Innate factors in imprinting¹

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Even though inanimate and unresponsive, a duck decoy produced much stronger imprinting of ducklings than a human being, indicating specific innate knowledge of the visual characteristics of the species as the parental object to be learned. While simultaneous imprinting of ducklings has been avoided by researchers because of possible imprinting to siblings, it was found to be just as effective as individual exposure in producing an attachment to the decoy. These findings indicate the importance of examining factors present in the natural situation in order to understand imprinting as an innately programmed process.

Recently the innate features of social imprinting have been thought to be limited to an inborn disposition to become very rapidly attached to any parental object. An innate recognition of the natural parent has been thought absent because filial behavior can be directed to other objects. Though the range of parental substitutes is very wide, there have been recurrent observations that certain types of characteristics, such as rhythmic sound, movement, and color, more readily elicit a display of filial behavior than do others.

Two imprinting experiments assessed the degree to which innate factors are present in the imprinting process, especially in relation to features of the natural imprinting situation.

EXPERIMENT I

Procedure

Thirteen wild mallard ducklings, individually hatched and without prior social experience, were individually imprinted for a ½-h session to a stimulus object at the age of 15-16 h. Six ducklings were exposed to a remotely controlled free-moving mallard decoy. The decoy was equipped with an internal loudspeaker emitting a recorded human rendition of "COME, come, come, come." Three different voices were used, permitting three separate S subgroups of two animals each. Seven other ducklings were individually imprinted to one of three different persons, two men of widely differing ages (S and G) and a woman (D), the same people whose voices were used for the decoy.

During the initial imprinting session which took place in a 10 x 20 ft room, the imprinting object, whether a person or a decoy, moved in a randomly intermittent fashion, and for a total of approximately one-fourth of the ½-h period. The operator of the decoy kept out of the immediate view of the duckling to avoid distracting it.

Then, over a period of three weeks, 10 additional ½-h imprinting exposure sessions were conducted, with ducklings maintained in individual isolation in lighted compartments with food and water freely available when not in an imprinting session.

At the age of three weeks the ducklings were individually tested for imprinting. The test, conducted in the same room as the imprinting sessions, consisted of having the duckling make a choice between the object to which it had been imprinted and a strange one. If a duckling had been imprinted on a person, the unfamiliar object was the remote-control decoy, emitting that person's voice. If a duckling had been imprinted on the decoy then the unfamiliar object was the same person whose voice had been emitted by the decoy. The duckling was placed between both objects, 5 ft away from each. The duckling's vocalization, the amount of time to go to within 1 ft of an object, and the object chosen, were recorded.

Results

All 13 ducklings followed their respective objects during the initial imprinting exposure at the age of 15-16 h. The test performances of the individual 13 animals, in terms of the object chosen, the latency to reach a point 1 ft away from that object, and "contentment tone" vocalizations, are shown in Table 1.

It is clear, from the data of Table 1, that while no duckling chose the object to which it had not been imprinted, the latency to reach the imprinted object was far greater when it was a human being than when it was a mallard decoy. In fact, in a good number of cases among the decoy-imprinted ducklings, the animal dashed to the decoy even before the stopwatch button had been completely pressed. Under such circumstances the minimum amount of time the stopwatch could record was 1 sec even though these ducklings obviously required less than that amount of time to traverse the distance to the decoy.

Discussion

While it might have been predicted that human beings should produce stronger imprinting in ducklings than the decoy since they are animate, move in an articulated fashion (Fabricius, 1951), and are more likely to provide appropriate feedback through the auditory modality (since the voice could change in intensity and frequency in coaxing the animal when it does not follow while the decoy emitted a programmed, fixed sound sequence), this obviously is not the case. Rather, the obtained differences in latency scores demonstrate that the visual characteristics of the decoy produce far more evident imprinting than do those of a completely unrelated species, human beings. Therefore, we must recognize a much stronger innate component in the imprinting process than has been accepted. There is, so to speak, a schema of the natural imprinting object which is innately possessed by young ducklings; the more a social object fits this schema the stronger the imprinting that occurs to this object.

It will be noted that in his original exposition on the topic of imprinting, Lorenz (1935) did not postulate that young ducklings have absolutely no innate schema of the parental object, as many subsequent researchers have thought, but one so sparse that the imprinting experience served to fill in the "gaps" since the young birds could imprint to objects that were not members of their own species. However, the present experiment shows that the "innate schema" is rather stronger than that postulated by Lorenz. There has been, we suggest, an evolutionary pressure for the young chick or duck to learn the

Table 1
Test Scores of Individually Imprinted Mallard Ducklings

Duck No.	Object Imprinted	Object Chosen	Latency to Reach 1 ft of Object	Contentment Tone Vocalization
1	S (♂)	S	5 sec	given
2	S	S	70 sec	given
3	S	S	120 sec	none
4	D (♀)	D	15 sec	given
5	D	D	75 sec	given
6	G (♂)	G	30 sec	none
7	G	G	5 sec	given
8	Decoy	Decoy	2 sec	given
9	Decoy	Decoy	1 sec	strong, immediate
10	Decoy	Decoy	2 sec	strong, immediate
11	Decoy	Decoy	1 sec	strong, immediate
12	Decoy	Decoy	1 sec	little given
13	Decoy	Decoy	1 sec	strong, immediate

Table 2
Test Scores of Two Sets of Group-Imprinted Mallard Ducklings

Duck No.	Object Imprinted	Object Chosen	Latency to Reach 1 ft of Object	Contentment Tone Vocalization
Group A				
1	Decoy	Decoy	2 sec	strong, immediate
2	Decoy	Decoy	1 sec	strong, immediate
3	Decoy	Decoy	2 sec	strong, immediate
4	Decoy	Decoy	1 sec	strong, immediate
5	Decoy	Decoy	1 sec	strong, immediate
Group B				
6	Decoy	Decoy	2 sec	strong, immediate
7	Decoy	Decoy	1 sec	strong, immediate
8	Decoy	Decoy	1 sec	strong, immediate
9	Decoy	Decoy	2 sec	strong, immediate
10	Decoy	Decoy	1 sec	strong, immediate

natural parent during the first day of life. This learning we call "genetically programmed."

EXPERIMENT 2

Procedure

Ten wild mallard ducklings, hatched and individually isolated as in Experiment 1, were imprinted to the remote-control decoy at the age of 15-16 h in the same room and with the same procedure. Five of these ducklings (Group A) were imprinted simultaneously upon the decoy and the other five (Group B) were imprinted in the same way. As in Experiment 1, the ducklings received 10 additional ½-h imprinting exposures over a period of three weeks.

At the end of the three weeks, the ducklings were individually tested for imprinting, just as in Experiment 1, with the person whose voice had been emitted by the decoy used as the unfamiliar object.

Results

All 10 ducklings followed the decoy during the initial imprinting experience. In the test situation, *all* ducklings went immediately to the decoy upon which they had been imprinted, with most ducklings taking only 1 sec or less to be within 1 ft of the decoy; many of them immediately dashed to

the decoy. In addition, *every* duckling emitted strong and immediate contentment tones to the decoy. There was absolutely no difference in the performance of the two groups of group-imprinted ducklings. These data are shown in Table 2.

Discussion

While in the natural situation ducklings are together in a group during the period that imprinting to the parent takes place, most laboratory experimentation on imprinting has exposed birds individually to the imprinting object, particularly since it is more difficult to observe a number of birds at once. Furthermore, this procedure has been observed as a precaution against the possibility of the young birds imprinting to each other rather than to the model.

While it is certainly true that young chicks and ducklings, as Polt & Hess (1964, 1966) and Hess (1964) have found, imprint to their siblings when a parent object is absent and then can fail to imprint to a parent object even when isolated from siblings, Experiment 2 in comparison with Experiment 1 shows that simultaneous exposure to siblings at the time imprinting to a parent object is taking place does not have any deleterious effect upon that imprinting. Fabricius (1951) noted that while the flocking tendency of naturally reared ducklings is very strong, when being with the parent object conflicts with being with siblings, the former will be chosen. He was, however, erroneously led by this observation to conclude that sibling imprinting does not take place. Once again, the importance of factors present in the natural situation becomes evident; they must be considered if we are to assess correctly the nature of the imprinting process.

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NOTE

This research was supported by Grant 776 of the National Institute of Mental Health and by the Wallace C. and Clara A. Abbott Memorial Fund of the University of Chicago.

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from approaching the arm. However, this would act against the prediction of the present experiment and so cannot be raised as an objection to the interpretation of the study.

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NOTES

1. This research was supported by Research Grant MH 14404-01 from the National Institute of Mental Health.
2. Lester, D. Effects of a repeated fear-arousing stimulus on the exploration of rats. Unpublished manuscript, Wellesley College, 1968.
3. Lester, D. Effects of a repeated fear-arousing stimulus on the exploration of rats: A second study. Unpublished study, Wellesley College, 1968.
4. The individual variation in performance is minimized here since no handling of the rats takes place between the different segments of the exploratory test.