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# *VISUAL REINFORCEMENT IN FIGHTING COCKS*[1]

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Fighting cocks were conditioned to emit a key-pecking response on a fixed ratio reinforcement schedule leading to the visual image of another fighting cock. In addition, the relative reinforcing properties of the visual reinforcer were compared with food and water reinforcers in a three-choice, non-reversible option situation. The relative reinforcing effects of mirror presentation and another rooster visually presented through a window, were compared. The mirror maintained a relatively lower response output.

The analysis of unlearned agonistic behavior (Verplanck, 1957) has been primarily carried out using observational methods in controlled "natural" environments. Much of this research has been concerned with the characteristics of the stimulus sufficient to evoke agonistic display (Aronson, 1957; Crane, 1949; Tinbergen, 1957). Frequently this complex stimulus is a male member of the same species or a replica of a male introduced by the experimenter, intruding into an established territory (Baerends and Baerends, 1950; Forselius, 1957; Picciolo, 1961; Tinbergen and Van Iersel, 1947). While the domestic rooster does not exhibit territoriality, *per se*, a species-specific agonistic display pattern, directed toward other roosters has been observed (Guhl, 1953). In fighting cocks, this threatening display is elicited by the visual image of another rooster. Such threat behavior very rapidly leads to attack, with resulting injury and frequently to the death of one of the adversaries.

The present research makes use of the visual image of a rooster, not as a releasing stimulus (Tinbergen, 1951), but rather as a positively reinforcing stimulus for an operant response. The purpose of this experiment was to establish the positive reinforcing effects of the visual image of one fighting cock for the operant behavior of another. In addition, the reinforcing effects of this visual stimulus were compared with food and water reinforcers.

## METHOD

### *Subjects*

Two sexually mature Red Gavillan roosters obtained from a nearby farm served. The subjects (*Ss*) had been maintained in common flocks with hens and roosters until the time of purchase, when they were transferred to individual cages. During the two weeks prior to the experiment, the *Ss* (A and B) received *ad libitum* food and water, and had free access to pigeon grit.

### *Apparatus*

A chamber, 24 by 36 by 24 in. inside dimensions, equipped with three pigeon keys, a pellet feeder and a solenoid valve-operated water dispensing device, served as the experimental living space. The response keys and two receptacles to receive food pellets (D and G 45 mg) and tap water were located along one wall. A conical receptacle 1½ in. deep and 2 in. in diameter was filled with water, and drained at a constant rate, (15 sec per reinforcement). Visual stimuli were presented through a window 12 in. square cut into the left wall of the chamber. Red, blue and green lights were located behind the keys so the translucent key disc could be illuminated. A 25-watt lamp showing through a grating in the ceiling served as a general house light. An exhaust blower provided continuous ventilation and

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helped maintain a relatively constant temperature in the chamber.

*Procedure*

Bird A was placed in the test chamber for a period of 61 days, following the two week pre-experimental period. The *S* received all of its food, water and social stimulation in the experimental situation. Since there was adequate time to obtain sufficient quantities of all three reinforcers, no effort was made to maintain constant body weight.

Initially, a mirror was presented to the *S* in the experimental chamber by turning off a lamp behind a one-way glass window for 10 sec. Responses on the appropriate key would be followed by water reinforcement, three 45-mg food pellets, or mirror presentation. All three key lights were illuminated before a response occurred on any key. As soon as a response was emitted on one key, the other two key lights turned off, and further responses on those keys had no effect until the response requirement on the first-pecked key was completed. Upon completion of the response requirement (a fixed number of responses) on that key, a reinforcer was presented and all three key lights turned on again, providing the opportunity for *S* to select the reinforcer for which it would work. This procedure has been described by Findley (1962) as a three choice non-reversible option situation. The number of pecks required to procure a reinforcer on the three keys was gradually increased to 75 over a period of 25 days. In order to specify that the mirror presentation was the reinforcing stimulus, a piece of transparent plate glass replaced the one-way glass for five days at the end of this period.

Subsequently, another cage containing rooster B was placed adjacent to the experimental cubicle. Vision between the experimental and adjacent stimulus cage was effected by rotating a screen, when the *S* completed the response requirement on the appropriate key. The *S* in the outer cage had no control over the screen, but acted as a reinforcing stimulus for the experimental *S*. Throughout this phase of the experiment, the reinforcing stimulus bird had *ad libitum* food, water and pigeon grit.

Upon completion of this series of procedures using Bird A as subject, Bird B was placed in the chamber and a similar series of manipulations was performed. While there were differences in number of sessions required to reach various levels of performance, the general sequence of procedures was alike for the two birds.

## RESULTS

The logarithms of the numbers of responses emitted on each of the three keys over the first 61 days of the study are presented in Fig. 1. The rate of acquisition of the ratio behavior leading to the three reinforcers reveals the general propensity of the *S* to work for these stimuli. Food reinforced behavior reached the highest stable baseline level after three, 24-hr sessions, water reinforced responding following six sessions and mirror-reinforced behavior after 10 sessions. Baseline performance for food at FR 25 was approximately 100 times that for the "social" reinforcer, and 10 times the total number of water responses per session.

As the ratio was changed by increments of 10 above FR 25, a decrease in response output was followed by a return to the previous daily output. Successive increments in the FR resulted in increasingly larger decreases in total daily response output on the three keys, followed by longer recovery times to the pre-increase levels of performance.

Increasing the ratio to FR 75 produced a marked reduction in responding for the mirror reinforcer, with lesser decrements in food and water output. After three more days at FR 75, responding on all three keys had ceased. The ratio was reduced to 25 after three successive days with no indication of a return of mirror responding. Both food and water responding rapidly stabilized at near the pre-increase level, but behavior for the mirror reinforcer was returned more gradually. Replacement of the one-way mirror with transparent glass resulted in a reduction in mirror responses to 35 on the first day, with no mirror responses for four succeeding days. Cessation of responding on the "mirror" key indicates that the mirror presentation was responsible for maintaining this operant rather than illumination changes associated with the mirror presentation.

At this point the lucite screen and the second bird were introduced. Responding on the three keys was re-established, substituting

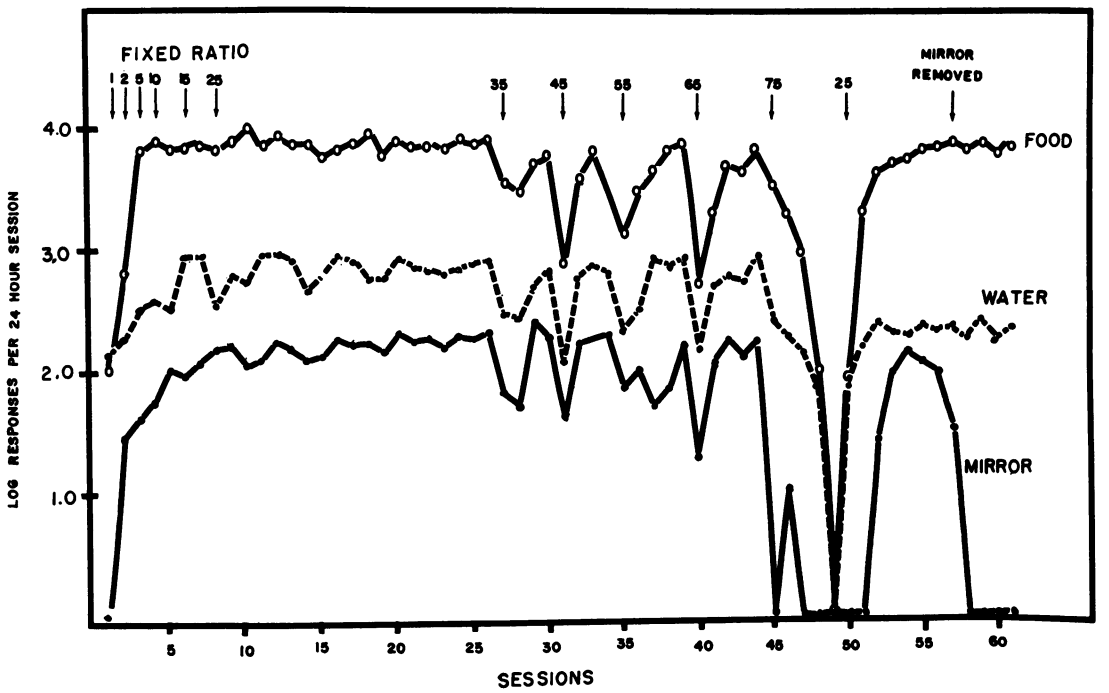


Fig. 1. The logarithms of the numbers of responses for food, water and social reinforcement during the first 61 days of the study. The ratio size is indicated by the numbers along the top of the figure.

the visually presented *S* for the mirror image. The ratio was increased from FR 1 to FR 5 during the first 24-hr session. Over the next 10 days, the ratio was gradually increased to FR 25. The characteristic ratio performance (Ferster and Skinner, 1957) began to deteriorate at ratio values above FR 25, so the behavior was allowed to stabilize at this level. The course of acquisition of responding for the three reinforcers was very much like that seen using the mirror as the visual stimulus and is, therefore, not reproduced graphically. Responding on the "social" key stabilized at values closer to the total output for water reinforcement (food $\cong$ 10,000, water $\cong$ 700, social $\cong$ 500).

Figure 2 presents sample cumulative records for both *S*s (A and B) for food, water and social reinforcers. In general, when an *S* began to work for a food reinforcer, the ratio was completed in a characteristic, positively-accelerated scallop, and a brief post-reinforcement pause.

Ratio performance for water and visual reinforcement was at an overall lower rate and tended to be more erratic. Responses on the "social" key differed somewhat from water behavior in that they occurred in irregularly-spaced short bursts, interspersed with periods of more characteristic ratio behavior. Furthermore, as the size of the ratio increased, the magnitude of such variability increased, finally associated with total disruption at FR 75.

## DISCUSSION

The visual image of a fighting cock almost invariably precedes aversive consequences for another rooster in the "natural" environment. The present data indicate that this same stimulus can act as a positive reinforcer for a key-pecking operant in another rooster. The number of responses maintained by this reinforcer was found to vary with the amount of work required to obtain food, water and visual reinforcement.

The relative biological significance of the three reinforcers in this situation is suggested by the order in which the three operants were acquired, the order by which responding was diminished by increasing the work requirement and the order in which responding reappeared upon lowering the ratio size. The stability of the behavior emitted for the three reinforcers over a range of work requirements from FR 5 to FR 65 indicates the constancy

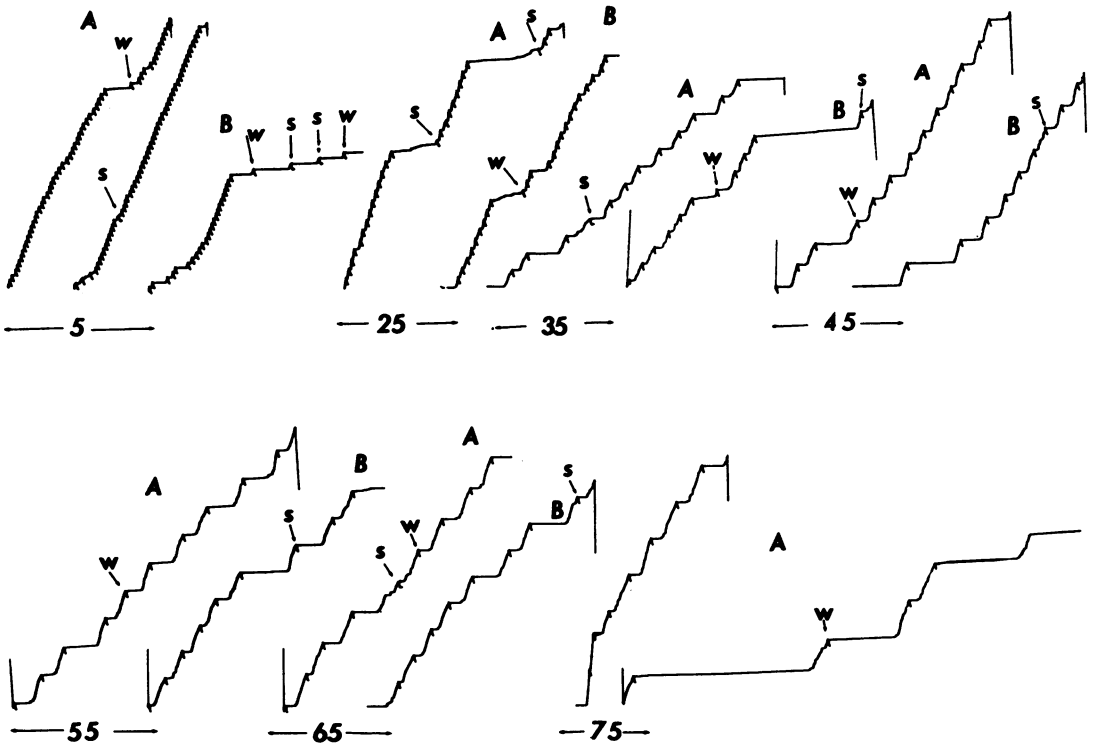


Fig. 2. Sample cumulative records for Birds A and B at fixed ratio values of 5, 25, 35, 45, 55, 65 and 75. All reinforcements were food except those indicated by an arrow and the letters W(water) and S(social).

of the relationship of these reinforcers and the reliability of the procedure.

The possibility that a first response on the visual reinforcement key was "accidental", and then followed by responses reinforced by reinstatement of the opportunity to respond for food or water reinforcement, seems highly unlikely. During the four-day period when the mirror was removed, but the illumination changes continued as previously, no responses were emitted on the visual reinforcement key (Fig. 1, days 58-61). On day 82 the lamp illuminating the "visual" key burned out, unnoticed by the experimenter for 18 hr. No responses were recorded on this key during this period despite the fact that responses would have been reinforced as usual. When the lamp was replaced, the *S* began responding within 5 min, re-establishing the prior FR 25 performance almost immediately.

Thus, responding on the "visual" key appears to be a function of the appropriate discriminative stimulus (key illumination) and reinforcing consequences (mirror presentation), not generalization from one key to another or chaining of responding on the "visual" key leading to food or water.

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