***Animal Behavior,* Twelfth Edition**

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***Thinking Outside the Box: Answers***

**Chapter 2: The Integrative Study of Behavior**

**Box 2.1 Integrative Approaches: Characterizing sounds made by animals**

*Answer*: The question must have been something like this: Do birds adjust the songs that they make in relation to the ambient noise of their environments? The hypothesis was that birds can make these adjustments. The prediction was that birds in the city where low-frequency traffic noise is loud should shift their songs away from the low-frequency channel over the years. Figure C shows an increase in the minimum sound frequency used by white-crowned sparrows singing their dialects in San Francisco. The conclusion that the researchers reached was that the sparrows do indeed alter the songs that they sing in response to environmental noise. These adjustments could be the result of evolution by natural selection, or they could be the product of a strategy in which individuals have the flexibility to change their songs somewhat over time (the shift seen in the data could stem from increasing urban noise levels during the years of the study).

**Box 2.2 Exploring Behavior by Interpreting Data: Song learning in birds adopted by another species**

*Answer*: All behavioral traits require both genetic and environmental inputs to develop. Therefore, none of the calls of a galah can be purely genetic or purely environmental. The brain and the vocal apparatus of the parrot developed under the influences of both genetic information and the material and experiential environment. However, the *differences* between the alarm calls of two individuals could be the product of differences either in the birds’ DNA or in their environments. The difference between alarm calls of the adopted galahs and the cockatoos appears to be genetic, given that the environment of foster-reared galahs is essentially the same as that for cockatoo nestlings. On the other hand, the difference in the contact calls given by galahs that have been adopted by cockatoos and those that have been reared by their genetic parents can be attributed largely to differences in the acoustical and social environments of the galahs.

 Interspecific vocal learning could occur in any system in which the young of one species are raised by the parents of another species. This might happen in brood parasitic species where females lay their eggs in the nests of other species. Brood parasitic young might escape detection by the host parents if they are able to learn the host’s begging calls.

**Box 2.3 Exploring Behavior by Interpreting Data: Proximate mechanisms underlying song preferences in females**

*Answer*: The brain cells that process acoustical stimulation have the genetic information needed to produce one pattern of activity in response to long songs and another in response to short songs, and to provide stronger rewarding sensations when the birds hear long songs. This difference in neural activity should be related to differences in the activity of the *ZENK* gene. This prediction could be tested by sacrificing samples of female starlings shortly after they had listened to recordings of long or short songs. The NCMv in these birds could then be assayed for the *ZENK* gene product. The point of collecting these data would be to test the hypothesis that cells in the NCMv possess a gene or genes that contribute to the operation of the physiological mechanisms underlying song preferences by female starlings.

**Box 2.4 Darwinian Puzzle: Why might song learning make males communicate more effectively with rivals or potential mates?**

*Answer*:

Potential Benefit: Singing more complex songs can be used to attract more potential mates.

Comparative Test: Compare the complexity of the vocal repertoires in song learners and non-song learners.

Experimental Test: Determine experimentally how males from the same species that sing songs of different complexity do in mate-choice trials.

Potential Benefit: More complex songs can be used to share more information with group members.

Comparative Test: Compare song complexity of vocal learners that live in complex groups with those that do not.

*See Hypotheses 2.2 for additional potential benefits of song learning, and tests of these hypotheses, in the text.*

Potential Cost: Song learning may slow development.

Comparative Test: Compare the development times of song learners and non-song learners.

Potential Cost: Song learning requires complex and expensive brains.

Comparative Test: Compare brain size in song learners and non-song learners.