

HOW DOES PROBABILITY AFFECT VISUAL SEARCH?

Previous work has shown that probability affects performance in both spatial (Geng & Behrmann, 2005) and sequential (Walther & Gilchrist, 2006) tasks. Here, we investigate the effects of probability in a more deliberate, top-down visual search task.

GENERAL METHOD

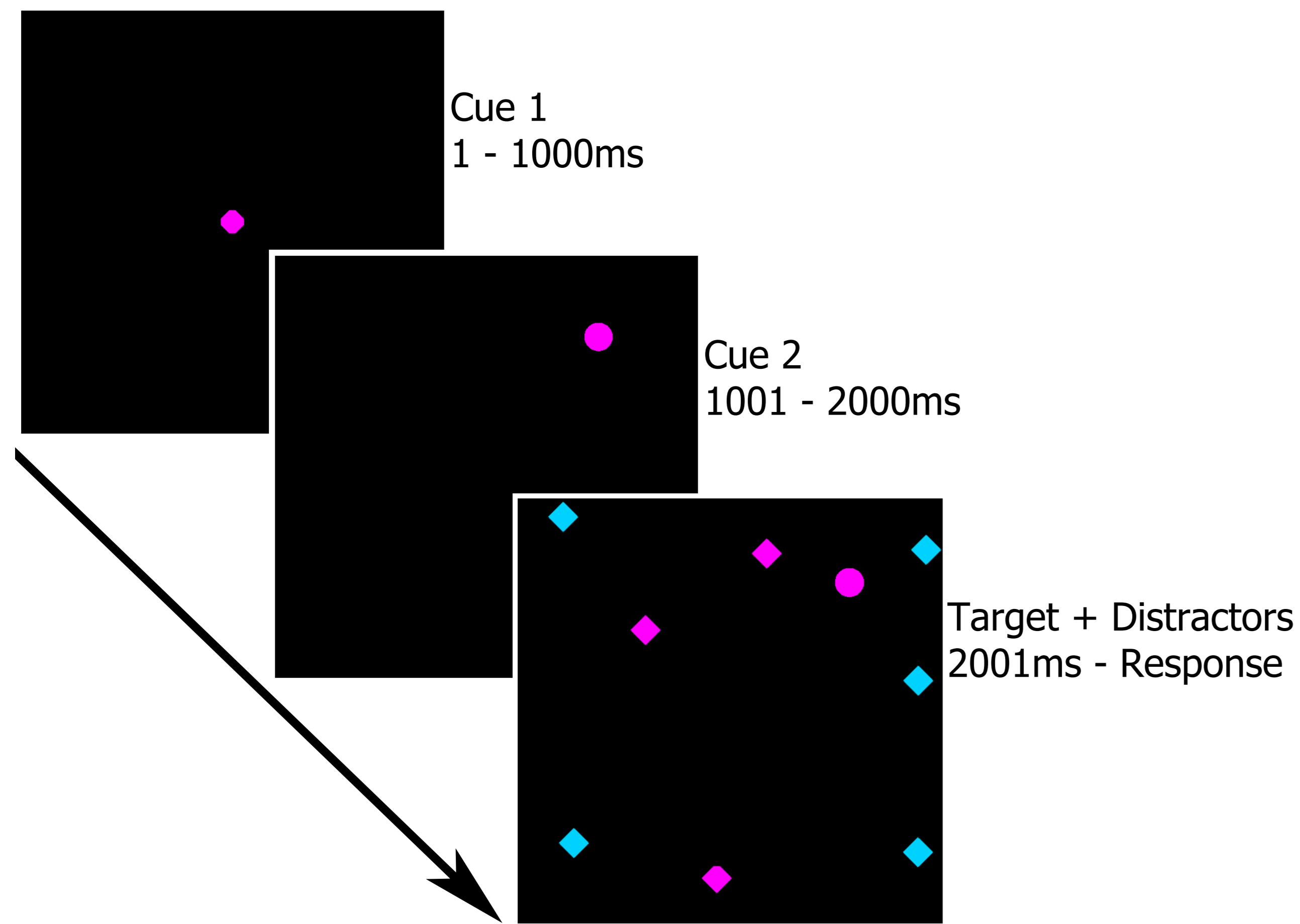


Figure 1: Details Participants saw two independent cues which indicated the probability of a particular target color and then searched displays of 8, 12, 16, or 20 stimuli until they located the target. All results reported for this task were significant at $p < 0.05$.

EXPERIMENT 1: CONDITIONAL PROBABILITY IMPROVES THE EFFICIENCY OF VISUAL SEARCH

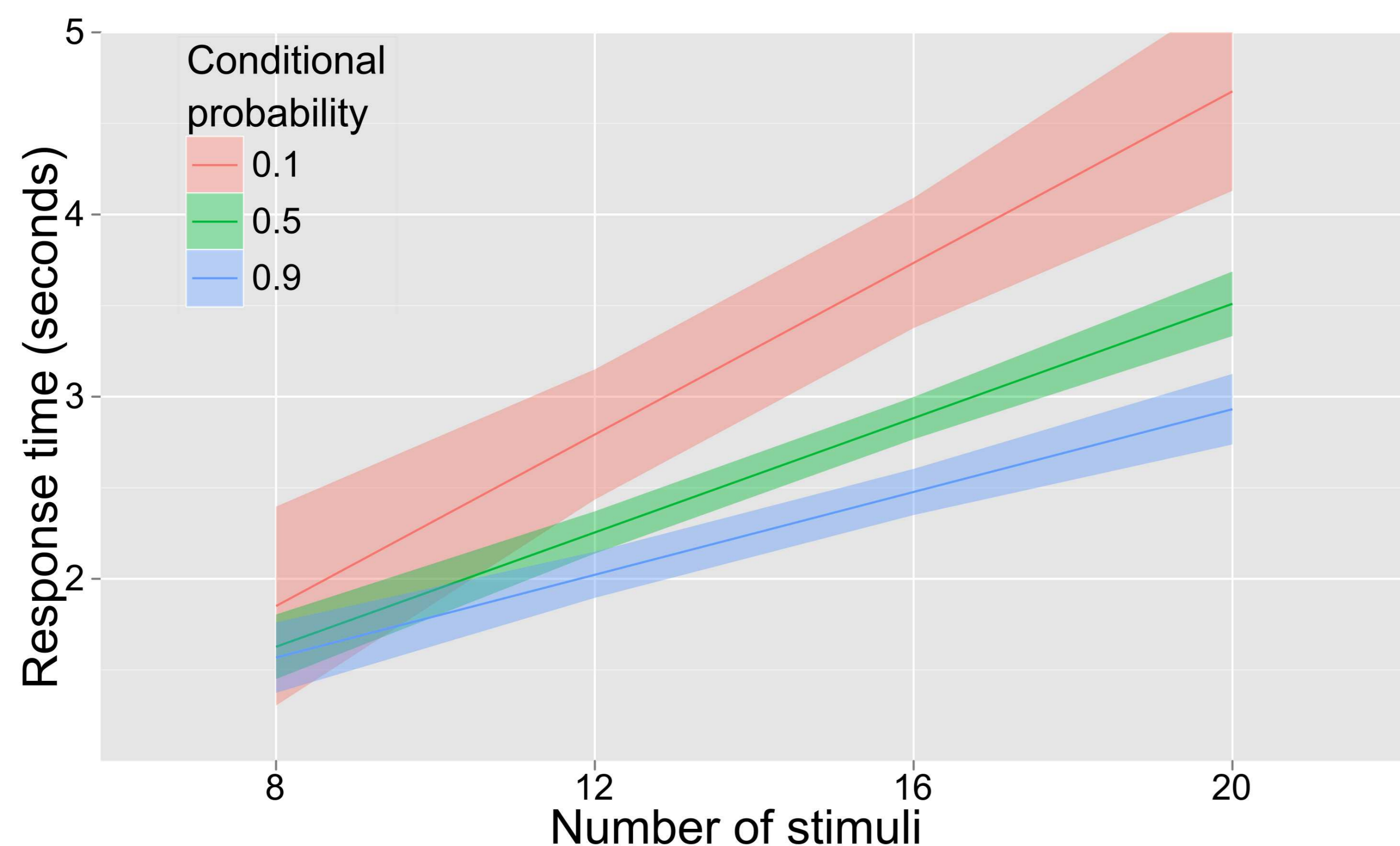


Figure 2: Search times were affected by conditional probability. Participants searched faster and more efficiently for high probability targets, and slower and less efficiently for low probability targets.

EXPERIMENT 2: BETTER PERFORMANCE DUE TO PROBABILITY, NOT COLOR PRIMING

In experiment 1, high probability targets were also primed by like-colored cues. In experiment 2, we eliminated probability but preserved color priming.

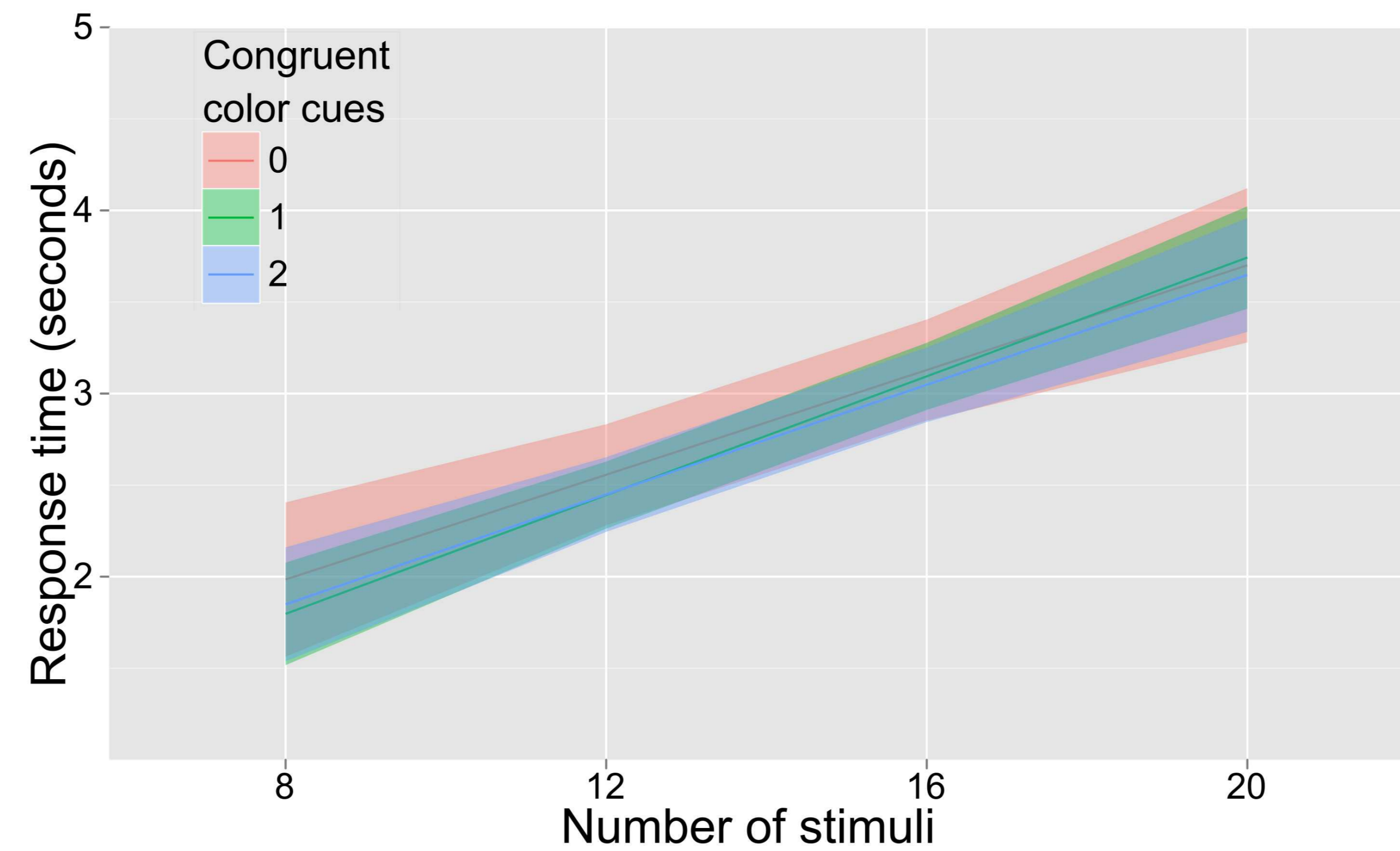


Figure 3: Non-predictive (but like-colored) cues had no effect on performance. If effects on performance were driven by low level color priming then results should show the same pattern as in experiment 1 even when the cues are non-predictive. We see no such results, and therefore rule out color priming as an explanation for search performance.

EXPERIMENT 3: EFFICIENCY BENEFITS PERSIST FOR COMPLEX CUES

In experiment 3, the second cue to appear did not indicate the likely color of the target; instead, it indicated whether or not the first cue was predictive.

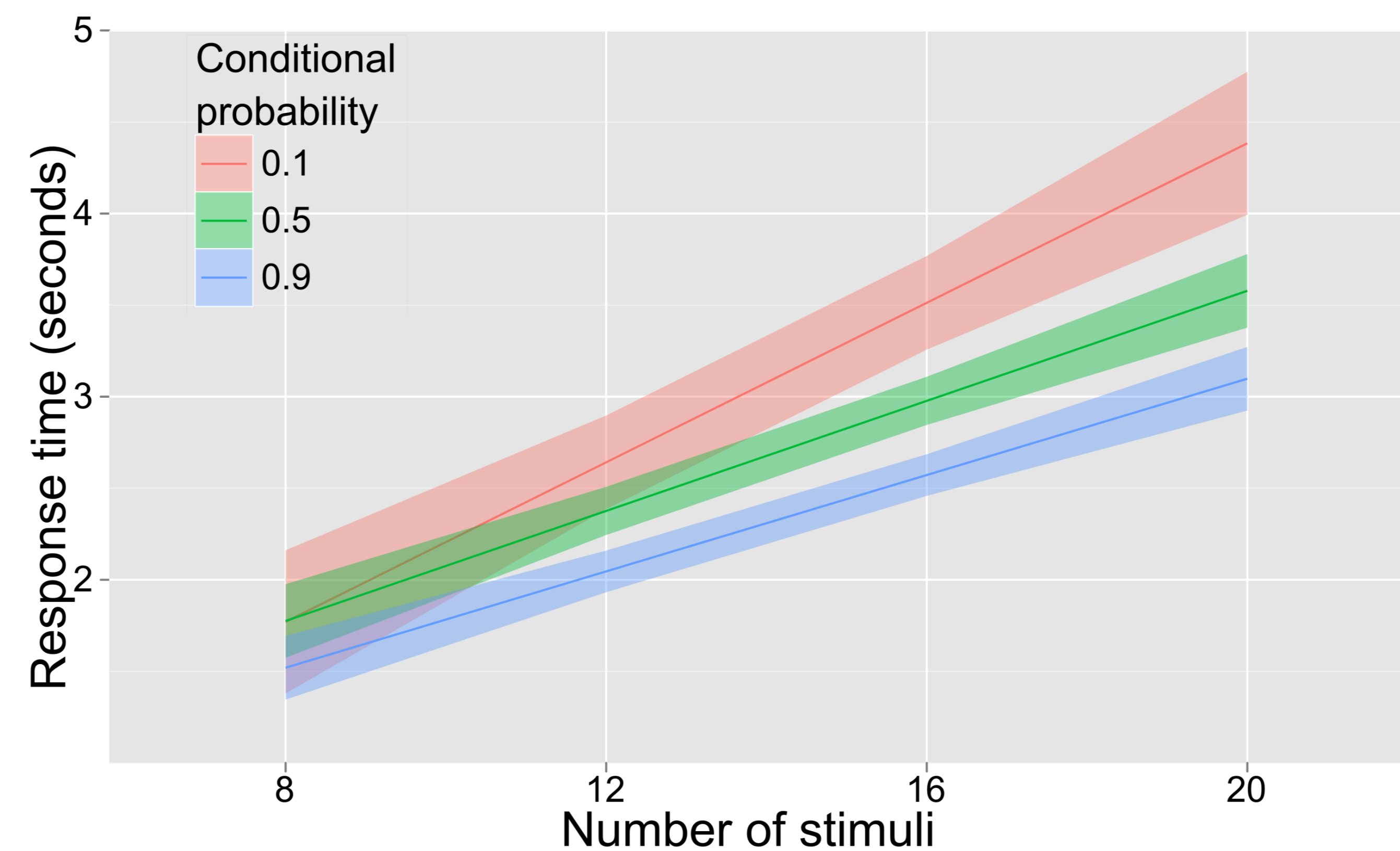


Figure 4: Even for complex cues, probability affects reaction times. The pattern is identical to experiment 1; as probability increases, search is faster and more efficient.

EXPERIMENT 4: PROBABILITY REQUIRES EXPLICIT KNOWLEDGE

In experiment 4, participants were given correct information (as in experiment 1), no information, or misleading information about the probability relationship between cues and target color.

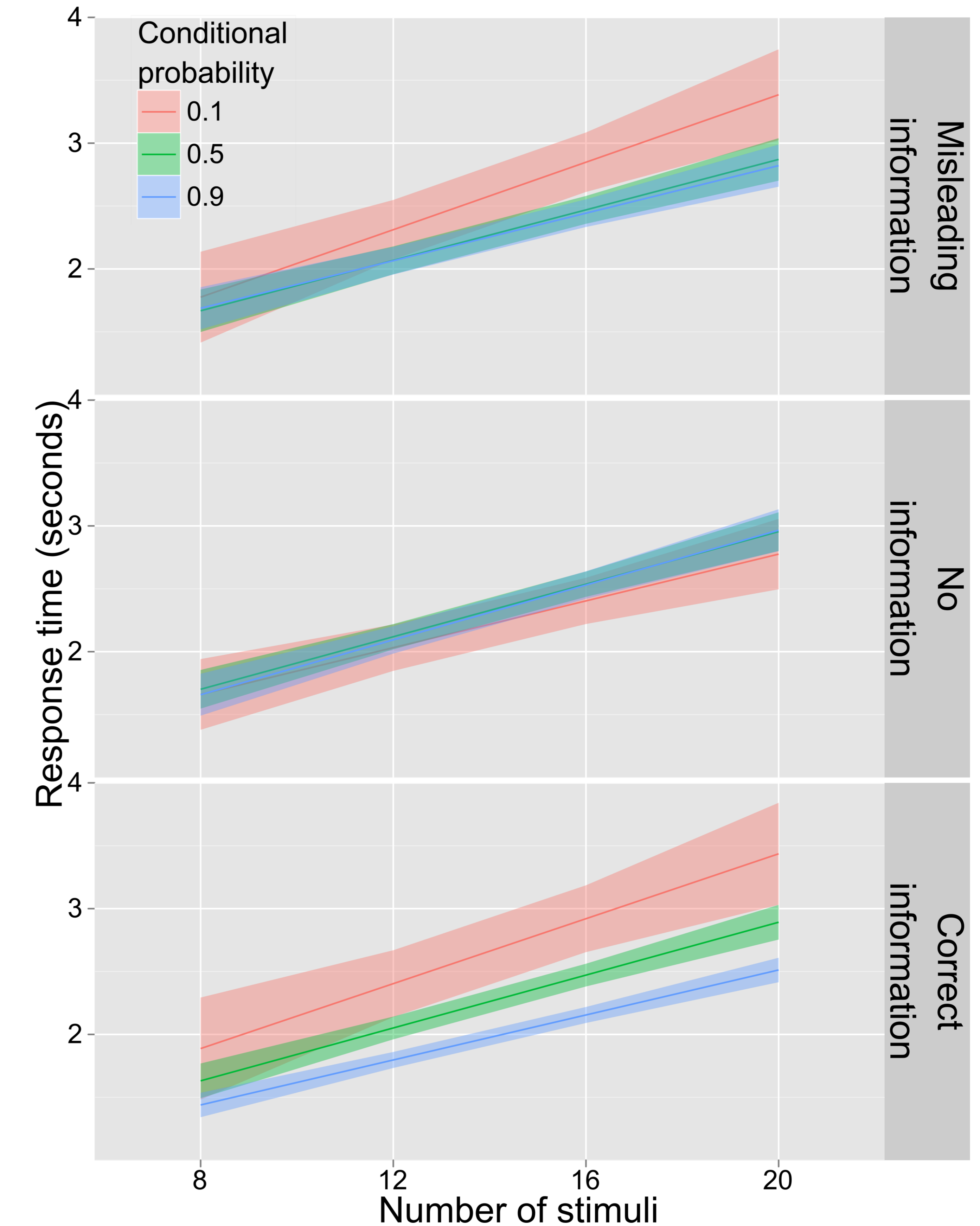


Figure 5: Search times of misinformed and uninformed participants are not affected by probability. Such participants did not spontaneously learn or utilize the probability information in the task. Only participants who were explicitly informed of the probability relationship showed evidence of utilizing it in search.

CONCLUSIONS

Conditional probability modulates visual search performance by improving search efficiency for high probability targets and lowering efficiency for low probability targets. This modulation is not simply due to low level color priming. Probability effects persist for complex cue-target relationships, but require explicit knowledge to utilize. This suggests that probability influences visual search through a top-down mechanism.