Mom Always Liked You Best: Examining the Hypothesis of Parental Favoritism

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Many birds have bright, ornamental plumage. Most often it is displayed by the male of the species, who is believed to use the plumage to attract females. The female may select male breeding partners on the basis of this feather advertisement, perhaps assessing their health. According to evolutionary theory, it behooves the female to choose a strong, healthy male to be the father of her chicks, not only because the male helps to feed them but also because the chicks will carry dad's healthy genes. Darwin labeled such mate choice "sexual selection."

Another possible form of plumage selection has been studied by biologists in Canada. They think that the parents of certain bird species may select the "prettiest" chicks out of a nest as favorites and feed them better (why they might do this is an interesting question).

American coots are birds that live in the marshes of western North America. As adults they are grayish-black and have a spot of white on their bills. The chicks are unusual, for unlike most birds whose nestlings are usually drab, coot chicks are surprisingly conspicuous. They have long, orange-tipped, slender feathers, brilliant red papillae around their eyes, a bright red bill, and bald red head. The chicks lose this colorful appearance at three weeks. The Canadian biologists speculated that the plumage may make some chicks more attractive to their parents; possibly the most "attractive" chicks might be able to successfully beg for more food from their parents and have a better chance of survival. That seemed possible since sometimes one-half of all chicks died from starvation. But how could the authors test such an unusual notion?

Here is your challenge:

- First, identify the specific question(s) the authors are asking.
- Second, what is the hypothesis that they suggest?
- Third, what predictions (deductions) can you make if the hypothesis is correct?
- Fourth, how can we test the predictions, i.e., what exactly might we do if we were the authors who had studied coots for several years?

Part II—The Authors Find a Method to Attack the Problem

During the breeding season of 1992, Bruce Lyon, John Eadie, and Linda Hamilton studied 90 pairs of coots nesting in the marshes of British Columbia. They decided to try and alter the plumage of the chicks by dyeing them. Unfortunately, the dye made the chicks sick and it removed the oils from their feathers. They next tried to alter the appearance of the chicks by cutting the orange tips off their body feathers. This produced black chicks that seemed to act the same as the normal orange chicks. The scientists now began a test of their hypothesis using this technique. What do you expect they might do?

Part III—What Should Be Measured?

The biologists decided to set up three types of nest conditions. In the first group of nests (let's call this the experimental group), they trimmed half of the chicks and made them black, and they left half of the brood with orange feathers. In a second group (call this a control group), all of the chicks were trimmed so they appeared black. In a third group of nests (call this another control group), all the chicks were left their natural color, orange. In all three groups, the chicks were captured within a day of hatching and were generally handled the same way even though some were trimmed. The chicks were kept in captivity for 30 minutes before being replaced in their nest. To control for the effects of hatching order in the experimental groups, the first chick hatched was randomly assigned to be trimmed or left orange. Thereafter, treatments were alternated with hatching order. The biologists worried about what kinds of data to collect, how to collect the data, and what kinds of results to expect. What would you suggest they do?

Part IV—At Last, Here Are Some Data!

The biologists decided to compare feeding rates, relative growth rates, and survival rates of the chicks in the different nests. Since the chicks had been individually color-marked, they could be easily observed and identified from floating blinds. To estimate growth rates, swimming chicks were photographed at known distances and their body length at waterline was estimated from projected slides. This measure of size is strongly correlated with body mass ($r=0.97$, $n=43$). Part of the data have been reproduced in the handout showing Figure 1. Predict the results of the other values by plotting the values on the graph. Why have you made these predictions?

Part V—The Rest of the Story

In the handout showing Figure 2 you will see the real results that the authors collected. How do the data compare with your predictions?

The authors ran a series of statistical tests and noted that there were no significant differences between the two control groups in any of the measures--that is, when the orange and black chicks were in separate nests, they had similar feeding, growth, and survival rates.

But in the experimental group where both black and orange chicks occurred together and the parents had a true choice of whom to feed, statistical analysis showed that the orange chicks fared better. Orange chicks were fed at a higher rate, had a higher growth rate, and enjoyed a higher survival rate than the black chicks in the same brood. What conclusions might the biologists make about their original hypothesis?

For example:

1. Do black chicks survive more poorly simply because they are black or because they are "inferior" relative to the orange?
2. Do the data support the hypothesis?
3. Do the data prove the hypothesis?

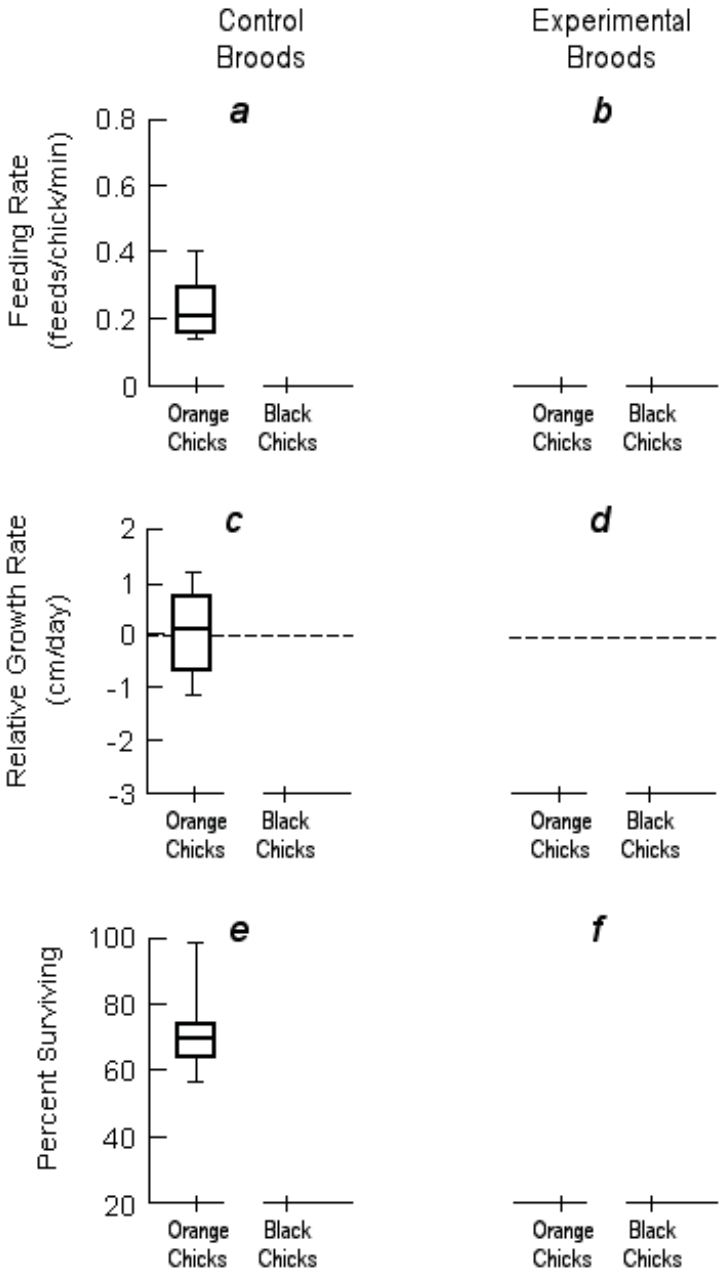

Figure 1: Feeding, growth, and survival rates of coot chicks

On the left side of the figure (panels a, c, and e) are the values for the two control groups (nests with either all orange chicks or nests with all black chicks). But the only data shown are for the nests composed entirely of orange chicks. Remember this is the normal situation that we find in the wild. The values shown are the medians, interquartile ranges, and 10–90 percentiles. With this knowledge, plot the values on the graph you would expect for the control black chicks raised with only black nest mates.

On the right side of the figure (panels b, d, and f) is a space for the expected values for the chicks in the experimental broods. Here half of the chicks are black and half are kept orange. Now plot what you predict the values will be *if the authors' hypothesis is correct.*

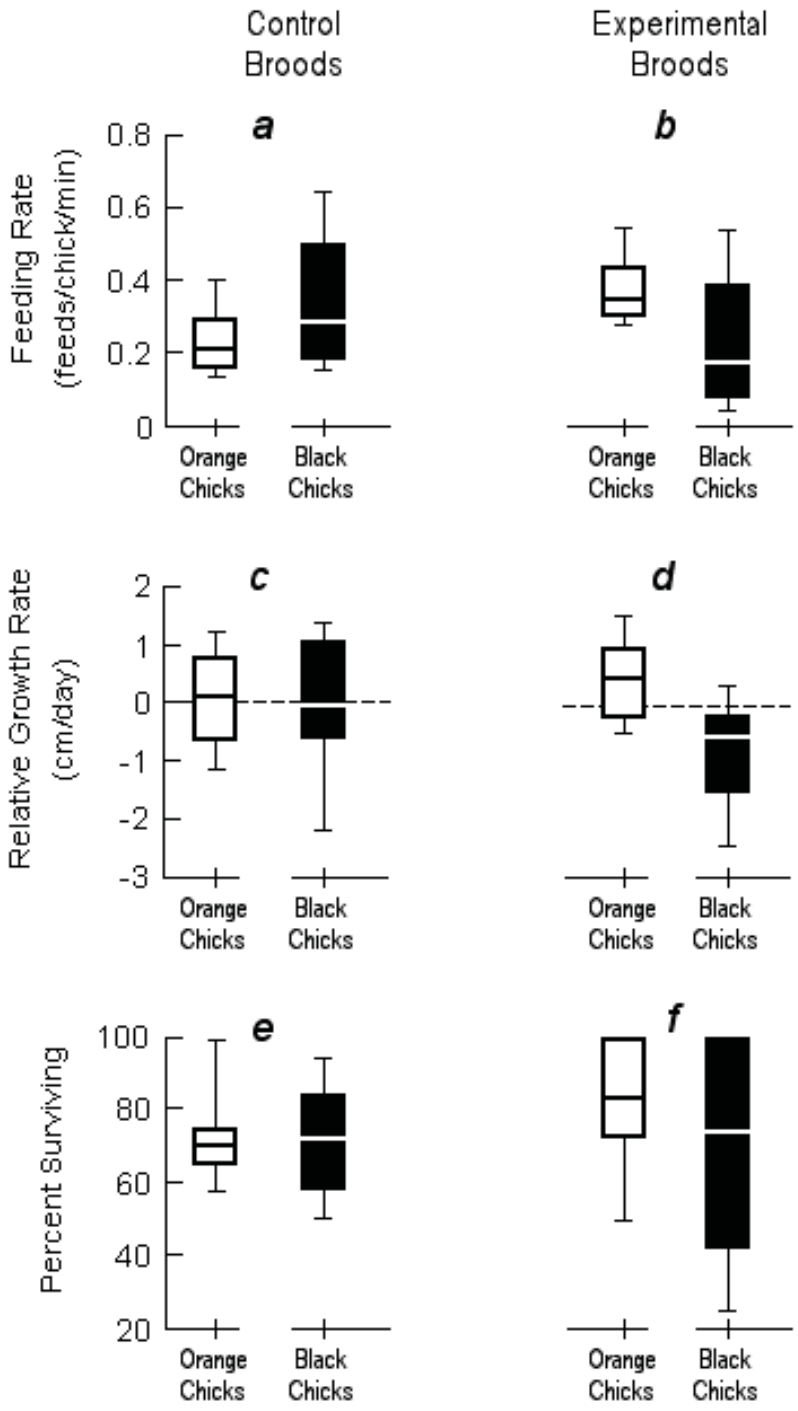

Figure 2: Feeding, growth, and survival rates of coot chicks

The values shown are the medians, interquartile range, and 10–90 percentiles.

Note: There are no statistical differences between orange and black chicks (controls) in separate nests. In the experimental nests, there were significant differences between the orange and black chicks in feeding, growth, and survival rates.