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The Assessment of Individual "Aggressiveness" in Pigeons by a Variety of Means

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Pigeons attack or threaten animate and inanimate targets. The assessment of their aggressiveness was studied by exposing them in their home cages to three different stimuli: the experimenter's hand, a live pigeon, and a rear-projected conspecific image when the birds were exposed to intermittent access to food. A positive correlation between the hand test and live pigeon test was evident, but no relationship between either of these responses and the response to a pictorial image was observed. These results combined with other ethological observations cast doubts on the usefulness of schedule-induced responses to pictorial targets in the assessment of the individual aggressiveness in pigeons, but suggest that the hand test is an adequate and reliable procedure for such evaluations.

Key words: pigeon, live target, pictorial target, attack, aggressive behavior, intraspecific aggression, schedule-induced aggression, irritable aggression

INTRODUCTION

Patterns of attack and the presumed levels of underlying aggressiveness can be very variable in both individual animals and humans. It is often difficult to quantify individual differences, probably because of the dynamic, multivariate nature of aggressive behavior as well as its undoubted dependence on a variety of situational variables [Ramirez, 1981]. Nevertheless, progress in our understanding of such activities depends on our developing reasonably simple but reliable methods of measurement. Some procedures proposed as indices of aggressiveness of individual pigeons are compared and contrasted here.

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METHODS

Nineteen adult homing pigeons (*Columba livia*) of unknown sex were used in these tests. Fourteen experimental animals were maintained at 80% of their normal weight, and a further five birds were used as targets and fed ad lib. All subjects had free access to water, and most had served in earlier instrumental conditioning experiments where they had learned to peck an illuminated key for food reward. Birds were housed in standard 50 × 40 × 30 cm individual cages separated by blinds to reduce visual contact. They were kept in a 12 h light–12 h dark light cycle and at a controlled temperature of around 18°C.

Testing Procedures Used

The hand test was performed while the animals remained in their home cages. The experimenter waved a hand in front of the cage for 15 sec and then introduced his clenched fist into it and followed the animals about with it for 30 sec. Several stereotyped behavioral patterns that birds habitually showed in this situation were recorded. An arbitrary score was allotted for the occurrence of each of these patterns according to the following convention: 1) Aggressive patterns: wing raising above the back = +1; wing slapping the experimenter's fist = +2; pecking the fist = +3; pushing against the fist = +4. 2) Avoidance patterns: leaning head and body away from the hand = −1; crouching against the floor = −2; running away, attempting to leave the cage = −3; attempts to fly away = −4. Sixteen such testing sessions were administered to each subject at a rate of one a day except weekends. An overall aggression index was calculated for each individual by multiplying the percentage of testing sessions in which a given behavioral component had been shown by the score corresponding to that response and algebraically summing these products over all eight response types. The two observers achieved a rating agreement of 88%. Further details relating to hand test procedure and the behavior showed by pigeons during the tests are given in Ramirez and Delius [1979 a,b].

The live target test was carried out in an operant testing chamber (Skinner box) measuring 38 × 38 × 38 cm. A 24-V, 2-W bulb affixed to the ceiling illuminated the chamber, while white noise (30 dB) served as sound mask. A shelf protruded from one wall into the chamber 5 cm above the floor. An electromagnetically driven hopper could be raised under a hole in the shelf to give the subject access to grain. There was a 2-cm translucent pecking key, back-illuminated with a 12-V, 0.5-W bulb coated with orange glass lacquer, 25 cm from the floor above the feeder; 10 cm to the left of the key and 6 cm above the floor, set in the same wall, there was a 5 × 5 cm opening through which protruded the head of a target live pigeon, continuously available throughout the session. Its body was restrained by a tight cloth jacket, and it rested on a foam rubber cradle outside the chamber. The target birds were systematically exchanged between sessions. A multiple schedule, with a 15-sec period in which reinforcement (2 sec access to grain) was given for every peck on the key (CFR schedule component) alternated with a 45-sec period where responses had no consequence (EXT schedule component), was programmed with digital electronic modules. Because of the potential risk of injury to the target birds, only a total of five daily 15-min sessions were administered to each subject. A mirror placed above the transparent ceiling of the chamber allowed the experimenter to observe the subject's responses. The responses on the key were recorded automatically; the aggressive contacts with target pigeon as well as other behaviors were recorded manually.

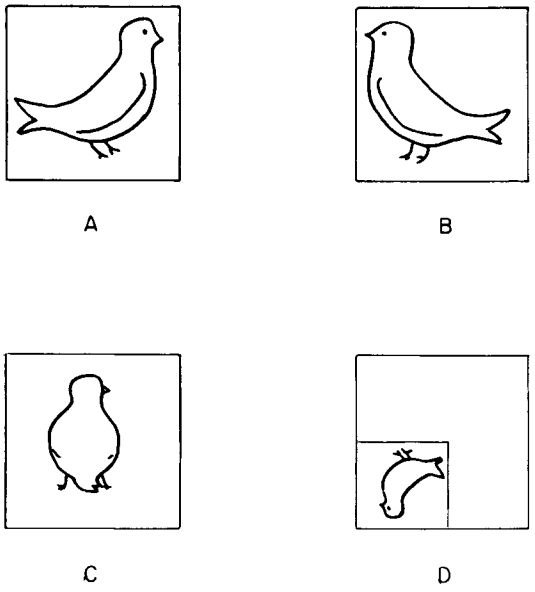

Fig. 1. Orientation of the different rear-projected conspecific images.

The slide target test was performed with the same apparatus and procedure except that target opening was replaced by a frosted panel measuring 15 × 11 cm, its lower edge being 5 cm above chamber floor. A slide projector was used to back project on it life-size color pictures of a pigeon in four different postures, including inverted and defocused ones (Fig. 1). The behavior of the subject was observed and recorded as described above, but contact responses to the projected panel exceeding approximately 10 g of force were additionally recorded automatically. Sixteen sessions of 15 min were conducted with this procedure with each bird. Each slide was presented on four occasions being projected in a random sequence in different sessions.

Statistical Treatment of Results

The aggression scores of hand and live target tests were contrasted using the chi-square test. The data were also assessed by Kendall's correlation coefficient test.

RESULTS

Preliminary testing served to select seven pigeons that responded predominantly aggressively and seven that responded mainly with avoidance. Two birds of the latter group developed aggressive behavior toward the live targets and began to attack the fist in subsequent hand tests; the remaining five responded negatively to both tests. Six of the nine finally aggressive animals (according to the hand test) also attacked the live restrained pigeon (Table I).

The aggressive responses toward the live target consisted of plumage fluffing, bow-cooing sequences including the corresponding vocalizations, and pecks directed at the throat, eyes, and face of the target, often gripping its beak with twisting motions. The target subjects did not counterattack, but attempted to avoid the attacks as best as they could.

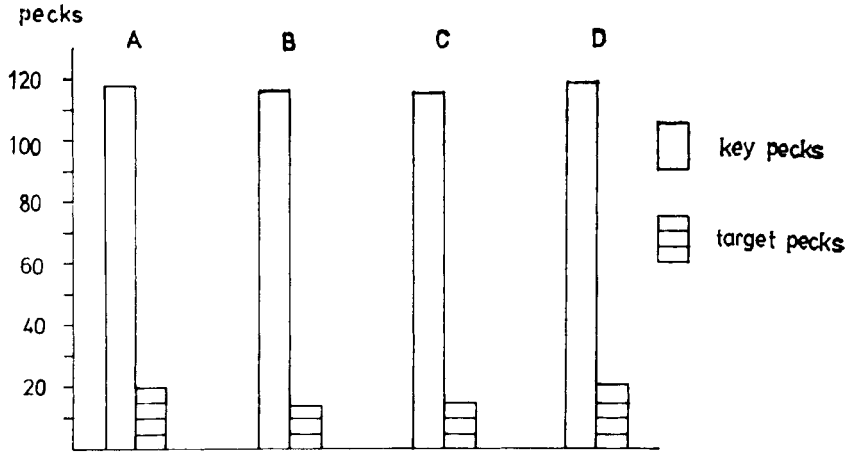

Fig. 2. Session means of the responses to feeding key and to slide targets during the projection of the four different images (letters correspond to those shown in Fig. 1).

TABLE I. Aggressiveness Rank of Individual Pigeons

Pigeon	Test score	Hand rank[a]	Test score	Live rank[a]	Test score	Slide rank[a]
128	+ 25	9	265	1	9	8
150[b]	+ 810	4	238	2		
131	+ 550	5	185	3	12	6.5
99	+ 915	3	162	4	0.25	13
160	+ 950	2	129	5	6	10
122	+ 380	7	97	6	0.5	12
70	+ 990	1	0	10.5	33	2
130	+ 415	6	0	10.5	12	6.5
132	+ 50	8	0	10.5	15	5
100	− 200	10	0	10.5	47	1
124	− 265	11	0	10.5	6	9
127	− 295	12	0	10.5	21	3
129	− 320	13	0	10.5	2	11
126	− 390	14	0	10.5	17	4

[a]Session means of the number of responses of each subject toward the target in the live and slide tests, as well as the composite aggression score in the hand test (this last is an arbitrary index explained in the text).
[b]Number 150 was not used for the slide test.

The response toward the target slide differed markedly from those aimed at the live target. Instead of full-blown attacks, they mainly consisted of relatively few pecks directed at the screen, similar if not identical to those directed at the key. Pecks were rarely directed at the image of the pigeon and even less frequently at its head. In general they were targeted at a particularly neutral part of the picture's background, and a similar number of responses at the screen were recorded regardless of the orientation of the picture projected (Fig. 2). This result is supported by an earlier extensive study [Ramirez, 1982].

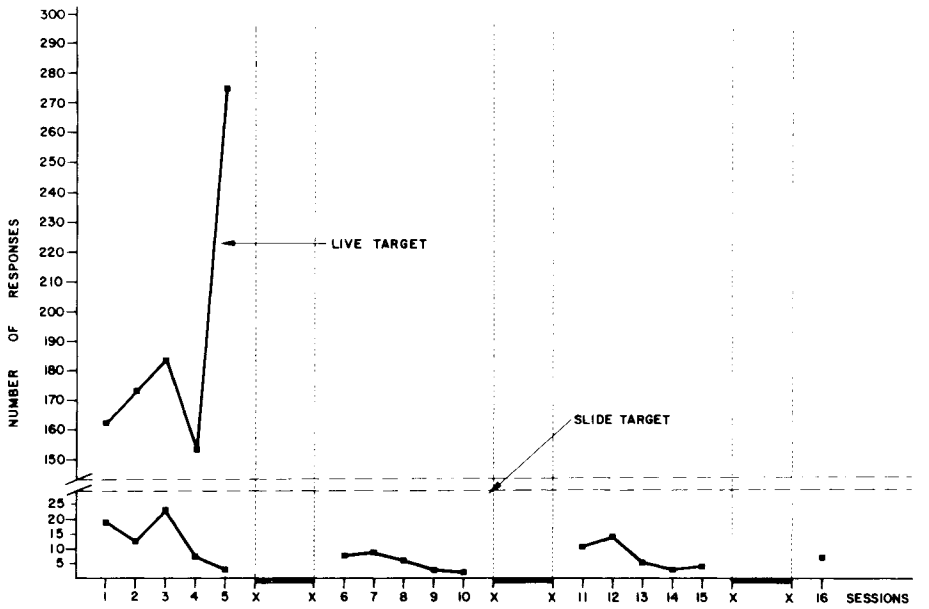

Fig. 3. Mean of the pecks at the live and slide targets over session. Weekend breaks (XX) are indicated.

On average, pecks to the target slide were much less frequent than to the live target. Although the response rates tended to increase over the sessions with the live target, the responsiveness declined over the target slide sessions, perhaps owing to habituation. The changes in scores over sessions in both tests are shown in Figure 3. There was a tendency for pecks and other agonistic responses toward the live targets to be bunched into bursts of activity whereas the pecks to the target slide were rather evenly distributed over time.

When the subjects were grouped according to their aggressiveness, no difference was found between hand and live target tests ($\chi^2 = 3.27$, not significant). This result was confirmed applying Kendall's rank correlation coefficients: the individual's ranks for aggressive responses were positively correlated in these tests ($\tau = 0.59$, $P < 0.05$). There is, therefore, a concordance between these measures of aggressiveness. In contrast, there was no correlation of the slide test ranking with ranks derived from another two tests (ST-LT: $\tau = -0.26$; ST-HT: $\tau = -0.14$, respectively). Aggressive and nonaggressive birds did not differ in the number of pecks to the screen or in the rates of the feeding key press during the CRF phases of the schedule, as documented elsewhere [Ramirez and Delius, 1978].

DISCUSSION

The form of behavior observed in the live test agrees well with that described in natural encounters [Spiteri, 1975]. It has been argued elsewhere [Ramirez and Delius, 1979a] that the hand test situation mimics an antipredatory behavior in which, however, there is also an element of intraspecific aggression inasmuch as tame pigeons may be partially imprinted on humans. In any case good agreement has been

found in both situations: all five birds that were avoiders in the hand test were nonaggressive to live pigeons in the operant situation, and all six animals that attacked a restrained pigeon were also labeled as aggressive according to the hand test. That three animals attacked the fist but not the conspecific might be interpreted as a different degree of fearfulness.

Since a restrained bird may inadvertently sustain ethically unacceptable injury, several alternative techniques have been proposed. Flory [1969], using only two birds, reported that a taxidermically stuffed pigeon target will elicit adequate responses, but other investigators have found that only a few subjects attack, and with a short durability, stuffed targets [Macurek et al, 1978].

The replacement of such targets by a two-dimensional pictorial representation [Flory and Ellis, 1973; Flory and Smith, 1983] is not validated by the present results. The responses seem of a nonaggressive nature as judged by their form and orientation and by the absence of their typical threatening patterns observed in the more naturalistic situations. There was also no significant difference in the number of responses between birds rated as aggressive and nonaggressive on less equivocal measures. Some authors [Looney and Cohen, 1974, 1982; Looney and Dove, 1978; Yoburn and Cohen, 1979] have reported convincing aggressive responses to photographic targets. It is uncertain what conditions facilitate this occurrence, as there is considerable variation in the procedures between the various studies. One must, in any case, doubt whether pigeons recognize photographs as equivalent to objects, particularly if these are stills of live, usually active organisms. As the pigeon's color vision is very complex, color slides geared to the simpler human chromatic system may not be appropriate for these birds. It seems unlikely that black-and-white pictures will circumvent this problem since pigeons also do not easily accept them as representations of three-dimensional objects [Emmerton, 1983], and they do not provide the same tactile feedback as live targets.

One can conclude that 1) pigeons do not recognize pictorial images of conspecifics (responses toward a projected picture of a pigeon are not positively correlated with attacks on live birds), and 2) responses in the hand test have the merit of being a simple and reliable procedure (they appear to reflect the aggressive dispositions of individual pigeons) and provide a preliminary experience of the observer with their responses in a natural setting.

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