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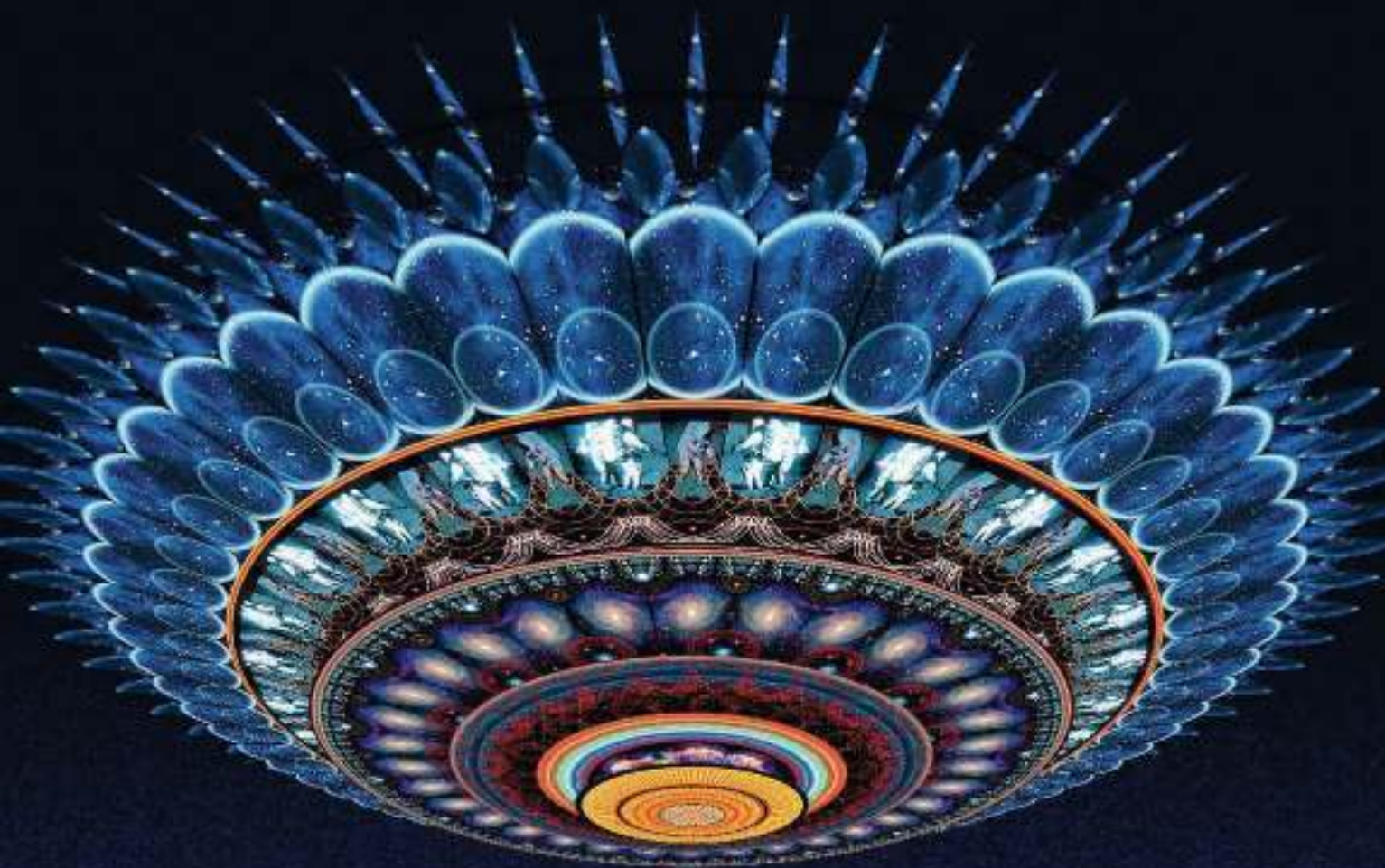
Why we've suddenly got the hots for Jupiter's icy moon

# NewScientist

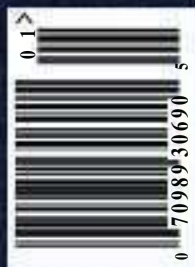
WEEKLY January 4 - 10, 2014

## BREAKING RELATIVITY

**The celestial signals that defy Einstein**



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# Arc 1.4 / Forever alone drone



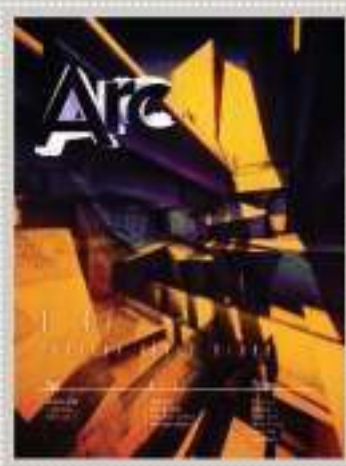
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# New year, new habits?

A short break from booze may have long-lasting consequences

GIVING up alcohol for January? For many people, in the UK at least, it has become a ritual in recent years. The assumption is that taking a break will help your liver to recover from the seasonal onslaught of alcohol and rich food.

Does it work? Upon investigation, we found little research on the effects of such “dryathlons”. We thought that was surprising. So a group of *New Scientist* volunteers took part in a ground-breaking study organised by medical researchers at University College London.

The preliminary results are striking, suggesting that abstinence significantly reduces levels of liver fat, cholesterol and blood glucose (see page 6). Intriguing, but we’ll have to wait for larger studies before we can be confident of how large or enduring those benefits really are.

But a period of abstinence may have consequences beyond the physiological. The health benefits of a one-month break may prove to be inconsequential when set against the detriments of drinking for the rest of the year – certainly if people take the break as licence to increase their alcohol intake at other times.

**“Get over the initial discomfort of drying out, and healthier habits may follow”**

But a dry period may help with that, too. Alcohol is a drug: one that kills 2.5 million people each year globally and which the World Health Organization ranks as the third largest risk factor for premature death. When, how and why we drink is strongly affected by personal and social factors.

Habitual drinkers can find it difficult to negotiate social events without alcohol. But get over the initial discomfort of drying out, and healthier habits may follow. Several *New Scientist* participants reported they found it easier to decline alcohol after the study had ended, or to start an evening off with low-alcohol drinks. But the lack of palatable, non-sugary choices proved frustrating: perhaps drinks manufacturers could make more effort to cater to the month-off market.

This is, of course, just the anecdotal experience of a handful of people. But the potential for people to rewrite their contract with alcohol may prove a stronger argument for dialling back on booze for a while every year than any health benefits. Worth considering as you decide whether to open another bottle of wine. ■

# Histories, not stories

ONE of the mind-broadening possibilities of travel is a visit to a historical site or ancient building. Gleaning something of a region’s past can be educational and inspirational, and tourists visit such places in droves.

That’s why heritage tourism is big business. But squaring sightseeing with history can be tricky: the managers of such sites

often have to tread a line between presenting complicated truths and spinning tourist-friendly yarns.

Most do it well. But sometimes the lure of money skews the balance too far. Perhaps the worst example is in Honduras, where actual history has been sidelined in favour of a slim connection to the more bankable Maya civilisation (see page 34).

That may seem a forgivable instance of not letting the facts get in the way of a good story. But it can also be seen as only a shade removed from denying history, with all the attendant concerns that raises. Myth-making about the past can foster the marginalisation of indigenous or minority populations.

Make-believe is fun; that’s why Disneyland exists. But it would be nice to think that if you visit the real world, you get real history. ■

# ET: off limits but within reach

“All these worlds are yours. Except Europa. Attempt no landing there.” So warned the protectors of life on Jupiter’s icy moon in 2010: *Odyseey Two*, by Arthur C. Clarke. The novel’s omnipotent aliens

are adamant that the life forms inhabiting Europa’s oceans should be left to evolve without interference.

The prospect of finding extraterrestrial life on Europa has inspired real scientists to plan ambitious – and expensive – missions. But they, too, are cautious about landing. The risk

of contamination is very real: no one wants to introduce earthly bugs to a pristine environment.

Now the discovery that Europa is emitting plumes that could be checked for biomarkers offers a tantalising alternative (see page 8). Perhaps we can detect life without attempting a landing at all. ■



Cool runnings

## Snorkelling in space

TAKE a breather, spacewalkers. Working tirelessly over the holiday, astronauts equipped with snorkels successfully repaired damage to the vital cooling system on board the International Space Station.

The system circulates ammonia to keep internal and external instruments at the correct temperature. NASA had to power down parts of three ISS modules when it went offline.

On 24 December, astronauts Rick Mastracchio and Mike Hopkins completed the second of three planned spacewalks to replace a failed pump module on the station's exterior. Although they were hit by a "mini blizzard" of toxic ammonia flakes that burst from a supply line, they finished the job ahead of schedule, eliminating the need for a third outing.

Hopkins was wearing the same spacesuit used last July by Italian astronaut Luca Parmitano, who nearly drowned when his helmet started filling with water. NASA investigators concluded that the most likely cause of the leak was contamination in the suit's cooling system, which blocked a filter.

Although the filter was cleared NASA didn't want to take any chances so instructed the astronauts to fashion snorkels from plastic tubes and Velcro. That would allow them to breathe air from lower in the suit in the event of a leak. As it was, their helmets remained bone dry. On returning to the ISS, Hopkins thanked ground crew: "Merry Christmas to everybody. It took a couple of licks to get her done, but we got it."

## Peak light bulb

WE HAVE reached peak light bulb.

The average amount of electricity needed annually to light a UK home fell from 720 kilowatt-hours in 1997 to 508 kWh in 2012, a drop of 29 per

**"Due to the UK's phasing out of incandescent light bulbs, there's been a huge drop in energy demand"**

cent. Brenda Boardman of the University of Oxford's Environmental Change Institute says this is largely down to the phasing out of inefficient incandescent light bulbs. "Because of the amount we are switching to compact fluorescent light bulbs and LEDs, there is a huge drop in demand," she says.

From 2007 to 2012, the UK's peak electricity demand fell from 61.5 to 57.5 gigawatts. The benefits of efficient light bulbs are good news for the UK, which will have to work hard to maintain its electricity supply. Ageing power stations are being mothballed over the next few years, new

capacity from renewable sources is slow in ramping up and planned nuclear reactors at Hinkley Point are a decade away. This means the risk of power shortages will rise in the next five years.

However, any shortage would be unlikely to cause a full-blown power cut. "If there were ever a shortage at peak time, there would be power reductions," says Boardman. In other words, the lights would dim but not go out.

Boardman presented her work at the Radical Emission Reduction conference at the Royal Society in London in December.

## Weird Higgs, please

THE world's favourite new particle could reveal exotic physics even before the Large Hadron Collider switches back on in 2015, thanks to a list of ways the Higgs boson could misbehave.

Misbehaviour sounds like a strange thing to catalogue, but when it comes to the standard model – our leading theory of particles and forces – it is desirable. The model cannot explain everything, so the hope is that the Higgs will offer clues to how to extend it to include

entities such as dark matter. The Higgs might do this by decaying into daughter particles in an unexpected way inside the LHC.

But for all the decay pathways tracked since the boson's discovery in 2012, it has behaved exactly as the standard model dictates. So a team of theorists has put together a list of further decays that would count as misbehaviour ([arxiv.org/abs/1312.4992](http://arxiv.org/abs/1312.4992)). The LHC is currently shut down for an upgrade, but up to 100,000 of these deviant decays could be lurking in the existing data.



Cost is first priority

## Meat source

WE WANT to know where our meat comes from, but not if it will cost us to find out, it seems.

A report published on 17 December by the European Commission found that 90 per cent of consumers thought it important that the country of origin should be indicated on all meat products. But only 20 per cent of respondents said they were willing to pay 5 to 10 per cent more money for the information.

## 60 SECONDS

UK consumers' sensitivity to the origins of their meat has increased over recent decades, exacerbated by the BSE outbreak and the more recent scandal in which horsemeat was sold as beef and pork in several products.

Indication of origin is mandatory for unprocessed beef and beef products, and the commission is looking into extending this to include all meat used as an ingredient in pre-packed foods. There is less concern over unprocessed meat from other animals as those supply chains are less convoluted, with less room for abuse.

## Lone Star evolution

CHILDREN in Texas will spend the next decade reading biology textbooks free of anti-evolution propaganda, thanks to the defeat last month of creationist attempts to cast doubt on the evolution content of such books.

Creationists on the 15-member Texas State Board of Education had been trying since 2009 to force textual changes designed to undermine the scientific consensus on evolution.

If the changes had been accepted, the "contaminated" books would almost certainly have spread to other states, since Texas is the second largest buyer of schoolbooks, behind California.

The defeat of this attempt to sabotage the evolution content has cleared the way for the acceptance of the Pearson *Biology* textbook. An unidentified volunteer reviewer complained to the board in November that the book contained 18 errors of fact. To settle the issue, the board appointed a panel of three eminent biologists to pass final judgement on the criticisms. "Our sources said all three panellists dismissed the claims of factual errors and recommended no changes to the textbook," says Dan Quinn, of Texas Freedom Network.

## Fukushima renews

THE name "Fukushima" still brings images of nuclear disaster to mind, but one day it might be associated with renewable energy.

Fukushima is the Japanese prefecture that bore the brunt of the tsunami and nuclear meltdown in March 2011. Now construction has started on a community-run project in the coastal city of Minamisoma to reuse farmland contaminated by fallout. About two-thirds of this lies within the evacuation zone.

So far the Renewable Energy Village boasts 120 photovoltaic

panels, generating 30 kilowatts of power for a local utility. The next step will be to plant crops tolerant of contamination, such as rapeseed, under the panels. Recreational facilities as well as an observatory are also planned.

**"It might have an amusement park feel, but we're trying to show what the future could hold"**

"There might be an amusement park feel to the project," says project leader Ryozi Hakozi, "but we're trying to show what the future could hold."

## 'Passport' to spot steroid cheats

SPORTS cheats beware. As of 1 January, professional athletes became subject to routine checks on steroid concentrations in their urine. These tests won't be used to spot specific drugs, but to form a baseline by which to detect any future suspicious deviations from the athlete's normal physiology. The checks have been added to the World Anti-Doping Agency's "biological passport", a procedure for monitoring every athlete's metabolic profile.

Since WADA introduced the passports in 2009, various components of athletes' blood are tested about nine times a year. These include the mass of oxygen-carrying haemoglobin, and the number of red blood cells present in a sample, which

can reveal a suspected blood transfusion or doping with the hormone erythropoietin, which enriches the oxygen content of blood.

Now the same routine is being applied to steroids found in urine. To date, the only routine check on steroid misuse is through individual measurements of testosterone and epitestosterone.

WADA says that the new steroid profile will monitor six steroids and the ratios between them to gauge any abnormal fluctuations from ratios normally present in urine. "We can't put a number on how many people will be caught out, but a more intelligent anti-doping programme should deter athletes from cheating," says Ben Nichols, a WADA spokesman.



No drugs allowed

## Beatle on Mercury

John Lennon lives on - but not on Earth. The late Beatle, along with author Truman Capote, is among the namesakes for 10 craters recently discovered on Mercury by NASA's Messenger probe. Tradition states that craters are named after deceased artists and authors.

## Heavenly weather

The UK is to become one of a handful of countries that forecast the weather in space. Solar flares and space storms can disrupt satellites, GPS and radio communications. The UK Met Office has teamed up with partners in the US to provide daily forecasts that will help protect vital services from celestial disruptions.

## Rescue robots are go

A two-legged robot called Schaft has won the penultimate round of DARPA's rescue challenge - intended to encourage the creation of robots that can help out in a disaster. During the 2-day competition in Florida, Google-owned Schaft climbed a 2.4-metre-high ladder, closed valves and cut through concrete walls. The winner of the final in late 2014 will be awarded \$2 million.

## Cracking pardon

Alan Turing, the British mathematician famed for breaking the German enigma code, arguably helping to end the second world war, has received a posthumous royal pardon. Turing lost his job and was chemically castrated after being convicted for homosexual activity in 1952. He committed suicide two years later.

## Antarctica's icy grasp

A second rescue mission has failed to reach the MV Akademik Shokalskiy, the scientific research vessel that has been stuck in ice off the coast of Antarctica since 25 December. The vessel intended to repeat studies carried out in 1911 to see how the area had changed over a century. Fifty scientists and tourists now await clear weather for evacuation.

PHOTOGRAPHY: DAVID STOCK FOR NEWSCIENTIST



## HERE'S TO A DRY JANUARY

**Andy Coghlan** and nine colleagues find that a month of alcohol abstinence made a difference to their livers

“DRY January”, for many a welcome period of abstinence after the excesses of the holiday season, could be more than a rest for body and soul. *New Scientist* staff have generated the first evidence that giving up alcohol for a month might actually be good for you, at least in the short term.

Many people who drink alcohol choose to give up for short periods, but there is no scientific evidence that this has any health benefits. So we teamed

up with Rajiv Jalan at the Institute for Liver and Digestive Health at University College London Medical School (UCLMS) to investigate.

The liver plays a role in over 500 processes vital for functions as diverse as digesting food, detoxification and hormone balance. In 2009, of the 11,575 people who died of liver disease in the UK, more than a third were attributed to alcohol consumption. Most of what we know about liver

*Mine's an orange juice: New Scientist staff forswore alcohol for a month and reduced their liver fat by 15 per cent*

health comes from studies of people with chronic disease, many of whom are alcoholics. Very few studies have focused on liver function in apparently healthy people.

Our project was on a small scale, but Jalan felt it could yield clues as to the effects of short-term abstinence. On 5 October, 14 members of the *New Scientist* staff – all of whom consider themselves to be “normal” drinkers – went to the Royal Free Hospital in London. We answered questionnaires about our health and drinking habits, then had ultrasound scans to measure the amount of fat on the liver. Finally, we gave blood samples, used to analyse levels of metabolic chemicals linked with the liver and overall health.

For the next five weeks, 10 of us drank no alcohol while four continued as normal. On 9 November, we returned to the hospital to repeat the tests.

“You’re going to be very excited,” said Jalan, when the results were in.

First off, he revealed that there had been no significant changes in any of



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- Virtual fashion gives perfect fit, page 20

the parameters measured for the four people who didn't give up alcohol.

But the changes were dramatic and consistent across all 10 abstainers (see charts, right).

Liver fat fell on average by 15 per cent, and by almost 20 per cent in some individuals. Jalan says this is highly significant, because fat accumulation on the liver is a known prelude to liver damage. It can cause inflammation, resulting in liver disease. "This transition is the harbinger first for temporary scarring called fibrosis and ultimately a non-reversible type of scarring that destroys liver structure, called cirrhosis," says Jalan. Although our livers were all judged to be generally healthy, the fat reductions would almost certainly help to retard liver deterioration, he says.

Then came another surprise. The blood glucose levels of the abstainers dropped by 23 per cent on average, from 5.1 to 4.3 millimoles per litre. The normal range for blood glucose is between 3.9 and 5.6 mmol/l. "I was staggered," says Kevin Moore, consultant in liver health services at UCLMS. "I don't think anyone has ever observed that before."

Glucose was measured using a fasting blood glucose test taken after participants had refrained from eating or drinking anything but water for 8 hours. This stimulates production of the hormone glucagon, which releases glucose from body stores into the blood. In a healthy person, a rise in glucose triggers the production of insulin, which tells certain cells to take up glucose from the blood to maintain a safe blood sugar level.

Type 2 diabetes results when cells no longer respond to insulin, leading to high blood sugar. A drop in circulating glucose in our tests could mean that our bodies had become more sensitive to insulin, removing more glucose from the blood – a sign of improved blood sugar control. We also lost weight, by 1.5 kilograms on average.

Total blood cholesterol, a risk factor for heart disease, dropped by almost 5 per cent, from 4.6 to 4.4 mmol/l. A healthy amount is considered anything below 5.2 mmol/l. "Basically, you're getting improved glucose and cholesterol management," says Moore.

The benefits weren't just physical.

Ultrasound scans measured how "fatty" our livers were

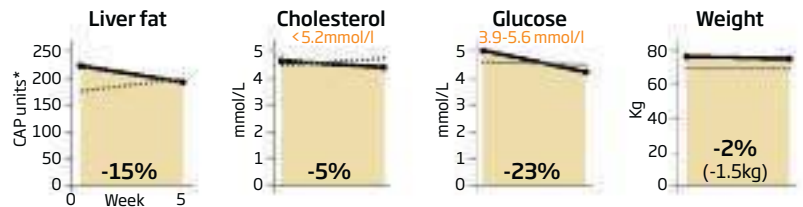


## Cutting out the booze

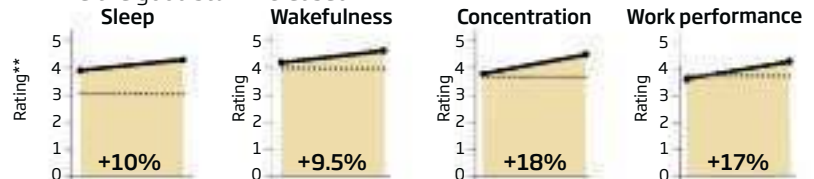
A small group of *New Scientist* staff gave up alcohol for 5 weeks. Here's how their bodies responded

— People who abstained from alcohol (10)  
- - - Control group - no change in drinking habits (4)  
Healthy range

The bad stuff decreased....



...while the good stuff increased



\*CAP measures the decrease in amplitude of ultrasound waves as they pass through the liver, which corresponds to the amount of fat present. \*\*Rating on scale of 0 (worst) to 5 (best)

Ratings of sleep quality on a scale from 1 to 5 rose by just over 10 per cent, improving from 3.9 to 4.3. Ratings of how well we could concentrate soared 18 per cent from 3.8 to 4.5. "It represents a significant effect on quality of life and work performance," says Jalan, although he acknowledges that self-reported experiences are open to bias.

The only negative was that people reported less social contact.

Our experiment gives no indication of how long the improvements persist. "Whether it's 15 days or six months, we don't know," says Jalan. However, it lays the ground for larger studies, he says.

"What you have is a pretty average group of British people who would not consider themselves heavy drinkers,

yet stopping drinking for a month alters liver fat, cholesterol and blood sugar, and helps them lose weight," says Moore. "If someone had a health product that did all that in one month, they would be raking it in."

Still, that doesn't mean it is OK to indulge for the other 11 months. "That's absolutely the wrong message to give out," says liver specialist Scott Friedman of the Mount Sinai Hospital in New York. "What's surprising is how quickly the benefits were evident, but think about how much you could gain from more prolonged abstinence."

"These results show that even a relatively short period of abstinence impacts on the liver," says Nick Sheron at the University of Southampton, UK. He says that liver disease can develop over the course of 30 years, so a short period of abstinence needs to translate into long-term behaviour change. "But what a hugely encouraging start this is," he says. "And if you can persuade a bunch of journalists to have a month off the booze there is really no excuse for anyone not to be able to do the same thing, is there?" ■

Thanks to all who gave up their free time, including Matteo Roselli and Emmanuel Tsochatzis at the Royal Free Hospital for performing the liver scans



Hello, anyone home?

# Water plumes spark a race to Europa

Lisa Grossman

LET'S put Mars in our rear-view mirror. Recent signs of water gushing from Europa could make Jupiter's icy moon the next hot destination in the hunt for alien life. And novel ways to propel tiny, cheap satellites could get us there within the next decade – although such a trip won't be easy.

Europa has long been one of astrobiologists' most desired destinations. The Galileo probe, which toured the Jovian system between 1995 and 2003, revealed signs of fissures on the moon that may periodically open up, letting water escape from a suspected sub-surface ocean.

Although searches for plumes during that period found none, the chance that its seas hold life has made Europa a high-ranking target for the US National Academy of Sciences. So far, however, none of the proposed missions has won NASA funding.

Many planetary scientists think they now have the evidence needed to change that. "The drumbeat is getting louder," says Kevin Hand at

NASA's Jet Propulsion Laboratory in Pasadena, California.

The main reason is a paper that sparked huge excitement at a geophysics meeting last month. Lorenz Roth at the Southwest Research Institute in San Antonio, Texas, presented images from the Hubble telescope that show a towering cloud of water vapour spouting from Europa's south pole. Other presentations at the meeting also showed that Europa has intriguing minerals on its surface, and hinted that active plate tectonics could help get

## THE CASE FOR LIFE UNDER THE ICE

Reports of a possible water plume on Jupiter's moon Europa have raised the stakes for a trip there – and two more findings, presented last month, also add to its appeal.

James Shirley at NASA's Jet Propulsion Laboratory applied updated analysis to archival data from the Galileo probe, which orbited Jupiter from 1995 to 2003. He found clay-like minerals on Europa's surface, debris from meteor impacts

nutrients into its seas (see "The case for life under the ice", below).

Plumes would make it easier to find and study any potential life, as samples could be scooped up from orbit without the more challenging task of drilling through the ice. Saturn's moon Enceladus also has such geysers, but they are thought to gush from a water pocket that seems less life-friendly than Europa's ocean.

So what needs to happen next? First, scientists must confirm that the plumes exist. The sighting appeared only in images from December 2012, which suggests that either the plume was an anomaly, or such eruptions are not always active. If a mission is mistimed, it may be in vain.

We should soon know more: William Sparks at the Space

that may contain life-building compounds called organics.

Simon Kattenhorn at the University of Idaho in Moscow also looked at Galileo data and found that Europa's ice crust has active plate tectonics. Water may rise to the surface where the plates are pulling apart, while ice may sink to the ocean where one plate slides under another. This would provide a way to seed the water with fresh nutrients.

Telescope Science Institute in Baltimore, Maryland, has been granted time to use Hubble to watch Europa pass in front of Jupiter, allowing his team to search for plumes.

If they are real and predictable, the next challenge will be choosing a spaceship. Europa is much further away than Mars, and Jupiter's powerful magnetic field bathes the moon in radiation that can fry inadequately shielded hardware. NASA has run through several ideas for a Europa mission, and the current front runner is the Europa Clipper. It is a lean craft that would avoid radiation damage by taking a wide orbit of Jupiter, only swooping in close to Europa during a series of fly-bys.

The team is now planning to add an instrument to sample and analyse the plumes. But the Europa Clipper is projected to cost up to \$2 billion, and with NASA's

## "Mini-probes called CubeSats, driven by xenon thrusters, could take a first look at Europa's seawater"

cloudy budget forecast, it may be a while before it can set sail, if ever.

In the meantime, mini-probes called CubeSats, some funded by private groups, could take a first look. Until now, these cheap little satellites have stayed in low-Earth orbit. Earlier this year, two teams announced plans for propulsion systems capable of taking the probes into deep space.

Benjamin Longmier at the University of Michigan in Ann Arbor is developing xenon thrusters for CubeSats, with a first test flight planned for the end of next year. His team had originally targeted Europa as a destination, and the plume has upped the ante. They are already working with NASA to develop tiny instruments that could sample the cloud. If all goes well, the thrusters could be ready in three to five years. "I'm hoping we can be at Jupiter before they launch the Clipper," Longmier says. ■

## Spray bacteria on the desert to halt its spread

AN ODD ally could stall the encroachment of deserts – bacteria. In northern China, the eastern edge of the Qubqi desert is a shifting wasteland of sand dunes. Most of the land is dusty and barren, but bacteria are giving some of it a new lease of life.

Desertification is a big problem for China. Overgrazing by livestock has destroyed much of the fragile layer of lichen, algae and mosses – the cryptobiotic crust – that binds the sand and soil to the ground. If left unchecked, creeping sands can slowly engulf vital infrastructure such as roads and railways. Farmland and even major cities can be swamped by dust storms that began in the desert.

Planting hardy grasses helps keep sand in place, but the wind can still whip away particles between the grasses. So Chunxiang Hu of the Chinese Academy of Sciences's Institute of Hydrobiology in Wuhan has developed an alternative approach. She coats planted dunes with a mixture of photosynthesising cyanobacteria that can thrive in the semi-arid environment.

Grown in nearby ponds, the cyanobacteria are trucked into the

desert every few days and sprayed over the dunes, where they form sticky filaments that hold soil particles in place and prevent them from being blown away. Cyanobacteria get their energy from sunlight via photosynthesis,

and as part of the chemical reactions involved, they absorb carbon from the atmosphere and provide the organic matter the soil needs to be productive.

Hu's long-running trial shows that after eight years, dunes treated with cyanobacteria developed a biological crust nearly 1 centimetre thick when on the shady side of dunes. On the sunny side, the crust

was about half as thick. The topsoil improved where the crust developed, spurring plant growth.

The method is vital if semi-arid regions are going to rebound on a reasonable timescale, says Brian Whitton, an ecologist at Durham University, UK. "Unless you do something to help, you're probably talking centuries for it to recover naturally," he says.

Hu says the cyanobacteria are now being used to shore up the verges of roads and railways in northern China as well as the margins of oases and farmland. Her team plans to seed 133 square kilometres over the next five years (*Environmental Science and Technology*, doi.org/qn9).

People have been trying to use bacteria in this way since the 1980s, says Matthew Bowker, a soil ecologist at Northern Arizona University in Flagstaff. His group is working on a similar method, but hasn't yet used it on a large scale.

Desertification is also a problem in the US, says Bowker, but the issue isn't yet big enough to prompt the country to pour money into projects like Hu's. That might change soon, though. "The western US is getting dusty. With dust come automobile accidents and health issues," he says. "These biological soil crusts are like the living skin of the soil," Bowker says, and they need protecting. **Hal Hodson** ■



Living on the edge

## First teasing glimpse of an alien moon

A NEWLY DETECTED celestial body may be the first moon spotted outside our solar system. Massive, far from its parent planet and with no host star, the candidate "exomoon" is unlike any other known moon.

With so many exoplanets already found, the hunt is on for exomoons. Until now, they had proved elusive. "This is the first serious candidate," says David Kipping of Harvard

University, who was not involved in finding it. The mooted moon and its parent planet drift star-less in the cosmos. This makes them unlikely to host life, but some people expect exomoons in general to be more life-friendly than their planets.

The uncertain status of the weird objects stems from how they were detected. As they passed in front of a distant star, their gravity amplified its light first by 70 times and then an hour later by a smaller amount. David Bennett of the University of Notre Dame in Indiana and his colleagues report that they spotted this "microlensing" effect in 2011, using

telescopes around the world. It fits with a large object passing in front of the star, followed by a smaller one.

Deducing what the objects are is harder. If they are only about 1800 light years from our solar system, then they are a planet about four times the mass of Jupiter and a moon about half the mass of Earth. But the readings also fit another scenario: a small, or failed, star orbited by a Neptune-mass planet

**"Not only would the exomoon be massive, it would also orbit 20 million kilometres from its planet"**

([arxiv.org/abs/1312.3951](http://arxiv.org/abs/1312.3951)).

Detecting the bodies again to determine the truth may be impossible because spotting objects via microlensing requires them to line up in a particular way.

If the planet-moon scenario is correct, then the duo is weird. Not only would the moon be massive, it would also orbit about 20 million kilometres from its planet. For comparison, Jupiter's moon Ganymede, the largest in the solar system, is about 1 million kilometres out and just 2 per cent Earth's mass. Strangest of all, the moon and planet have no host star. **Jacob Aron** ■



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# Designer plant oozes vital fish oils

Andy Coghlan

MOVE over, cod liver oil. A biofuel crop related to cabbages, called camelina, has been genetically modified to produce components of fish oils beneficial for cardiovascular health. The approach could relieve some of the pressure on the oceans.

The flesh of oily fish such as mackerel and salmon, plus the livers of white fish such as cod,

are good sources of omega-3 fatty acids. The most important ones are eicosapentaenoic acid (EPA) – known to reduce the risk of heart disease – and docosahexaenoic acid (DHA) – a lack of which has been linked to visual and cognitive problems.

Breast milk is a good source of both, and our bodies can make small amounts of EPA from another omega-3 called alpha-linolenic acid (ALA) found in nuts

and vegetable oil, which is then converted into DHA.

The richest source of these fatty acids is fish. However, they do not produce the acids themselves. In the wild, they get them from eating smaller fish that have eaten algae, the only organisms that can make appreciable amounts of EPA and DHA. Farmed fish are fed fishmeal enriched with fish oil containing these fatty acids.

Every year, around a million tonnes of oil is extracted from ground-up fish. A tenth of this goes to make fish-oil capsules and the rest is given to farmed fish. But supplies are limited and unsustainable, says Douglas Tocher of the Institute of

Aquaculture at the University of Stirling, UK.

Now Johnathan Napier and colleagues at Rothamsted Research in Harpenden, UK, have created an alternative, sustainable source of EPA and DHA. They took seven genes that algae use to produce these fatty acids and inserted them into the genome of *Camelina sativa*, a plant chosen because its seeds are already rich in ALA. The seeds of the modified plant yielded oil that, when purified, contained around 12 per cent EPA and 14 per cent DHA – the same proportions as in fish oil (*The Plant Journal*, doi.org/qn8).

Napier says that if all goes to plan, the plant oil could be available commercially within 10 years. It could then help replace the fish oil used in capsules or fed to farmed fish. “We’re never going to replace that 1 million tonnes a year from the sea, but if we could supply even 10 per cent, we would significantly take the pressure off fish stocks,” he says.

Tocher says that modified camelina should make it possible for people to consume the World Health Organization’s recommended daily intake of 400 to 1000 milligrams of EPA and DHA. Without the plants, “if everyone ate that much, there would only be enough to supply about half the population, through capsules, fish or both”, he says. ■



Better harvested from fields?

## GPS satellites hint at Earthly dark matter

GPS is handy for finding a route, but it might be able to solve fundamental questions in physics too. An analysis of GPS satellite orbits hints that Earth is heavier than thought, perhaps due to a halo of dark matter.

Dark matter is thought to make up about 80 per cent of the universe’s matter, but little else is known about it, including its distribution in the

solar system. Hints that the stuff might surround Earth come from observations of space probes, several of which changed their speeds in unexpected ways as they flew past Earth. In 2009, Steve Adler of the Institute of Advanced Studies in Princeton, New Jersey, showed how dark matter bound by Earth’s gravity could explain these anomalies.

Ben Harris at the University of Texas at Arlington wondered if dark matter might also affect satellites. “The nice thing about GPS satellites is that we know their orbits really, really well,” he says. From nine months of

data on the satellites in the GLONASS, GPS and Galileo groups, he calculated Earth’s mass as “felt” by each one.

At a meeting of the American Geophysical Union in San Francisco in December, he reported an average figure that was between 0.005 and 0.008 per cent greater than the value for Earth’s mass established by the International Astronomical Union. A disc of dark matter around the equator

191 kilometres thick and 70,000 km across can explain this, he says.

Harris has yet to account for perturbations to the satellites’ orbits due to relativity, and the gravitational pull of the sun and moon. What’s more, preliminary data from NASA’s Juno probe, also presented at the AGU meeting, suggests its speed was as expected as it flew by Earth, casting doubt on the earlier anomalies.

But if Harris’s explanation is correct, satellites could reveal properties of dark matter, such as whether its particles interact with each other. Anil Ananthaswamy ■

**“The extra weight of the Earth may be explained by a disc of dark matter around the equator”**



Left hand of darkness

## Past is a blur if the right side of your brain is faulty

DRAW a line across a page, then write on it what you had for dinner yesterday and what you plan to eat tomorrow. If you are a native English speaker, or hail from pretty much any European country, you no doubt wrote last night's meal to the left of tomorrow night's. That's because we construct mental timelines to represent and reason about time, and most people in the West think of the past as on the left, and the future as on the right.

Arnaud Saj at the University of Geneva, Switzerland, and his colleagues wondered whether the ability to conjure up a mental timeline is a necessary part of reasoning about events in time.

To investigate, they recruited seven Europeans with what's called left hemispatial neglect. That means they have damage to parts of the right side of their brain, limiting their ability to detect, identify and interact with

objects in the left-hand side of space. They may eat from only the right side of a plate, shave just the right side of their face, and ignore numbers on the left side of a clock.

The team also recruited seven volunteers who had damage to the right side of their brain but didn't have hemispatial neglect, and seven people with undamaged brains.

All the volunteers took part in a variety of memory tests. First, they learned about a fictional man called David. They were shown pictures of what David liked to eat 10 years ago, and what he might like to eat in 10 years' time. Participants were then shown drawings of 10 of David's favourite foods, plus four food items they hadn't seen before. Participants had to say whether it was a food that David liked in the past or might like in future. The tests were repeated with items in David's apartment,

and his favourite clothes.

People with hemispatial neglect could remember just as many items as the other two groups of volunteers. However, of these items, significantly fewer were from David's past than his future. They were also more likely to make mistakes about items when they were from the past. In other words, people with hemispatial neglect have trouble imagining the left side of their timeline, and consequently assign past events to the future (*Psychological Science*, doi.org/qgd).

Together these results suggest that concepts of time and space share neural underpinnings in the brain, and that the ability to represent space in the mind's eye is vital to our ability to remember and reason about events that occur along that timeline.

It would be interesting to see whether people with neglect of the right space have trouble with events that are supposed to happen in the future, says Saj, but these kinds of symptoms are rare since the brain areas that represent space are predominantly in the right hemisphere.

"This adds nicely to the growing body of research on spatial representations of time," says Rafael Nunez, who

**"They have trouble imagining the left side of their timeline, and assign past events to the future"**

studies embodiment of time at the University of California in San Diego.

"It gives us an understanding of the representation of time in humans," says Saj. His team will now investigate how people with spatial neglect represent their own perception of space and time. "They get bored less than others in hospital, and the time spent in hospital seems shorter to them," he says. Raj's team will test whether these people experience a compression of "personal time".  
**Helen Thomson ■**

## How to turn back the clock on ageing

IMAGINE if we could turn back time. A team that has identified a new way in which cells age has also reversed it, giving old mice younger bodies.

One way mammalian cells produce energy is via aerobic respiration. This takes place mainly in mitochondria - the powerhouses of cells. While mitochondria carry their own genomes, some cellular components needed for respiration are produced by the nucleus, so the two must coordinate their activities. As we age, mitochondrial function declines, which can lead to disease.

To investigate why, Ana Gomes at Harvard Medical School and her colleagues compared levels of messenger RNA - molecules that convey genetic information around a cell - for the cellular components needed for respiration in the skeletal muscle of 6 and 22-month-old mice.

Levels of mRNA in the nucleus were similar in young and old mice, while levels in the mitochondria decreased with age.

Similar changes were seen in mice lacking a protein called SIRT1. These mice also had higher levels of a protein produced by the nucleus called HIF-1-alpha. This suggests that communication between the nucleus and the mitochondria depends on events involving both these proteins. As long as SIRT1 levels remain high, this type of ageing is kept at bay. But SIRT1 levels are controlled by another molecule called NAD+, and crucially that declines with age, leading to a breakdown in communication.

To see if they could fix this breakdown, the team injected the old mice twice daily for a week with a molecule known to increase NAD+.

At the end of the week, markers for muscular atrophy and inflammation had dropped and the mice developed a muscle type common in 6-month-old mice (*Cell*, doi.org/qpb). "It gives us a new pathway to target that can reverse some aspects of ageing," says Gomes. Laasya Samhita ■



## High-pressure fake volcano proves a spark of inspiration

HOW realistic can you make a model volcano? One team of geologists seems to have gone the extra mile - their crackles with lightning as it erupts.

Volcanic lightning was first documented by Pliny the Younger following the eruption of Mount Vesuvius in AD 79, but no one knows exactly what causes it. One idea, suggested by previous research, is that ash particles slam into each other as they are ejected during an eruption, generating a frictional charge. So Corrado Cimarelli and colleagues at Ludwig Maximilian University in Munich, Germany, built a model volcano to mimic the process.

They took recently ejected ash, including some from the infamous 2010 eruption of Iceland's Eyjafjallajökull, and put it in a tube kept at 100 times atmospheric pressure. They then allowed it to vent through a nozzle into a large tank of air at normal pressure, mimicking the sudden release of material from a volcano.

By filming their miniature eruption with a high-speed camera, the researchers discovered that it generated lightning sparks. The finer the ash particles, the more lightning the team recorded (*Geology*, doi.org/qfz).

Cimarelli says the correlation between the number of lightning bolts and the ash concentration may help us predict the level of disruption to flights after large eruptions. It is this fine ash that is most likely to rise to cruising altitude and pose a threat to air traffic.

## Pacific coral happy as water acidity rises

COULD corals survive ocean acidification against the odds? That's the hope raised by reefs found to be thriving in naturally acidified waters.

Corals use the carbonate ions in water to build their skeletons from calcium carbonate. But ocean acidification caused by climate change reduces the available carbonate ions. Lab studies suggest that this leaves

corals unable to grow and survive. The few known reefs living in naturally acidified water also tend to be unhealthy.

So Kathryn Shamberger of the Woods Hole Oceanographic Institution in Massachusetts and her colleagues were surprised to find that coral reefs around the Palau archipelago in the west Pacific were dense and diverse - even though the pH of the water

and the amount of carbonate were unusually low (*Geophysical Research Letters*, doi.org/qnj).

This suggests that the corals have a way to calcify in more acidic waters, says Philip Munday at James Cook University in Brisbane, Australia, or that they have adapted to low carbonate levels.

Working out just how they do this will be important in understanding the likely impacts of ocean acidification on coral communities elsewhere, he says.

## A safer way of testing embryos

IVF success rates could go up, now that a method of detecting genetic defects in embryos has been improved.

Couples at risk of having a child with genetic abnormalities can reduce this by undergoing IVF and having their embryo genetically sequenced before it is implanted. This usually involves removing a cell from the dividing embryo, which can jeopardise the chances of it implanting.

Now Sunney Xie from Harvard University and his colleagues have developed a way to sequence the maternally inherited genome of the embryo without taking a biopsy. They do this by sampling the polar bodies - cells expelled from the developing egg as it divides (*Cell*, doi.org/qpc). Team member Fuchou Tang of Peking University in Beijing says the method could double the IVF success rate for live birth from around 30 to 60 per cent.

## Metal world has magnetic appeal

THERE'S a metal world in the solar system that may be magnetic, and it might attract a robotic visitor.

The asteroid 16 Psyche is about 200 kilometres across and is made almost entirely of iron and nickel. This composition is similar to Earth's metal core, suggesting that the asteroid is all that's left of a young planet that had its rocky outsides stripped away by collisions. If the core was ever liquid, Psyche could even have remnant magnetism, says Linda Elkins-Tanton at the Carnegie Institution in Washington DC.

During a geophysics conference in San Francisco last month, Elkins-Tanton said her team's proposed mission to Psyche may be our only chance to visit the core of any planet-like body.



## Meteor hits freed Mercury's lava

CRACK open Mercury for a rich lava surprise. Meteors smacking into the planet probably triggered volcanism that had previously been hard to square with its shrunken crust.

When the solar system formed, Mercury was a hot ball of molten material. The tiny planet cooled quickly, shrinking in size and causing its crust to crumple up and form wrinkly ridges. This should have made a tight seal that would have prevented any magma from leaking to the surface.

But in 2008, NASA's Messenger probe, which is orbiting the planet, discovered smooth plains indicative of ancient lava floods. Adding to the puzzle, Paul Byrne at the Carnegie Institution in Washington DC recently found that Mercury shrank even more than previously thought, losing about 11 kilometres from its original girth.

Using Messenger data, Christian Klimczak, also at the Carnegie Institution, and his colleagues have mapped the lava flows and figured out the ages of the surrounding surfaces. They found that volcanism overlapped with rapid contraction for roughly 200 to 300 million years.

At a geophysics meeting in San Francisco last month, Klimczak said meteor impacts could have released built-up pressure in the compressed crust and let lava pour out while the planet was shrinking.



## Mystery of link between flu vaccine and narcolepsy solved

IT WAS unexpected and tragic. Some children are at greater risk of developing narcolepsy – characterised by falling asleep involuntarily – after receiving one particular vaccine against the 2009 swine flu pandemic.

Now we know why: part of a surface protein called HA on the 2009 virus resembles hypocretin, a brain chemical that helps keep people awake. When our body learns to recognise the virus – by encountering it or a vaccine based on it – the immune system can mistake hypocretin for an invader.

It then destroys hypocretin and the cells that make it.

The finding emerged in work by Emmanuel Mignot and colleagues at Stanford University School of Medicine. They studied the activity of CD4 immune cells in narcoleptic children who received Pandemrix vaccine during the pandemic, and in their vaccinated but non-narcoleptic siblings.

In children with narcolepsy, the CD4 cells reacted to hypocretin and to a specific bit of HA unique to the 2009 flu strain. CD4 cells from siblings reacted to neither.

When the researchers gave the children with narcolepsy a 2012 flu vaccine containing the HA protein from the 2009 strain, they saw a surge in CD4 cells against hypocretin – showing that certain flu vaccines can trigger its destruction (*Science Translational Medicine*, doi.org/qnm).

Why only some people's CD4 cells mistake hypocretin for the virus is not yet clear, Mignot says, but it may be that prior exposure to different infections primes each of our immune systems to act in different ways.

## Ice-loving anemone found in Antarctica

TALK about being chilled out: a species of sea anemone has been found on the underside of Antarctica's ice sheets. They are the only marine animals known to live embedded in ice, and no one is sure how they survive.

Frank Rack of the University of Nebraska-Lincoln and colleagues made the surprise find when they drilled through the ice for a geological study. They were using a camera attached to a remote-controlled drill to explore the underside of the Ross Ice Shelf when they discovered large numbers of the white anemones, which they christened *Edwardsiella andrillae*, burrowed inside the ice shelf with only their tentacles dangling into the water.

Marymegan Daly at the Ohio State University analysed samples, but dissecting the creatures revealed little – they looked just like other anemones (*PLoS One*, doi.org/qnk). Other species burrow into surfaces by inching their bodies in or digging with their tentacles, but ice should be too hard, says Daly, who thinks the new species may secrete chemicals to dissolve the ice. It is also unclear how they survive without freezing, and how they reproduce.



MARIE GENEL/PICTURETANK

## Quick injections blow hay fever away

HERE'S something not to be sneezed at. A vaccine against grass pollen, which can cause hay fever, has been shown as safe and effective in a trial of 180 patients. If larger trials are a success, a vaccine could be available within four years.

Hay fever is caused by the immune system's immunoglobulin E (IgE) antibodies reacting excessively to pollen. Therapy to prevent this reaction typically builds up immunity by injecting regular small doses of pollen over several years.

To offer faster relief, Biomay, a firm in Vienna, Austria, has

developed a shot that combines part of a pollen molecule with a hepatitis B protein. The IgE antibodies still get activated, but the protein mobilises other antibodies, which block the IgE ones. This prevents an excessive immune response. Just four injections over a few months should be required, says Angela Neubauer of Biomay.

Another hay fever vaccine, made by Allergy Therapeutics in Worthing, UK, is about to re-enter trials after research was put on hold for five years while severe side effects in one patient were investigated.



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# The virtual, in reality

A new blending of the physical and virtual suggests we could one day live our lives in "mixed reality"

**Sandrine Ceurstemont**

I SLIP on the virtual reality headset, expecting the real world to vanish. Instead, something odd happens: I can still see the room I'm in, but it's slightly blurry. I look down at my body – everything's where it should be. With the click of a button the floor suddenly becomes cluttered with virtual objects and an avatar appears before me, extending her arm to shake my hand. She's trying to blend in with the real people but I can tell she's computer-generated. Then everything goes black and white, and suddenly the entire scene feels real.

This is a new type of augmented reality (AR) – called mixed reality (MR). A system that creates it is being demoed for the first time at an event at the graphics company Inition in London. The idea is to show how seamlessly the physical and digital worlds can be blended.

The setup uses an Oculus Rift headset, known for its ability to immerse people in virtual reality.

But Will Steptoe of University College London has designed an attachment that pipes in real-time video of the real world, then augments that view. "In tablet-based AR, the user holds a window on to the mixed reality so there is a clear disconnect between what is physical and what is virtual," says Steptoe. With the new rig, a person sees the real world from their normal, embodied perspective (see video at [bit.ly/mreality](http://bit.ly/mreality)).

To blend the two spaces, Steptoe's system applies filters

available in image editing software to the combined world. The filters make everything appear slightly cartoonish, but they hide the imperfections of virtual objects, making it hard to tell what's real and what's virtual.

Steptoe thinks the system will transform multiplayer gaming, allowing faraway friends to beam into a shared reality in which virtual players are indistinguishable from people. It could also work for telepresence systems, which allow colleagues

## Out-of-body experiences

Despite the rise of videoconferencing and apps like FaceTime, virtual systems still cannot match meeting in person. A European Union project called Beaming aims to change that by placing people in a virtual location where they can interact in a way that feels just like the real world.

Will Steptoe's system is one way of doing this (see main story), but other

projects are already giving people a physical form at their destination, allowing them to "inhabit" the body of a robot, say. New insights into how the brain represents the body are helping to make such embodiment more realistic. Beaming is focusing on systems for remote teaching, virtual conferences and rehab for patients in remote areas.

in separate places to work together in a common space. Current systems still require interaction through a screen, which limits the experience, says Steptoe. "In 2D, you can't truly share a space."

The prototype system has its flaws: its object-recognition software keeps track of the floor and walls but cannot locate people

**"In mixed reality, a person still sees the real world from their normal, embodied perspective"**

or objects in three dimensions. This causes a discrepancy when, say, you wave your hand in front of you. If it passes between you and the avatar, it should appear in front of the avatar, but instead your hand is obscured (see picture). Steptoe says mounting a Kinect depth camera on the headset should fix the problem.

Still, inhabitants of MR can manipulate virtual objects. The most compelling of these, Steptoe says, is a virtual display. With the push of a button, you can summon up a device in the palm of your hand, allowing you to browse the internet without having a real device. "In this display, you can simulate other displays," says Steptoe. "You can mimic a tablet or a mobile phone and get it to hover anywhere."

In the future, Steptoe envisions the MR setup will work on a more lightweight headset like Google Glass, as its small display might prove less intrusive than the Oculus Rift one, which covers the wearer's face. And improvements in graphics and display resolution should make the MR experience more coherent.

Back in the real world, I reach for my cellphone but realise the battery is dead. I catch Steptoe immersed in his headset, browsing the *New Scientist* website on a virtual computer screen. "You can't forget it like an iPad, or run out of batteries," he says with a smile. ■

# Game on, computer

AIs are taking on humans in a contest to create engaging video games

ROBOTLOVESKITTY/LUDUM DARE



Could AIs match this kind of surreality?

**Douglas Heaven**

MAKING games that are engaging and creative is always a challenge. Could an AI outdo humans?

That's what Mike Cook of Goldsmiths, University of London, is investigating with Angelina, his AI game designer. Last month, Angelina submitted its first entry to the game-making event Ludum Dare.

"I can safely say that the game created by Angelina has better gameplay and graphics than several other entries," says Alan Zucconi, a game developer and researcher at Imperial College London who also took part.

Cook is developing Angelina as part of his work on computational creativity – looking at whether software can be made to do things that would be considered creative if done by a human. Angelina has

created many games in controlled situations, but this is the first time an AI has competed against humans in such a setting.

Ludum Dare is a game jam, held four times a year, in which developers create games from scratch over a weekend. It has been growing in popularity, with 2064 entries to this latest event.

"Making a game is a process that requires months, often years, of work," says Zucconi. Game jams instead encourage people to see what they can create in a few hours.

At the end, the games are posted online and everyone who took part is asked to vote for their favourite. One of the judging criteria is how well the game reflects a theme. This year's was "You Only Get One".

Most entries incorporated this theme by making it a feature of

the gameplay, giving players only one life or one item. For example, in Zucconi's entry, *Orbitalis*, you have one chance to launch a projectile into the orbit of a gravity well. In another game, called *Cat Gentlemans Play: Insult Spinner 10 Cents* (pictured) and created by Calvin Goble of two-person studio RobotLovesKitty,

**"The game created by the AI had better gameplay and graphics than several other entries"**

you have one opportunity to settle a duel between glove-slapping, cat-headed Victorians.

In Angelina's game, *To That Sect*, the player must collect one type of object and avoid another. The rules are a variation of a pre-coded template, but the rest, including the aesthetic choices,

is the work of the AI. The game is set in a place with blood-red walls and unsettling music, and the atmosphere this creates is striking. Voters have described the result as "creepy" and having "a weird little unsettling vibe" – positives from the point of view of creating an engaging experience.

One thing Angelina falls down on is the theme. The game does not reflect it particularly well, Cook admits.

Angelina starts by identifying a key noun in the phrase and using that to search an online database for associated words and images. In this case, it looked up associations for the word "one".

"That was way too general," says Cook. The database gave about 240,000 associations. If it finds too many occurrences, Angelina throws out the first word and picks a related one. This time, it chose "founder" – related to "one" in the sense of being the first or the originator.

Angelina then expands the interpretation by looking up this word in a database of metaphor. This gave terms such as "charmed", "tombs" and "disgruntled child", which it then uses to search for suitable colours, images, objects and music.

A future version of Angelina will be able to adapt its gameplay to suit the theme too. Cook is aiming for game-design software that invents things a human designer would not think of. Entering game jams is part of achieving that goal. "Someday an AI will do our job better than us," says Goble.

The abstract themes common in Ludum Dare are a good starting point, says Cook. He has also recently got hold of an Oculus Rift virtual-reality headset, which will make visiting Angelina's game worlds even more compelling.

"Eventually Angelina will enter a game jam with an idea that surprises people. It won't be because I gave it better templates, it'll be because I gave it more freedom," he says. ■

## Battery-in-a-box backpack charges gadgets on the go

WEARABLE computers are on their way and soon you'll be able to power them yourself. A new type of nano-generator converts movement from walking into electricity to keep your gadgets going.

Wearable generators often use electromagnetic induction, which is efficient but requires bulky, heavy magnets. Smaller, lighter piezoelectric generators use ceramic crystal to convert pressure into voltage, but they are expensive and a lot less efficient.

Now Zhong Lin Wang and colleagues at the Georgia Institute of Technology, Atlanta, have captured the electricity generated from bringing two differently charged surfaces into contact, then separating them. This is called the triboelectric effect, the same process that causes static electricity shocks.

To use triboelectric nano-generators (TENGs) to create a power-generating backpack, the team coated one side of plastic cards with aluminium film filled with nano-scale pores. The other side had copper film that had an array of polymer nanowires on its surface. They then arranged the cards in a rhombus, like a collapsible cardboard box (see diagram).

Every step you take makes the box collapse in on itself so the two sides

of the cards come into contact. Nanowires and pores interlock, increasing the contact area and, correspondingly, the amount of charge that builds up. After each collapse, a spring makes the sides jump back into shape, separating the cards and creating a potential difference that drives current through a circuit. The TENGs are about 50 per cent efficient, comparing well to piezoelectric systems, which struggle to get beyond 8 per cent.

In tests the 2 kilogram backpack generated over 1 watt of power

**"The 2 kilogram backpack generated 1 watt of power during walking, enough electricity to run 40 LEDs"**

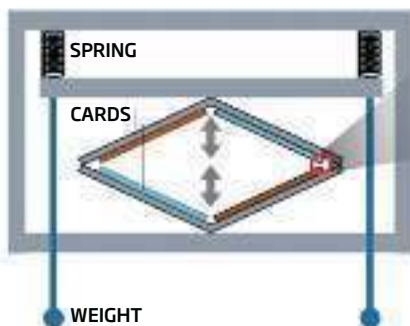
during walking, enough to run 40 LEDs simultaneously (*ACS Nano*, doi.org/qhz). Existing backpack generators based on electromagnetic induction produce 5 to 20 watts, but weigh 10 times as much.

A separate experiment used the same method to charge a lithium-ion battery (*ACS Nano*, doi.org/qhzqx). Wang envisions TENGs built directly into sensors, phones and wearable computers. His team recently built a stand-alone generator capable of powering a smartphone.

MacGregor Campbell ■

### Have backpack, will charge batteries

The body's movement causes the weights to bounce compressing the box, while the springs return it to its original shape



Aluminium nanopores  
Copper nanowires

The nanowires and pores interlock, increasing contact area and creating the charge

## ONE PER CENT



DAYZ

### Moral zombie game DayZ takes off

A video game has made a huge splash: the unique survival shooter "DayZ" sold over 172,000 copies in just 24 hours after its release on 16 December by Bohemia Interactive of Prague in the Czech Republic. Zombies are always a threat and so is disease and starvation. The real interest stems from its unusual premise. Players compete for resources like medicine, food and weapons but crucially, when a player dies, they lose everything and must start from scratch.

**"The current storage by the government of bulk metadata creates potential risks to public trust, personal privacy, and civil liberty"**

A White House report into the NSA's surveillance of US citizens released on 12 December called for wholesale changes to the way the agency collects phone data

### Now your fridge is on the net

Sharks, pedometers, fridges, radiation sensors. All these things, and many more, can now talk to the internet. Thingful.net, launched last month, is a map-based interface that aims to unlock the potential of all that chatter. Thingful collates information from the Internet of Things data sets and displays it on a map. For example, you can find tagged sharks and follow their progress as they explore the oceans.

### Laugh and the world laughs with you

It is funny how funny a stick man can be. Harry Griffin and a team at University College London have captured how people move their bodies when they laugh and transferred it to simple avatars. The laughing stick men are part of Ilhaire, a European project that aims to make chatbot avatars laugh more realistically. It will help cartoons video game and CGI movie animators make their characters more believable.

## INSIGHT Online shopping



Clothes will hug every contour

# Perfect fashion by numbers

Virtual fitting rooms and body scans will make ordering clothes foolproof

IT'S the curse of online clothes shopping. You come across a shirt you simply must have, only to find that what you receive doesn't fit despite being in your size. How can you order clothes with confidence when you can't try them on?

A new wave of start-ups are finding clever ways to address the problem. Virtual fitting rooms are one solution. The London-based firm Fits.me, founded in 2010, creates them for brands such as Hugo Boss and Superdry. The company teamed up with researchers at several universities to build robot mannequins that can adjust their proportions to match just about any set of human measurements.

To set up the fitting room, developers run through most of the size-shape combinations the dummies can assume, and take several thousand photos of them dressed in every available size of each shirt or dress, from extra small to XXXL. Software then looks at measurements keyed in by shoppers, such as height, arm length and collar size, and displays the mannequin photo set that best matches their body trying on clothes in sizes the user is interested in. Potential problems - where a shirt is too tight, for example - are flagged up. In a trial

involving the British clothing brand Henri Lloyd, the return rate for garments was 4.5 per cent for a group of customers who used the software, compared with 15.3 per cent for a group that did not.

Another start-up wants to redefine our system for sizing clothes. "We think it's kind of ridiculous that, despite all of us coming in so many different shapes and sizes, we're stuck with small, medium and large," says Matt Hornbuckle, co-founder of Stantt, a New Jersey-based firm that

## "Kinect sensors record 1.5 million body contour points, for the tailoring to be outsourced to China"

manufactures men's shirts to fit 70 sets of body measurements.

To arrive at these, Hornbuckle hired another company to analyse 200,000 measurements of men's bodies, looking for correlations. It found that three numbers - chest size, waist and sleeve length - are enough to predict which of those 70 options would best fit someone. Stantt's first shirts, priced at \$98, will ship in May. The company's recent Kickstarter campaign raised \$120,000 and collected

pre-orders for around 1000 shirts - a sign, Hornbuckle says, that customers are eager for change. "The retail store itself, and how they operate, is becoming obsolete," he says.

Arden Reed, a New York-based start-up, wants to take this personalised approach a step further with its bespoke suits. Six months ago, the company began sizing customers using a remodelled truck equipped with a 3D body scanner. It has 14 Kinect sensors that record around 1.5 million body contour points in a process lasting 10 minutes. The readings are converted into measurements for the tailoring to be outsourced to China, and customers receive their suit six weeks later for between \$500 and \$1500. They can order more in the same size online.

The scanner has ventured to Boston and Washington DC, and will debut in Miami this year. "The truck concept allows us to not limit ourselves to a store," says Carlos Solorio, Arden Reed's co-founder. Stantt and Arden Reed now want to expand their range to include women's clothing.

"There's no question that virtual fitting tools will become a standard part of online shopping," says Fits.me CEO Heikki Haldre. **Rachel Nuwer** ■

## Log your routine and ditch those inane passwords

SICK of having to remember a zillion passwords? Logging in using obscure facts about your everyday life could be the answer.

Called narrative authentication, the system was developed by Carson Brown and colleagues at Carleton University in Ottawa, Canada. It uses software running in the background on a computer or smartphone to log your activities. The system can, for example, note how long you spent playing a video game, which one it was and the time you stopped. It also logs videos you posted to Facebook and any check-ins you made on social networking sites such as Foursquare. You can also add your own events to the narrative, such as when you passed your driving test.

Once set up, the system will generate questions based on its records - making logging in a little like playing a text-based adventure game, according to Brown. It's fun, he says, and nowhere near as boring as entering passwords. The work was first presented at a security conference in September.

Robert Ghanea-Hercock, chief security researcher at BT's lab in Ipswich, UK, says the system could be a valuable addition to our range of login strategies. "Humans are better equipped to process stories than random pass phrases," he says. **Paul Marks** ■



ERIC GARAU/PICTURETANK

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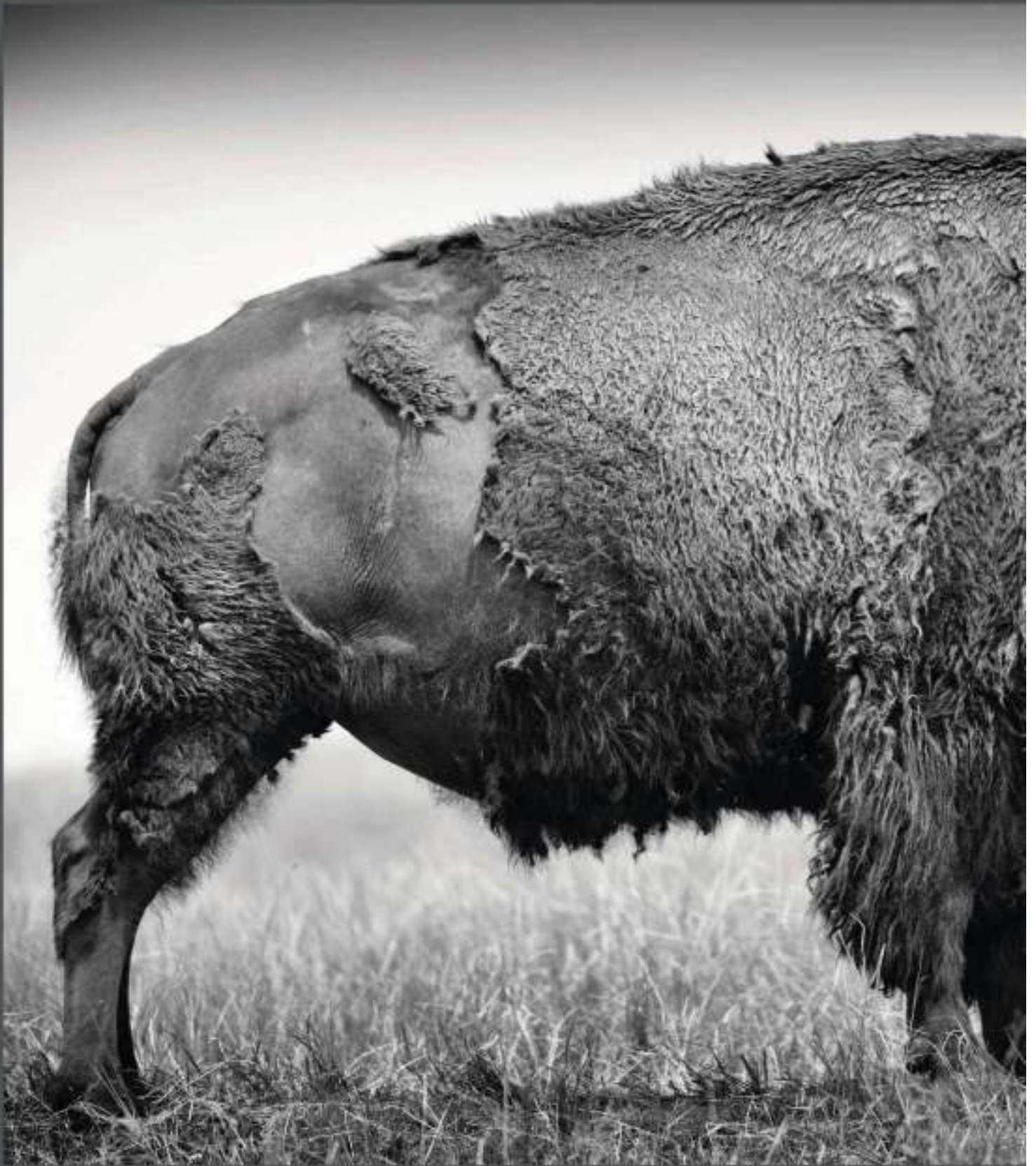


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\*Based on published fastest print speeds for the HP X551dw and X576dw compared to laser and inkjet colour desktop MFPs <math>\leq 800</math> and printers <math>\leq 650</math> validated by WirthConsulting.org Jan. 2013. Comparison based on manufacturers' published specs of fastest available colour mode as of Mar 2012. Includes colour laser MFPs <math>\leq 800</math> and colour lasers <math>\leq 650</math> available Mar 2012 based on a model share by IDC Q1 2012 and HP testing in fastest colour mode. Test file: ISO 24/34 from sample four-page category. For more info: [hp.com/go/printerclaim](http://hp.com/go/printerclaim). Cost per page (CPP) claim based on the majority of colour laser MFPs <math>\leq 800</math> excluding VAT, colour laser printers <math>\leq 650</math> excluding VAT, Mar 2012. For details, see [hp.co.uk/officejetprox](http://hp.co.uk/officejetprox). © 2013 Hewlett-Packard Development Company, L.P.





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