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Experiential Factors Affect Red and Blue Preferences in Neonatal Chickens (Gallus Gallus)[1]

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Abstract. White leghorn chickens (Gallus Gallus) were isolated and reared in either white, half red and half blue, red, or blue cages, and at 60 hrs. and 120 hrs. were given a preference test for either a red or blue stationary object. Chicks housed in white cages were exposed to white throughout the experiment, and chicks housed in half red and half blue were exposed to red and blue in the same manner. Subjects housed in red cages for the first 60 hrs. were reversed to blue cages for the second 60 hrs. and subjects initially housed in blue cages were reversed to red cages. Subjects exposed to white, red and blue, or red, showed a preference for red at 60 hrs. while subjects initially exposed to blue showed a tendency to prefer blue. At 120 hrs. subjects exposed to white showed no preference, while the subjects exposed to red and blue continued to display a red preference. Subjects initially exposed to red and reversed to blue showed no preference, but subjects reversed from blue to red showed a red preference. This suggests that color preferences in chicks may be affected by an interaction between the initial attractiveness of a color and the amount of experience with that color at an early age.

This experiment attempts to demonstrate that relatively long term exposure of chicks to color may influence their preferences for colors at a later time. Grey (1961) tested the ability of different colors to elicit the approach-response in chicks at various ages by using a box with three compartments; a center compartment for the subjects, an empty compartment at one end, and the other compartment containing the colored stimulus rotating in a circle. Each day for five days the subjects were put into the center compartment and the amount of time spent near each end compartment was recorded. The results showed that red is more successful than blue in eliciting the approach-response, and that the eliciting ability of colors decreases as age increases. Hess (1959) found conflicting results. Using the following-response as a training method, he exposed chicks of various ages to different colors for a 30-minute period, and tested them for a color preference using stationary objects. Among other preferences, Hess reported that chicks preferred blue over red, and red over white. In a similar experiment, Smith and Meyer (1965) gave chicks a preference test at 12-14 hrs. for either a red or white rotating object without giving them previous experience with either color. The results of this experiment showed that chicks preferred the red stimulus object, thus suggesting that a basic preference for red exists in the absence of a training session. Taylor, Sluckin, and Hewitt (1969) made a further attempt to determine what factors influence color preference by

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using three experimental groups which received either exposure training, training by means of the following response, or conditioning. Subjects were given a preference test at 24 hrs., prior to any training, and the results showed that there was an initial preference for red. Then using relatively brief (2 hr.) training periods, each subject was trained by one of the above methods to either blue or red. It was found that all types of training produced a shift in preference towards red for the red trained chicks, but produced only a slight tendency to shift towards blue in the blue trained. Salzen and Meyer (1968) improved methodology over previous experiments by using relatively long (72 hr.) exposure periods, but by using blue and green stimulus objects they failed to deal with the basic red preferences reported by previous investigators (Grey, 1961, Smith & Meyer, 1965).

Despite the improvements in methodology, there is still very little evidence describing the nature of factors influencing color preference in chicks. Previous studies have either not dealt with the basic red preference, have used mainly short training periods, or have exposed subjects to only one color at a time. These omissions raise important considerations regarding the nature of color preferences, and it is with these variables that this paper is concerned. Specifically, we attempted to determine the effects of relatively long exposure periods using red and blue stimulus objects, and the effects of exposing chicks to more than one color at one time.

Method

Subjects. Subjects were White Leghorn chickens hatched by a commercial hatchery, transfered to the laboratory when less than six hrs. old, and randomly assigned to individual home cages. The home cages were 6 in. in diameter and 9 in. deep, and the walls were painted either white, half red and half blue, red or blue. Each cage was provided with food and water, and heated by a group of thermostatically controlled brooder lamps suspended over the chick's cages. Subjects were removed from their cages only for their solitary sessions in the testing apparatus, and received no human contact at any other time.

Apparatus. The preference testing apparatus consisted of a box 17 x 17 x 20 in. with a white interior. The testing objects were two spheres 4 in. in diameter, painted either red or blue in correspondence with the colors used in the home cages. The two spheres were suspended against one wall of the testing apparatus about 6 in. apart and 1 in. off the floor. A flourescent light over the box provided a uniform light over the entire testing apparatus.

Procedure. At 60 hrs. (early test) each chick was tested for a preference for either the red or blue stimulus object. The subject was placed in the testing apparatus facing the objects at a point

15 in. away and midway between them, and given a two-minute period to respond to either stimulus. A preference was recorded if the subject approached one of the stimulus objects and pecked at it, or if he stayed within 1 in. of the object for at least one full minute, and emitted a series of low intensity and high pitched contentment notes (Hess, 1959). The trial ended when the bird made a clear preference by pecking, or at the end of the two minutes. Each subject was given six consecutive trials at 1 min. intervals, reversing the position of the stimulus objects on alternate trials. At the end of the early test, the chicks were returned to individual home cages according to the following scheme: Those chicks initially housed in white cages were returned to white cages, subjects that were initially housed in half red and half blue were returned to cages of the same type, subjects that were housed in red cages were returned to blue cages, and the subjects that were housed in blue cages were returned to red. At 120 hrs. (late test) each chick was given a second preference test, preferences being determined in the same manner as described above.

Results

A difference score was computed for each chick by subtracting the number of responses emitted to blue over all six trials from the total number of responses to red. The subject was said to have preferred red if his resulting difference score was positive, blue if negative, and to have no preference if the resulting score was zero. Although some chicks responded to the objects during the early or late test only, and others did not respond at all, only those birds which responded during both tests were considered in the analysis of the data. With this restriction 7 of 15 subjects were excluded from the white control group, 8 of 18 from the red/blue group, 6 of 18 from the red group, and 2 of 17 from the blue group.

Table 1 indicates that on the early test subjects in the white control group showed a preference for the red stimulus object (Wilcoxon matched-pairs, signed rank statistic, $T=0$, $N=8$, $p < .05$), as did subjects in the red/blue group ($T=5$, $N=10$, $p < .05$), and subjects in the red group ($T=2$, $N=12$, $p < .05$). Subjects in the blue group showed a tendency to prefer the blue stimulus object, but only approached the traditional statistical criterion ($T=23$, $N=15$, $p < .07$). On the late test, after 60 more hrs. of exposure training, subjects in the white control group did not show a preference for either the red or blue stimulus objects, subjects in the red/blue group preferred the red stimulus ($T=0$, $N=10$, $p < .05$), subjects in the group initially exposed to red and reversed to blue showed no preference, and subjects initially exposed to blue and

TABLE 1

NUMBER OF RESPONSES TO RED, BLUE, AND DIFFERENCE SCORE (RESPONSES TO RED MINUS RESPONSES TO BLUE)

Group		Early Test	Late Test
Control Group	Red	15	9
(white early and late)	Blue	6	11
	d	9*	-2
Red/Blue Group	Red	27	41
(r/b early and late)	Blue	4	6
	d	23*	35*
Red Group	Red	34	27
(red early and blue late)	Blue	3	23
	d	31*	4
Blue Group	Red	14	50
(blue early and red late)	Blue	30	6
	d	-16[1]	44*

*p $<.05$, [1]p. $<.07$

TABLE 2

MEAN NUMBER OF RESPONSES OF EACH GROUP TO COMBINED RED AND BLUE STIMULUS OBJECTS ON EARLY AND LATE TEST.

Group	Early Test	Late Test	Total
Control Group (white early and late n=8)	2.62	2.50	5.12
Red/Blue Group (r/b early and late n=10)	3.10	4.70	7.80
Red Group (red early and blue late n=12)	2.93	3.73	6.66
Blue Group (blue early and red late n=15)	3.08	4.17	7.25
Total	11.73	15.10	

reversed to red showed a preference for the red stimulus object ($T=0$, $N=15$, $p<.05$).

Responsiveness of subjects was measured by combining the total number of responses of each chick to the red and blue stimulus objects over the six consecutive trials. Table 2 indicates that there was an overall increase in the responsiveness of chicks from the early test to the late test, and that subjects in the experimental groups appeared to respond more than the subjects in the control group. However, the results of an analysis of variance (unweighted means solution) showed that while the increase in responsiveness from the early test to the late test was significant ($F=15.04$, $df=$

1/41, $p < .05$), the difference in responsiveness between the experimental groups and the control group was not.

Discussion and Conclusions

In this investigation, there were four groups of subjects. One group acted as a control group and was concerned with determining whether there is a natural preference in chickens for either red or blue. The second group was concerned with the effect of initially exposing the subjects to both red and blue, and the third and fourth groups were concerned with the possibility of changing preference from one color to the other.

The data suggest that preferences of chicks for red and blue can be modified by relatively long periods of exposure to them. Chicks initially exposed to red preferred the red stimulus object, and after an equal exposure period to blue showed no preference. Subjects initially exposed to blue showed a tendency to prefer blue, but after exposure to red showed preference for red.

Data from the red/blue group and white control group provide evidence suggesting that red is an initially more attractive color than blue. When exposed to both red and blue at the same time, chicks displayed a red preference on both the early and late test. The white control group, however, showed a red preference only on the early test. This is inconsistent with the results reported by Hess (1959), but it is consistent with the more recent findings of Taylor, Sluckin, and Hewitt (1969). A natural preference for red might be explained by the transmission characteristics of colored oil droplets or globules located between the inner and outer cone segments of the bird's retina (Oppenheim, 1968). Hailman (1964) showed that a preference of gull chicks for red objects was related to the transmission characteristics of the oil droplets in the gull's retina; however, our data would seem to indicate that this basic color preference is modifiable by relatively long periods of exposure training.

Our data also show that chicks increase responsiveness to the stimulus objects as the amount of exposure time to color is increased. One possible explanation for this increase in responsiveness is that, as chicks become more familiar with a new stimulus through exposure to it, they tend to respond to the stimulus more often. In an experiment by Reimer (unpublished) this exposure effect is shown to hold true for chicks using different shapes. Chicks were exposed to four styrofoam shapes for varying amounts of time. When tested for a preference, the birds approached the shapes to which they had been exposed the longest—clearly showing an exposure effect. Cairns (1966) found that this exposure effect is true for mammals also.

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