

Rachlin H. Contrast and matching. *Psychol. Rev.* 80:217-34, 1973.
[Department of Psychology, State University of New York, Stony Brook, NY]

Behavior of animals exposed to multiple or concurrent schedules of reinforcement (successive or simultaneous discriminations) consists of the combination of two effects, a biological effect wherein responses are excited or inhibited at points of transition and an economic effect wherein conditions are equalized. [The *Social Sciences Citation Index*® (SSCI)® and the *Science Citation Index*® (SCI)® indicate that this paper has been cited in over 145 publications since 1973.]

Howard Rachlin
Department of Psychology
State University of New York
Stony Brook, NY 11794-2500

December 4, 1984

In the spring of 1972, I was visiting Robert Boakes, who was then at Princeton on leave from Sussex. We discussed Seligman's article, "On the generality of the laws of learning,"¹ which had recently been published and which was generating much comment. Boakes claimed that the research reviewed by Seligman constituted a serious blow to the effort to find general laws of learning. I claimed that the phenomena seen by Seligman (and Boakes) as exceptions to general laws would eventually be incorporated into those laws, much as friction and aerodynamics have been incorporated into classical physics.

Our discussion focused on the phenomenon of autoshaping, the finding that a pigeon can learn to peck a key even though keypecks had not previously been reinforced or even approximated (shaped). All that was necessary was, first, that the key be lit and, then, that the pigeon be fed. If these conditions were met, keypecks seemed to emerge suddenly, out of nowhere. Autoshaping seemed to indicate that biological laws that had seemed general actually applied only to pigeons, and even with pigeons, were valid only in certain circumstances.

Boakes and I were both familiar with several recent studies that, taken together,

seemed to indicate that positive behavioral contrast (the phenomenon whereby response rate on a given schedule of reinforcement varied inversely with the reinforcement density of its context) was nothing but autoshaping. The general law with which we were concerned was Herrnstein's matching law.² Herrnstein himself had argued that contrast and matching were similar phenomena. If matching was nothing but an extreme form of contrast, and contrast was nothing but autoshaping, and autoshaping was a biological rather than an economic (i.e., instrumental) phenomenon, then Herrnstein's matching law (which Boakes and I agreed was the best general law of learning extant) might not be a general law at all. It would be just an illustration of autoshaping at work.

When I got home from Princeton, I decided to review the current evidence regarding matching and behavioral contrast to see how the two might be related. The crux of the difference, I realized, was that contrast emerges when the animal is constrained within successive reinforcement conditions controlled by the environment, whereas matching emerges when that constraint is removed and the animal is allowed to shift from one condition to the other at will.

Matching, in this conception, is a pure instrumental (economic) phenomenon, "uncontaminated" by autoshaping, and a true general law. This was the basis for the article. It has probably been cited more frequently for the evidence it marshals about contrast being an additive biological and economic effect (evidence since challenged³) than for the purely economic theory of matching it propounds.

Since the article appeared, general agreement has been reached that matching is indeed an economic phenomenon. Debate now focuses on whether the relatively molecular economic view I proposed then (which sees the animal as shifting periodically from lower-valued to higher-valued situations) or a more molar economic view (which sees the animal as allocating its time optimally among alternatives) is more true to the facts.^{4,5}

1. Sellgman M E P. On the generality of the laws of learning. *Psychol. Rev.* 77:406-18, 1970. [See also: Seligman M E P. Citation Classic. *Current Contents/Social & Behavioral Sciences* 12(8):14, 25 February 1980.]
2. Herrnstein R J. On the law of effect. *J. Exp. Anal. Behav.* 13:243-66, 1970. [See also: Herrnstein R J. Citation Classic. *Current Contents/Social & Behavioral Sciences* 12(15):16, 14 April 1980.]
3. Williams B A. Another look at contrast in multiple schedules. *J. Exp. Anal. Behav.* 39:345-84, 1983.
4. Herrnstein R J & Vaughan W, Jr. Melioration and behavioral allocation. (Staddon J E R, ed.) *Limits to action: the allocation of individual behavior*. New York: Academic Press, 1980, p. 143-76.
5. Rachlin H, Battalio R, Kagel J & Green L. Maximization theory in behavioral psychology. *Behav. Brain Sci.* 4:371-88, 1981.