

This Week's Citation Classic

Herrnstein R J. On the law of effect. *J. Exp. Anal. Behav.* 13:243-66, 1970.
[Harvard Univ., Cambridge, MA]

The 'law of effect' refers to the strengthening of behavior by reinforcement (i.e., reward). Experimental findings indicate that each behavior's strength is directly proportional to its level of reinforcement and inversely proportional to the total reinforcement concurrently obtained. [The *Science Citation Index*[®] (SCI[®]) and the *Social Sciences Citation Index*[™] (SSCI[™]) indicate that this paper has been cited over 260 times since 1970.]

R.J. Herrnstein
Department of Psychology
and Social Relations
William James Hall
Harvard University
Cambridge, MA 02138

January 31, 1980

"It has long been known that the strengths of behavioral alternatives depend on the reinforcement associated with them. This principle was embodied in E.L. Thorndike's law of effect,¹ in B.F. Skinner's concept of 'operant conditioning,'² and in other theories of behavior. Though the principle was widely accepted in qualitative form, there was no general quantitative expression to cover the large variety of settings in which behavioral strength could be shown to depend on reinforcement. My article proposed that each behavior's strength (as measured, for example, by its average rate of occurrence during a specified observation period) is directly proportional to its own level of reinforcement and inversely proportional to the total reinforcement concurrently obtained from all sources. The empirical literature was shown to fit this simple principle, and the accumulating evidence has continued to support it. Its simplicity, generality, and at least approximate validity no doubt explain the frequency with which the article has been cited.

"My interest in the quantification of the law of effect started in 1954, during my second year as a graduate student at Harvard University. After some unsuccessful experiments, a particular procedure using pigeons started to yield orderly results in 1958. Pigeons allocated the proportion of pecking at each of two response-keys so as to equal the proportion of reinforcements obtained by pecking that key. The matching of proportions of responses to reinforcements was first published by me in 1961 and has since been more or less substantiated in over one hundred experiments on a variety of species including human beings.³ The occasional, and usually minor, deviations from the 'matching law' (as the finding is commonly called) have themselves been related to the underlying formulation of the law of effect.

"During the early 1960s, I sought a version of the law of effect applicable not just to proportions of responses (as in the original matching law) but to absolute rates of responding as well. The solution given in the 1970 article first occurred to me on 10 December 1965. It is easy to show mathematically that response rate should be a hyperbolic function of its own reinforcement if my equation is right and if all sources of reinforcement besides those associated with the response in question are held constant. The predicted hyperbolic relationship has been approximately confirmed in several score experiments on various species including human beings.

"Present work on the matching law is directed less at its empirical accuracy than at its relation to other, possibly more fundamental, behavioral processes. The law of effect articulates with optimal foraging in biology and utility maximization in economics, each dealing with the control of behavior by its consequences. Several new theories by various workers have attempted to unify these concepts, but at this writing no final conclusion can be drawn."

1. Thorndike E L. *Animal intelligence*. New York: Macmillan, 1911. 297 p.
2. Skinner B F. *The behavior of organisms*. New York: Appleton-Century, 1938. 457 p.
3. Herrnstein R J. Relative and absolute strength of response as a function of frequency of reinforcement *J. Exp. Anal. Behav.* 4:267-72, 1961.