

# Complexity *at large*

## NEWS ITEMS

### GUIDING THE SWARM

The following news item is taken in part from the August 2005 issue of *Animal Behaviour* titled, “Honeybee Swarms: How Do Scouts Guide a Swarm of Uninformed Bees?” by S. Janson, M. Middendorf, and M. Beekman.

The organized movement of a swarm of honeybees towards its new home is a perplexing phenomenon because only a small number of scout bees, approximately 5%, know the direction in which the swarm has to move. Nevertheless, in the majority of cases a swarm, comprising about 10,000 mainly uninformed bees, reaches the new home. How do the scouts transfer directional information en route to the uninformed bees? ... We developed a model ... and showed that when scouts fly through the swarm at a speed slightly higher than the speed of the other (uninformed) bees....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.30#22041](http://www.comdig.org/index.php?id_issue=2005.30#22041)

### YOU USE, YOU LOSE

The following news item is taken in part from the 20 July 2005 issue of *New Scientist* titled, “Cocaine Use Prevents Adaptive Behaviour” by Gaia Vince.

Cocaine may keep users from adapting to new situations by disrupting connections between key brain regions, suggests a new study in rats. The finding may shed light on the impulsive behavior seen in cocaine addicts, researchers say.

A team looked at the connections between two regions of the brain: one involved with learning, memory and processing information—the prefrontal cortex and hippocampus—and one involved with pleasure seeking, emotion and reward behavior—the nucleus accumbens in the limbic system.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.30#22081](http://www.comdig.org/index.php?id_issue=2005.30#22081)

### REMOTE TRAFFIC MONITORING

The following news item is taken in part from the 19 July 2005 issue of *The New York Times* titled, “All Traffic, All the Time and Just a Click Away” by Joe Sharkey.

Though traffic helicopters are still on the job, traffic is increasingly monitored from roadside digital sensors. Thanks to this kind of digital data-gathering, broadcast stations are now able to put on comprehensive and highly accurate reports, augmented by animated graphics, on traffic flows and traffic jams. And thanks to personal digital wireless technology, it's now possible to get this data, in some cases coupled with road navigation guidance, customized and delivered right to you.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.30#22078](http://www.comdig.org/index.php?id_issue=2005.30#22078)

### SCALE-FREE NETWORKS OF THE BRAIN

The following news item is taken in part from the 15 July 2005 issue of *Science Daily & Max-Planck-Gesellschaft* titled, “Good Connections Are Everything.”

The biosphere contains many scale-free networks. Prominent examples are provided by the functional networks within the human brain.... discovered that activity patterns in such biomimetic networks have unusual dynamic properties, which are controlled by a few, highly connected nodes. As a result, ordered activity patterns are very robust against random perturbations but rather sensitive to selective perturbations. Disordered patterns, on the other hand, decay very fast and relax toward an ordered pattern even if the network becomes infinitely large. In addition, these scale-free networks can also be used to store and retrieve a large number of fixed patterns....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.30#22050](http://www.comdig.org/index.php?id_issue=2005.30#22050)

### **NATURAL SELECTION AND PROBLEM SOLVING**

The following news item is taken in part from the 28 July 2005 issue of *Nature* titled, "Outsmarted by Ants" by Francis Ratnieks.

The main lesson, however, is one that we have yet to grasp: that we can learn from ants. Natural selection has made insect societies good at solving a problem that is simple to state but hard to solve.... Because social insects have been solving this complex dynamic problem for millions of years, they have probably evolved some simple and elegant solutions. We should care about these solutions because human life depends more and more on engineering systems that must solve similar problems....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue+2005.31#22169](http://www.comdig.org/index.php?id_issue+2005.31#22169)

### **MALE SEEKING FEMALE**

The following news item is taken in part from the 27 July 2005 issue of *Science Now* titled, "Worthless Gifts Get the Chicks" by Kim Krieger.

Males seeking a mate often give gifts. Whether it's a guy with a bouquet of roses or a fly offering a tasty dead insect, the message is the same: the better the gift, the better the guy. But how can a sincere male protect himself from a gold-digging female who takes the goods and runs? A new model suggests the best solution is for males to give gifts that are expensive for them, but worthless to the female.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.31#22167](http://www.comdig.org/index.php?id_issue=2005.31#22167)

### **INNOVATIVE PERFORMANCE—EU VS US**

The following news item is taken in part from the 29 July 2005 issue of *Information Society Technologies News* titled, "Gloomy Picture on EU-US Innovation Comparison."

A report comparing the innovative performance of the US and the EU has painted a gloomy picture of Europe's ability to compete, and has offered several recommendations to get the EU back on track.... "We suggest that effective European catching up would require much less emphasis on various types of 'networking,' 'interactions with local environment,' 'attention to user need'—current obsessions of the European and national policy makers—and, conversely, much more on policy measures aimed to both strengthen 'frontier' research and, at the opposite end, strengthen European corporate actors," argue the paper's authors....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.31#22114](http://www.comdig.org/index.php?id_issue=2005.31#22114)

### **PROSPECTING THE EARLY UNIVERSE**

The following news item is taken in part from the 29 July 2005 issue of *NewScientist.com* titled, "Life's Ingredients Found in Early Universe" by Maggie McKee.

The molecular building blocks of life had already formed by the time the universe was only a quarter of its present age, new observations by NASA's Spitzer Space Telescope reveal. The research bolsters the case for extraterrestrial life and may shed light on the nature of galaxies in the early universe. Lin Yan, an astronomer at the Spitzer Science Center in Pasadena, California, and colleagues used the telescope to observe eight galaxies at an average distance of about 10 billion light years away.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.31#22148](http://www.comdig.org/index.php?id_issue=2005.31#22148)

### **THE EARTH'S OWN POWER PLANT**

The following news item is taken in part from the 30 July 2005 issue of *Science News* titled, "Glints from Inner Space: Sensing Earth's Hidden Radioactivity" by Peter Weiss.

---

The new data enable the scientists to directly measure planet-wide quantities of the elements thorium and uranium, whose radioactive disintegrations generate about half of the planet's heat, according to previous estimates. The power from those nuclear decays, which exceeds that of 10,000 nuclear power plants, propels many dynamic features of the

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.32#22299](http://www.comdig.org/index.php?id_issue=2005.32#22299)

### **THE GRID COULD BE OUR WEAKEST LINK**

The following news item is taken in part from the 13 August 2005 issue of *The New York Times* titled, “The Terrorist and the Grid” by Gregory S. Mcneal.

To attack the grid, a terrorist need only study publicly available trade journals, which explain where new facilities are constructed.... A terrorist could then disable a particular system by destroying the computers and relays housed in the poorly protected building.

An attack on one facility would likely plunge the served area into immediate darkness..., particularly in summer, when usage is at its peak. A coordinated attack on four or five critical sites could send much of the nation into darkness for weeks.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.33#22298](http://www.comdig.org/index.php?id_issue=2005.33#22298)

### **COOPERATION IN ARTIFICIAL SOCIAL SYSTEMS**

The following news item is taken in part from the Summer 2005 issue of *Artificial Life* titled, “Emergence of Cooperation: State of the Art” by Geoff Nitschke.

This review presents a review of prevalent results within research pertaining to emergent cooperation in biologically inspired artificial social systems. Results reviewed maintain particular reference to biologically inspired design principles, given that current mathematical and empirical tools have provided only a partial insight into elucidating mechanisms responsible for emergent cooperation, and then only in systems of an abstract nature. This review aims to provide an overview of important and disparate research contributions that investigate utilization of biologically inspired concepts such as emergence, evolution, and self-organization as a means of attaining cooperation in artificial social systems.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.33#22276](http://www.comdig.org/index.php?id_issue=2005.33#22276)

### **THE THREE-BODY PROBLEM**

The following news item is taken in part from the 13 August 2005 issue of *Science News* titled, “Strange Orbits” by Ivars Peterson.

Subsequent work by Henri Poincare (1854–1912) and others demonstrated that, in general, it’s impossible to obtain a general solution, expressed as an explicit formula, to the three-body problem. In other words, given three bodies in a random configuration, the resulting motion nearly always turns out to be chaotic. No one can predict precisely what paths those bodies would follow.

In 1993, Chris Moore, now at the Santa Fe Institute, added to the sparse list of exceptions. He discovered, via computer calculations, that three equal masses can chase each other around the same figure-eight curve in the plane.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.33#22288](http://www.comdig.org/index.php?id_issue=2005.33#22288)

### **CREATING “MASTER CELLS”**

The following news item is taken in part from the 16 August 2005 issue of *BBC News* titled, “Scientists Make Nerve Stem Cells.”

The world’s first pure nerve stem cells made from human embryonic stem cells have been created by scientists at the Universities of Edinburgh and Milan. It is hoped the newly created cells will eventually help scientists find new treatments for diseases such as Parkinson’s and Alzheimer’s. BBC science correspondent Pallab Ghosh said the cells should help researchers test the effectiveness of new drugs. Stem cells are “master” cells that can become many kinds of tissue.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.33#22286](http://www.comdig.org/index.php?id_issue=2005.33#22286)

### **PRACTICE INDUCES PLASTICITY**

The following news item is taken in part from the 07 August 2005 issue of *Nature Neuroscience* titled, “Extensive Piano Practicing Has Regionally Specific Effects on White Matter Development” by Sara L. Bengtsson, Zoltn Nagy, Stefan Skare, Lea Forsman, Hans Forssberg, Fredrik Ullén.

Using diffusion tensor imaging, we investigated effects of piano practicing in childhood, adolescence, and adulthood on white matter and found positive correlations between practicing and fiber tract organization in different regions for each age period. For childhood, practicing correlations were extensive and included the pyramidal tract, which was more structured in pianists than in non-musicians. Long-term training within critical developmental periods may thus induce regionally specific plasticity in myelinating tracts.

... [W]e tested if a fiber tract was susceptible to training-induced plasticity during the period when it was still under maturation.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.34#22358](http://www.comdig.org/index.php?id_issue=2005.34#22358)

## ROOT COMPETITION

The following news item is taken in part from the 12 August 2005 issue of *ScienceDaily* and Penn State titled, "Plants Discriminate between Self and Non Self."

Two peas in a pod may not be so friendly when planted in the ground and even two parts of the same plant, once separated may treat the former conjoined twin as an alien enemy," according to a Penn State researcher. "We were looking at how plants determine who is a competitor when competing with other roots for limited resources.... There is no reason for roots to fight if they belong to the same plant." ... The mechanism for this self/non-self discrimination could be based on either individually specific chemical recognition—such as that known from plant reproductive systems....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.34#22322](http://www.comdig.org/index.php?id_issue=2005.34#22322)

## SYNTHETIC BIOLOGISTS

The following news item is taken in part from the 19 August 2005 issue of *MSNBC/AP* titled, "Researchers Creating Life from Scratch."

They're called "synthetic biologists" and they boldly claim the ability to make never-before-seen living things, one genetic molecule at a time.

They're mixing, matching and stacking DNA's chemical components like microscopic Lego blocks in an effort to make biologically based computers, medicines, and alternative energy sources. The rapidly expanding field is confounding the taxonomists' centuries-old system of classifying species and raising concerns about the new technology's potential for misuse.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.34#22351](http://www.comdig.org/index.php?id_issue=2005.34#22351)

## DRIVEN TO ORDER?

The following news item is taken in part from the 18 August 2005 issue of *Nature* titled, "Complex Systems: Order out of Chaos" by John Whitfield.

Can the behavior of complex systems from cells to planetary climates be explained by the idea that they're driven to produce the maximum amount of disorder? In the past couple of years, Paltridge's hypothesis of maximum entropy production (MEP) has been given a new theoretical underpinning.... Entropy could even explain how linked complex systems interact, which could potentially lend legitimacy to the contentious theory of Gaia—the idea that living things act together to regulate Earth's climate to keep conditions favorable for life.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.34#22345](http://www.comdig.org/index.php?id_issue=2005.34#22345)

## DIVISION COULD MEAN CHAOS

The following news item is taken in part from the 29 August 2005 issue of *BBC News* titled, "Iraq Charter: A 'Recipe for Chaos.' "

Parts of the Iraqi draft constitution submitted on Sunday are a "recipe for chaos," Arab League Secretary General Amr Moussa has warned.... They fear the proposals would lead to the break-up of the country into a Kurdish north and Shia south, depriving the Sunnis of access to the country's oil resources....

"I do not believe in this division between Shia and Sunni and Muslims and Christians and Arabs and Kurds," he said. "I don't buy this and I find in this a true recipe for chaos and perhaps a catastrophe in Iraq and around it."

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22432](http://www.comdig.org/index.php?id_issue=2005.35#22432)

### **BICYCLES USED IN CONTROL EDUCATION**

The following news item is taken in part from the August 2005 issue of *Control Systems Magazine, IEEE* titled, "Bicycle Dynamics and Control: Adapted Bicycles for Education and Research" by K. J. Astrom, R. E. Klein, and A. Lennartsson.

In this article, the dynamics of bicycles is analyzed from the perspective of control. Models of different complexity are presented, starting with simple ones and ending with more realistic models generated from multibody software. Models that capture essential behavior such as self-stabilization as well as models that demonstrate difficulties with rear wheel steering are considered. Experiences using bicycles in control education along with suggestions for fun and thought-provoking experiments with proven student attraction are presented. Finally, bicycles and clinical programs designed for children with disabilities are described.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22386](http://www.comdig.org/index.php?id_issue=2005.35#22386)

### **PROTEIN MOTORS**

The following news item is taken in part from the 25 August 2005 issue of *Nature* titled, "Evolution: A Treasure Trove of Motors" by Margaret A. Titus.

The myosins are a superfamily of protein motors. Analysis of their sequences in a wide range of organisms reveals an unexpected variety of domains and provides insights into the nature of the earliest eukaryotes.

Motor proteins use chemical energy ... to generate unidirectional movement along a filamentous track. How a group of proteins acquired and then varied this property to generate a range of movements as evolution proceeded is a fascinating problem in biology. Answers are within reach because of the availability of genome sequences from a diverse cadre of organisms....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22435](http://www.comdig.org/index.php?id_issue=2005.35#22435)

### **BIODIVERSITY AND FUNCTION**

The following news item is taken in part from the 25 August 2005 issue of *Nature* titled, "The Contribution of Species Richness and Composition to Bacterial Services" by Thomas Bell, Jonathan A. Newman, Bernard W. Silverman, Sarah L. Turner, and Andrew K. Lilley.

Bacterial communities provide important services. They break down pollutants, municipal waste, and ingested food, and they are the primary means by which organic matter is recycled to plants and other autotrophs.... Biodiversity influences the way in which ecosystems function, but the form of the relationship between bacterial biodiversity and functioning remains poorly understood. Here we describe a manipulative experiment that measured how biodiversity affects the functioning of communities containing up to 72 bacterial species constructed from a collection of naturally occurring culturable bacteria.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22438](http://www.comdig.org/index.php?id_issue=2005.35#22438)

### **ESTIMATING THE NUMBER OF PROKARYOTE TAXA IN SOIL**

The following news item is taken in part from the 26 August 2005 issue of *Science* titled, "Exploring Microbial Diversity—A Vast Below" by T. P. Curtis and W. T. Sloan.

Exploring microbial diversity is becoming more like exploring outer space with soil representing a "final frontier" that harbors a largely unknown microbial universe. There are more than  $10^{16}$  prokaryotes in a ton of soil compared to a mere  $10^{11}$  stars in our galaxy. Astronomers have wisely inferred the population of celestial objects by mathematical inference. Now microbiologists are following suit, adopting a similar strategy to estimate the number of prokaryote taxa in soil.... [T]he inferred diversity is staggering—higher than previously thought by almost three orders of magnitude.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22425](http://www.comdig.org/index.php?id_issue=2005.35#22425)

### **EXTRATERRESTRIAL LIFE MAY NOT HAVE NEEDED WATER**

The following news item is taken in part from the 26 August 2005 issue of *Science* titled, "Water and Life: Seeking the Solution" by Philip Ball.

Is there any fundamental reason to be fixated on water as the universal elixir of life? ... But is it right to see water as the sole medium for extraterrestrial life? Some think not. "Water is a terrible solvent for life" .... Unlike physics, of course,

biochemistry adapts to its environment ... [L]ife on Earth is adapted to water rather than the other way round. "Life on Earth itself is fine-tuned to water—a consequence of it evolving in close association with the medium"....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22439](http://www.comdig.org/index.php?id_issue=2005.35#22439)

### **CHIMPS' CULTURAL NORM**

The following news item is taken in part from the 21 August 2005 issue of *News@Nature* titled, "Chimps Show Sign of Culture" by Andreas von Bubnoff.

Researchers have found that a group of chimpanzees will stick to the same method used by their peers, even if they stumble across a different way of using a tool by themselves. That shows that chimps follow a cultural norm that is socially learned and maintained, the researchers say—proof, perhaps, that chimpanzees really do have culture.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22381](http://www.comdig.org/index.php?id_issue=2005.35#22381)

### **VOCAL REPERTOIRE DEVELOPS SOCIAL SET UP**

The following news item is taken in part from the 24 August 2005 issue of *NewScientist.com* titled, "Primate Communication Linked to Social Bonding" by Cuncan Graham-Rowe.

Communication evolved hand-in-hand with social bonding, suggests a new study of non-human primates, which probes the origins of language. "The work tells us that communication is right there at the base of social behaviour and that having a larger vocal repertoire allows you to have a more complex social set up," says Karen McComb, at the University of Sussex, UK, who carried out the work.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22422](http://www.comdig.org/index.php?id_issue=2005.35#22422)

### **LEARNING FROM EMBRYOS**

The following news item is taken in part from the 25 August 2005 issue of *Nature* titled, "Scar Prevention: The Healing Touch" by Meredith Wadman.

Wound an embryo and it heals perfectly, with no scars. Can we teach adult wounds the same trick.... There are striking similarities between the mechanisms embryos use to heal wounds and those they use to knit their body parts together during normal development....

A fruitfly embryo closing a wound rapidly assembles a cable of the protein actin in the "skin" cells at the wound's edges. Contraction of this cable seems to pull the edges together much as a drawstring pulls a bag shut.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22437](http://www.comdig.org/index.php?id_issue=2005.35#22437)

### **THE COLLECTIVE BEHAVIOR OF NANOROBOTICS**

The following news item is taken in part from the June 2005 issue of *Nanobioscience, IEEE* titled, "Nanorobotics Control Design: A Collective Behavior Approach for Medicine" by A. Cavalcanti and R. A. Freitas, Jr.

The authors present a new approach using genetic algorithms, neural networks, and nanorobotics concepts applied to the problem of control design for nanoassembly automation and its application in medicine. As a practical approach to validate the proposed design, we have elaborated and simulated a virtual environment focused on control automation for nanorobotics teams that exhibit collective behavior. This collective behavior is a suitable way to perform a large range of tasks and positional assembly manipulation in a complex three-dimensional workspace....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.35#22385](http://www.comdig.org/index.php?id_issue=2005.35#22385)

### **THE RELATIONSHIP BETWEEN NEOCORTEX AND SOCIALITY**

The following news item is taken in part from the 24 August 2005 issue of *Biology Letters* titled, "Neocortex Evolution in Primates: The 'Social Brain' Is for Females" by P. Lindenfors.

According to the social intelligence hypothesis, relative neocortex size should be directly related to the degree of social complexity. This hypothesis has found support in a number of comparative studies of group size. The relationship between neocortex and sociality is thought to exist either because relative neocortex size limits group size or because a larger group size selects for a larger neocortex. However, research on primate social evolution has indicated that male

and female group sizes evolve in relation to different demands. While females mostly group according to conditions set by the environment, males instead simply go where the females are....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.36#22460](http://www.comdig.org/index.php?id_issue=2005.36#22460)

### **CHIMPANZEE DNA SEQUENCE**

The following news item is taken in part from the 01 September 2005 issue of *Nature* titled, "The Chimpanzee and Us" by Wen-Hsiung Li and Matthew A. Saunders.

Publication of the draft DNA sequence of the chimpanzee genome is an especially notable event: the data provide a treasury of information for understanding human biology and evolution.

What genetic changes make us so different from the chimpanzee, our closest relative? Scientists have been trying to answer this challenging question for decades, and publication of the draft of the chimpanzee genome ... is a significant step forward. The species studied is the common chimpanzee, *Pan troglodytes*; its only "sister" species is the pygmy chimpanzee or bonobo, *Pan paniscus*....

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.36#22481](http://www.comdig.org/index.php?id_issue=2005.36#22481)

### **COMMUNICATING COMPLEXITIES**

The following news item is taken in part from the 01 September 2005 issue of *Nature* titled, "Responding to Uncertainty."

Some societies have been known to lobby the media publicly or discreetly to try to discourage them from allowing minority voices to be heard. Nothing could be more counter-productive. Even if a high-profile scientist is judged by peers to be lacking credibility, the media will rightly be provoked by attempts at censorship.... It is better to attack such claims explicitly on a scientific basis....

It tutors scientists in communicating complexities such as risk with respectable but effective soundbites.

A link to this article can be found at [http://www.comdig.org/index.php?id\\_issue=2005.36#22479](http://www.comdig.org/index.php?id_issue=2005.36#22479)