

# **Scientists ponder beauty and the eye of the beholder**

## **Evidence increasingly suggests the human brain is hard-wired for aesthetics**

**By Ian Hoffman STAFF WRITER, Oakland Tribune**

For all their vaunted acuity, our senses gather only fragmentary and ambiguous information about the world around us. All that our eyes "see" and ears "hear" are photons of light and pressure waves traveling across space. The energy forms don't necessarily contain data critical to human survival - such as where they came from, what object caused them or how far they traveled. Our brain supplies all this - fills in the blanks and resolves the ambiguities - with remarkable speed and agility.

The brain interprets these sparse stimuli as real objects and sounds. It stretches well beyond the available data to makes our world visible and audible in meaningful ways.

But what makes an opera stirring? A photograph beautiful? A piece of modern art emotionally shocking or intellectually arousing? Scientists are just opening this new chapter in exploring the brain and human nature. Rather than scalpels, they're using powerful new brain-scanning tools to decipher responses to language, music and art. And in a rare case at Berkeley, they're reaching across the traditional chasm between the sciences and humanities to seek insight from artists, musicians and architects.

Artists might not think of themselves as neuroscientists, but they've been at least as successful in tapping the wellsprings of human emotion, intellect and appreciation of form, according to University of London neurobiology professor Scour Zeki, a pioneer in the rapidly evolving field of "neuraesthetics," a term he coined.

" Scientists have a view of artists as 'the world out there,'" said Zeki. Yet from Renaissance sculptors to Impressionists to modernists, artists manage to depict the essential and unchanging nature of things in ways that appeal to their own brains and

to ours. Zeki's school and the Berkeley based Minerva Foundation brought dozens of experts in art, music, architecture and neuroscience to Berkeley recently for a conversation about the latest and future research in the neurology of aesthetics.

Increasingly, neuroscientists suspect our sense of beauty - and perhaps a wealth of emotional and intellectual triggers - are at least partly hardwired, a product of evolution as much or more than cultural or personal experience. How much is a matter of debate.

"I would say it's not a settled issue," said University of Arizona psychology professor Lynn Nadel, now on sabbatical at Berkeley. "There's no question that evolution shapes the way we are, but there's plenty of questions about how detailed that shaping is with respect to human evolution, especially for things like beauty and harmony."

Scientists already possess some intriguing clues. Designers of the Egyptian pyramids and the Greek Parthenon drew on a special formula to make their forms balanced and pleasing. Architects know it as the Golden Rule, the Golden Mean or phi - a mathematical ratio of length to width or other features equal to  $.6150339$  ad infinitum - that seems unfailingly to elicit a sense of harmony and balance. It also dictates the distribution of petals on chrysanthemums and the shape of shrimp shells. It crops up in studies by Leonardo da Vinci and fills the modern art of Piet Mondrian with harmonious rectangles.

"We're born with a hard-wired part of our brain geared to proportion, and that proportion is the *Golden Rule*," said John P. Eberhard, director of research planning for the American Institute of Architects. "Now why we needed this concept of proportion biologically in architecture, I don't know. But there's this generic foundational concept of good proportion, and we apply that in architecture and in art." Music supplies other clues to this notion of human beings' hard-wired aesthetics.

Every culture for thousands of years has employed some form of harmonic organization similar to the octave. It could be the human need to break musical information into understandable pieces. Or it could have an altogether different explanation. Pythagoras studied harmony in sound and reasoned it had a mathematical basis that appealed to something innate in the brain, across cultures, said David A. Schwartz, a cognitive psychologist and researcher in the famed Purves Lab at Duke University Medical Center.

" He said the evidence suggested this particular ordering of tone is much the same among people of different societies, even among infants. So it seems to be somewhat independent of the musical environment in which one grows up," Schwartz said. "It seems to be telling us something fundamental about the human auditory system."

Scientists such as Schwartz are looking for evidence that musical aesthetics, a love of specific harmonies, cross cultural lines and so are products of evolution. If so, the implication is that playing CDs of Japanese language or Bach concerti in the nursery won't necessarily give a child a jump start on genius. But it also would imply a fundamental human need for beauty and harmony that has nothing to do with art or music.

"I think everything arises on evolutionary scales," Zeki said. "And to seek an answer, we have to ask, 'Why do we have an evolutionary sense of beauty?'"  
Some scientists suggest beauty must be tied to a biological advantage, for example, discerning ripe fruit on a tree or attractive qualities in the opposite sex.

"At a very vague level, it must be to attract the individual from things that are biologically useful and away from those that are harmful," Schwartz said.  
"How specific the evolutionary instructions are, I think, is where the debate is now," said the University of Arizona's Nadel. "It could be that all humans fixate on something early in life, and that could prefigure everything we do... What we end up preferring could very well depend on experience."

For the next 10 or 20 years, neurobiologists will search for explanations. Are there "golden rules" of harmony and beauty for all arts? Or for each kind of art? Or do we as individuals develop our own, unique rules for aesthetics?

Studies suggest the areas of the brain engaged in making music or art are scattered all over, producing a complex landscape for neurobiologists to navigate. Is the same true for those parts engaged in appreciating beauty and satisfaction? What is their evolutionary cause and rationale?

So far, Zekt said, science's evolving picture of the brain and its aesthetic responses "has been stunning in its simplicity."

"I think there will be layers of complexity," he said. "But one thing I'm sure of: Whether it's 100 years or 50 years or 20 years, it's going to be simply organized. Well look back and say, 'My God, we spent all this time, and here it is.'"