

On the Song of the Linnet (*Carduelis cannabina* (L.)).

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(Med et dansk resumé: Torniriskens (*Carduelis cannabina* (L.) sang).

The question whether the song of birds is innate or learnt has been much discussed and much work has already been done, but in most cases the observations are accidental and therefore exact studies are necessary. The data on the inheritance of song in birds have recently been summarized in a valuable paper by THORPE (1951). The present author have earlier studied the song of the Chaffinch (*Fringilla coelebs* L.) (POULSEN 1951) and found that the song of this species is partly innate and partly learnt. It was important now to study a species in which the whole song had to be learnt. Already BARRINGTON (1773) showed that the Linnet has to learn its song; this was confirmed later by other writers *e. g.* BECHSTEIN (1794) and HEINROTH (1927).

Therefore the song of the Linnet was studied and recorded on tape-records (made possible through financial support from Statens Almindelige Videnskabsfond). Spectrographs of these records will be made at a future date. In this way the songs of the observed birds is preserved in order to compare the songs of the different individuals and to trace the development of the song in young birds. The present paper is a preliminary report of the investigations so far.

Six linnet-young were reared by hand from an age of one week. The birds were kept in isolation so that they could not hear other birds. Unfortunately, some of the reared birds died and the following spring only two males were left. Already as fully feathered young they began to sing a quiet twittering sub-song and so they did now and then, but not until February did they begin to sing loudly. The two birds were singing the same song but it was different from the normal linnet-song; also the flight-notes were identical but different from the normal ones.

The normal linnet-song is a varied twittering song, without set form, combining melodious fluty notes with twittering

notes. The following are the flight-notes: a rapid twittering *chichichichit*, slightly metallic, and the call-note *tsoet* and variations of these notes. Often a short phrase called crowing (*krähen* in German) can be heard. It has certainly developed from the innate aggressive notes: *gae, gae, gae* as also maintained by SAUER (personal communication). A characteristic feature of the linnet-song is that it is very often delivered in a peculiar imperfect way or with pauses between the different phrases. Different individuals prefer different phrases and often repeat them, but apparently the song is not subject to any individual variation or show any geographical variation as for instance in the Chaffinch (*Fringilla coelebs*), as shown by PROMPTOFF (1930) and MARLER (1952). In the Linnet the song has no close connexion with territory; it is often delivered by several males in chorus from a branch, on wing or occasionally on ground. It is often used in courtship-display, the bird singing vigorously with drooping wings and spread tail.

The song of the isolated reared Linnet is much shorter consisting of fewer notes uttered in a much slower rhythm. The pitch and the timbre seem to be innate but the rhythm and the melody are not innate; only one phrase—the crowing—is completely innate. The flight-notes resemble somewhat the flight-note of a normal Linnet, but they are harsher and thus are not completely innate whereas the aggressive notes are innate.

When the isolated reared birds had sung their innate song for about two months they were put together with a normal Linnet and a Canary (*Serinus canarius* (L.)), each in a cage on each side of the reared birds so that they could hear the normal song of their own species and the song of another species. Would the reared Linnets now learn to sing, and would they learn the song of their own species. The birds were kept in the same room for more than a month (May) and they were still singing their innate song. It seemed as if they had passed the sensitive period in which to learn the right song.

The Linnets leave Denmark in October–November. When the last young have left the nest in August and the beginning of September the birds flock together, and they sing at the

roosting places in trees. Then the normal Linnet-song can be heard, but one also hears a choir of twittering and warbling which may be the young birds now learning the right song. In order to find out whether they had already learnt the right song, some young birds were caught in August before they had begun to sing loudly. These birds began to sing a subdued twittering and in addition fragments of the right song could be recognized. In the Chaffinch the autumn-song (of adult males) is not common as in the Linnet, so that the young Linnets may learn the right song already in the autumn or perhaps earlier, while the young Chaffinches do not learn the right one until they are nearly one year old.

In connexion with the question of learning the song of the species it would be of interest to know whether a Linnet which had learnt the songs of other species could learn the right song later on. From a bird fancier I got a Linnet, which had been reared from egg by canaries and then kept together with canaries and Grey Singing Finches (*Poliospiza leucopygia* Sund.). This Linnet had a song which was a mixture of the innate linnet-song and the songs of canaries and of the Grey Singing Finch. The bird was two years old when I got it in the spring of 1953. After having recorded its song I put it in a room together with a Linnet, which was singing the normal song, and recorded its song a month later, and the song was still the same as before. As many other songbirds the Linnet is not an imitator, it does not imitate notes and songs of other birds as do for instance the Starling (*Sturnus vulgaris* L.) and the Marsh-Warbler (*Acrocephalus palustris* (Bechst.)). These birds presumably are always able to imitate whereas the Linnet and also the Chaffinch imitate only in a certain period. But why do some birds imitate notes from other species? Has it any biological significance? MARSHALL (1950) maintains that in birds inhabiting places where visibility is restricted imitation is biologically advantageous as vocal advertisement supplementing their natural notes with a borrowed repertoire. MORREAU, on the other hand, holds that imitation is of no biological significance (personal communication). He has found that in some African birds one population is imitating whereas another population of the same species do not imitate.

The song of the Linnet has to be learnt as regards the rhythm and the melody except the crowing phrase. If it has become fixed—whether it is the innate song or a song learnt from other species—it seems that it cannot be altered. It is not right to conclude from BRAUN'S observations (1915) on reared Linnets that it is necessary to observe the birds for several years because he found that some of his reared birds which were only imitating the first year were singing the right song in the second spring and others were singing correctly the third spring and others again in the fourth spring. Compared with the present investigations his statements seem quite unintelligible.

Some authors object to observations on reared birds in captivity holding that such birds do not get in reproductive mood or that maturity is delayed in captivity. They maintain that the song of such birds is innate and that the right song appears with advancing age. This is not right. The reared Linnets were singing with great intensity and displayed towards females, and, further, they were not able to imitate the song of a Linnet.

Just as in the Chaffinch the method of learning the song seems to be imprinting: the song is learnt in a certain sensitive period and when the song has been learnt it cannot be altered.

The time when the song is learnt under natural conditions is not yet known. The young bird may learn the song of its father or it may learn it later when the Linnets are singing in the autumn or it may learn it when singing in the winter quarters. In any case all Linnets are singing completely when they return to Denmark in the third week of March to mid-April. The young Chaffinches, on the other hand, are singing imperfectly when they begin to sing in February and learn to sing correctly in the course of some days (1–2 weeks). Further it has to be investigated how long a young Linnet has to hear the complete Linnet-song before it imitates this song and whether the song is learnt gradually or suddenly. It should also be investigated whether there is a selective preference for imitating the specific song pattern as in the Chaffinch (POULSEN 1951).

In the related species the Canary the fairly complicated

song is innate. This was proved by METFESSEL (1940) and I found the same in two birds. This is peculiar, considering that canary fanciers stress the importance of teaching the young birds a perfect song by an adult good singer. The value of the schoolmaster is that it provokes singing and thus stimulates the intensity of the song of the young birds and further that the young birds learn new song elements and modify their own song and give a new combination of elements. I have found that young canaries beginning to sing their innate song in their first autumn by this time imitate. A bird kept together with a Grey Singing Finch for a month is two years later still singing its own song and the acquired song. A son of this male was singing its normal song in its first autumn and was then kept together with the Grey Singing Finch, but it never imitated the song of this bird. In this canary its own song had already become fixed and the bird was no more able to imitate.

DANSK RESUME

Torniriskens (*Carduelis cannabina* (L.)) sang.

Forf. har studeret, hvordan sangen udvikles efterhånden hos den unge Tornirisk, og optaget forsøgsfuglenes sang på stålband. To kunstigt opmadede Tornirisker, der aldrig havde hørt artsfællers sang, havde en medfødt sang, der var kortere og langsommere end den normale tornirisk-sang. Rytme og melodi er ikke medfødt, tonehøjde og klangfarve er derimod medfødt. Et enkelt element af sangen – nogle hæse lyde i hurtig rækkefølge – er helt medfødt. Denne del af sangen er sikkert udviklet af de lyde, Tornirisker udstyder, når de er aggressive over for hinanden; de lyder nærmest som *gæ, gæ, gæ*. Flugtstemmen, som også indgår i sangen, er ikke helt medfødt. Hos de kunstigt opfostrede Tornirisker er disse lyde lidt skarpere end normalt.

Da de to forsøgsfugle var et år gamle, var de hele maj måned anbragt sammen med en Kanariefugl og en normal Tornirisk. De lærte dog ikke noget, men sang stadig deres medfødte sang. En toårig Tornirisk, der var opfostret af kanariefugle og senere havde lært at synge af Kanariefugle og Ædelsangere (*Polioptila leucopygia* Sund.), lærte ikke at synge den rigtige tornirisk-sang, skønt den hele maj måned var sammen med en normal Tornirisk.

Tornirisker lærer sangen ved prægning een gang for alle i en bestemt sensibel periode. Er denne periode først passeret, kan fuglen ikke lære noget nyt i modsætning til de fugle, der er imitatorer f. eks. Stæren og Kærsangeren. Hvornår de unge Tornirisker i naturen lærer deres

sang vides endnu ikke. Man ved heller ikke, hvor længe en ung fugl skal høre den rigtige sang for at kunne synge rigtigt, og om den foretrækker artsfællernes sang for fremmede arters sang. Unge fugle fanget i august har senere en sang, der kunne tyde på, at de allerede på dette tidspunkt har lært den rigtige sang i modsætning til Bogfinken, der først lærer at synge, når den begynder at synge i det tidlige forår næsten et år gammel.

Kanariefluglens ret komplicerede sang er fuldstændig medfødt. De unge fugle, der begynder at synge, er dog også i stand til at lære. Herpå beror kanarieflugleopdrætternes skoling af deres unge fugle ved hjælp af en særlig fremragende gammel han, der er forsanger. En ung Kanariefugl, der lige var begyndt at synge, lærte Ædelsangerens sang. Endnu to år efter synger den stadig foruden sin egen sang også den tillærte sang. Da en søn af denne Kanariefugl, der havde udviklet sin sang fuldstændigt, blev anbragt sammen med en Ædelsanger, lærte den ikke Ædelsangerens sang. Den hørte nemlig først den fremmede sang, da dens egen sang var fuldstændigt udviklet, hvorimod dens fader hørte den fremmede sang, mens den endnu sang ufuldkomment.

Literature.

- BARRINGTON, D. 1773: Experiments and observations on the singing of birds. – Philos. Trans. **63**, pp. 249–291.
- BECHSTEIN, J. M. 1794: Naturgeschichte der Hof- und Stubenvögel. – Leipzig.
- BRAUN, F. 1915: Über die erblichen und individuell erworbenen Bestandteile des Vogelgesanges. – Orn. Monatsber. **23**, pp. 120–124.
- HEINROTH, O. und M. 1927: Die Vögel Mitteleuropas **1**. – Berlin.
- MARLER, P. 1952: Variation in the song of the Chaffinch *Fringilla coelebs*. – Ibis **94**, pp. 458–472.
- MARSHALL, A. J. 1950: The function of vocal mimicry in birds. – Emu **50**, p. 5–16.
- METFESSEL, M. 1940: Relationships of the heredity and environment in behavior. – Journ. Psych. **10**, pp. 177–198.
- POULSEN, H. 1951: Inheritance and learning in the song of the Chaffinch (*Fringilla coelebs* L.). – Behaviour **3**, pp. 216–228.
- PROMPTOFF, A. N. 1930: Die geographische Variation des Buchfinkenschlags (*Fringilla coelebs* L.) in Zusammenhang mit etlichen allgemeinen Fragen der Saisonvogelzüge. – Biol. Zentralblatt **50**, pp. 378–503.
- THORPE, W. H. 1951: The learning abilities of birds. – Ibis, **93**, pp. 1–52, 252–296.