**Discussion Questions**

to accompany

***Animal Behavior,* Twelfth Edition**

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### **Chapter 2**

### **The Integrative Study of Behavior**

2.1 Male white-crowned sparrows (*Zonotrichia leucophrys*) must learn to sing a particular dialect of the full song of their species. But this fact does not mean that genetic information present in the cells of white-crowned sparrows is irrelevant for the development of the bird’s singing behavior. Why not? In this regard, remember that white-crowned sparrow males can learn their species’ song far more easily than the song of, say, the white-throated sparrow (*Z. albicollis*). What about the finding that white-crowned sparrow males that hear white-crowned sparrow song only during a 40-day period early in life can nevertheless generate a complete song, although they do not start singing themselves for several months after their early exposure to a tutor’s song?

*Answer*: To say that the behavioral differences between two individuals are not genetic does not mean that the behavior itself can develop without the genetic information possessed by the two individuals. For example, both Marin and Berkeley birds have genes (which could be identical in both individuals) that are vital to the development of their brains. The genes in question influence the structure and capacities of their brains, an essential contribution if their brains are to grow and acquire the ability to learn things. The fact is that all male white-crowns have learning biases that steer them toward the acquisition of a local dialect of their own species. Thus, the gene–environment interactions that take place during development produce a very special kind of brain with limited but adaptive properties.

2.2 If we were to say that the scientific conclusion of Marler’s research on young captive white-crowned sparrows was that the birds could pick up a dialect by listening to recordings of white-crowned sparrow song in the laboratory, we would say that they were mistaken. What is the real point of this and all other scientific experiments?

*Answer*: Scientific conclusions are decisions about the validity of hypotheses. The experimental data that Marler collected were gathered to test a prediction from a hypothesis. The hypothesis was that dialects are learned by young birds as they listen to the songs of adults around them. The prediction from this hypothesis was that young birds exposed to recordings of a particular dialect of white-crowned sparrow song would come to imitate that dialect. The data supported that prediction, leading to the conclusion that young white-crowned sparrows do indeed learn the particular song type that they eventually come to produce. All scientific conclusions take the form of “hypothesis accepted” or “hypothesis rejected.” Scientific evidence is gathered to reach one or the other of these conclusions.

2.3 The song of the white-crowned sparrow is composed of several parts or phrases, one of which is the “note complex” and another, the terminal “trill.” In playback experiments testing the aggressive response of male birds to modified songs, researchers found that changes to the trill were more likely to reduce the male’s aggressive reaction than were changes to the note complex component (Nelson et al. 2004). With this background, predict how much improvisation will be done to the note complex versus the trill by young captive hand-reared birds exposed to social tutors in the lab. What is the basis for this prediction?

*Answer*: It appears that the terminal trill is critical for communication of aggressive intent among males. Because improvisation would be damaging to a young male’s ability to announce his readiness to defend a territory, we might predict that captive hand-reared birds would be unlikely to modify the trill component that they acquired by listening to a social tutor.

2.4 William Searcy and colleagues played recorded songs to captive female song sparrows (*Melospiza melodia*) that had been given hormone implants shortly after being taken to the laboratory from the wild (Searcy et al. 2002). The recorded songs came from male song sparrows that lived in the females’ population, as well as from males living various distances (18, 34, 68, 135, and 540 kilometers) from that population. Songs from males living 34 or more kilometers from the females’ population were not nearly as effective in eliciting the precopulatory display as songs from local males. However, songs from males living only 18 kilometers away were about as sexually stimulating as local songs. These data have relevance for more than one ultimate hypothesis on song learning by male sparrows. What are the hypotheses, and what importance do these findings have for them?

*Answer*: One hypothesis is that females prefer songs of males in their natal neighborhood because these males will supply locally adapted genes to their offspring if chosen as mates (environmental adaptation hypothesis). Another is that the females prefer the songs of males that most closely match those that they heard as they developed because males capable of producing good matches went through the early song-learning phase under good developmental conditions that promoted full brain development (sexual selection hypothesis). Males of this sort may either be genetically superior or be in superior condition, with the capability of providing above-average parental care. Both hypotheses generate the prediction that females will be more stimulated by males living in their natal area or close to it (because these nearby males will probably sing the same or a similar dialect). The findings support both hypotheses.

2.5 Parasites are often microscopic in size but have large negative effects on their hosts. If this is true for the parasites of songbirds, what predictions follow about their effects on male song performance, and how should females respond to the song of infected males as opposed to uninfected individuals (Garamszegi 2005)?

*Answer*: Given that parasites are damaging to their hosts, we would expect that they should make it more difficult for infected males to sing their species’ complex song as well as uninfected males. Females should be able to detect even subtle acoustical signs of infection, in order to avoid picking up transmittable parasites and to avoid mating with individuals unable to provide superior genes (for parasite resistance) or parental care (if males can help rear young but are less capable of doing so when infected).

2.6 Both young males and young females of the sac-winged bat (*Saccopteryx bilineata*) appear to learn and eventually reproduce the territorial songs of harem-controlling males that associate with groups of females (Knörnschild et al. 2010). Why might males imitate a song tutor of this sort? And why might females do the same?

*Answer*: Harem controllers are socially dominant individuals. The ability to imitate song tutors that are harem masters may help young males achieve the high status needed to secure a similar position later in life. Alternatively, young males that imitate the harem master’s song may be able to better communicate their subordination to individuals of this sort and thereby be tolerated by males that could otherwise make life difficult for them.

Females may learn the song of harem masters to better identify males of this sort when choosing partners as adults. In so doing, they may secure good genes or better protection from their mates.

2.7 What features of language learning in humans are similar to song learning in birds? What do these similarities suggest about the genetic and developmental bases of human language learning? Do comparisons with birds also suggest some interesting hypotheses on the adaptive value of learned language for members of our species?

*Answer*: The shared features include the apparent window of language learning that makes it much easier for an infant or young person to learn a language than it is for an older child or adult. Another is the stunning ease with which these complex acoustical signals can be learned by very young infants. Another is the acquisition of local dialects, a function of the capacity of members of both species to precisely match the communication sounds they hear. And infants, like young white-crowned sparrows, go through a prelanguage babbling phase in which they practice the sounds that they can make and match them to their memories of the sounds they have heard others make, a process that requires the child to be able to hear themselves (rather than being deaf). Thus humans, just like white-crowned sparrows, must possess genetic information that helps make the development of a learning-capable brain possible. The human brain is, like the white-crowned sparrow’s, very strongly influenced by the acoustical environment and the social environment, with human infants highly attuned to the sounds produced by their primary caretaker, usually their mother. One ultimate hypothesis that might apply to both birds and humans is that the skill with which a male uses his group’s dialect could be important in mate choice, with females evaluating male language ability unconsciously as an indicator of the developmental history of potential mates (see Chapter 14). Language acquisition takes place during a very demanding period of growth, and people handicapped by inadequate diets may exhibit lifelong deficits in speech and body condition, which should make them less likely to elevate the fitness of a partner.

2.8 Consider the study of how white-crowned sparrows changed their song during the Covid-19 pandemic. After vehicle traffic declined to levels not seen for nearly 70 years, birds rapidly changed by singing higher performance songs at lower amplitudes. What is likely to have happened once the pandemic lessened and vehicle traffic increased back to pre-pandemic levels?

*Answer*: The rapid change in vocal behavior in white-crowned sparrows suggests that males in this species can plastically shift their behavior. Therefore, as anthropogenic noise increases again, birds are likely to return to their original song amplitudes, shifting their behavior back to match the new (or pre-pandemic) environment.

2.9 The critically endangered regent honeyeater (*Anthochaera phrygia*) has been declining in population size and density throughout most of Australia. Sons in this species do not learn song from their fathers because adult males do not sing during the period that their offspring are resident on the natal territory and offspring are forced to disperse from natal areas before fathers recommence singing. Instead, young males learn vocalizations from nearby conspecifics. How might the declining population of regent honeyeaters affect the ability of males to learn song? Generate a hypothesis to explain what may be happening.

*Answer*: Ross Crates and colleagues studied regent honeyeaters from a number of populations in eastern Australia, to test the hypothesis that population declines in this species would negatively affect song. Overall, the researchers found that the complexity of the song had declined over the past few decades, and that 12 percent of males actually produced songs of other species rather than that of their own. Because regent honeyeater males learn song from neighbors rather than from their fathers, this study suggests that declining population size is negatively affecting vocal culture and learning in this species.

2.10 Recent evidence suggests that some species of suboscine birds can learn to sing, just as most oscine songbirds. Design and experiment to test the hypothesis that suboscines can learn song. What evidence would we need to show to conclude that suboscines can actually learn song?

*Answer*: Just as has been done in oscine songbirds like the white-crowned sparrow, researchers could rear chicks of one or more suboscine species in soundproof aviaries so that they cannot hear song of their own species during development. Some of the birds could be raised in silence, and others exposed to heterospecific song by a tutor. If the birds raised in silence without tutors fail to sing, but those that were exposed to tutors could sing, then we would conclude that this species can learn song. If birds raised in silence without tutors can sing, then we would conclude that they do not learn song, but instead have an innate ability to sing.

References

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