to extinction conversely reduce or enhance rate of differentiation by appropriately varying the number of trials necessary before speeds to S- diverge from the speeds to S+. Sometimes it has been reported that a variable which affects extinction performance does not affect rate of differentiation, which results because the effect of the variable on speeds to S- is paralleled by its effect on speeds to S+ (for example, Spence, Goodrich, & Ross, 1959; Experiment 1). A similar effect was noted in the early trials of the present set of experiments in which long-duration confinement produced a generalized decrement in speeds on S+ as well as S-; by itself, however, this generalized effect should have resulted in equal rates of differentiation in the two groups rather than faster learning in the short detention group. But this may be the time to exercise the caveat expressed in the introduction to this section and to withhold judgment on the effect of detention time on rate of differentiation until it has been manipulated in the context of a single experiment.

The similarities between the two experiments are several; although the positive induction effect may be more pronounced under conditions of long detention time, the facilitory effects of the interposed S- trials are evidently most prominent in the initial sections of the runway with either procedure. Both experiments indicated that the induction procedure markedly reduced the number of avoidance responses that occur in extinction, and both agreed in placing the locus of these avoidance responses predominantly in the first sections of the alley, with about 50% of these responses occurring immediately on the presentation of the nonreinforced stimulus. It may be that the major effect of the induction procedure is to reduce the occurrence of avoidance responses on the former S+, and thus, because avoidance responses are otherwise most likely to occur on the initial presentation of that stimulus, the PI effect is most pronounced at the beginning of the runway.

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Peeping in chicks as a function of environmental change

CLARE FULLERTON, JULIA C. BERRYMAN, and W. SLUCKIN
University of Leicester, Leicester, England

Peeping was measured in 1-day-old and 4-day-old chicks in four different testing conditions. No differences were found between the two ages, but peeping increased markedly with the degree of environmental change. This latter variable may have been overlooked in past work because of the prevailing interest in changes of behavior as a function of disruption of social imprinting bonds.

Vocalizations of the domestic chick range from "pleasure calls" or twitters to "distress calls" or peeps, which in the most extreme form may be described as shrieks (Andrew, 1964). It is well known that peeps are readily evoked by a wide range of stimuli, occurring when birds are hungry, in pain, under restraint, or when approached by a large object (Collias, 1952). Peeping also occurs when a chick is separated from its mother or companions (Bermant, 1963; McBride et al, 1969); and it is a response to ambient temperatures below or above 88°-90°F (Kaufman & Hinde, 1961; Herbert & Sluckin, 1969). The question we wished to ask was to what extent certain disturbances of the physical environment other than those mentioned above could affect peeping.

PRELIMINARY EXPERIMENT

Apparatus

The only pieces of apparatus used were standard grey cardboard chick rearing boxes, 1 ft square. Constant heating and lighting were provided by 60-W light bulbs placed centrally, which gave a temperature of 85°F directly underneath and 75°F around the sides of the box. Food and water were always available.

Subjects

The Ss were 80 chicks hatched from Cobb eggs in the laboratory. Chicks were allowed to dry off in the incubator before being isolated in the rearing boxes, where they remained until testing.

Procedure

The chicks were placed at hatching in groups of four in the chick rearing boxes. Testing took place at either 1 or 4 days of age. Two tests were given to each age group, and the chicks were thus allocated at random to one of four possible groups. Peeps were recorded from a single chick in a 5-min test following the removal of the chick from its rearing box to another box of exactly the same design but containing

no other chicks. In the second experimental condition, peeps were recorded from a single chick in a 5-min test following the removal of its three penmates from the rearing box. In both cases the chicks were tested in isolation, but in one case the environment was familiar and in the other it was strange, although similarly designed. It should be noted that the chicks removed to another similar box were also handled by the E, whereas those left in the rearing box were not.

Results

All Ss were highly distressed in the test period (see Table 1), and the differences between the groups were not significant.

Discussion

It looks as though when there is a high level of "distress," as at social bond disruption, differences in the amount of handling and in the physical environment do not have enough impact to be reflected in a rise in peeping. Our main experiment, however, in which all the chicks were singly reared, was an attempt to find out whether, when there are no social bonds, relatively slight degrees of "stimulus contrast"—a term used by Andrew (1964)—can bring about differences in peeping.

MAIN EXPERIMENT

Apparatus

Chicks were reared and tested in three of our four experimental conditions in boxes made of grey cardboard measuring 1 x 1 x 1 ft. Heat and light were provided by a centrally placed 60-W bulb which gave a temperature of 85°F directly underneath and 75°F around the sides of the box. Food and water were always available.

An open field was used in the fourth experimental condition. This was built of white hardboard and measured 2 x 2 x 1 ft high. One wall was made of white gauze to allow the E to observe the chicks unnoticed by them. The open field was lit by a 60-W bulb placed above it and to one side. The temperature was maintained at approximately 76°F.

*We should like to thank Mr. P. Kerrigan for having helped with some of the testing.

Table 1
Peeping at Social Bond Disruption
(Mean Scores and Standard Deviations)

Ages	Treatment					
	Remain in Home Rearing Box			Remove to Similar Box		
	N	M	σ	N	M	σ
1 Day	20	294.6	235.8	20	265.8	254.4
4 Days	20	273.2	240.2	20	293.3	115.3

Total N = 80 chicks

Subjects

The Ss were 160 chicks hatched from Cobb eggs in the laboratory. Chicks were allowed to dry off in the incubator before being isolated in the rearing boxes, where they remained until testing.

Procedure

Chicks were tested at either 1 day or 4 days of age and were allotted to each age group at random. There were four experimental conditions, and 20 chicks from each age group were tested in each condition. The four experimental conditions were as follows: (1) Remain—The chick remained in its rearing box for this test, and peeps were counted (using a click counter) in a 3-min period following a single tap on the side of the chick box. (2) Lift Up—The chick remained in its rearing box for this test, peeps being counted in a 3-min period after the E had gently lifted the chick up in its box and replaced it. (3) Remove to New Box—Peeps were counted during a 3-min period after the E had gently lifted the chick from its rearing box and placed it in another box of exactly the same design. (4) Remove to Open Field—Peeps were counted during a 3-min period after the E had gently lifted the chick from its rearing box and placed it in the open field described earlier.

Results

The table of mean scores (Table 2) shows that the results obtained for the 1-day-old and the 4-day-old chicks were quite similar. The condition involving the least change in environment—tapping the home rearing box—produced by far the least number of peeps, and the number of peeps increased with increasing environmental change, removing the chicks to the open field having produced by far the greatest number of peeps.

A two-way analysis of variance shows that significantly different numbers of peeps were obtained in these different experimental treatments ($F = 6604.9$, $df = 3$, $p < .001$); that there was no significant difference in the number of peeps produced at the two ages ($F = .02$, $df = 1$, $p > .05$); but that the Ages by Treatments interaction was also significant ($F = 11.17$, $df = 3$, $p < .01$).

Table 2
Peeping With Increasing Degrees of Environmental Change
(Mean Scores and Standard Deviations)

Ages	Treatment							
	Remain + Tap		Lift Up		Remove to New Box		Remove to Open Field	
	M	σ	M	σ	M	σ	M	σ
1 Day	0.7	1.4	24.9	59.4	98.6	101.2	247.7	59.1
4 Days	1.65	5.7	43.9	6.9	88.9	77.0	244.4	103.2

N = 20 per group; total N = 160 chicks

Discussion

These results confirm in one respect what one would have predicted—that with singly reared chicks a greater degree of environmental change would be reflected by an increase in peeping. Peeping in the open field may have been boosted somewhat by the slightly lower prevailing temperature in this condition, despite our attempts to control it. Our finding is consistent with those of Andrew (1964), concerning the effects of "stimulus contrast," who considered peeping to be a function of perceived contrast between past and present stimulation. It is known (Bateson, 1964) that chicks can learn details of their isolation pen and discriminate between them and dissimilar objects, and that young chicks readily develop attachments to static features of the environment (Taylor & Taylor, 1964). Peeping, then, is associated with changes in the environment, including a disruption of bonds with familiar surroundings.

The most surprising factor to have emerged from both our experiments was that no differences were found between the amount of peeping of 1-day-old and 4-day-old chicks. If peeping is regarded as a measure of "distress" at separation, then one would expect this to be proportional to the strength of the attachment. One would have expected that the older chicks would have had more time to develop strong attachments, both to other chicks and to the static features of their home environment, and that, consequently, any change in this environment would be more distressing to them. Furthermore, Bronson (1968) maintains that this fear of the unfamiliar does not develop until some time after hatching and that this delayed appearance of the fear response is due, at least in part, to the need to "encode" the familiar before unfamiliarity produces aversive responses. One possible explanation is that suggested by evidence put forward by Brown (1964), who claims to have found a critical period in the area of the fifth posthatch day for the learning of motionless stimulus properties in chicks. If this were the case, perhaps our 4-day-old group could not be expected to be more distressed than the 1-day-old group at a

change in their environment.

A complicating factor is that of the duration of immobility during the test period. Up to 4 days of age immobility rarely occurs in response to unfamiliar situations (Salzen, 1963), and it is known that immobility is incompatible with peeping (Sluckin et al., 1970). Therefore, 4-day-old chicks in our experiments may have had on the whole slightly less time per test for peeping than 1-day-old chicks. This may have prevented the higher rates of distress peeping from being reflected in higher total scores of the older chicks. It would appear that further research is needed to show how peeping and other aversive responses, which follow a disruption of social and environmental attachments, are related to the age and rearing history of chicks.

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