



Can a Robot Serve as a Simulated Client?

Lisa M. Stedman-Falls, Ellie Kazemi,
Denice Rios, and Melissa L. Mendoza

California State University, Northridge

ABAI, 2014
Chicago, IL



A Methodological Challenge

A Methodological Challenge

Trainee performance depends on client

A Methodological Challenge

Trainee performance depends on client

- Responses differ in
 - Topography
 - Frequency
 - Duration

A Methodological Challenge

Trainee performance depends on client

- Responses differ in
 - Topography
 - Frequency
 - Duration

A Methodological Challenge

Trainee performance depends on client

- Responses differ in
 - Topography
 - Frequency
 - Duration
- Challenges

A Methodological Challenge

Trainee performance depends on client

- Responses differ in
 - Topography
 - Frequency
 - Duration
- Challenges
 - Variability can be a confounding variable

A Methodological Challenge

Trainee performance depends on client

- Responses differ in
 - Topography
 - Frequency
 - Duration
- Challenges
 - Variability can be a confounding variable
 - Unequal opportunities to perform

A Methodological Challenge

Trainee performance depends on client

- Responses differ in
 - Topography
 - Frequency
 - Duration
- Challenges
 - Variability can be a confounding variable
 - Unequal opportunities to perform
- Incorrect conclusions



What Does this Challenge Look Like?

What Does this Challenge Look Like?

- Two participants trained to conduct DTT

What Does this Challenge Look Like?

- Two participants trained to conduct DTT
- Trainee Target Skills:

What Does this Challenge Look Like?

- Two participants trained to conduct DTT
- Trainee Target Skills:
 - Deliver SD
 - Use least intrusive prompt
 - Praise correct responses
 - Ignore incorrect response and look away

What Does this Challenge Look Like?

- Two participants trained to conduct DTT
- Trainee Target Skills:
 - Deliver SD
 - Use least intrusive prompt
 - Praise correct responses
 - Ignore incorrect response and look away



VIDEO

Performance Checklist

Trainee 1

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				



Performance Checklist

Trainee 1

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = $6/6 = 100\%$				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = $4/8 = 50\%$				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = $6/6 = 100\%$				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = $4/8 = 50\%$				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				



Performance Checklist



Trainee 1

Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A

Overall Performance =
 $6/6 = 100\%$

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2

Overall Performance =
 $4/8 = 50\%$

Performance Checklist



Trainee 1



Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A

Overall Performance =
 $6/6 = 100\%$

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2

Overall Performance =
 $4/8 = 50\%$



Performance Checklist



Trainee 1

Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				



Performance Checklist



Trainee 1

Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				



Performance Checklist



Trainee 1

Trainee 2

	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	N/A	N/A	N/A
Praise Correct Response	+	+	+	3/3
Ignore Incorrect Response and Look Away	N/A	N/A	N/A	N/A
Overall Performance = 6/6 = 100%				

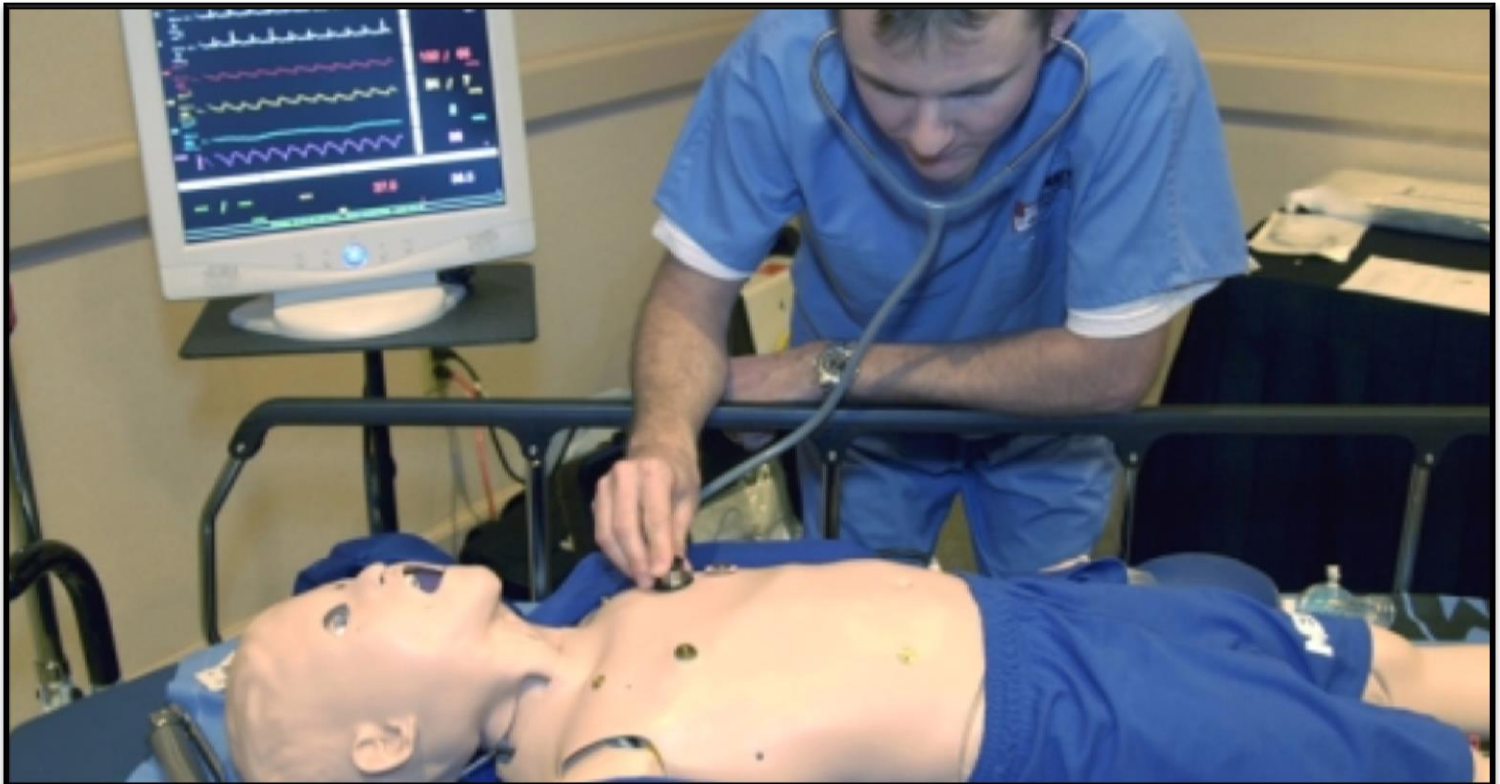
	Trial # 1	Trial # 2	Trial # 3	Total
Deliver Sd	+	+	+	3/3
Use Least Intrusive Prompt	N/A	-	-	0/2
Praise Correct Response	N/A	N/A	+	1/1
Ignore Incorrect Response and Look Away	-	-	N/A	0/2
Overall Performance = 4/8 = 50%				



Use of Simulated Clients

Use of Simulated Clients

- In Medicine
 - PediaSIM (CAE Healthcare)
 - Used to train nursing students



Use of Simulated Clients

- In Medicine
 - PediaSIM (CAE Healthcare)
 - Used to train nursing students





Use of Simulated Clients

Use of Simulated Clients

- In Behavior Analysis

Use of Simulated Clients

- In Behavior Analysis
 - Thompson et al. (2011)
 - Evaluated the role of negative reinforcement in caregiving

Use of Simulated Clients

- In Behavior Analysis
 - Thompson et al. (2011)
 - Evaluated the role of negative reinforcement in caregiving
 - Baby doll simulated client
 - Tape-recorded sounds of an infant crying



Use of Simulated Clients

- In Behavior Analysis
 - Thompson et al. (2011)
 - Evaluated the role of negative reinforcement in caregiving
 - Baby doll simulated client
 - Tape-recorded sounds of an infant crying



Use of Simulated Clients

- In Behavior Analysis
 - Thompson et al. (2011)
 - Evaluated the role of negative reinforcement in caregiving
 - Baby doll simulated client
 - Tape-recorded sounds of an infant crying





Robot as a Simulated Client

Robot as a Simulated Client

- Robot responses are identical in
 - Topography
 - Frequency
 - Duration

Robot as a Simulated Client

- Robot responses are identical in
 - Topography
 - Frequency
 - Duration
- Equal opportunities to perform

Robot as a Simulated Client

- Robot responses are identical in
 - Topography
 - Frequency
 - Duration
- Equal opportunities to perform
- Trainee's can engage in the same behaviors

Robot as a Simulated Client

- Robot responses are identical in
 - Topography
 - Frequency
 - Duration
- Equal opportunities to perform
- Trainee's can engage in the same behaviors
- Simulated client always available

Objective

To experimentally evaluate if a robot

- Is equatable to a human actor
- Can be used to test trainings

Method

- Participants
 - 5 undergraduate students

Method

- Participants
 - 5 undergraduate students
- Response Measurement
 - DV = % of trials correct

Method

- Participants
 - 5 undergraduate students
- Response Measurement
 - DV = % of trials correct
- Reliability
 - Trial-by-trial IOA = 95%

Method

- Participants
 - 5 undergraduate students
- Response Measurement
 - DV = % of trials correct
- Reliability
 - Trial-by-trial IOA = 95%
- Design
 - Multiple baseline across participants

Simulated Clients

- Participants assigned to:
 - Human actor



Simulated Clients

- Participants assigned to:
 - Human actor
 - Humanoid robot



Simulated Clients

- Participants assigned to:
 - Human actor
 - Humanoid robot
- Human actor
 - Scripted behaviors
 - Bug-in-the-ear



Simulated Clients

- Participants assigned to:
 - Human actor
 - Humanoid robot
- Human actor
 - Scripted behaviors
 - Bug-in-the-ear
- Humanoid robot, NAO
 - Pre-programmed behavior
 - Computer



Experimental Conditions

- Baseline
 - Fisher et al., 1992 modified methods section

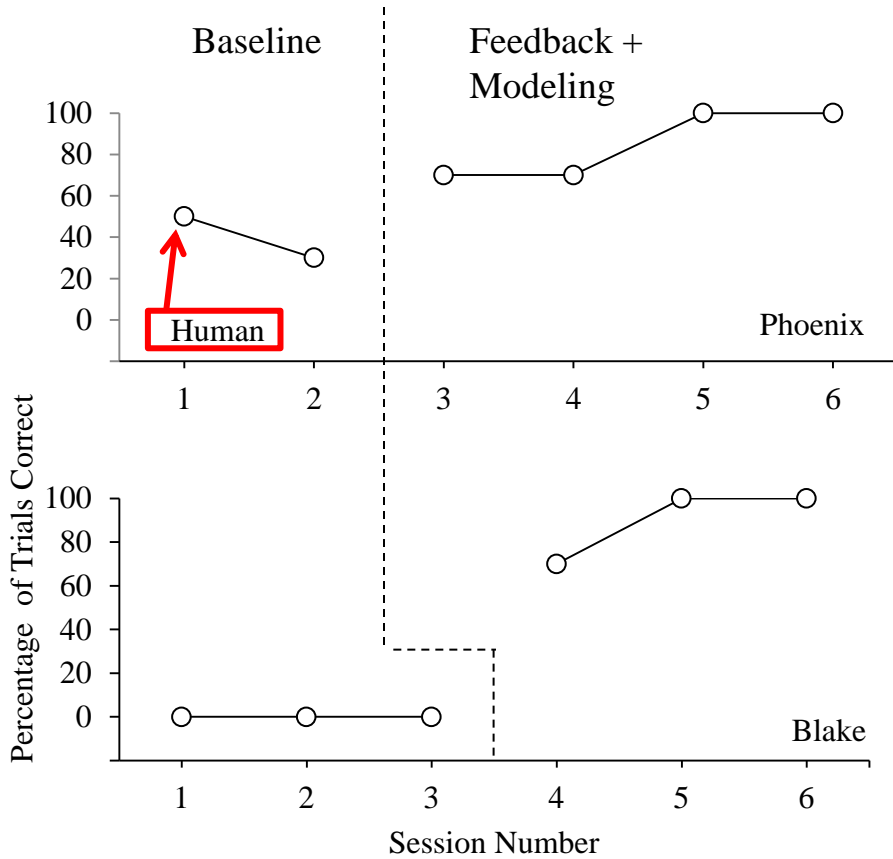
Experimental Conditions

- Baseline
 - Fisher et al., 1992 modified methods section
- Intervention
 - Feedback and Modeling

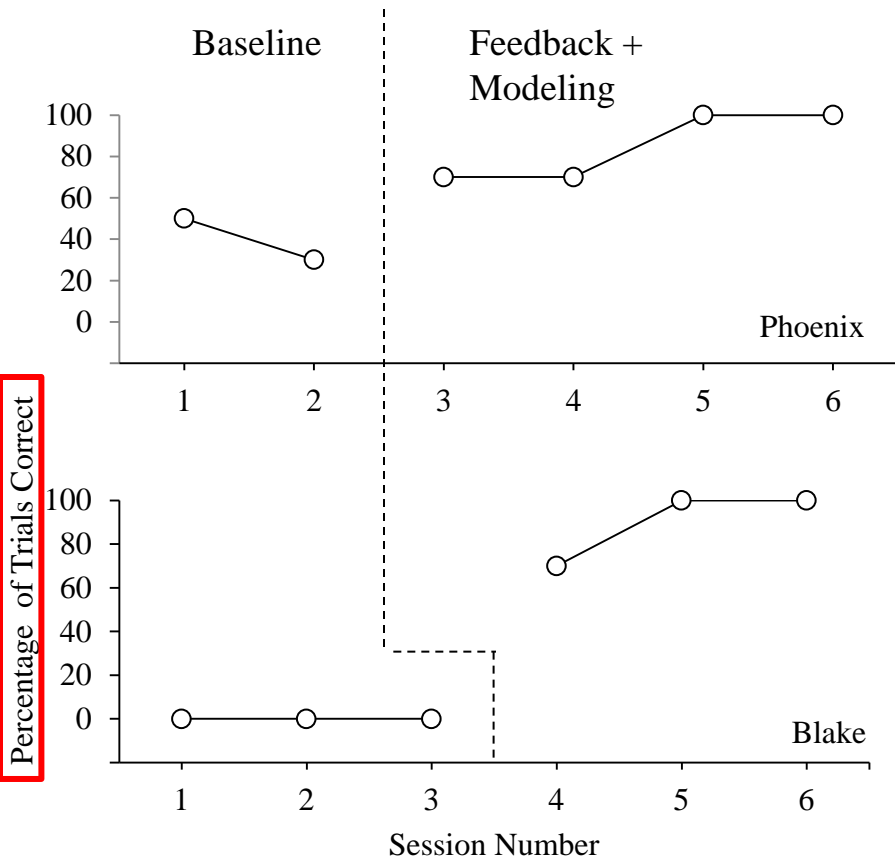
Experimental Conditions

- Baseline
 - Fisher et al., 1992 modified methods section
- Intervention
 - Feedback and Modeling
- Generalization probe
 - With human actor

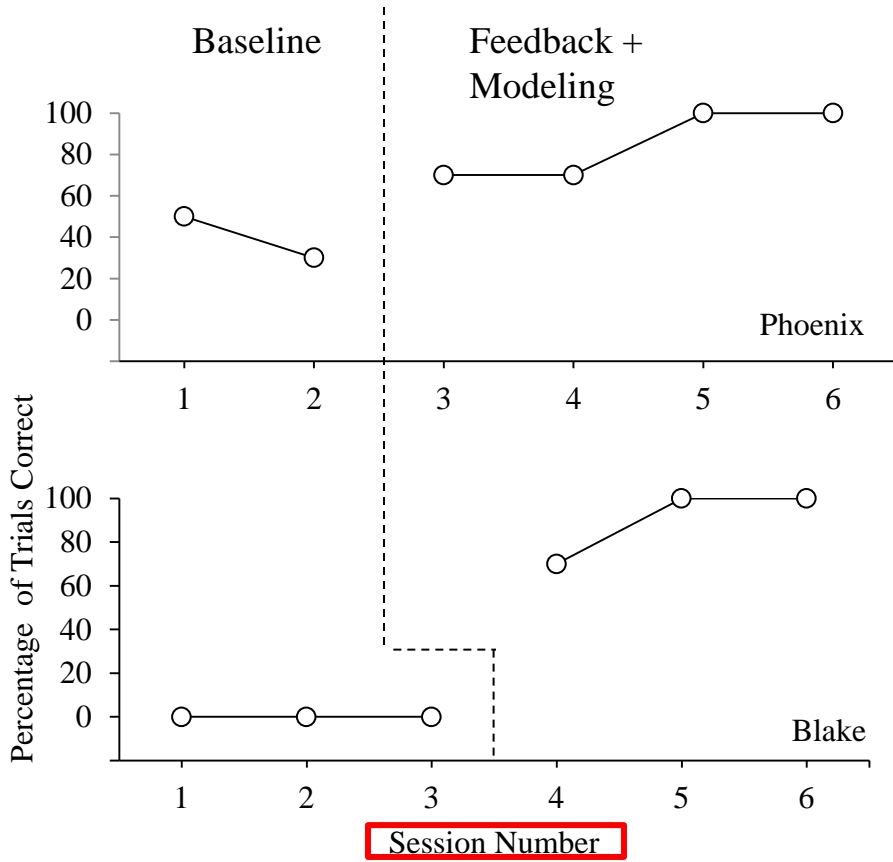
Results



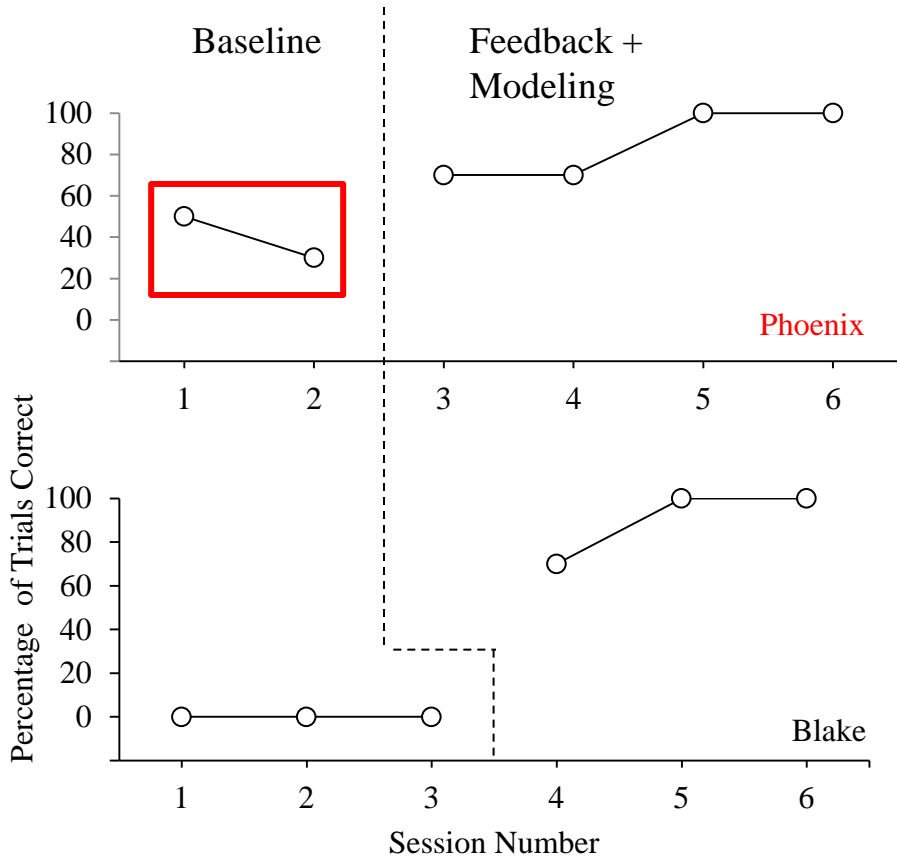
Results



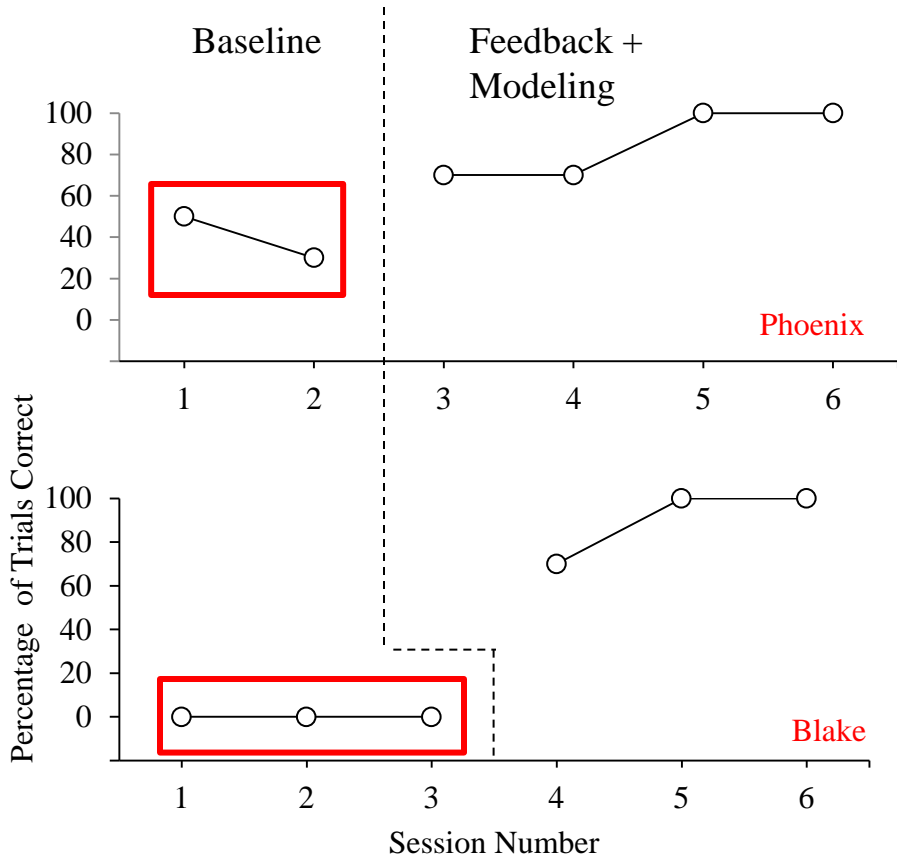
Results



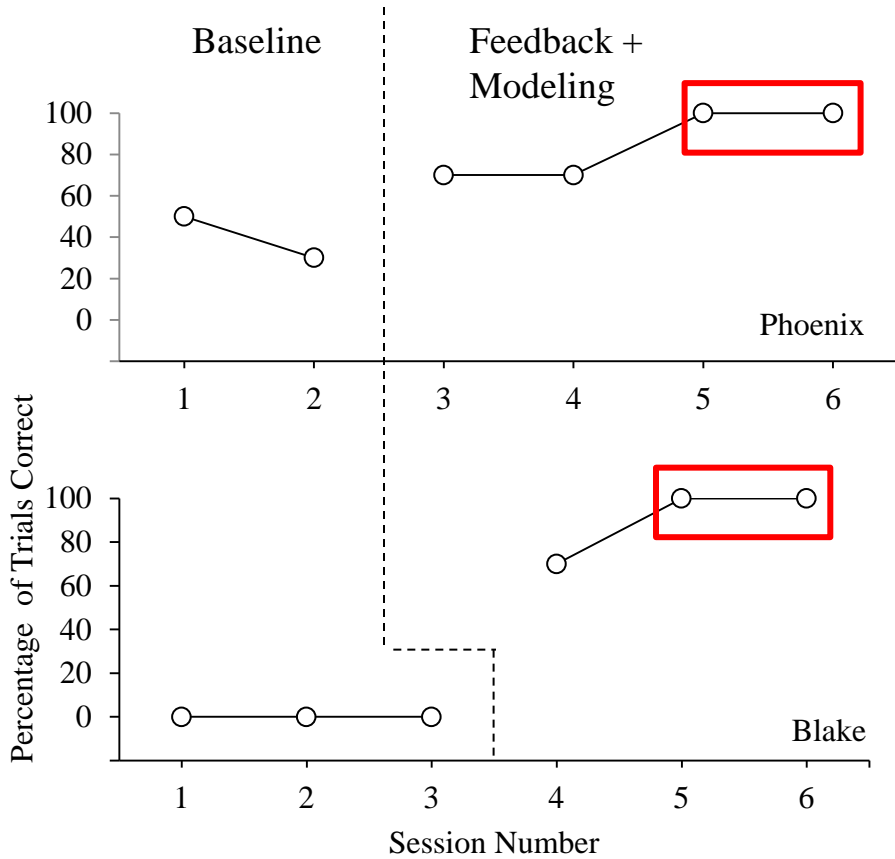
Results



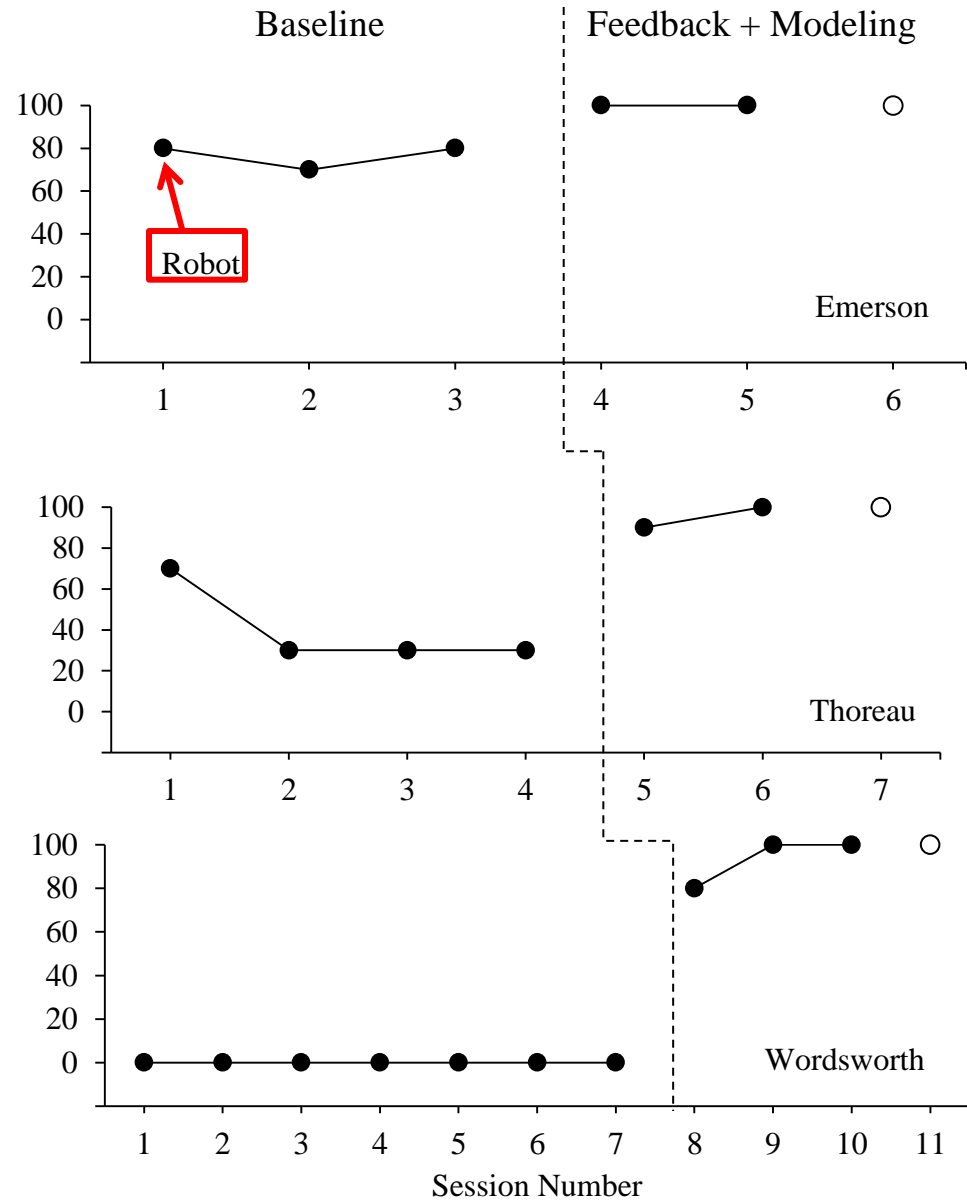
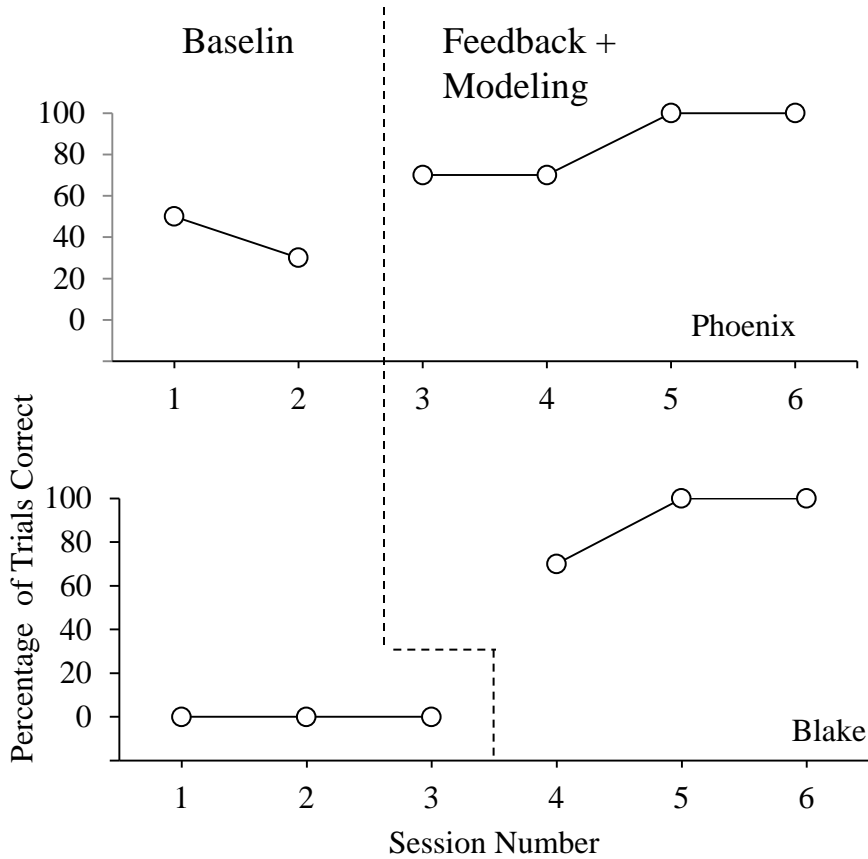
Results



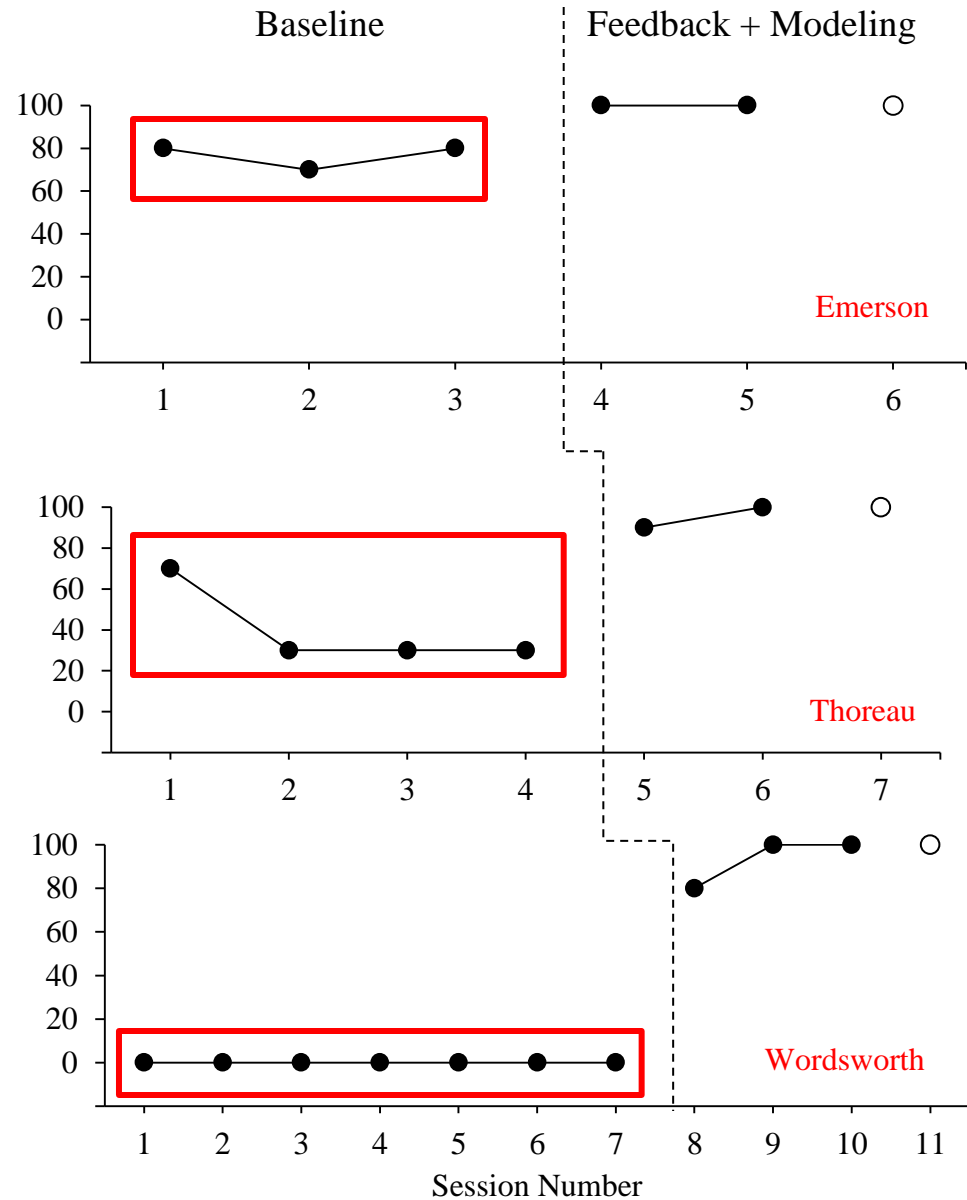
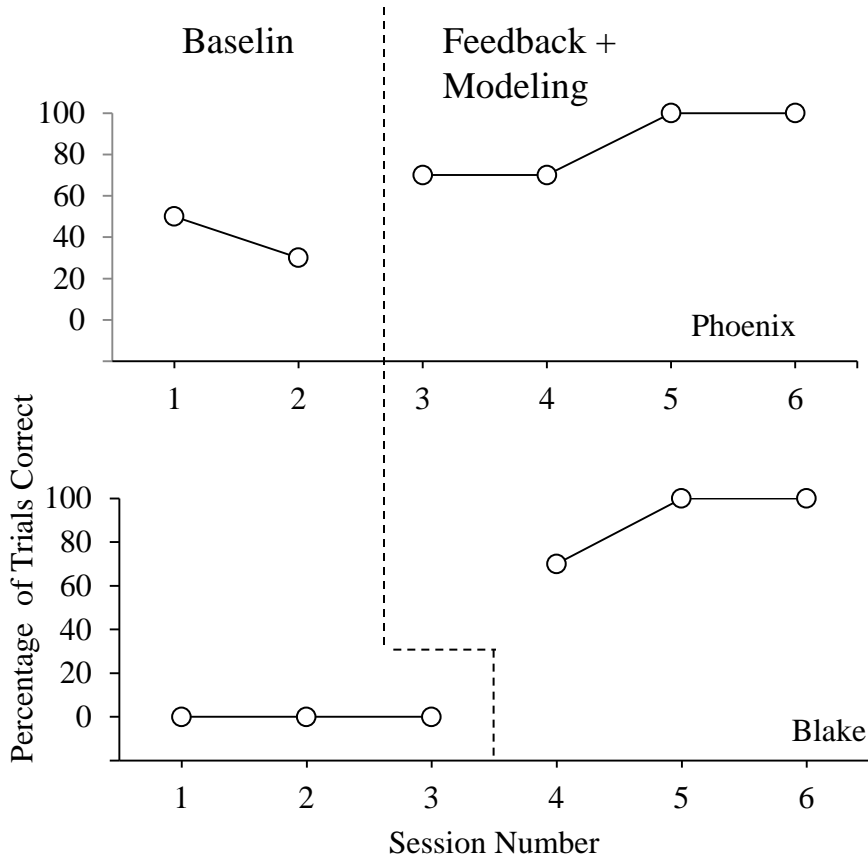
Results



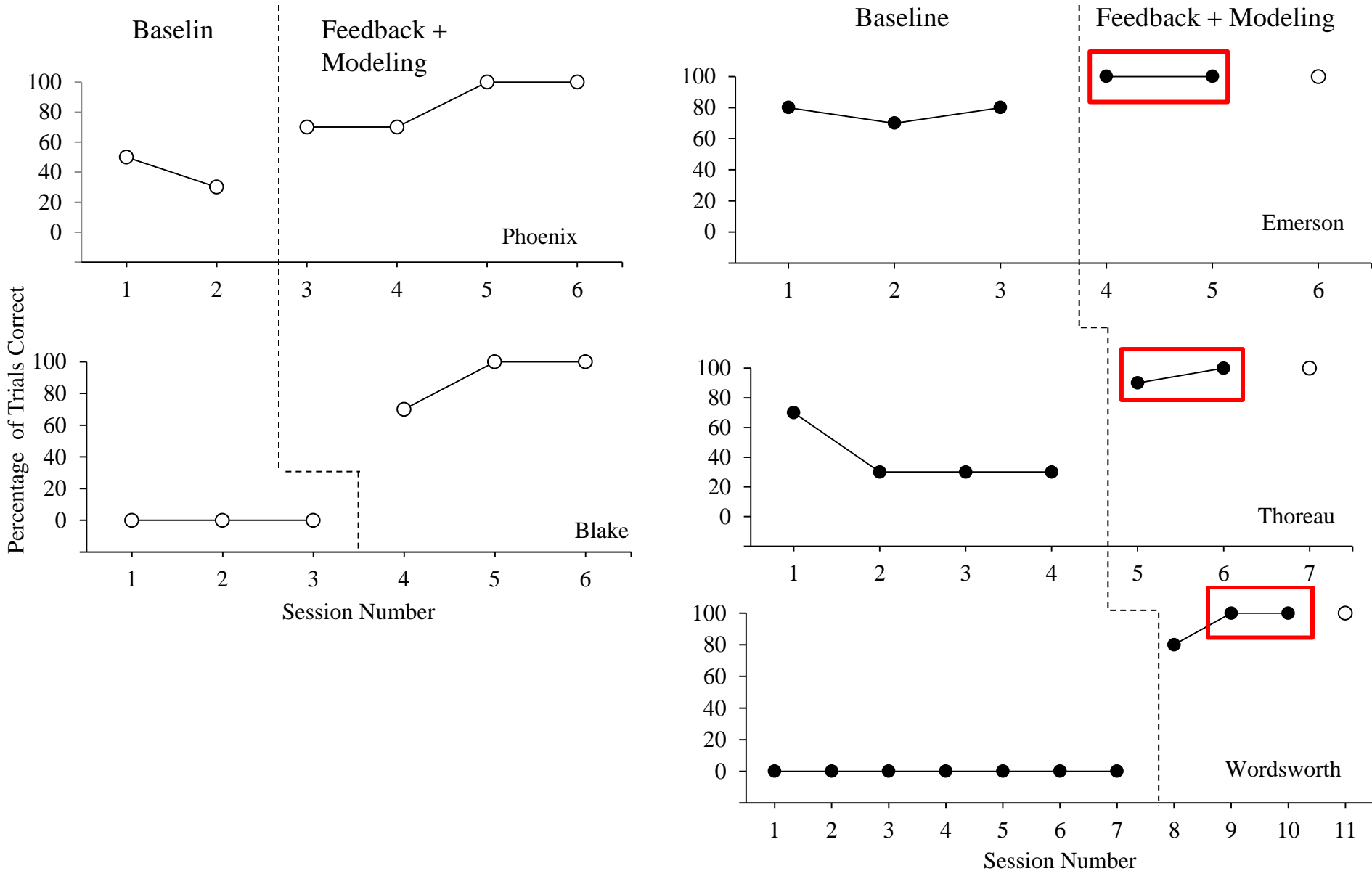
Results



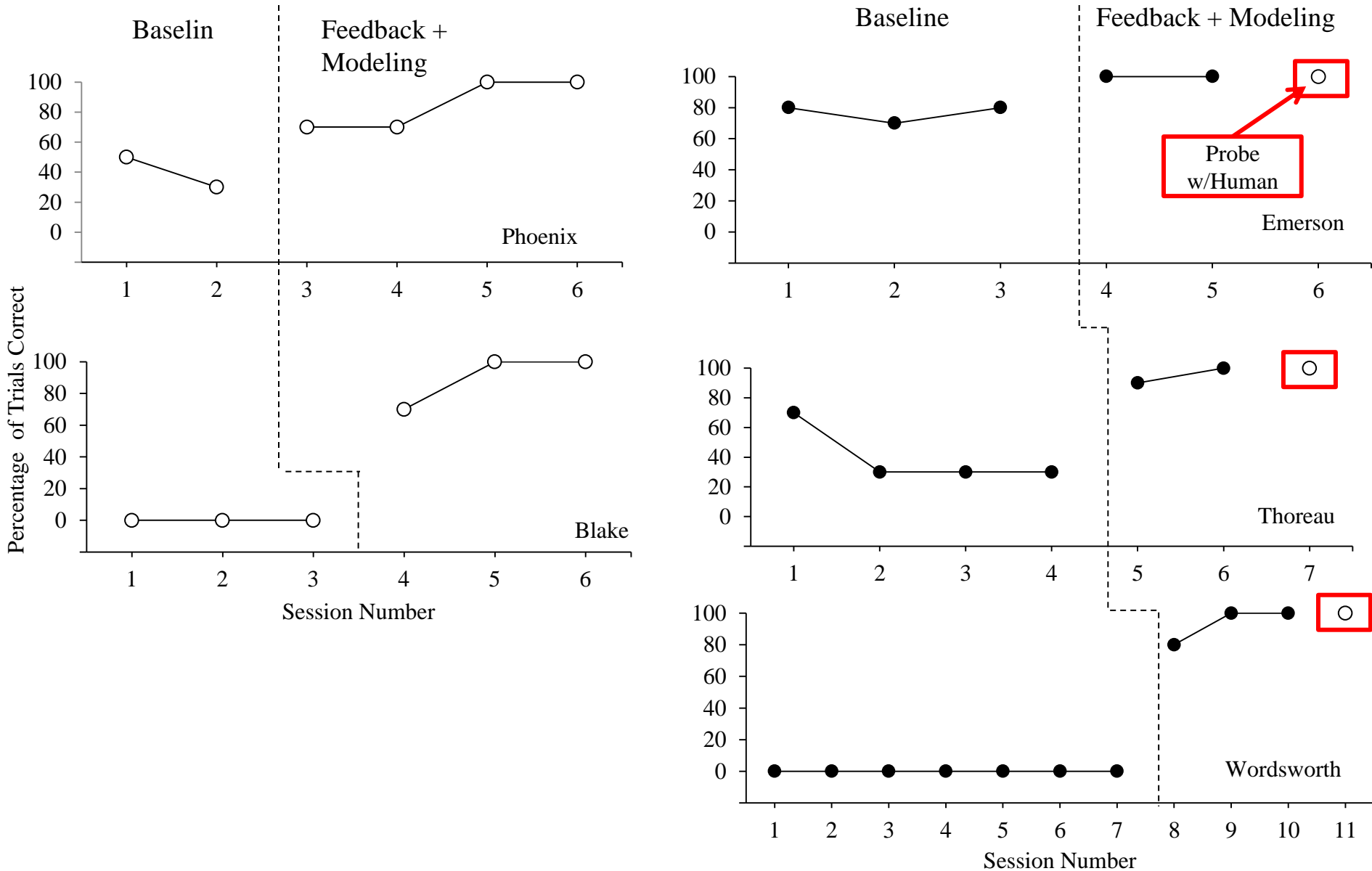
Results



Results



Results



Conclusion

- Regardless of simulated client
 - All 5 participants reached mastery

Conclusion

- Regardless of simulated client
 - All 5 participants reached mastery
- Equatable to human simulated client

Conclusion

- Regardless of simulated client
 - All 5 participants reached mastery
- Equatable to human simulated client
 - For testing training interventions
 - Teaching paired-stimulus preference assessments

Future Research

- Replications

Future Research

- Replications
- Extensions

Future Research

- Replications
- Extensions
- Examine variables
 - Previously impossible or unethical to isolate

References

Graff, R. B., & Karsten, A. M. (2012). Evaluation of a Self-Instruction Package for Conducting Stimulus Preference Assessments. *Journal of Applied Behavior Analysis*, 45(1), 69–82. doi:10.1901/jaba.2012.45-69

Thompson, R. H., Bruzek, J. L., & Cotnoir-Bichelman, N. M. (2011). The Role of Negative Reinforcement in Infant Caregiving: An Experimental Simulation. *Journal of Applied Behavior Analysis*, 44(2), 295–304. doi:10.1901/jaba.2011.44-295

