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Testing human use of probability in a visuo-motor conjunction task

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Abstract

People overestimate the conjunctive probability of independent events (Bar Hillel, 1973). We examined conjunctive performance in a task involving motor uncertainty and binomial sampling. Human probabilistic judgment is typically near-optimal with either of these sources of uncertainty alone. Four subjects attempted to earn rewards by reaching to circular targets. They chose between a single smaller target and one of N larger targets. Hitting the single target always earned a reward but only one on the N larger targets was rewarded: they chose between $P[\text{Smaller}]$ and the conjunctive probability $(1/N) * P[\text{Larger}]$ as we varied N and the sizes of the targets. The ideal observer should be indifferent when $P[\text{Smaller}] = (1/N) * P[\text{Larger}]$. We also asked observers to estimate the probability of hitting targets of different sizes to verify that they could do so accurately. Remarkably, three out of four observers ignored numerosity N in their preferences.