Observations and Experiments Conducted on a Tame Blue Tit (*Parus caeruleus* L).

Af Mogens Højgaard.

(Med et dansk resumé: Iagttagelser over og forsøg foretaget med en tam Blåmejse (*Parus caeruleus* L.)).

On the 10th June 1953 I found a newly-fledged young Blue Tit (*Parus caeruleus*) lying on the ground in Charlottenlund Wood. It is possible that the bird had been incapable of flying with the others to the nearby beech-trees. In my experience Blue Tits do not normally feed one of their young which falls to the ground, and, therefore, I took the abandoned bird with me to Danmarks Akvarium. The young bird developed into a strong and healthy male Blue Tit, on which I conducted several experiments, until it died on the 23rd March 1954. A history of the bird based on my diary record is recounted in the subsequent section.

First Period.

June 10th. The bird was placed in a small cage with ordinary perches. Hard-boiled egg-yolk, larvae of *Galleria mellonella*, meal-worms cut into pieces and various grubs and insects collected in the open served as food. An attempt was made to give the bird boiled Mussel (*Mytilus edulis*), but it refused to eat it after only a few days. The bird was fed by means of tweezers, and at each feeding it was given just as much as it wanted, with the result that it accustomed itself to being fed every $^3/_4$ of an hour. For the first few meals it was only given a very small quantity every 10 minutes, as the bird was overcome by hunger and I was afraid that excessive feeding might kill it. As grown up the bird would eat Mytilus and was also very fond of sweet fruits.

On the *15th June* the Blue Tit was transferred to a somewhat larger cage (50 × 55 × 30 cm) which contained, apart from the ordinary perches, a fresh twig of *Forsythia* with leaves. The bird did not dare to perch on the branch till the following day, and even then only for brief periods at a time. There seemed to be no suggestion that the bird had any kind of "innate understanding" of the nature of green branches.

These had, like all other unfamiliar objects, an utterly negative primary valence. (RUSSELL 1935, FISCHEL 1938 and HØJGAARD 1947).

On *June 27th*, the bird, which had been named Pjevs, was moved into another room. The bird was very restless immediately subsequent to its removal, but in the course of 10 minutes recovered its composure. It showed signs of fear when strangers approached the cage quite closely, but accustomed itself in the course of the day entirely to the traffic in the new room. Pjevs was already aquainted with my colleague Dr. BARTH, his wife and two children in addition to myself. In a couple of days it grew familiar with yet 5 to 6 other people. These were then able to go right up to the cage and poke their fingers between the bars without the bird showing any signs of fear. Often it pecked at the fingers. The bird, however, did not primarily dare to fly down to my hand or onto that of anyone else, it had to accustom itself to it. It was, however, perfectly willing to allow itself to be picked up by hand, which it objected to most firmly at a later stage.

That same day (June 27th) I introduced the Blue Tit to a stuffed Tawny Owl and a Magpie. The Owl inspired no display of fear even when held right up to the cage, whereas the Magpie frightened the Blue Tit as soon as it was brought within a distance of 50 cm. The bird at once fluttered restlessly about in the farthest corner of its cage.

It subsequently became clear that Pjevs was primarily afraid of all objects whose colouring was bright or contrasting, which presumably explains the fear inspired by the Magpie.

June 28th. Today I attempted to accustom Pjevs to perching on my hand by the use of meal-worms as bait. After five offers in the course of two hours the bird flew down onto my hand. From then on it strutted about on my hand quite unperturbed even when I had no food for it to eat. On the same day I tried to tempt the bird out into my office, where its cage had already been placed the preceding day. Released in my office it at once flew to my hand and took a meal-worn, then returned to its cage to eat it. This occurred several times in succession. After this it flew about the room, but on almost every occasion landed on its cage.

While the bird was perched on top of the cage, I lifted my rough-haired hunting-dog "Bella" right up to it at a distance of approximately 50 cm., but the bird remained quite calm. It must be added that the bird had seen my dog periodically throughout the course of the preceding day.

Immediately subsequent to this, the bird, which was now sitting in its cage, appeared to be frightened by the following objects which I held within the critical distance of c. 50 cm.: My waste-paper basket, a bottle of glue, and an ink-well with a pen sticking out of it (it was not afraid of either the pen or the bottle by itself). Thereupon I once more introduced it to the Magpie and the Owl, and as on the previous occasion it only showed fear of the Magpie.

Initial Training. It was my intention in the course of time to test the bird's ability to distinguish between various shapes and different numbers of spots painted on small squares which were used to cover the bait (KÖHLER 1937, MAROLD 1939). In order to familiarise the bird with the intended experiment, I took the following steps: on the morning of July 2nd I placed a small piece of meal-worm on a square, light grey piece of cardboard (2.5 × 2.5 cm.) and offered it to the bird on my hand which I stretched into the cage. Pjevs who was under normal conditions utterly familiar with the process of taking food from my hand, on this occasion was afraid to do so. At 9.45 a.m. I placed the piece of cardborad with the bait in the bottom of the cage. Pjevs had still not touched it at 10.15 a.m. I thereupon put the cardboard with the bait in the palm of my hand as before, but at the same time placed two pieces of meal-worm in my hand at the side of the cardboard. The bird at once flew down to my hand, devoured first the unencumbered pieces of meal-worm and immediately after that the piece which lay on the square of cardboard—and in immediate succession took a whole meal-worm which was on the cardboard. On the numerous occasions in the course of the day Pjevs took a meal-worm from the piece of cardboard in my hand. Once in the course of the day I offered the bird a harvestman (*Opilio*) on my palm. Pjevs was afraid of flying to my hand; nor did it dare to fly down onto my hand to pick up a small fly, although he was otherwise perfectly accustomed

to eating small flies. The circumstance "a fly in my hand" apparently did not present a familiar impression and, therefore, rendered both hand and fly objects of "suspicion". When I thereupon placed a piece of meal-worm on my hand beside the fly, Pjevs at once flew down to my hand and took the fly first of all which it then devoured sitting on my palm, and only after that did it take the meal-worm.

Although as has been said, the bird was now completely familiar with my hands, it was unwilling to permit itself to be picked up by hand. This is perhaps a case of congenital behaviour in reaction to the claws of a bird of prey (KRAMER 1951). Although I picked up the bird against its will, it is even so not afraid to fly down onto my hand immediately after having been released. The moment, however, I start to close my fingers around it when it is perched on the palm of my hand, it immediately moves and generally speaking goes to the tips of my fingers.

Pjevs continues to greet me with quivering of the wings when I return to the room after an absence of some hours, but positively refuses to be fed by hand.

July 3rd. I, today, attempted to teach Pjevs to pick up a piece of meal-worm which lay hidden under the afore-mentioned piece of cardboard. With the bird watching I placed a piece of meal-worm under the cardboard in my hand and then stretched my hand right into the cage. After seven attempts in the course of the day the bird gradually acquired the technique of turning over the cardboard and from then on it continued to do so with complete confidence even without watching me hide the food. When the bird had learnt to turn over the cardboard with perfect confidence, I offered it likewise on my palm, a piece of meal-worm hidden under a bit of green leaf which was cut to exactly the same size as the cardboard. The bird was afraid to touch, but went at once to the familiar piece of cardboard and turned this over.

On the same day I observed Pjevs for the first time making attempts at copulation. This occured on the tips of my fingers, and the copulation motions were somewhat imperfect, but there was no doubt as to their nature.

July 4th. I made two pieces of zinc of a size identical

to the cardboard square (2.5 × 2.5 cm.). I held out the one on my hand, and Pjevs without hesitation alighted on my palm, turned over the plate and took the bait. Immediately after this I placed the plate without bait in the bottom of the cage, and the bird flew directly down and turned it over. I, thereupon, offered both plates simultaneously in my hand with a meal-worm hidden under one of them. Pjevs turned over the "right" one first, ate the bait and then turned over plate number two. Immediately afterwards I let the bird out of its cage and placed the two first plates (the one without a meal-worm underneath) on the table beside the cage. It must be noted that it was not primarily frightened by the zinc plate which in colour and shape was not substantially different from the familiar light grey piece of cardboard as for example the green leaf had been.

July 10th. For use in the course of the experiments I had made a green board (23 × 23 cm.) with 49 bowl-shaped hollows of a diameter of 1.5 cm. and 0.5 cm. in depth. The large number of hollows permitted both to vary the distance between the plates, between which choice had to be made, and to vary the relative positions of the plates in the course of the different tests. It was essential to familiarise the bird completely with the board by, at first, placing the food quite openly in the hollows. After the board had been presented three times with a meal-worm clearly visible in a hollow, Pjevs flew down and took the food which it carried up again to its cage to eat. Throughout the period of the subsequent experiments in connection with the board, Pjevs was free to fly around in my office. On every occasion the bird took off from the top of the cage on its flight to the boare. During all the following experiments the zinc plates were always placed at a distance of two hollows = 6.5 cm., but the plate covering the food was changed on each occasion. It was placed either above or below, to the right or to the left, but not in any particular order.

July 12nd. On being presented with the board with two zinc plates covering a hollow each (one of them containing a piece of meal-worm) Pjevs at once flew down and turned over both the zinc plates, the right one before the other. From

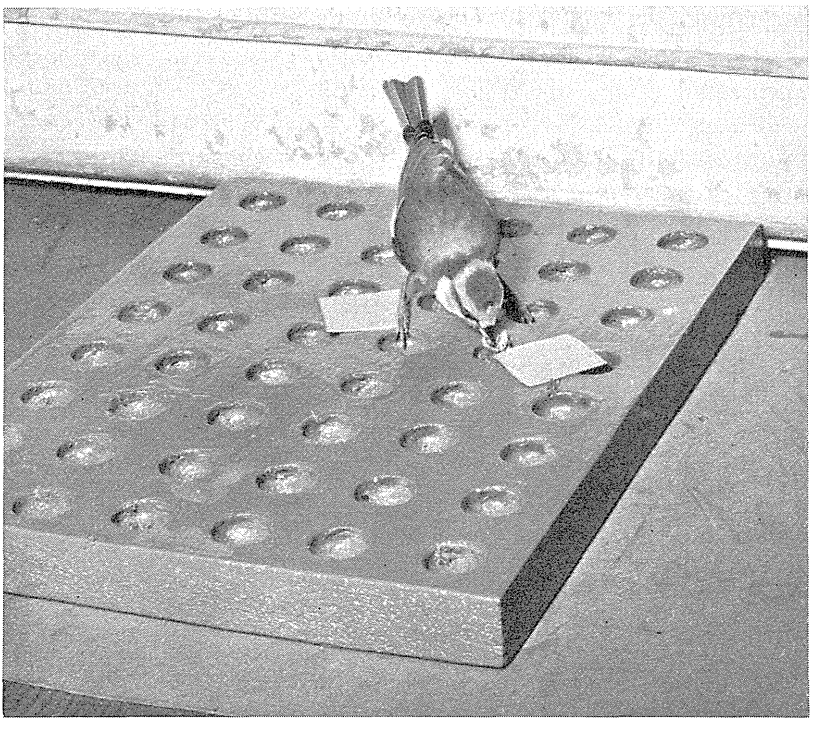


Fig. 1. The Blue Tit on the experimental board. The bird was unable to discriminate between the two zinc plates. In the photo it has turned the "wrong one" (without food beneath it) at first.

Blåmejsen på forsøgsbordet. Fuglen var ude af stand til at skelne de to zinkplader fra hinanden. På fotografiet har den først vendt den forkerte plade (uden foder i hullet nedenunder).

today the bird was given the opportunity of taking a piece of meal-worm from the board with the zinc plates six times every day. I had sought to make the plates as identical as possible, and such inevitable minute differences as there were between them were not observed by the bird, for it was quite accidental which plate it turned over first. Pjevs did not hesitate at all, but flew down to the board the moment this was presented to it with the two plates. To begin with, when it happened to fly to the right one first, it nevertheless turned over the 'wrong' one afterwards. But after only three days it no longer paid any attention to the wrong plate if it found the meal-worm under the first one.

Experiments with various unfamiliar objects.

July 13rd. Green twigs of Elm, Oak and Ash were placed at one end of the cage. Pjevs was frightened only for a moment (fluttered about), but dared not alight in the twigs till twelve minutes had elapsed. Only after a period of twenty-five minutes was it not afraid to jump about among the twigs and examined them more closely. On the other hand it never flew over to a twig of *Forsythia* which had its place in a vase on my desk every day

July 16th. Pjevs was for the first time introduced to a small mirror which I held quite close to the cage. The bird was frightened, so I removed the mirror at once. Later that day I once again held the mirror quite close to the cage. Pjevs was not frightened this time, and when the reflection happened to catch its eye, it showed a slight threatening reaction by opening its beak (but without raising its wings). From now on and throughout the future, Pjevs showed no interest whatsoever in the mirror!

July 18th. Today Pjevs was introduced to an unfamiliar rough haired hunting-dog, of roughly the same colour (pale dappled) as my own. The dog was lifted up to the cage and in spite of the fact that it sniffed eagerly, the bird showed no signs of fear.

July 19th. The same experiment was repeated with another dog, white, rough-haired and with brown markings. The result was identical. On the other hand Pjevs was obviously frightened by the dog's owner, a lady who was wearing a mottled and brightly coloured summer dress. Later the same day Pjevs was introduced to a black poodle. The bird instantaneously showed signs of fear, but only for a few seconds, and after that did not appear to be frightened. A black cat was thereupon placed on the table beside the cage. Pjevs paid no attention to the cat which continued to sit and stare with its head quite close to the bars. Pjevs ate a meal-worm out of my hand behind the grill immediately in front of the cat's nose.

Interval in experimentation with the board.

From the July 31st to the Sept. 7th, 1953, I did not permit Pjevs either to turn over the zinc plates on the board, or for that matter to see the zinc plates at all.

Aug. 5th. Pjevs was today discovered attempting motions of copulation in connection with a leaf of *Forsythia* on a twig in the cage. Since it was observed for the first time, on the July 3rd. Pjevs has almost daily attempted copulation motions on the hands of those who had dealings with him.

A period follows in which no observations have been recorded, due in part to my absence.

Work in connection with the board continued.

Sept. 7th. After an interval of 38 days Pjevs was once more shown the green board with the usual two zinc plates at the customary distance form each other of two hollows, *i. e.* 6.5 cm. The bird perched on top of its cage and observed the object with penetrating attention. After that, however, it flew briskly about in the room and appeared not to notice the board. But after a lapse of approximately 20 minutes it flew back to its cage and immediately down onto the board where it turned over one of the plates. The actual experiments with the board were commenced in january 1954 and will be circumstantially mentioned below p. 23.

Sept. 10th. After returning from my holidays on the Sept. 7th, I have not observed Pjevs making attempts at copulation. On the other hand it has grown extremely aggressive and, when it is out of its cage, frequently attacks in fury the hands and face of persons with whom it is perfectly well acquainted.

Bird of prey dummy.

Sept. 21st. I had produced an extremely schematic dummy bird of prey (cf. TINBERGEN 1951). It was cut from a piece of cardboard and painted black, so that in fact it only reproduced the silhouette of the Sparrow-hawk in flight. Pjews was today and on subsequent days introduced to the dummy in a variety of ways. It was attached to the end of a pole and made to

swing down over the bird-cage. Pjevs was somewhat startled when it came within a distance of 50 cm., but swiftly accustomed itself to the dummy. The bird was no more disconcerted by the dummy than by a rectangular piece of cardboard and a rag swung in the same manner; in other words a case merely of ordinary fear of the unfamiliar object and definitely not a specific reaction. Pjevs, incidentally, remained silent throughout these experiments. Pjevs was on another occasion taken into the grounds behind the Aquarium where the dummy hawk was made to glide on a wire from the top of the tower down over the cage (at a height of 1 meter). Pjevs paid no attention to it; nor, incidentally, did the wild birds in the vicinity.

I checked Pjevs' fear for unknown objects by showing it, one after another, a number of rectangular pieces of paper (11×19 cm.) of varying colour (all the colours of the spectrum). When brought within the critical distance (50 cm), they frightened the bird. On the other hand, Pjevs paid no attention to the coloured paper when rolled into a ball in my hand. Under these circumstances the positive, secondary valences of the hand apparently dominated over the negative, primary valences of the paper. (FISCHEL 1938, HØJGAARD 1947). On the Nov. 7th I introduced Pjevs to a stuffed male Blue Tit and a Siskin (*Carduelis spinus*). Pjevs' reactions to these were in no wise different from its reaction to unfamiliar objects in general. It was a little disconcerted when the stuffed birds were brought quite close to it, but quickly accustomed itself to them, and from then on paid them no attention.

Nov. 8th. A Buzzard, stuffed as though in flight with outstretched wings, was made to glide on the wire from the tower immediately above Pjevs' cage. The bird showed no signs of reaction at all, in spite of the fact that the Buzzard went gliding over the cage at a height of approximately 1 meter. The experiment was repeated several times, but always with the same result. Neither did the small wild birds in the area react, since, of course, they are not accustomed to react in the case of a live Buzzard.

Nov. 17th. A dead Sparrow-hawk (young male) was to-day found near the Aquarium. It had apparently been killed by

flying into the wire, which I used for my experiments with the dummy. The hawk was treated with formol and set as though in flight.

Nov. 26th. The dead hawk was to-day allowed to glide immediately above Pjevs, whose cage had been placed on the ground near the Aquarium. The hawk was made to glide at an angle, as though about to strike its prey, but Pjevs did not react at all even when the hawk was immediately above the cage. The wild birds on the other hand were roused to a state of great commotion. The following species were concerned: House-Sparrow (*Passer domesticus*), Chaffinch (*Fringilla coelebs*). Great Titmouse (*Parus major*), Blue Titmouse (*Parus coeruleus*) and Nuthatch (*Sitta europea*). The House-Sparrows and Chaffinches, which I had lured into the back-yeard of the Aquarium before the experiment by feeding them there, fled to a nearby thicket. After the dummy had been put aside and the wild birds completely recovered their composure, it happened by a stroke of chance that a live Sparrow-hawk flew over the Aquarium's grounds immediately above the tree-tops. The wild birds remained silent, but it is not unusual for them to pay no attention to a bird of prey which happens to fly past when it is not out hunting. Pjevs, still perched in its cage out in the open, did not show any reactions either; as was to be expected. It must be mentioned that Pjevs had not been involved in experiments with the dummy since the experiment with the Buzzard on the Nov. 8th which suggests that it was hardly a case of its becoming used to birds of prey in general.

Nov. 29th. I was at this time visited by a young man who had with him a tame Jackdaw, which flew freely about. Pjevs, who had been put out in the area behind the Aquarium, did not react when the Jackdaw perched on the owner's arm was brought into the vicinity of the cage outside a limit of approximately 50 cm. We made the Jackdaw circle about the cage and fly quite low over it a number of times. Pjevs continued to jump around in its cage entirely unperturbed throughout the experiment. On one occasion only, when the Jackdaw flew particularly low over the cage, did Pjevs churr gently, and for only a moment, but it showed no signs of fear.

Dec. 2nd. In the course of the past week or so Pjevs has become noticeably aggressive. It frequently attacks both one's face and hands the moment it is released from the cage. This is specially the case with unfamiliar persons, but also with children with which it is acquainted, as for example Dr. Barth's son and daughter, who are 10 and 13 years of age respectively; they inspired the bird to particular fury. It is no longer reasonably possible to let it out of its cage when there are children present. It has as yet made no particularly serious attacks on me. It must be added that on no occasion have any children ever had the opportunity to tease Pjevs.

Dec. 12th. Pjevs' aggressive attitude continues to increase. It now frequently attacks even myself. It flew straight at my eye today, and its aim was so successful that it was necessary for me to go to the doctor this evening. I now wear sun-glasses whenever the bird is out of its cage. Pjevs is no longer permitted to be out without supervision.

Jan. 3rd, 1954. Pjevs has of late ceased to attack me and other adult persons with whom it is familiar. I no longer find it necessary to wear sun-glasses when the bird is out of the cage. Children, however, who have not reached the age of puberty, continue to excite Pjevs to an ever increasing state of fury. The sound alone of children's voices from behind a closed door or out in the open is sufficient to make the bird violently excited. In pours forth a vast volume of churring, relieves itself, raises its wings and spreads its tail-feathers, while alternately raising and lowering the feathers of its crest. At the same time it swings its body from side to side in quick rhythm. Pjevs today pursued Dr. Barth's son right the way down a badly-lit staircase leading from the fodder-room to the reception-room of the Aquarium.

Jan. 4th. Pjevs was today permitted to attack Dr. Barth's son, who, with this end in view, was wearing a pair of sun-glasses. The bird continued for several minutes in succession to attack his hands and face so violently that it was compelled to rest every now and then, gasping with its beak open, but each time it immediately renewed its attack. It was then stopped and once more shut up in its cage. When I let it out

two hours later, it for the first time since the Dec. 12th made a serious attack on me.

Jan. 26th. Pjevs today escaped via a small opening in the sky-light of the fodder-room. I dit not discover this at once. I was afraid that something had happened to the bird and spent three-quarters of an hour searching for it here. Afterwards I went outdoors where I found Pjevs not further than 100 metres or so from the Aquarium, where it was sitting in a tall beech-tree. I discovered the bird by hearing its voice. It was easy to lure it back into the cage with the bait of a meal-worm. It was 2° C below freezing-point outside, but this did not appear to have troubled the bird although it was accustomed to a fairly constant temperature of about 15–18° C.

Jan. 30th. Pjevs today discovered another opening in the skylight and flew out into the open. I quickly realised what had happened and soon found the bird in the company of another Blue Tit outside the main entrance of the Aquarium. It allowed itself to be lured down at once by a meal-worm and perched on my shoulder where it remained sitting quietly while I carried it back indoors through the main entrance of the Aquarium. The temperature outside was 6° C below freezingpoint and a strong wind was blowing. The bird's condition had not been the least affected, although it had been out for approximately 10 minutes.

Experiments on the bird's ability to discriminate between form and number.

These experiments, unfortunately terminated prematurely by the death of the bird, were carried out with the aid of the previously mentioned green board (23 × 23 cm.), in which there were 49 bowl-shaped depressions of 1.5 cm. in diameter and 0.5 cm. deep (cf. fig. 1). Preliminary experiments showed that the bird could learn to discriminate between a cross and a circle drawn in ink on a white zinc background measuring 2.5 × 2.5 cm. These experiments were not recorded in detail.

The actual experiments were commenced on the January 25th, 1954. Pjevs was given the task of choosing between

two white zinc plates on which there were various forms or various numbers of black dots.

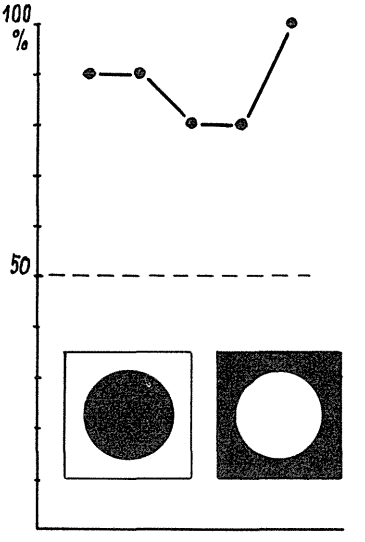
In all the experiments described here, the bird made series of ten choices. The percentage of correct choices for each series is shown in the diagrams. There was a rest interval of 5 minutes between each choice, and an interval of 30 minutes between each series in order to avoid overfeeding. Correct choices were rewarded with $^1/_3$ of a meal-worm; the bird was nevertheless always allowed to turn over the correct plate even if it made an incorrect first choice. The position of the correct plate was randomised, and it might be above, below, to the right or to the left of the wrong plate seen from the bird's starting point (the top of the cage).

During the experiments, Pjevs flew freely in my office. Immediately after a choice had been made, the board was rearranged out of sight of the bird, and covered with a piece of card-board, which was first removed when the bird sat on the top of its cage ready for the next trial. The distance between the zinc plates was constant at 6.5 cm.

The choice was recorded as wrong even if Pjevs only touched the wrong plate with his beak without turning it over. If, however, Pjevs flew first to the wrong one without touching it, stood there a moment, and then passed on to the correct plate, the choice was regarded as particularly good.

Series of experiments 1 (diagram 1). The positive figure was a circular black figure on a white background. The negative plate was marked with a white circular figure on a black background. Both figures were 18 mm in diameter. The correct choices totalled 88 % of 50 trials, and it will be seen from the graph that the bird seemed quite sure of itself right from the beginning. The explanation of this certainty probably lies in an after-effect from the preliminary experiments, in which the negative plate was marked by a black circle on a white background, the positive one having a black cross. It seems possible that the bird learned to avoid the plate with "nothing" in the middle, and that it transferred this reaction to the subsequent experiments. Possibly the bird actually could have achieved a higher percentage of correct choices, but as it escaped from the room during this series the last two trials

Diagram 1.



of the 4th series were not made, and were counted as wrong choices.

During this experiment, the bird never flew to the negative plate without touching it.

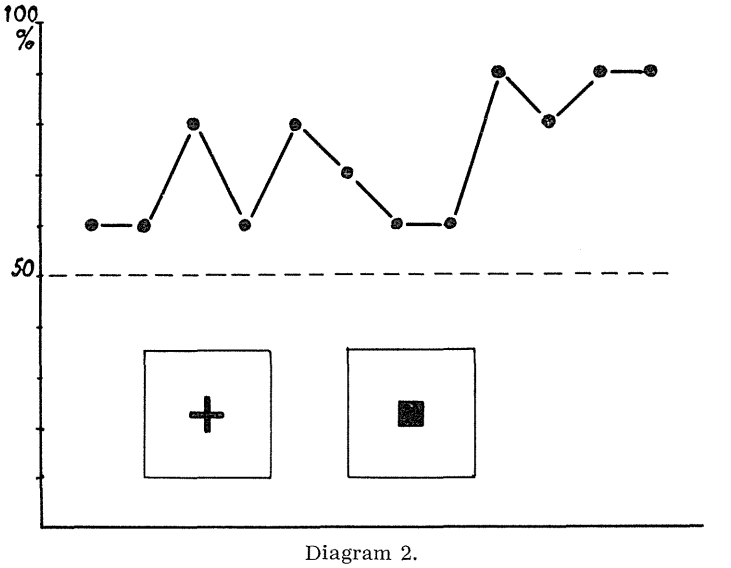


Diagram 2.

Series of experiments 2 (*diagram 2*). The positive figure was a 7 mm cross, the negative a 5 mm square. The graph lies above

the 50 % level right from the beginning, presumably due to chance circumstances. It is far flatter than graph I, and out of 120 choices there was an average of 73.3 % correct ones. During this series Pjevs flew to the negative plate first without touching it 11 times (9.2 %).

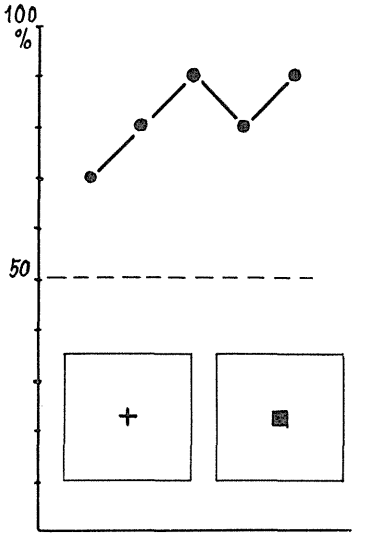


Diagram 3.

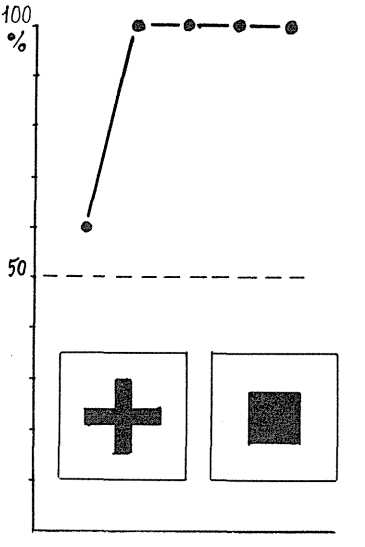


Diagram 4.

Series of experiments 3 (*diagram 3*). The figures were the same and had the same value as in the experiments just reported, but of smaller size, the cross being 4 mm and the square 3 mm. 82 % of 50 choices were correct, so the alteration in size does not appear to have affected Pjevs. The bird never flew to the negative plate without touching it.

Series of experiments 4 (*diagram 4*). The figures were a cross (positive) and a quadrangle (negative), but larger than those used in the first experiments, being 14 and 10 mm respectively. 92 % of the 50 choices were correct. In the first series the bird seems to have been somewhat confused by the change in size; the following 40 choices were all correct. Pjevs flew once to the negative plate without touching it (2 %).

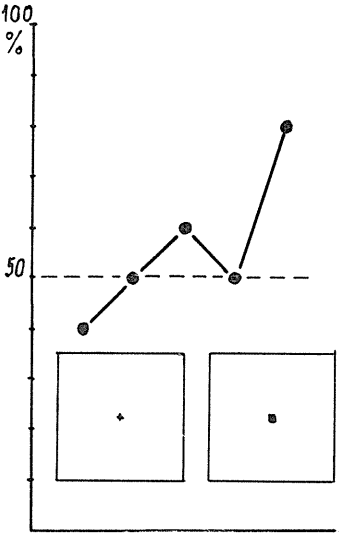


Diagram 5.

Series of experiments 5 (*diagram 5*). The same figures and with the same value as in the fourth series of experiments, but very small, each being only 1 mm. Only 55 % of the 50 choices were correct. The first 40 choices gave only 47.5 % correct choices, after which the curve rises sharply. Pjevs flew 3 times to the negative plate without touching it (6 %). This may be interpreted as expressing that the bird to some extent recognised the figures. The sharp rise in the curve may be similarly interpreted.

Series of experiments 6 (*diagram 6*). The figures comprised the contures of the cross (positive) and quadrangle (negative) in their original sizes (7 and 5 mm). 69 % of the 110 choices were correct. It seems that Pjevs had to learn the choice reaction all over again. The negative plate was approached 4 times without being touched (3.63 %).

Series of experiments 7 (*diagram 7*). The bird's ability to "count" was now taken up to investigation. The positive plate was marked by a single spot in the middle, the negative one having three spots arranged in a triangle. The spots in these and the subsequent experiments were approximately 3 mm.

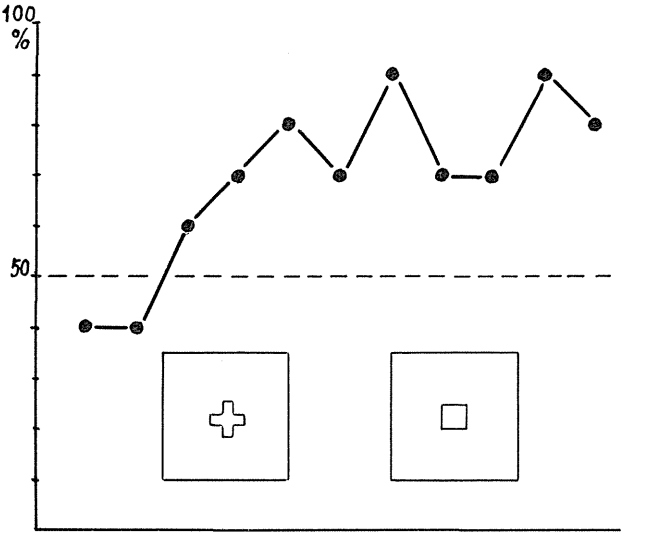


Diagram 6.

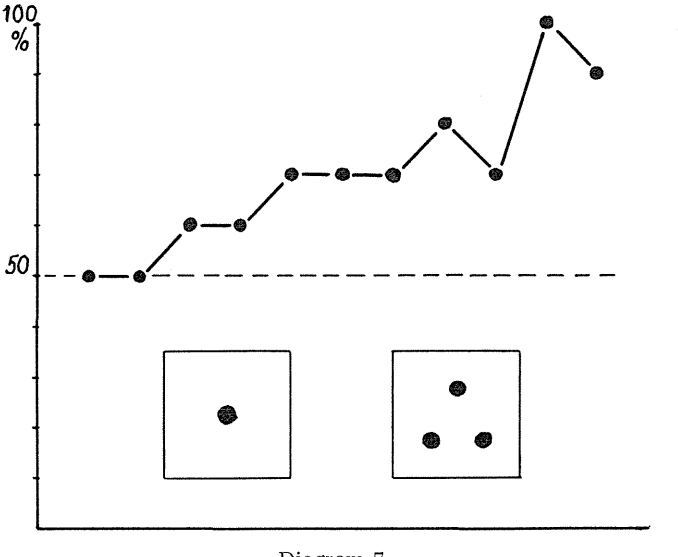


Diagram 7.

in diameter. 70 % of 110 choices were correct. The curve seems to be a normal learning curve. Pjevs flew to the negative plate 9 times without touching it (8.2 %).

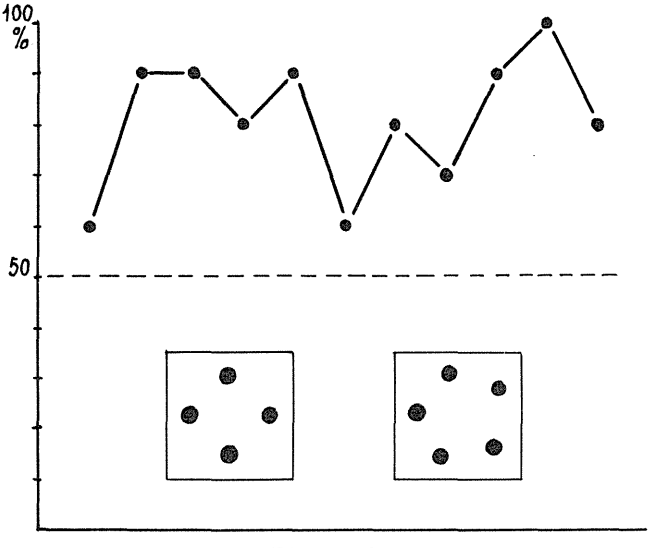
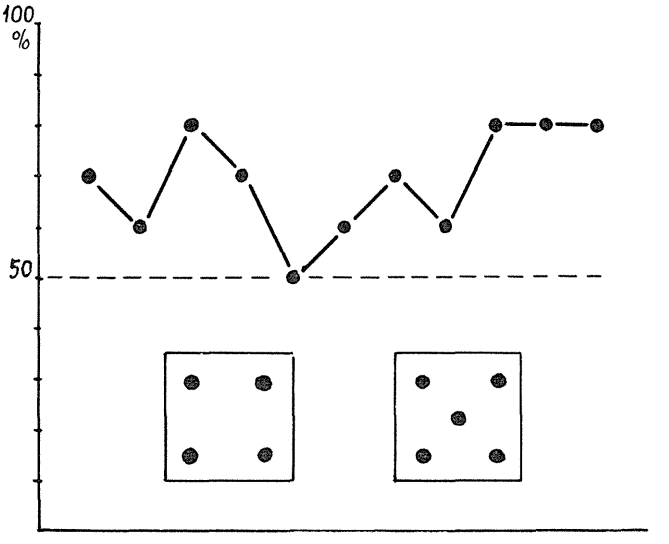


Diagram 8.

Series of experiments 8 (*diagram 8*). The positive plate had 4 spots, the negative one 5, both sets being arranged in a circle. 80.9 % of 110 choices were correct. It is interesting to note that the curve lies on a high level after the end of the second series of 10 choices apart from a decline in the 6th series. This may be interpreted as indicating that the bird had a tendency to choose the plate with the fewest spots transferred from the immediately preceding experiments. Pjevs flew to the negative plate 17 times without touching it (15.5 %).

Series of experiments 9 (*diagram 9*). The positive plate was marked with 4 spots and the negative plate with 5, arranged as on a dice. 69 % of 110 choices were correct. This curve lies on such a high level from the very beginning of the experiments that it seems that the bird primarily reacted to the smallest number of spots. Pjevs flew 7 times to the negative plate without touching it (6.4 %).



Diegram 9.

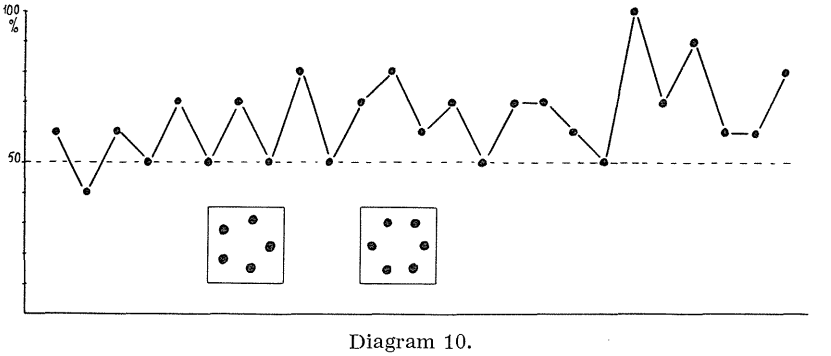


Diagram 10.

Series of experiments 10 (*diagram 10*). The positive plate had 5 and the negative one 6 spots arranged in a ring. Of the 250 choices, 60.4 % were correct. It is clear that the bird was more uncertain in this series of experiments. The curve is flat, but in average lies above the 50 % level right from the start of the experiments. The bird flew 21 times to the negative plate without touching it (8.4 %).

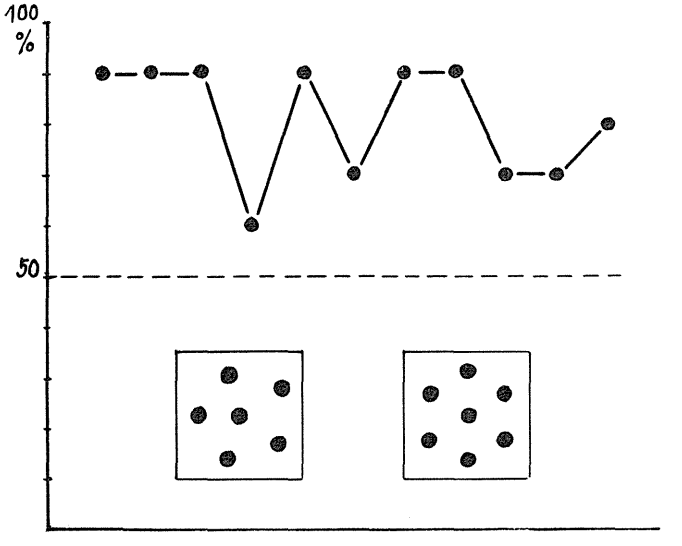


Diagram 11.

Series of experiments 11 (*diagram 11*). The positive plate had 6 and the negative plate 7 spots distributed in a ring with a spot in the middle. 81 % of the 110 choices were correct. The curve lay on a surprisingly high level right from the start. Pjevs flew to the negative plate 18 times without touching it (16.3 %).

It seems improbable that I have unconsciously aided the bird by means of slight signs. If this had been the case, one would have expected the curves to resemble each other more than is the case. As an extra precaution, I had some of the experiments performed by someone else without this influencing the bird's choices. It should also be noted that the bird's choices were quite random during the preliminary training with two identical plates.

Conclusions drawn from the bird's record.

It would appear from the observations that the Blue Tit is without an innate reaction to natural foes. It did, however, show signs of innate fear in the face of numerous unknown objects, but the flight-distance under these circumstances was as a rule only 50 cm. However, Pjevs sometimes changed its mood radically without the slightest visible provocation, to such an extent that the bird was at times easily frightened by objects to which it otherwise paid no attention. The bird appeared to have a "craving for flight", for at certain times it gave the impression of being afraid even of itself (vacuum-activity) (TINBERGEN 1951). On occasion, for example, when out flying it might suddenly break into warning cries, whereupon it rushed off as if it were hotly pursued by a bird of prey, throwing itself from side to side in its flight and pressing itself on instead of flying in the usual hopping manner. When, however, it landed after one of these outbursts, it was, nevertheless, perfectly tame in its relations with me. I observed these outbursts of spontaneous flight from once to twice a week.

These flights are not to be confused with the pleasure Pjevs always took in flying, the moment it was released from its cage every day. From time to time Pjevs caught imaginary insects in the air (vacuum activity); it is impossible for me to say whether or not small particles of dust or fluff excited it to do so. At first when I released *Galleria mellonella* moths in the room, Pjevs caught them; but ceased to do so after a few attempts as it did not eat them anyway.

Throughout the first three months of its life Pjevs had a considerable demand for sleep; after periods of being actively occupied the bird settled down to about a quarter of an hour's sleeping. This occured several times in the course of the day, but became progressively more infrequent as the bird grew older. Pjevs moulted during the month of August and at that stage acquired the bright blue crown which is a characteristic of male Blue Tits. The bird passed through the moulting process quite normally and was after this in its very best form. It practically never slept in the course of the day, and was highly active virtually all the time, both in the cage and when it had been released.

Vocal expressions. Blue Tits are capable of producing a number of different sounds. The cry of the young can best be reproduced by the syllables: *tee tee chä.* In the case of newly-fledged young especially the last syllable (*chä*) is very low on the scale and has an almost plaintive note. In the course of time as the young birds grow, the cry acquires a sharper sound as a whole and the last syllable rises on the scale. Adult Blue Tits are known to produce a modification of the cry of the young on occasion; it can be reproduced something like *tee tee teev,* and is uttered by the birds particularly when flitting about in the vicinity of the nesting-hole before and after egg-laying. My own observations tend to show that this cry is produced more especially by the female, but that the male also employs it on occasion, *e.g.* when visiting the brooding female. The Blue Tit's warning signal consists of extremely obvious churring, fairly low on the scale. It resembles that of the Great Tit a good deal, but has a softer quality coupled with a faster rhythm. When a Blue Tit is particularly excited it frequently introduces the churr with a long drawn *tee tee,* which then at once developes into a shrill churring sound, and after a while falls to a lower point on the scale. The Blue Tit, peacefully foraging, frequently emits a quiet pip, which is more especially audible in flight. This is a neutral sound and signifies that the bird is in a quiet mood. The battle-cry, which Blue Tits produce in combat, is best reproduced by a constantly repeated but moderately quiet *cheer cheer.* The male's song, sounds (with some slight modifications) like *tee tee tee heet tee hee hee hee hee–ee*! The sounds which have just been discussed are the most remarkable of the Blue Tit's attempts at vocal expression, as heard in the study of wild Blue Tits.

In Pjevs' case, I heard it produce all the sounds uttered by wild Blue Tits with the exception of the above mentioned song. A few wild Blue Tits had already begun to sing in the trees surrounding the grounds behind the Aquarium before Pjevs died on the March 23rd, 1954, but although he must have heard them quite distinctly, he never joined them in singing. In the course of February–March, however, it did begin to utter the nesting-signal *tee tee teev* which it was able

to keep up for long periods at a time. A bird-box intended for Tits hung suspended in the feeding-passage, which Pjevs was known to enter from time to time, but it paid no particular attention to the box, and the nesting-signal was never heard in connection with Pjevs' flight to or from it.

When Pjevs was restless and jumped about its cage, it constantly emitted a sound, which I have never heard wild Blue Tits produce, a *tee tü* or *tee tü tü* (with a modification of the pitch especially on *tü*) and it was on occasion known to last for hours. If, after that, it was released and free to fly, it immediately changed to a restrained chirping exactly like that of wild Blue Tits in a neutral frame of mind. When Pjevs was out the cage remained open permitting the bird to return and eat, and it frequently took advantage of the opportunity. Only when it was time to shut Pjevs up in the cage, did I lure it back with the help of a meal-worm in my hand. After being out for a long period of time, and, if one may be pardoned the expression, "expecting" that a meal-worm would shortly be in the offing, it would start to scream *tee tü* and allowed itself to be lured back into the cage with the greatest ease. On the strength of these observations I am led to assume that the sound *tee tü* was an expression of discomfort. Pjevs, incidentally, was very quick to learn that a meal-worm in my hand signified that the cage was about to be closed, and on occasions when the bird had not been out for long, it would either ignore the meal-worm completely under these conditions, or else try to snatch it at great speed and fly out of the cage again with its spoil. And it not infrequently succeeded in doing so.

On one of the occasions when Pjevs disappeared and had been out in the frost for about three-quarters of an hour, I discovered the bird by hearing a very long-drawn and apparently "melancholic" *tee tü tü*; and it also emerged that it was extremely hungry.

There were two sounds of interest, which I have never heard wild Blue Tits produce. The one was a sonorous, highly-pitched ringing, constantly repeated, like *cheer*; the other a quiet sound, which resembled to a remarkable degree the long-drawn call of the Canary-bird, and is best reproduced by *bööee.*

Pjevs was not known to utter either of the two sounds just mentioned before the Winter of 1953. The bird had had no opportunity to learn from a Canary. Pjevs only produced the sound *cheer* when in the cage, and only when it had been shut up for a particularly long period of time. It was on such occasions especially ready for battle as soon as it was released, and the sound *cheer* was in reality an intensified version of the first syllable in the bird's battle-cry: *cheer cheev*. Pjevs only produced the sound *bööee* when it was in a particularly quiet mood, and then only when sitting still. This sound is, in fact, so subdued as easily to pass unnoticed under natural conditions or be mistaken for that of a Finch.

Throughout the entire Winter, after an interval during the months of September, October and November, Pjevs on and off made attempts at copulation on the hands of various people. The attempts became more frequent in the course of the month of March, but were no longer inspired by my hands, whereas Pjevs flew to the hands of unfamiliar persons, particularly the young, with great ardour and made consistent attempts at copulation, especially on the finger-tips. It now attacked all children with greater fury than formerly, whereas adults in general ceased to interest to any degree. It continued to pay no attention to the stuffed Blue Tit nor to its own reflection in a miror. On the March 23rd, 1954, the bird was killed by an accident.

Summary.

The author reared a young male Blue Tit, and observed its behaviour, as well as carried out various experiments on it from June 6th, 1953, to March 23th, 1954.

The Blue Tit appeared completely to lack instinctive fear of natural enemies. It did not react to dogs or cats, but continued, for example, with its meal while a cat sat immediately in front of its cage watching it. Neither did the bird manifest fear of dummy birds of prey, nor of a stuffed Buzzard and Sparrow-Hawk, the latter being made to glide down over the cage suspended on a wire, as if they were attacking. The wild birds, on the other hand, reacted strongly towards the stuffed Sparrow-Hawk. In many cases, however, the Blue Tit showed primary fear of unfamiliar objects, especially of contrasting colours, when they were within a distance of about 50 cm. Natural enemies could likewise

arouse fear within this distance, but only when they were "unfamiliar objects".

The bird's reflection in a mirror and a stuffed Blue Tit did not elicit any reaction of importance, although attempts at copulation on human hands were often observed. The bird was very aggressive against all children, but rarely did it attack adults, even though it was not afraid of them.

The bird uttered all the sounds normal in Blue Tits, with the exception of the male song. In addition, it uttered some quite low sounds which the author has never heard from the wild birds, possibly because the sounds are so quiet that it would be difficult to hear them in the open.

Some experiments concerning the bird's ability to discriminate between form and number were carried out, and the results are presented graphically. The bird learned quickly compared to birds examined by other authors possibly because nothing in the experimental set-up could arouse its "mistrust" or frighten it. Neither was it distracted, as it would have been, for example, if others of its species had been present.

DANSK RESUMÉ

Iagttagelser og forsøg foretaget med en tam Blåmejse (*Parus caeruleus* L.).

Afhandlingen fremlægger en række iagttagelser over og forsøg med en ung Blåmejse ♂. Forfatteren fandt fuglen som lige udfløjen unge i Charlottenlund skov den 6. juni 1953, hvor den øjensynlig var gået tabt for forældrene. Den var halvdød af sult og blev taget med til Danmarks Akvarium, hvor den straks villigt lod sig made og fra begyndelsen viste fuldstændig tamhed, en tamhed, der holdt sig i tiden fremover og gjorde det let at anstille en række forsøg både over fuglens eventuelle medfødte frygt over for naturlige fjender og over dens evne til at lære. Fuglen, som fik navnet »Pjevs«, blev holdt i et almindeligt fuglebur, men kom hver dag ud at flyve nogle timer, enten på akvariets fodergang eller i forfatterens kontor på Danmarks Akvarium. Som foder til Blåmejsen anvendtes forskellige slags dyrisk føde (også melorme og larver af voksmøl) samt solsikkefrø og søde frugter. Til fuglen omkom ved et uheld den 23. marts 1954 var den i aller fineste kondition.

»Pjevs« syntes at mangle medfødt frygt for naturlige fjender. Den viste ingen frygt for hunde, som snusede til dens bur, og den fortsatte uanfægtet sit måltid i en afstand af kun få cm fra en kat, der sad uden for dens bur og stirrede på den. Denne mangel på frygt for de omtalte pattedyr kan muligvis hænge sammen med, at fuglen mens den endnu blev madet, hver dag havde lejlighed til at se min ruhårede hønsehund på nært hold.

»Pjevs« blev siden præsenteret for en udstoppet Natugle og Skade. Uglen gjorde intet indtryk, men Skaden derimod fremkaldte flugtreaktion, når den blev bragt inden for en afstand af ca. 50 cm, som gennem en række forsøg blev fastslået at være fuglens kritiske afstand for de ting, der primært fremkaldte flugtreaktion. Sådanne viste sig at være ting med stærke farver (eller kontrastfarver, jf. Skaden) eller indeholdende kontrasterende former. Pjevs var således meget bange for et blækhus med et penneskaft ragende op, men reagerede hverken over for pennen eller blækhuset hver for sig. Nye siddepinde eller grene med blade sat ind i buret udløste også flugtreaktion, men fuglen faldt i reglen til ro i løbet af en halv snes minutter og gav sig da til at undersøge de nye ting nøje.

Over for attrapper af rovfugle (flugtbilledet af en Spurvehøg skåret ud i pap) viste Pjevs ingen reaktion, når den kritiske afstand på 50 cm blev overholdt. En udstoppet Musvåge med udspilede vinger, som ad en wire fra Akvariets tårn blev bragt til at glide ned over Pjevs' bur, der stod i Akvariets gård, skræmte ikke fuglen. En død Spurvehøg anvendt på samme måde gjorde heller intet indtryk, men fik derimod de vilde småfugle til at varsle heftigt.

Sit spejlbillede viste Pjevs ingen synderlig interesse og en udstoppet Blåmejse samt en udstoppet Grønsisken lodes også upåagtede.

Da Pjevs havde overstået fældningen, foretog den ofte parringsforsøg på menneskers hænder, især fingerspidserne, men parringsforsøg sås også finde sted på blade af f. eks. *Ficus*, når fuglen var ude at flyve på Akvariets fodergang.

I løbet af vinteren 1953–54 viste fuglen stigende aggressivitet over for alle børn under puberteten, og da den angreb øjnene, måtte den holdes borte fra børn. Over for voksne (også fremmede) forholdt den sig i reglen neutral (kunde dog angribe), men da den aldrig vides at være blevet drillet af børn, er dens reaktion over for disse vanskelig at forklare.

Pjevs ytrede alle de lyde, som man hører hos en normal vild blåmejse (se p. 33) med undtagelse af hannens sang, der kan lyde som et langtrukkent *tititi hit tititi hii*. Tillige hørtes en lyd, som forfatteren aldrig har hørt hos en Blåmejse i det fri, det var en meget sagte lyd, nærmest som kanariefuglenes *bøi*. Denne lyd hørtes kun, når Pjevs sad helt stille og er vel vanskelig at høre i det fri, fordi den er så sagte. Pjevs har aldrig haft lejlighed til at lære af en kanariefugl.

Dressurforsøg.

Der blev foretaget en række undersøgelser over Blåmejsens evne til at skelne mellem forskellige figurer og et forskelligt antal pletter malet med sort på hvidmalede zinkplader. Et grønt bræt (23 × 23 cm) blev fremstillet, og i dette bræt (fig. 1) fandtes 49 huller, 0,5 cm dybe, hvori små stykker melorm kunne tildækkes med en plade. Efter at Pjevs gennem indledende forsøg var blevet gjort fortrolig med at

vende plader på brættet, skulle den nu vælge mellem to plader med forskelligt udseende, og af hvilke den ene dækkede lokkemaden. Pladerne skiftede plads ved hvert valg, så fuglen ingen mulighed havde for at »regne ud« hvor føden lå. Af indledningsforsøg var det fremgået, at Pjevs ikke kunne skelne mellem to ens bemalede zinkplader.

I de anførte forsøg fik fuglen lejlighed til at vælge i en række serier med 10 valg i hver serie. Hvert punkt på kurverne i diagrammerne svarer altså til 10 valg, og procenten af rigtige valg i hver serie kan aflæses i diagrammerne. Mellem hvert valg i hver serie var der en pavse på 5 minutter, og mellem hver serie en pavse på 30 minutter. Et rigtigt valg blev belønnet med $^1/_4$ melorm, men fuglen fik i alle tilfælde lov til at vende den rigtige plade, selv om den først havde vendt den forkerte.

Umiddelbart efter hvert valg blev pladerne atter arrangeret på brættet uden at Pjevs så det og dækket med et papstykke, som først blev fjernet, når fuglen sad ovenpå sit bur parat til næste valg. Afstanden mellem zinkpladerne var konstant 6,5 cm.

Valget blev registreret som galt, hvis fuglen blot med spidsen af sit næb først berørte den forkerte plade, selv om den ikke vendte den. Hvis fuglen først fløj til den forkerte plade og stod der et øjeblik uden at røre den og derpå gik til den rigtige, blev valget regnet for særlig godt.

Forsøgsrække 1 (Diagram 1). Den positive figur var en sort cirkelrund plet på hvid baggrund, den negative en hvid cirkelrund plet på sort baggrund, begge figurer 18 mm i diameter. Af 50 valg var 88 % rigtige, og af kurven fremgår, at fuglen synes at have været indstillet på den rigtige plade fra begyndelsen af Forsøgsserien. Dette skyldes sikkert en eftervirkning af for-forsøgene, i hvilke den negative plade var mærket med en sort cirkel (altså ikke en sort plet) på hvid baggrund. Det er rimeligt at antage, at Pjevs lærte at undgå pladen med »ingenting« i midten, og at den overførte denne reaktion til det følgende pladepar. Fuglen kunne muligvis have nået en højere procent af rigtige valg, men da den slap ud af forsøgsrummet i 4. serie, blev de to sidste valg ikke foretaget i denne serie og blev derfor registreret som gale. I denne forsøgsrække fløj fuglen ikke til den negative plade uden at røre den.

Forsøgsrække 2 (Diagram 2). Den positive figur var et kors på 7 mm, den negative et kvadrat på 5 mm. Kurven lå fra begyndelsen over 50 %'s tærskelen, sandsynligvis på grund af tilfældighed. Den er meget fladere end i forrige forsøgsrække, og af 120 valg var 73,3 % rigtige. I denne forsøgsrække fløj Pjevs 11 gange først til den negative plade, men uden at røre den (9,2 %).

Forsøgsrække 3 (Diagram 3). Figurerne på pladerne var de samme som i foregående forsøgsrække og havde samme værdier, men de var mindre: korset 4 mm og kvadratet 3 mm. 82 % af 50 valg var rigtige, så den ændrede størrelse synes ikke at have virket forstyrrende. Pjevs fløj i intet tilfælde først til den negative plade uden at røre den.

Forsøgsrække 4 (Diagram 4). Korset er her 14 mm og kvadratet 10 mm. Figurernes værdi den samme som hidtil. Af 50 valg var 92% rigtige. I de første serier syntes fuglen noget forvirret af figurernes ændrede størrelse, men de sidste 40 valg var alle rigtige. Pjevs fløj en gang først til den negative plade uden at røre den (2 %).

Forsøgsrække 5 (Diagram 5). Samme figurer og med samme værdi som i forrige forsøgsrække, men meget små: hver kun 1 mm. Kun 55 % af 50 valg var rigtige. Af de første 40 valg var kun 47,5 % rigtige, hvorpå kurven stiger brat. Pjevs fløj 3 gange først til den negative plade uden at røre den (6 %). Dette kan tydes som, at fuglen til en vis grad genkendte figurerne. Kurvens bratte stigning tyder på det samme.

Forsøgsrække 6 (Diagram 6). Figurerne gengav konturerne af korset og kvadratet i deres oprindelige størrelse (forsøgsrække 2). Af 110 valg var 69 % rigtige. Det ser ud til, at fuglen ikke har kunnet transponere, men måttet lære disse figurer som helt nye. Pjevs fløj 4 gange først til den negative plade uden at røre den (3,63 %).

Forsøgsrække 7 (Diagram 7). Pjevs' evne til at »tælle« blev nu undersøgt. Den positive plade blev mærket med en enkelt plet i midten, den negative havde tre pletter anbragt i trekant. Pletterne i dette og alle følgende forsøg var ca. 3 mm i diameter. 70 % af 110 valg var rigtige. Kurven synes at være en normal indlæringskurve. Pjevs fløj 9 gange først til den negative plade uden at røre den (8,2%).

Forsøgsrække 8 (Diagram 8). Den positive plade havde 4, den negative 5 pletter anbragt i ring på begge plader. Af 110 valg var 80,9 % rigtige. Det skal bemærkes, at kurven ligger højt efter den anden serie af valg (bortset fra et fald i sjette serie). Dette kan tydes som om fuglen fra starten havde en tendens til at vælge pladen med det laveste antal pletter, at den med andre ord benyttede sin »lærdom« fra forrige forsøgsrække. Det skal i samme forbindelse fremhæves, at Pjevs fløj 17 gange først til den negative plade uden at røre den (15,5 %).

Forsøgsrække 9 (Diagram 9). Den positive plade havde 4, den negative 5 pletter arrangeret som på en terning. Af 110 valg var 69% rigtige. Kurven ligger så højt fra starten, at det synes som om fuglen straks har været indstillet på at vælge det laveste antal. Det bratte fald i kurven i femte serie kan skyldes, at Pjevs er blevet ophidset af en eller anden grund, f. eks. ved at høre stemmer af børn bag en lukket dør. Hvis fuglen kom i affekt, gik det altid ud over dens evne til at vælge. Pjevs fløj 7 gange til den negative plade uden at røre den (6,4 %).

Forsøgsrække 10 (Diagram 10). Den positive plade havde 5, den negative 6 pletter ordnet i ring. Af 250 valg var 60,4 % rigtige. Det er klart, at fuglen var usikker nu. Kurven er flad, men ligger dog fra starten over gennemsnittet af 50 %. Pjevs fløj 21 gange først til den negative plade uden at røre den (8,4 %).

Forsøgsrække 11 (Diagram 11). Den positive plade havde 6,

den negative 7 pletter ordnet i ring med en plet i midten. Af 110 valg var 81 % rigtige. Kurven lå fra starten forbavsende højt. Pjevs fløj 18 gange først til den negative plade uden at røre den (16,3 %).

Det forekommer mig usandsynligt, at jeg ubevidst skulde have hjulpet fuglen til at vælge rigtigt. Hvis dette havde været tilfældet, kunne man have ventet, at kurverne i de forskellige forsøg havde lignet hinanden mere end de faktisk gør. Af træningsforsøg, som desværre ikke blev ført til protokols, fremgik som tidligere nævnt, at fuglen ikke kunne kende forskel på to for det menneskelige øje ens plader. I en enkelt forsøgsserie lod jeg Dr. Barth, som fuglen kendte, arbejde med fuglen, uden at dette på nogen måde nedsatte dens præstationer.

Literature Cited.

ARNDT, W. 1939: Abschliessende Versuche zur Frage des »Zähl«vermögens der Haustaube. – Zeitschr. f. Tierpsychologie, **3.**

BRAUN, HILDEGARD 1952: Über das Unterscheidungsvermögen unbenannter Anzahlen bei Papageien. – Zeitschr. f. Tierpsychologie, **9.**

FISCHEL, W. 1938: Psyke und Leistung der Tiere. – Berlin.

GOETHE, F. 1940: Beobachtungen und Versuche über angeborene Schreckreaktionen junger Auerhüner. – Zeitschr. f. Tierpsychologie **4.**

HEDIGER, H. 1947: Ist das tierliche Bewusstsein unerforschbar? – Behaviour **1.**

HØJGAARD, M. 1947: Om Tingenes Værdi for Dyr og Mennesker. – København.

KRAMER, G. & M. ST. PAUL 1951: Über angeborenes und erworbenes Feinderkennens beim Gimpel. – Behaviour **3.**

KÖHLER, O. 1943: »Zahl«-Versuche an einen Kolkraben und Vergleichsversuche an Menschen. – Zeitschr. f. Tierpsychologie **5.**

— 1937: Können Tauben »zählen«? – Zeitschr. f. Tierpsychologie **1.**

LORENZ, K. 1943: Die angeborenen Formen möglicher Erfahrung. – Zeitschr. f. Tierpsychologie **5.**

MAROLD, E. 1939: Versuche an Wellensittichen zur Frage des »Zähl«vermögens. – Zeitschr. f. Tierpsychologie **3.**

PLATZ, EBERHARD 1939: Wahrnehmung und Erinnerung bei der Futterwahl von Vögeln. – Zeitschr. f. Tierpsychologie **3.**

RUSSELL, E. S. 1935: Valence and attention in animal behaviour. – Acta Biotheoretica **1.**

TINBERGEN, N. 1951: The Study of Instinct. – Oxford.

ULRIKE, S. 1952: Versuche zur Frage des »Zähl«-vermögens bei Elstern. – Zeitschr. f. Tierpsychologie **9.**