The influence of maturation upon sensory reinforced behavior of chicks¹

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The sensory reinforced behavior of 160 chicks was investigated as a function of maturation development. The effect of the sensory reinforcer was inversely proportional to the age level. The results were further described in terms of an activation or arousal hypothesis.

One of the variables that apparently influences sensory reinforced behavior is that of the maturational development of the organism (Kish, 1966). From the findings based upon the rat and the monkey, Kish suggests "a curvilinear relationship exists between age and reactivity to sensory reinforcers, with responsiveness increasing with maturational status to some maximal value and falling off with further increments in age" (p. 140). The present study examined the function of maturation in sensory reinforced operant behavior using cockerel chicks as experimental animals and the disruption of a photoelectric beam as the operant.

Subjects

The Ss were 160 white leghorn cockerel chicks obtained from a local commercial hatchery on the day of hatching. They were housed in a brooder box placed in a 85°F room and were fed ad lib on food and water. Twenty-four h before testing, the S was placed in a 10 x 10 cm light-tight box.

Apparatus

The experimental chamber has been described previously (Eacker & Meyer, 1967). In general, the interior of the chamber was 35 x 25 x 25 cm and was painted flat gray. Five cm above the hardware cloth floor and centered between two opposing walls was an infrared photoelectric cell. This cell was on the outside of the chamber and the infrared beam passed through a 1.3 cm aperture. When the photocell beam was broken by the experimental S, a light source was activated for 3 sec with a light intensity of 4 ft c on the floor inside the chamber. A similar chamber was used for the yoked control, and both chambers were housed in a sound deadened box. The reinforcement contingencies were programmed by standard commercial units.

Procedure and Design

Random assignment of Ss was made to one of four age levels (1, 5, 10 or 20 days) and to experimental or yoked control condition, with 20 Ss in each condition. Light onset was contingent upon the response of the experimental S, and the yoked control S was exposed to the same stimulus consequences. Each pair of experimental and yoked control Ss was tested simultaneously for one 30 min session.

Results

The mean number of responses and reinforcements for the four maturational conditions and for their appropriate yoked controls are shown in Fig. 1. Pearsonian coefficients were obtained between the experimental and yoked control groups because of the possible correlation effect.² It can be seen in Table 1 that the four correlation coefficients all differed significantly from zero. These coefficients were then compared and were found to be homogeneous ($p > .05$). Therefore, the four groups could be considered as estimates of the same population parameter and were pooled and a common estimate obtained ($r = .59$, $df = 78$, $p < .01$). Analysis among the four experimental groups and their respective yoked controls revealed that a significantly greater number of responses were made by the experimental Ss than by the controls ($p < .01$), as shown in Table 1.

The analysis of variance yielded a significant difference in response rate as a function of age ($F = 11.37$, $df = 3/76$, $p < .001$). A breakdown of the variances was made by the Neuman-Keuls multiple comparisons test: the 1 day group differed significantly ($p < .001$) from the 10 and 20 day groups but not from the 5 day group ($p < .10$); the 5 day group differed significantly ($p < .01$) from the 10 and 20 day groups; and the 10 and 20 day groups did not differ significantly ($p > .05$). Thus, the highest rate of response occurred with the younger groups.

A significant difference was found in the mean number of reinforcements across the age levels ($F = 9.68$, $df = 3/76$, $p < .001$). The multiple comparisons for the

Fig. 1. The mean number of responses and reinforcements for various maturational levels.

Table 1
Summary of t Tests and of Correlation Coefficients.

Group Day	t (df = 19)	r (df = 18)
1	7.24**	.46*
5	5.71**	.86**
10	3.41**	.52*
20	3.08**	.58**

* $p < .05$

** $p < .01$

number of reinforcements were: the 1 day group differed significantly from the 10 and 20 day groups ($p < .001$) but not from the 5 day group ($p > .05$); the 5 day group differed significantly from the 10 and 20 day groups ($p < .025$); and there was no significant difference between the 10 and 20 day groups ($p > .05$). These findings were comparable to the data of the number of responses.

Discussion

These general findings conflict with those reviewed by Kish. This may be due to the fact that various species have been used as the experimental organism, different age levels investigated, diverse stimulus modalities examined as sensory reinforcers, and various operant responses performed. The chick differs in rather marked ways from the other organisms used in comparable studies in that it is highly visually oriented at the time of hatching, is very mobile shortly after hatching, and the breaking of a photoelectric beam is well within its behavioral repertoire.

It is suggestive that light onset as a sensory reinforcer will vary widely from species to species with

maturation as the treatment condition. If the visual system of the chick is mature or matures soon after hatching, the requirements for sensory input may decrease as a function of age (Fiske & Maddi, 1961).

The significant relationship between the experimental and yoked control Ss over the various maturational levels suggests that the light onset as a sensory stimulus acts as a reinforcer but also serves to activate or arouse the organism. Berlyne (1967) has suggested that a reinforcing stimulus may serve as a reinforcer as the result of the change in arousal of the organism elicited by the reinforcing stimulus. These data, in part, are supportive of his hypothesis.

References

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Notes

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2. Meyer, Merle E. The arousal and reinforcing properties of light onset as a function of duration and of visual complexity for chicks. Submitted for publication.