their biological functioning depends specifically upon the existence of a great diversity of molecules. To speak of *a* DNA or *the* DNA's is proper, but to refer simply to "DNA" as though it designated a chemical substance is unfortunate and leads to mixed-up thinking on the part of those who may not be fully initiated.

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Stimulus Generalization Gradients

In a recent report [*Science* **132**, 1769 (1960)] Eliot Hearst compares the stimulus generalization gradients obtained in the case of each of a concurrent pair of responses, one response being maintained by an appetitive reward, the other by aversive reinforcement. From his results he concludes that aversive reinforcement produces greater generalization (flatter gradient) than an appetitive reward. This conclusion is not warranted from the data presented because there is not even an attempt to equate the drive level corresponding to the two responses.

Since the earliest Pavlovian work it has been known that increased hunger (deprivation) flattens the generalization gradient of an alimentary conditioned reflex. Hearst could have readily manipulated the flatness of his appetitive gradient in this fashion. In the case of the aversively maintained response, the relevant drive variables are the intensity of the electric shock, the number of shocks received, and the time since the delivery of the last shock. Of these, the first is particularly significant. By decreasing the shock intensity in conditioning the avoidance response, a sharper gradient would have been obtained.

The equating of drive between positively and aversively reinforced habits is certainly unattainable in practice, and probably even in principle. Thus, Hearst's conclusions would in any case be questionable. The report would have had some factual value, however, if the deprivation schedule of the food-reinforced response and the electric shock parameters had been clearly described in the text. The absence of this information means that the data are not even reproducible by the noninitiated reader.

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I am glad to have the opportunity to make some additional comments on our stimulus generalization data and to answer several points raised by Michael Halasz.

1) Since appetitive and aversive

drives have quite different properties, any attempt to equate them would be very dubious. In my opinion this "obstacle" does not render futile or questionable all comparisons of appetitive and aversive behavior. A more positive approach to the problem might initially involve the design of a model situation in which both generalization gradients can be obtained, and then an analysis of the effects of various factors on the relative slopes of the two gradients. In our laboratories my co-workers and I are currently investigating such variables as type of avoidance and reward schedule, kind of response measured, visual versus auditory cues, method of testing, and amount of food deprivation to determine whether the reported results can be generalized to a wider variety of experimental conditions.

2) Extremely flat gradients of the sort reported for avoidance have rarely, if ever, been noted in prior investigations of appetitive drives, even with extremely high hunger motivation [for example, with subjects at 60 percent of normal body weight (*1*)]. In support of our avoidance findings, Sidman (*2*) has recently presented data which also indicate a very flat gradient for the type of avoidance behavior we studied; Sidman's results were obtained for an auditory dimension, and the two subjects were trained under different levels of shock.

3) It is not likely that shock parameters are extremely influential variables here. The monkey subjects rarely received more than one or two shocks per 2-hour session, and such factors as shock level, number of shocks, and time since preceding shock probably are important only in a situation where a meaningful number of shocks are received. In any case, it was noted in the report that no rewards or shocks were possible during generalization testing. Thus these factors could not have had a direct effect during the generalization tests sessions.

4) Halasz's assertion that decreases in shock intensity would have resulted in sharper avoidance gradients is rather premature, since there are very few experimental data bearing on this problem. As a matter of fact, Sidman (*2*) has recently shown that threefold changes in shock duration, though affecting response rate, have no effect on generalization. Additional experimental work is needed on this interesting problem, however.

5) The specific parametric values of the reported experiment are typical of those used in many current comparative studies of appetitive and aversive behavior—for example, in several productive investigations of differential drug effects on reward-motivated and fear-motivated behavior. Limitations of space made it impossible for me to include several details of the experimental method in the published report. The monkeys were maintained during the experiment on a daily diet of 60 to 70 Foringer D & G whole diet pellets, and each monkey was given one orange immediately after the session; the subjects had thus been food-deprived for approximately 22 hours at the beginning of each experimental session. Water was continuously available in their home cages. The shock level was set at an intensity of approximately 5 ma (0.6-sec duration), and shocks were delivered through a Foringer shock power supply and grid scrambler, which randomly reversed the polarity of the voltage on the grids. According to the animal's particular posture and movements at the time of punishment, the shock might vary by as much as 0.5 to 1.0 ma from the predetermined value.

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