

Swets J A, ed. *Signal detection and recognition by human observers: contemporary readings*. New York: Wiley, 1964. 702 p.

Modern signal detection theory, as an extension of statistical decision theory, shows quantitatively how discrimination performance is determined by two independent factors: (1) the observer's intrinsic capacity to discriminate between the alternative stimuli presented, and (2) a decision criterion adopted by the observer to reflect the stimulus probabilities and response utilities in the particular situation at hand. [The *Science Citation Index*® (SCI)® and the *Social Sciences Citation Index*® (SSCI)® indicate that this book has been cited as a whole, or for chapters authored by the editor, in over 375 publications since 1966. Other individual chapters have been cited over 175 times.]

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First compiled as class notes for a special summer program at the Massachusetts Institute of Technology, this volume's record of citations may be a testimony to the usefulness of at least some collections of articles. Though almost all of its selections were available in the open literature (and the introductory article was to become a *Citation Classic*!), its topic draws on developments in electrical engineering and mathematical statistics as well as in psychology and has applications also in several fields. According to the book's preface: "It is exceptional when the journals in which [these articles] appear are housed in fewer than three libraries."

Indeed, citations to this book continued even though its usefulness was soon reduced by the publication of a systematic textbook that covered much the same content^{2,3} (and

that has now been cited about four times as often). This latter book, I understand, was much of the basis for the 1985 award to its authors of the Warren Medal of the Society of Experimental Psychologists.

The commentary on the article earlier designated as a *Citation Classic*¹ describes the convergence of the three disciplines just mentioned at the University of Michigan in the early 1950s. The main concept was an analytical technique that separates a measure of the observer's capacity for discrimination (between two given, confusable alternatives) from a measure of the observer's decision criterion, that is, the requirement on the evidence that the observer sets for choosing a given alternative (which may also be thought of as the observer's bias toward that alternative). The technique is basically a graph that shows how the proportions of true-positive and false-positive decisions covary as the decision criterion changes from strict to lenient: a function called the relative (or receiver) operating characteristic (ROC). This solution to the previous confounding of the two factors in existing measures of discrimination accuracy, recently reviewed,⁴ served to question again the concept of the threshold in psychology⁵ and aided studies of sensation, perception, learning, memory, and cognition.⁶ Purer measures of discrimination ability were thus available and certain independent variables were seen to affect the decision criterion rather than discrimination.

The ROC is now used also in connection with a variety of practical problems—specifically, in the evaluation of humans and devices that make discriminations in the interests of "diagnosis." Examples come from clinical medicine, information retrieval, weather forecasting, mineralogy, aptitude testing, polygraph lie detection, process-plant supervision, product inspection, and nondestructive testing. Recent publications spell out⁷ and exemplify⁸ the application of the ROC in such fields.

1. Swets J A, Tanner W P, Jr, & Birdsall T G. Decision processes in perception. *Psychol. Rev.* 68:301-40, 1961. [See also: Swets J A. *Citation Classic. Current Contents/Social & Behavioral Sciences* 11(8):14, 19 February 1979.]
2. Green D M & Swets J A. *Signal detection theory and psychophysics*. New York: Wiley, 1966. 455 p. (Cited 1,385 times.)
3. *Signal detection theory and psychophysics*. Huntington, NY: Krieger, 1974. 479 p. (Cited 110 times.)
4. Swets J A. Indices of discrimination accuracy: their ROCs and implied models. *Psychol. Bull.* In press.
5. Is there a sensory threshold? *Science* 134:168-77, 1961. (Cited 95 times.)
6. The relative operating characteristic in psychology. *Science* 182:990-1000, 1973. (Cited 130 times.)
7. Swets J A & Pickett R M. *Evaluation of diagnostic systems: methods from signal detection theory*. New York: Academic Press, 1982. 253 p.
8. Swets J A. Form of the ROC obtained in discrimination and diagnostic tasks: implications for theory and measurement of performance. *Psychol. Bull.* In press.