

Mathematicians don't see equations as tough, they see 'beautiful women'!

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Chennai: "Beauty lies in the eyes of the beholder" they say, and there is a reason for it. While a student may find a tough mathematical equation complex, mathematicians find them beautiful — the same way a human being would find the opposite sex attractive, a process that's biological.

This is because the neural stimuli for both situations are triggered in the same part of the brain and produces characteristically similar logical deductions, said Semir Zeki, professor of neurasthenics at the University College London, UK.

Zeki was in the city on Sunday to deliver the 38th T S Srinivasan endowment oration when he explained why it is not odd for a mathematician to find numbers in an equa-



Venu Srinivasan, chairman, TVS Motor Company, presenting a citation to professor Semir Zeki

tion aesthetically pleasing. "When people look at something they find beautiful, a portion in the front part of the brain called the medial orbitofrontal cortex (mOFC) lights up," said Zeki, adding that this portion of the brain witnesses increased blood flow due to the added buzz of neurons.

Zeki defined conventional beauty as a code we are born with. "The brain has a templa-

te of how faces should look like. Any departure from this code and the brain concludes that the face is not beautiful," he said.

While aesthetics in art or music besides the opposite sex are what people usually appreciate, or relate to as being beautiful, Zeki said mathematicians used emotive terms to describe a formula's aesthetic value. Zeki said he was inspired by the Indian mathematician Srinivasa Ramanujan to probe this aspect of beauty as visualised by number wizards.

Over the six-year duration of his research, Zeki asked subjects to choose between a set of equations and classify them either beautiful or ugly. The subjects, he said, identified the Euler's identity as a beautiful formula while Ramanujan's own equation, which calculates the inverse value of pi as an infinite sum, was

identified an ugly equation.

The result observed was that the subjects' mOFC witnessed excess activity when looking at Euler's identity in much the same way as an average person's mOFC acted up when shown the picture of a woman deemed beautiful by conventional standards, or when made to listen to an elegant and moving musical composition.

"The common experience reveals that mathematical beauty also belongs to the biological category," he said.

Zeki added that understanding mathematical beauty changed his perception about the concept of beauty itself. Quoting the British poet John Keats' verse on the likeness between truth and beauty, Zeki said discoveries of black holes and gravitational waves could only be proved true courtesy of "beautiful formula".

'Beauty best measured on a one to 10 scale'

SWETHA TRIPATHI

Semir Zeki, Professor of Neurasthenics at University College London, discussed the neurobiological basis of beauty and explains the activation of different parts of the brain that get activated in people when appreciating art or music. He was in the city delivering the 38th edition of the TS Srinivasan Endowment Oration,

In his talk titled "Beauty and Your Brain," the professor explained the fact that aesthetic experiences can be quantified. Dr Zeki presented various visual and auditory pieces. "If one experiences an object or a face as very beautiful and rates it as 10 (on a scale of 1 to 10), then the activity is going to be stronger than if the experience is rated as 1. This answers a critical question in the study of aesthetics, one that has been debated since time immemorial, whether aesthetic experiences can be quantified and the answer is yes," he said.

A research by professor Zeki on beauty and neurological changes in the brain explained that when people look at something they find beautiful, a portion at the front part of the brain called the medial orbito-frontal cortex 'lights up' with an increased blood flow in this part of the



Venu Srinivasan honours Dr Semi Zeki

brain due to an increasing buzz of neurons. "With emerging brain imaging techniques, it is now possible to understand the changes that kick start when one lays eyes on a beautiful person, or a stunning landscape painting, or when one hears an electrifying piece of music," he says.

He mentioned that while symmetry is an important aspect of biological beauty, it might not play as vital a role in arte-factual beauty. Citing an example, he stated that there are limits

within which a face can be beautiful and biological symmetry has a big role to play here. He mentioned that the largest number of articles on the 'golden ratio', also known as the divine proportion, are to be found in journals of reconstructive surgery. Maintaining biological symmetry is the main principle in reconstructive surgeries.

Apart from the different sources of beauty such as faces, buildings, picturesque landscapes, music, beauty is also

derived from highly cognitive sources as in mathematics as mathematicians give the description of mathematical formulas in emotive terms.

"Since mathematicians from very different cultures are nevertheless able to experience the beauty of the same mathematical formulae, which depend upon the operations of the brain's logical deductive system, it follows that the logical deductive system in all brains is the same. Mathematical beauty, therefore, belongs to the biological category," Prof. Zeki said.

Comparing the studies of beauty with mathematical formulae, Prof. Zeki said that like musical extracts and visual stimuli could be rated on a scale of 0 to 9 as very beautiful, beautiful and not so beautiful, this can be applied to mathematical formulae also. As for him personally, Mathematical beauty changed his whole conception of beauty, personally. He cited the example of great advances in physical sciences like black holes, gravitation waves, the graviton, the photon, the neutron, all of these were arrived at by mathematical formulations that were regarded as beautiful and therefore also truthful. So, it would not be wrong to say that mathematical beauty also gives us knowledge of the universe.

'Brain can perceive beauty even in mathematical formulae'

Samir Zeki delivers 38th T.S Srinivasan endowment oration

SPECIAL CORRESPONDENT

CHENNAI

What happens in the brain when it is exposed to a beautiful object? Is it possible to understand the responses it generates to beauty? How does the brain react to good music from bad or a mathematical formula?

Samir Zeki, professor of neurasthenics at the University College, London, walked a captivated audience through a series of paintings and audio clips of music to explain that the image is perceived as beautiful when the brain is intensely active.

'Answers found'

Mr. Zeki, who delivered the 38th T.S Srinivasan endowment oration on 'Beauty and Your Brain' here on Sunday, said though beauty is a sensory perception it could trigger responses in the brain. "The question of how the brain reacted to beauty has been asked for over 2,500 years, but it is only in the last 15 years that an answer had been found."



Venu Srinivasan, chairman, TVS Motor Company, presenting Prof. Semir Zeki with a scroll and a medal on Sunday.

■ M. VEDHAN

Aesthetics is not limited to paintings or music. Even a mathematical formula could trigger an intense reaction in the brain, Mr. Zeki said. Mathematicians have become emotional when they describe mathematical formulae. Since mathematicians from various cultures have experienced the beauty of the same formulae, it followed that the logical deductive system in all the brains is the same, he said.

"The common experience of mathematical beauty is revealing something common in the function-

ing of our brains. Mathematical beauty therefore belongs to the biological category," Mr. Zeki said. In an experiment when people were given around 300 stimuli of faces, landscapes and flowers they were asked to rate them on a scale of 0-9 for beauty. A similar exercise was followed using music as stimuli. But it was mathematical beauty that changed the concept of beauty, personally, he said. B.N. Gangadhar, director, National Institute of Mental Health and Neuro Sciences, presented the report for the year.