# DEVELOPMENT OF SONG IN A MOCKINGBIRD HAND-REARED FROM THE EGG IN A CONTROLLED AUDITORY ENVIRONMENT

by SCOTT M. LANYON

The development of successful techniques for hand-rearing songbirds from the egg (Lanyon and Lanyon, 1971) has opened new possibilities for the investigation of song development. Artificially incubating the eggs isolates young birds from the natural stimuli and learning experiences normally provided by the adult birds and the nest environment. With this technique it is now possible to determine the relative importance of learning in the development of song in a variety of species. The technique by no means is limited to work in vocalizations, for it is equally applicable to research on other aspects of avian behavior.

Our Mockingbird *(Mimus polyglottos)* is of particular interest because of the diversity of its songs and the inclusion of imitations of environmental sounds in its repertoire. The purpose of this study was primarily to determine whether a Mockingbird hand-reared from the egg in sound isolation is capable of developing a song characteristic of its species. Secondly, I asked whether a bird reared as stated above and placed in an enriched auditory environment at one year of age would then modify its song, and if so, in what way.

I have not been the first to attempt to answer these particular questions with respect to *Mimus polyglottos.* Several birds were raised in varying degrees of isolation from two to three days of age (Hatch, 1967) and several others were raised from the nestling stage with no attempt at auditory isolation (Laskey, 1944). Hatch found that the song of his partially isolated birds was generally characteristic of Mockingbird song. Both Hatch and Laskey produced evidence to suggest an ability of Mockingbirds to modify their song at one year of age. To my knowledge, no one previously has hand-reared Mockingbirds successfully from the egg.

## METHODS

This study was conducted at the American Museum of Natural History's Kalbfleisch Field Research Station on Long Island. Two eggs were taken on 10 June 1973 and placed in a sound control chamber operated as a still air incubator. The two eggs hatched on 13 June, after having been artificially incubated for three days. The

diet of the nestlings was a special nestling soft-bill mix developed at the Kalbfleisch Station (Lanyon and Lanyon, 1971).

The two birds, subsequently sexed as male and female, were kept together throughout the first year. When two months old they were moved to a windowless "white noise room" where the motor noise from a powerful air-conditioning unit served to isolate them acoustically by masking all sound from outside the room. At four months of age they were moved to a larger "white noise room" where this masking effect was produced by a window air-conditioning unit. They remained here until eleven months old.

At this point the second phase of my study began for it was at this eleven month old stage that they were placed in an outdoor aviary. Here they were exposed to numerous territorial birds including a male Mockingbird.

Only the hand-reared male sang, and therefore my remarks are concerned solely with this bird, which I will henceforth refer to as the "experimental."

To analyze my recordings I used three representative selections, each five minutes in length. I used three basic parameters in this study: group length, inter-group interval, and the number of phrases per group (See figure 2).

A *phrase* is a set of notes in close temporal association which occurs in a set pattern as shown in figure 2. A *group* is a set of one or more identical phrases as shown in figure 2.

*Group Length*—The distance between the beginning of the first phrase of a group and the end of the last phrase in that group as shown in figure 2.

*Inter-Group Interval*—The distance between the end of the last phrase of one group and the beginning of the first phrase in the next group as shown in figure 2.

*Number of Phrases Per Group*—The number of phrases in each group; it demonstrates the repetitive nature of the song as shown in figure 2.

These data were obtained through actual measurement of each indicated segment of tape and the conversion of this linear measurement into units of time based on a constant tape speed of 7½ inches/second.

In making this analysis I discovered a fair imitation of a call of a Blue Jay *(Cyanocitta cristata)* included in the experimental's song at nine months of age. I then tested the effectiveness of the sound

isolation of the large "white noise room" and concluded that the only sounds that the experimental could possibly have heard were those exceptionally loud calls that were given directly outside the window. There were no territorial Mockingbirds in the vicinity to which the experimental could have been exposed, but it is likely that he did hear a Blue Jay at some point during his first winter.

Recordings were made on a Uher 4000 Report-L Tape Recorder and a Uher 4400 Report-Stereo at a tape speed of 7½ inches/second. Several recordings were made both before and after the experimental

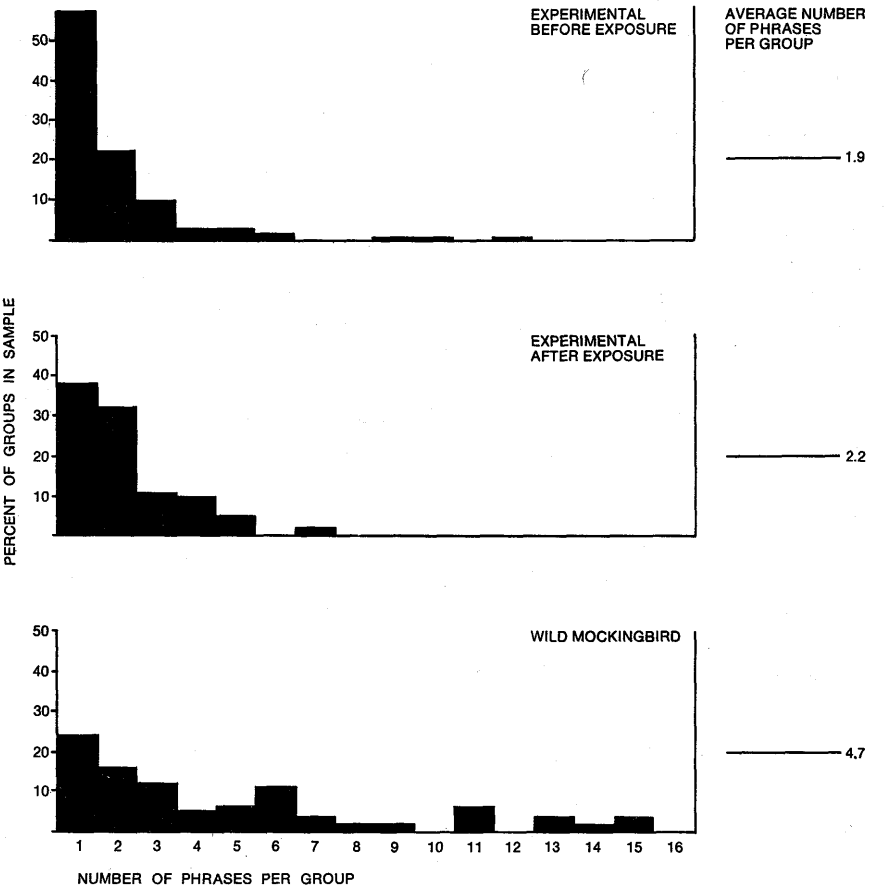


Figure 1. A comparison of the number of phrases per group between the experimental before exposure, the experimental after exposure, and a wild Mockingbird.

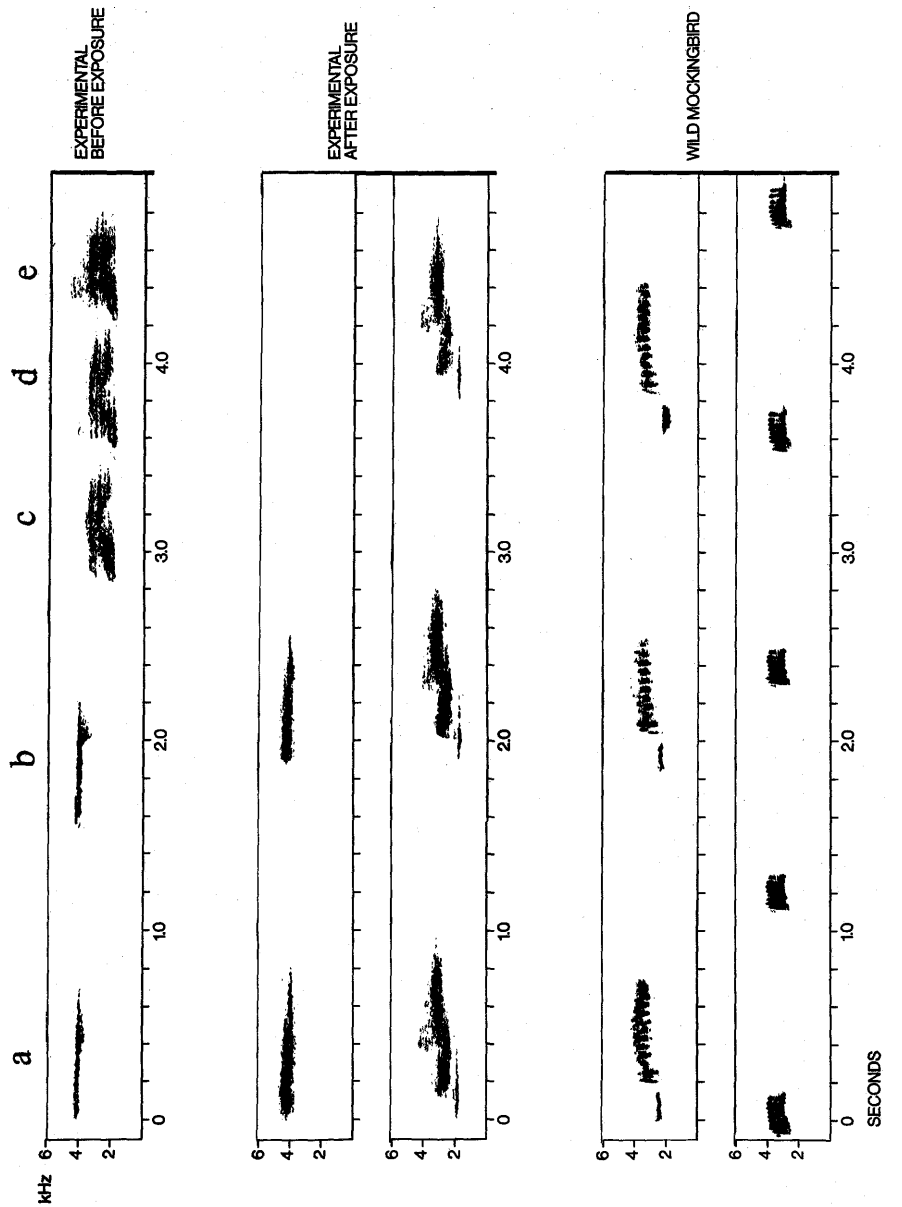


Figure 2. A comparison of song structure in the experimental before exposure, the experimental after exposure, and a wild Mockingbird. a, b, c, d, e are all phrases, a, b comprise one group and c, d, e comprise another (a group being defined by one or more similar phrases in succession).

was placed in the outdoor aviary. A recording of a wild Mockingbird was made at the Kalbfleisch Station to serve as the control in my analysis.

## RESULTS

The number of phrases per group, and thus the repetitiveness of the song, had a much lower average in the experimental's song before exposure than in the song of a wild Mockingbird (1.9 versus 4.7, see figure 1). This was also the case in the experimental's song after exposure to the enriched auditory environment (2.2 versus 4.7), although at this point the experimental had increased the average slightly over the value of his first year (1.9 versus 2.2). Figure 2 consists of a segment of song from the experimental before and after exposure, and a segment of the song of the wild Mockingbird. Each segment consists of two groups, and in the case of the experimental's song these groups contain a total of five phrases in both cases, while in the wild Mockingbird's song there is a total of eight phrases. This is a good example of how much more repetitious the wild Mockingbird's song is than either song of the experimental.

The next parameter measured, that of the group length, proved to be considerably shorter in the experimental's song before exposure than in the song of the wild Mockingbird (1.5 versus 4.7), and the inter-group interval was shorter as well (0.5 versus 1.1, see figure 3). Due to the relative shortness of these parameters the experimental in the first phase of the study had a much faster rate of delivery (in terms of groups per minute), a rate three times that of the wild Mockingbird (30.4 versus 10.5). This is demonstrated in figure 2 by the fact that the two groups for the experimental before exposure are only half as long as the two groups for the wild Mockingbird.

In the second phase of the study, after exposure to a varied sound environment, the experimental's average group length nearly doubled (3.2 versus 1.5), but the most dramatic modification occurred in the delivery rate. Whereas in the first phase the experimental had a rate three times that of the wild bird (30.4 versus 10.5), in the second phase the delivery rate was almost identical to that of the wild bird (10.9 versus 10.5). This drastic modification was accomplished by an increase in the length of the pauses in its song (inter-group interval), which in fact exceeded that of the wild bird by a factor of two (2.4 versus 1.1).

As a result of its exposure, the experimental's song contained several imitations, including Great Crested Flycatcher *(Myiarchus crini-*

*tus),* Common Crow *(Corvus brachyrhynchos),* Blue Jay *(Cyanocitta cristata),* and Red-winged Blackbird *(Agelaius phoeniceus).*

## CONCLUSIONS

It appears that the general characteristics of the song of *Mimus polyglottos* with respect to the repetitious nature of the patterns and the pitch, are inherited, that is, are not dependent upon learning from experienced birds. The detail of the actual patterns within the song, including imitations of sounds from the environment, must be learned. Secondly, it appears that Mockingbirds are capable of learning and adding to their vocal repertoire even when one year old.

## SUMMARY

A Mockingbird, hand-reared from the egg and in isolation from other birds during its first year, developed a song generally characteristic of its species with respect to the pitch and the repetitious nature of the song, but lacking in the precise characteristics of timing. After exposure to an enriched auditory environment, even though one year old, this bird added to its repertoire a number of imitations of recognizable tutors to which it had been exposed, and modified its song by slightly increasing the number of phrases per group, by lengthening each group, and by a dramatic decrease in the rate of

| | GROUP DELIVERY RATE (groups/minute) | GROUP LENGTH (average and range, in seconds) | LENGTH OF INTERGROUP INTERVAL (average and range, in seconds) |
|---|---|---|---|
| EXPERIMENTAL BEFORE EXPOSURE | 30.4 | 1.5 (0.1–4.4) | 0.5 (0–4.3) |
| EXPERIMENTAL AFTER EXPOSURE | 10.9 | 3.2 (0.1–17.5) | 2.4 (0–5.2) |
| WILD MOCKINGBIRD | 10.5 | 4.7 (0.2–15.5) | 1.1 (0.1–3.5) |

Figure 3. A comparison of three parameters between the experimental before exposure, the experimental after exposure, and a wild Mockingbird.

delivery of groups—all modifications that brought the experimental bird's song closer to that typical of its species.


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