FURTHER STUDY OF THE ENGLISH SPARROW AND OTHER BIRDS.

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INTRODUCTION.

In an earlier paper on "The Psychology of the English Sparrow" the writer committed himself to the further study of the same and other species. Like most programmes, perhaps always more or less unwisely made, this has seemed tardy of fulfillment. For experimenting with such frail and nervous animals one must have an unlimited amount of time and the possibility of making the surroundings very free from disturbing noises, etc. It is scarcely necessary to say that neither of these conditions could be fully satisfied. The birds have been kept and the experiments tried in a large animal room with alligators, white rats, and Jack the monkey, in other cages near by. These were often a disturbing factor while an experiment was in progress. Then, too, the necessity of carrying along simultaneously the same test with a number of birds led to a change in the method from that used earlier; at least, during the first experiments. To do this each bird was kept in a small cage outside the large one (the latter being twelve feet long and wide and six feet high). When tests were made these cages with the birds were carried inside the large one. Later they were allowed to go directly from the small cages into the large one. This latter method it seems to me is much better as it eliminates the fright which always results from carrying the small cage and the birds become more accustomed to the large cage. They are not suddenly confronted with so

much that is new and consequently there is less distraction. Notwithstanding the fact that the same precautions as to food, air and sunshine, have been taken as in the earlier study I have found it difficult to keep the birds in good condition for any great length of time. Since from the first I was on the sharp lookout for abnormal conditions of any kind, allowance will be made for these in the interpretation of results.

Description of Birds Experimented with and Work Done by Others.

The birds experimented with were a Vesper Sparrow, a female Cowbird, a male Dove-cot pigeon, a female Passenger pigeon, and some half dozen English Sparrows. The results of a few tests on a Red-headed Woodpecker will also be described. Some facts by way of description of the species, their habits and habitat, and of interest chiefly from a psychological point of view, will now be given.

The Vesper Sparrow, Grass Finch or Bay-winged Bunting is somewhat smaller than the English Sparrow and not so strongly or roughly built. According to Chapman (1, p. 141, and facing p. 122 for picture) its habitat is the great broad fields where it finds its food. It is protectively colored, the upper parts being grayish black and brown; breast and sides streaked with black and brown; belly light; lesser wing coverts chestnut. It has a very sweet song, some parts of which as well as the sharp, clear calls were to be heard in the laboratory. Its habit of feeding and flying near the ground is so strong that it required some patience and several trials to get it to leave the large cage by an opening in the upper corner. Its scratching habit was so persistent that to the last, after months of captivity, no food could be kept in its food-box.

From the standpoint of its habits and instincts the Cowbird is one of the most interesting and hated of birds. It is somewhat larger than the English Sparrow, being rather an obscure looking bird of dusky grayish-brown color. This is particularly true of the female. See Chapman (1, facing page 114) for colored picture. Like the European cuckoo it builds no nest of its own but lays its eggs in other birds' nests. According to Coues (2, p. 402), "it is migratory, abundant, gregarious, polygamous, polyandrous, and parasitic. . . . It appears to constitute, furthermore, a remarkable exception to the rule of conjugal affection and fidelity among birds. A wonderful provision for the perpetuation of the species is seen in its selection of smaller birds as the foster-parents of its offspring; for the larger egg receives the greater share of the warmth during incubation and the lustier young Cowbird asserts its precedence in the nest; while the foster birds, however

reluctant to incubate the strange egg (their devices to escape the duty being sometimes astonishing), become assiduous in their care of the foundling even to the neglect of their own. The number of species thus imposed upon is now known to be about one hundred. In the western prairies great flocks of this bird may be seen following herds of cattle. They very often feed upon the parasitic insects found on the backs of these cattle. When kept in captivity with other birds the Cowbird, according to Prof. C. F. Hodge and Mr. Raymond, performs the same good office for them. My Cowbird I have never seen do this, but she had the habit of approaching quite near to the English Sparrows and looking them over very carefully. Does this act relate itself to the food-getting instinct or does it have its setting in the friendly stealthy attitude and approach which this bird has in order to lay its eggs in other birds' nests? Another very interesting performance was the turning of her head on one side and moving it round as though to take in the whole expanse of sky. She did this most often immediately after alighting. This has not been seen in other birds which I have observed. It would seem to find its explanation in the necessary watchfulness she must exercise in order to deposit her egg in the nests of other birds without being seen.

The Pigeon is so familiar that just a word of description will suffice. Schmeil (12, p. 195) writes as follows: "The races of our domestic pigeons are the descendants of the rock-pigeon which inhabits the cliffs of the coasts of the Atlantic and Mediterranean and other similar places. It has been domesticated from times immemorial. By means of constant selection numerous races or varieties of pigeons have been produced which frequently exhibit in shape, color, formation of beak, feet, etc., more considerable differences than distinct species of birds. The pigeon has a keen sense of sight. It is a defenceless bird and is consequently *shy* and *timid*." Yet in this respect Professor Mills (6, p. 257) makes a difference between the different varieties of pigeons. He says "though differences between the mature forms of varieties of pigeons, so pronounced as regards physical form, less so psychically, but still real and always present, are obvious to even a superficial observer, it is interesting to note that even at an early date such differences do appear. To illustrate: the Dragoon is a bird of very bold appearance, and as compared with many varieties, is somewhat wild. It has been spoken of as the 'game bird' of the pigeon family. Such characteristics are manifest in the young before they are twenty days old. They peck sooner and more vigorously in the nest. They are shyer of approach, etc. This cannot be explained by a more rapid

development, for several other varieties mature sooner than they do."

The English Sparrow and its habits are, like the pigeon, so familiar that it needs but little description. For this the reader is referred to my earlier paper (9, pp. 313-316).

A few words will suffice to set forth all that has hitherto been attempted in the investigation of the psychical differences between birds of the same or different species. Professor Whitman (15, pp. 331-338) has made experiments which point to a difference in intelligence between the three varieties of Pigeons —the Homing, Ring-neck, and Dove-cot. The first experiment consisted in placing the egg just outside the nest. Would they have intelligence enough to modify their instinctive way of reacting and thus pull or try to pull the egg back into the nest? The Passenger Pigeon recognizes, not by sight but by feeling, that something is wrong. Her instinct being keenly attuned she promptly leaves the nest. The Ring-neck may try to reclaim one egg. Having done so she is satisfied. The Dove-cot tries to reclaim both eggs and failing leaves her nest with more hesitation than the others.

Here, then, according to this author, is a difference between the power of intelligent action to be found in these birds. The reason for this difference, according to Prof. Whitman, lies in the fact that domestication has let down the bars to alternative choice. And this means the beginning of intelligent action. The wild or semi-wild pigeon has always nested in a place where it has never recovered its eggs after they were once out of the nest. With the domesticated pigeon conditions have been different. It could reclaim its egg.

Prof. Whitman also notes that the Ring-neck has great difficulty in locating her nest-box even though it has been moved but little out of its accustomed place and everything else remains the same. She depends entirely on its relations to the environment.

The above constitutes the sole experimental contribution, so far as the writer's knowledge goes, to the mental differences between birds. Whether or not we agree that Prof. Whitman has placed the correct interpretation upon the fact which he has found is a question aside. However, we are able to see that he finds by experiment and observation that there are these differences in intelligence and variability of instinct between his three varieties of pigeons. Domestication and semi-domestication are responsible, according to him, for these differences. Now, no one will question the statement that the English Sparrow has been for thousands of years in just as favorable, indeed, if not more favorable, conditions with relation to domestication. As stated in a former paper, it has

retained its native wildness, and yet lives with man, compelling the latter, in spite of his efforts to the contrary, to feed it and give it shelter. That these are good conditions necessary for the development of variability or alternative choice there can be little doubt. Apropos of an investigation into the mental differences between birds not only into the cognitive but the emotional and volitional as well, the following from Chapman (1, p. 137) is not without interest,—"Even after leaving the nest the parasite (the cowbird) continues its call for food, and when seeing a Maryland Yellow Throat, or some other small bird feeding a clumsy fledgling twice its size, one wonders it does not detect the deception. The better we know birds the more strongly are we impressed with their individuality. To one who has no friends in feathers it seems pure fancy to endow some insignificant "chippy" with human attributes; but in reality there are as clearly defined characters among birds as among men. To be convinced of the truth of this statement we have only to compare the Cowbird, a thoroughly contemptible creature, lacking in every moral and maternal instinct, with the bird who constructs a well-made nest, faithfully broods her eggs, and cares for her young with a devotion of which mother love is alone capable." What additional evidence can controlled observation and experiment offer as to mental differences among birds?

Tests with a Simple Maze.

After making several trials with Dr. Small's complex maze, a reduced form of which was used in my earlier work, I concluded that it was too difficult for a beginning test as well as too great a tax upon my time, a single test sometimes requiring as much as four hours' time. Accordingly a simple maze was made. Fig. 1 shows the plan of this maze which was four feet square with alleys five inches wide and high. The bottom and top were of the same wire mesh both being cut away at C, the centre, leaving this open. The partitions and sides were fastened by unravelling the wire mesh of the edges and clinching these into the top and bottom along their entire length. This maze is therefore very free from landmarks but since it is so simple this is not of so much consequence as in the more complex one. It will be seen that there are two longer ways, and one short one, to the centre. The maze was placed in the middle of the floor of the large cage and food at C. The small cages were placed with open door at O, the opening to the maze. After reaching C the bird was free to eat and fly about in the large cage. There were thus two incentives to cause the birds to put forth greater efforts in order to get to C; namely, the desire for food and for the greater freedom afforded

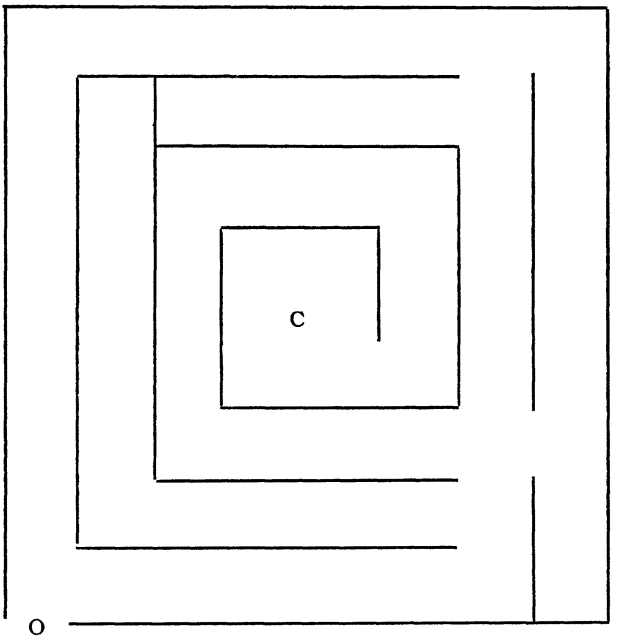

FIGURE I. SIMPLE MAZE.

by the larger cage. The birds were recaptured by hanging the small cage with open door on the outside of the larger one and carefully driving them through a small door in the upper corner of the larger cage. Six different birds were tested with this maze. Each approximately the same number of times daily. The birds were a Vesper Sparrow, a female Cowbird, two male and two female English Sparrows. The table following shows the results for a series of thirty tests, the numbers under "Time" and "Errors" being averages of each two consecutive trials. The time is given in seconds and an error means a retracing, no matter how slight, in the wrong direction or toward the starting point. A record of the path taken by the bird was made by tracing a line through a reduced plot which I held in my hand. F means failure. F–F means failure both trials of the first two tests of the Cowbird. F–880 indicates that there was a failure the third trial and the fourth trial required 880 seconds. Other cases so indicated are to be interpreted in like manner. Ch. indicates the number of reversals from the short to the long way or *vice versa*.

The Cowbird and a male English Sparrow failed to get through the maze during the first trials. Their claws seemed to hook round the wire in the floor of the alleys so that they

TABLE I.

Tests with Simple Maze.[1]

No. of Trial.	VESPER SPARROW.		COWBIRD.		ENGLISH SPAR'OW. F.5		ENGLISH SPARROW. M.6		ENGLISH SPAR'OW. F.7		ENGLISH SPAR'OW.M.8	
	Time.	E'rs.	Time.	E'rs.	Time.	E'rs.	Time.	E'rs.	Time.	E'rs.	Time.	E'rs
1–2	44	3·5	F–F	91	116	7·5	F–504	58–45	645	121	130	11
3–4	112	3·5	F–880	F–27	32	1	59	2	133	13	91	7
5–6	30	1	231	44	36	1·5	56	0	78	6	20	2
7–8	44	4	F–420	6	170	7·5	68	4·5	16	·5	14	1
9–10	31	·5	F–57	7	12	0	36	0	14	1·5		
11–12	26	1	27	1	22	1·5	13	0	11	0		
13–14	43	8	13	1	88	0	13	·5	11	1		
15–16	39	3·5	12	1·5	98	2	7	·5	7	1		
17–18	13	1	6	·5	16	0	124	2	14	0		
19–20	26	2·5	8	2	14	·5	10	0	9	0		
21–22	10	0	6	·5	7	0	15	·5				
23–24	8	·5	5	·5	13	0	9	0				
25–26	11	·5	7	·5	23	1·5	7	0				
27–28	9	1	4	0	9	·5						
29–30	13	1·5	5	·5	9	·5						
Ch.	15		2		3		1		2			

[1] In this and all following tables the *time* is given in seconds.

had considerable difficulty in getting along at all. It will be seen that the English Sparrow overcame the difficulty more rapidly than the Cowbird. The fact that the latter's claws are more hooked may very well account, in part, for her greater difficulty. Results from other experiments would agree with this. She probably is also less rapid in adapting herself to new situations. Her later progress in learning the maze, as indicated by the table, shows that it was probably nothing more than a late start.

The Vesper Sparrow, during all the trials, and especially during the first one, seemed most at home of any of the birds. To one who knows the native haunts and habits of this bird this has seemed surprising. But from a bird that lives and nests near the ground amid thickets and clumps of bushes this is just what I should expect. Her habit of staying very near the ground was shown very clearly when I tried to drive her from the large to the small cage. She persisted for some time in flying about near the floor. Furthermore, the Vesper Sparrow was throughout less easily frightened than the others. This would be an advantage to her during her first trials in the maze. She, the Cowbird and the English Sparrow, No. 7, became quite tame as the experiments progressed. The Cowbird wanted to come through the maze before I could get out of sight. But the tameness of the English Sparrow was probably due to his abnormal condition as he died a few days later. On the contrary, the female English Sparrow, No. 5 (which I

pronounced to be a young one, judging from the yellow bill, the color of her feathers, and her size), became very much frightened, and at the slightest disturbance she would crouch at some place in the maze instead of going through. Her fright was caused by her escape into the large room from the small cage. She had to be caught and this was done only after a prolonged chase. English Sparrows learn much more readily than other birds to take advantage when the small door is opened. Her wariness was shown by the time she remained in the small cage before entering the maze at all. This was considerably greater and more persistent with her than with the others. A later series with this same bird was discontinued on this account.

A glance at the table will show that all of the birds learned the maze during the twenty or thirty trials. All of them did not take the short way through, but if some habitually went the long way this did not lengthen the time much and should not be counted against them. But if there were many reversals from the long to the short way and *vice versa* then this should be noted since it would seem to indicate either a failure to discriminate or, what is more probable, an incapacity to hold in memory the way last travelled. The Vesper Sparrow made thirteen such reversals in thirty trials, the Cowbird three, the female English Sparrow, No. 5, four, the male English Sparrow, No. 6, one, and the male English Sparrow, No. 7, two such reversals. These reversals with the Vesper Sparrow grew less frequent toward the last of the series. Taking the results just mentioned in connection with the reduction of the time required and the number of errors, the Vesper Sparrow would seem to have the poorest record of any. If there is any difference between the Cowbird and the English Sparrow it is slightly in favor of the latter, particularly at the start. This is not so noticeable in the time as in the number of mistakes made. One reason for the Cowbird's short time is that she chose the most direct way and went very rapidly.

It can be seen from the table that the number of errors does not always increase with the time. The early adaptation of all these birds, and, according to these results, especially of the English Sparrow, is one of the chief points of interest. Many of the errors were very slight, and although they were corrected at once, record was always made of them. Habit seemed to hold them to their mistakes just as it does with us, and recognition of a certain part of the maze through sight or muscular sense, or both, seemed to be the cue for retracing their steps.

Memory Tests.

Following an interval of thirty days a series of ten memory

tests was made with three birds, the Vesper Sparrow, the Cowbird and the female English Sparrow, No. 5. There were no intervening tests and all the conditions were as nearly as possible the same as for the initial series. The results are given in Table II which is to be interpreted in the same manner as the table preceding.

TABLE II.

Memory Tests with Simple Maze.

No. of Trials.	VESPER SPARROW.		COWBIRD.		ENGLISH SPARROW. Fe. 5	
	Time.	Errors.	Time.	Errors.	Time.	Errors.
1–2	17	1	7	1	17	1
3–4	49	1·5	4	0	10	5
5–6	26	2·5	5	0	15	1
7–8	7	·5	7	·5	19	5
9–10	13	·5	4	0	9	0

The results in this table show that birds have a very good memory. The Cowbird shows the best results, her average time for the memory tests being the same as for the last ten trials of the first series. There are also fewer errors in the memory series. The average time for the other two birds is not quite equal to the last ten trials of the initial series but is better than the second ten of this series. The Cowbird seems to have forgotten little or nothing, the other two forgetting more of what they had learned a month previous but by no means enough to place them in their earlier inexperienced condition. Here again the differences between the individual birds are so slight, especially between the Vesper Sparrow and the English Sparrow, that it is well not to make too much of them.

Immediately following these memory tests the maze was reversed thus compelling the birds to enter from the opposite

TABLE III.

Tests with Maze Reversed.

No. of Trials.	VESPER SPARROW.		COWBIRD.		ENGLISH SPARROW. Female. 5.	
	Time.	Errors.	Time.	Errors.	Time.	Errors.
1	554	33	135	27	780	24
2	33	1	15	4	120	5
3	31	2	11	1	41	2
4	35	4	38	5	106	5
5	36	3	10	2	62	2
6					23	1

corner. In this table the individual results for each trial are given. I have not averaged each two successive trials. It can

easily be seen from the accompanying table that the effect of this was to upset entirely the habits previously formed. The beginning times and errors are very high. At a certain turn in the maze they tried very hard to go in the old direction. This was rapidly overcome as the succeeding trials clearly show. The behavior of the birds in this experiment tends to strengthen the opinion formed from earlier experiments with the more complex maze; namely, that, especially after the maze is learned, the birds do not depend on sight alone for their cues as to when to turn and in which direction, but on a sense of direction and distance as well. That this is, at least in part, in terms of muscular sensations is probable.

Test with Food-box with Pigeons and Cowbird.

The box used was not identical with the one used in the earlier study with the English Sparrows alone. It was thought advisable to make it considerably larger, especially for the

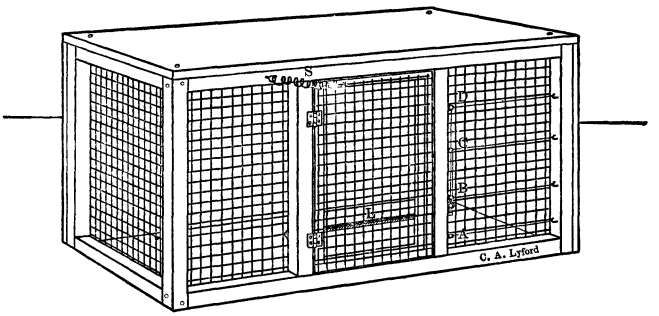

Fig. 2.

pigeons. This box is twenty inches long, thirteen inches wide, and twelve inches high. The latch L is on the inside and when let down the door closes by means of a small catch which is fastened to the door. This latch may be easily raised by pushing or pulling any one of the strings A, B, C, or D. A spring at S pulls the door open when the latch is raised. The end to the left and the entire front are of wire mesh, so that the food is easily visible from most points in the large cage. The top and the other side and end are solid. When experimenting the right end was placed against the wall of the large cage. As in the earlier tests, the birds were fed in this box with the door open for at least two days before the experiments proper were begun. During most of the time this box was removed after the bird had eaten. This gave the birds the freedom of the large cage during the interval between tests, a very desirable condition to fulfill if it is at all possible. In taking the time the watch was not started until the birds

reached the floor near the box or were standing on the box itself. As in all other tests previously described, a record was kept of the number and kind of errors made. These, however, do not appear in the table. The tests were made several times daily, varying from two to nine in number. This number was practically the same for the different birds. In the table below, which is to be interpreted in the same manner as Table I, will be found the results obtained with the Cowbird, a male Pigeon and a female Pigeon. The female Pigeon was some five or six years old and of the Passenger variety. The male was younger but apparently had attained his full size and growth. He was of the common Dove-cot variety. I could do nothing more than merely begin a series with the young English Sparrow, No. 5, her fright by this time had caused her to become so unmanageable. The other English Sparrow, No. 8, died before I could try her by herself, and still another one fell a prey to gray rats.

As is probably the case with all tables, the notes describing the actual behavior of the animal are quite necessary for the correct understanding of the results. This is especially true in the present case. The description of the conditions and the results for the Cowbird will be given first. Her first method of opening the door was by hopping up on the side and pushing in the strings with her claws. This was done entirely at random during the first and following trials. She was somewhat frightened and consumed much time in standing before the strings in a half crouched attitude ready to act. To make it easier for her, as well as to see what they each would do, the Vesper Sparrow and an English Sparrow were turned into the cage at the same time. But the Vesper Sparrow was soon removed because she showed little disposition to get into the box, and also because of the vociferous attention which she paid to the others. I was not able to satisfy myself as to whether this was a manifestation of hunger or sexual excitement. It was probably the latter. She later fluttered against the side of the cage and showed a strong desire to escape. She soon died. It was in early spring and her actions were probably those of the mating period. With very few exceptions the English Sparrow was leader. She often made several excursions to the box before the Cowbird reached it. Some few times I have thought the Sparrow was imitating in some slight way the other's method of opening the door, but I could not be sure of this. The Cowbird gradually reduced the number of useless efforts at other places on the box and at the same time learned to use the bill instead of the claws. She also dispensed with the hopping up on the side of the box and remained standing on the floor while opening the door. This is

TABLE IV.

Experiments with Food-box.

No. of Experiments.	COWBIRD.	PIGEON, Male.	PIGEON, Female.
	Time.	Time.	Time.
1–2	140	345	397–F
3–4	570–F	F–670	248
5–6	F–125	F–240	101
7–8	220	810–F	72
9–10	630	F–550	25
11–12	117	687	75
13–14	64	217	34
15–16	31	882	38
17–18	95	97	26
19–20	45	130	57
21–22	71	470	34
23–24	75	117	18
25–26	40	240–F	18
27–28	45	277	66
29–30	79	210	25
31–32	116	702	38–F
33–34	52	112	32
35–36	81	320	19
37–38	24	51	23
39–40	47	112	23
41–42	39	65	
43–44	21	118	
45–46	21	205	
47–48	16	F–100	
49–50	7	377	
51–52	10	F–192	
53–54	3	76	
55–56	20	76	
57–58	7	246	
59–60	40	58	
61–62	4	138	
63–64	3	201	
65–66	3	98	
67–68	7	176	
69–70		72	
71–72		198	
73–74		217	
75–76		140–F	
77–78		62	

a very similar procedure to that used by the Sparrow No. 4 of the earlier study. Although the two boxes were not alike the method of opening was quite the same. The Sparrow used the bill at the tenth trial and stood on the floor at the twenty-seventh. The Cowbird used her bill on the forty-sixth trial and opened the door from floor at the fiftieth, though she does not consistently use this method until eleven tests later. As compared with the English Sparrow she seems rather slower

in leaving off the unessential and in learning just the thing to be done. However, it is a point worthy of note that both proceed in the same manner to reduce the necessary action to its lowest terms.

The male Pigeon opened the door first and last in the same way—striking one of the strings with his bill. There was thus no opportunity for him to simplify his action. He stood on top of the box or on the floor near the box a great deal of the time. Seeing parts of the box or the food seemed to suggest with difficulty the required actions. He early established the habit of going for a drink and sometimes opened the door on his return. His manner seemed to indicate considerable indecision, even after he had approached the box a number of times. In the fourteenth trial he struck the string three times after the door had swung open. The same thing occurred twice in the following trial, once in the twenty-fourth and the twenty-sixth, twice in the twenty-seventh, once in the twenty-eighth, and four times in the sixty-eighth. Three of the latter were rather vicious hard pulls on the string, and after starting to enter he turned and pulled the string the fourth time. Often after stopping in front of the strings he made several feints at striking them before really doing so. He seemed to see very keenly. The slightest shadow on the cloth side of the cage was enough to disturb him. He was very easily distracted, reminding one not a little of a nine months' old child, who apparently starts across the room for some object but forgets about it before it has scarcely started.

The female pigeon opened the door by simply walking up the side over the strings until some one of them was pushed in. In the fourth trial she used the bill on the top string. During the succeeding trials she used several methods—pushing in with her breast. and pulling the lower string with her bill or claw while standing on the floor. Not until the thirty-first trial did she use one method exclusively. This consisted in pulling down on the lower string with one foot. As with the male Pigeon, many trials show several approaches to the strings before the door is opened.

An attempt was made with the female English Sparrow whose wildness had caused me to discontinue the series with the reversed maze. She was so wild that but eight trials were made, she being successful only on the second and fourth trials. However, in the fifth and succeeding trials it was clear that she tried repeatedly to seize the strings with her claws without alighting or even touching the box. But before quite reaching them she hovered and flew away. It was probable, judging from my experience with others of her kind, that she had already selected in spite of her fear, or it may be because of it,

the essential part of the apparatus. I say because of fear, for it may very well be that a reasonable amount of fear and caution may act as a stimulus to a more rapid singling out of just the required things to do, and the parts to be worked upon.

While making the tests, the results of which are recorded in an earlier paper, a Red-headed Woodpecker came in through the open window and was caught. A short series of experiments was made with the food-box, figured (9, p. 319); also several unsuccessful attempts were made to get him through the same maze as that used with the English Sparrows. He showed very little caution in his first approach to strange objects placed in the cage. The food-box he opened very readily the first time. He did this by pecking the latch; and as we all know this is, *par excellence*, his one natural method of getting his food. But succeeding trials showed lack of ability to profit by experience. This in spite of the fact that apple and other food more to his liking than that used for the English Sparrows was placed on the inside. Yet most amusing and instructive of all was the way he pounded the bottom, but chiefly the wire mesh, of the maze with his bill. It is true that the maze was a little small for him, particularly when he attempted to turn round; but instead of trying to walk through he spent the greater part of his time in pecking at the sides and bottom of the maze. Frequently he thrust his long tongue, peculiar to his kind, through the wire mesh. These results, though few and negative for the most part, serve to re-emphasize the place which very often the natural instinctive activity of the animal should be given in our efforts to study its intelligence.

These results also served to suggest for solution a question concerning the learning act in the individual animal. As indicated above, this Woodpecker opened the door very easily on the first trial; so also did the Vesper Sparrow the first times through the maze, and the male pigeon in opening the food-box. Now the query arises whether greater difficulty and therefore more vigorous activity on the part of the animal in the initial trials of any series may naturally be expected to lead to more rapid progress in the later ones. The greater activity would give through the back-stroke impulses a richer experience. All the movements except the one bringing the right result may be looked upon as having a slightly disagreeable affective tone; at least, the movement opening the door or bringing the correct adjustment of the organism is affectively colored in an agreeable way. The trouble which the Cowbird had with the Simple Maze, and the fear and caution which she had in consequence of this, may have made her react in this particular experiment in a way similar to the habitual way of the English Sparrow. With the food-box, designs, colors, and

forms she was much more at ease. These facts are far from conclusive and all that is attempted is again to call attention to a very desirable further analysis of the learning act, especially as it is modified by those mental states which are more predominantly affective and motor.

There is some ground in what has just been said for thinking that the first half of the proverb, "No man learneth but by pain and shame," may very well be true of animal learning as well. To be sure, the difficulty, activity, or emotional condition must not be too extreme. "Soon learnt, soon forgotten," and "One learns by falling (failing)" may be found to be even more applicable. The above suggestions gain added weight from the fact that Professors Jennings ('04 and '05) and Pillsbury ('06) have recently so extended the trial and error method as to make it constitute, according to the former, the essential principle of regulation, chiefly of behavior, in the inorganic as well as the organic, according to the latter, as the essential factor in evolution, even including the social life of man. As further proof that this same method may be found to apply to the instinctive activity of higher invertebrates, the reader is referred to the abstract of the writer's work with Spiders (10, pp. 44, 45). The original paper will appear in the next number of this *Journal.*

The preceding may be of some help in interpreting the failures recorded in the above table, particularly those against the male Pigeon. Some of these fall late in the series. Such is not the case for the Cowbird except during the first few tests, and the female Pigeon failed but once after she was well along in the series. The time measure for the male Pigeon is irregular and very slowly drops toward the minimum, indicating that learning is rather a slow and uncertain process with him. The Cowbird is considerably better, but not quite so rapid and well sustained as the female Pigeon; while if we compare the time for the English Sparrows it will be seen that in general they are very similar. While the times for the English Sparrows show a better ability to learn than even the female Pigeon and the Cowbird, yet the variations are not so great but that they may be cancelled by individual differences. It is quite obvious that the cases tried are too few to permit of any elimination of these differences.

Memory Tests.

After an interval of thirty days these same three birds were tried again with the same box. As before, with the simple maze, there were no intervening tests. In general the same differences obtain in these memory tests as in the initial series. There is not much difference between the Cowbird and the

TABLE V.

Memory Tests with Food-box. Thirty Days Interval.

No. of Trial.	COWBIRD. Time.	PIGEON, Female. Time.	PIGEON, Male. Time.
1--2	65	102	36
3-4	12	320	27
5-6	36	20	14
7-8	46	29	15
9-10	8	38	19
11-12	12	23	87
13-14	12	19	40
15-16	39	30	32

female Pigeon. The male Pigeon is not long in returning to his former record. It should be added, however, that I had learned by this time to take extra precautions to be sure that the male Pigeon was really hungry. There were some indications that the over-night interval did not make him as hungry as the other birds, especially the English Sparrows. If there is really a difference of this kind here, it is very important, and should be taken account of in later experiments.

Both the Cowbird and the female Pigeon lapsed to their earlier way of opening the box after this interval of thirty days. It will be recalled by those who read the results of my first study that a change in the fastening caused the English Sparrow to revert to his old habit. But it is interesting to note that his following of the old habit is of short duration, lasting only during the first few trials. The male Pigeon's method, as pointed out above, was as simple from the first as it could be. But in this memory test he must approach the box as many as four times before acting. In the following trials there is less of this.

One hundred and twenty days later for the Cowbird and one hundred and forty days for the male Pigeon a second memory series was obtained. It is evident from Table VI that there is greater loss through this longer lapse of time and the same difference between the two birds is more marked than in the other memory series.

After the thirteenth test in this series with the Pigeon, the strings which opened the door were placed to the left of the door, the original strings being left on the right, but which it now did no good to pull. The food was taken from immediately back of the old strings and placed in the same position with reference to the new ones. This change caused him some trouble. Most of the times are long and he shows a much less rapid reduction of useless efforts than the female Sparrow (9, pp. 22 and 23), with which a very similar test was made. He

TABLE VI.

Memory Tests with Food-box. Second Series. Intervals 120 Days for Cowbird and 140 for Pigeon.

No. of Trials.	COWBIRD.	PIGEON, Male.
	Time.	Time.
1–2	132	1800–F
3–4	37	355
5–6	54	24
7–8	34	80
9–10	15	132
11–12		33
–13		55

is also slower and more irregular in reducing the time to a minimum.

TESTS WITH DESIGNS.

These were made only with the Cowbird. The test was an exact repetition of the one made earlier with the female English Sparrow. Glasses covered with gray paper were surmounted by cards carrying designs. The food was first placed in the glass carrying the card with three horizontal black bars, and alongside of this was placed a similar glass carrying a blank card. Next the food was placed in the glass with the card carrying a black diamond, and used as before along with the glass carrying a blank card. In the third series the horizontal bars and the diamond were used, the food being in the glass bearing the diamond-marked card.

The place of the food-glass was irregularly shifted from right to left and *vice versa* while the bird was behind me. Twenty tests were made at each sitting. If the bird came to the wrong glass she was allowed to feed a little out of the right one. The table below gives the correct number of choices out of twenty trials for both the Cowbird and the English Sparrow, the results for the latter being taken from my earlier work (9, p. 345).

FOOD IN GLASS WITH HORIZONTAL LINES.

Cowbird,	11	16	17	19	19	19	18	18	19	19	19	
English Sparrow,	14	13	15	14	15	16	16	20	20	18	17	20

FOOD IN DIAMOND-MARKED GLASS.

Cowbird,	16	17	14	17	19	20
English Sparrow,	18	14	12	18	18	20

FOOD IN DIAMOND-MARKED GLASS TO BE DISTINGUISHED FROM ONE WITH HORIZONTAL LINES.

Cowbird,	1	4	6	7	10	12	12	16	17	19
English Sparrow,	11	14	12	18	18	20				

It should be noted that the Sparrow made alternate choices from opposite ends of the cage while the Cowbird flew always from the same perch. The Sparrow usually alighted directly on the edge of the glass of her choice but the Cowbird always flew to the floor and then walked slowly to the glass of her choice. Her vacillation or indecision was very noticeable at times. The first and second series show little if any difference in the rate of learning or ability to discriminate. However in the last series where somewhat nicer discrimination is called for and an old habit must be inhibited the Cowbird seems much the slower. Some may ask if it is not possible to find designs that are not so foreign to the animal's experience. My answer would be that such may be quite possible. The reason for using these was the fact that Dr. Kinnaman used them with his monkeys and obtained negative results with them. By using the same apparatus and methods of experimentation as nearly as may be is the only way to obtain results which will admit of close and exact comparison. Both the Sparrow and the Cowbird learn to discriminate these designs from no design and from each other and it was that the comparison might be made as exact as possible that these designs were used.

Color Discrimination.

Six glasses were covered with the Bradley colored papers, a dark gray, a light gray, a bright yellow, a dark blue, a light green, and a dark red. Samples of the papers used with the Sparrow were used to match from. These glasses were placed in holes in a board. The same programme which determined the place of the glass for the Sparrow was used here. Here also twenty tests were made in each successive series. The following table gives the number of correct choices for each series with the results for the Sparrow again brought forward for comparison.

Food in Blue.

Cowbird,	5	9	11	12	12
English Sparrow,	12	14	13	12	19

Food in Yellow.

Cowbird,	4	4	9	11	10	11	15	18	17	18
English Sparrow,	0	5	1	5	8	16	11	13	18	19

Food in Red.

Cowbird,	8	6	14	16	17	20
English Sparrow,	2	1	9	15	14	20

Food in Green.

Cowbird,	6	10	16	18	17
English Sparrow,	9	17	15	14	18

Both birds learn to discriminate between the different colors at almost an equal rate. The first color used, the blue, showing the widest difference in favor of the Sparrow. Again, it should be added the latter's approach was much more direct and her choice seemed more decisive. The closest attention on my part was necessary to see that the Cowbird did not peek into the glass next to the food glass before committing herself to a final choice. She did not manifest the color preferences which the Sparrow was found to have. The latter was at first disposed to avoid red, yellow and green.

The few tests which I was able to make with the forms indicate that the Cowbird was learning to distinguish the triangular from all the others. This the Sparrow could or did not do. Yet there was one important difference which crept into my way of trying the experiment with the Cowbird. The box containing the food was shifted each time, it is true, but the triangular box always presented the same face to her. With the Sparrow there was a constant shifting of faces, and it is possible that this makes it too difficult. Yet it will be most interesting to determine if the Cowbird in her detection of other nests, and within limits of those best for the preservation of her species, gets any help, instinctive or otherwise, in the correct distinguishing of these forms. Some tests with the same male monkey which Dr. Kinnaman experimented upon, indicate that he has considerably greater difficulty in distinguishing these forms than those which Dr. Kinnaman used. The latter, it should be stated, were not so free from differences in size.

Affective and Volitional States.

Since this work was begun attention has been given to the emotional and volitional reactions of the birds dealt with. When confined in the small cages the English Sparrows were most frightened by my near approach. They were as cautious as the Cowbird, perhaps more so, while the Pigeons and the Vesper Sparrow showed little of caution. The former sustained their reputation for timidity while the latter seemed so fresh from wild nature itself that it could not be otherwise than trustful. The female English Sparrow, as we have seen, was too fearful to open the food-box in a reasonable length of time; yet when the door to this box was open, and the male Pigeon inside, the same Sparrow entered and re-entered, although the Pigeon had already driven her out.

When conditions were reversed the Pigeon sometimes failed to enter when the Sparrow held possession. This characteristic boldness of the English Sparrow is seen in the way it frequently despoils the Robin of the worm the latter has just found. At most any time in late summer on the University

lawn one may see a Sparrow alight some six or eight feet away, wait until the Robin has found a tempting morsel, then rush in and relieve him of it. Even the Cowbird, perhaps, accomplishes the laying of her egg in some other bird's nest rather through stealth than by driving the rightful owner from the nest. It seems to me that this stealthy manner was evident many times during the experiments with her. When confined in small cages with English Sparrows she was able to lord it over only the sick ones. She seemed to keep her weather eye open, and especially just after alighting would turn her head half way over so that she might take in the whole expanse of the sky. Rouse (11, pp. 512 and 513) in his study of Respiration and Emotion in Pigeons, finds that the breathing previous to habituation is profoundly influenced by sounds, mechanical jars, and, perhaps, odor, jars particularly causing abrupt inhibitions and irregularities. Stimulation by light caused much less disturbance than mechanical stimuli. It is probable that *agreeable feelings* are accompanied by respiratory quickening (and perhaps by shallowing and irregularity). After hearing a report of the present paper (10, p. 45), Mr. Rouse tells me that his later results on the intelligence of the Pigeon point to the same general differences in favor of the English Sparrow.

The English Sparrow is more active than any of the other birds. This with his boldness and caution makes him appear, at least, to have a goodly amount of curiosity. This, according to many writers on Psychology, is the best possible basis for a rapid development of the learning process. I refer here especially to lectures by Prof. Wm. H. Burnham, of Clark University, on such instincts as those of Workmanship, the Instinct for Further Cognition, etc.

Kinnaman (5, pp. 195 and 196) says of the individual differences between his two monkeys: "In their reaction to the locks, the male moved more rapidly about the boxes. He tried more persistently and gave up only after many fruitless efforts. . . . She always seemed stupid in the beginning, but often came suddenly to the idea, and finally, if it was an easy thing, learned it more quickly than he. . . . In all of the very difficult things he appeared to be superior, but for the easy things she was superior. If we turn to the association with forms the reactions were very much alike. . . . The female learned the colors more readily than the male." The author suggests that the male was too rapid and nervous for the best results in these last two tests; so also for the lower numbers of the number tests, but he continued the associations up to six, while she stopped at three.

Watson (14, p. 47) has very well emphasized the necessity

of keeping the kind of test well in mind if we would distinguish between mental accomplishments of animals. He says: "Considering first a problem where mere activity is at a premium for its solution, we find that the adult rat consumes more time for a first solution than does a young rat, but that for a second solution this difference in favor of the immature rat is not so marked. . . . Considering next a problem not so conditioned upon activity—such as the test with Box II—we find that not only does the adult rat show a smaller record for the second success, but that even the time for the *first* success is *much* less than is the time for the first success of any group of the young rats." There are many more useless movements made by the young rats. Small (13, p. 159) also makes superior vitality and activity explain the advantageous showing which his young rats made. The general impression which one gets from seeing my birds go through the tests (my attempts to actually measure the amount of their daily activity not having progressed far enough yet to allow of any definite results) is that the English Sparrow is most active of any, the pigeons being least so.

The Cowbird imitates the Sparrow in following her to the food-box. In turn it was thought that the Sparrow showed some signs of reacting in the same manner as the Cowbird toward the fastenings of the food-box. About the first of August, in Illinois, I have seen large flocks of these Cowbirds, many of which were apparently young ones. At this season they seem to feel that they belong together as the young of English Sparrows do. The young of both no doubt are better able to survive by association with the old and each other.

All the birds are able to confine their attention to a particular part of the box. This implies control of an inhibitory as well as a positive kind. Roughly speaking, the Pigeon and Vesper Sparrow showed least of this. They were not tried with the same apparatus, so that the above statement means so far as their respective tests are concerned and as contrasted with the other birds, Cowbird and English Sparrow. The Sparrow is no better in many of the tests, so far as this control is concerned, than the Cowbird. In the breaking up of an old habit where it antagonizes the new, and in the early reduction of a habit to its lowest terms, the English Sparrow is perhaps a little better than any of the others. The writer hopes that the present paper may approach more nearly to the standard recently set forth by Prof. Mills (7, p. 751), namely, that animals be tested in such manner as will bring out their powers of inhibition and control.

However true the above differences may be, or may be found to be on further experimentation, the writer does not hold that

the facts set forth in the present paper are at all sufficient in number to permit of any safe generalizations as to the superiority, in a mental way, of any one species of bird over another.

A summary of the results obtained and conclusions arrived at may be stated as follows:

1. The Vesper Sparrow, Cowbird, and four English Sparrows, learn the simple maze, a plan of which is shown on page 253. They all have it pretty well learned by the 15th-20th trial. After qualifying conditions are allowed for, there is perhaps little superiority of the English Sparrows over the Cowbird. The Vesper Sparrow seems to be the slowest in learning, a fact which is further strengthened by her changing fifteen times out of thirty from the long to the short way.

2. The memory tests with this same maze thirty days later show a surprising memory on the part of these birds. The Cowbird is best here. Her average for ten trials quite equalling that of the last ten of the initial series. The Vesper Sparrow and the female English Sparrow do not do quite so well. The latter was too young and too easily frightened to be a good subject.

3. The results with the food-box, see Fig. 2, page 257, which was used with the Cowbird and a male and female pigeon, give evidence of ability to rapidly profit by experience on the part of these birds. There are more failures later in the series by the Pigeon, especially for the male, than for the Cowbird. If we compare these birds with the English Sparrow, the latter were tried with a different box but it was not an essentially different fastening, there would seem to be a more rapid and consistent reduction by the English Sparrows of the time and efforts put forth. If we include the further simplification of the act of opening the door and its saving in effort, the English Sparrow is perhaps superior.

4. Memory tests after thirty days with these same three birds and the same box, no other tests being made in the meantime, show, in addition to the experiments on memory described above, that the Pigeons as well have a fairly good memory. This lapse of time has the interesting result of causing a reversion to a habit older than the one used when the former series ended. An interval of one hundred and twenty days for the Cowbird and one hundred and forty for the male Pigeon showed that much more was forgotten than during the former shorter interval.

5. The Cowbird learns to distinguish between the different designs—the three horizontal black lines on one card to be distinguished from a blank card, a card marked with a black diamond, from a blank card, and the two marked cards. There is not much difference here between the Cowbird and the English

Sparrow. The latter unlearns the old habit and therefore learns the new one earlier in the third series which, of course, is the most difficult.

6. In learning to distinguish between the colors the female English Sparrow does better with the first color tried—blue. After that the difference is not so great.

7. The tests with forms had to be left unfinished; but the Cowbird showed that she was learning to distinguish the triangle. The sparrow gave no evidence of this. Whether or not this is a real difference between the birds or is due to a different method of trying the experiments, must be left for further investigation to decide. Experiments with Jack, the same male monkey which Dr. Kinnaman experimented with, and my form boxes show that he has considerably more difficulty with these from which differences in size have been eliminated, than with those of Dr. Kinnaman.

8. The English Sparrow when confined in the same cage with the other birds has shown itself more capable of fear, courage or boldness, caution, and independent action. It was more of a leader, more persistent and more active. The Cowbird was almost as wary as the Sparrow yet at other times she was not so bold. The Pigeon's popular reputation for timidity and keen sense of vision was well borne out by my observations and experiments. The value to the animal of these differences, some of them marked, in emotional and volitional states is apt to be overlooked or, if noted, underestimated.

9. All, of course, show a distraction of attention as is quite to be expected from wild birds experimented on in captivity. This distraction or inability to keep the attention on one thing was (barring the wildness of the young female English Sparrow) most noticeable in the Pigeons, Vesper Sparrow, and Cowbird, and least in English Sparrows.

It is a pleasure to me to again acknowledge helpful suggestions from Professor E. C. Sanford; also to Mr. Toshi-yasu Kuma for making for me most of the Form tests on Jack, the monkey, and to Mr. Burton N. Gates, a fellow student, for the female pigeon used in some of my experiments.

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