ADAPTATION OF DECISION CRITERIA

IN VIGILANCE TASKS

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SUMMARY

Adaptation of decision criteria in vigilance tasks

Decrements in performance during vigilance tasks are usually associated with an increased strictness in the criterion for a signal response. In order to determine whether this can be attributed to a drop in signal probability between training and testing, in Experiments 1 and 2 signal probability was reduced in a ramp fashion during the trial sequence of a discrimination task. Contrary to the predictions of signal detection theory, bias increased toward making signal responses in a manner which also disconfirmed an alternative hypothesis that observers will maintain an initial proportion of signal responses. Instead, observers appeared to adjust their decision criteria so as to maintain the local probability of a signal response at the level of cumulatively-based signal probability. This response stabilization model received further support in Experiment 3 in which signal probability was held constant following a ramp decline during a discrimination task. These results were replicated in a task more appropriate to vigilance in Experiment 4.

In Experiment 5 signal detectability was varied, while a priori probabilities were held constant. Observers did not maintain a fixed sensory cutoff, in order to satisfy the Neyman-Pearson objective, nor vary the cutoff according to a continual regulation process, in order to match
response and stimulus probabilities. Instead they appeared initially to maintain a fixed cutoff, which varied afterward, according to a stabilization process. A confidence-based model was introduced, incorporating response stabilization, and according to which observers adjust their decision criteria so as to maintain observations at some constant average distance from the decision criterion. As in the previous single-criterion detection models, control is mediated through variation in response bias, with the result that no compensation would be predicted when symmetrical effects occur for the two response alternatives. In Experiment 6, such effects were produced by a ramp decline in stimulus discriminability. Changes in latency to a constant amount of stimulus difference indicated that there had been adaptation consistent with a change in the general level of response caution. In Experiment 7 stimulus discriminability was varied in a recurring step fashion. In agreement with the adaptive accumulator model of Vickers (1979), caution was inversely related to the level of discriminability. While a reformulation of a sequential decision model of signal detection can also account for this relationship, neither model can explain the direct relationship between speed and accuracy which followed a step change in discriminability. A model is presented in which sensory boundaries are adjusted to maintain the rate at which information enters the decision process, while control accumulators ensure that decisions are made at target levels of confidence. The model can account for a number of seemingly contradictory trends found to occur over time in vigilance tasks.