The Roles of Context and Working Memory in Probability Matching

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Introduction

Probability matching, where a participant's choice frequency matches the probability of an alternative, is the modal response strategy in many probabilistic choice tasks. According to traditional norms, the probability matching strategy results in a sub-optimal payoff, compared to the utility maximizing strategy of always choosing the most probable alternative. Some researchers, however, have argued that probability matching is evolutionarily adaptive in certain environments (e.g., Gigerenzer, 1996) and recent evidence suggests that use of the matching strategy is sensitive to different kinds of feedback and incentives (Gallistel, 1990; Wolford, Newman, Cutler, & Miller, 2001).

Others have applied a dual-systems approach to explain the strategies that participants use in probabilistic choice and other tasks (Stanovich & West, 2000), finding that those who use a utility maximizing strategy have higher cognitive ability on average than those who use a probability matching strategy. This evidence supports the theory that the two strategies are products of two different reasoning processes; one that is rule-based and analytic and one that is based on evolutionarily derived heuristics.

The present experiment explores the roles of working memory and task context in probability matching. These factors are proposed to differentiate between the two reasoning processes. Analytic processing requires working memory resources; thus taxing these resources with a secondary task should reduce the use of the maximizing strategy in the probabilistic choice task. Heuristic processing requires a meaningful, socially relevant context; thus an enriched context should increase the use of the matching strategy in this task.

Method

A 2x2 between-participants design was used with two levels for each of the independent variables. Participants were assigned at random either to do the probabilistic choice task by itself or in parallel with a random number generation task (single vs. dual task condition). Half the participants saw a contextually sparse version of the choice task in which there were two blank squares on a computer screen and they had to guess which square would not change color. The other half saw a contextually enriched version in which there were two parking lots and they had to guess which lot would not be ticketed. Participants received feedback after each trial. The experiment was programmed to make the target event occur 75% of the time at the location on the left side of the screen.

Results and Discussion

The 150 trials were divided into five blocks of 30 and a difference from matching score was calculated for each block by subtracting the number of times the left side was chosen from the number of times the target event occurred on the left. There was a significant main effect for both the task condition and the context condition (see Figure 1.). In the first block, participants in all conditions chose either side with equal frequency. In the last block, participants in the single task/rich context condition were more likely to use a maximizing strategy, whereas participants in the other conditions were more likely to use a matching strategy.

These findings suggest that analytic processing resources are needed to use the maximizing strategy, as was predicted. Surprisingly, the enriched context facilitated a maximizing, rather than a matching strategy.

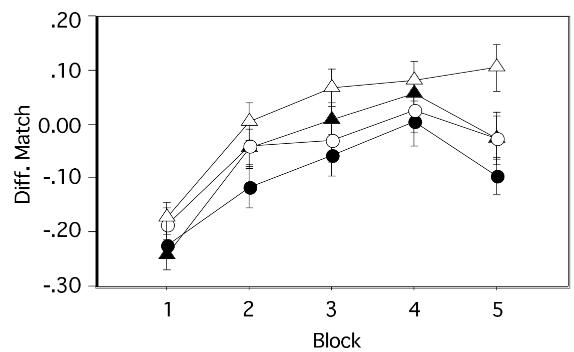

Figure 1: Single task condition and rich task context facilitate a utility maximizing strategy. Filled shapes = Sparse context, open shapes = Rich context; circles = Dual task, triangles = Single task.

References

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