



Psychophysics, Computing, and Donald S. Blough

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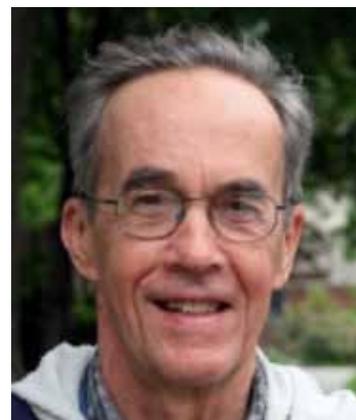
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One of the readings this week for my graduate course, “Reinforcement and Punishment,” was Green et al.’s (2014) useful chapter on “Delay and probability discounting.” In it, they mention the connection between the methods used in these reward-discounting procedures and psychophysical procedures that have been a part of psychology since its birth as a separate discipline in the late 1800s. They were developed and used by German physiologists to map humans’ responsiveness to stimuli as diverse as sounds and weights. Anyone familiar with the psychology of sensation and perception undoubtedly has learned of them *ad nauseum*. The psychophysical methods also were the starting point for much of what today is called psychometrics, which includes both measurement theory and psychological test construction.

At least two different procedures of delay discounting have their roots in the psychophysical traditions of psychology. In one, across successive trials, the delay to the larger of two reinforcers is systematically increased. A point of subjective equality is reached when the subject/participant’s choices are indifferent between the two rewards. This technique descends from the psychophysical method of limits. The other type was used by Mazur and his colleagues (e.g., Mazur 1988) and allows the behavior of the subject/participant to adjust the delay or reward amount. Green et al. (2014) noted that this is a variant of the psychophysical staircase procedure, a method of adjustment-type procedure.

There is a particular contemporary poignancy to the role of psychophysical methods in behavior analysis because on Sept 6, 2022 behavior analysis lost one of its founders and a prominent early student of animal psychophysics, Donald S. (Don) Blough (<https://www.golocalprov.com/obituaries/highly-regarded-brown-professor-donald-s.blough-dies>) at the age 93.



Blough’s doctoral dissertation at Harvard was published in the first issue of the first volume of the *Journal of the Experimental Analysis of Behavior (JEAB)* in 1958 under the title [“A method for obtaining psychophysical thresholds from the pigeon” \(pages 31- 43\)](#). Using pigeons in an operant conditioning chamber, Blough showed how the food-reinforced key pecking of a pigeon changed

Figure 2. Don Blough (dark shirt) in an undated photo working with an unidentified colleague in front of a LINC computer.

as a function of changes in the intensity of a visual stimulus. His method was adapted from that developed by Nobel-prize winning physiologist G. V. von Békésy (1947) to examine human auditory stimulus detection (the same one we use today for hearing tests). Even in 2022, this early application of behavior-analytic methods is impressive. Blough's analysis was seminal not only as a study of animal psychophysics, but also in showing the utility of behavior-analytic methods in studying many "complex" psychological phenomena in both human and non-human animals.

Blough, along with Uber and Weiss, was the first to describe using a digital computer to control behavioral experiments. His article describing the use of a LINC computer for experiment control (Blough, 1966) appeared in the same issue of *JEAB* as one by Uber and Weiss (1966; see also Weiss et. al., 1966), also describing the control of experiments by a digital computer. Blough used his computer acumen to study the reinforcement of inter-response times (IRTs), work that is cited not only in that context but also in the context of research on behavioral variability (e.g., Neuringer & Jensen, 2010). Those early adaptations of digital computing forever changed the face of behavioral research. Another member of Don's family also holds title to a significant first in behavior analysis. His life-mate, Patricia, who predeceased him, was the first female Associate editor of *JEAB* (1977-1979).

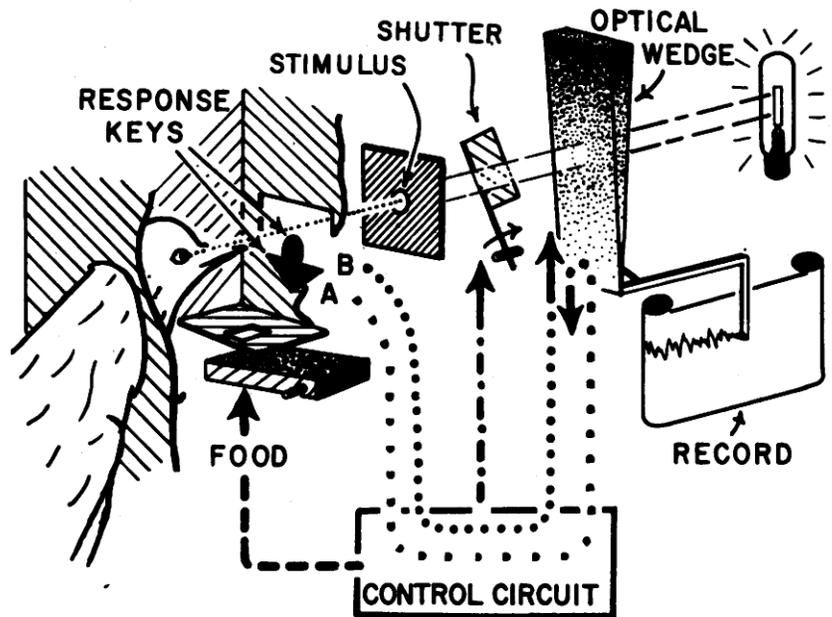


Figure 1. Apparatus for studying psychophysical thresholds with pigeons. For details see Blough (1958). (Copied from Blough, 1958)

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