News for May 15, 2008

Thirty-Meter Telescope Focuses on Two Candidate Sites

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Illusions of the Present

Have you ever noticed that signposts and trees on the side of the road seem to whoosh by faster right as you drive past them, or that a door frame seems to curve outward as you approach it? These are just two examples of real-life movements that underlie more than 50 types of illusions, now systematically organized and explained by scientists at the California Institute of Technology. The systematization also lends a glimpse into how illusions are not simply tricks your brain likes to play on you; they are manifestations of how the visual system evolved to keep up with real-life motion. These illusions now fall into 28 predictable categories defined by Mark Changizi during a fellowship in the Sloan-Swartz Center for Theoretical Neurobiology at Caltech and appearing May 28 in the journal Cognitive Science.

Sight Recovery After Blindness Offers New Insights on Brain Reorganization

Studies of the brains of blind persons whose sight was partially restored later in life have produced a compelling example of the brain's ability to adapt to new circumstances and rewire and reconfigure itself. The research, conducted by Caltech postdoctoral researcher Melissa Saenz and Christof Koch, the Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and professor of computation and neural systems, shows that the part of the brain that processes visual information in normal individuals can be co-opted to respond to both visual and auditory information. That brain reorganization persists even if the blind subjects later regain their vision—for example, through technologies such as corneal stem-cell transplants, retinal prosthetics, and gene therapy.

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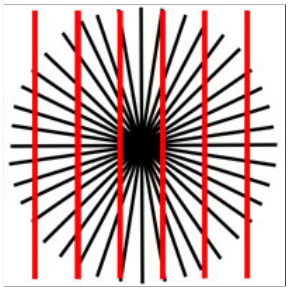

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Page 2 Headlines

Bike-to-Work Day
71st Annual Alumni Seminar Day
J. Kent Clark Oral History Available Online
Blood Drive for Huntington Hospital
Caltech/JPL Dodger Day on August 17
53rd Annual Staff Service Award Program
CEFCU SAVES YOU TIME AND ENERGY
Read the *Chronicle of Higher Education* for Free
New Printing Policy for Students, Faculty, and Staff
Caltech Career Partners Alumni Bio: Laserfiche's Fei Wang, '06
Voter Registration Deadline
Emergency Information Hotline
Caltech's Annual Bike to Work Day on May 15
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Campus Training
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Research News

Caltech Helps Open the Universe in "WorldWide Telescope"

Panoramic images of the sky obtained at Palomar Observatory and by the Two Micron All Sky Survey (2MASS), plus pointed observations from the Spitzer Space Telescope, form a significant part of the "World Wide Telescope" (WWT), a new product released today by Microsoft aimed at bringing exploration of the Universe and its many wonders to the general public. **More...**

Chemistry of Airborne Particulate—Lung Interactions Revealed

Exactly how airborne particulates harm our lungs still puzzles epidemiologists, physicians, environmental scientists, and policy makers. Now California Institute of Technology researchers have found that they act by impairing the lungs' natural defenses against ozone. The researchers harnessed breakthroughs in chemistry to focus on what happens when air meets the thin layer of antioxidant-rich fluid that covers our lungs, protecting them from ozone, an air pollutant that pervades major cities. **More...**

Partnerships of Deep-Sea Methane Scavengers Revealed

The sea floor off the coast of Eureka, California, is home to a diverse assemblage of microbes that scavenge methane from cold deep-sea vents. Researchers at the California Institute of Technology have developed a technique to directly capture these cells, lending insight into the diverse symbiotic partnerships that evolved among different species in an extreme environment. The community's interconnected metabolism sheds light on how the anaerobic microbes, which consume nearly 80 percent of the methane leaked from marine sediments, limit oceanic emissions of this potent greenhouse gas. **More...**

Featured Events

Blood Drive for Huntington Hospital

Huntington Hospital's new Bloodmobile will be parked outside Winnett Center for a blood drive from 9 a.m. to 3:30 p.m. on May 20. Walk-ins are welcome, or you may schedule an appointment by calling the Huntington Hospital at (626) 397-5796. Please remember to eat and drink plenty of water beforehand, and bring your ID.

The Caltech Folk Music Society Presents the Limeliters

The Limeliters will perform in Beckman Institute auditorium at 8 p.m. on May 16. Since 1959, the group has blended harmony with humor and contemporary satire to create popular and well-known folk music, including a string of best-selling albums, as well as the "Things Go Better with Coke" jingle. **More...**

Caltech Alumni Association Sundial Unveiling

At 3 p.m. on May 16, alumni, students, faculty, staff and visitors are invited to the unveiling of the Alumni Association's analemmatic sundial, an interactive public artwork in Winnett quad. Stand on the plinth and become a human timepiece by using your shadow to tell the current time. To learn more about analemmatic sundials and the Caltech Alumni Association's sundial project, go to **http://alumni.caltech.edu/sundial**.

Caltech Student Chamber Ensembles Concerts

At 8 p.m. on May 17, Caltech Student Chamber Ensembles will perform a concert in Dabney Lounge featuring trios by Hummel, Fauré, Ibert, and Schickele, as well as Mendelssohn's String Quintet No. 2. Chamber ensembles will present another concert in Dabney Lounge on Sunday, May 18, at 3:30 p.m. That program will feature trios and quartets for woodwinds, Mendelssohn's Piano Quartet No. 1, and Grieg's String Quartet and "Sunrise of the Planetary Dream Collector" for string quartet. A free reception will follow each performance. **More...**

Today's Weather

at 7:22 AM 05.16.08
Current Temperature: 70.6 ºF
High: 70.6 ºF **Low:** 61.8 ºF
Wind: W at 0.0 mph
Humidity: 59.85 %
Ed Lewis Memorial Weather Station
Courtesy of KNBC, News 4

Caltech Theater

Jim Woolsey: The Need for Energy Independence
5/6/2008

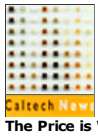
In Depth

A Book for the Curious Brain

Neuroscientist Sam Wang was asked so many questions about his work that he decided to write "a user's manual for the brain." **More...**

Baker's Dozen with Anneila Sargent

The internationally known astronomer and Caltech's new vice president for student affairs talks about the "fortunate accidents" that have shaped her life, among other topics. **More...**



The Sun Also Catalyzes

Tucked away in a chemistry lab, a $200 desktop printer may hold a key to solving the world's energy crisis. **More...**

The Price is Wrong

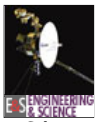
In a new study, researchers have determined that the stated price of wine directly affects how much people like it. **More...**

The Fall and Rise (and Fall?) of Life on Mars (pdf)

After decades of searching, no one's found life on Mars—or have they? **More...**

Voyager's Odyssey (pdf)

The two Voyager spacecraft transformed our view of Earth's place in the solar system, and 30 years after launch, they're still going where no one has gone before. **More...**

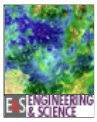


From Rockets to Spacecraft: Making JPL a Place for Planetary Science (pdf)

From its humble beginnings as a remote patch of the Arroyo Seco used to test rockets, JPL has grown into the leading U.S. center for robotic space exploration. **More...**

What Lies Beneath (pdf)

A self-professed Caltech "lifer," JPL Director Charles Elachi has spent 40 years using spaceborne radar to explore such exotic places as the Sahara, Venus, and Titan. **More...**



Illusions of the Present

PASADENA, Calif.--Have you ever noticed that signposts and trees on the side of the road seem to whoosh by faster right as you drive past them, or that a door frame seems to curve outward as you approach it? These are just two examples of real-life movements that underlie more than 50 types of illusions, now systematically organized and explained by scientists at the California Institute of Technology.

The systematization also lends a glimpse into how illusions are not simply tricks your brain likes to play on you; they are manifestations of how the visual system evolved to keep up with real-life motion. These illusions now fall into 28 predictable categories defined by Mark Changizi during a fellowship in the Sloan-Swartz Center for Theoretical Neurobiology at Caltech and appearing May 28 in the journal Cognitive Science.

"I had been reflecting on the classical geometrical illusions always shown in Psychology 101 classes--the ones involving lines and vanishing points--and it struck me that I can explain them," Changizi says.

To picture a geometrical illusion, imagine a spoked bike wheel with two squares superimposed on it in different places. The square closer to the center, where the spokes meet--called the vanishing point--will always seem larger than the square toward the rim of the wheel. In other words, the closer an object is to the vanishing point, the larger it appears.

Your brain thinks that you are physically moving forward. In real life, forward motion would generate "spokes" on the eye's retina, "like in Star Trek, when they go into warp speed," Changizi describes. It would also bring you closer to that square near the wheel's center, naturally making it seem larger than the other object. "Your brain generates a perception of what the world will be like in the next moment because by the time that perception finally occurs--it takes about a tenth of a second--that object will be larger," explains Changizi.

"Later I realized that my same old idea could be radically generalized, so that it made predictions not just about geometrical illusions, but about 27 other illusion classes as well," Changizi says. "I realized that I could make a massive pattern of predictions about the kinds of illusions humans are subject to."

Changizi built a table, a matrix that distributes the different kinds of illusions into four columns distinguishing what visual feature is misperceived (size, speed, luminance, and distance), and seven rows indicating the different kinds of optical features that occur when an observer is moving forward. "Each spot in this table makes a prediction about perception," he says.

From there, Changizi culled a century's worth of papers reporting what people see when they look at different kinds of illusions. "There are hundreds of illusions collected like butterflies over the years," he notes, "with no real systematics behind them. Just a massive heap of illusions." He wanted to see if each individual case would fall into one of the 28 classes he had designated. "I found that the disordered pile of illusions followed the predicted pattern, and I was able to arrange the illusions in an orderly fashion inside the unifying matrix."

Changizi believes these illusions arise from the way the visual system evolved to process and react to visual cues. Called "perceiving the present," the theory explains, for example, why your hand is ready to hit the ball in a game of tennis: your brain translates the ball's motion into where it will be when you hit it.

"Motion is crucial to the story of illusions. What you perceive is a premonition, not present reality!" Changizi notes. Shinsuke Shimojo, a biology professor at Caltech and a coauthor on the report, explains, "We have evidence from other studies showing that when you perceive a moving object, you localize it in the current position because your brain normalizes it. The brain has been trained via genetic and learning processes to compensate in dynamic situations. This paper says even more--that the brain applies the same algorithm to perceive a static image. Nobody had come up with this theory to explain all illusions in this framework."

The potential applications that the new organization of illusions presents are dizzying. Movies or video games, for example, could incorporate illusions to "make someone perceive motion when the object is actually motionless," Changizi suggests. Another possibility: street signs or other visual warnings could incorporate visual tricks to grab attention, by having a pattern that seems to bulge, spiral, or turn redder as the viewer approaches.

Changizi is now an assistant professor of cognitive science at Rensselaer Polytechnic Institute. Other authors on the study are Andrew Hsieh, a former Caltech undergraduate student now at the University of Southern California; Romi Nijhawan, a psychologist at the University of Sussex in England; and Ryota Kanai, a former postdoc in Shimojo's lab now at the Institute of Cognitive Neuroscience in London. ###

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