STIMULUS DETERMINANTS OF SEXUAL BEHAVIOR IN THE MALE JAPANESE QUAIL (COTURNIX COTURNIX JAPONICA) AND THE INFLUENCE OF EARLY ISOLATION FROM FEMALES ON THE SEXUAL-OBJECT CHOICE OF THE ADULT MALE

> Thesis for the Degree of M. A. MICHIGAN STATE UNIVERSITY ROBERT E. OTIS 1968

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ABSTRACT

STIMULUS DETERMINANTS OF SEXUAL BEHAVIOR IN THE MALE JAPANESE QUAIL (<u>COTURNIX</u> <u>COTURNIX</u> <u>JAPONICA</u>) AND THE INFLUENCE OF EARLY ISOLATION FROM FEMALES ON THE SEXUAL-OBJECT CHOICE OF THE ADULT MALE

By

Robert E. Otis

The purpose of Experiment I was to expose those features of the female Japanese quail which are important for the elicitation of male sexual behavior. Experiment II sought to determine what effect isolation from females, prior to sexual maturation, would have on the stimuli which elicit sexual responses from the adult male. Several females and a male were taxidermically stuffed with various parts of their bodies either missing or modified. These stimuli were experimentally presented to two groups of males; one group (Experiment I) was normally reared with other females while the second group (Experiment II) was separated from females just prior to sexual maturation and raised in all-male groups.

Sexual responses were elicited from only a few quail in Experiment I and no preference for a particular model was shown. The results of Experiment II indicated that social experience with females, up to the time of sexual maturation, is sufficient to ensure female-elicited sexual behavior from adult males. The quail in this study responded sexually more often and to a wider range of stimuli than did the normally reared quail. There was also evidence of an enhanced general activity level. Stimulus specificity was also more apparent in these quail; a preference for a female model with missing tail feathers was shown.

Treatment effects in both studies may have become contaminated with the unknown effects of head height. The occurrence of homosexual behavior indicated that the quail were responding in an abnormal manner, perhaps due to the experimental design. It was suggested that the experimental design did not provide optimal conditions for expression of sexual behavior in either study. Further work is needed to assess other ways of investigating the stimulus control of this bird's sexual behavior.

Approved: Ralph J. Levi-Date: Nov 22, 1968

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Ву

Robert E. Otis

A THESIS

Submitted to Michigan State University in partial fulfillment of the requirements for the degree of

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To my parents Robert and Veda Otis and to my grandparents Ed and May Sills who have made this possible.

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INTRODUCTION

One of the more fascinating problems in the study of animal behavior concerns the nature of the stimuli which control reproductive behavior in birds. Insemination of the female by the male usually is the culminating phase of an orderly series of displays and actions by both partners. Interest has centered on the chain sequence nature of the behavior pattern (Schein and Hale, 1965), particularly as it relates to the elicitation and coordination of the male's courtship responses. Although researchers have shown that (internal) hormonal changes influence the male's responses (Beach, 1948), many are convinced that these endocrine changes are consequences of feedback from (external) stimulus-induced behavior and that this behavior depends for its appearance upon definite patterns of stimulation from the female mate (Hinde, 1965; Ratner and Denny, 1964).

The fact that many domesticated male birds will court and copulate with models of their mates has made it possible to study these sexual stimuli under controlled laboratory conditions. Both chicken and turkey males, for example, respond to crouching female models in a manner indistinguishable from their reactions to receptive females (Domm and Davis, 1948; Schein and Hale, 1965).

Fisher and Hale (1957) found that the posture of a female plays an important role in the type of response (i.e., sexual or aggressive) elicited from chicken males. These investigators changed the posture of the hen model from a squatting to a raised stance and observed aggressive rather than sexual responses in the cock.

Both chicken and turkey males show greater sexual activity to female models which have the head in a lowered rather than a raised position (Carbaugh, Schein, and Hale, 1962; Hale, 1960), suggesting that the effectiveness of a crouching posture may be determined by the position of the head.

Various parts of the body also play crucial roles as sexual stimuli. Carbaugh, Schein, and Hale (1962) found that hen models without bodies were the least effective sexual stimuli for cocks, indicating the importance of the body component. Later, Schein and Hale (1965) concluded that both the head and body together are necessary for sexual activity in cocks.

Turkey males, on the other hand, require only the female's head for complete sexual responding. Schein and Hale (1965) have described how a bodyless female turkey head, supported 12 to 15 inches above the floor, elicited courting displays, approach, and properly oriented mounting movements in male turkeys. But when headless bodies were presented alone, these same turkey males would court and approach the

model but rarely mount it. Hale (1960) found that this female head model was courted by young (4 weeks old) androgen-injected males when it was raised 5 inches off the floor and attacked when it was raised 12 inches off the floor. Scjoettle and Schein (1959) further found that the factors of texture, color, size, shape, and detailed features all contributed materially and equally toward making the female turkey head an effective sexual stimulus.

The "stillness" of the female may also be a determining factor for male sexual behavior (Lack, 1941). Tinbergen (1948) reported that "keeping quiet" was a stimulus which demonstrated the female's readiness to mate. Fisher and Hale (1957) noted that male chickens responded sexually to both standing and squatting models and suggested that both the posture and the stationary quality of the model were important factors.

Investigators have also been concerned with the problem of early social experience as it relates to the stimuli which elicit sexual behavior in adulthood. Lorenz (1935) theorized that juvenile experience with an object leads to a preference for that object in adulthood, but research evidence has been contradictory. Positive evidence for this hypothesis can be found in the studies of Heinroth (1910) and Lorenz (1935) with ducks, Räber (1963), Schein (1963), and Schein and Hale (1959) with turkeys, and Guiton (1961, 1962) with chickens, all of whom found that male nedifugous fowl,

raised in isolation from all but their human caretakers, showed courting responses to humans in preference to females of their species. Likewise, Warriner, Lemmon, and Ray (1963) reported that male pigeons mated with birds of the same color as the adults that reared them. On the other hand, some investigators have reported instances of domestic fowl failing to show a preference for objects towards which they had previously directed their early filial responses (Goodwin, 1948; Wood-Gush, 1958). Fabricus (1962) mentioned the fact that hens are often used as foster parents for a wide variety of species, but abnormalities in mating activities are rarely observed.

Schutz (1965) raised ducks for 1-3 weeks with their own species and then with another species for 5-6 weeks. He found that about one-third of his subjects showed a sexual preference for the other species when they were adults. Schutz also reared bantam cocks with others of their species until three weeks of age, then shifted them to a pen which contained only a mallard. In adulthood, these bantam cocks directed their sexual responding to mallards even though hens of their own species were also present. These results indicated that the time at which early social contact was given was an important factor (see also Kruijt, 1964).

It thus seems that mating responses in the male bird may be elicited by a relatively few visual features of the female and that social experiences during certain periods

early in the male's life may determine his responsiveness towards these stimuli. Research in this area, however, has not been without its limitations. Most studies have focused on only a few of the domesticated species, and when early experience has been the independent variable, researchers have only been concerned with the gross nature of the stimuli to which the adult bird responds. As a result, the data on species other than the chicken and turkey are fragmentary, the precise nature of early experiential effects upon the specific stimuli which elicit sexual behavior is unclear, and the degree of generality among domesticated birds remains undefined.

The present studies served to add some comparative data to this area of investigation through the use of Japanese quail (<u>Coturnix coturnix japonica</u>) as experimental subjects. Very little behavioral information is available for this species. Farris (1964) studied the development of the quail's sexual behavior and later (1967) showed that the male's courtship display could be classicially conditioned to a buzzer. Beach and Inman (1965) reported that "all sexual activity disappeared (in the male) within eight days after removal of the testes and returned to normal within eight days after the implantation of an androgen pellet" (p. 1428). No research, however, has been directed at defining the stimulus features of the female which control the male's mating responses. This problem was investigated in

Experiment I. The importance of the male's early social experience, as it relates to the stimulus control of his sexual behavior in adulthood, has, likewise, not been investigated. This problem was studied in Experiment II. Since the Japanese quail is being used more extensively in behavioral research (Padgett and Ivey, 1959; Reese and Reese, 1962; Fidura and Gray, 1966), it becomes imperative that we understand the conditions which control its characteristic (species-specific) behaviors (Scott, 1958).

EXPERIMENT I: MORPHOLOGICAL FEATURES OF THE FEMALE WHICH ELICIT SEXUAL RESPONSES IN THE MALE QUAIL

Experiment I sought to determine those features of the female Japanese quail's body which elicit sexual responses in the male. Preliminary investigation by this author showed that a male quail, when housed separately from other quail, would readily court and copulate with taxidermically stuffed female models. A number of female models were then taxidermically constructed, differing with respect to the presence or absence of various body parts. Experiment I was designed to observe sexual responses of males in the presence of these models.

Method

<u>Subjects</u>.--The <u>S</u>s were 14 male Japanese quail, designated the "Normals" in this study. These birds were hatched on May 10, 1967, under the care of the Poultry Science Department at Michigan State University. When twoand-a-half months old, these <u>S</u>s were transported to the Psychology Department and kept in commercial stock sheet metal pens with an approximately equal number of females. Room temperature was kept at 75° F, and the lights remained on continually.

During the experiment, two of these quail were slightly injured and their data were discarded. Both of these birds were tested in the same manner as the other <u>S</u>s so as to maintain standard experimental conditions, such as total test times, for the remaining <u>S</u>s.

Apparatus.--The apparatus used in this study consisted of a sheet metal brooder and a wooden superstructure. The superstructure was placed in front of the brooder and served two functions: (1) as a shield through which observations were made and (2) as a platform for the boom and pulley mechanism which controlled the exposure of the test models (see Appendix A).

The brooder was of commercial stock and measured 23 by 36 by 10 inches. Its floor was of one-half inch hardware cloth. A sheet of one-eighth inch masonite served as the roof of the brooder. Extending below the roof in the far right-hand corner of the brooder (i.e., with respect to the observer's position) was a white seven-and-a-half watt bulb (GE 115-125 volt).

The superstructure was essentially half of a wooden box, measuring $24\frac{1}{2}$ by $48\frac{1}{2}$ by 24 inches. Observations were made through a window, measuring 8 by 8 inches, in front of this superstructure. This window was covered with red cellophane paper to minimize, if not eliminate, visual stimuli that could be produced by <u>E</u>. A distance of two feet separated an exposed model from the observing window.

A shroud, raised and lowered through the roof of the brooder, served to cover or expose the test models on the floor of the brooder (see Appendix A). It measured 3 7/8 by 6 7/8 by 11 1/4 inches and was constructed of one-eighth inch masonite. One end of the shroud was open and the other was covered by a hinged top. The shroud was controlled by <u>E</u> from his observing position by way of a pulley system. A wooden boom (42 inches long) extended obliquely upwards from the superstructure to a point above the brooder. A cord was attached to the shroud and run through an eye bolt at the top of the boom down the front of the superstructure (i.e., to the observer's position). <u>E</u> was able to hoist and set the shroud at the height of the brooder by hooking the cord to the superstructure. This could be done without looking so that behavioral observation was not interrupted.

Behavioral measures were taken on an Esterline Angus event recorder. The recorder was placed in an adjacent room and controlled via microswitches attached to a wooden frame. The frame could be held in the observer's lap and controlled without interrupting observation (see Appendix A).

Temperature in the experimental room was thermostatically controlled and was kept as near as possible to 72° F. During the experiment, however, malfunction of this thermostat caused temperatures to fluctuate from 71° to 75° F on several days. To determine the effect of such fluctuation, temperature gradients were determined within the brooder

under hot and cool room conditions. When room temperature was 70° F, temperature fluctuated between 72° and 73° F within the brooder, being warmer near the bulb. Under 76° F room conditions, brooder temperatures ranged from 75° to 76° F. These measures were taken under simulated experimental conditions. Measures were again recorded 60 minutes later and brooder temperatures were found not to have changed.

Test stimuli.--The test stimuli included seven taxidermically stuffed quail (see Appendix B) and live quail of both sexes.

The models were six female and one male quail, between three and four months old when sacrificed and taxidermically stuffed. These models represented six combinations of three body components--the head, the anterior features of the body (the female's spotted chest, in particular), and the posterior half of the body (the tail). The seven models were characterized as follows:

females--head only
tailless body
full bird
headless body
headless body with a black rather
than a spotted chest
body without head or tail.

male--full bird.

The height of the head above the floor for the "head only," "tailless body," and "full bird" models was 4, 4, and 5 inches respectively.

In addition to the models, six live males and females served as stimuli. These birds were the same age as the $\underline{S}s$ and were raised under the same conditions as the Ss.

<u>Procedure</u>.--Testing was begun in early August when the quail were three months old. The l4 \underline{S} s were separated from the females and placed together in the test brooder for three days prior to testing. During this adaptation period all lights in the room remained off, the shroud was on the brooder floor, and food and water were always available. On day 4, all birds were transported to a nearby room and placed in retaining cages in pairs. Only food was available to the \underline{S} s in these retaining cages. The \underline{S} s were then brought back to the experimental room individually for testing. The order in which the \underline{S} s were tested was randomly determined.

Each bird received two trials per day. One trial was given in the morning, between 8:00 and 12:00 A.M. and the second was given at night, between 7:00 and 11:00 P.M., resulting in an intertrial interval of approximately 12 hours.

A test trial lasted 13 minutes and was begun by placing the <u>S</u> into the brooder through a side opening. An adaptation period of 10 minutes was allowed during which time the shroud rested on the brooder floor. A test stimulus was then exposed, and all behavior of interest was recorded. The shroud was then lowered to the brooder floor, covering the test stimulus, and the S was returned to its retaining

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cage in the nearby room. After all <u>S</u>s had been tested in this manner, they were placed, as a group, back into the testing brooder until the next test session. All lights remained off, and the shroud rested in its down position during the non-testing periods.

The testing procedure beyond day 4 was divided into three phases (I, II, and III) according to the stimuli tested.

Phase I--On day 4, following the three day adaptation period, the <u>S</u>s were habituated to the raising shroud. This procedure involved raising the shroud without exposing any of the models.

Phase II--From days 5 to 12 the eight stimulus conditions (the seven models plus a shroud conditioning control event identical to the habituation event given in Phase I) were randomly presented to the <u>S</u>s in a manner such that each bird was exposed to each stimulus twice during this eight day period. No two birds had the same stimulus presentation schedule.

Phase III--On day $13, \underline{S}s$ were randomly divided into two groups of even size. One group was exposed to live male quail in the same manner as they were to the other eight stimulus conditions, once in the morning and once at night. The second group was exposed to a live female quail, once during the morning session and once during the night session.

The original design of this study had a fourteenth day of testing. On this day the <u>S</u>s were exposed to live quail of the sex opposite to that given on day 13. Construction in a nearby room interfered with testing on this day, and consequently, these data were not reported. Classification of behavior. -- The components of the

male quail's sexual behavior were classified as follows:

1. Neck and body tonus--head is extended forward, slightly downward, cocked toward the female. The neck appears as slightly bow-shaped with a hump behind the head. Body is raised up on the legs and slightly tipped forward. Legs are stiff. Large primaries are fanned, almost touching the floor.

2. Strut--stiff legged walk while body is raised up on its toes, showing full body display as described in 1. Male usually strutted short distances in arcs around the female when in the brooder. Distance and frequency of the strut are probably influenced by the size of the enclosure and, of course, the behavior of the female. When the female runs away, the strut is abandoned in the chase.

3. Vocalization--typically occurs while strutting. A low, hoarse call described by Farris (1967) as a two-syllable squawk sound lasting several seconds.

4. Body Orient--the male cranes its head over the head and neck of the female while orienting its body to the axis of female's body.

5. Neck Grab, Mount--male grabs skin on back of female's head or neck in his beak and mounts by placing both feet on female's back. The male lowers his posterior, raises his tail and vent feathers, spreads his wings for balance while pulling backwards on the female's neck. Copulation follows.

For a carefully detailed description of the quail's sexual behavior, the reader should refer to Farris (1964). In the present study a somewhat modified version of Farris's classification system was used. Several components of his system, such as "feather puffing" during courtship, were extremely difficult to measure by visual observation alone, and no attempt was made to do so. The "body orient" was added as a behavior class because it appeared as a distinct

component and was capable of being measured. The classification system used was based upon easily identified body movements.

Other non-sexual responses were recorded as follows:

6. Approach--movement within l_{2}^{1} inches of the model. This response was determined by noting the position of the <u>S</u> in relation to the number of $\frac{1}{2}$ inch "squares" (in the hardware cloth) between it and the model.

7. Crowing

8. Wing Flap Display-head and body raised to full height, wings flapped several times, often while running.

9. Defecation

10. Aggressive Pecking--pecking at the test stimuli

11. Preening, eating, and drinking.

Results

The stuffed models elicited sexual responses from ten of the twelve quail $\underline{S}s$. Table 1 shows the number of quail giving each of the defined sexual responses to the various models and to the control event. The two sessions each \underline{S} had with each model have been combined. A \underline{S} responding to a model during one or both sessions was reported as responding once to that model. The sexual responses have been listed in their order of natural occurrence and the Approach response was included because it was obviously necessary for copulation to occur. Although the response classes were mutually exclusive, the reported response frequencies represent repeated measures on similar $\underline{S}s$.

Table 1. Se to du	xual and Aj tal number ration (in	pproach b of <u>S</u> s gi seconds)	ehavior of th ving componen of <u>all</u> sexua	e 10 Norma t sexual a 1 behavior	l sexual r nd Approac per respo	esponders, h response nding <u>S</u>	includi s and th	ng the e mean
			Exp	erimental	Stimuli			
Response	Control	Female Head	Headless Female Black Chest	Headless Tailless Female	Headless Female	Tailless Female	Full Female	Full Male
Neck and				, c	Ċ			,
Body Tonus Strutting	00	-0	0 0	ה ת	ηO	- 0	4 0	-0
Vocal	0	0	0	0	0	0	0	0
Approach	80	4	7	4	7	m	4	9
Body Orient	0	0	0	0	2	-1	0	0
Neck Grab	*	0	0	0	0	0	0	0
Mount	*	0	0	0	0	0	0	0
Total N giv- ing sexual behavior	0	г	2	ĸ	4	2	4	г
Mean dura- tion	0	2.0	5.0	5.0	5.0	7.0	1.8	1.0
+ one SD	0 +I	0.0+	<u>+</u> 5.7	+3.0		<u>+</u> 7.1	<u>+</u> 1.0	0.0+

*Response was impossible.

Individual quail often gave more than one component of the mating pattern to a particular model.

The total number of quail responding sexually to each model and control event, irregardless of the response types, and the mean duration (in seconds) of their sexual behavior is also reported in Table 1. Approach responses were not considered to be sexual responses in the computation of these two measures.

As can be seen, all seven models elicited sexual behavior from at least one <u>S</u>. Since there were no sexual responses observed during the shroud Control event nor during the Day 4 habituation phase, we can be sure that the models alone were eliciting these behaviors. Complete sexual patterns, i.e., courting followed by mounting and copulation, were never elicited. Two models (Headless Female, Tailless Female) elicited Body Orienting movements but none of the <u>S</u>s actually made body contact with these two models.

The Cochran Q test (Siegel, 1956) was used to determine whether the seven models differed in terms of the total number of <u>S</u>s giving sexual responses to them. The resulting Q score of 5.51 (p < .50) indicated that differences were not statistically significant.

It was of interest that two <u>S</u>s gave Body Orienting movements to the Headless Female and Tailless Female models without first giving any Neck and Body Tonus or Strutting behavior. Ss frequently abbreviated their responding at the

Neck and Body Tonus stage. This latter behavior occurred during 12 test sessions and at least once with each of the seven models.

It should be remembered that each \underline{S} was exposed to each experimental stimulus twice, a total time of six minutes. However, the longest mean duration of sexual behavior given to any model was only seven seconds. This particular model was the Tailless Female, the model with the four inch head height.

Only three of the ten sexual responders gave any sexual responses to the live stimuli on day 13. Table 2 shows how these three <u>S</u>s responded. Six <u>S</u>s were tested with the Live Male stimulus and four others were tested with the Live Female. This discrepancy in N tested was due to the fact that two <u>S</u>s, originally assigned to the Live Female group prior to testing, did not give any sexual responses to the models. Only the behavior of the model reactors was reported. One of these two non-reactors did show brief (approximately one second) Neck and Body Tonus to the Live Female.

Table 2 reveals that two <u>S</u>s responded to the male stimulus and only one to the female stimulus. This frequency difference was not statistically significant (p < .05, Fisher Exact Probability test; Siegel, 1956). The Live Male elicited much different durations of sexual behavior from two <u>S</u>s.

Table 2. The number of Normal sexual responders giving component sexual and Approach responses to the Live Male and Live Female stimuli and the mean duration (in seconds) of all sexual behavior per responding <u>S</u>

Response	Live Male (N=6)	Live Female (N=4)
Neck and Body Tonus Strutting Vocal Approach Body Orient Neck Grab Mount	2 1 3 1 1 1	0 0 2 1 1 1
Total N giving sexual behavior Mean duration <u>+</u> one SD	2 107.5 <u>+</u> 147.7	1 65.0 <u>+</u> 0

One \underline{S} responded for three seconds, the other for 212 seconds. This explains the large standard deviation reported for this stimulus.

<u>Approach behavior</u>.--Approach responses were recorded χ regardless of whether they were a part of a longer sequence of sexual activity or not. The fact that some quail Approached a model without giving any of the defined sexual responses to it is clear from Table 1. The occurrence of Approach behavior was found to correlate -.23 (p>.05) with the occurrence of defined sexual responses (see Table 4). This was determined by first ranking the experimental stimuli according to the frequency of quail Approaching them and according to the frequency of quail giving sexual responses to them, and then computing the Spearman rank correlation coefficient (Siegel, 1956) between these two rank orders. Since Approach was assumed to be a component of the mating pattern, this very low correlation was unexpected.

The Cochran Q test was used to determine if the ten model reactors showed any preference towards certain models in terms of their Approach behavior. The resulting Q score of 12.7 (p<.10) was large but a .05 level of significance was not reached. Inspection of these data in Table 1 points out the fact that twice as many quail Approached the Control stimulus event as Approached the Full Female model. It was also found that the same eight quail that Approached the Control event also Approached during the day 4 habituation phase. It should be remembered that the shroud Control event was the same stimulus condition given during the day 4 habituation phase.

Other behavior observed in Experiment I.--Table 3 reports the number of <u>S</u>s giving crowing, wing flap, defecating, aggressive pecking, preening, eating, and drinking responses in the presence of the various experimental stimuli. Included in Table 3 is the behavior of the six <u>S</u>s which were given the Live Male and the four <u>S</u>s which were given the Live Female on the final day of the study. Only the behavior of the 10 sexual responders is reported.

including the total num-	4 and to the experimental	
r given by the ten Normal sexual responders,	ponding during the habituation phase on day	
Table 3. Other behavio	ber of <u>S</u> s res	stimuli

				EX]	perimenta]	L Stimu.	Li				
Response	Day 4	Control	Female Head	Headless Female, Black Chest	Headless Tailless Female	Head- less Female	Tail- less Female	Full Female	Full Male	(N=6) Live Male	(N=4) Live Female
Crowing Wing Flap	н	г	н	7	0	0	7	7	7	0	0
Defecation	-1 4	2 5	ы С	10	01	0 0	Г 5	0 m	чм	ч о	
Aggressive Pecking Preening Eating	000	* 4 0	044	044	000	040	- ო ო	040	ဝကက	0 N M	0 0 0
Drinking	4	2	9	7	ŝ	2	ъ	œ	4	7	7

*Response was impossible.

The Cochran Q test was again used to determine whether the experimental stimuli could be differentiated by the number of <u>S</u>s giving each of these behaviors to them. The data from the live stimuli and from day 4 were not included in these Q tests because these stimuli were presented separate from the models. Thus, procedural differences would have confounded any effects had this data been included. The Q scores and probability levels, all of which were not significant at a .05 level of significance for each response tested, were as follows: crowing, Q =10.36, p <.20; Wing Flap Display, Q = 5.79, p < .70; defecation, Q = 9.31, p < .30; aggressive pecking, Q = 6.00, p < .70; preening, Q = 3.93, p < .80; eating, Q = 7.50, p < .50; drinking, Q = 7.60, p < .50.

As can be seen in Table 3, crowing was elicited in the presence of all but two of the models but not at all in the presence of the live stimuli. Three <u>S</u>s, however, accounted for all of this crowing behavior. Wetherbee (1961) stated that this vocal response is usually associated with the absence of a female quail and is heard from mid-March to August. He further noted that a captive coturnix will only crow in a darkened room. Observations showed that the quail in the present study crowed in both lighted and darkened rooms and even while being handled in a lighted room.

The patterning effect of crowing responses was very interesting and should be further investigated. Crows

initially heard in a three minute test session were typically single responses. Later in a session the crows were typically heard as a burst of two responses and still later three or four crows would often be heard in close temporal association. It was felt that longer test sessions might have allowed even longer bursts of crowing responses.

Although the crowing response has been associated with the quails' sexual behavior (Wetherbee, 1961), the significance of the Wing Flap Display is not known. But this latter response, like the defecating and aggressive pecking responses, was infrequently elicited in this study.

The Wing Flap Display was a dramatic response, often carrying the bird completely across the brooder before the response was completed. This response was observed in both standing and running birds. On one occasion a male seemingly attacked the model by running up to it and displaying the violent movements of the wings.

Preening, eating, and drinking responses were clearly the most frequently elicited of the seven responses reported in Table 3. The models which frequently elicited these three responses also elicited sexual behavior more frequently. This association was determined by first combining the frequency of <u>S</u>s giving preening, eating, and drinking responses to each model and ranking the models according to this index frequency. This rank order correlated .81 (p<.05, Spearman

rank correlation) with a rank ordering of these models according to frequency of sexual responders (see Table 4).

Qualitatively, the reaction of a quail to a stimulus situation was generally consistent from session to session. Several <u>S</u>s could be reliably identified by their characteristic responses. For instance, one <u>S</u> would run over beneath the light bulb in one corner of the brooder whenever a stimulus was uncovered. In this location <u>S</u> would perform the characteristic "orienting" movements of the head and neck. This behavior pattern appeared early (by the third day of testing) in the study and could be reliably elicited by raising the shroud. Other birds could be easily identified by the frequency of crowing or by the manner in which they ate, drank, or preened.

Relationship between General Activity, Approach, and sexual behavior.--The Spearman rank correlations between these three behaviors have been summarized in Table 4.

Table 4. Spearman rank correlation coefficients between sexual behavior, Approach, and General Activity

	Approach	General Activity
Sex Behavior	23	.81**
Approach		.64*

*p<.05. **p<.01.

As can be seen, there was a tendency for those models eliciting greater amounts of preening, eating, and drinking behavior to also elicit more sexual and Approach behavior. There was, as reported earlier in the Results, essentially no relationship between the elicited amounts of sexual and Approach behavior.

Other behavior observed outside of experimental situation .-- Of particular interest in this study was the appearance of homosexual activity among the quail during inter-test periods. It was not unusual for a \underline{S} to give little or no sexual behavior during a test session with a model and then show immediate and fervent copulatory activity with other males when placed back into its retaining cage. When Ss were placed together in the brooder, following the completion of the morning and evening sessions, the homosexual activity elicited was of such high magnitude that injury to the quail was a primary concern. The flexible masonite roof on the brooder probably reduced the number of injuries incurred from popping (i.e., upward leaps). When the lights in the room were turned off, there was an immediate reduction, and often complete cessation, of this homosexual activity. Turning the lights back on resulted in an immediate resumption of this copulatory behavior. This behavior was not noticed during the first two or three days of the study, suggesting that adaptation to the test conditions may have been a critical factor.

For several Ss the test brooder was an average situation which elicited active attempts to escape. This behavior consisted of "popping," rapid pacing back and forth along one wall, and attempted escape through the water and feed troughs. There was a noticeable increase in such behavior upon stimulus presentation and over the test sessions. Observations showed that <u>S</u>s which consistently gave such avoidance behavior were those which were consistently copulated with by other males during inter-test periods. No objective measures of avoidance were used in this study, unfortunately. One of the two Ss which were discarded would have been classified under the category of active "avoider." This S apparently injured its neck during a session by "popping" into the roof of the brooder upon stimulus presentation. The other discarded S showed continued abnormal behavior during the entire study, resting its head on the floor of the brooder during most of the test sessions.

<u>Discussion</u>

The male quail in this study did not show a clear preference for any of the models nor for either of the live stimuli. The number of <u>S</u>s responding sexually to each model was very low, never exceeding 40% of the total N tested for any one model. The fact that the female head, presented alone without the rest of the body, elicited sexual responses from only one S does not parallel the research with turkeys

(Schein and Hale, 1965). The fact that the Full Female and the Headless Female models elicited sexual behavior more often than did the other models, and since these two models were the most "complete" in terms of body surface suggests that completeness of the female body may be an important factor. However, these differences were low and not statistically significant.

It would be premature to conclude that stuffed females are not adequate sexual stimuli for male quail, especially since the live quail presented on the final day of testing elicited sexual responses from only three Ss. During preliminary investigation (i.e., prior to the present study) the Full Female model was used reliably to elicit courting, mounting, and copulation from males. This same female model did not elicit any copulation when it was used as a stimulus in the present study. The reason for these contrasting effects is most likely to be found in the differing experimental procedures. During pilot work the male Ss were maintained alone in the test brooder for several days at a time and the model was presented once a day, usually in the afternoon. The Ss in the present study were kept with other males when not being tested so that opportunity for sexual behavior (homosexual) was not prevented. Furthermore, these Ss were not maintained in the brooder for continuously long periods of time. Perhaps isolation from all other quail and familiarity with the environment lowers the

threshold for sexual behavior by reducing the probability of avoidance or other competing responses. This question must be answered experimentally.

Both the Headless Female and the Tailless Female models elicited Body Orienting responses in male quail. The fact that body contact was never made with these models indicates that the stimuli eliciting Neck Grab and Mounting responses were missing. During normal mating patterns the female either runs away or crouches when the male orients his body above hers. Since these movement stimuli were absent in the passive model, the probability of Neck Grab and Mounting may have been reduced. This argument does not, however, explain why a passive model was able to elicit the full copulatory pattern during the pilot investigations. Furthermore, the repeated testing of <u>S</u>s should have removed any surprise or novelty element; nevertheless, the full pattern was not displayed to the models.

The fact that none of the <u>S</u>s showed any preference for the stuffed male model was surprising since fervent homosexual activities were observed during inter-test periods. This observation further suggests that sexual behavior in male quail may be under the control of moving stimuli of a visual nature. The importance of visual stimuli was indicated by the fact that darkness completely eliminated homosexual behavior in the interval between test sessions.

The live birds presented as stimuli on day 13 remained unexpectedly quiescent during the three minute exposure period. Unless sexual behavior was elicited from the \underline{S} , it was not unusual to be able to lower the shroud back down over the live stimulus at the end of the three minute test period. This quiescence was most likely due to an apparent "blinding" effect of the 25 watt lamp on the outside of the brooder; this due to the fact that the bird was kept within the darkened shroud during the entire ten minute adaptation period prior to exposure.

Preening, eating, and drinking were the most frequently observed nonsexual behaviors. Since the retaining cages held only food containers, those <u>S</u>s tested near the end of a test sessions were deprived of water for approximately three and one-half hours. These <u>S</u>s were expected to show considerably more drinking behavior during the ten minute adaptation period prior to a stimulus's exposure. Observations showed that <u>all S</u>s, upon placement in the test brooder prior to testing, would either eat or drink within one minute's time. In general, after ten minutes time, eating, drinking, and preening responses were reduced to a minimum in all <u>S</u>s, irregardless of whether they were tested early or late in the morning (or evening) session.

The results of the present study were difficult to assess because of the small amount of sexual behavior

actually given in the presence of the models. The experimental design has been suggested as the possible reason for this low response level. Another interpretation of these data is that normally reared quail do not respond sexually to biologically inappropriate objects because of their past sexual experiences with appropriate females. If this early experience were a factor in the present study, then it would be of interest to test a population of quail which did not have past heterosexual experiences. This problem was investigated further in Experiment II.

EXPERIMENT II: MORPHOLOGICAL FEATURES OF THE FEMALE WHICH ELICIT SEXUAL RESPONSES FROM THREE MONTH

OLD, SEXUALLY NAIVE, MALE QUAIL

In Experiment II, male quail, which were originally reared with females, were separated from them on day 28. Since the male quail does not reach sexual maturity until day 28 (Farris, 1964), these <u>S</u>s were sexually naive in the sense they had never copulated with a female. The object of the present study was to determine the effect of such isolation on the stimulus features of the female which elicit sexual behavior from the male. Also of interest was the general question of whether early social contact with females, up until the time of sexual maturation, is sufficient to ensure female-elicited sexual behavior from males when tests are given at three months of age.

Method

<u>Subjects</u>.--The <u>S</u>s were 14 male Japanese quail of the same stock used in Experiment I. These birds were hatched on March 17, 1967, under the care of the Zoology Department at Michigan State University and were reared communally with approximately 100 other quail of both sexes. When 14 days

old, these chicks were transported to the Psychology Department and kept in commercial stock sheet metal pens with an equal number of females from the same brood. Room temperatures and light conditions were the same as for the Normals in Experiment I. When these chicks were 28 days old, the females were removed from the pen, leaving the males visually but not auditorally isolated from females in the room. No courting or copulatory responses were ever observed among these male <u>S</u>s. For purposes of comparison with Experiment I, these <u>S</u> were designated the Isolates.

<u>Apparatus</u>.--The apparatus was the same as that used in Experiment I. Temperature fluctuation in the experimental room was again an uncontrollable factor. Temperature gradients in the test brooder under hot and cool room conditions were found to be the same as those reported for Experiment I. Attempts were made to maintain a 72[°] F room temperature.

<u>Test stimuli</u>.--The test stimuli were the same as were used in Experiment I.

<u>Procedure</u>.--Testing was begun in mid-June when the <u>S</u>s were three months old. Other than the time of the year, these <u>S</u>s were studied under the same conditions and by the same procedure as were the Normals in Experiment I. Again, half the group was given a live female, the other half a live male, after being tested with the models.

<u>Classification of behavior</u>.--Behavioral measures were the same as those recorded in Experiment I.

Results

The stuffed models elicited sexual responses from 13 of the 14 Isolated males. Table 5 shows the number of \underline{Ss} giving component sexual and Approach responses to the various stimuli, the total number of \underline{Ss} responding sexually to each model, and the duration of sexual behavior given by those responding \underline{Ss} . The duration of the vocal response was not measured and thus did not enter into the computation of the mean duration of sexual behavior. Table 5 is analogous to Table 1 in Experiment I.

No sexual responses were elicited during the day 4 habituation phase. As can be seen in Table 5, one <u>S</u> gave a Sex Vocal response to the shroud Control event but none of the other components of the mating pattern were elicited. Each of the seven models, however, elicited sexual responses from at least four Isolated males.

There was an apparent preference shown for the Tailless Female model, both in terms of the frequency of courting behaviors, and in terms of the total number of <u>S</u>s giving sexual behavior of any type to it. The ten quail giving Neck and Body Tonus and the six quail giving Strutting responses to this model equaled, in each case, 31% greater frequency of such behavior than was elicited by the next most effective models. Overall, 23% greater frequency of sexual responding was shown to this model. This difference in total number of sexual responders was not statistically

Table 5.	Sexua. the to mean o	l and Ap otal num Juration	proach b ber of <u>S</u> (in sec	ehavior of th s giving comp onds) of <u>all</u>	e l3 Isola onent sexu sexual beh	te sexual al and App avior per	responders roach resp responding	, includ onses and <u>S</u>	ing 1 the
				Exp	erimental	Stimuli			
Response		Control	Female Head	Headless Female, Black Chest	Headless Tailless Female	Headless Female	Tailless Female	Full Female	Full Male
Neck and									
Body Ton	sut	0	Ŋ	9	4	4	10	S	2
Strut ting.		0	2	0	0	1	9	0	Ч
Vocal		н ;	0	0	0	Ч	0	Ч	7
Approach		10	8	10	6	10	6	9	6
Body Orien	t	0	0	0	0	2	2	0	0
Neck Grab		*	0	0	0	0	0	0	0
Mount		*	0	0	0	0	0	0	0
Total N gi ing sexu behavior	Lv- lal	-	ъ	Q	4	٢	10	ىر س	ъ
Mean durat	ion	**0	4.2	3.2	2.8	3.7**	8.4	10.2**	6.0**
+ one SD		♀	-4. 1	<u>+</u> 1.6	<u>+</u> 1.5	<u>+</u> 7.0	<u>+</u> 6.7	-6.0 	+7.5
		•							

*Response was impossible.

**Only frequency of the vocal response was measured, not its duration.

significant, however. This was determined with the Cochran Q test, which yielded a Q score of 8.42 (p < .30).

Neither the Normals nor the Isolated quail gave mating responses beyond the Body Orient stage. It was interesting that the Headless Female and the Tailless Female models elicited Body Orienting behavior in both studies.

Mean duration of sexual behavior in the present study was again very low and the standard deviation was again very high in comparison with the mean. None of the models elicited sexual behavior lasting longer than 10.2 seconds on the average.

The difference in a stimulus's effectiveness across the two studies was determined by comparing the total frequency of Isolate and Normal sexual responders in a Fisher exact test (Siegel, 1956). Only one significant difference was detected, that being for the Tailless Female model. A greater proportion of Isolate quail responded sexually to this model than did Normals.

Of note was the fact that the Isolated males gave Sex Vocal responses to four different stimuli in the present study. Vocalization was never heard during Experiment I.

There was other evidence of enhanced sexual responsiveness of Isolated quail in the present study. Sixty-two percent of the Isolates responded to three or more different models, the range being from one to six models and the median was 3.2 models. On the other hand, 70% of the

normally raised qual responded to only <u>one</u> model, the range being from one to five models and the median number of models responded to was 1.2.

Eleven of the 13 Isolate sexual responders gave sexual responses to the live stimuli on day 13. Table 6 shows how these eleven quail responded. The discrepancy in N tested for each sex (seven with the Live Male, six with the Live Female) was due to the fact that one of the <u>S</u>s, originally assigned to the Live Female group prior to the start of this study, did not give any sexual responses to any of the models. Only the behavior of those quail that

Table 6. The number of Isolate sexual responders giving component sexual and Approach responses to the Live Male and Live Female stimuli and the mean duration (in seconds) of all sexual behavior per responding S

Response	Live Male (N=7)	Live Female (N=6)
Neck and Body Tonus	6	4
Strutting	3	4
Vocal	2	1
Approach	6	5
Body Orient	4	3
Neck Grab	4	3
Mount	4	3
Total N giving sexual behavior	6	5
Mean duration	87.3	99.2
<u>+</u> one SD	<u>+</u> 103.2	<u>+</u> 95.9

responded sexually to the models was reported. This one quail <u>S</u> that failed to respond to a single model did give 4 seconds of Neck and Body Tonus to the Live Female.

Table 6 reveals that one more <u>S</u> responded sexually to the Live Male than to the Live Female. This difference was not statistically significant (p > .05, Fisher exact test). Differences in the duration of sexual behavior given to each live stimulus were likewise found to be insignificant (t = .18, p > .05). It is of note that both the Live Male and Live Female stimuli elicited complete mating patterns.

Approach behavior.--Frequency of Approach behavior was found to correlate .10 (Spearman rank correlation) with frequency of sexual behavior in the present study (see Table 8). This low correlation, plus a similar low correlation found in Experiment I between these two behaviors ($r_s = -.23$), was unexpected, since Approach was assumed to be a component of the full mating pattern.

The Cochran Q test failed to detect any significant differences in frequencies of <u>S</u>s giving Approach responses to the various models (Q = 3.4, p>.90). Inspection of these data (Table 5) pointed out the interesting fact that, as in Experiment I, more <u>S</u>s Approached the shroud Control event than the Full Female model.

Differences between frequencies of Normal and Isolated quail Approaching a particular model were analyzed

with the Fisher exact probabilities test. Only one significant difference was detected, that being for the Tailless Female model which elicited a greater number of Approachers from the Isolate group (p < .05).

Other behavior observed in Experiment II.--Table 7 reports the number of Isolated quail giving crowing, Wing Flap, defecating, aggressive pecking, preening, eating, and drinking responses in the presence of the various experimental stimuli. Only the behavior of the 13 sexual responders is reported.

Differences between the experimental stimuli, in terms of the number of <u>S</u>s giving each of the above responses to them, were analyzed with the Cochran Q test. These analyses did not include the day 4 data nor the data for the live stimuli. Results of these analyses for each response measure were as follows: crowing, Q = 12.85, p < .05; Wing Flap Display, Q = 5.12, p > .05; defecation, Q = 5.19, p > .05; aggressive pecking, Q = 6.00, p > .05; preening, Q = 1.00, p > .05; eating, Q = 4.54, p > .05; drinking, Q = 6.55, p > .05.

The only significant difference was found with the crowing response. Inspection of the crowing data in Table 7 reveals the high response rate given to the Headless Female with the darkened chest. It was also interesting that all but the Live Male stimulus elicited crowing.

6	xperim	ental st	imuli	n							
				Exi	perimental	Stimu]	Li				
Response	Day 4	Control	Fem ale Head	Headless Female, Black Chest	Headless Tailless Female	Head- less Female	Tail- less Female	Full Female	Full Male	(N=7) Live Male	(N=6) Live Female
Crowing	г	7	m	9	5	7	7	7	ĸ	0	Ч
wıng riap Display	0	m	4	ъ	m	m	m	9	പ	Ч	Ч
Defecation	Ч	ŋ	с	m	m	с	4	7	ഹ	0	0
Aggressive Decking	c	*	c	c	c	-	F	c	~	ç	F
Preening	ы С	• 00	2	ით	οα	י ס	+ œ	οœ	4 00	<u>م</u> 1	чю
Eating	10	12	ი	10	10	8	11	11	11	7	m
Drinking	ß	80	8	11	7	7	9	6	11	m	0

Other behavior given by the thirteen Isolate sexual responders, including the total number of Ss responding during the habituation phase on day 4 and the Table 7.

*Response was impossible.

The preening, eating, and drinking responses were clearly the most frequently elicited of the seven responses listed in Table 7. This was also true in Experiment I. However, in study I there was a very high correlation between the frequency of <u>Ss</u> giving sexual responses and the frequency giving combined preening, eating, and drinking, responses. In the present study these two behaviors correlated -.14 (Spearman rank correlation, see Table 8).

Frequency of preening, eating, and drinking behavior is indicative of general activity level. It was E's evaluation that not only did the Isolated quail give more sexual behavior during the study but they were also more active in nonsexual ways. This hypothesis was tested statistically by comparing the combined frequency of Ss giving preening, eating, and drinking responses to each stimulus across the two studies. Three significant differences were found, all indicating a greater level of activity among the Isolated quail. The three models were the Headless Female with the darkened chest $(X^2 = 4.20)$, the Tailless Female $(X^2 = 4.06)$, and the Full Male ($X^2 = 5.80$). All chi squares were significant at the .05 level with one degree of freedom. No differences were found between groups on day 4 nor with the live stimuli.

Relationship between General Activity, Approach, and sexual behavior. -- The Spearman rank correlation between these three behaviors have been summarized in Table 8.

sexual	behavior,	Approach,	and General	Activity
		Approach	General Act	tivity_
Sex Be	havior	.10	14	
Ap	proach		74	*

Table 8. Spearman rank correlation coefficients between sexual behavior, Approach, and General Activity

*p<.05.

As can be seen, models eliciting greater amounts of preening, eating, and drinking behavior had a tendency <u>not</u> to elicit Approach responses. This finding is opposite to that found in Experiment I (see Table 4). It is noteworthy that analogous correlations in Tables 4 and 8 have opposite signs.

Other behavior observed outside of experimental situation.--Homosexual responses were again observed in the present study. These behaviors occurred during inter-test periods, both in the brooder and in the retaining cages. There were no apparent differences between the Isolates and Normals in terms of the form and frequency of these responses. This was a subjective evaluation since there were no objective measures of homosexual activity used in either study.

Discussion

Although further evidence is needed, the results of the present study suggest that social contact with females, up until the time of sexual maturation, is sufficient to ensure female-elicited sexual behavior from male quail at three months of age. This finding parallels the report by Kruijt (1962) with junglefowl.

There was evidence of enhanced sexual activity among the Isolate quail in that they responded more often and to a wider range of stimuli than did the normally reared birds. However, the quail in the present study also showed an enhanced general activity level as well. This was denoted by frequency of <u>S</u>s giving preening, eating, and drinking responses. The validity of these responses as representative of general activity is questionable. It was interesting, however, that this measure of general activity correlated highly with sexual activity in Experiment I, but not in Experiment II. This is puzzling and cannot be explained with the data available.

The Isolate quail showed an apparent preference for the Tailless Female model. This preference may have been due to the model's lower head height since head height is a critical factor for sexual behavior in both turkeys (Hale, 1960) and chickens (Carbaugh, Schein, and Hale, 1962). It was interesting that the normally reared quail did not show a similar preference for this model.

It is difficult to explain why <u>S</u>s in both studies directed sexual responses to stuffed models of males and to other live males. It should be said that such homosexual behavior is not an unusual occurrence among all-male groups in our laboratory (Fidura, 1967). Schein (1963) theorized

that young birds develop preferences for secondary sexual objects early in life. Whereas imprinting determines the primary sexual preference for the female, other males or objects may take on secondary sexual identity through the process of familiarization. The literature contains many instances in which male birds have directed sexual responses to biologically inappropriate stimulus objects (cf., Ficken and Dilger, 1960; Lack, 1941). Schein and Hale (1965) caution investigators not to mistakenly interpret such abnormal responses to secondary preferences as "hypersexuality."

It is not known how the male discriminates the sexes, whether on the basis of behavioral responses or morphological features. The most reasonable hypothesis is that both are important factors. Since all of the models elicited Neck and Body Tonus, presumably the adequate stimulus characters were present on the models. It follows that the female must respond to the male's courting display in some characteristic manner in order that the male reciprocate with Mounting and Copulatory responses. Since the models could not provide this necessary female behavior, the male quail did not procede further in their mating activities. Further studies are necessary to substantiate these ideas but it is noteworthy that the data fit such a conceptualization.

It was mentioned earlier (Discussion, Experiment I) that the manner in which the quail were repeatedly tested with the models may have had marked effects on their sexual

behavior. A repeated measures design was used in the present studies because only a few quail were available for testing with the seven models. The major limitation of a repeated measures design is the possibility that treatment effects may not dissipate before the next treatment is administered (Lindquist, 1953). In the present studies the quails' responses may have become conditioned through practice with the various models. Some examples of apparently conditioned behavior have already been mentioned (e.g., avoidance responses). A shroud control event was included in both studies to determine if sexual responses would become conditioned to the rising shroud, and they proved not to be. Possible effects of practice or conditioning due to the order and sequence in which the models were presented were ruled out by randomization techniques. But there was no way of defining to what extent practice with the models influenced the Ss' sexual behavior (cf., Tinbergen, 1942). And one is still unable to ascertain how quail might respond to any one model if it were presented alone.

A model's effectiveness as a sexual stimulus was determined by the total number of <u>S</u>s directing sexual responses of any type to it. Completeness of the elicited mating patterns were also reported but deemphasized by this author. Components of the mating pattern were, on several occasions, observed to occur out of normal sequence, followed by responses which normally occur earlier in the chain. The

factors governing this out-of-sequence behavior are unknown. The duration of elicited sexual behavior was also deemphasized because of the possibility of human error in measurement. No reliability checks were possible with only one \underline{E} recording behavior.

Perhaps some of the contradictory evidence on early experience effects is due to differences among investigators in the response measures they use. Different investigators have used different measures to illustrate the effectiveness of a particular stimulus, including the percentage of sexually reactive <u>Ss</u> giving sexual responses to the stimulus (Kruijt, 1962; Schein and Hale, 1959), frequency with which component responses are elicited by this stimulus (Fisher and Hale, 1957; Guiton, 1962), percentage of copulators (Andrew, 1966), and sexual behavior scores based on level and latency of the elicited responses (Carbaugh, Schein, and Hale, 1962). Further work is necessary to understand relationships between these various measures.

Note of caution when classifying sexual behavior.--The high degree of similarity between the aggressive, sexual, and what appears as "orienting" responses in the male quail creates a problem in response classification when such classification is based on visual observation of responses without full knowledge of the effective eliciting stimuli. The vocal call heard during courtship is also commonly heard during fighting behavior. During pilot work, a live male was

often substituted for a female model and the behavior of the Ss was highly predictable. A S would move rapidly towards the newly introduced male, spread its wings in a "fanning" motion, and give a vocal call which was similar, but discriminably different from the call given during courtship. The characteristic tonus of the head, neck, and body, which is observed during courtship, was not observed during these apparently aggressive activities. The "orienting" response, commonly observed in all Ss during the first few seconds after a model was exposed, could also be mistaken for the neck stretch given during the courtship display (i.e., the Neck and Body Tonus). The head is raised higher, however, and it is not cocked to one side as it is during the mating reaction. It appears as if the S were "looking over" the stimulus situation. Aggressive, sexual, and orienting behavior in the quail must eventually be defined operationally in terms of the sets of stimuli that lead to their occurrence (Selinger and Bermant, 1967). It is apparent that future work of this nature may find it necessary to rely on more objective means of observing the quails' behavior, such as high-speed photography.

SUMMARY

The purpose of Experiment I was to expose those features of the female Japanese quail which are important for the elicitation of male sexual behavior. Experiment II sought to determine what effect isolation from females, prior to sexual maturation, would have on the stimuli which elicit sexual responses from the adult male. Several females and a male were taxidermically stuffed with various parts of their bodies either missing or modified. These stimuli were experimentally presented to two groups of males; one group (Experiment I) was normally reared with other females while the second group (Experiment II) was separated from females just prior to sexual maturation and raised in all-male groups.

Sexual responses were elicited from only a few quail in Experiment I and no preference for a particular model was shown. The results of Experiment II indicated that social experience with females, up to the time of sexual maturation, is sufficient to ensure female-elicited sexual behavior from adult males. The quail in this study responded sexually more often and to a wider range of stimuli than did the normally reared quail. There was also evidence of an enhanced general

activity level. Stimulus specificity was also more apparent in these quail; a preference for a female model with missing tail feathers was shown.

Treatment effects in both studies may have become contaminated with the unknown effects of head height. The occurrence of homosexual behavior indicated that the quail were responding in an abnormal manner, perhaps due to the experimental design. It was suggested that the experimental design did not provide optimal conditions for expression of sexual behavior in either study. Further work is needed to assess other ways of investigating the stimulus control of this bird's sexual behavior. REFERENCES

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APPENDIX A

APPARATUS

APPENDIX A

APPARATUS



Observer's view of model



Raising shroud above model



Pulley and boom system above the superstructure



E with recording equipment

APPENDIX B

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14 - F

MODELS

APPENDIX B

MODELS



Headless Female, Black Chest Headless Female



Full Male



Full Female





Tailless Female

Headless-Tailless Female (below) and Female Head (above)

