

SCIENCE CENTRE NEWS LETTER

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SCIENCE CENTRE

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WHAT'S NEW IN SCIENCE?

Brain activity associated with specific words is mirrored between speaker and listener during a conversation.

When two people interact, their brain activity becomes synchronized, but it was unclear that - to what extent this 'brain-to-brain coupling' is due to linguistic information or other factors, such as body language or tone of voice. Researchers from Princeton University, United States reported this article in the journal *Neuron* that brain-to-brain coupling during conversation can be modeled by considering the words used during that conversation and the context in which they are used.

"We can see linguistic content emerge word-by-word in the speaker's brain before they actually articulate what they are trying to say and the same linguistic content rapidly reemerges in the listener's brain after they hear it.", says Neuroscientist and first author of this article Zaid Zada, Princeton University, United States.

To communicate verbally, we must agree on the definitions of different words, but these definitions can change depending on the context. For example, without context, it would be impossible to know whether the word "cold" refers to temperature, a personality trait or a respiratory infection.

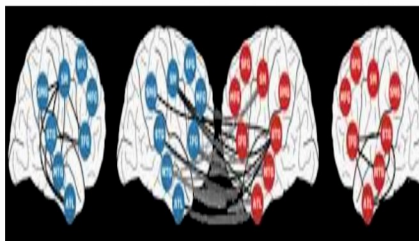
"We wanted to test the importance of context in aligning brain activity between speaker and listener to try to quantify what is shared between brains during conversation", says Neuroscientist and Co-senior author Samuel Nastase of Princeton University. To

examine the role of context in driving brain coupling, Researchers collected brain activity data and conversation transcripts from pairs of epilepsy (a disorder in which nerve cell activity in the brain is disturbed, causing seizures) patients during natural conversations.

Researchers used the large language model GPT-2 (Generative Pre-trained Transformer-2, it was pre-trained on a data set of 8 million web pages) to extract the context surrounding each of the words used in the conversations and then used this information to train a model to predict how brain activity changes as information flows from speaker to listener during conversation.

Using the model, the Researchers were able to serve brain activity associated with the context specific meaning of words in the brains of both speaker and listener. They showed that

word-specific brain activity peaked in the speaker's brain around 250 ms (multiple sclerosis) before they spoke each word and corresponding spike in brain activity associated with the same words appeared in the listener's brain approximately 250 ms after they heard them.



Main Source/Author:

<https://www.sciencedaily.com/releases/2024/08/240802132837.htm>

Meaning of Gpt-2 : en.m.wikipedia.org/wiki/GPT-2

Image: Medicalxpress.com/news/2024-08-brain-specific-words-mirrored-speaker.html

SCIENTIST OF THE MONTH

Dr. Ennackal Chandy George Sudarshan

Dr. Ennackal Chandy George Sudarshan was born on 16 September 1931, in Pallom, Kottayam, Travancore, British India. He did B.Sc (Bachelor of Science) in Physics from the Madras Christian College, Chennai in 1951 and M.Sc (Master of Science) from the University of Madras, Chennai in 1952. He did Ph.D (Doctor of Philosophy) degree in Theoretical Physics from the University of Rochester, New York in 1958.

Dr. Sudarshan made significant contributions to several areas of physics. The most significant work may have been his contribution in the field of 'Quantum Optics'. His theorem proves the Equivalence of Classical Wave Optics to Quantum Optics.

Dr. Sudarshan and his collaborators initiated the "Quantum theory of charged-particle beam optics", by working out the focusing action of a magnetic Quadrupole

using the 'Dirac equation'. His areas of interest included Elementary Particle Physics, Quantum Optics, Quantum Information, Quantum Field Theory, Gauge Field Theories, Classical Mechanics and Foundations of Physics. He was also deeply interested in Vedanta on which he lectured frequently.

Dr. Sudarshan received C. V. Raman Award in 1970, Padma Bhushan Award in 1976, Bose Medal in 1977, The World Academy of Sciences in 1985, Presidential Citation Award from the University of Texas at

Austin in 2006. Majorana Prize in 2006. Padma Vibhushan in 2007. Dirac Medal of the ICTP (International Centre for Theoretical Physics) in 2010. He died on 13 May, 2018.

Main Source:

https://en.wikipedia.org/wiki/E._C._George_Sudarshan#Awards

Image: https://en.wikipedia.org/wiki/E._C._George_Sudarshan#/media/File:ECG_Sudarshan.jpg





Timings

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& Public Holidays
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SCIENCE FACTS SEPTEMBER 2024

1 September 1887	British Chemist and Physicist Francis William Aston (Winner of the 1922 Nobel Prize in Chemistry for his discovery of isotopes in many non- radioactive elements and for his enunciation of the whole number rule) was born.
2 September 1853	German Chemist Wilhelm Ostwald (Winner of the 1909 Nobel Prize in Chemistry for his scientific contribution in the fields of catalysis, chemical equilibria and reaction velocities) was born.
2 September 1877	British Chemist Frederick Soddy (Winner of the 1921 Nobel Prize in Chemistry for his contributions in this field of the Chemistry of radioactive substances, and his investigations into the origin and nature of isotopes) was born.
4 September 1906	German Biologist Max Delbruck (Co- winner of the 1969 Nobel prize in Physiology or Medicine for their discoveries concerning the replication mechanism and the genetic structure of viruses.) was born.
6 September 1892	English Physicist Edward Appleton (Winner of the 1947 Nobel Prize in Physics for his work proving the existence of the ionosphere) was born.
7 September 1917	Australian Chemist John Cornforth (Winner of the 1975 Nobel Prize in Chemistry for his work on the stereochemistry of enzyme-catalysed reactions) was born.
8 September 1918	British Chemist Derek Harold Richard (Co-winner of the 1969 Nobel Prize in Chemistry for contributions to the development of the concept of conformation and its application in chemistry.) was born.
9 September 1922	German –born Physicist Hans Georg Dehmelt (Co-winner of the 1989 Nobel Prize in Physics for co-developing the ion trap technique) was born.
9 August 1911	American Physicist William Alfred Fowler (Co- winner of the 1983 Nobel Prize in Physics for his theoretical and experimental studies of the nuclear reactions of importance in the formation of the chemical elements in the universe) was born.
10 September 1892	Arthur Holly Compton (Inventor of Compton effect) was born.
12 September 1897	French Physicist Irene Joliot-Curie (Co-winner of the 1935 Nobel Prize in Chemistry for their discovery of induced radioactivity) was born.
13 September 1887	Croatian Chemist Lavoslav Ruzicka (Co-winner of the 1939 Nobel Prize in Chemistry for his work on polyethelenes and higher terpenes) was born.
16 September	“International Day for the preservation of the Ozone Layer”. (U.N.)
18 September 1907	American Physicist Edwin McMillan (Co-winner of the 1951 Nobel Prize in Physics who is the first to produce a transuranium element, Neptunium) was born.
19 September 1926	Japanese Physicist Masatoshi Koshiha (Co-winner of the 2002 Nobel Prize in Physics for pioneering contributions to Astrophysics , in particular for the detection of cosmic neutrinos.) was born.
21 September	"International Day of Peace"(U.N.).
21 September 1926	American Physicist Donald A. Glaser (Winner of the 1960 Nobel Prize in Physics for his invention of the bubble chamber used in subatomic particle physics.) was born.
22 September 1791	Michael Faraday (Discoverer of electromagnetic Induction) was born.
22 September 1888	The first issue of National Geographic Magazine was published.
23 September 1915	American Physicist Clifford Shull (Co-winner of the 1994 Nobel Prize in Physics for the development of the neutron scattering technique) was born.
23 September 2023	Autumnal equinox: On this day, Day and night becomes equal on the Earth.
25 September 1866	American geneticist Thomas Hunt Morgan (Winner of the 1933 Nobel Prize in Physiology or Medicine for discoveries elucidating the role that the chromosome play in heredity.) was born.
28 September	“World Rabies Day”. (WHO)
29 September 1901	Enrico Alberto Fermi (Winner of the 1938 Noble Prize in Physics for his work on “Induced Radioactivity) was born.
U. N. : United Nations WHO -World Health Organization UNESCO - United Nations Educational Scientific & Cultural Organization	

Ans. 1. b 2. c 3. a 4. b 5. b

SCIENTIFIC QUESTION

What are Near Earth Objects (NEO)?

A Near-Earth object (NEO) is any small Solar System body orbiting the Sun whose closest approach to the Sun (perihelion) is less than 1.3 times the Earth–Sun distance (astronomical unit, AU). This definition applies to the object's orbit around the Sun, rather than its current position,

thus an object with such an orbit is considered an NEO even at times when it is far from making a close approach of Earth. If an NEO's orbit crosses the Earth's orbit, and the object is larger than 140 meters (460 ft) across, it is considered a potentially hazardous object (PHO). Most known PHOs and NEOs are asteroids, but about 0.35% of them are comets.

There are over 34,000 known near-Earth asteroids (NEAs) and over 120 known short-period near-Earth comets (NECs). A number of solar-orbiting meteoroids were large enough to be tracked in space before striking Earth. It is now widely accepted that collisions in the past have had a significant role in shaping the geological and biological history of Earth. Asteroids as small as 20 metres (66 ft) in diameter can cause significant damage to the local environment and human populations. Larger asteroids penetrate the atmosphere to the surface of the Earth, producing craters if they impact a continent or tsunamis if they impact the sea. Interest of Scientists in NEOs has increased since the 1980s because of greater awareness of this risk. Asteroid impact avoidance by deflection is



possible in principle, and methods of mitigation are being researched.

Are we at risk of an asteroid strike?

Simply, no. We're not at risk of getting hit by a near-Earth object. In fact, there are no known significant asteroid risks of impact on Earth over the next 100 years.

The biggest risk of an asteroid impact is less than 0.2% which will be in Earth's proximity in 2185 A.D. If you look over the next one

thousand years, there are only a handful of dinosaur-killing scale threats

How do we know where near-Earth objects are?



We mostly use ground-based and space telescopes to find near-Earth objects. But there's some uncertainty if we can

spot them all with 100% certainty. Part of the reason is that ground-based telescopes have limited viewing angles. Because it can't see in some directions, we miss out on the potential to track some objects in space.

Main Source: https://en.wikipedia.org/wiki/Near-Earth_object

<https://earthhow.com/near-earth-objects-neo/>

KNOW THE EXHIBIT

Your Weight Varies

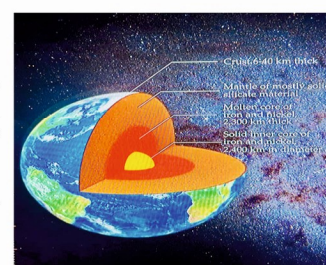
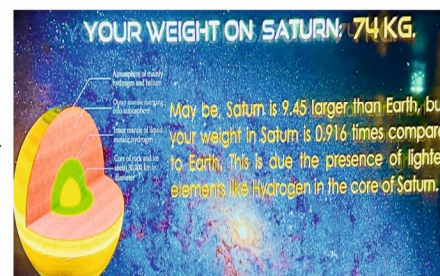
Person has to stand on the platform of the Exhibit. The weight of a person on the different planet will be shown on screen.

Saturn is 9.45 larger than Earth, but person's weight on the Saturn is 0.916 times less as compare to Earth. This is due to presence of lighter elements like Hydrogen in the core of Saturn.

Saturn is the flattest planet. Its polar diameter is 90% of its equatorial diameter. This is due to its low density and fast rotation. Saturn is also the least dense plant of the Solar System. Saturn's rings are made up of billions of particles that range in size from tiny dust grains to objects as large as mountains. These are made up of chunks of ice and rock.

Saturn's upper atmosphere is divided into bands of clouds. The top layers are mostly ammonia ice. Below them, the clouds are largely water ice. The lowest layer is made up of cold Hydrogen and Sulfur ice mixtures.

This exhibit is situated at "Entering Space Gallery" between Fun Science Gallery and Power of Play Gallery at the first floor of Science Centre.



SCIENCE FAIR-2024

"Science Fair-2024" was organized by Surat Municipal Corporation at Art Gallery of Science Centre, which was inaugurated by Cultural Committee Chairperson Smt. Sonalben Desai. During 16 & 17 August, 2024, total 80 projects prepared by 260 Students and 72 Teachers from 53 Schools of Surat were displayed in this Science Fair.

The theme of this Science Fair was "Indigenous Technologies for Viksit Bharat".

In this Science Fair, projects having innovative ideas were displayed by the students of the School under the following topics:

- | | |
|---|---------------|
| 1. Indigenous Technologies to improve Human life | - 16 Projects |
| 2. Indigenous Technologies for Agriculture | - 30 Projects |
| 3. Indigenous Technologies for Renewable Energy Sources | - 15 Projects |
| 4. Indigenous Technologies for Health care Innovations | - 15 Projects |
| 5. Indigenous Technologies for Revival of Indigenous Crafts | - 04 Projects |

Cultural Committee Chairperson Smt. Sonalben Desai observed the projects and presented mementos.



QUIZ

1. Acid turns blue litmus paper into which color?

- a) Blue b) Red c) Black d) Orange

2. Which of the following compound is mainly used in hand sanitizer?

- a) Aldehyde b) Acetic Acid c) Alcohol d) Ketone

3. What is the Scientific name of Frog?

- a) Anura b) Homo Sapience c) Felis Catus d) Mangifera Indica

4. Who discovered the X-Ray?

- a) Maxwell b) Wihelm Roentgen c) Faraday d) Hertz

5. Which one has the highest density?

- a) Snow b) Teflon c) Soil d) Sand