respect, although a portion of these fossils may be derived from either Wisconsinan flora or Tertiary sedimentary rocks (for example, the Ogallala group) of the Missouri River drainage basin. Presence of sponge spicules indicates sponge occupancy of streams not directly influenced by glacial melt waters during much of the period of loess deposition (*10*).

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Cognitive Factors in the Extinction of the Conditioned Eyelid Response in Humans

Abstract. *Rate of extinction of the conditioned eyelid response in humans is a function of the degree of discriminability of the procedural changes that occur with shift from acquisition to extinction. Extinction is greatly retarded when these changes are minimized or the subject is distracted by another task.*

Experimental extinction of the conditioned eyelid response in human subjects has typically been found to be extremely rapid. Thus, when extinction curves are plotted in terms of the number of previously nonreinforced trials, performance may reach its minimum (asymptotic) level in as few as six to eight trials, with many individuals ceasing to respond after the first nonreinforcement. Questioning of subjects from some of our studies has suggested that a possible factor underlying this rapid extinction might be the subject's recognition of the change in the experimental conditions with shift from acquisition to extinction. Even when not aware of the fact that their eyelids have been conditioned to respond to the conditioned stimulus (CS) most subjects appear to become aware of it when, with the onset of extinction, the unconditioned stimulus (UCS) is suddenly discontinued. Under such conditions the response decrement is probably, in part, a function of some higher order process, some kind of inhibitory set that is more or less immediately adopted by the subject upon recognition of the change. The present report is a preliminary account of a study which shows that the response decrement in extinction is much slower when the change in conditions from acquisition to extinction is reduced and, hence, is more difficult for the subject to recognize.

A number of techniques designed to reduce the difference in the conditions of acquisition and extinction have been employed in previous studies done in our laboratory. McAllister (*1*), after demonstrating that an extended CS–UCS interval of 2500 msec did not lead to conditioning, showed that a conditioned response established with a CS–UCS interval of 500 msec became extinguished when this interval was extended to 2500 msec. He found, furthermore, that extinction under this extended interval proceeded more slowly than when the UCS was discontinued. Subsequent studies (*2*), however, have shown that this relatively slower extinction under the extended CS-UCS interval holds only when the original conditioning is conducted under a partial reinforcement schedule. After 100-percent reinforcement, no difference is obtained in the rate of extinction under the extended CS-UCS interval and the condition of no UCS. Extinction is extremely rapid with both procedures.

In these earlier studies the conditioning procedure that was used involved a CS duration of 550 msec. With the shift to extinction with the extended CS-UCS interval, this duration was increased to 2550 msec. Finding that subjects readily reported noticing this change in the duration of the CS, we decided to try to reduce recognition of the change in conditions from conditioning to extinction by keeping the CS duration constant at 2550 msec for both acquisition and extinction.

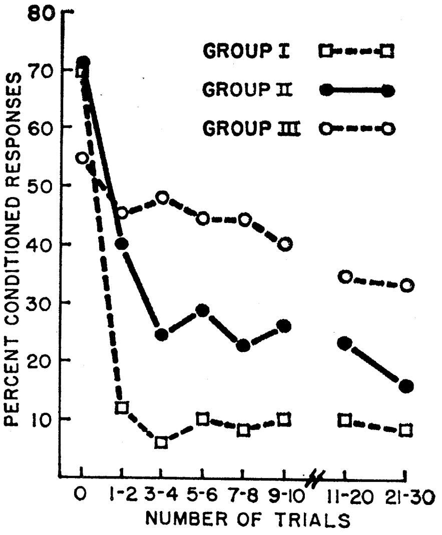

Fig. 1. Percentage of conditioned responses during extinction as a function of number of previous nonreinforced trials.

Three groups were run. In group 1 the UCS was omitted in extinction. In groups 2 and 3 the UCS was continued during extinction but at a CS-UCS interval of 2500 msec. In the case of group 3 a second learning task was introduced into the situation. It was believed that this procedure would decrease still further the likelihood that the subjects would observe the changes in the stimulus events related to extinction. Also, it was presumed that this technique would prevent the subject from recognizing that he was being conditioned.

The learning task used for this purpose was the light-guessing or probability-learning task designed by Estes and Straughan (*3*). The situation involved a centrally placed signal light which, when it came on, was a signal for the subject to anticipate within its duration (2 seconds) which of two small bulbs, one to the left and one to the right of the signal light, would subsequently light up. The subjects were given a set of instructions to the effect that the experiment was concerned with the effects of distraction on performance in a difficult problem-solving situation. They were instructed that their task was to predict which of the two small lamps was going to light up and to signify their prediction by pressing the push button located on the left or right arm of their chair. They were told further that distracting stimuli in the form of a tone and air puff to their eye would be given in between their response of pressing a button and the lighting up of one of the lamps. The onset of the tone coincided with the turning off of the signal light. The subjects were urged to predict to the best of their ability and to attempt to improve their prediction with practice. The small lamps lighted up according to a prearranged schedule. For half the subjects, the left lamp lit up seven times in each block of 10 trials, the right lamp three times. In the other half, these frequencies were reversed.

The acquisition phase involved 50 trials, the last of which was not reinforced. Thirty extinction trials were then given. The CS, a 500–cy/sec tone, had a duration of 2550 msec. The CS-UCS interval during conditioning was 500 msec and the UCS was a 1.0 lb/in.^{2} air puff, 50 msec in duration. Each group contained 25 subjects from an introductory psychology course.

Figure 1 presents the extinction curves for the three groups. Clearly evident are the markedly different rates with which the decrement in conditioned responses occurs during the extinction trials. Group 1, extinguished with no UCS, dropped precipitously to a random level of responding (10 percent) after two nonreinforced trials. The curve of group 2, which was extinguished with a 2500-msec CS-UCS interval, also dropped quite rapidly, but somewhat slower than that of group 1. In terms of the number of conditioned responses in the first ten extinction trials the difference between these two groups was significant at the .01 level. This finding differs, it will be noted, from that of earlier studies (*2*) which obtained no difference between groups extinguished with no UCS and with an extended CS-UCS interval after continuous reinforcement. The only difference in the experimental conditions is that in the present experiment the CS duration was 2550 msec during acquisition, whereas in the previous studies it was increased from 550 msec to 2550 msec in the case of the group extinguished with the extended CS-UCS interval.

In sharp contrast to the findings for groups 1 and 2, the extinction curve of group 3, which was conditioned and extinguished in the context of the probability-learning task, exhibited a very gradual decrease. Thus, by the ninth and tenth extinction trials, this group's performance level had decreased only 14.4 percent from its final acquisition level, whereas the corresponding decrements for groups 1 and 2 were 56 percent and 45.2 percent, respectively. The differences between the performance levels of group 3 and the other two groups during the first ten extinction trials were highly significant, at the .01 level in the case of group 2 and the .005 level for group 1.

After the experiment the subjects were questioned as to whether they noticed any change in the experimental procedure during the course of the experiment. If the subject replied "yes," further questions were asked to ascertain if the change in the CS-UCS interval or the cessation of the UCS in the case of group 1 was noted. The results of these questions indicated considerable differences among the groups. Twenty-one subjects of group 1, 19 of group 2, but only one of group 3, reported noticing the procedural change. Correlated with this absence of recognition on the part of group-3 subjects is the strikingly slower extinction. The slight difference between groups 1 and 2 in the number of subjects that recognized a difference in procedure with extinction indicates that some other factor than difference in proportion of subjects that observed the change must be appealed to in order to account for the difference in mean rate of extinction of these two groups. A possible interpretation is that the lesser change in the case of group 2 than group 1 required, on the average, more extinction trials before the difference in procedure was recognized.

It is apparent from these data that extinction of the conditioned eyelid response in humans is to a considerable degree a function of cognitive factors relating to observation on the part of the subject of procedural changes with the shift to extinction, a finding that suggests support for some version of the discrimination hypothesis. Attempts to infer the quantitative properties of an intervening theoretical variable, for example inhibition, that results from the operation of nonreinforcement, will need to take account of these potent cognitive factors (*4*).

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Testosterone-Induced Incubation Patches of Phalarope Birds

Abstract. *In order to determine the endocrine factors in the production of the incubation patch of phalarope birds* (Steganopus tricolor *and* Lobipes lobatus), *adults of both sexes have been maintained in captivity and injected with estradiol, testosterone, or prolactin, or with different combinations of these hormones. Only testosterone and prolactin in combination produced incubation patches in all birds, both male and female, in the two species.*

The incubation patch is a naked vascular area on the ventral surface of one or both sexes of many avian species. It is found during part of the breeding season. It transfers heat from bird to egg during incubation and is considered analogous in certain functional aspects to the primitive mammary gland (*1*). Furthermore, the hormones required for the development of the incubation patch are said to be "strikingly similar" to those required for the development of the mammary gland, except that the latter requires progesterone (*2*). This conclusion is based chiefly on the work of Bailey (*3*), who showed that estrogen and prolactin are essential for the development of the incubation patch in passerine birds. He suggested that in those species in which only males possess the incubation patch (tinamous, phalaropes, button quail, jacanas) androgen may have the same relation to the patch as estrogen does in the passeriform birds.

To test this hypothesis, we experimented with Wilson's phalarope, *Steganopus tricolor*, and the northern phalarope, *Lobipes lobatus*. In these species the female develops bright nuptial plumage and displays aggressive courtship behavior. Only the male, whose nuptial plumage is a drab counterpart of that of the female, has the incubation patch. Furthermore, only the male builds the nest, incubates the eggs, and broods the young (*4*).

Our observations of wild birds in-