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AN ANALYSIS OF AGGRESSIVE DISPLAY IN THE GAME COCK: RESPONSE DECREMENT AND REINSTATEMENT

by

William H. Herbert Fullmer

A Thesis
Submitted to the
Faculty of the School of Graduate
Studies in partial fulfillment
of the
Degree of Masters of Arts

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William H. Fullmer

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INTRODUCTION

Many species of animals exhibit unconditioned behavior patterns in the presence of certain stimuli. Some of these patterns have been described as display behaviors, such as courting and aggressive display. Hinde (1966) suggested that such displays become ritualized within a species and serve as a form on communication. Ethologists have demonstrated the "signal-like" nature of certain displays in a variety of species. Tinbergen (1960) found that the "upright threat posture" in Herring Gulls signaled conspecifics to attack or flee, and Eibl-Eibesfeldt (1963) reviewed similar findings on cichlid fish, antelope, and numerous other species.

Laboratory analysis of such display behaviors has produced many interesting results. Farris (1967) found that courting display in Japanese quail could be classically conditioned. The entire display was elicited by a previously neutral stimulus. Similar findings have been reported by Thompson and Sturm (1965a) and Adler and Hogan (1963) on the aggressive display of Siamese fighting fish. Second, Adler and Hogan (1963) reported that the unconditioned display in fighting fish can be suppressed by punishment. Finally, the opportunity to display was found to be an effective reinforcer in an operant paradigm for fighting fish (Thompson and Sturm, 1965b; Thompson, 1963; Thompson, 1968) and with fighting cocks (Thompson, 1964).

The strength or endurance of aggressive display has also been investigated in Siamese fighting fish and it appears that the be-

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havior wanes as a function of continous stimulation. Clayton and Hinde (1968) exposed fighting fish to a mirror image for 10 days and reported almost complete loss of the aggressive display. The behavior partially recovered after a two day rest period, but not to the pre-experimental level. Baenninger (1966) reported similar findings for fighting fish in a free-choice situation. Although the fish initially stayed in one of two areas where they were exposed to another fighting fish or a mirror image, after 4-8 hours they tended to stay in an area where they were not exposed to these stimuli.

The waning of unconditioned responses typically has been attributed to an habituation process. For example, Humphrey (1933) defined habituation as a decrement in responding as a function of repeated stimulation, and Thorpe (1963) added that decrement was "relatively permanent" (p.61). Thorpe further suggested that habituation differs from fatigue and sensory adaptation in that "it is specific to the stimulus, and relatively enduring. . ." (p.61). Other characteristics of habituation are: (1) if the stimulus is withheld the response recovers, (2) the more rapid the stimulation the more rapid the habituation, (3) continued habituation training leads to slower recovery, and (4) the presentation of another stimulus results in recovery of the habituated response, especially if the new stimulus is stronger than the original (Thompson and Spencer, 1966). Thompson and Spencer refer to the latter point as dishabituation.

These characteristics, and more specifically the dishabituation process, served as a basis for the analysis of response decre-

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ment in the present study. Once the decrement criterion was achieved, the effects of a classical conditioning paradigm were investigated.

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DESCRIPTION OF THE BEHAVIOR

The aggressive display of the game cock is similar to that of domestic fowl (Wood-Gush, 1956; 1957) and jungle fowl (Kruijt, 1964), but the similarity between sexual and aggressive display observed by Wood-Gush is less apparent in the game cock. The aggressive display, elicited by the physical proximity of another game cock, or by a mirror image, consisted of (1) facing the stimulus, (2) assuming a slight crouch with the legs bent and the wings dropped slightly, (3) extending the neck and raising the hackle feathers (around the neck), and (4) occasionally bobbing the head back and forth. The hackle erection was the most discriminable component of the display and appeared to be the most consistent. Because of this quality, hackle erection was used as an index of aggressive display in the present study.

Since the magnitude of the hackle response varied, an erection of approximately 30 degrees or greater constituted a response (the hackle feathers frequently erect 80-90 degrees).

Reliability checks between the experimenter and two other observers were run at the beginning of Experiment I, and between sessions 40 and 56 of Experiment II. Agreement between observers as to the occurrence of a hackle response was 100% using the above criterion.

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EXPERIMENT I: Response Decrement

The purpose of this experiment was to demonstrate a decrement in unconditioned aggressive display to a mirror, and to study the effect of a dishabituation procedure on this behavior.

METHOD

Subjects

A game cock, that had been exposed to a mirror image approximately 1,400 times in previous experiments, served as the experimental subject. Unconditioned aggressive display to a mirror had decreased to almost zero for this bird, but responding to a "real" bird showed no sign of waning. A second game cock served as a "target" for the experimental bird.

Both game cocks were approximately 3-4 years old at the start of the study, and were housed separately in 3 X 3 X 3 feet wire pens in the laboratory. The sides of the pens were covered with wallboard to prevent visual contact between the birds. The floor of each pen was covered with a thick layer of straw and general lighting was present 24 hours per day. Water was available at all times and food was provided at the end of the session.

Apparatus

A 48 X 23 X 24 inch conditioning chamber was constructed of 3/4 inch plywood. A 1/2 inch plywood partition divided the chamber

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into two compartments, each measuring 24 X 23 X 24 inches, with the front of each compartment covered with 1/2 inch hardware cloth to permit observation. A 16 X 16 inch square opening in the partition was covered on each side by a guillotine door, held in place by plexiglas railings. The left guillotine door was 3/8 inch plywood and a 14 X 14 inch mirror was fastened to the right side of this door. The right guillotine door was 1/8 inch masonite. Both doors were operated independently of one another from outside the experimental room by a manual cable-pulley system. A 40 watt bulb was enclosed above the right compartment and provided general illumination to that side as well as directing light onto the mirror when it was exposed. The left compartment was illuminated by general room lighting and was somewhat darker than the right compartment. The experimental room was insulated for sound and a constant "white" masking noise was always present.

Procedure

Two types of stimuli were presented in various sequences with a 60 second intertrial interval. "Mirror" trials consisted of raising the right guillotine door for 5 seconds, thus exposing the mirror for that duration of time. The "target" bird was presented by raising both guillotine doors simultaneously for 2 seconds. The experimental bird (subject 2) was always placed in the right compartment and the target bird was always in the left. Subject 2 could therefore be exposed to either the mirror or the target bird. Neither bird was restrained in the chamber.

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Phase I: Mirror presentations were presented in blocks of five trials. If a hackle response occurred to any of the mirror presentations the session was terminated at the end of that block. If there were no responses in a block of five mirror trials, a target trial was run, followed by another block of five mirror trials. This sequence continued until a response occurred to the mirror, or until four blocks of mirror trials had been completed. A session always started and finished with mirror trials.

Phase II: The second phase was similar to the first, but an increasing schedule of target trials was employed. On the first occasion (no response to a block of five mirror trials), one target trial was presented, on the second occasion two target trials, and so on up to five target trials. A session was terminated either by a response to the mirror, or when the five target trial - five mirror trial schedule was reached.

Phase III: Three sessions were run in which a target trial was randomly placed in a block of five mirror trials. In the first session the target trial came between the second and third mirror trials. In the second session it came between the first and second mirror trials, and in the third session it came between the third and fourth mirror trials. Random placement was determined by a table of random numbers (Edwards, 1958).

The experimenter observed the birds from outside the experimental room through a one-way glass, and manipulated the guillotine doors from this location. Observations were recorded by the experimenter on special data sheets at the end of each trial.

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RESULTS AND DISCUSSION

The frequency of hackle responses to the mirror during all three phases are shown on a cumulative graph in Figure 1. The arrows indicate the point at which a target trial was presented, and the numbers below the arrows in phase II indicate the number of trials presented. In all cases, the experimental bird (Subject 2) displayed hackle erection and attack toward the target bird. However, it is apparent that the presentation of the target bird did not effect the responding of the experimental bird to the mirror. Only 15 hackle responses were observed during 155 mirror trials.

The only significant responding to the mirror occurred during the first session of the experiment, and this may have been the result of a long recovery period. Subject 2 had not been exposed to a mirror for a month prior to the start of this experiment. However, when the bird was not exposed to a mirror for a five-day period (between trials 50 and 51), subsequent recovery was very weak. Since Clayton and Hinde (1968) reported 67% recovery of aggressive display in Siamese fighting fish after a two-day recovery period, the data from the present study suggest a more permanent decrement.

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EXPERIMENT II: Reinstatement of Display Through Conditioning

Since the presentation of a target bird failed to reinstate responding to the mirror in Experiment I, a classical conditioning procedure was employed. Instead of presenting the target stimulus as a separate trial, the presentation of the target bird was paired with the presentation of the mirror. The purpose of this experiment was to investigate the effectiveness of a Pavlovian paradigm in reinstating aggressive display to a mirror.

METHOD

Subjects and Apparatus

The subjects and apparatus used in Experiment II were the same as those reported in Experiment I.

Procedure

The subjects were placed in the chamber in the same manner as in Experiment I, with Subject 2 in the right compartment and Subject 3 as the target bird in the left compartment. Conditioning trials were run with the mirror (Conditioned Stimulus) presented by raising the right guillotine door. Three seconds later the target bird was presented by raising the left guillotine door (with the mirror on it). The Unconditioned Stimulus (target bird) was presented for two seconds, and the trial was terminated by lowering both guillotine doors simultaneously. The intertrial interval was 60 seconds, and

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five trials were run daily.

When the response was elicited by the mirror at a 100% frequency for a number of sessions, extinction was introduced whereby the target bird was no longer presented. The extinction criterion was two consecutive sessions (10 trials) without a response. When the extinction criterion was met reacquisition and a second extinction series were run to determine if the effect of these two processes would occur more rapidly the second time.

RESULTS AND DISCUSSION

Hackle responses to the mirror (conditioned responses) are plotted cumulatively in blocks of 15 trials in Figure 2. The first three blocks show the last nine sessions of Experiment I, and represent a baseline or pseudo-conditioning control. Only two responses occurred to the mirror during these 45 trials. This indicates that the mirror was not an effective eliciting stimulus prior to conditioning.

The probability of a hackle response is the number of responses observed in 15 trials divided by 15. Hackle response conditioned rapidly to the mirror and reached a .93 probability in the second block of acquisition trials, and a 1.00 probability in the third block. This probability of displaying to the mirror remained high throughout acquisition and was 1.00 during the last three acquisition blocks (45 trials).

During the first extinction phase, where the target bird was no longer presented, responding decreased gradually over 12 days.

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The probability of responding during blocks 15, 16, 17 and 18 was .93, .53, .20 and .06 respectively. Although it is not indicated in Figure 2, the extinction criterion of two consecutive sessions without a response was met. The one response in block 18 occurred in the first five trials of that block.

Reacquisition was more rapid than initial acquisition; the subject responded at .80 probability during the first block of reacquisition trials (block 19), and only .53 in the first block of initial acquisition (block 4). The second block of reacquisition was also higher than the second block of initial acquisition (1.00 to .93), but as indicated in Figure 2, block 20 represents 10 trials. Extinction following reacquisition was twice as fast as the initial extinction. The extinction criterion was met in six days and the probability dropped from .67 in block 21 to .06 in block 22.

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GENERAL DISCUSSION

A decrease in the effectiveness of an unconditioned eliciting stimulus after repeated presentations is not an unusual finding. However, the seemingly permanent decrement demonstrated in Experiment I is somewhat unusual in that an habituated response generally shows at least partial recovery within a 24 hour period (Hinde, 1961; Clayton and Hinde, 1968). Hinde (1961) differentiated between long-term and short-term decremental effects, but at least partial recovery was observed to occur in both cases.

One explanation for the permanence of response decrement in the present study may lie in the repeated habituation process described by Thompson and Spencer (1966). When habituation training and recovery are repeated, habituation occurs more and more rapidly. If this process were to be extended, it would seem possible to reach a point where recovery was no longer effective. The extension of this process appears similar to another characteristic described by Thompson and Spencer: additional habituation training after the response has decremented results in slower recovery. Since the aggressive display of the subject in the present study had decreased prior to the start of this study, it is possible that both of these processes had produced the extreme decrement. The fact that responding did recover briefly after the one month recovery period (at the start of Experiment I) seems to support this position, but certainly needs further investigation.

The reinstatement of aggressive display to the mirror in

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Experiment II is somewhat unique in that it demonstrates a method of maintaining an unconditioned stimulus as an eliciting stimulus, regardless of habituation. The habituation studies cited above demonstrated partial recovery of behavior through a recovery period, or dishabituation, but the conditioning method employed in the present study produced complete and lasting recovery as long as the two stimuli (mirror and target bird) were paired. It appears that hackle erection could be maintained with this procedure as long as the target bird remained an effective elicitor, and there is no indication that responding to a real bird will habituate.

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FIGURE LEGEND

Figure 1. Hackle responses to the mirror are plotted cumulatively for phases I, II and III. The arrows indicate where a target trial was presented, and the numbers below the arrows in phase II indicate the number of target trials presented.

Figure 2. Hackle responses to the mirror (CS) are shown cumulatively in blocks of 15 trials. The first three blocks represent the last 45 trials of Experiment I. The remaining blocks show conditioning and extinction for Experiment II. Block 20 (a) represents a block of 10 trials instead of 15.

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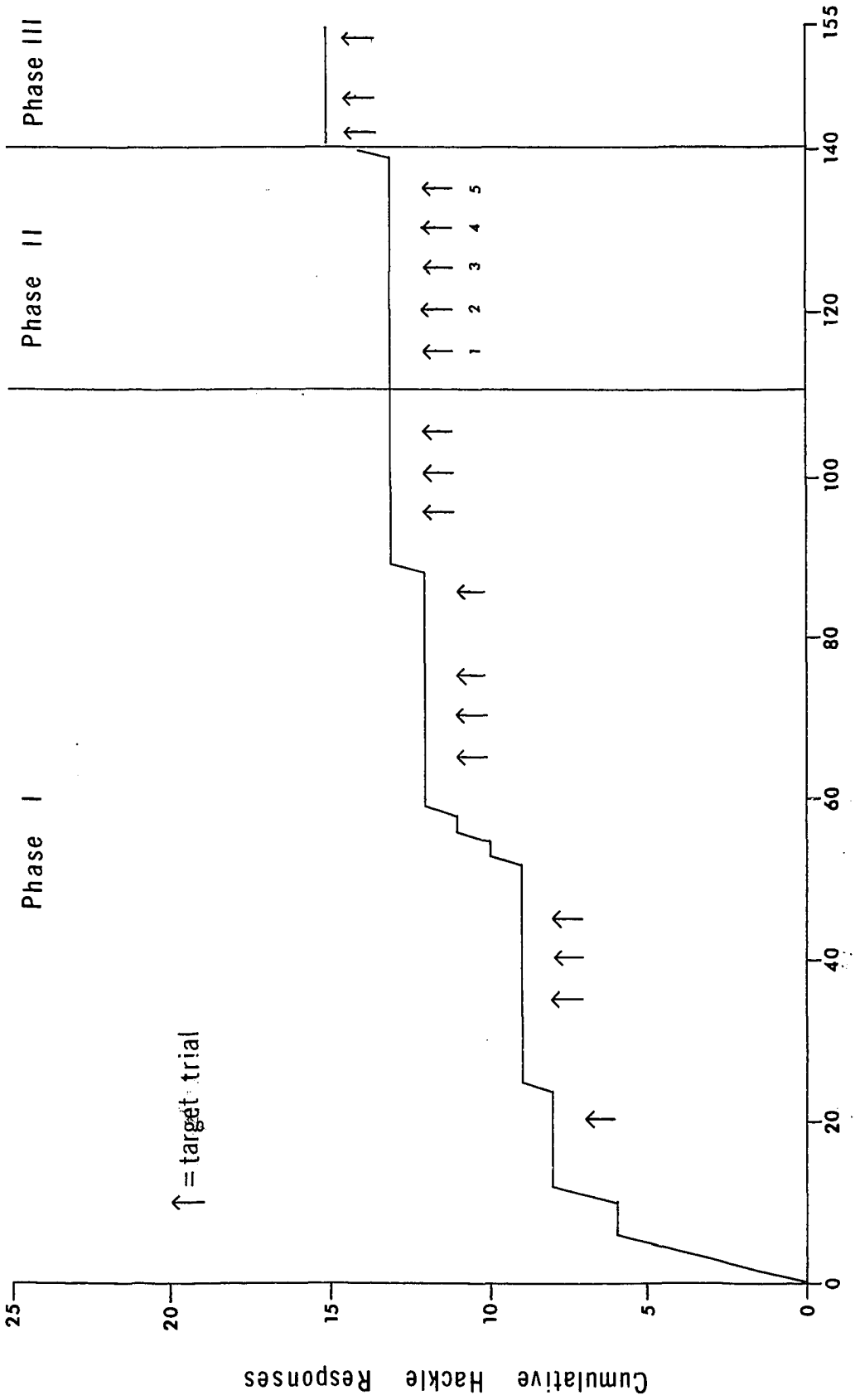

FIG. 1

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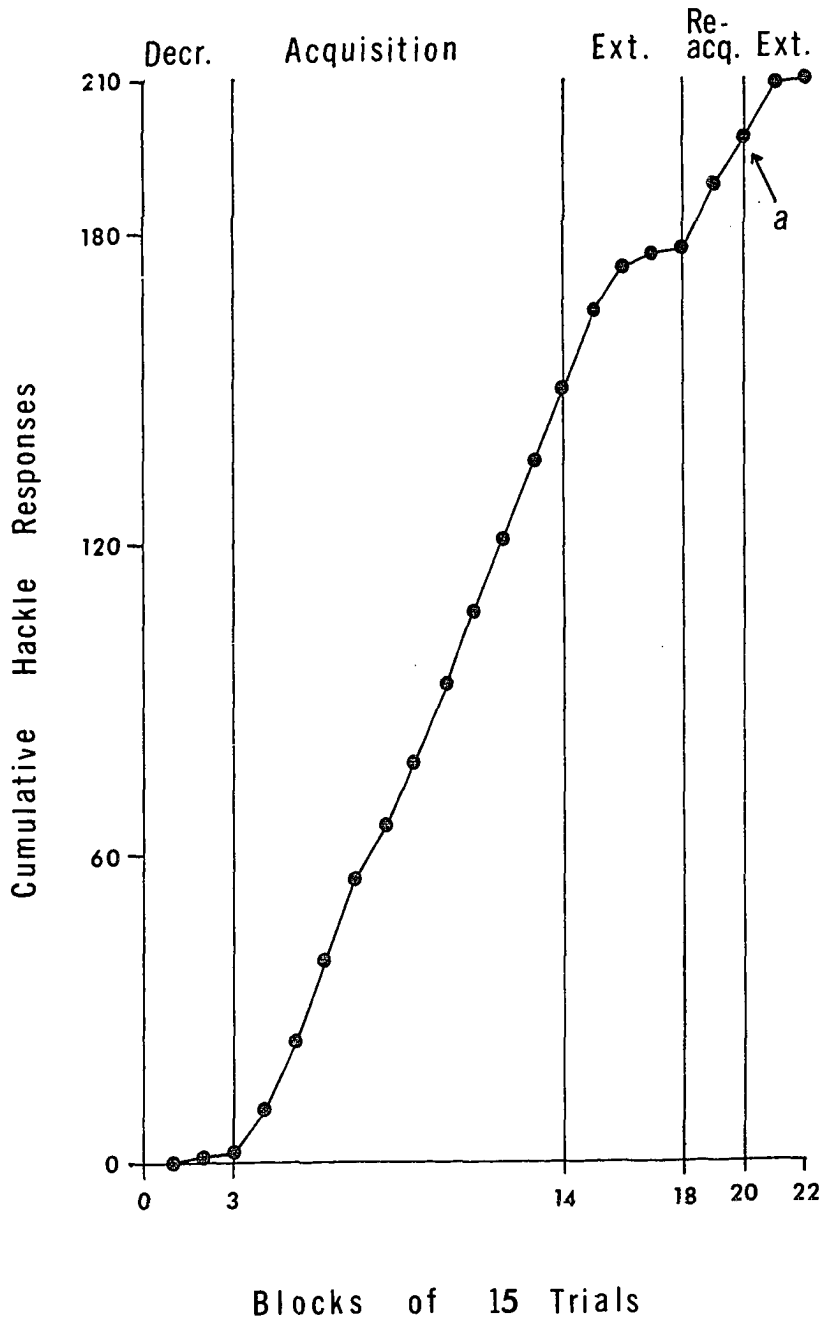

FIG. 2

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