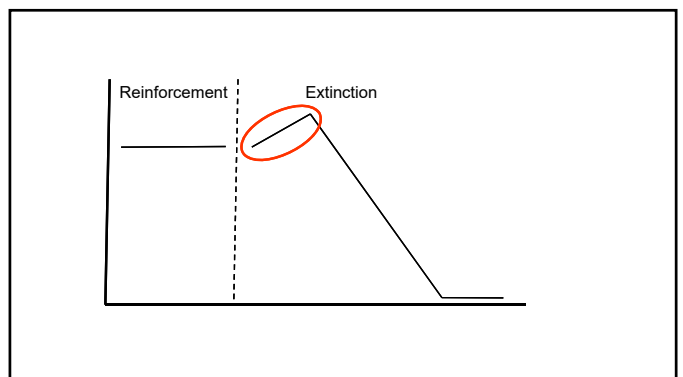
Can we counteract the Effects of Prior Learning During Extinction in Order to Prevent Treatment Relapse?

- Extinction Bursts
- Reinstatement
- Renewal
- Resurgence
- Spontaneous Recovery



Extinction Burst

- A temporary increase in responding when extinction is introduced to levels higher than those displayed when reinforcement was in effect.



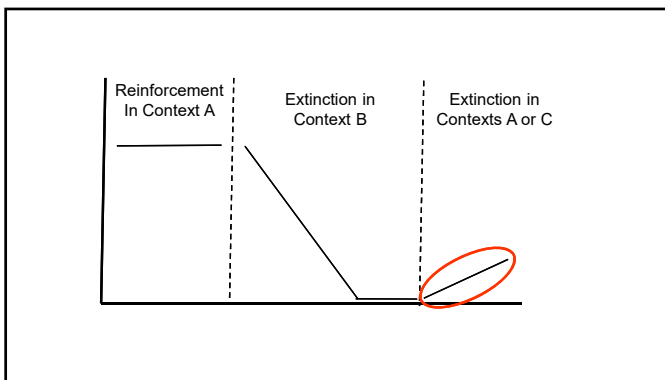
Risks from Extinction Bursts

- Are caregivers likely to continue a treatment that is markedly increasing the problem behavior?



Renewal

- Recovery of behavior that occurs when the subject is exposed to a change in context after extinction.



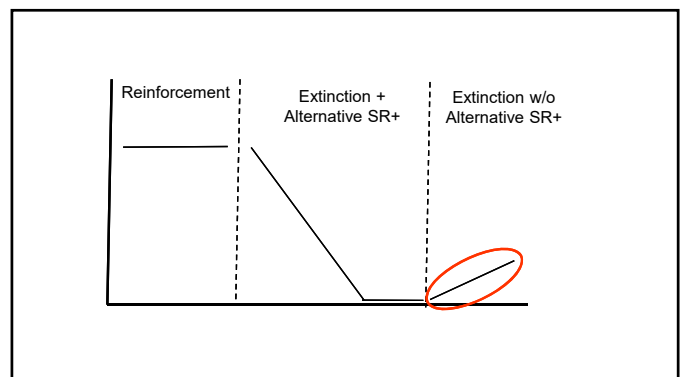
Risks from Renewal

- Do patients with problem behavior ever have a history of reinforcement at home, followed by treatment with extinction in the clinic, followed by the transfer of extinction back to the home?
- This would constitute an ABA renewal sequence.



Resurgence

- Recovery of behavior that occurs following treatment with alternative reinforcement plus extinction when the alternative reinforcement is withdrawn.



Risks from Resurgence

- ❑ Do caregivers and other interventionists ever fail to provide alternative reinforcement as scheduled?



Methods of Mitigating Extinction-Related Treatment Relapse



Preventing Extinction Bursts during FCT

- ❑ Controlling the establishing operation for problem behavior is particularly important during the early stages of treatment when extinction bursts typically occur.



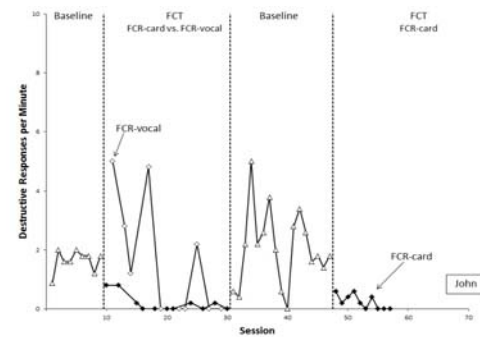
DeRosa et al. (2015).

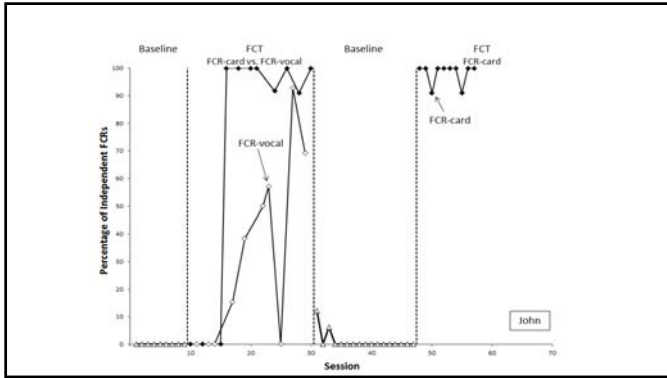
- ❑ We compared FCT using a picture exchange (or touch) as the FCR with a vocal FCR.
- ❑ The picture exchange version of FCT (FCT-card) allows strict control of the EO, because the therapist can immediately guide the FCR and deliver the reinforcer, which removes the EO.
- ❑ The vocal version of FCT (FCT-vocal) does not allow strict control of the EO, because one cannot guide a vocal response.



DeRosa et al. Procedures

- ❑ Following baseline, we introduced the two FCT treatments (FCT-card and FCT-vocal) using a progressive time-delay procedure to teach each FCR.
- ❑ We compared the two treatments using a multielement phase.
- ❑ Following a return to baseline, reintroduced the more effective treatment in the final phase.





DeRosa et al. Conclusions

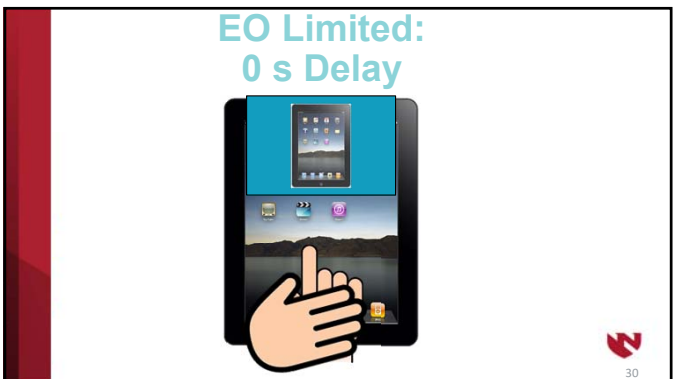
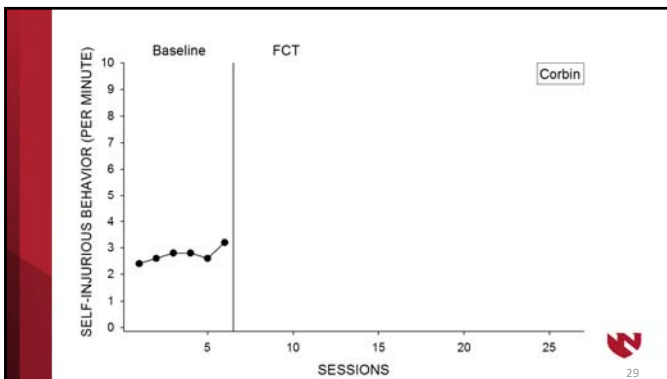
- ❑ The FCT-card condition allowed better control of the EO for problem behavior.
- ❑ The FCT-card condition produced more rapid reductions in problem behavior.
- ❑ The FCT-vocal condition was associated with an extinction burst for one participant, which was not observed in the FCT-card condition.

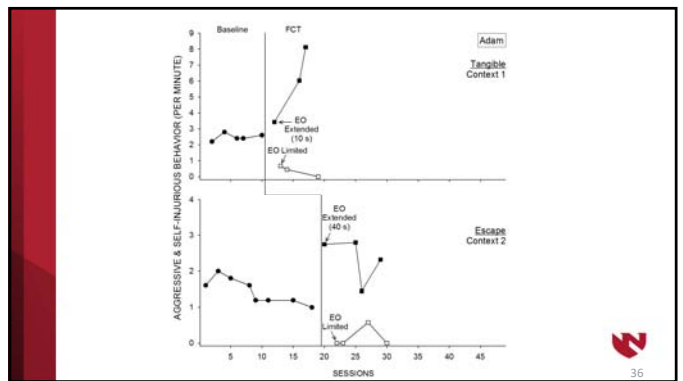
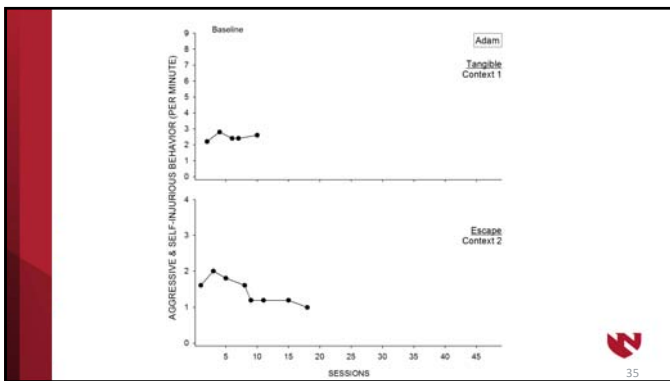
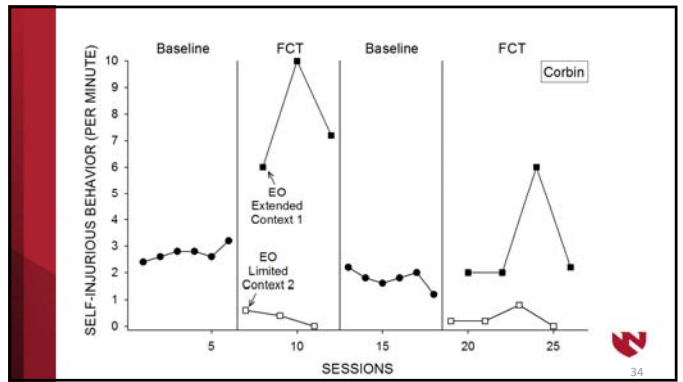
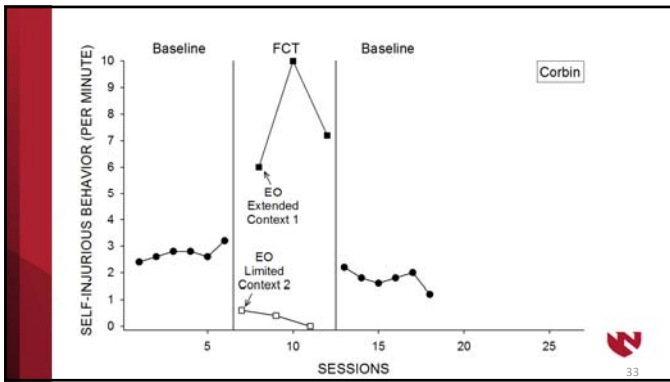
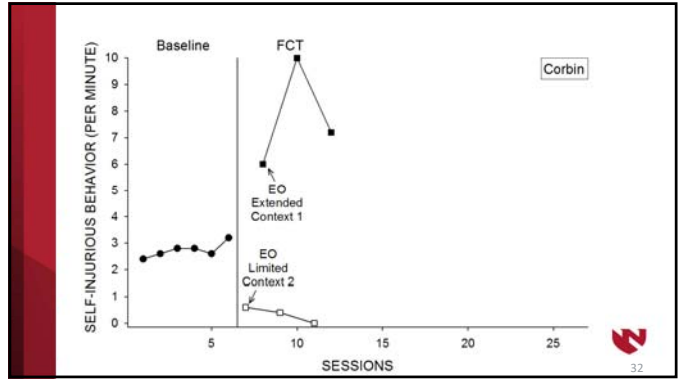
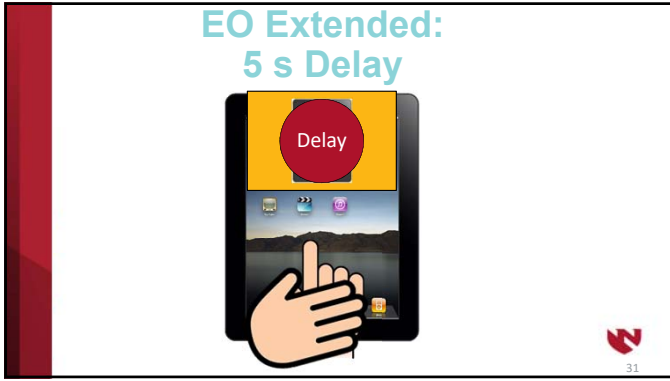
Limitation of DeRosa et al.

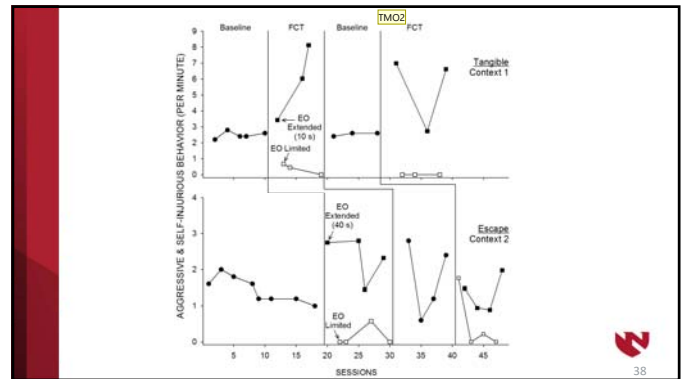
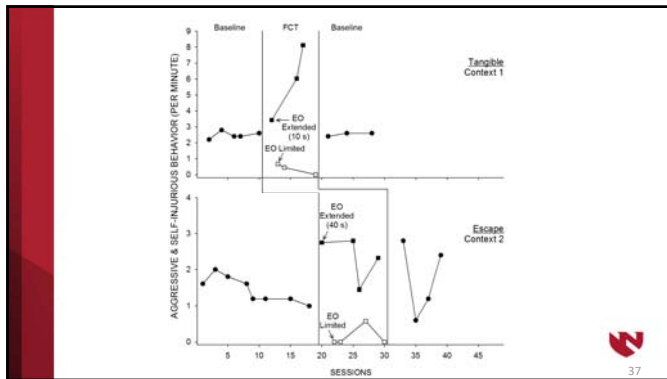
- ❑ The investigators did not isolate the effects of the establishing operation on destructive behavior because we used different FCT responses (FCT-card and FCT-vocal).
- ❑ This left open the possibility that the differences were due to the type of FCT response rather than different levels of exposure to the EO.

Fisher et al. (in press)

- ❑ We corrected the limitations of DeRosa et al. (2015) by directly manipulated the duration of exposure to the EO during FCT.
- ❑ We compared a limited-EO condition with an extended-EO condition using a card touch or card exchange response in both conditions.







Conclusions

□ Consistent with DeRosa et al. (2015)

- Even relatively brief exposure to EO (e.g., 5 s) can produce elevated rates of problem behavior and extinction bursts



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Conclusions (Cont.)

□ Extend DeRosa et al.

- EO exposure is an important predictor of functional communication training efficacy
- The limited-EO condition reduced problem behavior more rapidly and to a greater extent than the extended-EO condition
- EXT burst occurred in 5 of 6 applications of the extended-EO condition compared with 0 of 6 applications of the limited-EO condition



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Preventing Renewal during FCT

□ Establishing strong discriminative control of the functional communication response and problem behavior can help to prevent renewal effects when transferring treatments from one context to another.



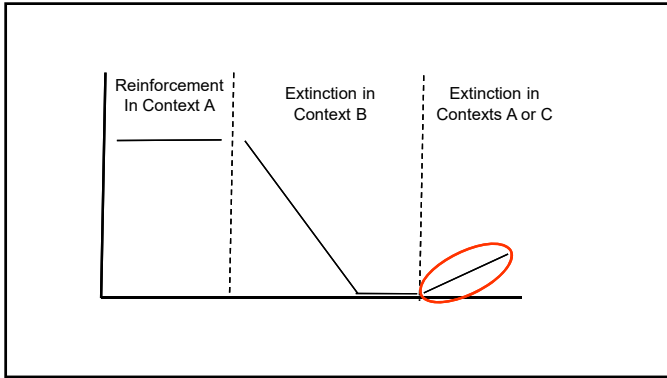
Renewal

□ Recovery of behavior that occurs when the subject is exposed to a change in context after extinction.




TMO2 Missing name box on upper right

Todd M. Owen, 4/8/2016



Fisher et al. (2015)

□ In this investigation, we evaluated whether the signals used in multiple schedules during FCT would facilitate rapid transfer of treatment effects from one setting to the next and from one therapist to the next without renewal of problem behavior.


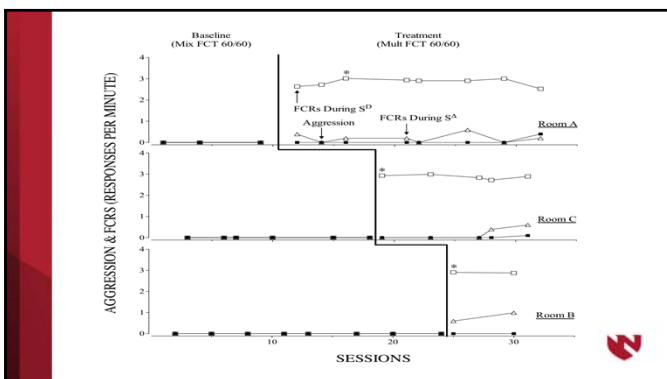
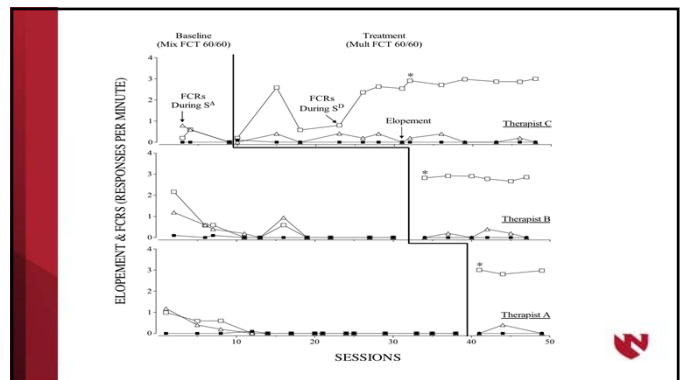


Fisher et al. (2015)

□ Compared rates of alternative and problem behavior when a multiple schedule was introduced across therapists or settings in a multiple baseline design:

Mixed FR-1:60 s / EXT:60 s to Mult FR-1:60 s / EXT:60 s


Mult FR-1:60 s / EXT:60 s to Mult FR-1:60 s / EXT:300 s

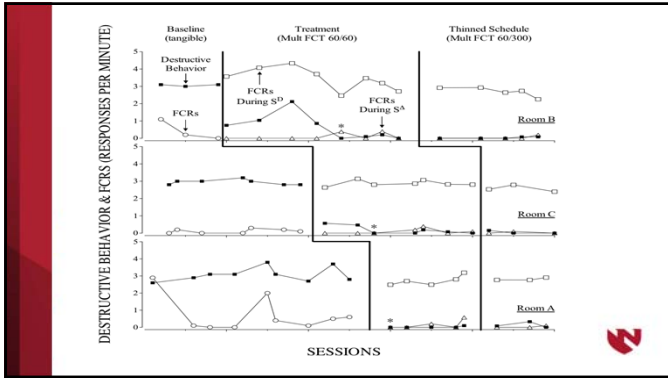



Limitation

□ One limitation of these analyses is that treatment had already reduced problem behavior to near-zero levels, so rapid transfer of treatment effects occurred primarily for the FCR.

□ Therefore, we conducted an additional analysis with another participant who showed high rates of problem behavior during baseline.





Conclusions

- Study 1 showed that inclusion of contingency-correlated stimuli resulted in the rapid transfer of FCT treatment effects across therapists and settings without renewal of problem behavior.
- Study 2 showed that using a multiple schedule during FCT facilitated increasingly more rapid reductions in problem behavior across settings.

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Preventing Resurgence during FCT

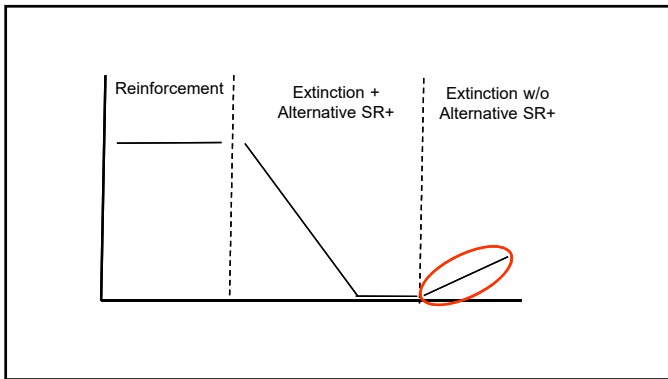
- Establishing strong discriminative control of the functional communication response and problem behavior can help to prevent resurgence effects when alternative reinforcement is discontinued.

A red lightning bolt logo is in the bottom right corner.

Resurgence

- Recovery of behavior that occurs following treatment with alternative reinforcement plus extinction when the alternative reinforcement is withdrawn.

A red lightning bolt logo is in the bottom right corner.



Behavioral Momentum Theory (BMT)

- *Behavioral momentum theory* is a quantitative theory of behavior that employs a comparative metaphor based on the classical mechanics of the momentum of physical objects.

A red lightning bolt logo is in the bottom right corner.

Behavioral Momentum Theory (BMT)

Behavioral momentum theory is relevant to FCT because it provides quantitative models and predictions about the persistence and resurgence of problem behavior when the FCR fails to produce reinforcement.



The Momentum Metaphor

Momentum of a moving object =

$$\text{mass} \times \text{velocity}$$

Momentum of a response =

$$\text{rate of reinforcement} \times \text{response rate}$$



The Momentum Metaphor

Momentum of a moving object =

$$\text{mass} \times \text{velocity}$$

Momentum of a response =

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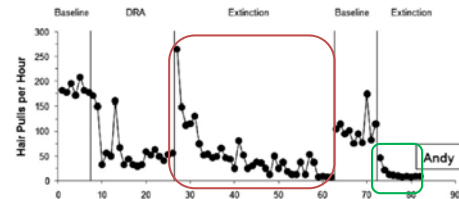


The Momentum of an Object Equal its Mass times its Velocity



Behavioral Momentum Effects of FCT

Reinforcing the FCR in the same stimulus context in which problem behavior was previously reinforced bolsters the momentum of problem behavior (e.g., Mace et al., 2010; Volkert et al., 2009).



Mace et al. (2010). Behavioral persistence during extinction following DRA and baseline.

Behavioral Momentum Effects of FCT

- ❑ Mult-FCT may circumvent this problem by establishing the FCR in a stimulus context that is distinct from the one(s) in which destructive behavior historically produced reinforcement.
- ❑ That is, with mult FCT, EXT challenges are signaled with the S^A . The presence of the S^A may change stimulus context and thereby reduce resurgence of destructive behavior.



Fuhrman et al. (2016). Mitigating resurgence of destructive behavior

- ❑ Baseline, Traditional FCT, EXT Challenge
- ❑ Baseline, mult FCT, EXT Challenge
- ❑ Compare levels of destructive behavior in the two EXT phases.



Fuhrman et al. (2016) Procedure

- ❑ Compare levels of destructive behavior in the two EXT phases.
 - EXT with S^A from mult FCT
 - EXT without S^A from Traditional FCT

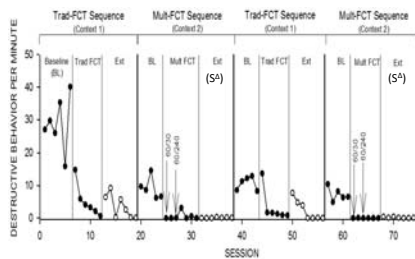


Fuhrman et al. (2016) Procedure

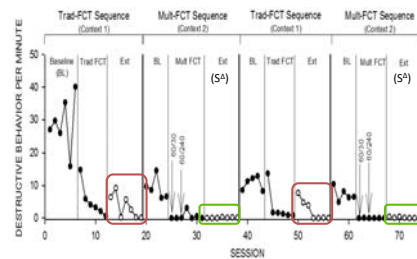
- ❑ Hierarchical ABAB design
- ❑ Within each A and B phase, we embedded three sub phases
 - Baseline Treatment EXT

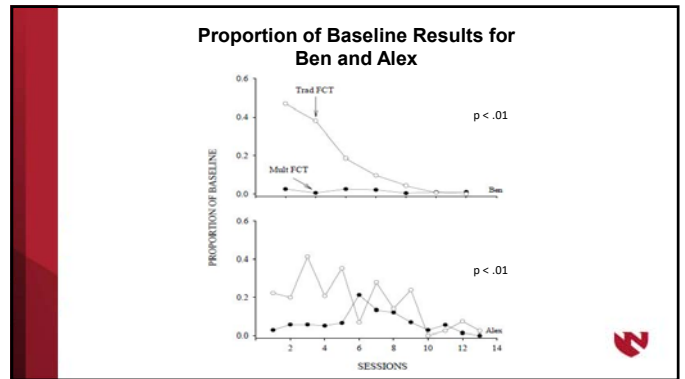
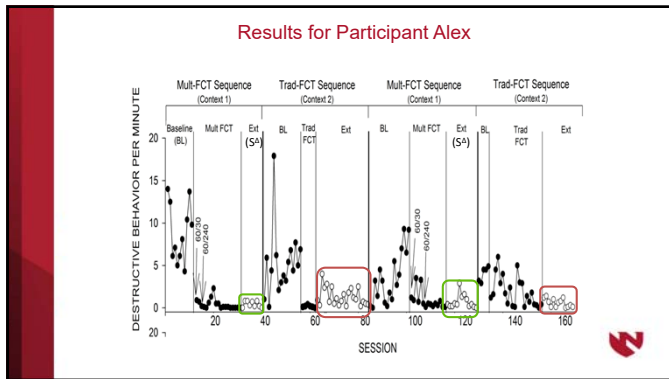


Results for Participant Ben



Results for Participant Ben





Fuhrman et al. (2016)

- Preliminary results suggest that mult FCT with schedule fading may mitigate or prevent resurgence of destructive behavior.

Fisher et al. (in press): Preventing Resurgence during FCT

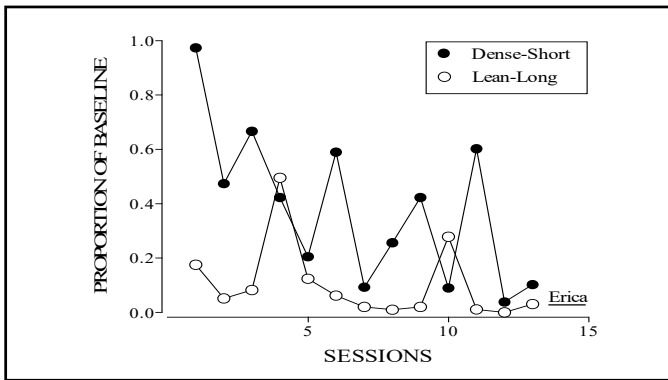
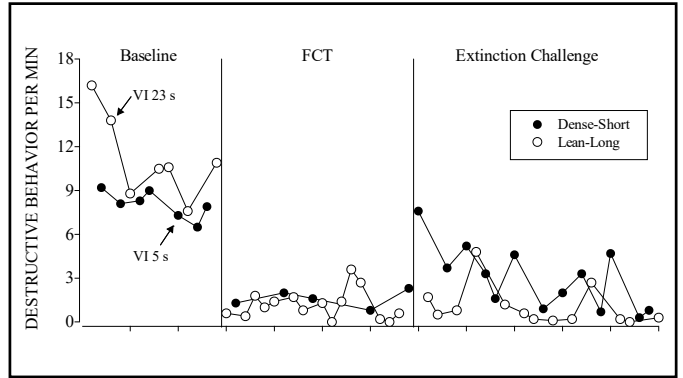
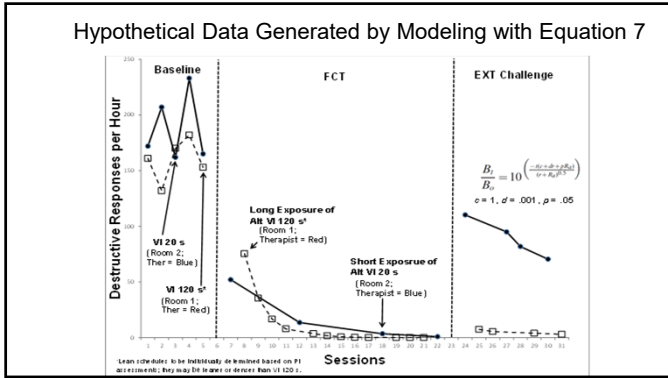
- Controlling the rates of reinforcement during baseline and FCT combined with extending the duration of treatment with FCT can mitigate resurgence.

Equation 7 Predicts the Effects of Adding and Removing Reinforcement for the FCT Response

$$\frac{B_t}{B_0} = 10^{\left(\frac{-t(c + dr + pR_d)}{(r + R_d)^{0.5}} \right)}$$

Modeling Potential Consequence-Control Refinements of FCT using BMT

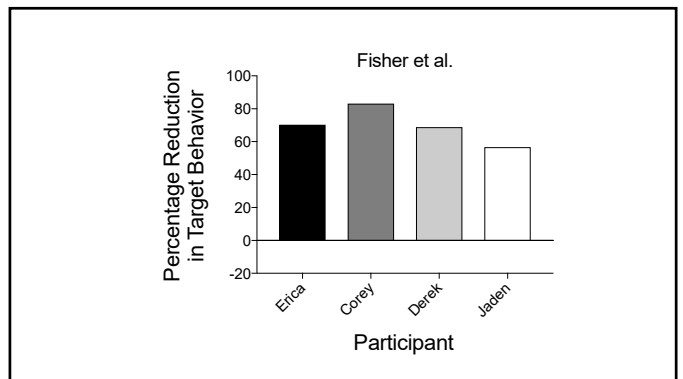
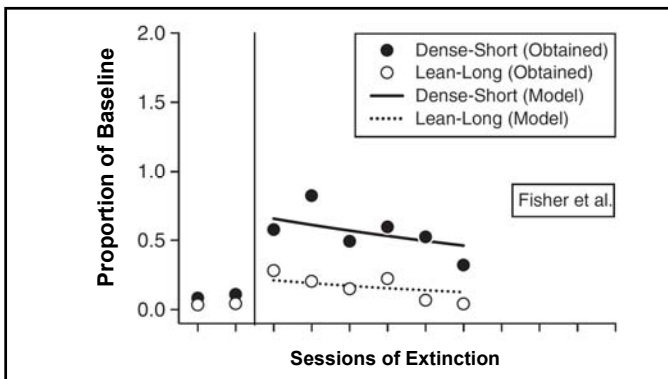
- What does the model predict will happen to resurgence if we implement all three recommended treatment components simultaneously?
 1. maximizing the value of t ;
 2. minimizing the value of r ; and
 3. minimizing the value of R_a .

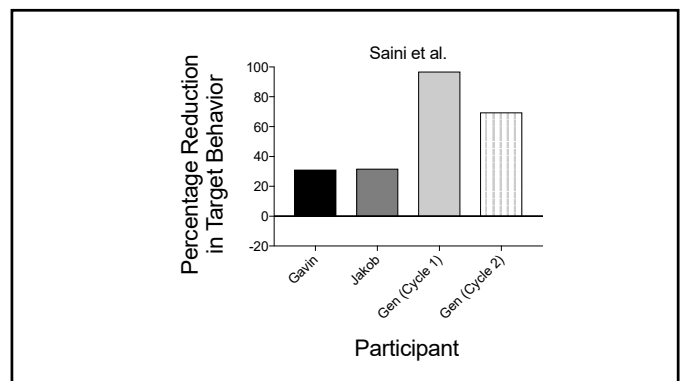
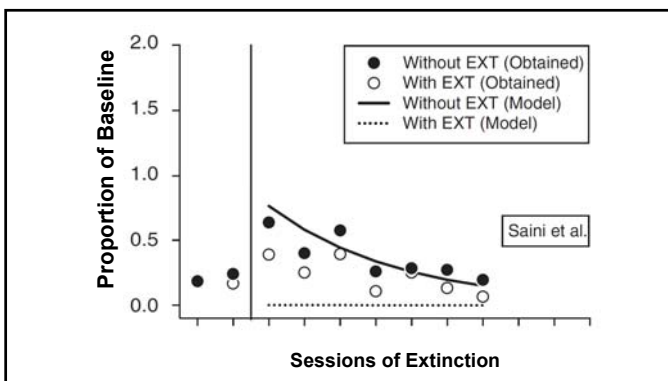
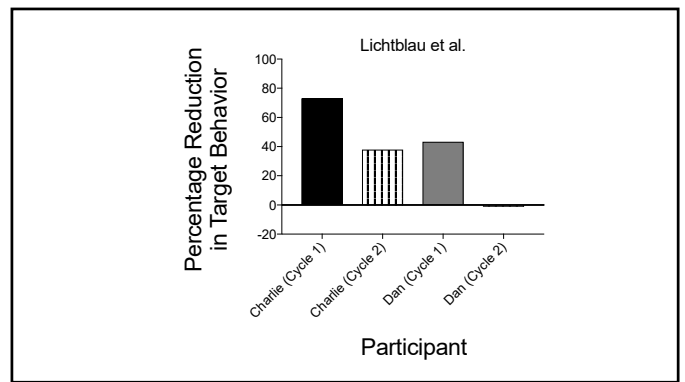
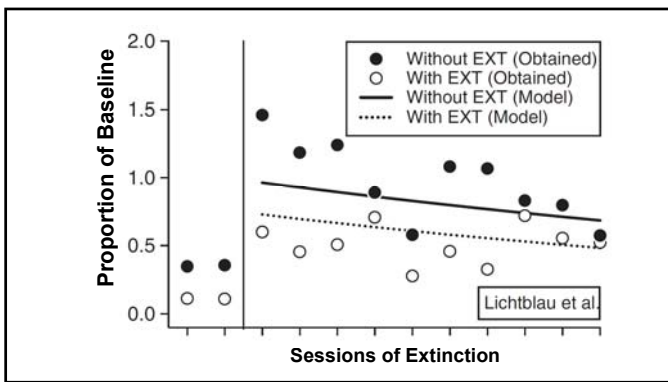
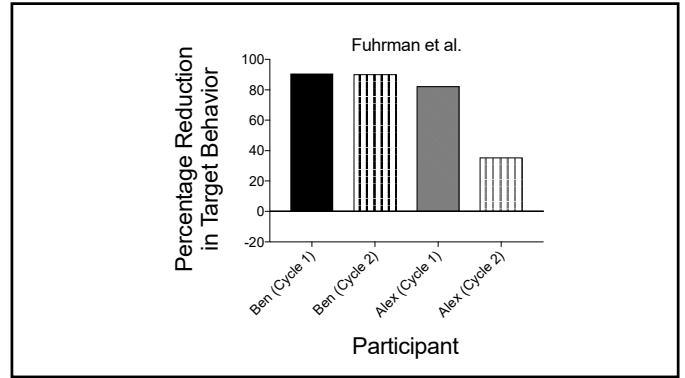
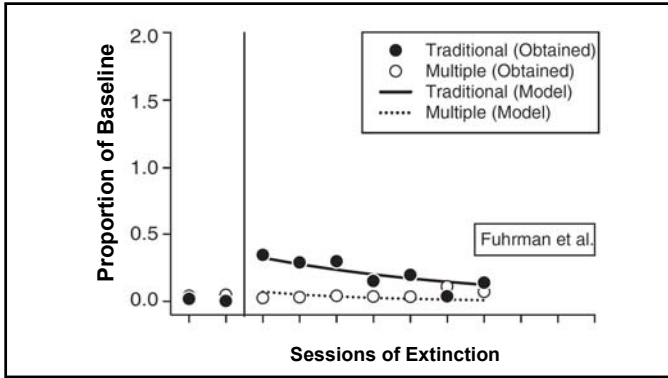


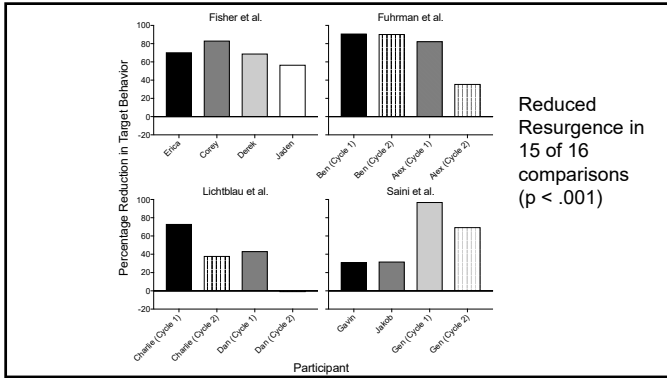
Predictive Validity of BMT for Preventing Resurgence of Destructive Behavior

□ Summary of our four recent research studies published or accepted for publication in which we compared a BMT-informed intervention with a control condition.

- Fisher et al. (in press)
- Fuhrman et al. (2016)
- Lichtblau et al. (in press)
- Saini et al. (2017)







Concluding Comments

□ Controlling the EO for problem behavior can lead to more rapid reductions in problem behavior and prevent extinction bursts.

Concluding Comments

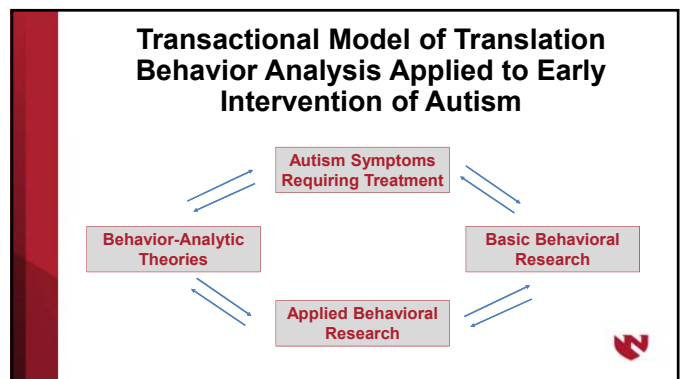
□ The use of discriminative stimuli within multiple schedules can be used to promote transfer of treatment effects across contexts and also prevent treatment relapse in the form of renewal and resurgence.

Concluding Comments

□ Schedule manipulations informed by BMT can mitigate resurgence of destructive behavior.

Concluding Comments

□ Mathematical models like behavioral momentum theory provide a method for developing new and interesting clinical research questions that have the potential to greatly improve treatments like FCT and prevent treatment relapse.



Translating Operant Theories of Stimulus Control and Verbal Behavior to Promote Generative Language

- Generative language involves correctly producing novel, functional sentences and correctly responding as a listener to another speaker's novel, functional sentences.



Recombinative Generalization

- Re-combining functional characteristics of stimuli into novel, functional units without direct teaching
- Serves as a basis for recombinative verbal behavior (or generative language)
- Ex: If I tell you that Lena is faster than Sven and Sven is faster than Ole, who would win a race between Lena and Ole?



Recombinative Generalization

- Recombinative generalization research is grounded in stimulus control research.
- Sidman's (1994) theory and research on stimulus equivalence has spawned a large and growing body of research on the basic learning principles and processes underlying generative language.

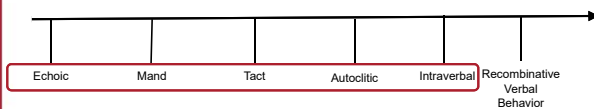


Translational Conceptual Model for Promoting Generative Language

- Skinner's taxonomy of verbal behavior describes the general functional operants that should be targeted to promote generative language.
 - Skinner, 1957



Skinner's Taxonomy of Verbal Operants



Skinner, 1957



The Relevance of Skinner's Taxonomy of Verbal Behavior to Autism

- Skinner's definition of verbal behavior encompasses all social and language behavior.
 - "Verbal behavior is behavior that is reinforced through the mediation of other people, but only when the other people are behaving in ways that have been shaped and maintained by an evolved verbal environment, or language" (p. 90; Skinner, 1987).
- This definition is relevant to autism because factor-analytic research has shown that social and language behavior are highly interrelated in children with autism.



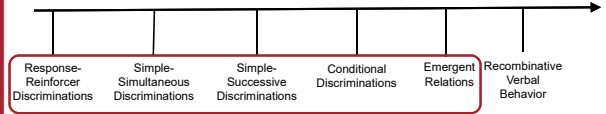
Translational Conceptual Model for Promoting Generative Language

□ Sidman's continuum of stimulus control describes the basic discriminative processes that should be invoked to promote generative language.

- Sidman, 2000



Stimulus Control Continuum



Sidman, 2000



Sidman's Stimulus Control Continuum

Skinner's Taxonomy of Verbal Behavior

	Response-Reinforcer Discriminations	Simple-Simultaneous Discriminations	Simple-Successive Discriminations	Conditional Discriminations	Emergent Relations	Recombinative Verbal Behavior
Echoic						
Mand						
Tact						
Autoshape						
Intraverbal						

Translational Conceptual Model for Promoting Generative Language

□ The model potentially serves three important functions:

- Cataloging the existing body of operant literature on verbal behavior and promoting generative language;
- Identifying gaps in the extant literature on verbal behavior to spur research to address those gaps; and
- Guiding ABA treatment for children with autism so that practitioners use the full research base on verbal behavior.



Sidman's Stimulus Control Continuum

Skinner's Taxonomy of Verbal Behavior

	Response-Reinforcer Discriminations	Simple-Simultaneous Discriminations	Simple-Successive Discriminations	Conditional Discriminations	Emergent Relations	Recombinative Verbal Behavior
Echoic						
Mand	Reinforcing "bah" but not "bee"				Alternately reinforcing the echoing of "ball" and "pelota" when teaching Spanish	
Tact						
Autoshape						
Intraverbal						

Sidman's Stimulus Control Continuum

Skinner's Taxonomy of Verbal Behavior

	Response-Reinforcer Discriminations	Simple-Simultaneous Discriminations	Simple-Successive Discriminations	Conditional Discriminations	Emergent Relations	Recombinative Verbal Behavior
Echoic						
Mand						
Tact						
Autoshape						
Intraverbal					Promoting the emergence of convergent intraverbals	

Example: Facilitating the Emergence of Convergent Intraverbals

❑ Can preschool children with ASD learn the following tasks without direct training?

- Name a mammal from the savannah.
- Name a bird from the rain forest.
- Name a bird from the savannah.
- Name a mammal from the rain forest.

DeRosa et al. (2017?)



Emergence of Convergent Intraverbals Requires Recombining Multiple Elements of the Spoken Stimulus

❑ Element 1:

- Name a mammal from the savannah.



Emergence of Convergent Intraverbals Requires Recombining Multiple Elements of the Spoken Stimulus

❑ Element 2:

- Name a mammal from the savannah.



Emergence of Convergent Intraverbals Requires Recombining Multiple Elements of the Spoken Stimulus

❑ Element 3:

- Name a mammal from the savannah.

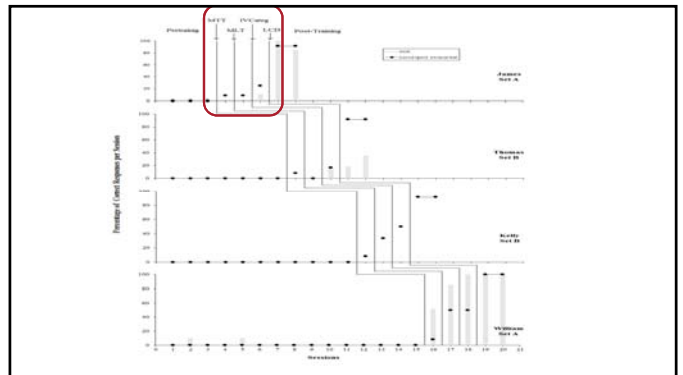


Emergence of Convergent Intraverbals Requires Recombining Multiple Elements

❑ Element 3:

- Name a mammal from the savannah.

Novel, untrained response



Conclusion

- These results show that preschool children with ASD can be trained to display novel, complex verbal responses like convergent intraverbals.
- The results strongly supported the supposition that training the children to emit the hypothesized prerequisite skills facilitated the emergence of convergent intraverbal behavior.

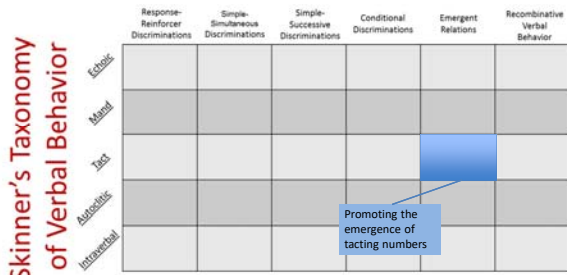


Recombinative Learning and Generalization via Matrix Training

- Matrix training involves teaching a specific subset of target skills such that the child acquires each component skill necessary for recombinative learning and generalization.



Sidman's Stimulus Control Continuum



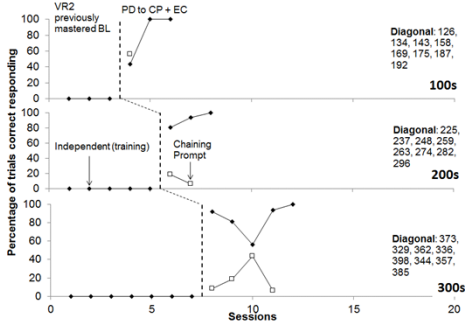
Matrices

- Relevant features:
 - 100
 - Tens: 20, 30, 40, 50, 60, 70, 80, 90,
 - Ones: 2, 3, 4, 5, 6, 7, 8, 9

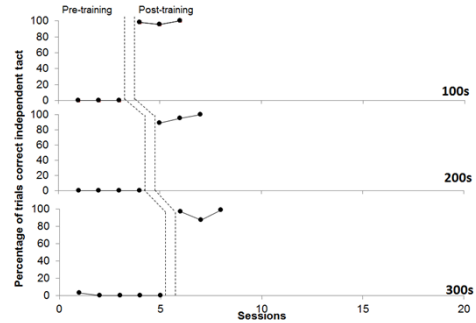
	8	3	4	5	2	7	9	6
15	158	153	154	155	152	157	159	156
14	148	143	144	145	142	147	149	146
13	138	133	134	135	132	137	139	136
17	178	173	174	175	172	177	179	176
19	198	193	194	195	192	197	199	196
18	188	183	184	185	182	187	189	186
16	168	163	164	165	162	167	169	166
12	127	123	124	125	122	127	129	126



Diagonal Target Training



Full Matrix Probes



Conclusions

- ❑ **Matrix training is an efficient means to teach a large number of stimuli**
 - 24 targets exposed to direct instruction
 - 168 untrained targets acquired
 - 192 targets acquired altogether
- ❑ **Efficiency ratio of 7 untrained targets learned for every 1 target exposed to direct training**

