

Science & Tech

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A mathematical route to consciousness?

ONE can use some imagination and see the world in a grain of sand, but mathematics in that grain of sand? There may not be many takers for the beautiful, precise subject of mathematics but believe it or not, much of our understanding of the universe and the laws that govern it have been possible because of mathematical theories that have helped model the physical world to a great degree. When mathematician Roger Penrose, author of *Shadows of the mind* and *The Emperor's new mind* and winner of many awards, who has specialised in algebraic geometry and the theory of non-periodic tilings, speaks, there can be no denying that mathematics is indeed the queen of all sciences.

Penrose has applied mathematics to explain not only the theory of relativity but also something as abstract as the Platonic ideal of truth and beauty or morality, suggesting that science has not made advances beyond a certain limit because it has made little attempt to understand consciousness mentality! Penrose has his pet theories for the physical basis of consciousness which he spoke about at the sidelines of the *The Science & Spiritual Quest (SSQ)* meet recently:



Mathematician Roger Penrose

Why does one need mathematics?

"The mathematical world is the product of our mind. Most of mathematics has nothing to do with our world though most of our world can be understood from laws of mathematics. However, and this is important," he adds, "very little of the mental world can be explained in terms of mathematical world and its laws."

What does he think of predictions of a time when machines will take over, an age of superhumans/supermachines that recognise, recall, learn and translate?

He smiles indulgently.

"All thought processes cannot be computationally simulated, nor can understanding be. Definitely not. The physical world operates by mathematical laws and much of this world is computational, but not everything." That part of the physical world which falls in the ambit of the mental world is outside the computational limit, he avers. Intelligence requires understanding, understanding requires consciousness. It lies between the active and passive aspects of consciousness. If understanding can be shown

to be beyond computation then intelligence cannot be computed and most aspects of awareness are also beyond computation.

Penrose challenges any computer that can study tiling patterns. And cites the classic Goodstein's theorem where a number is expressed first as binary, then in powers of three and powers of four, and at each step the powers are further placed as powers of simpler numbers to finally arrive at nonsensical answers. Don't even try working it out on a computer, he says.

And what is this consciousness?

He points out to how smaller organisms do not need neurons to do complicated things. "So, consciousness cannot be in the neurons. Where does it come from? Perhaps in the world somewhere between the classical world of determinism and the quantum world of daulities, at a size in between. For now the classical and quantum world are incomplete to satisfy consciousness. The quantum world which may be the closest fit has inconsistencies within it, at one point you have the wave function which speaks of deterministic world, and then you have the reductionistic state where nothing is for sure. A photon may be here or not here." Roger Penrose

would rather wait for a new theorem. But that being far for now, he believes that one needs to know the physical world better to know consciousness.

Underlining the power of understanding Penrose elaborates. "The mathematical world has its own existence independent of us but carries absolute truth. This does not mean it is intolerant. It is able to listen and come to conclusions. The rules here cannot be a set of mechanical rules. He cites the Godel's theorem that shows the need for understanding. For any set of theorem proving rules R we can construct a mathematical state $G \notin R$ which if we believe in the validity of R we must accept as true. Yet what we find is that $G \notin R$ cannot be proved using R alone. But only by using understanding."

Penrose believes a scientist cannot shrug off moral consequences of his work. He may not be aware of its consequences but cannot be absolved of his responsibility. "Morality is tied up with consciousness. Beauty connects the mathematical to the physical world while morality connects it to the mental world. Nothing abstract about that at all!"

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