

Country Bumpkins Have More Enthusiasm for New Things

Urban life changes the personality of blackbirds and makes them skeptical

City folk are generally assumed to be more open to new trends than those living in rural areas. Urban life also seems to



change the character of animals that have successfully colonized our cities – but the other way around. Researchers at the Max Planck Institute for Ornithology in Radolfzell have discovered that urban-born blackbirds are less curious about new objects than their country cousins. They are also more likely to be put off by unfamiliar stimuli. When it comes to settling in cities, evolution seems to have favored certain personality types.

Blackbirds clearly have to deal with constantly new, potentially dangerous situations in the fast-paced world of the city and have thus developed a general skepticism about anything new. The more settled way of life in the country, on the other hand, provides for more reliable living conditions. Scientists around the world have also noticed personality differences between city and country dwellers in other animal species – it's a global phenomenon. (GLOBAL CHANGE BIOLOGY, JUNE 19, 2013)

Curious about the unknown: In a behavioral experiment involving urban and forest blackbirds, the former wait longer before approaching a new object.

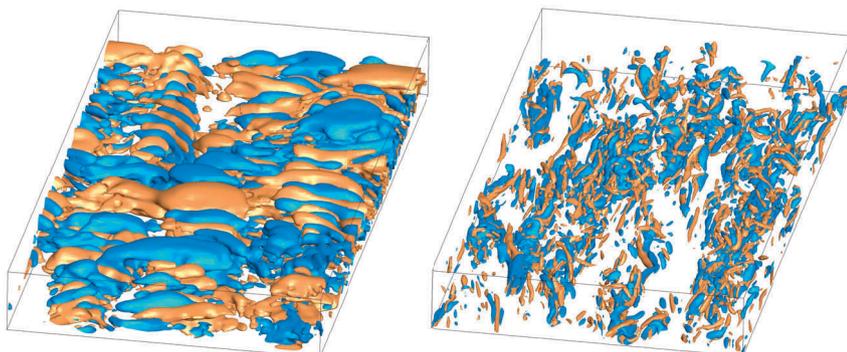
Chaos with Unfamiliar Swirling

A new form of turbulence explains why oil containing a low concentration of a dissolved polymer flows with almost no friction through pipelines

A team of researchers at the Max Planck Institute for Dynamics and Self-Organization in Göttingen and Saarland University in Germany have discovered a new type of turbulence. The chaotic state, which the scientists call elasto-inertial turbulence, occurs in polymer solutions, such as oil that is pumped through pipelines. Small quantities of

a polymer have long been added to the fossil fuel to reduce the friction of the oil by 80 percent when it is transported. This significantly reduces the energy required for the pumps. Researchers working with Björn Hof at the Max Planck Institute in Göttingen can now explain why this is. Oil to which a small amount of polymer has been

added – when compared with oil flowing without the polymer – becomes turbulent only at higher flow speeds. The elasto-inertial turbulence that occurs here at high flow speeds also generates less friction than the normal turbulence that transforms water flows or pure oil flows into wildly swirling streams. (PNAS, online, JUNE 11, 2013)



Chaos with new properties: Swirls always pervade the entire flow in the presence of elasto-inertial turbulence (left), unlike in normal chaotic flows (right). They are also perpendicular to the direction of the flow, which runs vertically in this picture. With normal turbulence, the turbulent swirls extend in the direction of the flow. The swirling regions in the flow are shown in orange; the blue sections indicate areas that are stretched.

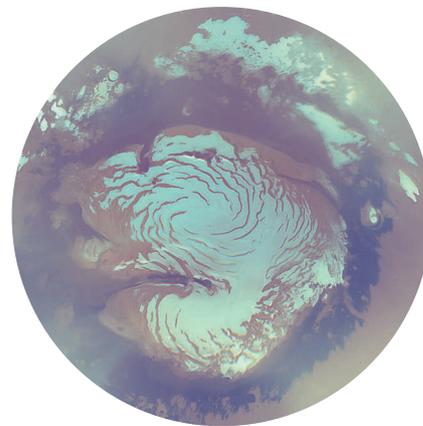
...and now for the weather on Mars

Snow regularly falls in the north of the red planet and can be forecast quite accurately

The seasonal ice that is a feature of winter on Mars has two origins: some of the carbon dioxide from the atmosphere condenses directly on the surface – similar to the way a layer of frost forms on Earth during cold, clear weather; some of it freezes into tiny ice crystals in the atmosphere, which form clouds and fall as snow. For the first time ever, scientists at Tohoku University in the Japanese city of Sendai and the Max Planck Institute for Solar System Research in Katlenburg-Lindau, Germany, have established a link between the appearance of such ice clouds and a wave-like weather phenomenon characterized by perio-

dic fluctuations in pressure, temperature, wind direction and wind speed.

These waves can be found with astonishing reliability in the Martian northern hemisphere between fall and spring. They propagate eastward with a uniform period of five to six days. Additional waves with higher frequencies can be observed close to the surface. According to the scientists' calculations, snowfalls in certain northern regions can be forecast well in advance. These types of weather forecasts would enable Mars rovers to avoid heavy snow showers on their routes. (GEOPHYSICAL RESEARCH LETTERS, April 29, 2013)



Ice Age: In winter, a layer of frozen carbon dioxide covers the Martian North Pole. Half of this ice cap originates from the carbon dioxide snow that falls to the ground from the ice clouds in the atmosphere. This image was taken by NASA's Mars Reconnaissance Orbiter space probe in 2006.

Charcoal in the Ocean

Wildfire residue is washed out of the soil and transported to the sea by rivers

An important factor in the Earth's carbon cycle used to be completely overlooked. An international team of researchers working with Thorsten Dittmar at the Max Planck Institute for Marine Microbiology in Bremen has calculated that approximately 25 million tons of charcoal is carried by rivers from the land into the sea each year. Wildfires burn millions of hectares of vegetation each year, resulting in large quantities of charcoal on land. Geoscientists previously thought that the charcoal remained in the ground. As the group working with the Bremen-based Max Planck researchers has now shown, however, charcoal accounts for 10 percent of the world's total amount of dissolved organic carbon compounds in rivers, lakes and oceans. These new findings help us gain a better understanding of the global carbon cycle through which the greenhouse gas carbon dioxide is released into the atmosphere. (SCIENCE, April 19, 2013)

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Fire in the boreal evergreen forest: Fires destroy millions of trees every year. They leave behind carbon, some of which, contrary to previous assumptions, rivers transport to the sea.



Photos: Stefan Doerr, Swansea University (bottom); NASA (top)

Revealing Games behind Bars

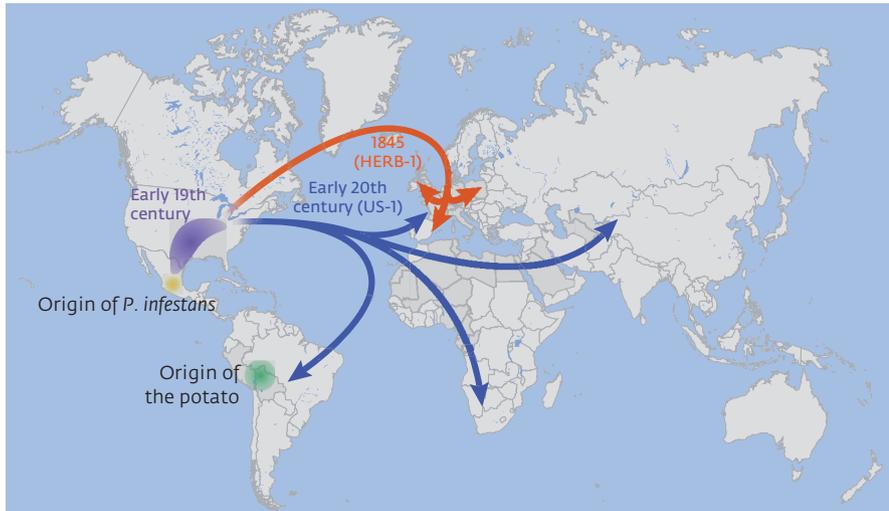
An experimental study that researchers at the Max Planck Institute for Research on Collective Goods acted out with prisoners produced an interesting result: convicted criminals are in no way more selfish than average citizens who have never been in conflict with the law. Moreover, people evidently don't become criminals because they are more self-seeking than others. At the juvenile correctional facility in Adelsheim, Germany, 58 inmates agreed to take part in a "dictator game." This involved sharing or not sharing, and the behavioral economists had a tried-and-tested tool to determine the social preferences of the participants. The result was that only 34.48 percent of participants proved to be selfish and kept the entire five euro endowment entirely for themselves; when the game was played with "normal citizens," the figure was 36.11 percent.

The researchers repeated the game three years later with a new group of inmates. The same results were obtained. The second time around, the recipient of the donations was changed: this time, the small donation would go to the German charity *Brot für die Welt*. The prisoners gave more than before to their fellow prisoners. Moreover, as in the previous game, they were also more generous than the average citizen.

(PREPRINTS OF THE MAX PLANCK INSTITUTE FOR RESEARCH ON COLLECTIVE GOODS 2013/5)

Herbarium Turned History Book

Molecular biologists reconstruct the historic spread of the potato blight



Suspected pathways for the spread of the two examined strains of the potato blight pathogen *Phytophthora infestans*.

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 scientists used historical herbarium samples for the first time.

Their analysis of the fungal genetic material showed that the 19th-century famine was caused by the HERB-1 pathogen strain, which is closely related to a North American strain. It is thus highly likely that the potato blight came to Europe through North America and raged throughout the world for more than 50 years. The pathogen was probably spread from its center of origin in the Toluca Valley in Mexico by the Spanish conquistadors in the early 16th century. The first resistant potato varieties were bred at the beginning of the 20th century, which means that the HERB-1 strain is now likely to be extinct.

(ELIFE, May 28, 2013)

It was one of the worst famines in history: In 1845 and subsequent years, a fungal disease destroyed vast swaths of Europe's potato harvests. In Ireland alone, one million people starved to death; at least another million emi-

grated. An international team including researchers at the Max Planck Institute for Developmental Biology in Tübingen, Germany, reconstructed the evolution of the pathogen *Phytophthora infestans*. To do this, the

New Keyboard for Touchscreens

With an optimized keyboard layout, it is significantly faster to type with two thumbs than on a keyboard with a conventional layout

Fast typists don't use ten fingers to type on a smartphone or tablet, but rather two thumbs. In the future, they could be able to move their fingers even more deftly. A team working with Antti Oulasvirta at the Max Planck Institute for Informatics in Saar-

brücken, Germany, has designed a keyboard layout for touchscreen devices. The researchers created a model of thumb movements and, using a computer algorithm, searched among several million potential keyboard layouts for one that would allow users to enter text as quickly as possible using alternating thumbs.

The team initially optimized the layout of the keyboard for the English language. This involved placing all vowel sounds, with the exception of the letter Y, in the area for the right thumb, while the left thumb was assigned more keys. The new design, dubbed "KALQ", allowed users to type 34 percent faster than on devices with the conventional QWERTY layout. The keyboard layout can also be optimized for other languages in the same way.

(PROCEEDINGS OF THE 2013 ANNUAL CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS [CHI 2013])

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 In the KALQ layout, which is optimized for inputting English text on touchscreens, all the vowel sounds except Y are located in the area near the right thumb; the area nearest the left thumb has more keys.



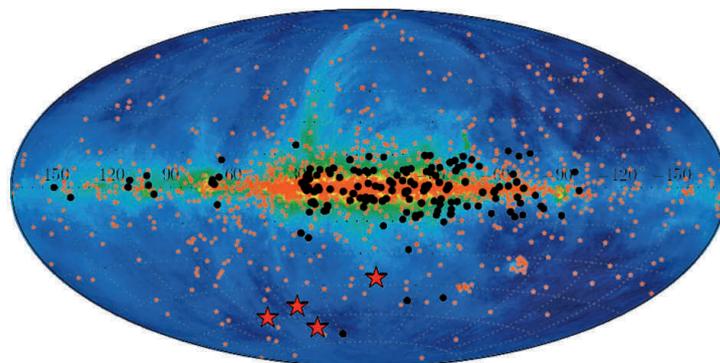
Mysterious Flashes in the Sky

Cosmic radio bursts point to cataclysmic events in the distant universe

An international team of researchers including scientists from the Max Planck Institute for Radio Astronomy in Bonn, Germany, has detected bursts of radio waves that appear to have originated billions of light years away at a time when the universe was between six and nine billion years old. The researchers are baffled about the origins of these emissions. Four Fast Radio Bursts (FRBs) with durations of only a few milliseconds were detected at high galactic latitudes in the southern sky.

The extremely short duration of the bursts and the inferred great distance imply that they were caused by some extremely high-energy cosmological event, such as two neutron stars merging, a sun dying or a star being swallowed by a black hole.

The researchers now want to use their findings to study the properties of the intergalactic space where the bursts occurred. (SCIENCE, July 5, 2013)



Radio map of the whole sky in galactic coordinates, with pulsars found within the High Time Resolution Universe Survey (HTRU) marked as black dots. The positions of the four Fast Radio Bursts (FRBs) are marked as red stars.

Resilient Harlequin

Biological weapons give Asian ladybugs the upper hand over their European relatives

Once introduced for biological pest control, Asian ladybug *Harmonia axyridis* populations have been increasing uncontrollably in the US and Europe since the turn of the millennium. The species has also been proliferating rapidly in Germany; conservationists fear that the

Asian ladybug, also known as the harlequin ladybird, will out-compete native beetle species. Scientists at the University of Gießen and the Max Planck Institute for Chemical Ecology in Jena, Germany, have now discovered why this animal is so successful.

The invader's body fluid contains what are known as microsporidia – single-celled, fungus-like parasites. The Asian ladybug is obviously resistant to these parasites in its own body. However, transferred to Germany's native species, microsporidia can be lethal. The invader is also better able to fend off infections. Its body fluid contains greater quantities of an antibacterial compound known as harmonine, and more antibiotic peptides than the seven-spot ladybird (*Coccinella septempunctata*), which is native to Germany.

(SCIENCE, May 17, 2013; BIOLOGY LETTERS, March 6, 2013; PROCEEDINGS OF THE ROYAL SOCIETY OF LONDON B, November 21, 2012)



Crucial difference: Colonies of *E. coli* (white dots) die off in the area surrounding the Asian ladybug (*Harmonia axyridis*, left) (circle). The native ladybug species *Coccinella septempunctata* (middle) and *Adalia bipunctata* (right), on the other hand, do little or nothing to stop the bacteria.

Fountains at the Heart of a Galaxy

Astronomers discover cool streams of dust in the central region of the NGC 3783 galaxy



Massive, turbulent monster: The artist's impression shows the surroundings of the supermassive black hole at the heart of the active galaxy NGC 3783. New observations not only point to a torus of hot dust around the black hole, but also to a wind of cool material in the polar regions.

Astronomers at the Max Planck Institute for Radio Astronomy and the Max Planck Institute for Extraterrestrial Physics in Germany have studied the most detailed observation ever of the area surrounding a supermassive black hole at the center of the active galaxy NGC 3783. To do this, they used the European Southern Observatory's Very Large Telescope Interferometer. The black hole has a mass approximately eight to ten million times that of the Sun, and is surrounded by a hot disk of gas. Matter falls into the gravity trap from the inner edge of this disk, heating the disk and making it very bright. It is surrounded by a donut-shaped torus of gas and dust. This dust is heated by the radiation from the gas disk and emits the heat energy as infrared light.

In addition to this radiation, which scientists have known about for a long time, the astronomers also discovered cooler dust above and below the radiation. This dust has a temperature of around 300 degrees Kelvin, in other words, room temperature. The streams of dust extend perpendicularly to the hot dust torus toward the polar regions. Depending on the wavelength, between 60 and 90 percent of the radiation in the mid-infrared originates from the two pillars of dust and not – as was previously assumed – from the torus. This raises a number of questions, such as the origin of the polar streams.

(THE ASTROPHYSICAL JOURNAL, online, June 20, 2013)

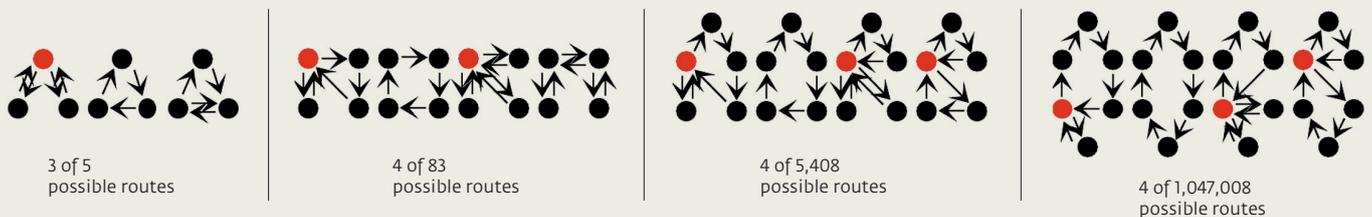
Mobility in the City

A model that describes movement over short distances and short periods could help manage traffic flows better

Transportation planners could soon have an easier time of it. An international team including Vitaly Belik from the Max Planck Institute for Dynamics and Self-Organization in Göttingen, Germany, developed a model based on data collected in Paris and Chicago that describes the mobility of people over short distances – such as in a city – and short periods of time. The researchers found that, on weekdays, 90 percent of people visit a maximum of six different locations, including their own home. They use just

17 of more than one million possible trip sequences to get to their intended destinations on a given day.

Models describing mobility across large distances and over long periods of time already exist. The new findings could help urban planners plan inner-city traffic routes and manage traffic more effectively. They could also be useful in helping prevent epidemics in smaller areas. (JOURNAL OF THE ROYAL SOCIETY INTERFACE, May 8, 2013)



Everyday routes: People can visit several places using very different routes, but in practice, they actually use very few of them. The diagram shows the number of relevant mobility profiles that can be used to reach between three and six different destinations. The number of destinations is compared to the number of potential routes. The central location, usually the person's home, is shown in red.

Preference in Mating

Mate choice in mice is influenced by paternal clues

Mate choice is a key factor in the evolution of new animal species. Researchers at the Max Planck Institute for Evolutionary Biology in Plön, Germany, investigated whether house mice would mate with each other even if they were from two populations that had been separated from each other for a long time. To do this, they brought together wild house mice from southern France and western Germany in a research enclosure



several square meters in size. The enclosure was divided up with wooden walls and contained nests made of plastic cylinders and plastic tubes. Both populations had been geographically separated for about 3,000 years.

While the mice initially mated with each other quite randomly, the German-French hybrid offspring were significantly more choosy: they showed a preference for breeding with partners who came from their father's original population. The paternal influence in choosing a mate therefore fosters the creation of genetically uniform groups, thus accelerating the speciation process.

(MOLECULAR ECOLOGY, online, March 18, 2013)

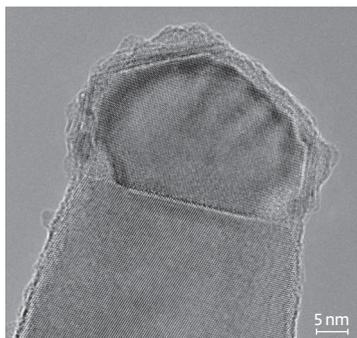
Communicating in the ultrasonic range: The animals use the "mouse song" to recognize one another and find out if they are related.

A Good Wire for Nanoelectronics

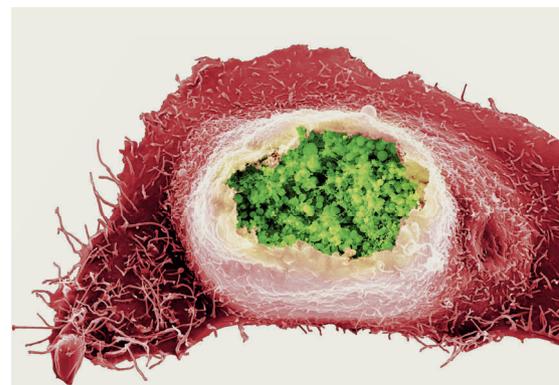
Silicon nanowires become doped with unexpectedly large amounts of aluminum during growth, increasing their conductivity

Nanoelectronics has taken another step forward. An international team including researchers at the Max Planck Institute of Microstructure Physics in Halle, Germany, discovered an effect that can be used to produce particularly conductive silicon nanowires, such as those used in electronics. Aluminum is used as the catalyst to grow such nanowires. Tiny drops of aluminum on a silicon substrate trap silicon from the gaseous compound silane. As soon as the aluminum droplets are saturated with silicon, they still continue to absorb the semiconductor's atoms, but they begin to deposit

crystals underneath, with the result that silicon wires gradually begin to form there. As the researchers working with Oussama Moutanabbir then discovered, significantly more aluminum atoms than expected go into the wires. The high proportion of aluminum – referred to in semiconductor technology as doping – improves the conductivity of the wires. (NATURE, April 4, 2013)



In the growth zone of a nanowire: The surface of an aluminum droplet absorbs silicon, which is present in the environment as silane. The silicon migrates to the bottom of the droplet, where it deposits in layers. In this way, a silicon wire is formed that contains significantly more aluminum deposits than expected. The image shows the interface between the aluminum and the silicon.



Uninvited guests: Chlamydia (green) inside a human host cell (red).

Chlamydia Wreaks Havoc in Genetic Material

The sexually transmitted bacteria evidently pave the way for the development of cancer

Cancer isn't just a question of genetic makeup or damaging environmental influences – it can even be contagious. In addition to various viruses, the gastric bacterium *Helicobacter pylori* can cause cancer. Scientists now suspect, however, that *Helicobacter* is just the tip of the iceberg. Particularly *Chlamydia trachomatis*, one of the most frequently sexually transmitted bacteria, is suspected of being a factor in the development of ovarian cancer.

Researchers at the Max Planck Institute for Infection Biology in Berlin, Germany, have now found another clue to indicate that Chlamydia can actually cause cancer. When these pathogens multiply, they cause immense damage to the genetic material of their host cells, which can't be fully fixed by the cell's repair mechanisms. This quickly leads to multiple mutations in the genetic material. The bacteria also prevent the mutated cells from dying off. They prompt them to continue growing – the first step to becoming a cancer cell.

(CELL HOST & MICROBE, JUNE 12, 2013)