

## AN ABSTRACT OF THE DISSERTATION OF

Blake A. Hutsell, for the Doctor of Philosophy degree in Psychology, presented on November 4, 2009, at Southern Illinois University Carbondale.

**TITLE: MECHANICS OF STIMULUS & RESPONSE GENERALIZATION IN SIGNAL DETECTION & PSYCHOPHYSICS: ADAPTATION OF STATIC THEORY TO DYNAMIC PERFORMANCE.**

**MAJOR PROFESSOR: Eric A. Jacobs, Ph.D.**

The area perceptual decision-making research seeks to understand how our perception of the world affects our judgment. Laboratory investigations of perceptual decision-making concentrate on observers' ability to discriminate among stimuli and their biases towards reporting one stimulus more frequently than others. Choice theories assume that these performance measures are determined by generalization of reinforcement along both stimulus and response dimensions. Historically the majority of research has addressed situations in which the difference among stimuli and resulting consequences of a perceptual decision are static. Consequently, little is known about the dynamics of stimulus and response generalization. The present research investigated the dynamics of discrimination accuracy and response bias by frequently varying differences among stimuli and the outcomes for correct decisions.

In Experiment 1, four rats responded in a two-stimulus, two-response detection procedure employing temporal stimuli (short vs. long houselight presentations). Sample stimulus difference was varied over two levels across experimental conditions. A rapid acquisition procedure was employed in which relative reinforcer frequency varied daily. Shifts in response bias were well described by a behavioral model of detection (Davison & Nevin, 1999). Within sessions, bias adjusted rapidly to current reinforcer ratios when the sample stimulus difference was large, but not when the difference was small. In

Experiment 2, three rats responded in a five-stimulus, two-response detection procedure employing temporal stimuli. Relative reinforcer frequency was again varied daily. Control by current session reinforcer ratios increased rapidly within sessions in a nearly monotonic fashion. Furthermore, response bias following each sample stimulus was observed within the first few trials of an experimental session. The speed of changes in response bias, especially following an unreinforced probe stimulus, provide strong support for an effective reinforcement process and suggest that this process may operate at a trial-by-trial level. In Experiment 3, three rats responded in a six-stimulus, two-response classification procedure. A repeated-acquisition procedure was employed in which the relationship between classes of short and long sample stimuli and their respective correct comparison locations reversed every 15 sessions. After several reversals, the probabilities of reinforcement for correct classification were also manipulated. In the majority of conditions across subjects, response bias reached half-asymptotic levels more rapidly than did discrimination accuracy. These findings provide some support for a backward chaining account of the acquisition of signal detection performance. An attention-augmented behavioral detection model accurately described the acquisition data; however parameter estimates expressing the probability of attending to sample and comparison stimuli differed widely among subjects.

The results of these experiments support the adaptation of dynamic research methodologies to the study of learning in perceptual decision-making tasks. Furthermore, discrimination performance and response bias adapt rapidly to frequent changes in reinforcement contingencies. Quantitative models formulated to describe static performance in detection procedures can be extended to predict dynamic performance.

Some theoretical assumptions of these models were supported and others were violated. Overall, this research supports a renewed emphasis on learning in signal detection procedures and suggests that stable behavioral endpoints are at least as much a function of contingency variables as they are of sensory variables.