

CLASSICAL CONDITIONING OF COURTING BEHAVIOR
IN THE JAPANESE QUAIL, *COTURNIX COTURNIX*
JAPONICA¹

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Male Japanese quail were classically conditioned to display courting behavior at the sound of a buzzer, a previously neutral stimulus. The buzzer (conditioned stimulus) was paired with the presentation of a female quail (unconditioned stimulus) for a number of trials. The courting display, invariably elicited from the male by the presentation of the female, began to appear in part to the conditioned stimulus as early as the fifth pairing. All components of the display were elicited from all birds by the conditioned stimulus alone within 32 pairings of the conditioned and unconditioned stimuli.

A number of animals exhibit complex unconditioned display reactions in the presence of certain stimuli. For example, many male animals display to the females of their species as part of the mating ritual and also display to other males before fighting. Braddock and Braddock (1955), Adler and Hogan (1963), and Thompson and Sturm (1965) report that a complex aggressive display is exhibited by the Siamese fighting fish, *Betta splendens*, in the presence of another *Betta*. The latter two studies have reported the classical conditioning of this unconditioned threat display using male *Bettas*.

Similarly, a complex courting display can be elicited from isolated male Japanese quail when a female quail is placed in its presence (Farris, 1964). The latency from the presentation of the female to the onset of the display is about 3 to 5 sec and the duration of the response pattern varies with the receptivity of the female. In most cases the display is terminated with copulation. After mating, there is

a post-copulatory response which is similar to the original courting response and terminates the entire sexual ceremony. The present study was concerned with the display which occurs before copulation.

Identification and Description of Behavior

The courting pattern consists of at least the following five components: (a) *Increased neck and body tonus*: the posterior is elevated and the neck is thrust forward and slightly downward. From a side view the back is parallel with the floor and the male circles the female with head cocked inward toward the hen. The neck is slightly humped just behind the head. (b) *Leg action*: the legs straighten and stiffen with the body being brought up and forward. The body is swiveled at the hips so that the legs appear to be straight down. The leg is stiff during the strut. (c) *Toe walking*: the bird raises itself on its toes beyond a normal stance and struts about the female. (d) *Vocalization*: the courting call is a subdued, hoarse, vibrating call given by the male only when courting. It is a two-syllable squawk sound which lasts for several seconds. (e) *Feather puffing*: most of the body feathers from the neck downward are fluffed, accenting the breast, rump, and wing primaries.

Sequence of Components

For all birds, the components tend to appear in the above sequence, the main difference being the amount of time elapsing between the onset of the respective components. Usually the first three components are exhib-

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ited almost simultaneously, with the last two appearing from 1 to 5 sec later. However, in some cases all five components occur almost simultaneously. Most birds in the normal courting display exhibit all of the components. However, on occasion, some birds will exhibit a courting pattern which includes only the first three components. If all components are not exhibited in the display, the last two components are usually omitted.

The purpose of this study was to investigate the extent to which the components of the courting display could be classically conditioned by consistently pairing a previously

neutral stimulus with presentation of the unconditioned elicitor, a female quail.

METHOD

Subjects

Five male Japanese quail, *Coturnix coturnix japonica*, approximately 75 days old at the beginning of the experiment, were used. All were sexually mature and all had had extensive sexual experience. The five subjects were selected from a colony of 24 birds, all of which consistently exhibited the courting display in the presence of the female. The five

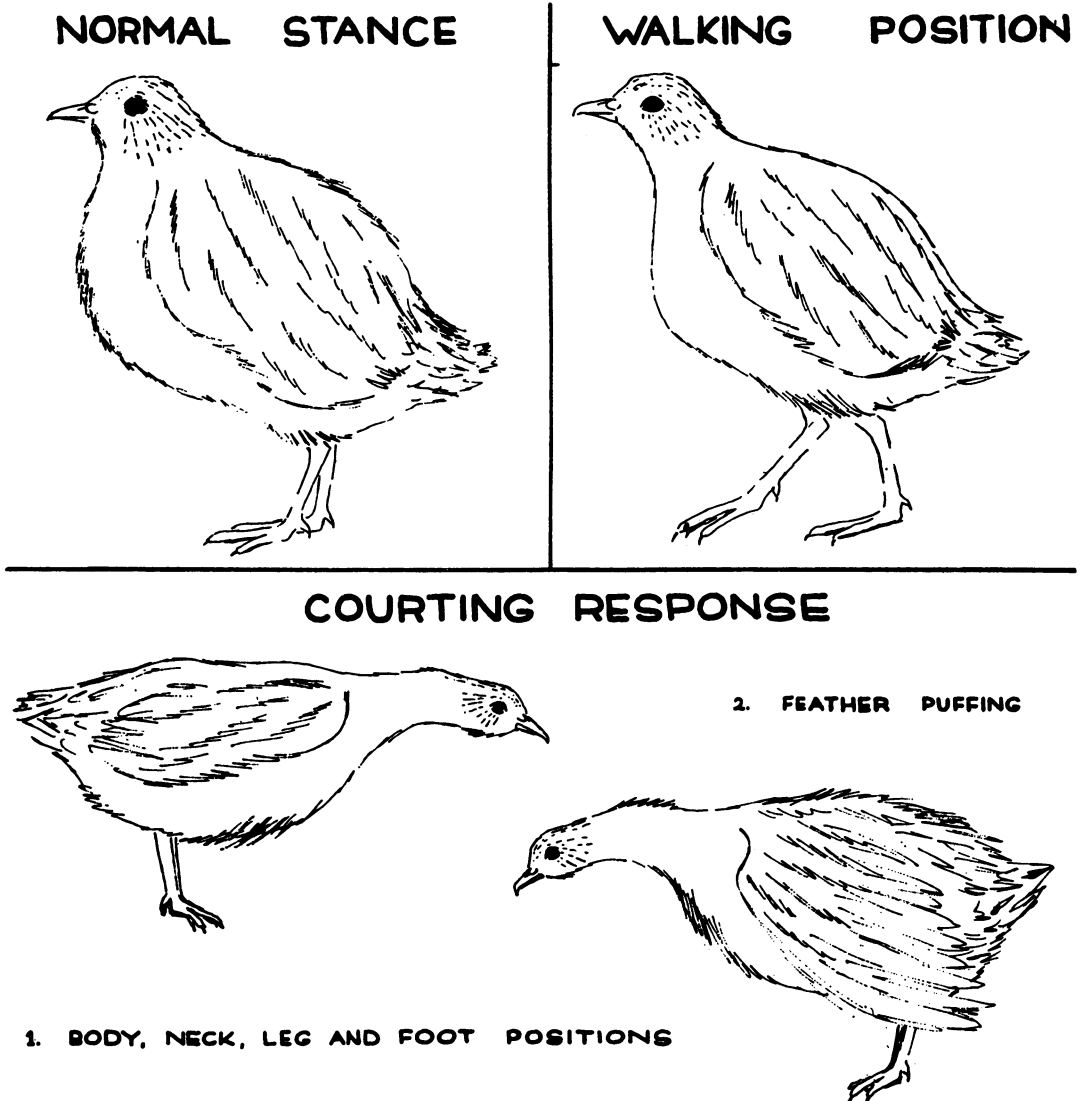


Fig. 1. Sketches showing the normal stance, walking position, and components of the courting display of the Japanese quail, *Coturnix coturnix japonica*.

were selected on the basis of apparent health and the tendency to exhibit all components when displaying. They were marked and placed in individual cages until the experiment commenced.

The six female stimulus birds, selected on the basis of apparent health, were placed together in a large community cage in the animal colony room.

Apparatus

A sheet-metal brooder 23 in. by 30 in. by 10 in. was used as a conditioning chamber and living quarters for each male during the experiment.² The front and one side of the brooder contained a 6 by 12 in. window covered with 0.5-in. hardware cloth through which observations were made. The front also contained a 4 by 6 in. Masonite swinging panel. The chamber was continuously lighted with one 60-w bulb. The floor of the chamber was 0.5-in. hardware cloth. Temperature was maintained at 75 degrees F and food and water were available at all times. The chamber was located on a table about 30 in. above the floor in a 15 by 12 ft darkened room. The lighting in this larger room remained off for the duration of the study.

The conditioned stimulus (CS) was a 6-v low-intensity buzzer attached to the top of the brooder; the unconditioned stimulus (US) was a female quail.

Procedure

Three of the males (S-1, S-2, and S-3) were used in the conditioning group. They were placed one at a time in the conditioning chamber two days before the experiment. This served both as an habituation period and a deprivation period from the female birds. On the morning of the third day, conditioning trials were begun. A female stimulus quail was taken from the living cage and brought to the experimental room in a small carrying cage. The experimenter seated himself in front of the brooder and placed the cage containing the female on the floor within easy reach. An observer was seated to the right

of the experimenter about 15 in. from the observation window, permitting a full view of the chamber. The female was removed from the holding cage and held by the experimenter for a variable delay period, usually not exceeding 30 sec. The CS was then turned on and a timer was automatically started. Ten seconds after the onset of the CS the female was placed by hand through the swinging panel into the brooder with the male. At no time was the male able to observe the female before it was introduced into the chamber. The female made no audible sounds during handling. The CS remained on for 5 sec after the introduction of the female and was then terminated by the experimenter. However, if copulation occurred in less than 5 sec after the female was presented, the CS was terminated at that time. The female was left in the chamber with the male until copulation occurred or a maximum of 1 min elapsed from the onset of the CS, whichever occurred first. Four trials were run each day with a minimum intertrial interval of 4 hr. The components of the display occurring to the CS were recorded by the experimenter and at least one other observer on forms to facilitate speed and accuracy of recording. Inter-observer reliability was never less than 90% and usually higher for the first four components.

Conditioning criterion was four consecutive trials on which all five components of the courting patterns were elicited within the CS-US interval. When this criterion was met, extinction was begun on the next scheduled trial and carried out for four trials a day with the same intertrial interval as used in acquisition. Extinction trials were continued until no display components appeared to the CS for four consecutive trials. Twenty-four hours after reaching extinction criterion, trials were again run to test for spontaneous recovery of any display component. These were continued until the original extinction criterion was met.

Two subjects (S-4, S-5) were run as pseudo-conditioning controls. They were treated the same as the birds in the conditioning group with respect to habituation, deprivation, and intertrial interval. However, during the presentation of the stimuli, the CS and US were never paired. Instead, they were presented for 20 trials each, according to a Gellerman series (Gellerman, 1933). A 15-sec CS was used on the CS-alone trials, and on the US trials, the

²The birds were raised in a similar brooder and habituated quickly to the experimental environment. An attempt to use another chamber specifically designed for the conditioning failed since the male subjects did not habituate readily to the new environment.

female was placed in the brooder and allowed to remain for 1 min or until copulation occurred.

RESULTS

Figure 2 shows the acquisition of all five components of the display for the three experimental birds. All subjects quickly learned the response, with the acquisition of the individual response components varying little from bird to bird. Generally the components of the courting display were acquired in the following order: (a) increased neck and body tonus; (b) stiffening of the legs; (c) toe walking; (d) vocalization; (e) feather puffing. In extinction, the sequence of events was reversed in that the last component conditioned tended to be the first to extinguish and the next to the last to condition, the second to extinguish, and so on through the components; the first component showed the most resistance to extinction. Spontaneous recovery was observed only for component (a) for S-2 and S-3 and lasted for only one trial. Subject S-1 showed spontaneous recovery only for component (a) on the first two test trials. At no time were any components of the display observed during the delay period between picking up the female and the onset of the CS.

Pseudoconditioning Controls

The results of the pseudoconditioning controls showed that the CS (buzzer) alone did not elicit any components of the courting display. The only reaction observed to the CS alone was an increase in generalized activity. The birds habituated to this stimulus after several presentations. The presentation of the female to the control males consistently elicited the courting display, as it did with the experimental animals. At no time were any of the components of the display observed before the female was introduced.

DISCUSSION

The data from this study indicate that complex motor behavior of the type involved in the courting display of the male Japanese quail can be classically conditioned. Elements of the display began to appear to the CS alone as early as the fifth pairing of the CS and US. No components of the display occurred to the

procedure attendant to handling of the female but only to the CS. This indicates that the buzzer alone served as a conditioned stimulus. However, in the trials approaching criterion, the male would occasionally exhibit a partial display to the experimenter when he first seated himself in front of the chamber. The individual components of the display conditioned progressively over trials. Only after a number of trials was each and every component elicited by the CS as a unit. This finding is similar to the individual component conditioning observed by Thompson and Sturm (1965) in the classical conditioning of the aggressive display in *Betta splendens*.

One of the most striking aspects of these data was the sequential orderliness with which the different components conditioned and extinguished across birds. As shown in Fig. 2, the components condition in order (a) through (e) with all subjects, the only exception being S-3, when vocalization was elicited on several of the early trials. Likewise in extinction, the order of events was reversed with

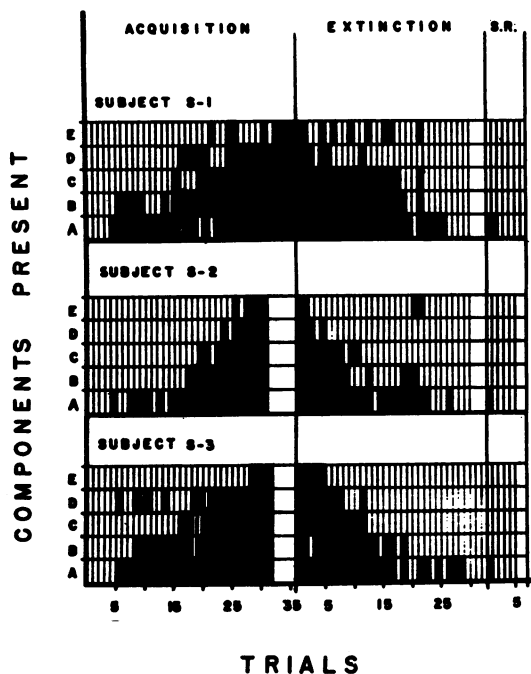


Fig. 2. Acquisition, extinction, and spontaneous recovery of conditioned courting behavior using Japanese quail. Shown on ordinate are different components of the display: (a) increased neck and body tonus; (b) leg action; (c) toe walking; (d) vocalization; (e) feather puffing. Data presented are for components displayed during the CS-US interval.

two exceptions; component (e) showed more resistance to extinction for S-1 and appeared on trials 15 and 16 for S-2. The sequence in which the individual components of the display were conditioned roughly paralleled that found by Farris (1964) in the ontogenetic development of the birds. In that study it was found that the first sign of courting behavior in the maturing male was increased neck and body action. The other components appeared as the male birds matured. It would be interesting in further research to investigate more fully the relationship observed between the emergence of the behavior during maturation and the sequence in which the response pattern appears during classical conditioning.

REFERENCES

- Adler, N. and Hogan, J. A. Classical conditioning and punishment of an instinctive response in *Betta splendens*. *Anim. Behav.*, 1963, 11, 351-354.
- Braddock, J. C. and Braddock, J. I. Aggressive behavior among females of the Siamese fighting fish, *Betta splendens*. *Physiol. Zool.*, 1955, 28 (2), 152-172.
- Farris, H. E. Behavioral development, social organization, and conditioning of courting behavior in Japanese quail, *Coturnix coturnix japonica*. Unpublished doctoral dissertation, Michigan State University, 1964.
- Gellerman, L. W. Chance orders of alternating stimuli in visual discrimination experiments. *J. genet. Psychol.*, 1933b, 42, 207-208.
- Thompson, T. and Sturm, T. Classical conditioning of aggressive display in Siamese fighting fish. *J. exp. Anal. Behav.*, 1965, 8, 397-403.

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