forcement (for example, money) in developing and maintaining human behavior is apparent. However, the rapid attenuation of the effectiveness of conditioned reinforcement when food delivery is delayed is a serious difficulty in most experimental studies (*4*). The method employed in the present study should make it possible to investigate many behavioral processes independently of the effects of food ingestion during a session. For example, the effect of varying the amount of conditioned reinforcement by delivering one or more poker chips per reinforcement could be investigated. Also, one could assess the effects of "inflating" this coin of the realm by requiring the subject to insert more than one poker chip to obtain one piece of food. The significance of such variables will have to be determined by further research.

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References and Notes

1. C. B. Ferster and B. F. Skinner, *Schedules of Reinforcement* (Appleton-Century-Crofts, New York, in press); B. F. Skinner, *Am. Psychol.* 8, 69 (1953).
2. This investigation was supported in part by research grant M-1005 from the Institute of Mental Health of the National Institutes of Health, U.S. Public Health Service, and in part by the National Science Foundation.
3. Two manuscripts presenting in detail the effects of delays in exchanging poker chips for food are in preparation.
4. For example, I. F. Saltzman, *J. Comp. and Physiol. Psychol.* 42, 161 (1949); J. F. Hall, *ibid.* 44, 246 (1951).

22 August 1956

Generality of Some Academic Reputations

College students often state their beliefs that some courses, fields of study, and professors, are "hard" or "easy." Descriptions of professors occasionally include references to their competence. There is little objective evidence that students on a single campus agree with one another to any statistically reliable extent regarding "hard" or "easy" courses, majors, or professors. When the Selective Service System authorized the nationwide administration of a scholastic aptitude test to help determine who should be deferred from the draft, 339,000 college students were tested in 1951. Chauncey (*1*) and Wolfle and Oxtoby (*2*) present data that compare test results from students in different areas of study. The present study (*3*) was conducted to (i) measure the extent to which college students at a western state university agreed in their recognition of "hard" and "easy" reputations supposedly acquired by different courses, majors, and professors, (ii) compare rankings of fields of study by reputation for difficulty with the Wolfle-Oxtoby rankings of students majoring in different fields, and (iii) compare the reputation rankings with grades given during one quarter by professors in the various departments at this same school.

The student population was stratified for class (freshman, sophomore, and so forth) and sex, and a random sample was drawn. Each subject was contacted by telephone, told how he had been selected to participate in a research study, told that the nature of the study could not be discussed with him until all respondents were assembled at one place and time, and asked to be at the Student Union Auditorium at a specific time.

Of 236 students contacted, 90 participated in the study. When the participating sample is compared with the total population with respect to the stratification variables utilized, the lowest probability (p) that the deviations of sample statistics from population parameters could occur by chance alone is approximately 0.3. This p value refers to the representativeness of the sample of graduate students participating in the study. The remaining p values range from 0.6 to 0.9. Therefore, the null hypothesis—that the deviations are not significant—is accepted.

The 90 subjects were simultaneously presented with a questionnaire that explained the nature of the study and stressed the subjects' anonymity. The questionnaire also cautioned against answering the questions on the basis of personal experience with various courses, professors, or majors and requested responses on the basis of the reputation that each participant thought the course, major, or professor had acquired (*4*).

The questionnaire did not structure the breakdown of majors, and the respondents tended to follow the breakdown employed by the university. To facilitate comparisons between these data and those of Wolfle and Oxtoby, I grouped the reputation data into the categories employed by Wolfle and Oxtoby. The same groupings were employed in comparing mean grade points per credit given in the autumn quarter of 1950–51 by professors in these various fields at the university where this study was conducted. Some fields—for example, nursing and engineering—were not represented on this campus. Therefore, the only field groupings compared were those that were common to the Wolfle-Oxtoby breakdown and the university where this study was conducted. Table 1 compares the different fields with respect to how students majoring in them on a nationwide basis performed on the Selective Service College Qualification Test (SSCQT), the reputation these fields have for difficulty on the campus studied, and their actual difficulty on the campus studied as measured by mean grade points per credit given 3 years earlier by the professors in the different departments. Kendall's tau coefficient, a rank-order test of relationships, seemed to be appropriate for correlating these three rankings. The correlation between the SSCQT rankings and the reputation for difficulty rankings is + .61, and the correlation between the local reputation for difficulty and the actual difficulty, locally, of these fields of study, is only + .39. In addition to the obvious possibility that the difference between the + .61 and + .39 correlations is a function of chance, there are several interesting explanations of this finding, and they are not mutually exclusive.

Common sense might dictate that local reputations for difficulty should correlate more highly with local grading. That both correlate more highly with the SSCQT results than with each other suggests that the reputation results obtained locally are to some degree representative of reputations (attitudes) attributed nationally. It also suggests that professors have a perception of themselves as representatives of their fields of specialty that is fairly congruent with the more widespread attitudes mentioned. Thus, it appears that the formation of these academic attitudes resembles the formation of other types of attitudes—for example, toward minority groups. That is, they derive from contact with the attitude more than from contact with the referent of the attitude. Wolfle and Oxtoby comment, "In conclusion, those fields which have reputations of requiring abstract and rigorous thinking (*e.g.*, physics, chemistry, law) attract

Table 1. Rankings of fields of study by SSCQT performance, reputation for difficulty, and strictness of grading on one campus.*

Fields of study	Rank of average AB (SSCQT) (2)	Rank of reputation by difficulty (local)	Rank by strictness of grading (local)
Physical sciences	1	2	1
Chemistry	2	1	2
English	3.5	4	3
Psychology	3.5	5	5
Fine arts	5	3	9
Business and commerce	6	9	4
Education	7	7	8
Home economics	8	6	6
Physical education	9	8	7

* Kendall's tau (SSCQT versus reputation), + .61; Kendall's tau (SSCQT versus grades), + .61; Kendall's tau (reputation versus grades), + .39.

students who are, on the average, superior to those who major in traditionally "easier" subjects (*e.g.*, business and commerce or education)" (*2*). The results presented here lend credence to the implication of Wolfle and Oxtoby that fields of study enjoy differential reputations that are generalized beyond the individual campus.

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References and Notes

1. H. Chauncey, *Science* 116, 73 (1952).
2. D. Wolfle and T. Oxtoby, *Science* 116, 311 (1952).
3. Sarah Gertrude Malone contributed significantly to this study. She administered the questionnaire, took responsibility for contacting the subjects, and coded some of the data in order that I would not learn the reputations of my colleagues.
4. Only one respondent claimed to be ignorant of the reputations in question. Fifty-seven percent admitted that they had been influenced by reputations in selecting their courses at least as often as one course per year. Approximately 7 percent of the teaching staff had reputations pertaining to difficulty and/or competence. These results do not indicate a relationship between competence and difficulty reputations.

2 August 1956

Blocking Effect of Ethyl Alcohol on Inhibitory Synapses in the Eye of Limulus

The lateral eyes of the horseshoe crab, *Limulus polyphemus,* appear to have a synaptic system in which only inhibitory effects are produced. Hartline (*1*) has found that the discharge of impulses from single receptor units in these eyes can be inhibited by shining light upon adjacent units. He and his coworkers have studied the inhibitory effect under a variety of experimental conditions and have found that the changes in frequency of the inhibited unit obey quantitatively simple relations to the areas, intensities, and positions of the spots of light that activate the inhibiting units (*2*).

Several years ago Ragnar Granit suggested to one of us (E.F.M.) that the inhibitory synapses might be blocked selectively by ethyl alcohol, since this substance appeared to block inhibition in the vertebrate eye: Bernhard and Skoglund (*3*) had found that both the "off" response and the PIII process, which is supposed to be associated with inhibition, were abolished by this alcohol.

The experiment was tried, and ethyl alcohol was indeed found to abolish the inhibitory effect reversibly (*4*). In fact, after the application of alcohol, the frequency of discharge was actually increased when the eye was illuminated in a manner that formerly caused inhibition. The increase in frequency was suspected to be due to the effects of scattered light rather than to a reversal of inhibition. These results were not published because neither a method of controlling scattered light nor facilities for making good oscillographic recordings was then available.

We have recently repeated the experiment a number of times and confirmed the earlier results under more suitable conditions (*5*). The excised eye was mounted vertically in a moist chamber, and the chitin and connective tissue were removed from the back to permit easy penetration of the bathing fluid into the nervous structures. The cornea was covered with a mixture of paraffin and lamp black to eliminate scattered light (the wax was pierced by small holes to permit light to fall on the desired areas) (*6*). The optic nerve was combed into bundles until one was found which showed unitary activity. Wick electrodes inserted into chlorided silver tubes were used for recording. Artificial sea water with or without alcohol was caused to flow down the back surface of the eye at a rate of about 1 cm^3/min throughout the experiment. Two sources of light of constant intensity and controllable duration were used to focus small spots of light on the excitatory and inhibitory regions. Electronic timers were used to time the illumination according to a fixed program repeated every 10 sec throughout each experiment. During each interval the excitatory illumination was turned on for 6 sec. The inhibitory illumination was turned on for about 1½ sec after a delay of 1½ sec from the start of the excitatory illumination.

Sets of three oscillographic records were taken at appropriate intervals. In the first record in each set, both the excitatory and the inhibitory illuminations were presented. In the second record, only the excitatory illumination was presented. The difference between the number of impulses discharged during the final second of inhibition and the number discharged in the same interval of the control record provided an index of the degree of inhibition. A third record in which the inhibitory illumination alone was presented served to indicate whether sufficient light was scattered into the excitatory area to cause the discharge of impulses. The results of experiments in which such an effect developed were discarded.

A typical experiment is shown in Fig. 1. The top record shows that a strong inhibitory effect was present after the preparation was equilibrated in artificial sea water. Four percent by volume of 95-percent ethyl alcohol was then added to the bathing fluid, and records were taken as the effect of the alcohol developed (second record) and after it had exerted its full effect (third record). It is evident that the inhibitory effect was almost completely abolished. Alcohol-free bathing solution was next applied, and records were taken during partial recovery (fourth record) and after complete recovery (fifth record). The inhibi-

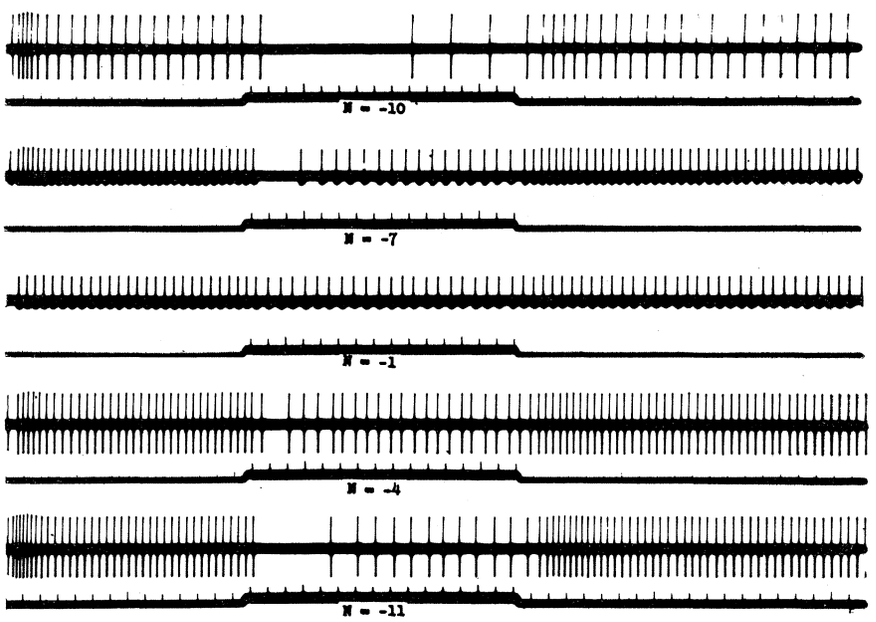

Fig. 1. Disinhibitory effect of 4-percent ethanol. Top record taken 1 min before application of alcohol; second and third records, 18 and 50 min after application. Fourth and fifth records taken 26 and 100 min after return to alcohol-free solution. N = inhibited frequency minus uninhibited frequency during last second of inhibitory illumination. Time marks in tenths of a second. Elevation of time trace indicates duration of inhibitory illumination. Time constant of amplifier, 0.01 sec. The decrease in spike height during application of alcohol is regularly observed and is presumed to be due to the effect of the alcohol vapor on the portion of the nerve bundle between the recording electrodes.