

MEASUREMENT OF COMPLACENCY IN BLACKBIRDS

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ABSTRACT

The complacency—agitation continuum in Blackbirds was studied by recording their behavior in an observation cage. A scoring pattern with a reliability of 0.91 was developed. Cowbirds are the most complacent species and Starlings the most agitated. Grackles and Red-wings are intermediate. Individual differences within each species are demonstrated. It is probable that the trait under investigation is composed of a number of factors and that a factor analysis of several tests like the present one will throw light on avian personality structure.

INTRODUCTION

The present study is the second in a series of investigations of avian personality (Burt and Giltz, 1969) and was prompted by some observations of birds in a large decoy trap. Brown-headed Cowbirds (*Molothrus ater*) spent much of the time sitting quietly on the perches which were provided, while Starlings (*Sturnus vulgaris*) flew back and forth or clung to the sides of the trap. These behaviors suggested differences in some dimension of personality that might be amenable to quantitative study. This dimension, for purposes of discussion, is termed the "complacency-agitation continuum". It was approached by placing birds individually in a small observation cage and recording their behavior systematically.

The main publications describing experimental work on bird personality deal with peck order and the differences in aggressiveness basic to that phenomenon (Ellis 1966). Otherwise the literature in this field is limited to anecdotes or to observations under "natural" rather than "laboratory" conditions. Robins differ individually in their tendency to attack a stuffed model (Lack 1964). An occasional bird is sufficiently unstable emotionally to die of fright (Peterson 1963, p. 138). Species may differ in tameness; one species of penguin attacks every man that approaches, while another species stands still (Murphy 1936). Some Carolina wrens handled repeatedly by a bander utter distress calls every time while others remain consistently silent (Norris 1965).

Meticulous observers of bird behavior such as Tinbergen and Lorenz indicate by their terminology an awareness of individual or species differences in personality. In describing individual birds, they use words or phrases such as: "self possessed", "self assertive posture", "strong fighting urge" (Tinbergen 1961); "the boldest" (Tinbergen 1954); "intense aggressiveness" (Tinbergen 1953); "personal courage", "self assurance" (Lorenz 1952). With reference to species differences, the phrases are: parrots are "vivacious"; parrots and corvines experience "boredom" (Lorenz 1952); Shel-drake mothers are "timid", while Eider-duck mothers are "fierce" (Tinbergen 1961). There is no mention of "complacency" as such. Obviously there is need for experimental quantitative work in this field, but the investigation of complacency-agitation must proceed *de novo*.

Birds for the investigation were available in connection with a banding program implemented by a large decoy trap described elsewhere (Burt and Giltz 1969).

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In addition to the Cowbirds and Starlings mentioned above, Red-winged Blackbirds or Red-wings (*Agelaius phoeniceus*) and common Grackles (*Quiscalus versicolor*) were included in the study.

METHOD

The observation cage was made of hardware cloth with $\frac{1}{2}$ " mesh and was 18" x 24" and 24" high. A perch consisting of a $\frac{1}{2}$ " dowel rod was 12" above the floor. The cage was placed on a bench approximately 20 feet from the observer. The latter sat inconspicuously behind a car watching through the two rear windows or in cold weather sat in a small utility building looking out the window. As far as could be judged, the birds paid no attention to the observer. Approximately 30 seconds elapsed between the placing of the bird in the cage and the beginning of the observation. All the observations were made in the early afternoon.

A bird was observed in the cage for a period of 100 seconds followed immediately by a second trial of 100 seconds. With two trials it was possible to compute the reliability of the test. As far as the bird was concerned, it had a continuous test of 200 seconds. This is like the standard practice in psychological tests with humans, in which the test is arbitrarily split at the middle, and the first half is then correlated with the second half. A tape recorder was used during the tests to note items of behavior such as moving from the floor to the perch or to the left side of the cage. Subsequently the tape was decoded so as to indicate to the nearest second when each response occurred.

This procedure yielded several items of score which could be combined into a single score to indicate the bird's position on the complacency-agitation continuum. Several scoring patterns were considered, but discarded on the basis of inadequate reliability. The pattern finally adopted was

$$C+T+S+FA+W, \text{ where}$$

C = number of changes of location, such as from perch to floor,

T = number of 180° turns made on the perch,

S = number of times the bird stepped or hopped sidewise on the perch,

FA = time (in seconds) active on the floor, and

W = total time on the walls of the cage.

A small score indicates greater complacency and a large score greater agitation.

Reliability

In developing a psychometric device, the first consideration is its reliability. This was determined in the present case by computing the correlation between the two trials using a sample of 550 birds of the four species indicated earlier. Products-moments correlation coefficients (r) were used throughout the study. The reliability is 0.83. However this represents the reliability of a test of 100 seconds duration, usually termed "split-half" reliability. In all subsequent analysis of the data, the scores for the two trials were totalled to constitute a 200-second test. The reliability of this longer test may be determined by substituting 0.83 for r in the Spearman-Brown formula $2r/1+r$ (Dunlap and Kurtz 1932, p. 88). The result is a reliability of 0.91 for the 200-second test. This compares favorably with the reliability of tests used in schools and industries.

Species Differences

Frequency distribution curves for the four species appear in Figure 1. Frequencies were tabulated for 20-point intervals of score and were then converted to percent of the total frequency for a given species. These percentages were plotted on the ordinate against the complacency scores on the abscissa. Cowbirds obviously are the most complacent and Starlings the least, with Grackles and Red-wings intermediate.

The means and standard deviations for the four species appear in the upper half of Table 1. A t-test applied to all possible differences between means indi-

TABLE 1
Species and Sex Differences

	Number of Birds	Mean	Standard Deviation
Cowbird	127	65	56
Grackle	148	133	59
Red-wing	166	137	63
Starling	109	160	33
Male cowbird	92	67	57
Female cowbird	35	59	50
Male red-wing	126	144	64
Female red-wing	40	116	56

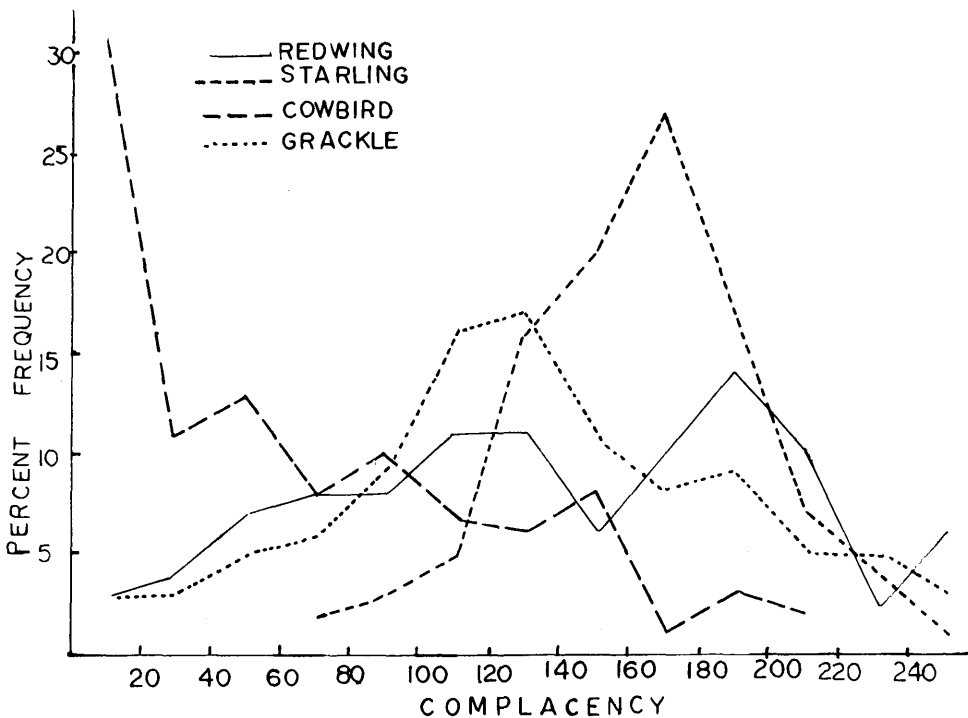


FIGURE 1. Frequency Distributions of Complacency Scores.

cates that Red-wings and Grackles do not differ significantly ($p > 0.05$) but that all the other differences are significant ($p < 0.01$).

With the Cowbird distribution curve so markedly skewed, it is inadvisable to rely entirely on a *t*-test for comparing the Cowbird mean with those of the other species. The differences in the actual *distributions* may be checked with a chi-square test. For Cowbirds *vs.* Grackles, chi-square is 81, where only 30 is needed for significance at the 1% level. The corresponding figures for Cowbirds *vs.* Red-wings are 87 and 21, and for Cowbirds *vs.* Starlings 126 and 26. Thus the Cowbird distribution differs significantly from all the others.

Robins (*Turdus migratorius*) and Mourning Doves (*Zenaidura macroura*) were trapped occasionally and checked in the observation cage. Their mean scores

are 41 and 35, respectively, which indicates greater complacency than the Cowbirds. Although these samples are small, their means do differ significantly from those of the other four species ($p < 0.01$).

Sex Differences

The lower half of Table 1 gives data for the two sexes of Cowbirds and of Red-wings. With both species the females are more complacent on the average than the males. However for the Cowbirds the difference is not significant ($p > 0.05$). For the Red-wings it is significant between the 5% and 1% levels. It is possible that a high degree of complacency is advantageous to a female bird in incubating eggs and raising young, and contributes to survival of the nestlings. Thus a sex difference might develop in the course of evolution. It is to be noted that the female Red-wings in the present study have greater complacency than the males, but the female Cowbirds, with no incubation and nest maintenance activities, do not differ from the males in this trait.

Individual Differences

Evaluation of intra-specific differences in complacency by the analysis of variance technique was feasible only with the Grackles. Some of these birds entered the trap repeatedly and were tested on each occasion. Thus there was available a sample of 21 Grackles, which were tested from 3 to 12 times each. The other species did not re-enter the trap with sufficient frequency to implement such an analysis. With the 21 Grackles, the ratio of the variance between birds to the variance within birds—the F-ratio—was 4.3, whereas only 2.05 is needed for significance at the 1% level. Obviously the individual birds were not a random sample from the same population as far as complacency is concerned.

Another approach would have been to compute the mean score for any bird and compare it with the mean for every other bird. This procedure appears scarcely necessary inasmuch as the analysis of variance establishes in a single operation the existence of intra-species differences in complacency. A further indication of substantial individual differences for all the species may be noted in the spread of the distribution curves in Figure 1 and the magnitude of the standard deviations in Table 1.

Other Variables

In addition to the inter-specific and intra-specific variations, it is possible that other variables may influence the complacency scores. Some of these may actually constitute contaminating variables. The temperature variable was approached by pairing each complacency score with the temperature (in shade) at the time of testing and computing the correlation for each species. With three species these correlations were negligible: Cowbird 0.10, Grackle 0.16, Starling 0.17. These coefficients do not differ significantly from a zero correlation ($p > 0.05$). With Red-wings there is a negative correlation of 0.33, which suggests a tendency toward greater complacency during higher temperatures. However, while this correlation does differ significantly from zero ($p < 0.01$), so that there is actually some relationship, the "forecasting efficiency" of an r of this magnitude is low. In predicting complacency score on the basis of temperature, the error of prediction would be only 5% smaller than the error if one guessed at the complacency score with no knowledge of temperature. Thus it appears that complacency-agitation is little influenced by temperature.

There are seasonal variables, such as mating, nesting, moulting, and migrating, that conceivably may influence the data. A longitudinal study of individual birds was not feasible. However, for each species, the mean complacency score was computed for each month. Many of the monthly samples are too small to warrant conclusions, but a few trends are apparent. Cowbirds are more com-

placent in April than in August, but the means do not differ significantly ($p > 0.05$). Grackles, on the other hand, are more agitated in May (mean score 149) than August (mean 119), the difference being significant between the 1% and 5% levels. Red-wings show a similar trend, with a mean of 170 in May and 121 in July, and a significant difference ($p < 0.01$).

It is possible that this greater agitation of Grackles and Red-wings in the spring is related to mating, territorial, and nesting factors. Why it should characterize only those two species is not clear. Much more data should be gathered throughout the year before drawing conclusions. This possible fluctuation during the year might be a contaminating variable in the present study if, for example, one species were sampled primarily in the spring and another species primarily in the summer. However this was not done; the birds were tested as they came throughout the year.

Diurnal variables may possibly influence complacency scores. There is an extensive literature on circadian and other physiological rhythms. These were not explored in the present study. All the testing was done in the early afternoon, so that diurnal factors were not a contaminating variable in the present case.

Another variable is the observation cage itself. It is a new situation for the bird and the confinement as such may have some influence. However if the cage does add an increment of agitation, it is presumably fairly constant from bird to bird. Thus, it is not believed to invalidate the comparisons between species or between individuals.

Relation to Aggressiveness

In another study (Burt and Giltz 1969), a technique was developed for measuring aggressiveness by means of a rating scale applied to a bird held in the hand and manipulated in a standard fashion. This scale has a reliability of 0.82. It was applied to all birds in the present study, prior to putting them in the observation cage. The correlations between the aggressiveness ratings and the complacency scores for each of the species are as follows: Cowbird—0.17, Grackle—0.09, Red-wing 0.14, and Starling—0.04. Thus these two traits are essentially independent or orthogonal.

DISCUSSION

There still remains the question of just what is being measured by the observation-cage technique. At the human level, a personality trait may not be a completely unitary type of behavior, but may comprise several components or factors, which are identified ultimately by the technique of factor analysis. Some of the behavior of birds in the observation cage likewise hints at the possibility of components of the trait under investigation. Starlings, for example, spend more time on the walls of the cage than do the other species—an average of 70 seconds, as compared with 11 seconds for the Cowbirds. This suggests an escape tendency as a possible component. Turning around or hopping sidewise on the perch may indicate restlessness or uneasiness. "Pacing" the floor of the cage may be an expression of excitement. However these items are suggested merely as possibilities that may emerge ultimately from a factor analysis.

At the moment, the term "complacency-agitation continuum" still appears as good as any, but it is subject to modification in the light of subsequent research. As other psychometric techniques are developed in this field, personality traits will be discovered that are interrelated to varying degrees. The orthogonal relation between the aggressiveness ratings and the present test is a case in point. Using these new psychometric techniques, a factor analysis of the matrix of inter-correlations of such traits will afford a better basis for speculation as to the nature of the factors measured. An extension of this approach should provide more insight into the structure of bird personality.

SUMMARY

Birds were placed individually in a small observation cage and watched from a distance. Five variables in their behavior were quantified with the aid of a tape recorder—changes of location, number of 180° turns in place, number of sidewise hops, time active on the floor, and time on cage walls. A scoring pattern combining these items has a reliability of 0.91. The dimension of personality involved is identified tentatively as a complacency-agitation continuum.

Distribution curves and mean scores indicate that Cowbirds are the most complacent and Starlings the least, with Grackles and Red-wings intermediate. While Grackles and Red-wings do not differ significantly, all the other differences between means are significant at the 1% level. Female Red-wings show significantly greater complacency than males (5% level).

Intra-specific differences are clearly demonstrated by the spread of the frequency distribution curves and the magnitude of the standard deviations and, in the case of the Grackles, by an analysis of variance for birds that were tested several times.

Temperature at the time of testing has little influence on complacency scores. There are indications that Grackles and Red-wings are more agitated in the spring than in the summer, but additional data are needed regarding seasonal fluctuations. The correlation of complacency scores with aggressiveness ratings for the same birds indicate that the two traits are orthogonal.

It is probable that the personality trait under investigation is composed of several factors. As more personality tests are developed and the results inter-correlated, factor-analysis techniques will afford greater insight into the personality structure of birds.

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