Female senses and the evolution of beauty

How to Impress Females?

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Female animals make the world more beautiful, and... more deceitful. Their selectivity forces males to become more conspicuous, or occasionally more cunning, in their attempts to stoke the passions of their potential mates

The songs of the nightingale, the extravagant feathers of birds of paradise, and the elaborate, decorated structures called "bowers", built by male bowerbirds - such examples of male animals' mating behavior have been seen by many people as setting the standard for beauty. It is due to the female "esthetic sense" that we have such natural wonders. Intensive research on sexual selection in recent years has confirmed Darwin's suggestion that females have evolved preferences for those characteristics in potential mates that are indicative of good physical condition, health, and vitality. Such traits are attractive because a preference for them has previously ensured such females' ancestors greater numbers of offspring. Yet sexual selection is intriguing in that it usually does not reward traits that increase survival chances - apparently running counter to the logic of evolution. It may actually increase the risk of death. Some examples? Bright coloring may attract the attention of predators, while long extravagant feathers hamper flight and make it harder to escape danger. Males risk death in exchange for greater reproductive success - male specimens that do have such extravagant traits or put on

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Showing off: for the raggiana bird of paradise, *Paradisaea raggiana*, a male's mating success depends on his display of magnificent plumage

extreme displays win more fertile females and sire more offspring than average males. These traits are the consequence of the evolution of male behaviors that stimulate the senses of females, leading to copulation. Success is achieved by those males that, during the evolutionary process, have best adapted their signals (visual, vocal, etc.) to the "feminine sensitivities" of their mates.

Pretty fathers and sexy sons

What controls the mechanism of female choosiness, i.e. the traits of their sensory and nervous system that determine which mates appeals to them? First, such choosiness could bring about direct benefits in the form of greater reproductive success. A male with the preferred traits might, for example, be better able to defend territory with more food and safer breeding sites. He might also bring in more food for his offspring, or be less burdened with parasites or illnesses, thus reducing the risk of infection for the female. Second, extravagant decoration or mating behaviors might also signal the benefits that females can gain in terms of the greater reproductive success of their future offspring. Sons sired by an attractive partner will themselves be more attractive (sexy son hypothesis), and thus a mother will leave more grandchildren behind. Such a mechanism might function mainly in situations when a small segment of the male population monopolizes access to most females.

If you've got it, flaunt it

Another reason why females choose males with extravagant decorations is explained by the so-called "good genes" or "handicap principle." The logic here is that producing impressive decorations is a great burden, and so their size and conspicuousness offers reliable information about the vitality and "genetic quality" of the males. The cost of "producing" adornments grows in proportion to their size, but more quickly in the case of males in poor condition. As a result, only males in the best condition can flaunt the most imposing ornaments.

There are numerous examples of male decorative traits that depend upon physical condition. These include the long tails of the swallow (*Hirundo rustica*) or African whydahs (*Vidua*) and widowbirds (*Euplectes*). As our research on swallows has shown, such traits develop from the typically "normal" tails of the present-day species' ancestors. The elaborate swallow tail could be costly even at a very early stage of its evolution, by reducing feeding efficiency. If, however, the swallow species is subject to selection due to greater maneuverability in flight, such as through a change in diet to include larger and more agile insects, then the development of decorated outer tail feathers might be advantageous. Up to a certain length, ornamental outer tail feathers increase maneuverability, but beyond that they begin to interfere. Preferring rudimentary decoration might give females a direct adaptive edge, via such males' greater ability to provide food for offspring. Later, when the tails become longer due to evolution, the handicap principle could come into play, or females might cease to prefer males with such tails.

Marcin Sielezniew

The long "horns" of male beetles serve as weapons in contests over females and food

Research by A. P. Moeller from the Université Pierre et Marie Curie, Paris, on the swallow has shown that males with long tails are less affected by parasites than their shorter-tailed rivals. Offspring sired by such males were also less affected by certain parasites, which means that they inherited greater immunity to them. One of an organism's most basic means of fighting pathogens is an effective immune system. However, decorative traits develop under the influence of testosterone and other sex hormones, which usually hamper immune responses. Nevertheless, in accordance with the "handicap principle," only individuals in good condition can afford to develop extravagant decorations, without compromising the effectiveness of their immune response.

Symmetry is beautiful

Animals quite frequently use symmetry as an indicator of individual quality. The

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development of the left and right sides of the body takes place under the influence of the same set of genes and control mechanisms, and so under ideal conditions both sides should develop symmetrically. This can be disrupted by various internal and environmental factors, which cause asymmetry in bilateral structures of an organism. Large aberrations in the symmetry of various traits point to weaker control mechanisms, and could stem from mediocre genetic constitution, malnutrition, or illness. An asymmetrical arrangement of the limbs of land animals or the wings and tails of birds makes it harder for them to keep up with the herd of flock, to hunt, or to escape from predators. And so, it comes as no surprise that symmetry plays an important role in sexual selection for a wide range of species, from arthropods to birds, mammals, and humans. Women prefer men with a symmetrical face and body. Such choosiness, which stems from the sensitivities of females' sensory and nervous system, gives them a direct adaptive advantage: symmetrical partners are healthier and more physically fit. Back when physical condition used to matter for human survival, such males used to take better care of their mates and offspring.

Being able to size up symmetry or asymmetry is also important in competition between males. When defending their territory in the spring, male chaffinches might display their white wing-patches, called epaulettes, to a greater or lesser extent - more exposed epaulettes signal a greater eagerness to fight. According to our research, male chaffinches assess the level of asymmetry present in other males' white wing-patches and more aggressively attack rivals that are potentially weak, i.e. those showing large and asymmetrical patches, than those with large and symmetrical patches. It seems that at the beginning of a conflict males may try to mask the asymmetry of their epaulettes, by modifying how they expose them so that any asymmetry (if it exists) is concealed. They only betray themselves when they reveal their epaulettes completely, when showing a high eagerness to fight. Our results suggest that the way in which chaffinches communica-

R. Brown/VIREO

The extent to which a "bower," seen here in the background, is well-constructed and well-maintained reflects the health and dominance of the male satin bowerbird *Ptilonorhynchus violaceus*

te is based upon the handicap principle - the cost of showing a high eagerness to fight seems to be greater for asymmetrical specimens than for symmetrical ones.

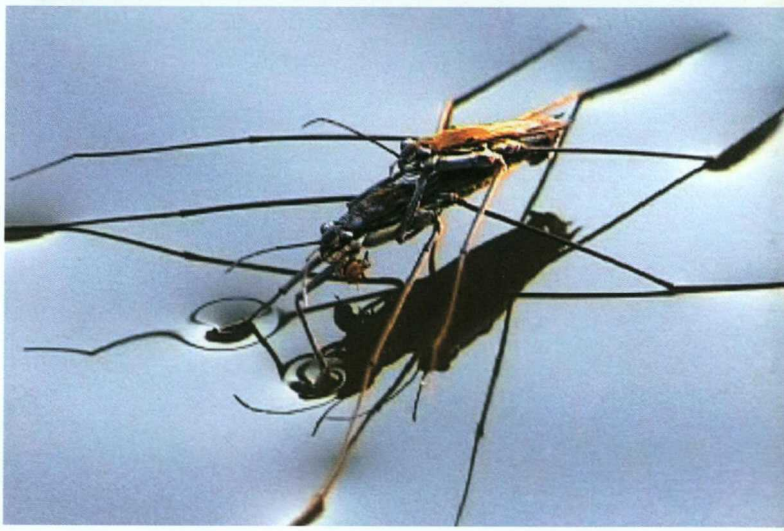
Deceptive mating

Females really do rule the world, but males also have their cunning ways. They can sometimes find a way to strike a particular chord with the senses of females, even if this is against the latter's interests. Evolution sometimes equips males with traits or skills that exploit females' existing sensitivities, even though these traits arose for reasons unrelated to sexual selection. Females react positively and prefer certain males not because this brings benefits in the form of "good genes" or "sexy sons," but because they cannot resist the signals such males send out.

Here is an example of one such "deception strategy" that we have studied. Female and male water striders (*Gerris lacustris*) are very sensitive to certain vibrations on the surface of the water, since this enables them to detect food - small insects that have fallen upon the surface and are trying to return to flight. Food is essential for life, and so such sensitivity has been promoted by natural selection. Male water striders know how to generate signals that imitate the typical vibration caused by prey, and in this deceptive manner they allure females to mate with them. The females would not normally be interested in this because they are carrying sperm from previous copulations and do not need new mates, and the costs of copulation are significant for them, including greater risk of falling prey to a predator. And so, resorting to trickery is a successful reproductive strategy for males.

Various similar strategies have previously been reported for other animals, such as the water mite (*Neumania papillator*), crabs from the genus Uca, or the bushcricket (*Metaplastes ornatus*). But when males are faced with situations in which they are unable to win a mate by demonstrating their vigor, health, or affluence, they might simply have no recourse but to resort to cunning. Since nature is diverse, the mechanisms described here might also operate in the opposite way, and such sexual roles may be reversed in some species. And so, coutrary to the old adage, here research shows that deception does sometimes pay. ■

Grzegorz Leśniewski



Marek Kozłowski

Male chaffinches (upper photo) can assess the degree of asymmetry present in other males' epaulettes and more aggressively attack rivals that are potentially weak

Lower photo: deception does indeed sometimes pay. Male waterstriders use water-surface signals that trick females into approaching them as if they were prey, to a distance close enough for the male to forcefully initiate mating

Further reading:

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