# Secondary reinforcers induce value-driven attentional capture without the expectation of monetary payout

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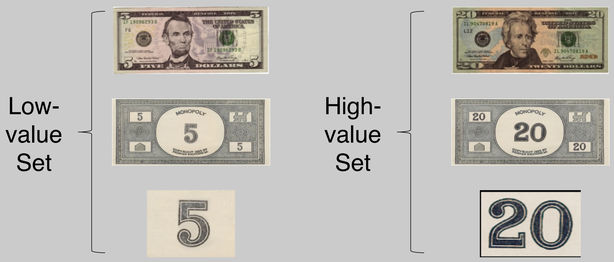
## Introduction

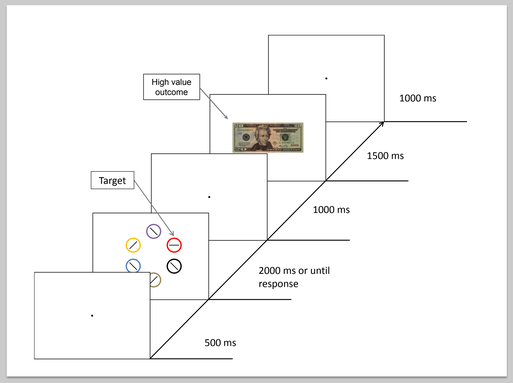
The animal learning literature has demonstrated that initially neutral stimuli can become salient when associated with reward (Pavlov, 1927). Thorndike's (1911) 'law of effect' demonstrates that behaviors increase in frequency when paired with reinforcement. Behavior, in turn, is apt to be shaped by environmental stimuli that share strong associations with satisfying outcomes. When paired with primary reinforcers (e.g., a squirt of apple juice or a grain pellet), otherwise commonplace stimuli become highly attractive and sought after because of their acquired predictive value (Lauwereyns et al., 2002). Greater rewards induce higher pertinence and garner more attention (Baum, 1974). Although human behavior is considerably more complex, it is nevertheless ordained by the very same law of effect that precipitates a wide array of animal behavior. This suggests that human cognitive processes, such as visual selective attention, are amenable to instrumental learning principles.

## Methods

### Stimuli

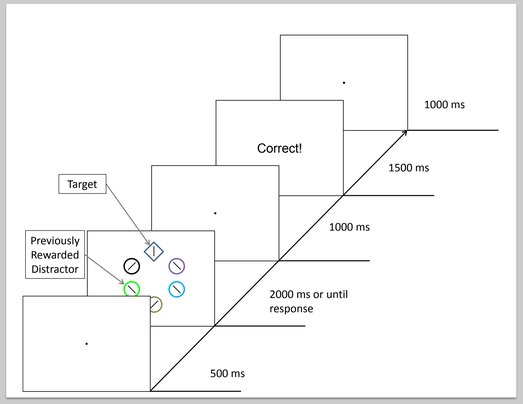



### Training Trial



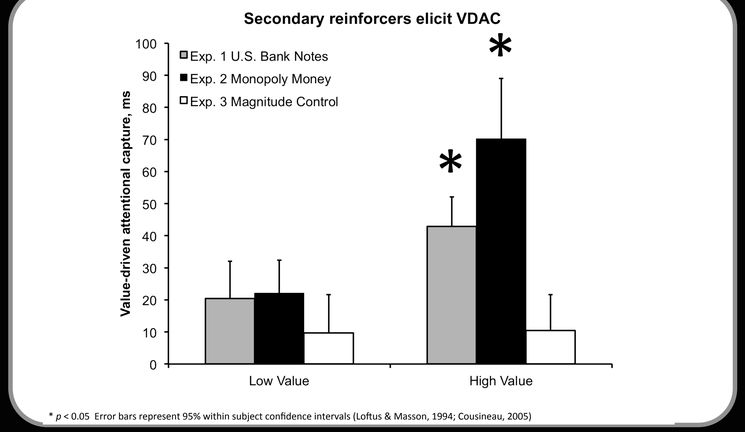

*Training trial schematic.* Targets – red and green circles – were paired with high value ($20) and low value ($5) stimuli during training.

### Extinction Trial




*Extinction trial schematic.* Targets – Blue Diamonds with previously rewarded distractors.

## Value-Driven Attentional Capture




* $p < 0.05$ Error bars represent 95% within subject confidence intervals (Loftus & Masson, 1994; Cousineau, 2005)

## U.S. Bank Notes

Mean correct reaction times (RT) for extinction trials were computed as a function of reward value (previously associated with $20, $5, or unrewarded). Response latencies greater than 2000ms and less than 150ms were excluded from the analysis (this eliminated 3.2% of the data). High value distractors produced the greatest RT (mean: μ = 958 ms, standard deviation: σ = 189 ms) followed by low value distractors (μ = 935 ms, σ = 210 ms) and no value distractors (μ = 915 ms, σ = 255 ms). These data were submitted to a repeated-measures ANOVA with associated dollar value as a factor. We observed a significant effect of reward value, $F(2,38) = 3.79$, $p = 0.032$, $\eta_p^2 = 0.17$. Follow-up analyses revealed that high reward distractors produced greater RT than no value distractors, $t(39) = 2.67$, $p = .011$.

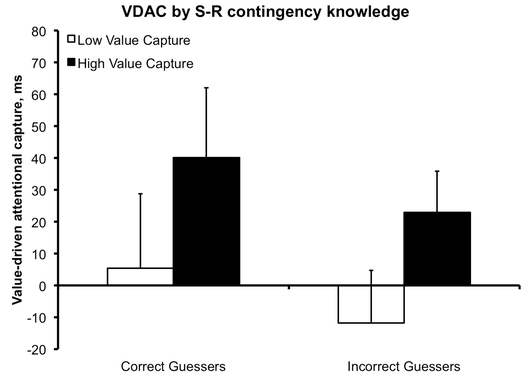
## Monopoly Money

High value distractors produced the greatest RT (μ = 892 ms, σ = 290 ms) followed by low value distractors (μ = 845 ms, σ = 218 ms) and no value distractors (μ = 823 ms, σ = 205 ms). These data were submitted to a repeated-measures ANOVA with associated Monopoly money value as a factor. We observed a significant effect of reward value, $F(2,18) = 4.73$, $p = 0.022$, $\eta_p^2 = 0.34$. Follow-up analyses revealed that high reward distractors produced greater RT than no value distractors, $t(19) = 3.09$, $p = .006$. No other pairwise contrasts were significant.

## Debrief Questionnaire

1. Did you believe you would be monetarily paid for your participation in today's experiment?
   **100% answered, "No."**
2. What specific strategies did you use to perform the task?
   **Representative response, "I looked for red and green and focused on that shape."**
3. In **part 1** of the experiment, the $20 bill (*number 20*) appeared most often when the target was in a circle of a specific color. Which color was more likely to predict the image of the $20 bill (*number 20*)? If you don't know, please make your best guess. (Circle one)
   **GREEN RED**
   **Correct Response, Exp.1: 52%, Exp.3: 50%**

## S-R Contingency Knowledge

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