Letter from the Desk of David Challinor
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Human concepts of beauty vary widely, not only among cultures, but also between individuals. The viewer's reaction, I believe, transcends culture. Natural landscapes range from awe-inspiring—the Grand Canyon, Victoria Falls—to breathtakingly beautiful—such as autumnal-foliaged temperate forests or tropical coral reefs. The same applies to buildings: virtually every visitor is stricken by the beauty of the architecturally symmetrical Taj Mahal when first seeing it in the distance, framed by its red sandstone entrance arch. This month's letter is about the concept of beauty and what humans look for consciously or unconsciously to determine beauty in our surroundings, our industrial products and, most fascinating for me, in our fellow beings.

Well-known natural landscapes seem to share a quality that inserts itself unconsciously into virtually all aspects of beauty—especially symmetry, which is defined as beauty resulting from balanced or harmonious arrangement. Consider the aesthetic pleasure of gazing from a fire tower across the forested hills of New England's Green Mountains at the peak of fall foliage. Were the view to be interrupted by a large incongruent swath of commercial development, our perceptive balance might be jarred in the same way as seeing almost any flagrant asymmetry, such as a man with a large moustache on his left side but clean-shaven on the other. A distant single peak, such as Mt. Kenya, Mt. Fuji or Mt. Rainier, whose conic symmetry rise unblemished on the horizon, will generally be considered more beautiful than a series of connected peaks.

In life we are surrounded by symmetry: in architecture, furniture, rug patterns, clothing, *et al*. Its ubiquity tends to dampen awareness of asymmetry, except when garish or large enough to command attention, as do the two steeple towers of Chartres' cathedral.

Symmetry's appeal in the human form has a long history. An early example is Leonardo da Vinci's famous drawing of "The Proportions of Man," depicting a man standing in the middle of a circle, his arms and legs spread to touch its perimeter. In order to understand why this quality is so appealing to us, scientists have studied the role and effect of symmetry in other organisms. Randy Thornhill, a behavioral ecologist at the University of New Mexico, chose Japanese scorpion flies. They are 2 cm-long scavengers that feed mostly on dead insects on low bushes. Individuals are easily identified by attached stationary body mites. After monitoring 288 matings, he found that 91 percent of them were by the dominant male fly from a competing pool of up to five or six. Through careful measurements he determined that those successful breeding males had bilaterally symmetrical wings. The losers had unequal wings. Searching further, he learned that during its larval stage, the fly's developing wings could be affected by such unpredictable conditions as late frosts, extreme droughts, pathogens, etc.

A male with symmetrical wings was, therefore, either lucky or so constituted that he overcame these stresses during development.

In one elegant laboratory experiment, Thornhill exposed females to pairs of males with varying degrees of wing symmetry. The female, however, could see neither male but only smell the pheromone they released. In 44 of 50 trials, the female was lured by the scent of the more symmetrical of the two males, even when the difference in their wing symmetries was trivial. From this experiment, Thornhill determined that male body size was not a factor, but that symmetrical males produce more appealing pheromones. He speculated that pheromone quality was contingent on diet, as he had observed that symmetrical males were more successful in defending the dead caterpillars they were eating from other males and thus were better fed than their rivals and became more successful breeders. By carefully controlled laboratory breeding, Thornhill and colleagues found that symmetry in scorpion flies is heritable, which means that asymmetry in wild individuals probably resulted from various stresses or pathogens during larval growth. If symmetry is heritable in these flies, then females would logically choose such males to pass on that quality to their offspring and thereby help ensure resistance to stress during their larval growth. A further experiment with both male and female flies released in a large enclosure for 10 days showed that the survival of both sexes was directly related to symmetry.

Similar physical damage from early life stresses are found in barn swallows where males with symmetrically long outer tail feathers are most successful in female choice experiments. Tail feather asymmetry in adult male swallows was traced to a nestling parasite, indicating that females were choosing mates perhaps partly because of their successful resistance as nestlings. This resistance could be valuable later to ensure against future damaging attacks by pathogens or parasites.

Humans, too, are susceptible to the lure of symmetry. The right and left side symmetry of the Venus de Milo or da Vinci's David have for centuries passed the test for beauty with flying colors. As in almost all vertebrates we are skeletally symmetrical, but neither side is ever the exact mirror image of the other—the wedding ring on your left ring finger seldom fits over the knuckle of your right one if you are right-handed. Such minor deviations do not really matter much, but deep in our psyche there seems to be a subconscious bias against fleshly asymmetry when selecting mates. Are we, therefore, subject to some of the same influences in our mating strategies as the scorpion fly or the barn swallow? The answer seems to be yes, at least to some degree. The problem of establishing a definitive answer is that when we study ourselves, both the researcher and the subject are carrying too much "baggage"—that is, because both parties are human, it is impossible to be completely dispassionate or unbiased. We must, therefore, wait for the arrival of some extraterrestrial intelligent beings to give us an objective answer. Meanwhile, scientists of many stripes are trying to unravel what constitutes human beauty and the role it plays in mate choice. The question becomes—is beauty adaptive in a Darwinian sense as an essential component to ensure the survival of the species or is it derived purely culturally?

Thornhill and other scientists such as Anders Moller, who investigated the work on swallows, propose that human symmetry also reflects such breeding qualities as disease resistance, desirable genes, healthy diet and potential reproductive success. On the other side are arrayed many anthropologists, psychologists, sociologists and some biologists who do not think that such zoological standards apply to humans and that cultural forces determine human perception of beauty or our choice of breeding strategies.

Thornhill and others who support the Darwinian or adaptionist approach have tirelessly measured the features (hands, feet, elbows, ears) of hundreds of subjects (usually volunteer students) to gain some measure of what is called fluctuating asymmetries (FAs)—that is, deviations from perfect symmetry. Scientists gave FAs numerical values for ease of analysis. Facial photographs of the subjects were then rated for "attractiveness" by the opposite sex. The result was that those judged most attractive were also most symmetrical, and that the degree of facial symmetry generally coincided with body symmetry.

The question of why body symmetry is attractive or sexy is still unresolved. In fact two researchers, J. P. Swaddle and I.C. Cuthill, published a paper, "Asymmetry and human facial attractiveness: symmetry may not always be beautiful." Proc. Roy. Soc. London B (1995). 261: 111-116. They manipulated facial photographs of their subjects and among those pictures to be assessed for attractiveness were mirror images, which produce perfect symmetry. These photos were <u>not</u> favored, which seems to indicate that some FA in a person's face is necessary to be beautiful.

How do asymmetrical animals fare? Among crustaceae asymmetry is fairly common and easily seen in the claws of male fiddler crabs or the ripper and crunching claws of lobsters. Non-skeletal asymmetry in fish is present in the flatfish (flounder, sole, halibut) where the bottom side eye migrates to the top of the adult's head, and in owls where ear openings are offset and differently shaped from each other to aid in directional hearing. Skeletal asymmetry in vertebrates is rarer. The only bird that comes to mind is New Zealand's wrybill plover (*Anarhynchus frentalis*), where the bill curves laterally to the right. Among mammals, skeletal asymmetry exists in two cetaceans. Sperm whales have only a left blowhole (nostril) and lack completely the left nasal bone; the right side of the skull is noticeably larger than the left. The other example is perhaps the most visible asymmetry among all mammals—the male narwhal's tusk. It develops from the left one of two upper teeth and spirals left. Occasionally, the right tooth also expresses through the hole it makes in the upper lip, but it never matches the length of the left one. Scientists are still not sure what role the tusk plays. It is evidently not used for feeding and may serve only as a sexual ornament. A tantalizing observation by Peter Beamish of the Marine Ecology laboratory in Nova Scotia may provide a clue to its use. He watched the tusks of captive males visibly vibrating when the whales were emitting calls at their highest frequencies. He speculated that they might use their tusks to focus calls in narrow directional beams. The males with the largest tusks (they can be over 7 ft. long and weigh more than 20 lbs.) would, therefore, be able to assert their dominance by directing the sound of their high frequency calls at the sensitive sound receptors of their challengers. Such ear-piercing sounds must be as hurtful to young narwhals as they are to us.

Confounding the lure and appeal of symmetry is the fascinating question of handedness. If humans are basically bilateral, why are we not all ambidextrous or at least equally divided between southpaws and righties? We now know handedness is controlled by one side of the brain or the other. Thus the majority of humans are right-handed, just as grey whales swim on their right sides significantly more than their left when bottom feeding in the mud.

The mysteries of the role of symmetry in mate choice in a wide range of animals, from insects to humans, will take time to unravel. People do not necessarily behave like Japanese scorpion flies, but we are both animals that must reproduce successfully under varying conditions to maintain our species. Parallel stimuli across a wide range of creatures may not be unreasonable. The research on symmetry and handedness are but two examples of the insatiable curiosity of scientists. The lure is in the search itself, and the ultimate reward of a significant discovery is often the result of the work of many. Good scientists are generous and willing to share their results.

Beauty's concept is as elusive now as ever. Emerson tried to explain it when he wrote, "If eyes were made for seeing then beauty is its own excuse for being," as did Keats when he penned his immortal lines "Beauty is truth, truth beauty—that is all ye know on earth and all ye need to know." Both philosopher and poet have left us scarcely the wiser. Truth, too, is equally ephemeral despite Francis Bacon's attempt in his brilliant essay—"what is truth said jesting Pilot and would not stay for an answer." For us it may be best to leave beauty in our mind's eye and rejoice in and encourage researchers to explore the interconnection of beauty and symmetry.

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P.S. Two useful references:

Thornhill, R. "The Allure of Symmetry." *Natural History*. 9/93: 30-36
Concor, D. 1995. "Sex and the Symmetrical Body." *New Scientist*. 146 (1974): 40-44.