

Physiology. — “*Factors which are of importance for the habit-formation of birds. I. Visual sensations*”¹⁾. By Miss LUCIE W. SCHUT. (Communicated by Prof. G. VAN RIJNBERK.)

(Communicated at the meeting of June 26, 1920).

Introduction.

In 1918²⁾ BUIJTENDIJK described experiments on habit-formation in birds. He found that a siskin very soon learns to look for food in a seed-box, where the food is hidden from sight by a flap. When this box is placed amongst similar, but empty ones, the bird invariably will go to the filled box, provided it is always kept in the same place amongst the others. The habit formed in this way was not forgotten, even after the bird having been taken for months to other surroundings, for on its return, placed in front of the same boxes, the bird at once flew to its old box for food.

Control and corroboration of BUIJTENDIJK's results.

I repeated the experiments made by BUIJTENDIJK and arrived at the same results as he did. The birds I selected for the experiments were the siskin (*Fringilla spinus*, 3 specimens), the redcap (*Fringilla carduelis*, 2 specimens), the paradise widow (*Steganura paradisea*, 2 specimens) and the Napoleon weaver (*Pyromelana afra*, 2 specimens). It is surprising how rapidly all these birds, but above all the siskin, learned to push their heads under the flap of the food-box. The siskins accomplished the task at the first trial, within fifteen minutes. The others took a little longer, the experiment having to be repeated regularly for a few days in succession. If, further, I replenished one particular box, placed amongst four similar ones, from the very beginning, as the rule was, the birds were equally quick in learning to look for food in that special box and rarely tipped up the flaps of the other boxes. BUIJTENDIJK believes that the fixed place the feeding-box takes amongst the others, is the ruling element in this case.

¹⁾ After experiments made in the physiological Laboratory of the University of Amsterdam.

²⁾ F. J. J. BUIJTENDIJK. Proeven over gewoontevorming bij dieren. Amsterdam 1918.

I can corroborate this in principal. In a great number of experiments taken with a siskin I endeavoured to remove every possible mark which might have led the bird to the right box. To this purpose I covered the frontside of the boxes, as also the bottom of the cage in front of them with strips of cardboard, which were constantly renewed. Husks of the eaten seed were carefully cleared away each time and the flaps of the boxes were renewed each time, in order that the bird might not be able to tell it by scratches it might have made with its beak. In spite of these precautions, the bird, once having learned that its food was placed in one particular box, rarely lifted the flap of another by mistake. As a positive proof, in connection with the supposition that the birds were led by other characteristics than the fixed place of the food box, I relate the following experiment: When the siskin had duly learned to go for its food to one particular box, I took a second cage, in all respects similar to the one in which the experiments had been made. This cage was perfectly new and the siskin had never been in it before. To this cage I had four new foodboxes attached, exactly like the four which up till that moment had been used for the experiments. The siskin had never eaten from these boxes, nor had they ever contained any seed. I now removed the siskin for a short time, on different days, from cage 1 to cage 2. No seed had been put into any of the boxes in order to avoid that the bird should smell the seed behind the flaps. It was evident that the bird felt strange in its new cage; it flew about continually, coming up close to the food boxes, without however lifting up any of the flaps. After it had quieted down a little, the bird, though it certainly made more mistakes in its new cage than in the usual experimental cage, nevertheless sometimes immediately after leaving cage 1 for cage 2, flew to the right box and tipped up the flap.

From this series of experiments I believe I am justified in forming the conclusion that the place the food-box takes is undoubtedly of great significance in the formation of habits. At the same time however I thought it possible that other impressions contributed to the result as well. I therefore decided to find out in how far it was possible to train the birds by means of another factor of impressions.

Other factors which may assist in forming a habit.

I have endeavoured to eliminate the factor of place entirely from the series of experiments, which I will now proceed to give. This was done by filling a different box with food each time, and thus

preventing the bird from becoming accustomed to a fixed spot for its food-box (for this purpose I employed siskins exclusively). I now however gave the food-box a visible mark, to distinguish it from the empty ones.

1. First of all, I pasted black paper over the flap of the food box, the remaining ones being of bright tin. In a few minutes the bird had learned that the seed was behind the black flap. And in an astonishing short space of time a bird that has first been trained to look for the seed box, according to its position, seems to have forgotten this and it learns that the seed is behind the black flap. By repeatedly hanging this in front of another box, the bird is literally taught to fly after this black flap and exclusively or almost so, to tip up this flap to look for its food¹⁾.

2. In a second series of experiments the flap of the food-box was pasted over with a blue paper. The flaps of the remaining empty boxes were also pasted over with blue paper, with blue of a different shade however. The result was that in a relatively short space of time the bird had learned again to go for its food to the box with the flap pasted over with blue of a particular shade, distinguishing it from the remaining flaps. The difference was scarcely perceptible: in a series of experiments I used blue N°. 1186 of the well-known coloured papers of BAUMANN for the empty boxes, and N°. 1187 for the food box (food-colour²⁾), this difference is barely perceptible to the human eye. (1187 is the merest shade darker).

3. A series of controls was still taken with green papers of different shades. It appeared that the siskin distinguished as food colour N°. 985 from green N°. 984, from BAUMANN'S scale.

4. In a subsequent series of experiments I selected an extremely small token of distinction for the food box. The flaps of all four boxes were pasted over with white paper, but on the flap of the food box a small round black disc was stuck in the centre.

Here again it was observed that it was comparatively easy by hanging the flap with the black food-token before another box each time, to teach the siskin, to look for its food exclusively behind the flap with the black disc.

¹⁾ In fact the bird had by no means forgotten the first learned token of locality. I will revert to this point in the exhaustive paper to be issued soon. For the rest, experiments were frequently made with blank specimen, (empty boxes), to prevent use of smell interfering.

²⁾ As is known, birds according to HESS do not see spectral colours further than the line of demarcation between green and blue. The difference detected must therefore be due to a difference in the shade.

5. Encouraged by the result of the series of experiments described so far, I resolved on employing a more subtle mark of distinction. I again employed white flaps for my purpose. The empty boxes had a black square, the food box a black disc of about the same size. The result of this series of experiments was not sufficiently convincing. Nevertheless I had the impression, when the siskin went to the box with the round disc, that this was not always entirely a matter of chance.

SUMMARY.

1. The result of my experiments is in corroboration with those of BUYTENDIJK, that the place a food-box takes in the midst of other (empty) boxes, is of great importance for teaching birds to form the habit of eating from that box.

2. In addition there are however numerous other visual factors which may tend to develop this habit.