Effect of presence of an imprinted object on response of ducklings in an open field and when exposed to a fear stimulus¹

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This study was designed to determine whether ducklings would show evidence of attachment to a previously "imprinted" object when they were placed in an open field at 14 days of age. It was found that they did show attachment, spending considerably more time in the center of the field when the object was there than when it was absent. It was also found that when a fear object was placed in the field, half the ducklings stayed close to the imprinted object despite the fact that it meant being closer to the fear object than any duckling would tolerate in the absence of the imprinted object.

Much interest in the imprinting phenomenon stems from the fact that according to the original theoretical discussion of imprinting (Lorenz, 1937), it represents a situation in which an attachment formed during a brief critical period of development has a widespread influence on subsequent behavior. However, as Moltz (1963) has pointed out, experimental study of imprinting has been confined largely to the following-response in precocial birds during the first few days of life. Thus, we have little experimental evidence on the generality of imprinting effects across stimulus situations or on responses other than neonatal following. Recently, Klopfer (1965) has suggested that it may be possible that the imprinting experience itself has very much more limited effect than is commonly believed, with the preferences resulting from imprinting limited to specific situations. He was led to suggest this partially on the basis of his findings that under certain conditions chicks imprinted on plain models will subsequently prefer brightly-colored models to the plain ones.

The present experiment was designed to determine the extent to which the imprinting attachment shown by ducklings (in terms of close and persistent following of an inanimate object) during the first few days of life would still be manifested at 14 days of age, in a different situation, where the object was stationary rather than moving. Further, the experiment was designed so that it might be possible to assess the influence of the imprinted object on responses other than those directed toward that object, *per se*.

Method

The Ss were 10 Peking ducks (*Anas platyrhynchos*) hatched in a forced-air incubator in the laboratory at Wayne State. When not being tested, they were housed in individual cages with *ad lib* food and water. The cages provided visual isolation from one another, but

not auditory isolation.

The imprinting apparatus was a circular wooden alley, 1.6 m in diameter, .6 m high, with a .3 m track around its perimeter. Six 150-w incandescent lamps were mounted above the alley to provide light and warmth. The imprinted object was a green Styrafoam rectangle, 10 cm x 15 cm suspended from a metal arm which carried it around the alley. A motor drove the arm so that it moved at a constant speed of 23 cm/sec.

The "open field" was a 1.2 m x 1.2 m x .6 m high enclosure made of masonite with the floor marked into nine .4 m x .4 m squares, numbered consecutively from upper left to lower right. A number of common objects were placed in the open field: a coil of rope in area 1; a man's cap in 3; a soup can in 6; and shoebox in 7. Two 150-w incandescent bulbs were suspended over the enclosure.

The imprinting procedure was to remove each S from the incubator within 7-14 hr. after hatching, then expose him to the moving rectangle for 30 min. On the second day of life, another 30-min. imprinting trial was given, and on days 3, 4, and 5, there were imprinting periods of 15 min. per day. On these last three sessions, the following-response was scored by E's activating a timer whenever S was either walking behind the object within a distance of 30 cm or standing on any side of it within a distance of 15 cm. At 14 days of age, each S was placed in the open field for two 20-min. sessions with 10 min. in between. Initial placement was in the lower right-hand corner of the field, area 9.

During the last 5 min. of each open field session, the fear-stimulus, a "raggedy Ann" doll, 25 cm high, was suspended from a wooden pole in the upper right-hand corner (area 3) of the open field. (Preliminary testing indicated that the doll reliably elicited vigorous escape responses and loud peeping from two-week-old ducklings.)

Half the birds (group PA) had the "imprinted" green rectangle present in the center of the open field (area 5) on the first session and absent from the field of the second, whereas for the other half (group AP) the order of presence and absence was reversed. These groups had been matched in terms of mean following scores on days 3, 4, and 5 combined.

Responses in the open field were recorded on data sheets that allowed E to trace the course of Ss' movements throughout the entire session. Times of entrance to and exit from each area were also recorded

and occurrences of calling, pecking, defecation, etc. were noted.

Results and Discussion

All of the birds showed a high level of following during the initial imprinting series, ranging from a low of 2265 out of a possible 2700 sec. of following over three days to a high of a flat 2700. In the open field, nine of the 10 ducklings showed evidence of attachment to the now stationary rectangle. The ducklings' behavior in the open field when the rectangle was *absent* consisted primarily of a continuous rapid pacing and loud peeping, or of standing in one of the corners of the field. When the rectangle was present, however, they spent a considerable portion of time in area 5, the center of the field, sitting or standing close to the rectangle. There were essentially no responses that could be detected as directed toward any of the other objects. The attachment to the imprinted object is reflected in Table 1, which shows the mean number of seconds spent in area 5 and the mean number of lines crossed under each condition. An analysis of variance for correlated measure revealed that there was significantly more time spent in area 5 in the presence of the object than in its absence ($F=21.53$, $df=1/8$, $p<.001$), with no significant effect of the AP versus PA order, and no significant interaction. The pattern of scores of line-crossing frequencies was essentially bimodal and extremely variable between Ss, ranging from 4 to 132 lines crossed. Neither a 2 by 2 analysis of variance nor a number of non-parametric tests yielded evidence of a significant difference in line-crossing frequency, although there was significantly greater variability when the object was present than when it was absent ($F=4.03$, $df=2/9$, $p<.05$). Three birds in the PA group did show a dramatic increase in activity when the object was absent (including one that spent relatively little time, 140 sec., with the object when it was present), but one showed a similar difference in the other direction.

Table 1. Mean time in seconds (T) in area 5 and mean number of lines crossed (LC)

Object condition	Open field				Fear			
	1st order		2nd order		1st order		2nd order	
	T	LC	T	LC	T	LC	T	LC
Present	451	12.8	527	24.2	127	5.4	118	9.2
Absent	40	24.4	142	68.2	0	3.0	0	11.6

The response to the *fear stimulus* when the imprinted object was absent was perfectly consistent and clear cut. All ducklings moved rapidly away from the fear stimulus to one of the corners of the field. None even so much as entered area 5, or any other area adjacent to the locus of the fear stimulus in 3. With the object present, there appeared to be conflicting tendencies between maximizing distance from the fear stimulus on the one hand, and maintaining contact with the object on the other. Thus, every duckling entered area 5 when the fear stimulus was presented, but half the Ss then withdrew rapidly into one of the corners. The other half spent most of the 5-min. period next to the object in area 5, even though it meant being closer to the fear stimulus than any bird would tolerate even momentarily in the absence of the object. The existence of so many "0" scores precluded parametric analysis of the data, but a chi-square test of frequency of staying in area 5 yielded a significant difference between conditions ($p=.016$ by Fisher's exact p). There was no indication of an order effect or significant interaction. Thus, the ducklings' attachment to the object as it stood motionless in the open field was strong enough to overcome the tendency to avoid the fear object for a significant number of birds, and compelling enough to elicit at least initial approach from all the birds.

These results provide evidence for extension of the early following-response attachment in several ways. It was extended from the alley to the open field, from a moving object to a completely motionless one, from 5 day-old ducklings to 14 day-old ones, and from following to standing or sitting in proximity. Each of these extensions is admittedly a relatively modest one, but the attachment was strong enough to significantly counteract avoidance of a fear stimulus, and on the whole, the results provide some support for the general conception of imprinting as having a strong influence beyond the neonatal following response. Certainly, further exploration along various dimensions of change is needed in order to determine the nature and extent of the influence.

References

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Note

1. Supported in part by NSF Grant GB-1854 to the senior author.