The tonic immobility reaction in chickens: Response characteristics and methodology*

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A total of 379 chickens were run in five studies to assess the effect of different procedures on tonic immobility and to measure some of the response components of the reaction. The optimal period of manual restraint, by way of producing the most durable immobility response, was found to be 15 sec, and pretest holding conditions were shown to exert a significant influence on the reaction in naive birds. Birds who defecated during immobility or shortly after termination, remained immobile longer than comparable nondefecators. Duration of eye closure and latency of vocalization were also found to be good predictors of the duration of an immobility episode.

The tonic immobility or hypnotic reaction in animals is well documented (Ratner, 1967) and has been found to obtain for many different vertebrate and invertebrate species. The animals most commonly used in studies of animal hypnosis have been chickens, rabbits, and frogs. Unfortunately, many reports are based on a small number of Ss, and there is a lack of quantitative data on the different response components of the reaction. For example, while numerous investigators report such things as vocalization (Salzen, 1963) and eye closure (Prestrude & Crawford, 1970) during immobility, attempts to quantify their relationship to the reaction have not been made.

The present series of studies represents an attempt to obtain data on the duration of self-paced immobility, to evaluate the effect of different procedures, and to investigate the relations among various other behavioral components of the immobility episode in naive domestic chickens.

GENERAL METHOD

Subjects

The Ss consisted of Production Red chickens (*Gallus gallus*), obtained from a local hatchery at 2 days of age. All birds were housed in commercial brooders with thermostatically controlled temperature regulation, and were given continuous access to Purina Chick Chow (Growena) and water. The photoperiod in effect during rearing consisted of approximately 14 h of natural and artificial light per day.

Apparatus

The apparatus was located in a separate test room and consisted of a three-sided induction box placed on

top of a table. The induction box, which was constructed out of plywood and measured .35 m high x .61 m wide, was used to reduce extraneous visual stimulation. Similarly, the window in the experimental room was covered with tin foil and illumination was provided by fluorescent overhead lights. The level of illumination in the induction box was approximately 20 fc, as measured by a Sekonic Incident light meter (Model L-28C). Hunter Klockounter timers (Model 120 A), wired to silent single-throw switches, were used to record the duration of immobility. Large cardboard boxes, perforated with holes for ventilation and light, were used to transport groups of chicks from the brooders to the test room and as pre- and posttest holding containers situated outside the experimental room. The bottom of each box was covered with paper, and food was available in both boxes.

Procedure

Testing was initiated when birds were 3-4 weeks of age and consisted of gently holding a chick in the standing position for a few seconds before abruptly placing the S on its right side in the induction box and applying manual restraint for 15 sec. During the restraint period, the E held one hand over the bird's head and neck, with the other hand on its body, and gradually released his grip to correspond with the end of the 15-sec induction period. During the resulting reaction, the S would characteristically remain on its right side in an apparent state of physical immobility and unresponsiveness and occasionally show leg tremors and eye closure. Duration of immobility was measured from the time lateral restraint was terminated until the chick rose to its feet. Each bird was given only one trial. During the immobility episode, the E sat quietly on a chair approximately .9 m from the bird and

avoided making direct eye contact with the S.

RESULTS AND DISCUSSION

Duration of Restraint

The common denominator of most techniques designed to elicit the immobility reaction is some form of manual restraint. In many studies with chickens the standard period of restraint has been 15 sec (e.g., Gilman, Marcuse, & Moore, 1950). However, this 15-sec period seems to have been used more by virtue of historical precedence than on the basis of empirical data. For example, Simonov and Paikin (1969) report that 45 sec of restraint produces the most prolonged response in rabbits.

In an attempt to establish which interval of restraint would produce the most durable reaction in chickens, we conducted an experiment employing 80 naive chicks. The chicks were assigned randomly to one of four groups and, according to group designation, were restrained for 5, 15, 30, or 60 sec, and the resulting duration of self-paced immobility was recorded.

Figure 1 depicts the median duration of immobility as a function of the duration of manual restraint. As can be seen, 15 sec of restraint appears to be optimal by way of providing for the most durable reaction. To normalize the data for purposes of analysis, a transformation of the form $\log_e(X+1)$ was performed on the raw data, and the resulting scores were analyzed by a between-groups analysis of variance. The overall effect of duration of restraint proved to be statistically significant ($F = 2.73$, $df = 3/76$, $p < .05$).

Normative Data

Since 15 sec of restraint appeared optimal, the next attempt was to collect normative data on a large number of 3-week-old chicks using this procedure. The only other normative data based on a substantial number of

Fig. 1. Median duration of self-paced immobility as a function of length of the restraint period.

*Appreciation is expressed to W. A. Montevecchi and D. P. Murphy for help in data collection.

Fig. 2. Number of chicks remaining immobile for varying intervals of time following their first experience with manual restraint.

birds is that reported by Ratner and Thompson (1960), who imposed a ceiling of 4 min on the duration of immobility.

Figure 2 represents the data obtained from 85 naive chicks in terms of the frequency of Ss remaining immobile for various intervals of time following their initial exposure to restraint. Only 15.3% of the birds failed to become immobile. The mean duration of self-paced immobility for the data in Fig. 2 was 577.79 sec, with a standard deviation of 712.59 sec. In the absence of other procedures, the immobility reaction in chickens is an exceedingly variable response which presents formidable problems in research design.

To circumvent this problem, we have devised a procedure for habituating birds prior to the introduction of experimental variables (Gallup, Nash, Potter, & Donegan, 1970). The use of a habituation criterion also reduces the problem of a potential ceiling effect which might otherwise mask the influence of procedures designed to enhance immobility (Gallup, Creekmore, & Hill, 1970). The habituation procedure involves repeatedly restraining a bird over days until some low level of responsiveness is achieved. Usually, birds are manually restrained on their right sides for 15 sec, five times in succession each day, until they remain immobile for 60 sec or less on the first habituation trial for 2 consecutive days. If, on any habituation trial, a S remains immobile for longer than

60 sec, the response is externally terminated by the E by means of gently prodding the S. To preclude the problem of punishing the chick for rising to its feet by administering another immediate induction, we generally allow for a 2- to 5-min intertrial interval between successive inductions.

We consistently find that the use of habituation criteria provides for a more homogeneous population of Ss prior to the introduction of independent variables and also makes for a preparation which is more sensitive to procedures designed to produce changes in arousal (e.g., Gallup, Nash, & Ellison, 1971).

Pretest Conditions

In a number of studies with chickens it has been common procedure to use cardboard boxes as pre- and posttest holding containers (e.g., Ratner & Thompson, 1960). However, we have obtained data which point to pretest holding conditions as being a potent source of variation in naive, unhabituated birds.

As a follow-up to the initial attempt to gather normative data, 50 3-week-old chicks were run under conditions identical to those employed previously, except that each bird was hand-carried by the E from the brooder to the testing room instead of being transported in cardboard boxes. The mean duration of resulting immobility was a surprisingly low 74.76 sec.

To check on the possible influence

of being temporarily contained in a cardboard box prior to restraint, the same birds were divided randomly into two groups of 25 Ss each, and were run for a second time 2 days later. The birds in one group were individually carried to the testing room, which involved traversing a distance of approximately 19.2 m, with an average elapsed carrying time of 57.5 sec. Upon arrival at the induction site, the S was immediately restrained for 15 sec. In the other group, chicks were placed in a large cardboard box before being transported as a group to the testing area. The box also served as a pretest holding container situated outside the testing room.

The mean duration of immobility for Ss which were hand-carried to the test room was 29.36 sec, while birds transported in the cardboard box remained immobile for 254.96 sec, and this difference proved to be significant ($F = 10.53$, $df = 1/48$, $p < .005$). It is not immediately apparent why temporary housing in a cardboard box should exert such a profound effect on subsequent immobility reactions, and studies are being planned to investigate this question. One obvious possibility relates to the findings on duration of restraint. Since it took about 57 sec to carry a bird to the test room, this would necessarily entail manual restraint and if added to the standard 15-sec induction period would make for a less than optimal restraint period (see Fig. 1).

Eye Closure and Vocalization

Ratner and Thompson (1960) noted occasional vocalizations and eye closure in their immobilized chickens but felt that their occurrence was unrelated to the termination of immobility. In an attempt to document and quantify the relationship of these characteristics to immobility, we ran another study.

The Ss consisted of 64 naive chicks run identically to those in the normative data study. Thirty-two of the birds showed some sustained eye closure during their first immobility reaction, with the mean cumulative duration of all eye closures being 290.22 sec per bird. The mean duration of immobility for Ss showing eye closure was 1,017.81 sec, as compared to 137.28 sec for chicks who failed to close their eyes, and a product-moment correlation between the total duration of eye closure and immobility yielded a value of .908 ($t = 17.04$, $df = 62$, $p < .001$). Thus, eye closure would seem to be a good predictor of the duration of an immobility reaction.

Latency of the first audible vocalization during immobility also appeared to be related to the duration

of the reaction, with a correlation of .819 ($t = 11.24$, $df = 62$, $p < .001$). For most birds, the initial phase of the immobility episode was characterized by an almost complete suppression of vocal behavior, with a mean vocalization latency of 333.42 sec. This finding is of particular interest in light of the fact that comparable chickens, when removed from their brooder mates for the first time and placed in a comparable situation without restraint, began vocalizing with an average latency of 68.7 sec ($N = 60$). Furthermore, it is important to note that distress calls, which are noticeably different from other chick vocalizations, either did not occur or occurred only just prior to the termination of the immobility response.

Defecation Data

Defecation also appeared to be related to the durability of the reaction. Using 40 naive chicks, the mean duration of immobility for those defecating either during immobility or within 20 sec after termination, was 1,109.5 sec ($N = 10$), while for the remaining birds the mean was

358.43 sec. Using a point-biserial correlation, a value of .458 ($t = 6.17$, $df = 38$, $p < .001$) was obtained between the duration of immobility and presence or absence of defecation.

The fact that prolonged immobility reactions are related to defecation would seem to implicate an arousal factor. To the extent that defecation can be used as an index of emotionality, these data along with others' (e.g., Gallup, Nash, Potter, & Donegan, 1970) are quite compatible with the idea that fear underlies tonic immobility in chickens. Similarly, the fact that vocalization and the tendency to peck at small extraneous objects occur only during the terminal phases of immobility could be viewed as evidence for waning fear, leading eventually to self-paced termination of the reaction.

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