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The effect of economic incentives on the learning of novel categories

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Do incentives change behavior?



Classic category learning task

- Six types of classification problems for the same 8 stimuli
- Performance decreases as type increases (approximately “difficulty”)
- Stimuli are robust and results have been replicated many times

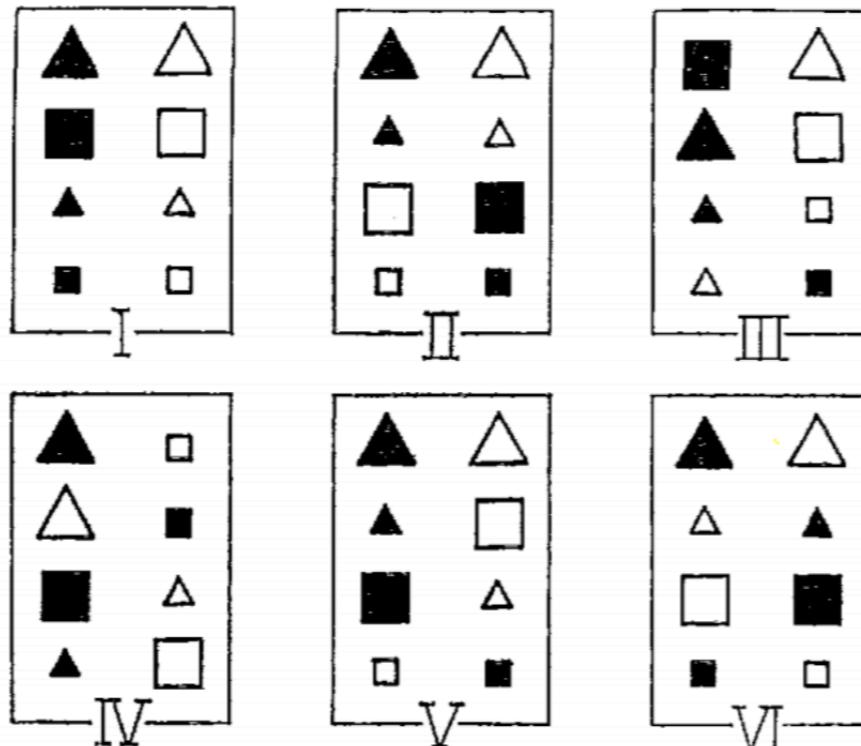


FIG. 1. Six different classifications of the same set of eight stimuli. (Within each box the four stimuli on the left belong in one class and the four stimuli on the right in the other class.)

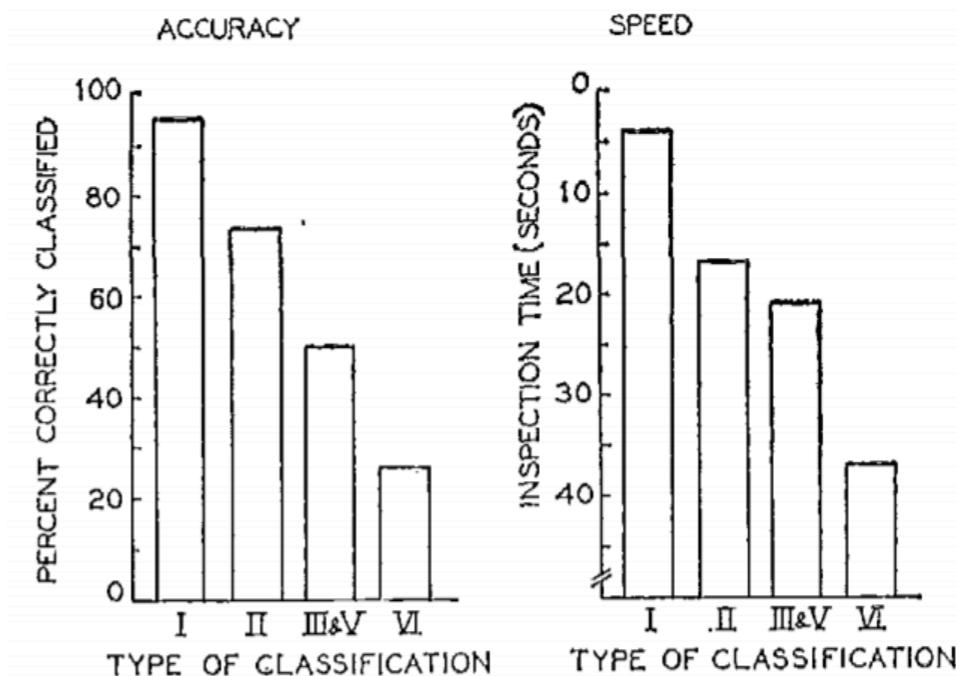
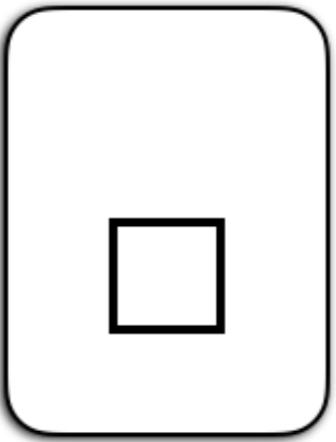
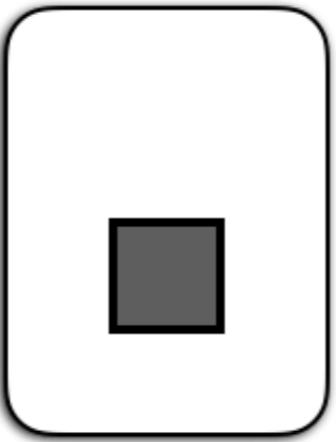
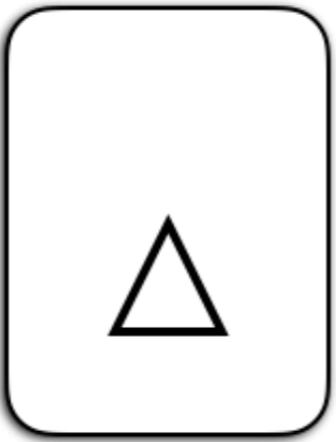
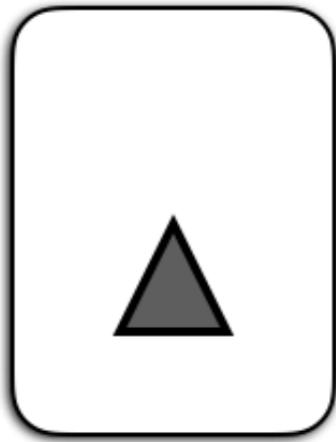
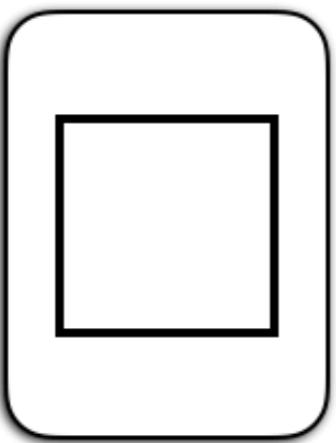
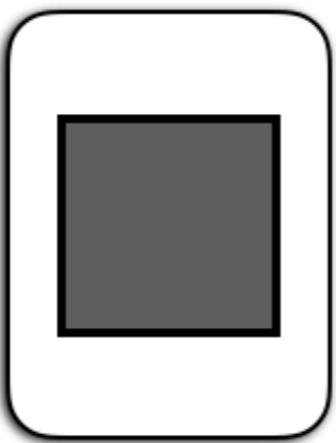
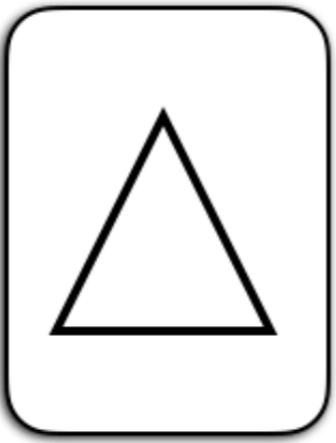
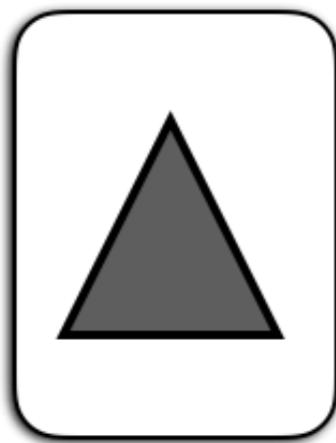


FIG. 10. Accuracy (percentage of *Ss* correctly assigning stimuli to appropriate category) and speed (time required to memorize assignment) for various types of classifications.

Stimuli



Approach

- In our task, **both** incentive and difficulty (Type) are varied **between** subject to avoid learning effects across blocks
- Each subject encounters one **16-trial** Learning Phase and one Test Phase of one problem type at one incentive level

Part 1: LEARN

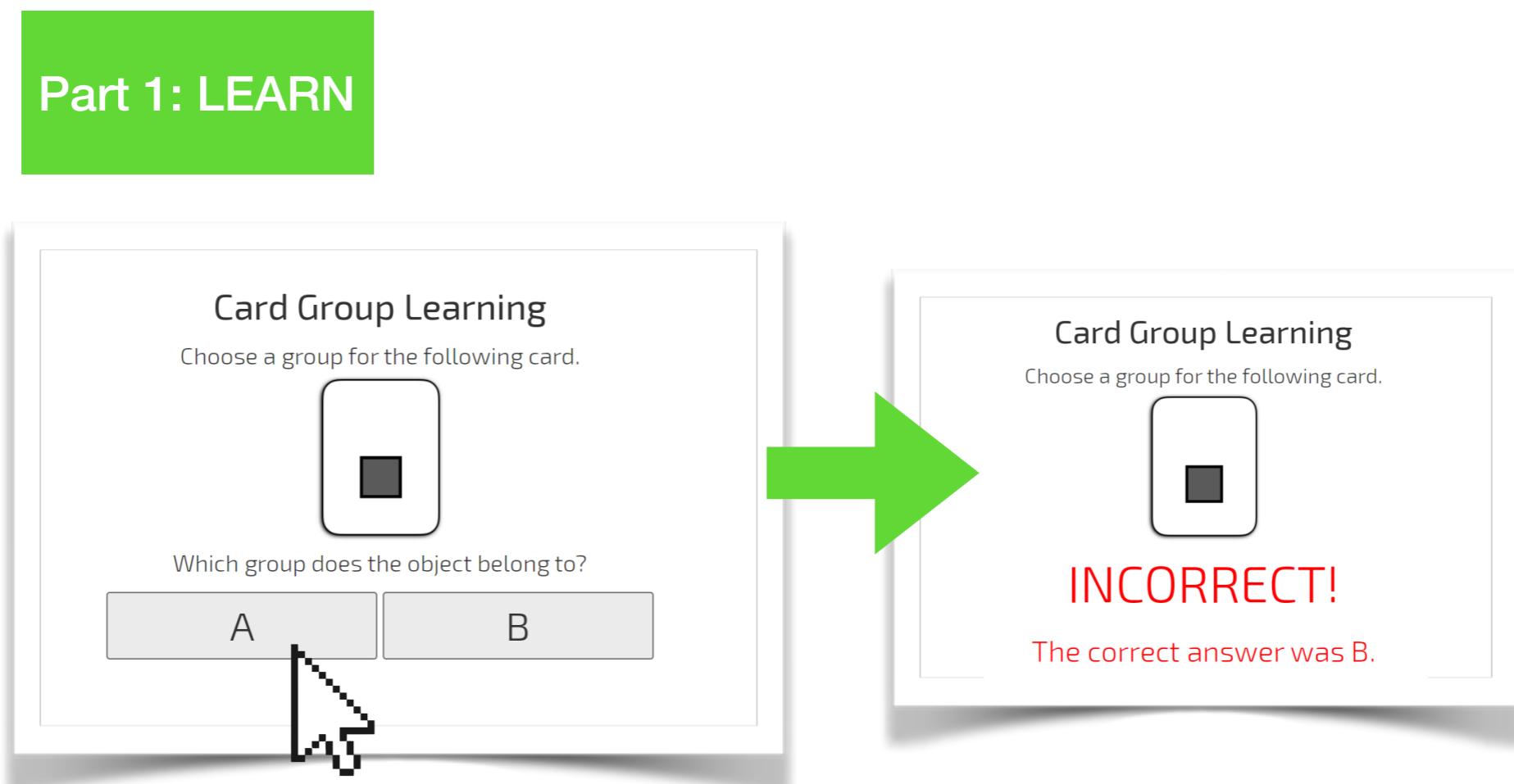
Part 1 is intended for you to learn, and it doesn't matter how many mistakes you make.

Part 2: TEST

Part 2 has eight test questions, and getting more answers correct will increase your chance at winning a \$10 bonus.

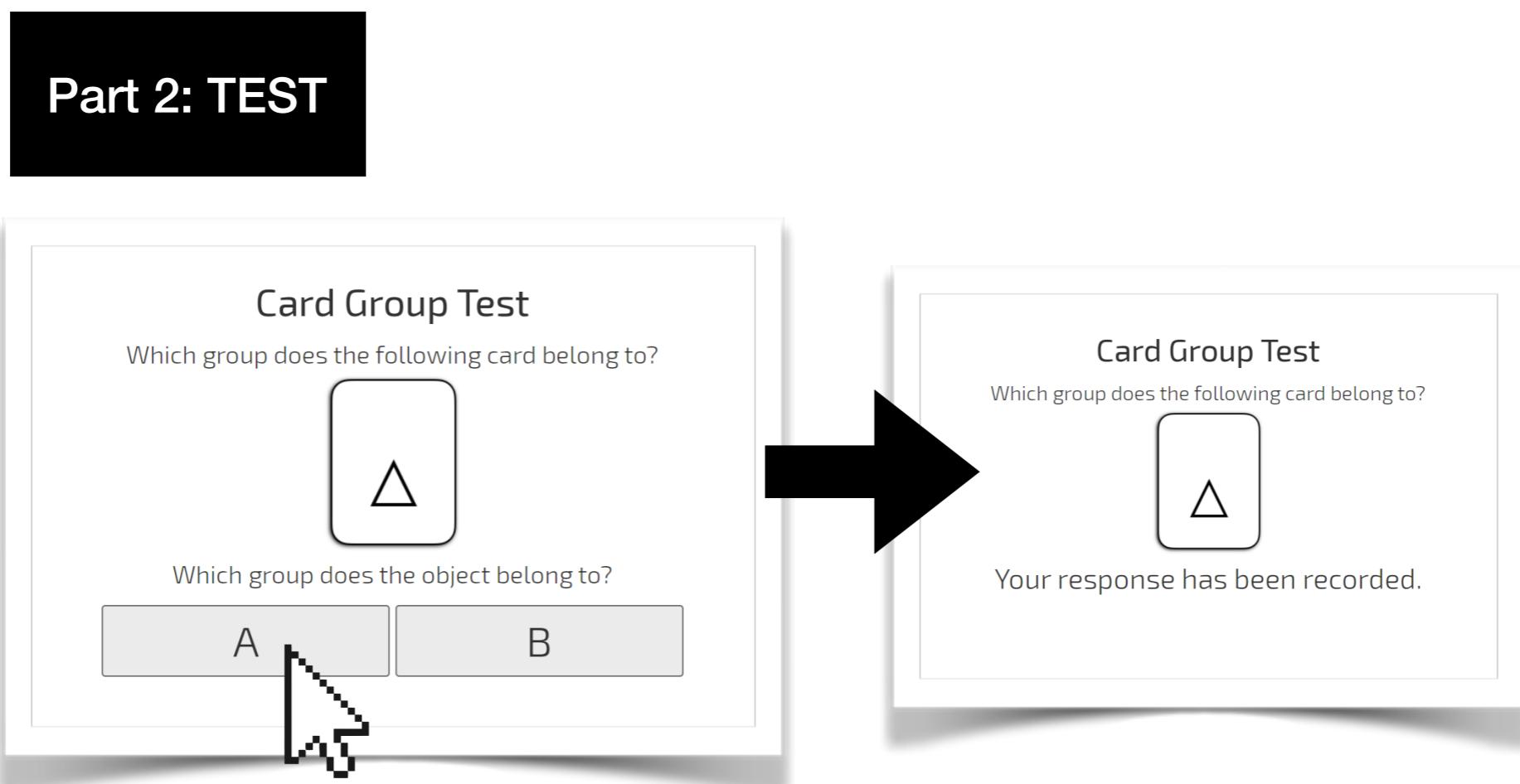
Approach

- Learning phase
 - 16 trials of equal temporal length
 - Response period allows subject to guess category membership
 - Feedback provided after response
 - No reward or punishment for correct/incorrect answers during this period



Approach

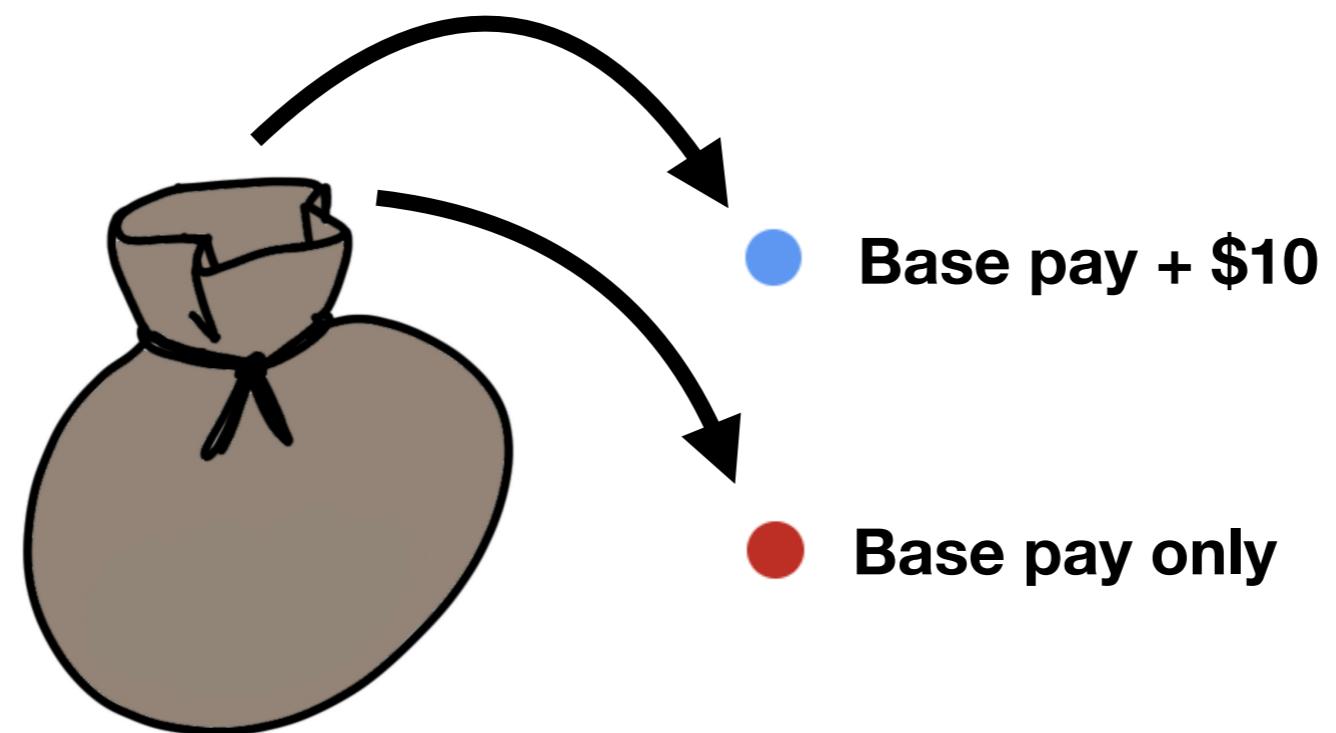
- Test phase
 - 8 trials testing category membership belief of each stimulus (one-shot response)
 - No feedback
 - Performance above chance determines bonus calculation based on incentive condition



Incentive conditions

Now I will explain how to increase your chances at winning a \$10 bonus.

Imagine a bag full of red and blue marbles. We pull out a marble at random. If the marble is blue, you win the extra \$10. If the marble is red, you receive only the base payment.



Incentive conditions

Let's look [inside the bag](#).

There are 8 marbles [in the bag](#).



8 correct answers



Turn 4 marbles blue

7 correct answers



Turn 3 marbles blue

6 correct answers



Turn 2 marbles blue

5 correct answers



Turn 1 marbles blue

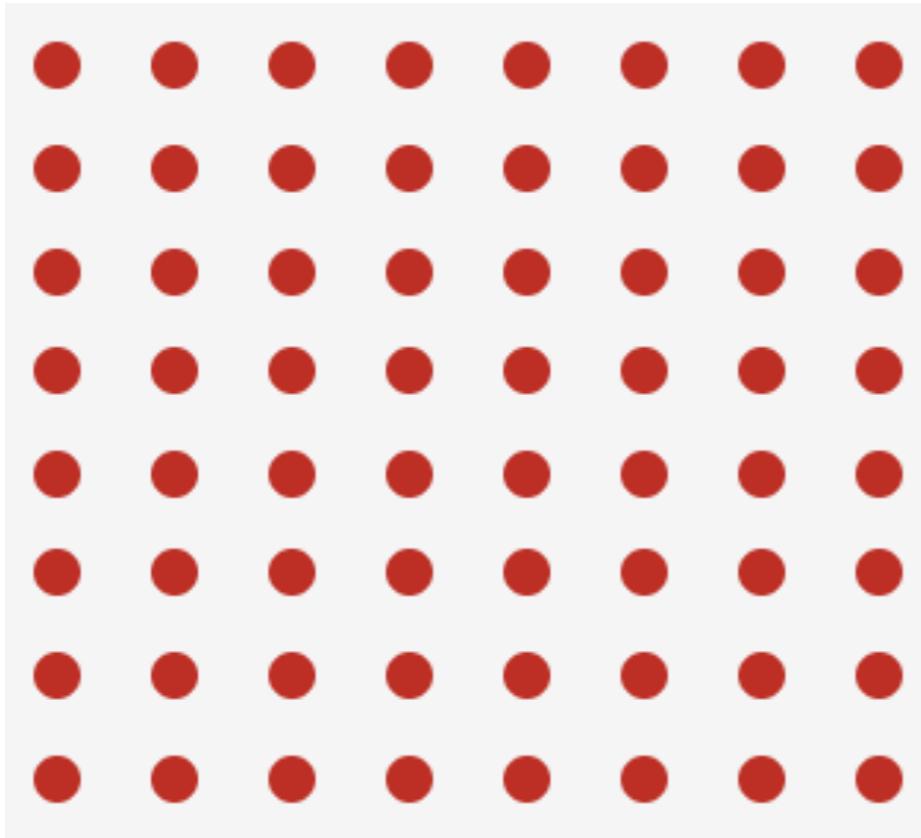
4 or less correct answers

Turn zero marbles blue - all marbles are red

Incentive conditions

Low

Let's look inside the bag.
There are 64 marbles in the bag.



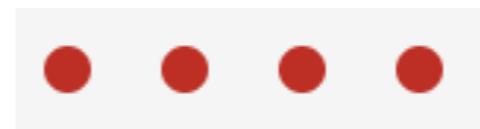
Medium

Let's look inside the bag.
There are 8 marbles in the bag.



High

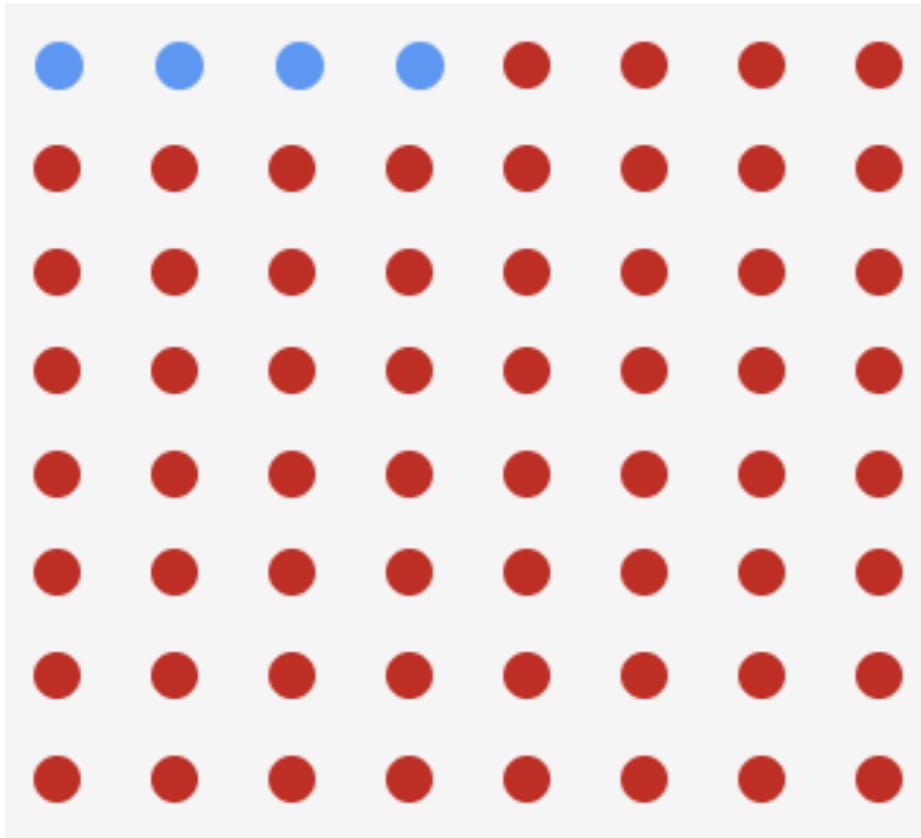
Let's look inside the bag.
There are 4 marbles in the bag.



Incentive conditions

Low

Let's look inside the bag.
There are 64 marbles in the bag.



Medium

Let's look inside the bag.
There are 8 marbles in the bag.



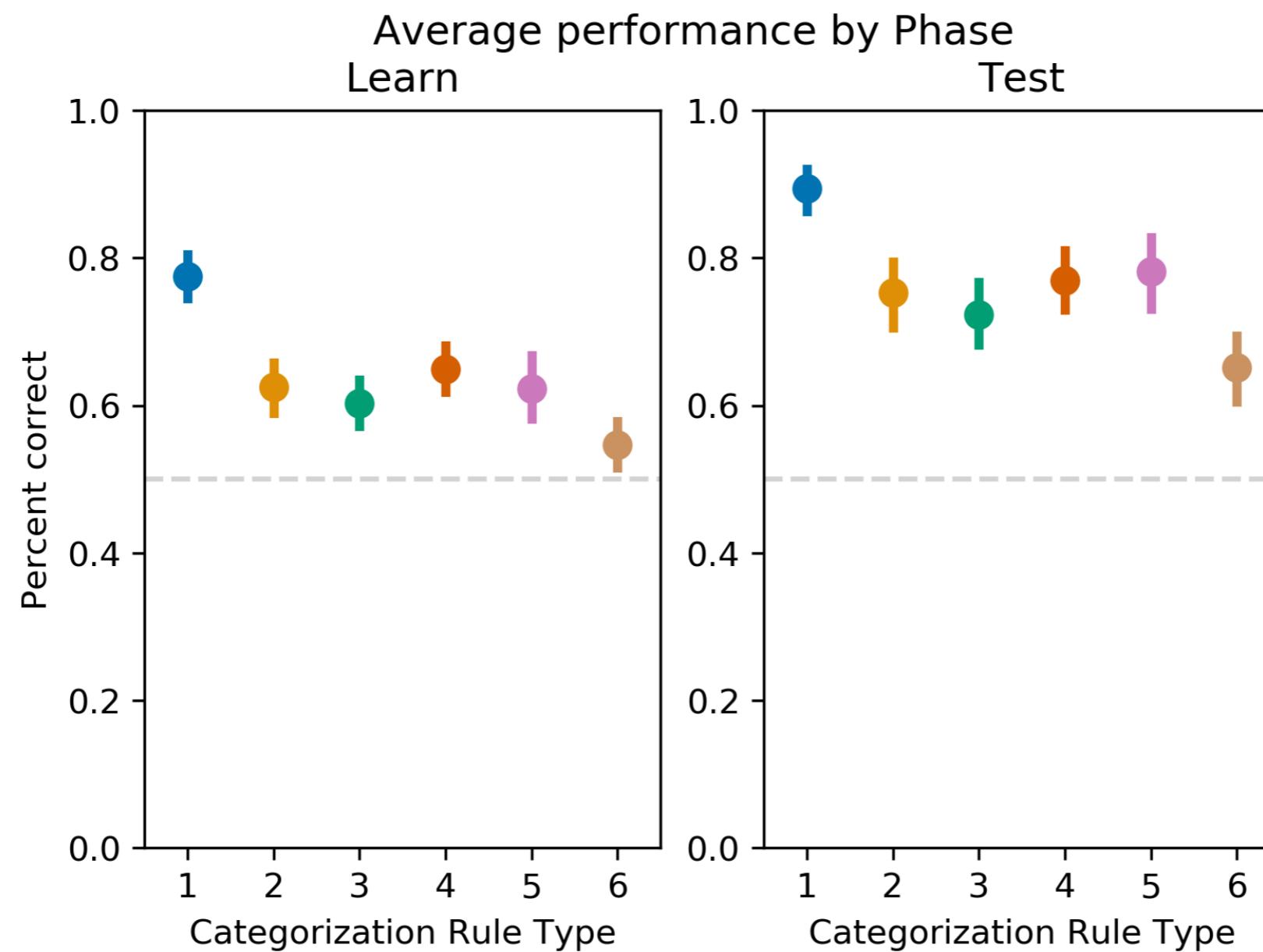
High

Let's look inside the bag.
There are 4 marbles in the bag.

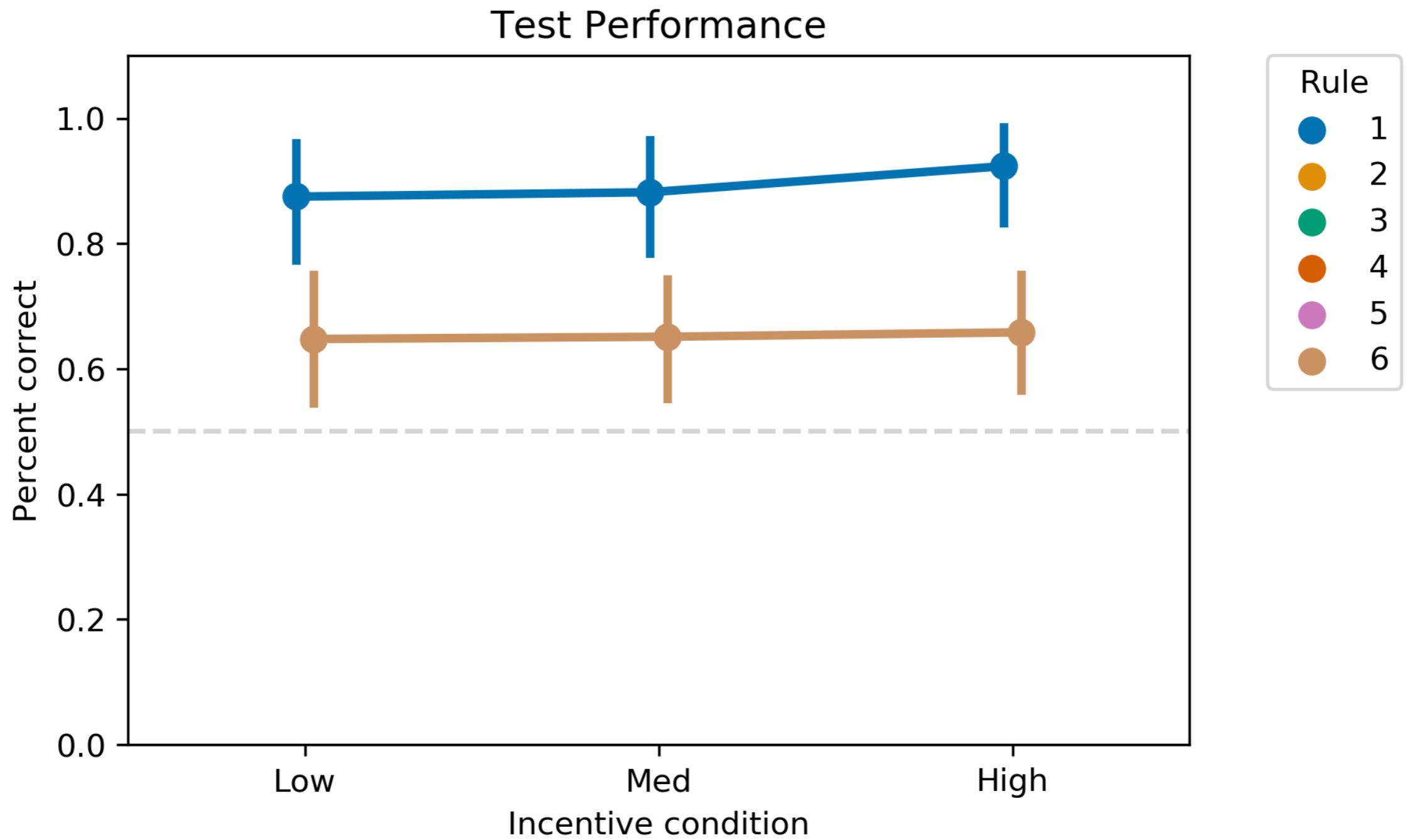


Results: Performance by phase

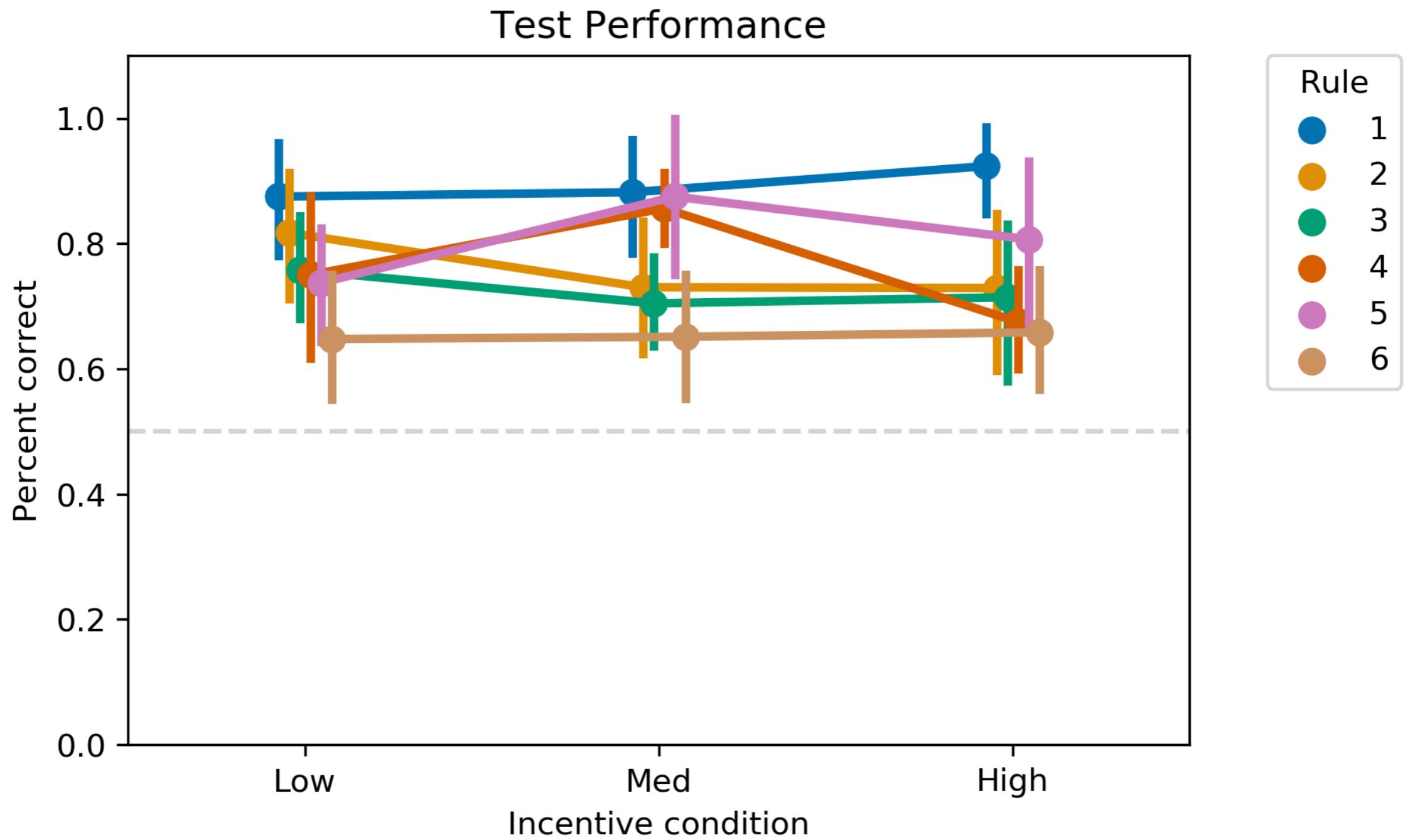
- N=292 across 18 conditions
(21 subjects were excluded due to admitting using memory help, repeating the instructions too many times, or experiment error)



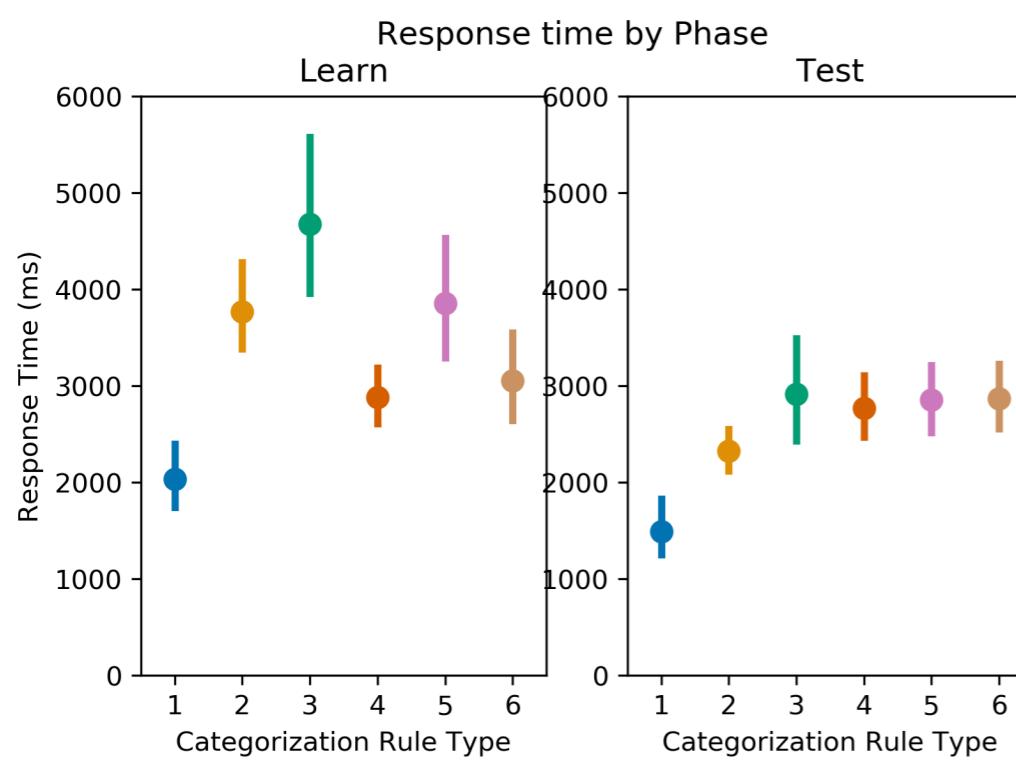
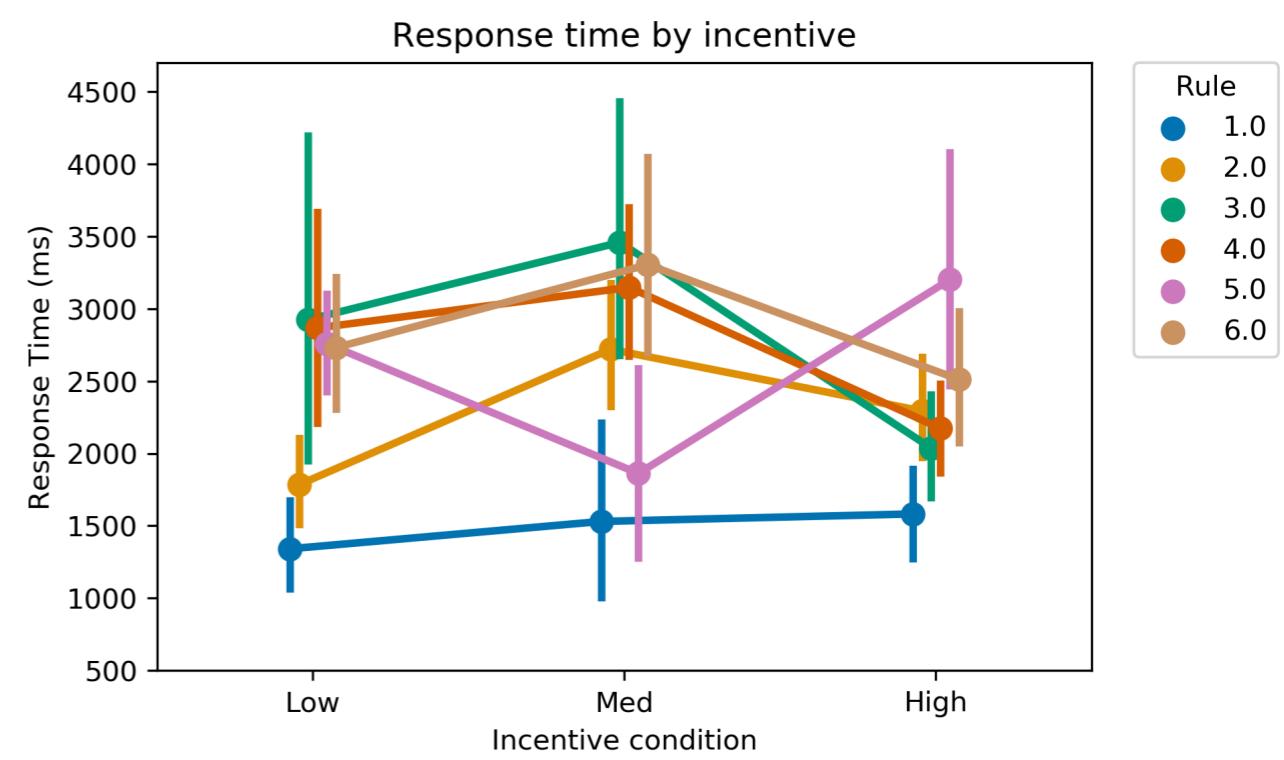
Results: Performance by incentive



Results: Performance by incentive



Results: Response Time

A**B**

Summary

- N=292 across 18 conditions
- Data successfully replicates effect of rule on performance (Shepard, Hovland, & Jenkins 1961)
- However, data shows no effect of incentive on performance, even at lowest difficulty
- Reaction time increases with rule difficulty, but not with incentive

Questions

- If performance **is** modulated by incentive, how can existing models account for the effect?
 - E.g., capacity or complexity parameters in RULEX (Nosofsky, Palmeri, & McKinley 1994)
 - E.g., learning rate parameters in ALCOVE (Kruschke 1992) or SUSTAIN (Love, Medin, & Gureckis 2004)
- If performance is **not** modulated by incentive, why is this learning task different from other tasks that are affected by incentive?
- Next steps:
 - Experiment version including transfer stimuli to differentiate specific learning strategies
 - Increase number of learning trials

Thank you!

<http://gureckislab.org/>



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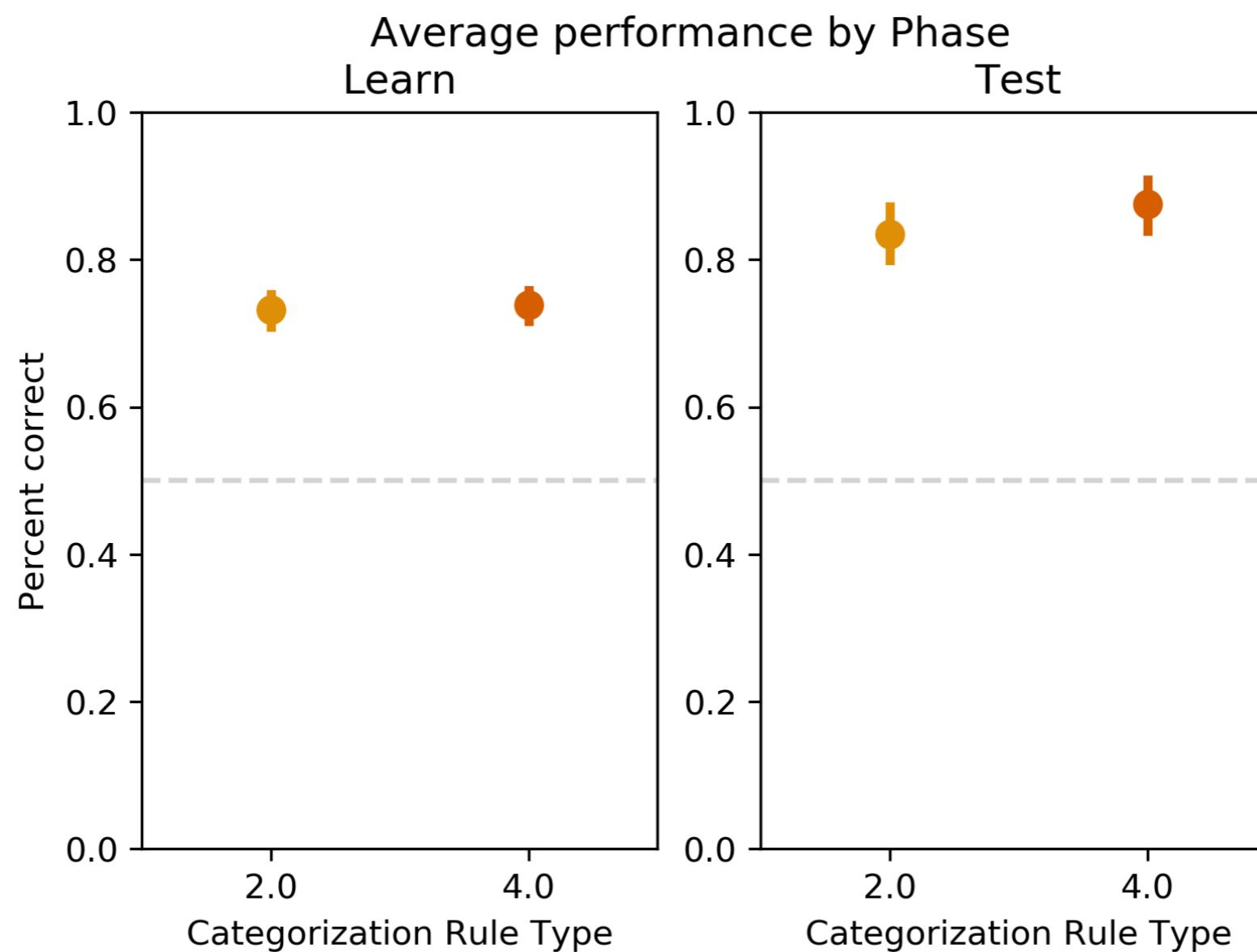
Benjamin Newell
UNSW



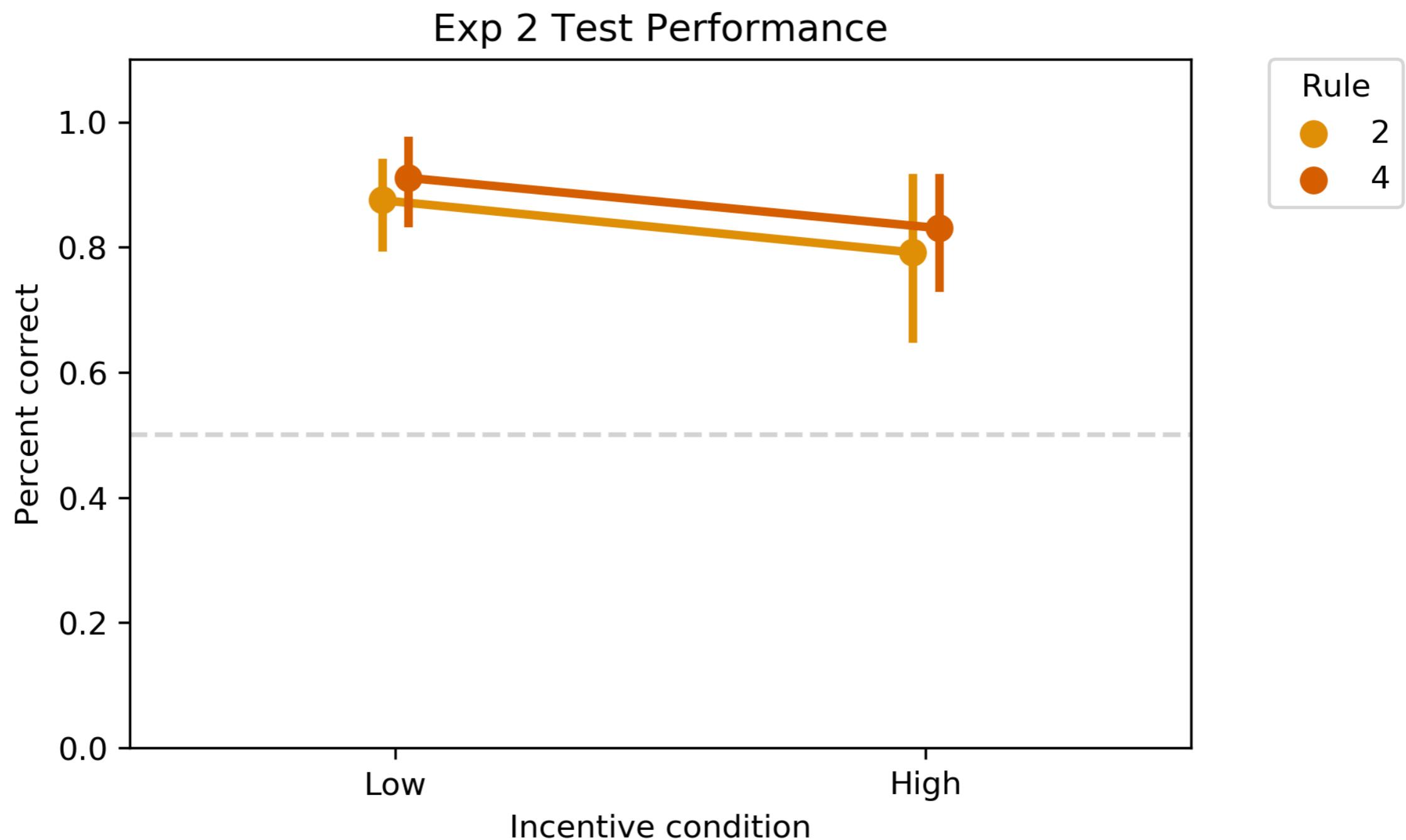
Daniel Bartels
U Chicago

Exp 2 Results: Performance by phase

- N=95 across 4 conditions
(6 subjects were excluded due to admitting using memory help or repeating the instructions too many times)

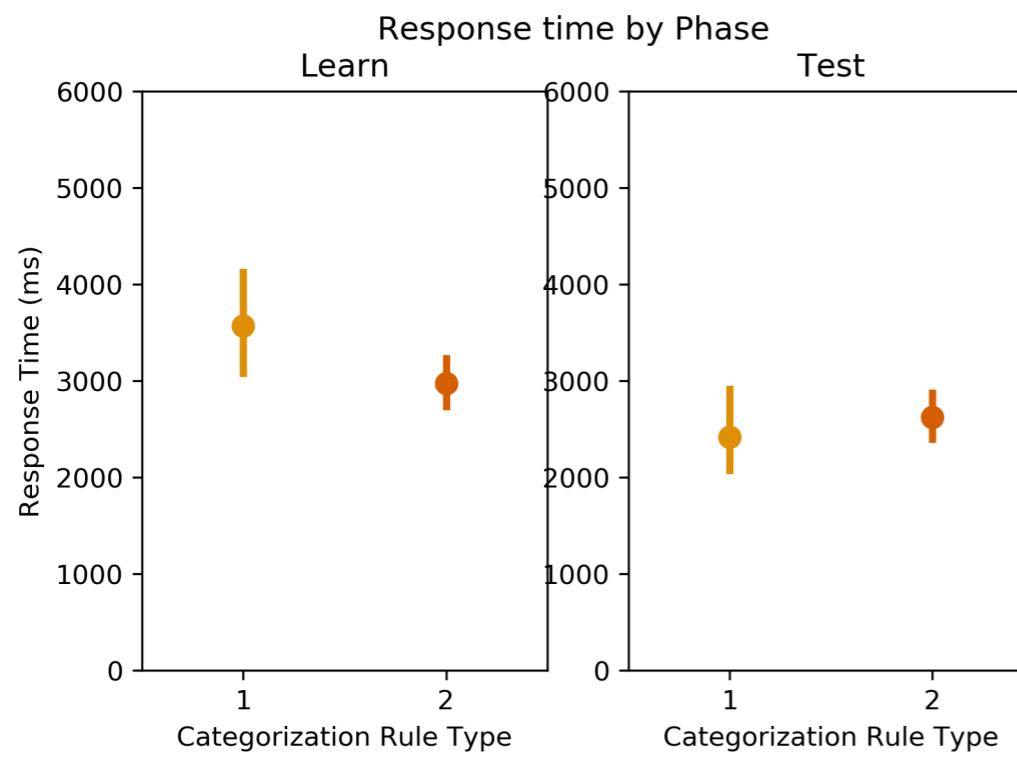


Exp 2 Results: Performance by incentive

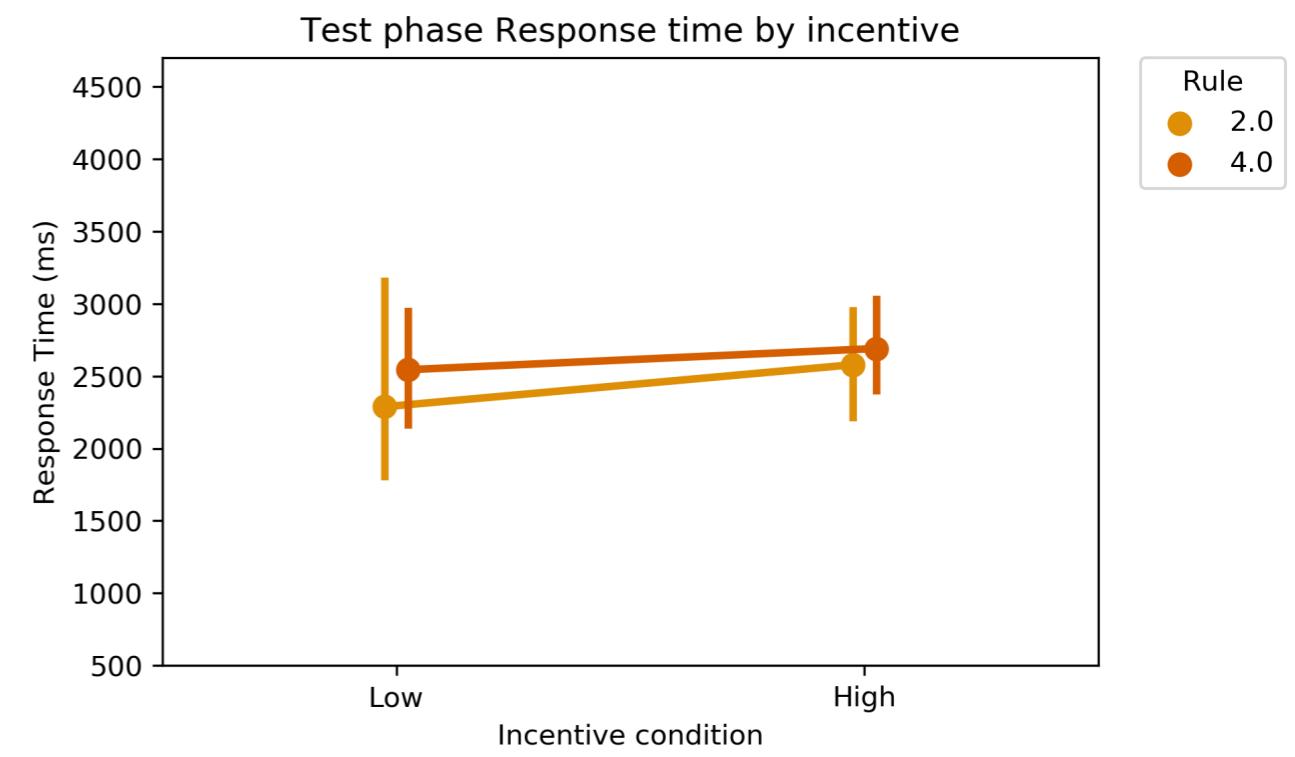


Exp 2 Results: Response Time

A

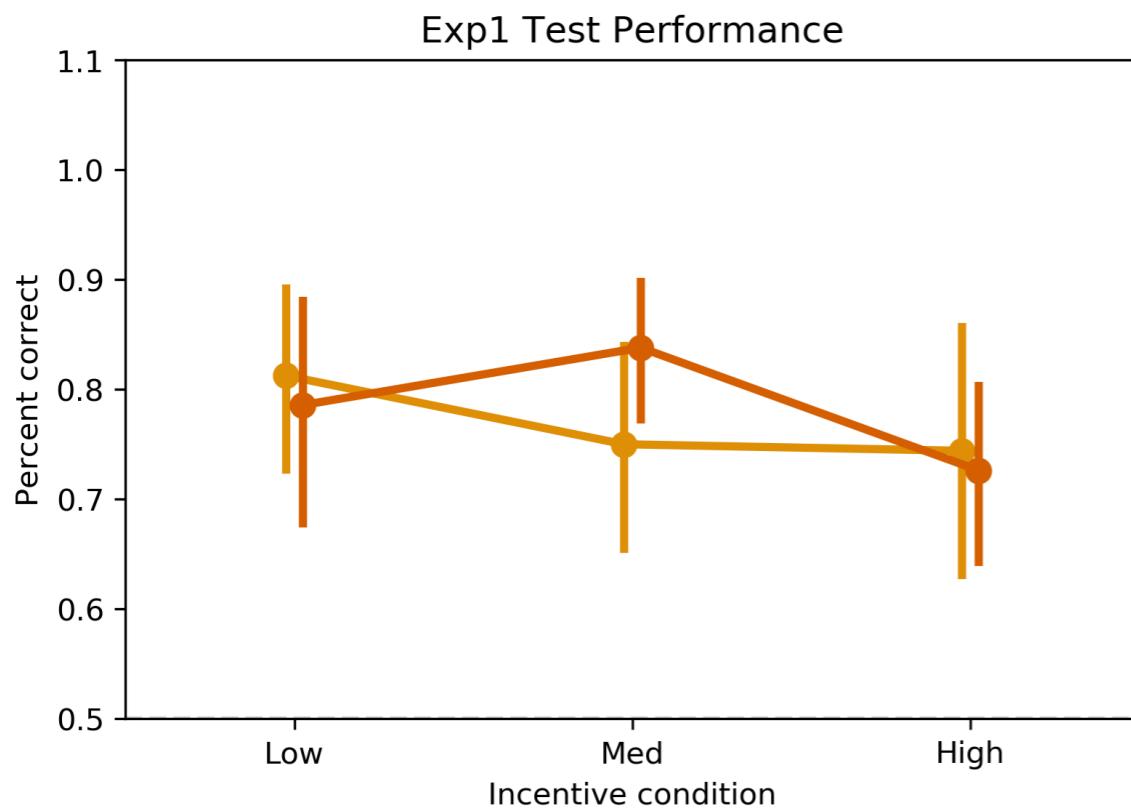


B



Comparing Experiments

Exp 1



Exp 2

