The development of preferences for live models in white peking ducklings

L. JAMES SHAPIRO and RUSSELL L. AGNEW

Bowling Green State University, Bowling Green, Ohio 43404

Live stimulus objects were used to assess the developing preferences of white peking ducklings. The live models were all female and were a rouen duck, a white peking duck, and a blue andalusian chicken. Testing occurred at 8 a.m., 1 p.m., and 6 p.m. The rouen duck was preferred more than the other models, the time of day had no effect, and no position effect was observed. The technique of using live, biologically appropriate, stimulus objects has much potential for assessing attachment behavior in birds.

Very few imprinting experiments conducted inside a laboratory use live models as stimulus objects. If imprinting, in general, is viewed as an attachment process occurring between parent and young, then one might wonder if experiments using decoys or other inanimate objects are really studying attachment behavior. To do so is to assume that the burden of the attachment process rests solely with the young organism being used as the experimental subject and that the biological caretaker, i.e., the mother, contributes little or nothing to the Parent by Young interaction.

Within the imprinting laboratory distortions in behavior may exist because of the presence of biasing stimuli not found in the natural environment, because of the absence of appropriate stimuli usually encountered by the duckling in its natural habitat, or because of a combination of these two factors. In this pilot study, the authors wanted to bring at least part of the natural environment into the laboratory. Since ducklings are frequently used in imprinting experiments, it seemed logical to concentrate on the Mother by Duckling interaction. Live female ducks, therefore, were used as stimulus objects and white peking ducklings were used as subjects. Since a live stationary model is a very complex stimulus, the authors were dealing with a fairly uncontrolled situation. In order to evaluate the feasibility of this approach for future studies, the following questions were asked: (1) Will white peking ducklings manifest a preference for a particular model, given several choices? (2) If so, does the preference persist throughout the day? Does it last for several days? (3) How do the nonbrooding female ducks, used as live models, react to ducklings that may exhibit a preference for them?

This paper is sponsored by N. R. Remley, who takes full editorial responsibility for its contents. L. J. Shapiro is now at the Avian Behaviour Laboratory, Department of Psychology, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2. Requests for reprints should be sent to the senior author at this address. R. L. Agnew is now with the Metropolitan Development Council, Tacoma, Washington 98401.

METHOD

Subjects

Seven white peking ducklings, approximately 4 h of age, were obtained from the Wayne Hatchery, Wayne, Ohio. Prior to being picked up the subjects were housed communally in the dark in a large commercial hatchery. The effects of this communal experience on the subsequent performance of the subjects was not evaluated in this study. It was held constant for all subjects, however. Each subject was subsequently housed individually in a rearing compartment 12 x 6 x 5 in. containing an ad-lib supply of food and water and maintained at 90° F. The floor was made of ½-in. wire mesh. Since each compartment had its own lid, the subjects were essentially reared in the dark.

Models

The models were all nonbrooding adult females. One model was a white peking duck, another was a rouen duck, and the third model was a blue andalusian chicken. The white peking and the rouen ducks are both descendents of the mallard duck (*Anas platyrhynchos*). While the rouen retains the mallard plumage, the white peking is all white. The rouen is the same size as the white peking, however, so the rouen duck was used instead of a much smaller mallard. In this way, at least for the ducks, differential size was eliminated as a variable that might influence a duckling's preference.

The chicken was used as a control model. It was assumed that if all live models are of equal attraction to a duckling, then the characteristics constituting "live model" would be just as present in the chicken model. Consequently, the chicken model should be preferred just as much as the duck models. If species characteristics are important, however, in addition to "liveness", then it was assumed that the chicken would be preferred less than the duck models.

Apparatus

The laboratory in which this experiment took place has been described elsewhere (Shapiro, 1970). Briefly, the subjects were tested within a sound-deadened, heat-controlled experimental chamber that contained a one-way vision window. The chamber's temperature was maintained around 90° F early in the testing week and gradually lowered to around 80-85° F toward the end of the week. Within the chamber was an elevated 5 ft. 3 in. square sand-filled platform that was enclosed by 4-in. wooden sides to which 8-in. wire mesh was attached. In each corner of the table was buried a 15 x 14-in. platform to which two handles were attached 11½ in. apart. Removable jesses were secured to these handles. The table was subdivided into four equal quadrants by drawing slight indentations in the sand.

Table 1
Amount of Time (in Minutes) Each Subject Spent With Each Model During Three 1-Hour Observations

Subjects	Testing Time	Models		
		Chicken	White Peking	Rouen
1	8 a.m.	.00	.00	53.42
	1 p.m.	20.97	.00	.00
	6 p.m.	54.58	.00	.08
2	8 a.m.	2.75	22.20	.75
	1 p.m.	.00	.33	9.15
	6 p.m.	.00	29.00	3.17
3	8 a.m.	.00	18.42	.23
	1 p.m.	.33	33.73	.58
	6 p.m.	3.33	31.73	3.35
4	8 a.m.	1.63	.70	54.00
	1 p.m.	.00	.00	57.45
	6 p.m.	.00	.00	51.70
5	8 a.m.	.00	.00	58.77
	1 p.m.	.00	.36	59.33
	6 p.m.	.00	.00	59.75
6	8 a.m.	1.45	3.50	44.57
	1 p.m.	.00	.00	60.00
	6 p.m.	.58	46.50	.23
7	8 a.m.	5.88	23.35	16.17
	1 p.m.	.00	.00	54.72
	6 p.m.	.00	.95	48.95
Total		91.50	210.77	636.37

Procedure

The adult models were secured to the jesses so that they could not travel about the platform. Although the jesses confined the adult models to one area of the platform, they did not prevent the models from moving freely within that area. The weight of the models on their platforms prevented the latter from moving. One quadrant remained empty. A table of random numbers dictated the position of the adult models during any given session. The only restriction placed on the randomization process was that each model had to appear in a different position during each testing session on a given day.

A single subject was used at each age so that the experimenters could evaluate, over an extended period of time, the reactions of both the adult models and the subjects. The experimenters were as interested in the reactions of the nonbrooding females to the subjects as they were in the reactions of the subjects to the nonbrooding females. One hour was chosen as an arbitrary but relatively long observation period to observe such an interaction. Three observation periods were used to check the possibility that the adult models may react differently to the subjects as a function of the time of day. The subjects were observed at 8 a.m., 1 p.m., and at 6 p.m. A different subject was observed each day for 7 days.

The subject observed during the initial trial of the first day was approximately 13 h old. Each successive subject observed was 24 h older at the beginning of its initial testing session. Hence, at the beginning of the initial observation periods, individual subjects were approximately 13, 37, 61, 85, 109, 133, and 157 h of age.

The subjects were placed at the center of the large platform, in the dark, facing the empty quadrant. When the experimenter left the experimental chamber he placed himself in front of the one-way window, turned on the lights inside the experimental chamber, and observed the behavior of each duckling for 1 h. The amount of time each subject spent in each quadrant was recorded by means of a stop watch. Behavioral observations were

also recorded. At the end of each trial the lights were turned off and the subject was removed from the experimental chamber and returned to its rearing compartment.

After the first day of observation each subject was subsequently given a 5-min. preference test each day for 7 days. The same procedure was followed as before. The purpose of the 5-min preference test was to see if each subject maintained its initial preference for at least one week.

RESULTS

The amount of time each subject spent with each model during the three 1-h observation periods is presented in Table 1. The Friedman test (Conover, 1971; Siegel, 1956) applied to the data indicated a significant difference in the degree to which the subjects preferred the models ($df = 2$, $\chi^2_r = 6.0$, $p < .028$). Since the null hypothesis was rejected, additional comparisons between the models were conducted to detect where the differences existed (Conover, 1971). Each model was compared to every other model. (It should be pointed out that this procedure is distorting the true level of significance on all tests performed except the first one. It is used to isolate *potential* differential preferences among the models.) The rouen model was preferred significantly more than the white peking model ($p < .001$) and the chicken model ($p < .001$). The chicken was not preferred significantly less than the white peking model ($p > .05$). The latter result, however, would probably not hold true if Subject 1 was eliminated from the analysis. Whether Subject 1 represents a reliable age dependent phenomenon or just an idiosyncratic performance of this subject is not known. Further testing, using more subjects, would clarify this question.

The amount of time each subject spent in the empty quadrant can be estimated by subtracting the total time spent with all the models from 60 min. This is an estimate only because the experimenter did not begin recording any time until the subject moved from its initial position. In most cases this was rather quickly. Some subjects, however, did remain stationary longer than others. Time was also not recorded if a subject was standing astride of a line dividing quadrants with one foot in each quadrant. As can be seen from Table 1, however, the subjects spent very little time in the empty quadrant as they grew older.

It is not possible to determine with any degree of reliability if the models were *differentially* preferred as a function of age. Overall, the rouen model seems to be preferred more during the later testing periods than the other two models. The effects of age on the amount of time spent with a model was analyzed, however, using the Friedman test. Reliable differences existed ($df = 6$, $\chi^2_r = 13.28$, $p < .05$) among the ages tested. More time was spent with the models on Days 5, 4, and 6, in that order, than on Days 1, 2 or 3. Apparently, the models

were more attractive to the subjects on Days 4-7 than on Days 1-3.

The Friedman test was also used to assess the effect of the time of day on subjects' preferences. The time of day at which the subjects were observed had no effect when the results for all models were combined ($df = 2$, $\chi^2_r = 2.04$, $p > .05$). When the time of day variable was examined for each of the models separately it was found that it also had no effect on the subjects' preference (or lack of preference) for the rouen ($df = 2$, $\chi^2_r = 2.52$, $p > .05$), the white peking ($df = 2$, $\chi^2_r = .48$, $p > .05$), or the chicken ($df = 2$, $\chi^2_r = 1.44$, $p > .05$).

The total amount of time that each subject spent with each model during the 1 week post-test period of observation is given in Table 2. The Friedman test applied to these data indicated no statistically significant differences in the subjects' preferences for the models ($df = 2$, $\chi^2_r = 3.07$, $p > .05$).

DISCUSSION

The results of this experiment indicate that the white peking duckling prefers a female rouen duck more so than it does a female white peking duck, at least during the first 7 days of its existence. The strength of this preference does not seem to vary during the course of the day. During the 1-week post-test period, however, the subjects seemed to lose their preference for the rouen.

An examination of Tables 1 and 2 reveals a striking consistency in the preferences of the subjects for the models they initially chose. During the 1-week post-test period, all of the subjects except subjects 2 and 6 continued to prefer the model or the models they initially chose. An inspection of the individual protocols verified this observation. In some cases the model the subjects initially preferred was consistently approached and preferred in excess of 4 min (out of a possible 5) during the 1-week post-test period. It is obvious that the subjects' initial exposure to the three models had a lasting effect on them. It is equally obvious that the mechanisms involved are unknown and unpredictable.

No evidence for a position effect was found. Had there been such an effect present, the subjects should have chosen a particular quadrant consistently, regardless of the model that inhabited that quadrant. Both the data and the authors' behavioral observations indicated that this was not the case. If the subjects had consistently manifested a preference for one quadrant over the others, each model would have had, on a random basis, approximately the same amount of time accumulated about it. This situation was not the case, according to the statistical analysis, since it was shown that the rouen model was preferred significantly more than the white peking and the chicken models. This result was true in spite of the fact that on any given day no model was ever in the same quadrant twice. Our behavioral observations confirmed this result. Where the subject manifested a particular preference in the morning, later testing revealed that it usually remained agitated and emitted distress vocalizations until it found the model it had preferred earlier. This usually took only a short while.

The female adult models were surprisingly good subjects with which to work. After becoming habituated to the apparatus and to the procedure they remained fairly passive during the testing sessions. They never emitted any vocalizations nor did they struggle wildly trying to escape. They did not peck at the sand nor did they frequently flap their wings. Since they were not brooding females they did emit some threat displays toward the ducklings and occasionally they would peck at the subjects.

Table 2
Total Amount of Time (in Minutes) Each Subject Spent With Each Model During the 1-Week Posttest Period of Observation

Subjects	Models		
	Chicken	White Peking	Rouen
1	15.60	.72	11.76
2	.00	.33	10.28
3	.08	31.66	.03
4	.14	5.22	27.13
5	.00	.00	33.50
6	.25	8.02	1.25
7	.00	.32	31.64
Total	16.07	46.27	115.59

Interestingly enough, a subject could be pecked severely but it would not change its preference. In fact, it seemed that the subjects' preference was enhanced. Pecking may make a model more salient and hence more noticeable and preferred (Cairns, 1966).

Although the chicken model was not preferred significantly less than the white peking model, it was preferred significantly less than the rouen model, at least with the significance levels associated with the subsequent use of the Friedman test in this situation. In addition, Subject 1 may be inflating the magnitude of the subjects' preference for the chicken. In point of fact, the time spent with the chicken model was a great deal less than that spent with the duck models. This result would seem to indicate that the characteristics of "liveness" are not, by themselves, sufficient to attract a duckling to a live model. Additional cues are necessary.

The results of this study suggest several changes that would make future testing of this sort more efficient. One change that could be made would be to reduce the length of the observation period from one hour to 15 min. It was noticed that if a subject's preference was manifested by the end of 15 min, then the subject's choice remained the same until the end of the hour. This result held in 18 of 21 observation periods. A second change that could be made would be to observe the subjects at any time of the day or early evening. (To include the evening in the former statement may be inviting trouble due to confounding effects of day-night cycles.) This change would allow the experimenter to run more subjects during a period of time that was convenient for him. Third, since there was no apparent position effect, experimenters may leave the live models tethered to the same spot. The advantage of such a procedure lies in the fact that the live models will not be disturbed as frequently as would otherwise be the case. The result is a more natural appearing and natural acting live stimulus object.

Finally, one can only speculate at the reasons why white peking ducklings would prefer a rouen duck instead of an adult white peking duck. The most apparent difference between the two models is their plumage pattern. Much additional research is needed, however, before one can identify with any degree of certainty what specific parameters of the rouen duck are so attractive to the white peking duckling.

REFERENCES

- Cairns, R. B. Attachment behavior of mammals. *Psychological Review*, 1966, 73, 409-426.
- Conover, W. J. *Practical nonparametric statistics*. New York: John Wiley & Sons, 1971.
- Shapiro, L. J. Automation and experimental control in a laboratory for imprinting research. *Journal of Comparative and Physiological Psychology*, 1970, 73, 421-426.
- Siegel, S. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill, 1956.

(Received for publication November 7, 1974.)