

## *Quitting rules in visual search*

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### Abstract

When and why people decide to stop searching for a target that they have not found is an old question. At VSS last year, we demonstrated that payoff matrices can bias observers towards responding that a target is present or absent in visual search. This year, we attempt to explain reaction time and detection rates by considering time-dependent reward-maximization models. Data come from 32 observers, performing a realistic x-ray baggage-screening task. X-ray images of empty bags were filled with semi-transparent, overlapping x-ray images of weapons and other objects. Bags contained 3, 6, 12, or 18 objects. Targets were guns and knives. Observers gained money for correct answers and lost money for incorrect answers. There were 5 possible payoff matrices crossed with two time pressure conditions. In the low pressure condition, observers completed 200 trials at their own pace. In the high pressure condition, they had 15 minutes to search as many bags as they wanted. Payoff matrices were equally effective in low and high pressure conditions. Unsurprisingly, observers became faster under greater time pressure. Moreover, they were close to maximizing expected reward under both conditions. We tested several time-dependent models of decision-making. Drift-diffusion models that decide when accumulating evidence exceeds a target-present or absent threshold failed to explain the data. Models that lack time-penalty (e.g., that decide when expected reward stabilizes) could not explain the effects of time-pressure. Models with linear time-penalty also failed to explain the data. An ideal observer model that maximizes reward rate accounts for: (i) why observers quit search more quickly when targets are rare (i.e., fast “no” responses in target absent trials); (ii) why miss errors are high for rare targets; and (iii) how changing the payoff matrix can make observers quit later and reduce miss errors.