



Transfer of Change Detection to Novel Changes with Pigeons

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Introduction

- Previous research has investigated the thresholds of perceptual and visual working memory.¹
- One task used by researchers to study perceptual and working memory is change detection (CD). This task requires a participant to view an array of stimuli (sample) for a short duration and following a short delay indicate whether the test display has changed or indicate which item in the array has changed. This task allows a variety of variables to be manipulated (e.g., view time, delay between displays, number of items, and the inclusion of a visual mask).
- The focus of our lab's CD task is to test the pigeons ability to transfer CD to novel changes through conceptual learning.
- Evidence from CD tasks indicates sensory memory is most influential at short delays (< 100 ms) and drops off precipitously, whereas working memory gradually declines across longer delays (1-15 s). Most recently, our lab has analyzed pigeon performance in a CD transfer from location to shape, size, and color.
- Non-human animals have been shown to learn and transfer concepts like same/different (Wright & Katz, 2006).
- Elmore et al. (2013) found that monkeys transferred color CD to shape and location change, but pigeons did not transfer.

Aim of Current Study

- The current task extends recent research in our lab with a location CD task by testing transfer to novel dimensions of change (size, shape, and color) with pigeons.
- We predicted that the pigeons would fail to transfer to the novel stimuli, requiring retraining with additional changes before transfer would be observed.

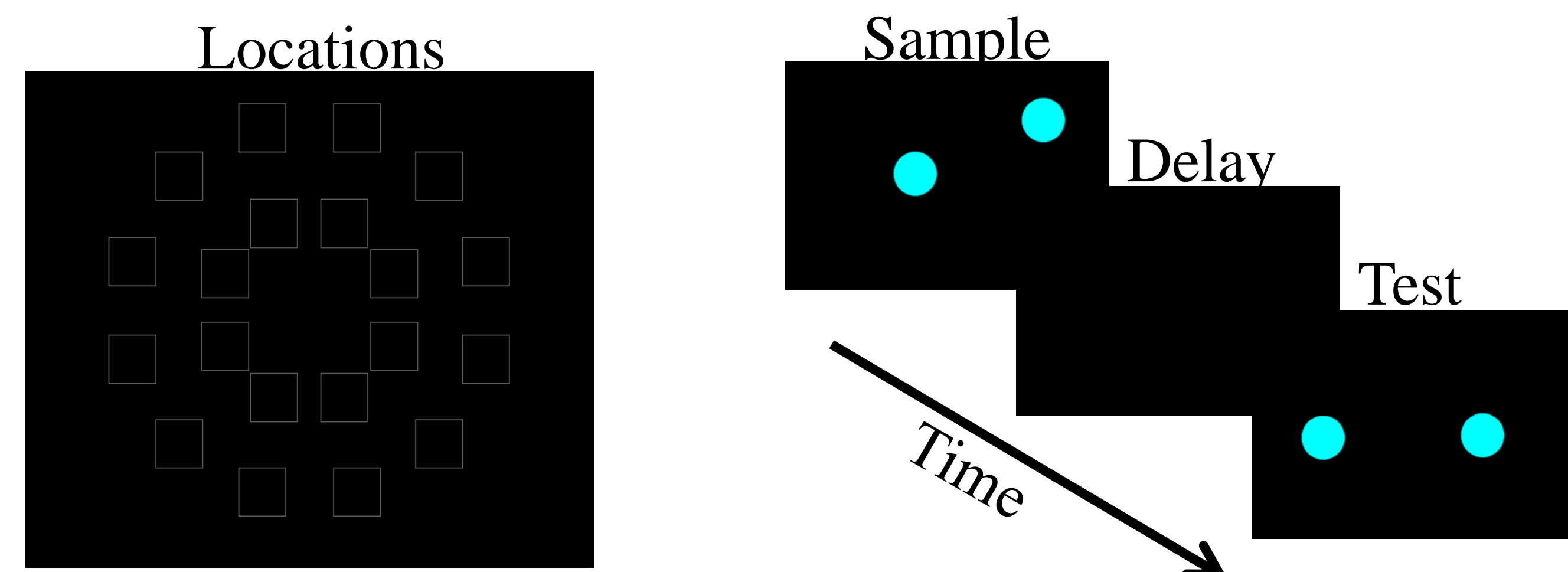
Method

Subjects

- Three pigeons (*Columba livia*)

Apparatus

- Testing was conducted in a flat-black Plexiglas chamber. All stimuli were presented by computer on a color LCD monitor. Pecks to the monitor were detected by an infrared touch screen.
- Reward was delivered via an automated hopper below the viewing screen.

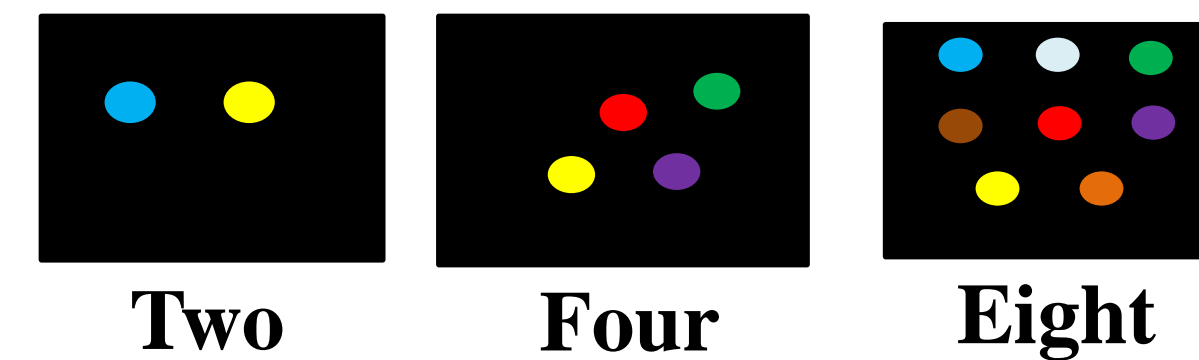


Method

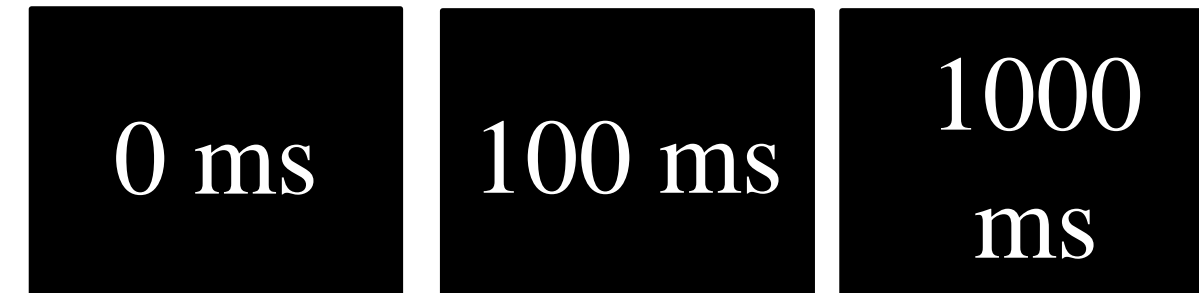
Experiment 1

- The pigeons were shown displays of 2-8 items with delays of either 0 ms, 100 ms, or 1000 ms on location change only.

Example Display Sizes

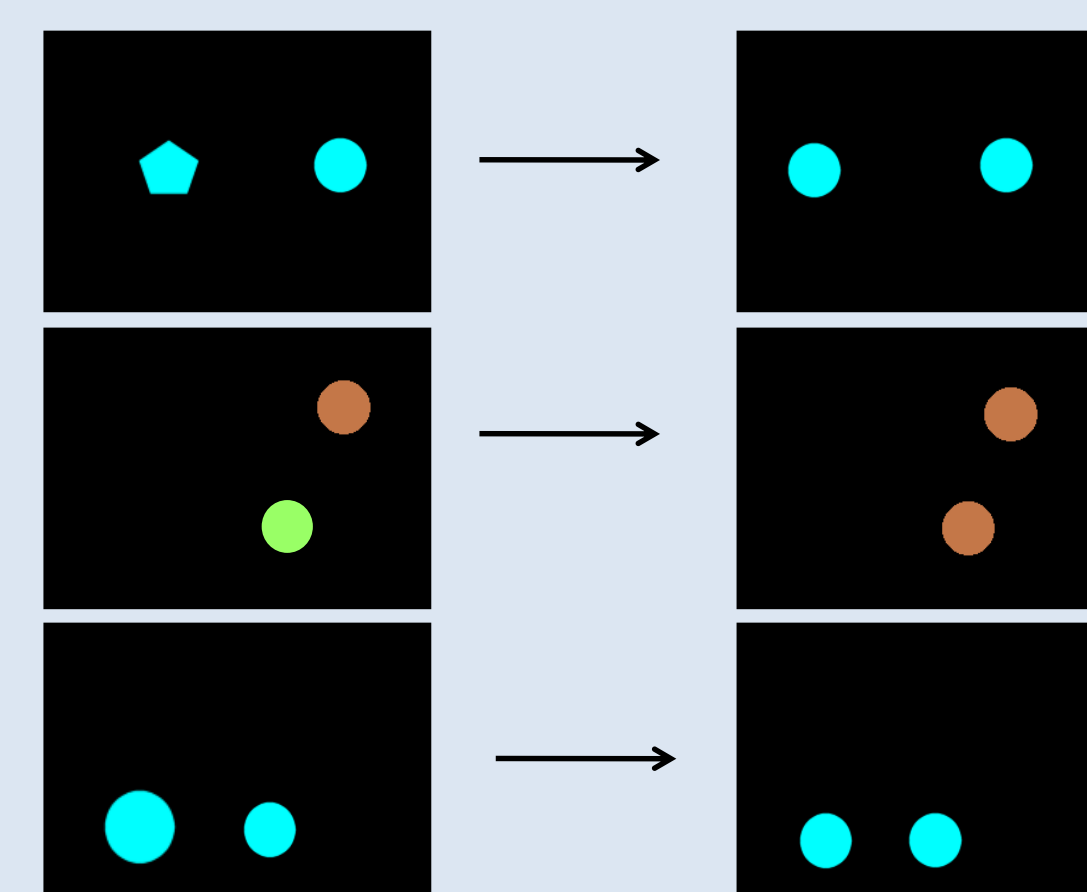


Delay Intervals



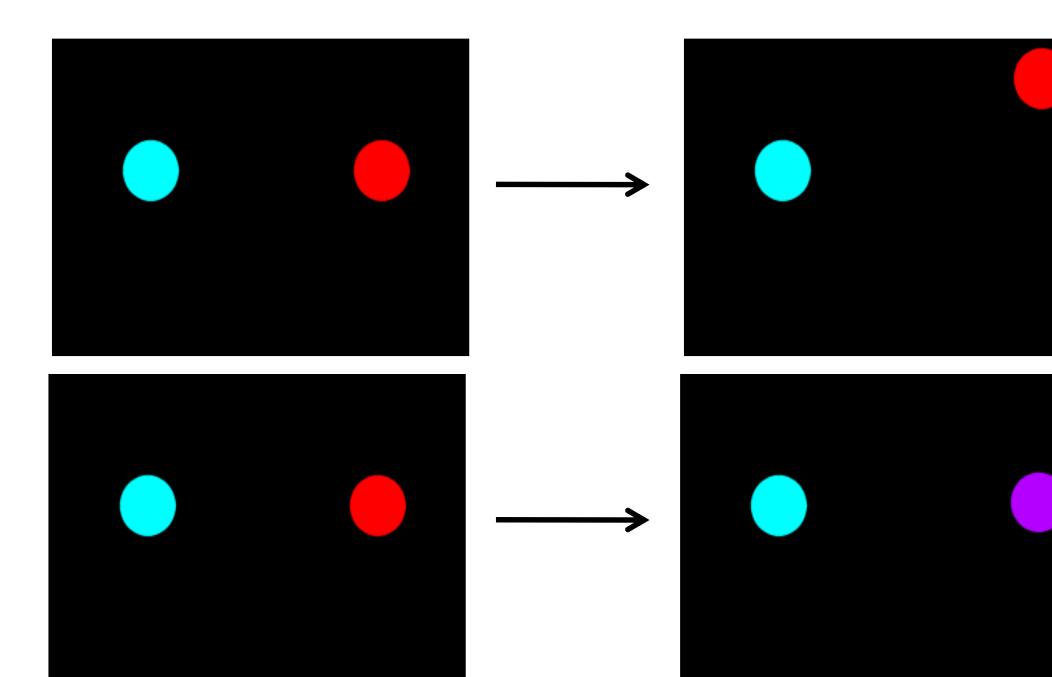
Testing

- The pigeons were given baseline trials of location followed by non-differential novel testing trials of size, shape, and color CD. The pigeons were only shown 2 items with delays of either 0 ms or 1000 ms.



Experiment 2

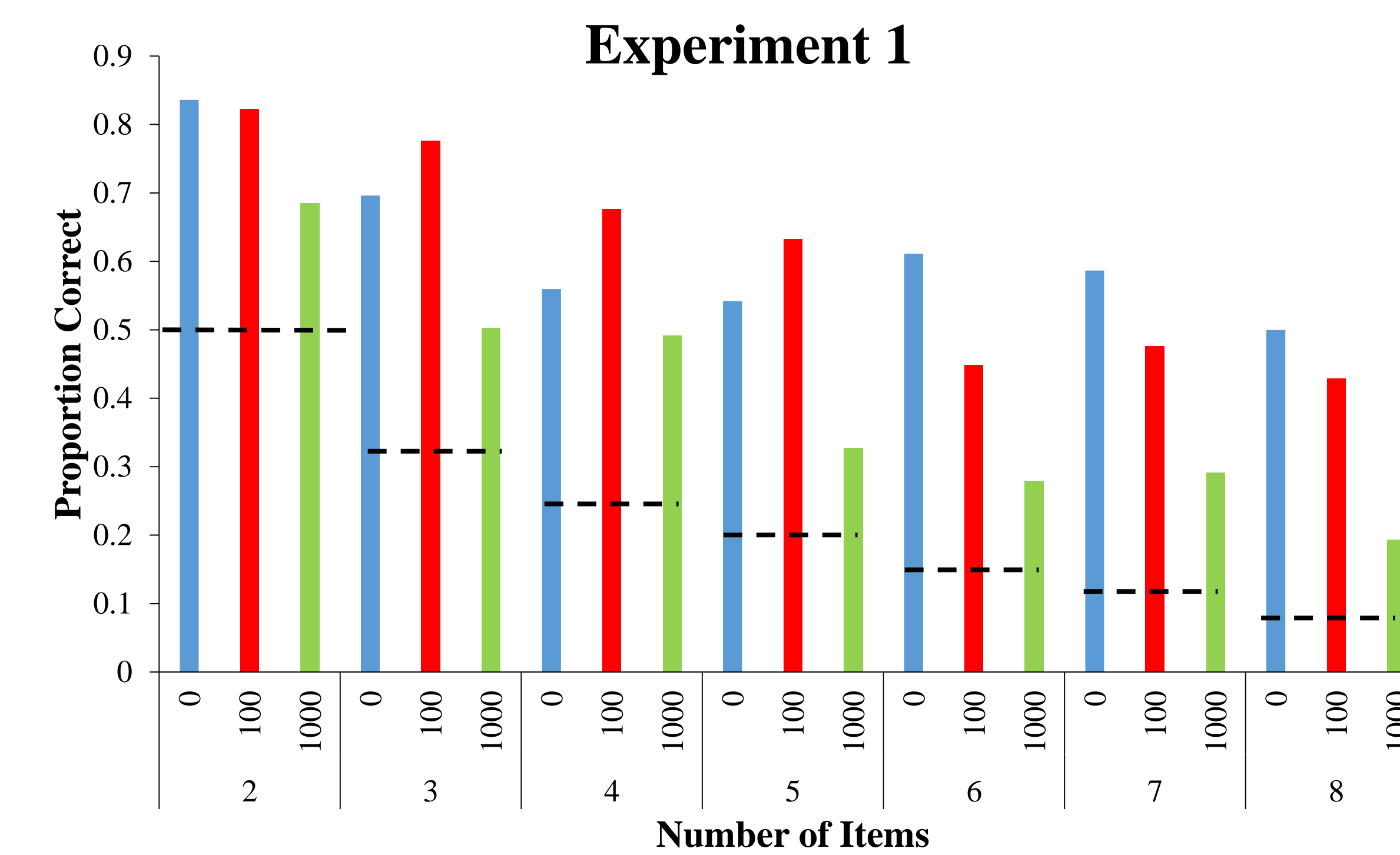
- The pigeons on location and color trials only with 2 display items and delays of either 0 ms or 1000 ms.



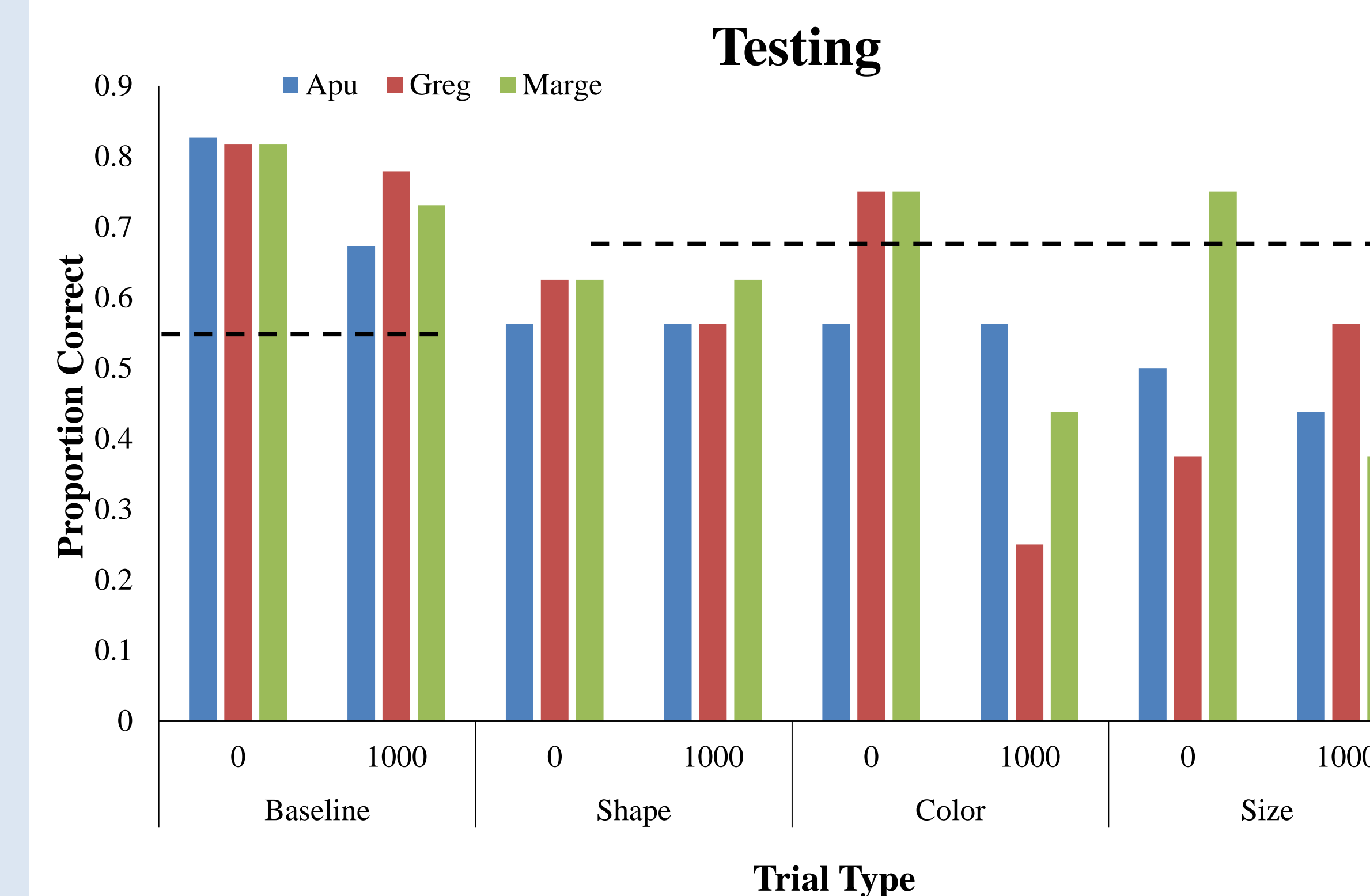
References

1. Phillips, W.A., (1974). On the distinction between sensory storage and short-term visual memory. *Perception and Psychophysics*, 16, 283-290.
2. Leising, K. J., Elmore, L. C., Rivera, J. J., Magnotti, J. F., Katz, J. S., & Wright, A. A. (2013). Testing visual short-term memory of pigeons (*Columba livia*) and a rhesus monkey (*Macaca mulatta*) with a location change detection task. *Animal cognition*, 16(5), 839-844.
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3. Elmore, L. C., Magnotti, J. F., Katz, J. S., & Wright, A. A. (2012). Change detection by rhesus monkeys (*Macaca mulatta*) and pigeons (*Columba livia*). *Journal of Comparative Psychology*, 126(3), 203-212.

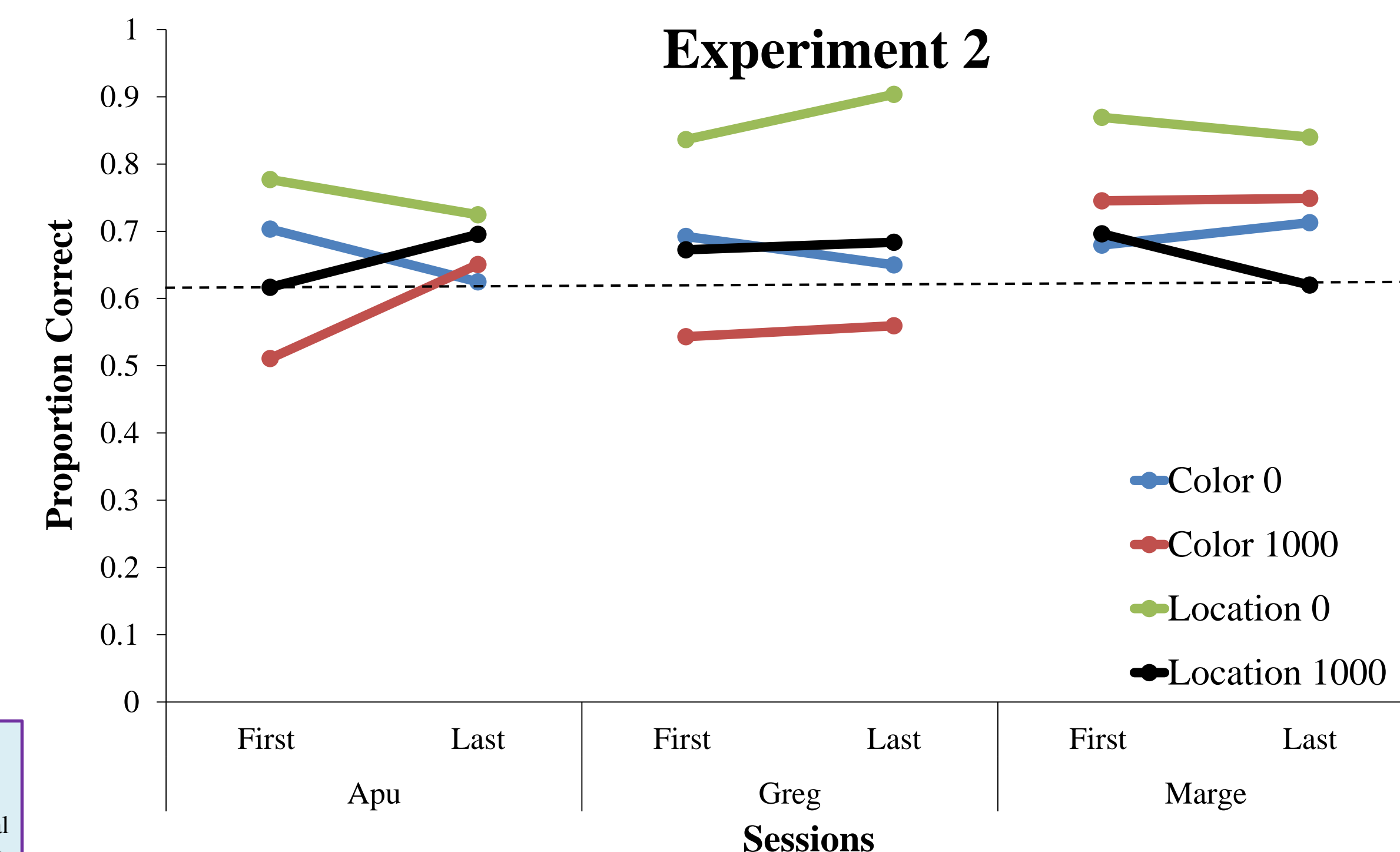
Results



An ANOVA with repeated measures revealed a main effect of Number of Items, $F(6, 12) = 22.24, p < .001$, Delay, $F(2, 4) = 57.78, p < .01$, and the interaction, $F(12, 24) = 2.37, p < .05$.



Delay, $F(1, 2) = 17.36, p = .05$, and all other effects and interaction were non-significant, $F_s(1, 2) < 6.30, p_s > .12$



First 5 sessions, $F(1, 2) = 25.52, p < .05$, but not the Last 5, $F(1, 2) = 2.47, p > .25$

Discussion

Experiment 1

- Every bar is an average of all three pigeons.
- During training, the trials with 2 items were the only ones in which all three birds were significantly above chance.
- 0 ms and 100 ms trials were statistically the same.
- Two of three birds were above chance for all but 8 items and the 1000 ms delay.

Testing

- Marge performed above chance at 0 ms delay for both color and size change detection.
- Greg performed above chance at 0 ms delay for color change trials
- Apu's performance was inconsistent throughout.
- Results indicate that the attentional mechanism used at 0 ms transferred, but learning performance did not.

Experiment 2

- With differential reinforcement two of three pigeons learned to detect an item that changed color with a 0 or 1000 ms delay.
- Marge performed above chance with the 1000 ms delay in the very first session of training.
- Contrary to Elmore et al., two of three pigeons were able to learned the color-change task.

General Procedure

Pigeons were required to peck circles on a screen throughout sessions with 76 trials per session. Correct pecks were reinforced with 4 s access to mixed grain while incorrect pecks resulted in a 4 s flashing light. Both rewarded and non-rewarded trials were followed by a 20 s inter-trial interval.