

THE SOCIAL ORDER IN FLOCKS OF THE COMMON
CHICKEN AND THE PIGEON.¹

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THE problems centering about the organization of flocks of birds are by no means solved despite the attention they have received. A portion of the pertinent literature to date has been summarized by Allee (1931, 1934) both with regard to the observed facts and their general social implications; hence no general literature survey will be undertaken now. It will suffice to call attention to certain work which is directly antecedent to ours. Schjelderup-Ebbe (1922) has analyzed the organization of flocks of Domestic Chickens and of both wild and tame Ducks (1923). In all of these he found a more or less definite organization revealed by the way in which the birds reacted in contact situations. He recognized a so-called peck-order in which the animal highest in the order pecks and is not pecked in return while that at the extreme bottom of the order is pecked without pecking in return. Throughout the entire order, any individual with the peck-right over another remains steadily dominant over it until by a combat their positions are reversed.

More recently (1931) Schjelderup-Ebbe has extended his observations to include a large number of different sorts of birds both in nature and in various kinds of confinement; he finds that when two birds of one species are together, one is despot and the other is subservient. Schjelderup-Ebbe believes that this sort of despotism is one of the fundamental principles of biology.

The older bird of a flock is usually despot because her matured body gives her strength which the young, partially developed birds lack; even after the latter attain their full size and strength, if of the same sex, the older individual maintains her despotic rights. Between the sexes, the larger males are usually despots over the females. When the two sexes are alike in size and strength and the

¹ The work upon which this report is based has been supported in part by a grant from the Rockefeller Foundation to aid investigations in the biological sciences at the University of Chicago. We are indebted to Dr. L. V. Domm for permission to study the group organization of Chickens in certain of the pens under his control and for two post-mortem examinations.

male possesses ornamentation, he is despot; otherwise either may be despot. Often males put on and lose their despotic rights with the assumption and loss of breeding plumage.

We have repeated Schjelderup-Ebbe's observations first on Brown Leghorn Chickens, both males and females but with sexes separate; then with flocks of Pigeons, first with sexes segregated, then when mated, and again with the sexes together. The observations were the result of joint planning and while the senior author was in very close touch with the work throughout, the actual observations were all made and the preliminary summary prepared by the junior author.

Two flocks of Brown Leghorn Chickens were observed in their Whitman Laboratory quarters during January, February and March, 1932. They were housed in pens 14.5 feet long, 5 feet wide and 8 feet high. These pens were in a heated house that was kept between 60° and 70° F. They were each provided with raised roosts which occupied a corner space of 3 by 4 feet. The floor below the roosts was protected from droppings. The cement floor was covered with straw litter which was changed weekly. On a few warm days, the Chickens were given access to separate outside runs which were about 5 feet long and were floored by wire mesh about a foot from the ground to prevent attacks by rats.

All the Chickens were about 10 months old when observations were begun. They had been raised together in the Whitman pens since hatching. One pen contained 11 cockerels and the other at the start contained 26 pullets. Toward the end of January, 12 days after the observations were begun, half of the pullets were removed and on February 27 a Barred Plymouth Rock rooster was added. The flock of cockerels was disturbed only by the experiences of one bird. On February 29, RB was removed because his eye was injured in fighting; he was returned to the flock on March 14 when his eye was completely healed and sight was normal; he was again removed five days later in a much battered condition.

All these Chickens were fed twice daily with mixed grain and in addition the cockerels were given a small amount of grain when the observations were being made, since relatively little pecking was done in the absence of food. In addition to the grain, the pullets were provided with a hopper of mash which remained in the pen

constantly. The cockerels received no mash since by omitting it most of their fighting was avoided.

The majority of the observations on contact reactions were made in the afternoon. The observer sat quietly in an adjoining pen, note pad on knee, and was separated from the Chickens under observation only by ordinary chicken-wire netting. When two animals came into contact with each other and one was pecked and retreated, this was considered to be the subservient member of that particular contact pair. Many times two Chickens would meet without showing any signs of pecking or being pecked; such neutral encounters were not considered in deciding on the peck-order. Often such contacts would start a battle, more often with the cockerels than with the pullets; pecking would be mutual. In these cases the Chicken that gave in and retreated was considered to be subservient to the other. The majority of the pecking contacts were observed over and over. Colored celluloid leg bands furnished a ready means of individual identification by the observer; the birds themselves appeared to recognize other individuals by means that were not always apparent to the human observer.

SOCIAL ORDER AMONG THE PULLETS.

The social order in the flock of 26 pullets had not been determined when, twelve days after the observations began, the flock was reduced to 13. The definite status of any one hen had not been established but the evidence at hand allows a fair approximation of the birds in the upper half of the flock and extreme lower part as follows:

1. W	7. GY	13. WW
2. B	8. BY ₂	
3. RW	9. G	22. Y
4. GY ₂	10. RY	23. BB
5. RY ₂	11. RG	24(?)BY
6. RR	12. BG ₂	25. M
		26. A

Although the observations were insufficient to establish the contact reactions between any one bird and all of its associates, the data at hand show that there was no absolute despot. One bird, GG, was not observed to receive pecks from another individual but

it pecked only A and YY during these observations. YY ranked below the 13 just given and A ranked at the bottom of the indicated order in the larger flock and at the very bottom of the better tested order of the reduced flock: hence it appears that GG cannot be assigned a place in the upper half of the peck-order.

In all the contacts observed in this crowded pen, there was only one reversal. W was seen to peck RY₂ once and the reverse was observed once also. This indicates a strong and stable social organization among the pullets. Pullets of inferior position always gave way to their superiors at the food hopper or water dish. Superiors were often observed pecking food from the bills of their inferiors. M, A, and BB, individuals low in the peck order, spent much of their time on the roost where there were fewer birds and when they did venture onto the floor, they were alert and avoided many pecks by darting away from an approaching hen.

After the flock was reduced to 13 individuals, it was observed for 60 days and the complete order obtained as shown in Table I.

TABLE I. SHOWING THE STATUS OF EACH INDIVIDUAL IN A FLOCK OF 13 BROWN LEGHORN PULLETS ON THE BASIS OF THE PECK-ORDER.

RW pecks all 12:	A, BG, BB, M, Y, YY, BG ₂ , GR, R, GY, RY, RR.
RR pecks 11	: A, BG, BB, M, Y, YY, BG ₂ , GR, R, GY, RY.
RY pecks 10	: A, BG, BB, M, Y, YY, BG ₂ , GR, R, GY.
GY pecks 9	: A, BG, BB, M, Y, YY, BG ₂ , GR, R.
R pecks 8	: A, BG, BB, M, Y, YY, BG ₂ , GR.
GR pecks 7	: A, BG, BB, M, Y, YY, BG ₂ .
BG ₂ pecks 6	: A, BG, BB, M, Y, YY.

YY pecks 4	: A, BG, BB, M.
M pecks 4	: A, BG, BB, Y.
Y pecks 4	: A, BG, BB, YY.



BB pecks 2	: A, BG.
BG pecks 1	: A.
A pecks 0	

It is apparent from the data of Table I that RW is the despot of the flock and that down to YY there is a straight line order; then YY, M and Y form a triangle order below which the straight line order continues to A, the lowest member which pecks none. As in

the larger flock, superiors often ate food from the bills of their inferiors without resistance from the latter. When a hen was sitting on even one or two eggs, it took much more pecking before she would relinquish her position to the superior hen; even so, no reversals in peck order for this or other reasons were observed in the reduced flock. RR, second in the social order, was much given to pecking her inferiors, more so than RW, the ranking hen. The impression of a social order gained in the observations on the large flock is definitely strengthened. The reduction in flock size did not change any of the observed peck-rights. R, which stood fifth in the social order of the reduced flock, had not been observed in contact with any of this group before the reduction took place; it had been seen to peck G and BR and to be pecked by W and RY₂.

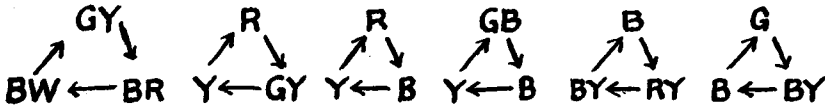
SOCIAL ORDER AMONG THE COCKERELS.

Practically the complete order for the flock of eleven cockerels was determined during the 70 days of observation. The findings are summarized in Table II, which is built on the same plan as Table I, and so allows ready comparison with the social order obtaining among the pullets. In this table the characters in italic indicate that these peck-rights were not settled; those in heavy faced type indicate that there was one reversal of the peck-order observed in each of these cases.

TABLE II. SHOWING THE SOCIAL ORGANIZATION OF A FLOCK OF 11 BROWN LEGHORN COCKERELS ON THE BASIS OF THEIR PECK-ORDER.

BW	pecks 9	: W, BY, G, RY, B, BG, Y, R, GY.
BR	pecks 8	: W, BY, G, RY, BG, Y, R , BW.
GY	pecks 8	: W , BY, G, RY, B, BG , Y, BR.
R	pecks 7	: W, <i>BY</i> , G , RY, B, BG, GY.
Y	pecks 6	: W, BY, G, RY, BG, R.
GB	pecks 5	: W, BY, G, RY, B.
B	pecks 4	: W, G, RY, Y.
RY	pecks 3	: W, BY, G.
G	pecks 2	: W, <i>BY</i> .
BY	pecks 2	: W, B.
W	pecks 0.	

In this order there are six triangle situations as follows:



These triangle situations run almost through the whole gamut of the social order. Those high or low in the peck-order are least involved and those in the middle of the order are most concerned. BW, the highest ranking cockerel is involved in one triangle; W, the lowest, in none; B, one of those near mid-rank is involved in four and Y, in three.

The social organization of this flock of cockerels was not as stable as was that of the pullets. After 70 days of observation, peck-rights were still unsettled as indicated in Table II by the letters in *italic*. They were those of BY-R and BY-G. BY was observed to peck G on six occasions and the reverse was observed on eight occasions. BY was likewise observed to peck R on six occasions and the reverse was true for the same number of contacts. The place of these cockerels must therefore be assigned tentatively and they are placed in their logical positions with reference to other relations which seemed to have been settled.

Four other cases of reversal were observed and are indicated in Table II by heavy faced type. In these the reversal occurred but once in each case. It is of course possible that there may have been an error in observation but the likelihood is no greater here than with the pullets and we are inclined to think that these reversals indicate a less stable and fixed peck-order in the cockerels as compared with the pullets.

On account of a fight which incapacitated BR, other consequences of which will be given later, this individual was removed before the peck-order between him and B had been observed. The other relationships indicate that B would probably have been pecked by BR, but one cannot be certain of this without direct observation.

The cockerels were much more given to fighting than were the pullets. Many times two of them would face each other and start to fight even though the peck-right records showed that the relations between the two were fairly definitely settled. Usually such combats were interrupted by another individual walking between

the two combatants, but if the battle was not interrupted, the cockerel which was usually pecked, finally retreated, but not, perhaps, until he had put up quite a fight. The individuals in the lower positions of the social order have a difficult life; they are continually being pecked by their superiors. When food was given, W, which stood lowest in the order, never ventured near those cockerels that were eating but waited until they had left the food and then ate what remained. W also spent most of his time on the roost where the others, if present, seemed to be more tolerant of their inferiors. As a rule very little pecking took place among the cockerels on the roost even though they were somewhat crowded at times. When W did venture on the floor of the pen, he was constantly running to avoid contacts with the other members of the flock. BW, which was first in the order, seemed more inclined to peck his inferiors than did any other cockerel; about half of the observed pecks were delivered by this individual.

The order among cockerels differs from that found among the pullets in the type of organization. That of the pullets is fairly regular while that of the cockerels is built about triangular relationships. For a time there was no despot among the males and in fact BW, the cockerel standing highest, was pecked by BR who stood just below him in rank. On February 29, this latter individual and Y started to fight, as they had many times before, but during this battle BR received a hard peck in the eye which closed the left eye and he retreated. He was then removed to another pen and two weeks later on March 14 he was replaced with the group of cockerels which he had almost dominated. At this time his eye was entirely healed and his sight was apparently normal; he was found to have lost his position in the peck-order completely. In fact he now stood lowest of all and was even pecked by W, which had not been observed to peck a fellow cockerel before. One or all of the following factors may have entered into his loss of status: he had lost an encounter; he had sustained a severe injury and he had been absent from the flock for 14 days. Whatever the reason, he was persecuted so badly that on March 19 his injuries prevented him from standing and he was removed permanently to save his life.

During the five days BR was in the pen after his recovery, he

avoided contacts with the others as much as possible and spent much of his time partially hidden under a low shelf upon which the water dish was kept. Not once was he observed to attempt to assert his former high position. After BR was removed no change was observed in the pecking. The absence of BR made BW despot. This change in the relations of BW did not seem to affect his behavior towards the other members of the flock.

OBSERVATIONS ON PIGEONS.

The observations on Pigeons were made upon 14 White King Pigeons, a heavy squab-breeding variety. The birds were equally divided as to sex. They were unmated but sexually mature when obtained from a reliable dealer. They were housed in a large out-of-doors pen about 30 ft. long by 18 ft. wide and 10 ft. high. The pen extended between a laboratory greenhouse and a brick building. It was closed by wire on both sides and on top. A small wooden roost and nesting cote was furnished and both runways and cote were divided into two equal parts by wire netting and boards during the periods when the Pigeons were sex segregated.

The majority of the observations were made at feeding time since the close contacts incident to feeding greatly increased the opportunities for pecking. The group of males was observed for 24 days and the females 30 days. After these observation periods, which ran concurrently, the partition was removed and the two groups were allowed to be together.

Soon after the observations on the sex segregated groups were started, two of the females simulated mating. One, GW, took the part of the male and the other, BW, that of the female.¹ Twelve days after mating both of the birds laid eggs which were removed. During the month that the sexes were together, five pairs mated; three of these matings resulted in fertile eggs that were hatched out before the sexes were again segregated for a second observation period that lasted for 28 days. RY and BY of the females and B and Y of the males did not mate.

OBSERVATIONS ON MALES AND FEMALES WHEN COMBINED.

When the sexes were united into a common flock, five pairs of the

¹ A common occurrence according to Whitman, 1919, p. 28.

Pigeons soon mated. Thereafter practically all the pecking was done by RY and BY, the two unmated females. The males were stimulated by the females and chased them almost continuously when they were not on the nests. Under these conditions the mated females were constantly running away from the pursuing males, eliminating most of the contacts between males and females, particularly between those belonging to different pairs. The resulting picture is of a flock composed now of couples, each couple with but few contacts with other couples.

The two unmated males were in about the same social position as were the mated ones. Both were stimulated by the presence of the females and were continually courting them. BY and RY, the two females that did not mate, were killed at the end of the post-mating observations and examined for any abnormalities of gonads which might show them to be intersexes. On gross examination by an experienced worker¹ both of these birds showed normal female gonads.

THE SEX SEGREGATED GROUPS.

Neither the segregated males nor the females showed a definite peck-right such as has just been reported for Chickens and such as Schjelderup-Ebbe reported for Chickens and Pigeons and many other birds as well. In our pens both the sex segregated groups showed a relationship which we shall call peck-dominance. Where two individuals peck back and forth, now one retreating and now the other, the one that is observed to retreat the fewest times is said to have the peck-dominance for that particular contact-pair. In only a few of the relationships observed was there a definite peck-right in which one of the contacting individuals does all the pecking and the other does all the retreating. The more usual relationship with these Pigeons was to have the pecking frequently shifting from one to the other of any given contact-pair of birds. The interval between such reversals varied from a few minutes to several days. It was not uncommon to see one bird being chased by another at the beginning of an hour of observation and itself chasing the former dominant before the end of the hour. To be counted as an actual reversal the temporarily subordinate indi-

¹ The examinations were made by Dr. L. V. Domm.

TABLE III. PECK-DOMINANCE IN A FLOCK OF SEVEN FEMALE PIGEONS.

Pigeons	Pre-mating period.				Post-mating period.			Grand Total
	14 days	20 days	26 days	32 days	16 days	22 days	28 days	
BY:BB	15:11	23:17	30:34	36:38 ¹	5:7	5:9	7:11	43:49
BB:GW	10:11	12:19	14:28	15:37	7:22	9:44	10:49	25:86
BB:BW	1:6	3:12	6:26	9:41	11:22	11:25	11:30	20:71
BB:RY	1:7	2:14	3:20	3:26	0:6	1:8	1:10	4:36
BY:RY	1:6	2:12	7:27	16:47	42:17 ²	48:21	53:22	69:69
BY:GW	9:12	9:21	10:33	17:41	5:20	6:28	7:39	24:80
BY:BW	2:8	4:19	5:35	9:42	0:10	2:16	6:24	15:66
BY:RW	5:10	8:14	9:25	11:37	2:16	4:33	4:50	15:87
GW:BW	1:7	2:8	2:8	4:13	3:9	7:12	8:14	12:27
BR:GW	6:3	7:6	7:7	9:10 ¹	2:21	3:21	4:21	13:31
GW:RW	2:9	3:10	5:10	6:12	2:8	3:9	3:10	9:22
BY:BR	11:9	14:15	15:20	17:24 ¹	0:16	0:21	0:31	17:55
BR:BW	1:3	2:7	4:8	7:10	1:0 ²	3:1	5:2 ³	12:12
BW:RW	2:6	2:6	4:6	6:8	1:0 ²	2:3	2:6 ³	8:14
BW:RY	1:2	1:4	3:6	10:13	41:0 ²	48:2	53:3	63:16
RW:BR	1:3	1:3	1:3	3:4	0:1	0:1	0:2	3:6
RY:GW	2:0	4:1	5:4	7:10 ¹	9:47	11:49	11:49	18:59
RY:RW	2:0	3:1	7:4	8:10 ¹	0:39	0:46	0:51	8:61
BY:RY	0:2	0:7	2:22	20:33	68:13 ³	76:16	83:18	103:51
BR:RY	0:3	0:3	2:5	8:7 ¹	33:1 ²	36:3	40:4	48:11
BB:RW	0:5	0:6	0:18	0:23	1:10	1:11	1:12	1:35

Order of Dominance.

BB(6)	RY(6)	RY(6)	RY(6)	RY(5½)
BY(6)	BY(6)	BY(6)	BY(6)	BY(5)
GW(4)	BB(5)	BY(5)	BY(5)	BB(4½)
BR, BW,	RY(3)	BB(4)	BB(4)	GW(2)
RW(2)	GW, RW(2)	GW, BW(2)	GW, BW(2)	
RY(0)	BW(2)	BW(2)	BW, BR	
BW, RW(2)	RY(0)	RY(0)	(1½)	
RY(0)			RW(1)	
			BW, BR(1)	
			RW, BR(1)	

¹ Peck-dominance changed in pre-mating observations.

² Peck-dominance changed during mating period.

³ Peck-dominance changed in post-mating observations.

vidual must actually retreat from the attack of a bird from which it had formerly retreated: merely pecking back and forth was not so considered. Such mutual peckings were frequently observed. The individual that did the pecking, whether male or female, usually showed a swelling of the crop, cooing and bowing not unlike the mating behavior.

The actual observations are summarized in Tables III, IV and V. The longer tables were constructed as follows: As with the Chickens, the individuals are represented by letters and are arranged at the left of the table in the order that indicates the relative dominance of the different individuals at the end of the first period of observation. The more dominant individuals are listed to the left in any given pair. The successive columns give the number of times of observed peck-dominance at the end of the indicated number of days from the beginning of observations. Each table is divided by the period in which the birds were mated into a pre- and a post-mating period.

Some of the observed relationships show only slightly greater peck-dominance on the part of one bird than the other of a given pair. Obviously great significance cannot be attached to these cases. Some measure of their significance is given by the regularity with which the same bird continues to be dominant in its relations with another individual.

THE FLOCK OF FEMALES.

In the relations between different females which are outlined in Table III, of the 21 possible contact-pairs 16 showed the same individual had the greater peck-dominance during the 32 days of the pre-mating period. During the mating period, 6 reversals of dominance occurred, two of these, those in which RY was not concerned, showed another reversal before the end of the post-mating season observations. In all, 11 of the 21 possible contact pairs, showed at least one reversal during the entire time of observation. Three of these pairs showed two reversals during this time. The reversals that occurred during the pre- or post-mating observations were all shown by contact-pairs in which there was but slight difference in the peck-dominance; changes during the mating period occurred in the case of RY even though the peck-dominance seemed to have been firmly established.

The position of this Pigeon in the social organization shows some of the elasticity of the system. For the first 26 days of observation, RY stood at the bottom of the peck-dominance order. In the last six days before mating, RY became slightly dominant over BR, GW and RW, all of which stood low in the social order. After the month of mating during which RY remained unmated, she was clearly dominant over the whole group. This change in the position of RY accounts for four of the six reversals that took place during the mating interval. The summary of the pre- and post-mating season position of this bird in the flock is of value and is given in Table IV.

TABLE IV. THE PRE- AND POST-MATING SEASON POSITION OF RY WITH RELATION TO THE OTHER MEMBERS OF THE SAME FLOCK.

Pairs	Pre-mating	Post-mating	
	$\begin{matrix} \rightarrow \\ \leftarrow \end{matrix}$	16 days $\begin{matrix} \rightarrow \\ \leftarrow \end{matrix}$	28 days $\begin{matrix} \rightarrow \\ \leftarrow \end{matrix}$
RY:BR	7:8	1:33	4:40
RY:BY	33:20	13:68	18:83
RY:RW	8:10	0:39	0:51
RY:GW	11:10	9:47	11:49
RY:BW	13:10	0:41	3:53
RY:BB	47:16	17:42	22:53
RY:ALL	115:74	40:270	58:329

In the 32 days of observation of the pre-mating flock of females, RY was dominant about two-thirds as many times as it was subordinate; in the 28 days of observation of the post-mating flock composed of the same individuals, RY was dominant over five times as frequently as it was subordinate. In each of its pair-contact relationships, in the post-mating flock, it clearly held peck-dominance without having absolute peck-right except with RW.

The other important changes in the peck-dominance order following the mating month were apparently a result of RY's move to power. BY, the other Pigeon which did not mate, had been the most dominant of the lot during the last half of the pre-mating period; it now ranked second to RY. BB likewise sank one place in the social order from second to third.

The habits of the birds may control their position in a social order arranged on the basis of total number of pecks received and

administered. Thus in the pre-mating flock BB always seemed to do the pecking when she was at the entrance of the roost: when BY tried to enter she would be pecked and would retreat. On the ground, however, BY was usually dominant. As long as BY tried to enter the roost during the day time, she lost in a majority of her contacts with BB and the latter stood at the head of the social order. Later BY did not try to gain entrance to the roost except at night: rather she stayed on the ground where she was usually dominant. This change in the behavior of BY during the first period of observation, shifted the social dominance from BB at the beginning to BY just before the mating period.

At the beginning of the observations RY was very peaceful: she gradually became more aggressive, and as stated before, became despot of the post-mating period flock. As despot, she usually stood in the pan of food at feeding time and drove the others away between times of taking mouthfuls of food.

The social relationships of the subordinate members of the female flock of seven Pigeons are shown in diagrammatic form in Fig. 1. Fig. 1A brings out some of the intricate relationships that may exist in such a flock. The relationships existing in the post-mating flock (Fig. 1C) and when all the information collected is considered together (Fig. 1B) are more simple.

Individuals differed widely in the number of contacts with other birds. In general, Pigeons low in the social order had fewer encounters with other members of the flock than did those of high social rank. If all the observed contacts in both observation periods are considered, the three birds ranking highest had 1407 observed pair-contacts, while the three ranking lowest had only 822 such contacts. Those high in the social rank met each other more frequently than did those ranking lower. Again using all the observations at hand, RY, BY and BB had 384 pair-contacts with each other while in the same length of time, RW, BW and BR, low in the social scale, were seen to have only 55 such contacts between themselves. BY and RY, leaders respectively in the pre- and post-mating flock, met as a pair 154 times, while RW and BR, low in the social scale, with otherwise equal opportunities, met only 9 times.

The relationships existing between the total number of pair-

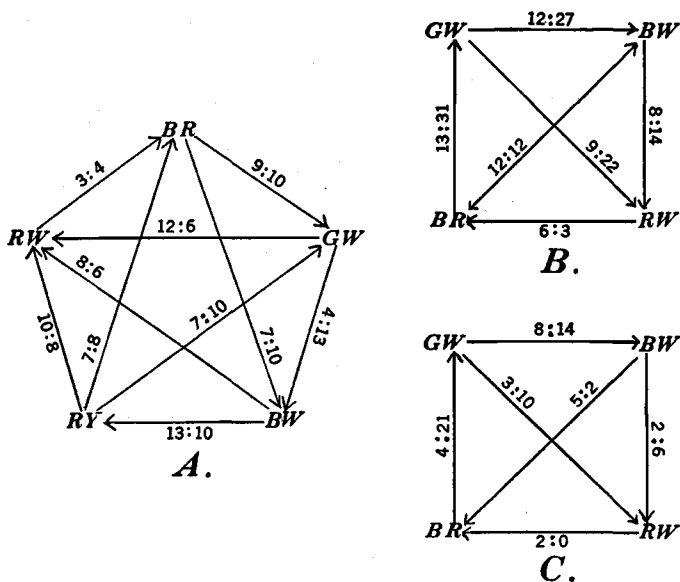


Figure 1. Relationships among those lowest in the social order in the flock of females. Arrows point to the subordinate birds. Numbers show the observed times of dominance and subordination. Thus BR dominated GW 10 times and was subordinate to GW 9 times in their pair-contacts.

A. The lower five birds in the premating flock: all these were dominated by BY and BB.

B. The lower four birds for the entire period of observation; all of these were dominated by RY, BY and BB.

C. The lower four birds in the post-mating flock; all these were dominated by RY, BY and BB.

contacts and place in the social order is again illustrated by the behavior of RY before and after the mating period. In the premating flock when she was low in social rank, RY had in all 189 pair-contacts, an average of 5.9 per day. In the post-mating flock in which she occupied the highest social rank, she engaged in 387 such pair-contacts, an average of slightly less than 12 per day.

THE FLOCK OF MALE PIGEONS.

The pair-contact behavior of the flock of male Pigeons is summarized in Table V in practically the same manner in which the

behavior of the females is summarized in Table III. In the 24 days of observation in the pre-mating flock, the same individual retained dominance in 17 of 21 contact-pairs. In one contact-pair, W:B, the few contacts observed were exactly even at each summarizing period. There were five reversals during the mating period; two concerned pairs which had already shown a reversal of peck-dominance and one other was in the case of the pair just mentioned in which there was a slight change in the hitherto balanced relationship. For the entire period of observation, 15 of the 21 contact-pairs of males showed the same individual dominant at each of these summarizing periods.

The general picture is of a more stable flock organization than was found among the females where, however, the social arrangement was upset by the rise of RY. A further evidence of greater social stability is found in the lack of reversal of dominance in individual contact-pairs in two cases in the pre-mating, and six cases in the post-mating flock and two cases for the entire period of observation. Among the females, there was one such case in the pre-mating, one in the post-mating flock and none that held so throughout the observations.

As with the females, the change in peck dominance during the pre-mating period did not concern pairs which had shown a high degree of uniformity in dominance. In the mating period something happened to BL, which had ranked near the top in the pre-mating flock; thereafter, it ranked below Y, YY and G. Its relations with G had not been clearly defined in the pre-mating period; it had definitely dominated YY and had dominated 15 out of 24 observed contacts with Y. This change in status of B1 accounted for three of the five shifts during the mating interval. B and Y remained unmated as did RY and BY of the females. Y's standing in the flock improved following the mating period while B remained at the bottom of the social order.

The peck-dominance which had been somewhat confused in the pre-mating flock (Fig. 2A) became a regular sequence in the post-mating period with Y having peck-dominance over all the rest and with B showing no regularity in dominance in pair-contacts. As with the females, some of the males showed a greater tendency toward dominance in certain spatial positions. YY stood higher

TABLE V. PECK-DOMINANCE IN A FLOCK OF SEVEN MALE PIGEONS.

Pigeons	Pre-mating period.			Post-mating period.			Grand Total
	12 days	18 days	24 days	16 days	22 days	28 days	
BL:G	10:8	14:12	19:19 ¹	15:6 ²	22:9	22:9	41:28
G:W	4:8	4:11	5:14	1:38	1:41	1:41	6:55
G:Y	8:8	12:14	15:20 ¹	13:12 ²	21:13	21:13	36:33
G:B	3:8	3:14	4:16	0:5	0:9	0:9	4:25
BL:W	2:8	2:12	3:19	3:9	4:13	4:13	36:38
BL:YY	4:13	7:30	18:30	21:6 ²	26:4	26:4	38:19
BL:Y	4:7	6:11	9:15	22:2 ²	28:3	28:3	53:26
W:YY	13:18	22:20	28:23 ¹	24:3	25:3	25:3	10:34
R:W	7:10	7:16	8:22	2:11	2:12	2:12	21:66
YY:R	5:20	7:28	13:45	5:16	8:21	8:21	61:98
R:B	8:11	11:30	17:47	20:41	24:51	24:51	3:27
G:R	1:15	2:22	1:5	1:5	1:5	1:5	16:30
BL:R	8:9	12:18	20:28	13:28	16:30	16:30	36:58
Y:YY	5:10	10:18	13:26	8:26	8:31	8:31	21:57
Y:W	2:7	4:9	11:19	15:26	24:47	24:47	5:36
Y:B	7:9	9:11	5:12	0:14	0:24	0:24	10:22
W:R	12:14	16:19	10:12	0:4	0:10	0:10	30:51
W:B	1:1	1:1	2:2	0:1 ²	0:1	0:1	2:3
BL:B	0:8	0:13	0:14	0:7	0:11	0:11	0:25
YY:B	0:11	0:20	0:29	0:9	0:11	0:11	0:40

Order of dominance.	
B(5) Y(4½), G(4½)	BL(5½) G(4½)
YY(3) R(2) W(1½) B(½)	YY(4), Y(4) R(2) W(½), B(½)
G(5), BL(5) YY(4), Y(4)	Y(6) YY(5) G(4) BL(3)
R(2) W(½), B(½)	YY(5) G(4) BL(3) R(2) W(1) B(0)
	YY(4), G(4), BL(4) R(2) W(1) B(0)
	Y(6)

¹ Peck-dominance changed in pre-mating observations.

² Peck-dominance changed during mating period.

in the social order when near the food pan and W when at the entrance to the roost.

Like the cockerels, the male Pigeons were inclined to fight more than were the females. The Pigeon fights were less severe. At times two males would indulge in a rapid pecking back and forth with neither giving way; such encounters were recorded without showing dominance. It was the individuals high in the social ranking that showed such behavior.

As with the females, the males lowest in the flock order had fewer pair-contacts than did those higher in social rank. B and W, which were consistently at the bottom of the order showed a total of 425 such contacts with other members of the flock while Y and YY, leaders of the post-mating flock showed 797.

In neither the flock of males nor of females, did the social rank necessarily run parallel to the number of pair-contacts. With the females, BY showed more such contacts than did RY although the latter clearly outranked her in the post-mating flock and for the entire period of observations. Similarly among the males, YY which held second place in the post-season flock had a total of 520 observed pair-contacts while Y, the more dominant individual in the latter flock and for the whole period of observations, showed only 338 pair-contacts in all. R, third from the bottom of the post-mating flock showed 404 such contacts.

Despite this irregularity, the general relationship held and the individuals high in the social order showed the greater number of pair contacts. The four ranking males had an average of 298 pair-contacts while the three subordinate ones showed a mean of 252. These three subordinates, R, W and B, had only 86 pair-contacts among themselves while, Y, YY and G, the dominants of the post-mating flock had a total of 299 such contacts. This substantiates the observation with the females that the subordinate members have fewer contacts with each other or with the group as a whole than do those high in the social scale.

The largest number of pair-contacts among the males was between YY and G, a total of 159. These birds ranked second and third in the post-mating flock. The lowest number of such contacts was between B and W, a total of only 5 between these two lowest ranking birds. With the females the similar records for greatest

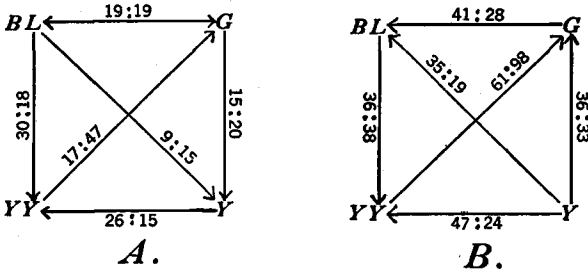


Figure 2. Relationships among those highest in the social order in the flock of males. As in Fig. 1 arrows point toward the subordinate birds and numbers show observed times of dominance and subordination.

A. Social order of the four more important males during the pre-mating period. All have peck-dominance over the remaining three.

B. The social order for the same males based on combined results from both periods of observation.

and fewest contacts between two individual birds rested with the highest and two of the lowest ranking birds respectively.

No one of the males showed as extreme a change in social status during the period covered by the observations as did RY among the females; BL came nearest. From being among the first rank in the pre-mating flock he came to occupy definitely the fourth place in the post-mating season observations. His pair-contacts averaged 7.7 per day for the first period and 7.0 for the latter one. The decrease in number of contacts with lowered social status while supporting the observations on RY of the females, is too slight to be certain of significance.

DISCUSSION.

The interrelations between the different phases of this investigation have already been discussed in close connection with the data. There remains the placing of these data in relationship with other published work, particularly that of Schelderup-Ebbe, and the suggesting of some of the more general significance of the facts which have been revealed by such studies.

In making comparisons with Schjelderup-Ebbe's work, it must be remembered that his studies on the flock organization of Domestic Fowls are much more extensive than are our own and that

they were made mainly upon Chickens running at large in roomy yards while our observations were made upon animals confined in somewhat crowded pens. This lack of space makes for greater frequency of contacts which is especially important in the case of the more pugnacious males.

Despite this difference, our findings support those of Schjelderup-Ebbe remarkably well and we may conclude that his picture of the flock organization of Chickens is essentially sound. Our observations differ from his in that with the Chickens in our pens, the ranking cockerel or pullet did not necessarily have a less pugnacious disposition than was shown by other high ranking but subordinate members of the flock. RW, the despot of the pullets, did as much or more pecking than did any other, and BW, first in order at all times and later despot of the flock of cockerels, was by far the most vicious of all in his relations to the other cockerels,

Our greatest disagreement with Schjelderup-Ebbe comes in the work with Pigeons, where we have to modify his conception of peck-right to include a situation in which it is the rule for inferiors to peck superiors and for the latter to retreat at times before the attack of an individual which is more usually subservient in its contact-pair relations with that particular bird. At times even after many such encounters, the dominance and subordination relations remain wholly unsettled. Usually, given sufficient time for contact relations and for their observation, the order becomes fairly definitely settled, but in the majority of these cases the subservient individual at times successfully attacks the dominant member of the contact-pair and forces it to retreat without, however, causing a permanent reversal of peck-dominance. Under these conditions, social ranking is apparently not determined with a high degree of finality at the first social contact of two individuals but is a matter of gradual development.

The fairly high degree of regularity in the peck-dominance revealed in Tables III and V is evidence that the relationship here revealed is a variation of Schjelderup-Ebbe's principle of despotism rather than representing a different fundamental principle. Absolute despotism is lacking in the relations revealed among these Pigeons since the dominance in a given contact-pair, while usually remaining with one individual in a majority of its contacts with

another, is yet subject to certain spatial restrictions in some cases and to temporary reversals for unknown causes in others.

Another difference in our report from that of Schjelderup-Ebbe lies perhaps in the realm of our personalities. We prefer to record our observations objectively without reading into them underlying motives in terms of such human traits as courage, fear, etc. The similarities between the social organization of these flocks of birds and those existing in human social circles are striking and one is constantly tempted to make anthropomorphic interpretations. Experience with other phases of animal behavior, however, compels us to use great caution in interpreting the behavior of one animal as being motivated by forces effective with another.

Unfortunately the working conditions available in our city location do not allow us an opportunity to test the relationship between social dominance of the type we have been discussing and flock leadership in group activities. Fischel (1927) has reported observations with Chickens covering this point. In his studies, groups of hens were observed in a large orchard where the animals moved about, according, in part, to the lay of the land and, in part, according to inner stimuli which were not analyzed. Fischel has evidence that among such groups, the group despot is not necessarily the group leader; in fact the leadership changes readily and only exceptionally is the same individual long at the head of the flock. The group despot, on the contrary, rarely changes.

There is evidence of social coherence in the groups that Fischel observed, since he found that the leader is dependent on followers; she goes little further than the other hens follow.

Neither do we have definite evidence concerning the relationship between position in the peck-order and relative intelligence as measured by ability to learn a given problem. Katz and Toll (1923) found evidence that hens high in the peck-order also stood high in relative intelligence. We have not collected sufficient data to permit a statement on this point.

The general significance of social organization such as we have been discussing deserves brief comment. The similarity to certain aspects of human society is close enough to be immediately apparent. This does not mean that human social life evolved from a

bird-like flock organization nor that both human and bird societies have developed from a common social pattern. It does mean, we think, that it is no longer possible to regard human, or avian society for that matter, as something definitely unique. These studies do not support the contentions of Rabaud (1931) that there is nothing to indicate that the animal living in a society has evolved further than the solitary animal since each behaves as if alone! Rabaud states further that there are no collective performances properly so-called among animals other than men; that such unions as are formed come about without the creation of anything which can be called social, since language is lacking.

Unless we are greatly misled, these flocks of Chickens and Pigeons which we have observed represent a condition in which actions speak louder than words and proclaim a social organization similar in some respects to that found among men in which the same principle often holds. We are not prepared to admit the entire lack of voice control in these social groupings of birds, but that is outside the field of our immediate interests and at least for Pigeons has been adequately discussed elsewhere (Craig, 1908).

SUMMARY.

Following leads furnished by the work of Schjelderup-Ebbe, the social organization has been studied as it exists in flocks of Brown Leghorn Chickens and of White King Pigeons. The results obtained are:

1. A social order exists in all the sex-segregated flocks studied. These included Brown Leghorn pullets, Brown Leghorn cockerels, female Pigeons and male Pigeons.
2. The social organization of the cockerels was more complex and was not as definitely organized as was that of the pullets of the same strain and age.
3. When Pigeons were allowed to mate, the resulting picture was of a flock composed mainly of couples, each couple with but few contacts with other couples. The majority of the pecking in such a flock was done by two unmated females.
4. The social order among both male and female Pigeons was based on peck-dominance worked out after many contacts rather than upon an initial combat with one member of any given contact-

pair regularly dominant thereafter. The latter relationship is characteristic for Chickens.

5. The Pigeons standing high in the social order have more social contacts than do those low in the scale.

6. In general our results support those of Schjelderup-Ebbe. The exceptions to this statement and some of the general implications of the work are discussed briefly in the last section of the paper.

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