

The Economist

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The next frontier

When thoughts control machines



The message of protests in Iran

Blue-state Republicans: no right left

Education lessons from Pakistan

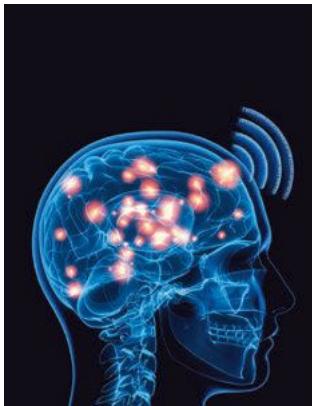
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**On the cover**

Brain-computer interfaces may change what it means to be human: leader, page 7. Innovations in neurotechnology sound like the stuff of science fiction. Sorting the reality from the hype. See *Technology Quarterly*, after page 34

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Protesters took to the streets in more than 70 towns and cities in **Iran**, some complaining about the economy, others wishing death on the president, Hassan Rouhani, and the supreme leader, Ayatollah Ali Khamenei. The clerical regime organised counter-demonstrations that attracted tens of thousands. At least 20 people have been killed, and many more arrested.

Ethiopia announced that it would release hundreds of political prisoners and close a detention centre where people were allegedly tortured. Amnesty International said this "could signal the end of an era of bloody repression".

North Korea said it might send a team to the Winter Olympics in South Korea. The two countries re-opened a defunct hotline. Kim Jong Un boasted that he had a nuclear button on his desk and could strike anywhere in America. Donald Trump retorted that he, too, had a button: a "bigger and more powerful" one.

Mr Trump repeated a long-standing gripe that **Pakistan** harbours terrorists America is fighting in Afghanistan, adding that it did not deserve American aid. A Pakistani official who clearly understood Mr Trump's complaint said it was "incomprehensible".

The new year saw the implementation of new trade measures in **China**: a ban on all sales of ivory and on imports of low-grade waste for recycling. Environmentalists may cheer, but not donkeys—China also cut tariffs on imports of the animals' skins, which is likely to fuel demand for them as an ingredient in traditional Chinese medicine.

A court in the Chinese city of Tianjin sentenced a **human-rights** activist, Wu Gan, to eight years in prison, the harshest punishment imposed during a crackdown on such activists that began in 2015.

Catalonia voted for a new parliament to replace the one

dismissed by **Spain's** prime minister, Mariano Rajoy, after it declared independence. Unfortunately for Mr Rajoy, Catalans returned the separatists to power again in the election on December 21st.

Italy's president dissolved parliament and set an election date, March 4th.

Russia's authorities banned Alexei Navalny, the country's most prominent opponent to President Vladimir Putin, from standing in the presidential election due in March, citing a trumped-up graft conviction.

Thousands of people in **Peru** protested against the pardoning of Alberto Fujimori, a former president who had served less than half of a 25-year jail sentence for corruption and human-rights abuses. The current president, Pedro Pablo Kuczynski, said he had pardoned the 79-year-old on health grounds. But he made the decision three days after Mr Fujimori's son and nine other legislators from his party abstained on a vote to impeach Mr Kuczynski.

Salvador Nasralla conceded defeat in **Honduras's** presidential election, held in November, after America recog-

nised the incumbent president, Juan Orlando Hernández, as the victor. The Organisation of American States had said that irregularities cast doubt on the result and called for new elections.

The decision by **Orrin Hatch** to step down from his Senate seat in Utah prompted speculation that Mitt Romney would run to replace him. Donald Trump had wanted Mr Hatch to stay on. Mr Romney, a former presidential candidate, could become a focal point for Republicans who are disgruntled with Mr Trump.

India's feuding **Ambani brothers** reached a deal on their telecoms assets. In what amounts to a defeat in an aggressive price war, Anil sold Reliance Communications to Mukesh's Reliance Jio, which entered the market by offering free calls and data packages. The deal hands back full control of the telecom company to the older brother, 12 years after Anil took charge.

SoftBank secured a deal to take a stake in **Uber**. The Japanese technology group will own 15% of the ride-hailing firm (the total holding of the consortium it heads is over 17%). The investment values

Uber at \$48bn, lower than the \$68bn placed on it after a recent round of fundraising.

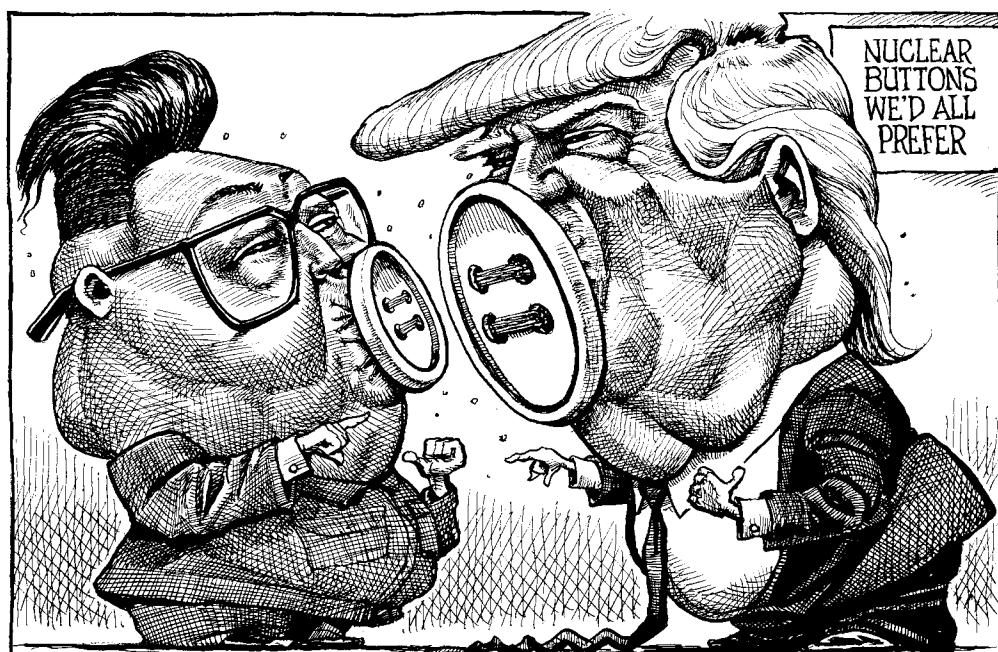
Spotify, a music-streaming firm, reportedly filed documents that could see it list in New York this year.

It was another volatile week for trading in **bitcoin**, which plunged in late December from a high of more than \$19,500 to below \$12,000. It recovered ground this week after a report that Peter Thiel, a famed Silicon Valley investor, had bet on the cryptocurrency.

Glitches were discovered in the design of **computer chips** that could give hackers access to passwords and encryption keys. The flaws are industry-wide. Intel said it was working with AMD and other rivals to resolve the problems, which could involve more than issuing the usual software patch.

There was not a single plane crash involving a **passenger jet** in 2017, according to the Aviation Safety Network, the first time that has happened since 1957. The number of deaths resulting from civilian aircraft accidents was just 44.

Other economic data and news can be found on pages 64-65



The background of the advertisement is a wide-angle photograph of a mountainous region. In the foreground, there's a small, rustic stone hut with a tiled roof situated on a grassy hillside. The middle ground shows steep, rocky slopes covered in patches of green vegetation. The background features a range of majestic, snow-capped mountains under a bright blue sky with a few wispy clouds.

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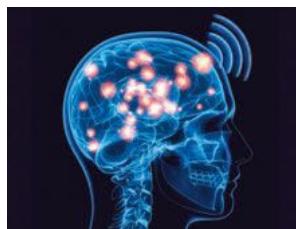
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The next frontier

Brain-computer interfaces may change what it means to be human



partly thanks to electrodes, implanted in his right arm, which stimulate muscles. But the real magic lies higher up. Mr Kochevar can control his arm using the power of thought. His intention to move is reflected in neural activity in his motor cortex; these signals are detected by implants in his brain and processed into commands to activate the electrodes in his arms.

An ability to decode thought in this way may sound like science fiction. But brain-computer interfaces (BCIs) like the BrainGate system used by Mr Kochevar provide evidence that mind-control can work. Researchers are able to tell what words and images people have heard and seen from neural activity alone. Information can also be encoded and used to stimulate the brain. Over 300,000 people have cochlear implants, which help them to hear by converting sound into electrical signals and sending them into the brain. Scientists have “injected” data into monkeys’ heads, instructing them to perform actions via electrical pulses.

As our Technology Quarterly in this issue explains, the pace of research into BCIs and the scale of its ambition are increasing. Both America’s armed forces and Silicon Valley are starting to focus on the brain. Facebook dreams of thought-to-text typing. Kernel, a startup, has \$100m to spend on neurotechnology. Elon Musk has formed a firm called Neuralink; he thinks that, if humanity is to survive the advent of artificial intelligence, it needs an upgrade. Entrepreneurs envisage a world in which people can communicate telepathically, with each other and with machines, or acquire superhuman abilities, such as hearing at very high frequencies.

These powers, if they ever materialise, are decades away. But well before then, BCIs could open the door to remarkable new applications. Imagine stimulating the visual cortex to help the blind, forging new neural connections in stroke victims or monitoring the brain for signs of depression. By turning the firing of neurons into a resource to be harnessed, BCIs may change the idea of what it means to be human.

That thinking feeling

Sceptics scoff. Taking medical BCIs out of the lab into clinical practice has proved very difficult. The BrainGate system used by Mr Kochevar was developed more than ten years ago, but only a handful of people have tried it out. Turning implants into consumer products is even harder to imagine. The path to the mainstream is blocked by three formidable barriers—technological, scientific and commercial.

Start with technology. Non-invasive techniques like an electroencephalogram (EEG) struggle to pick up high-resolution brain signals through intervening layers of skin, bone and membrane. Some advances are being made—on EEG caps that

can be used to play virtual-reality games or control industrial robots using thought alone. But for the time being at least, the most ambitious applications require implants that can interact directly with neurons. And existing devices have lots of drawbacks. They involve wires that pass through the skull; they provoke immune responses; they communicate with only a few hundred of the 85bn neurons in the human brain. But that could soon change. Helped by advances in miniaturisation and increased computing power, efforts are under way to make safe, wireless implants that can communicate with hundreds of thousands of neurons. Some of these interpret the brain’s electrical signals; others experiment with light, magnetism and ultrasound.

Clear the technological barrier, and another one looms. The brain is still a foreign country. Scientists know little about how exactly it works, especially when it comes to complex functions like memory formation. Research is more advanced in animals, but experiments on humans are hard. Yet, even today, some parts of the brain, like the motor cortex, are better understood. Nor is complete knowledge always needed. Machine learning can recognise patterns of neural activity; the brain itself gets the hang of controlling BCIs with extraordinary ease. And neurotechnology will reveal more of the brain’s secrets.

Like a hole in the head

The third obstacle comprises the practical barriers to commercialisation. It takes time, money and expertise to get medical devices approved. And consumer applications will take off only if they perform a function people find useful. Some of the applications for brain-computer interfaces are unnecessary—a good voice-assistant is a simpler way to type without fingers than a brain implant, for example. The idea of consumers clamouring for craniotomies also seems far-fetched. Yet brain implants are already an established treatment for some conditions. Around 150,000 people receive deep-brain stimulation via electrodes to help them control Parkinson’s disease. Elective surgery can become routine, as laser-eye procedures show.

All of which suggests that a route to the future imagined by the neurotech pioneers is arduous but achievable. When human ingenuity is applied to a problem, however hard, it is unwise to bet against it. Within a few years, improved technologies may be opening up new channels of communications with the brain. Many of the first applications hold out unambiguous promise—of movement and senses restored. But as uses move to the augmentation of abilities, whether for military purposes or among consumers, a host of concerns will arise. Privacy is an obvious one: the refuge of an inner voice may disappear. Security is another: if a brain can be reached on the internet, it can also be hacked. Inequality is a third: access to superhuman cognitive abilities could be beyond all except a self-perpetuating elite. Ethicists are already starting to grapple with questions of identity and agency that arise when a machine is in the neural loop.

These questions are not urgent. But the bigger story is that neither are they the realm of pure fantasy. Technology changes the way people live. Beneath the skull lies the next frontier. ■

Peru

The pardoner's tale

Presidential powers should not be used to undermine the rule of law



ON THE evening of December 24th, as Peru was preparing for its Christmas dinner, Pedro Pablo Kuczynski, the country's president, bestowed an unexpected present on a jailed predecessor, Alberto Fujimori: a pardon. This came just three days after Mr Kuczynski hung on to his job thanks to ten *fujimorista* legislators led by Alberto's son, Kenji, who abstained in a vote on an attempt to impeach him for links to Odebrecht, a tainted Brazilian construction firm. Mr Kuczynski insisted that the pardon was for "humanitarian reasons". Few Peruvians believe him. More likely, it was a grubby political deal that bodes ill for his country (see page 27). Many of his allies feel as conned by this pardon as people who bought fake relics from Chaucer's pardoner in "The Canterbury Tales".

More than 15 years after the collapse of his decade of autocratic rule, Alberto Fujimori continues to divide his country. His supporters say he saved Peru from hyperinflation and Maoist terrorism and set it on the path of sustained economic growth. For his critics, he was a dictator who shut down congress, destroyed checks and balances, engaged in bribery and was complicit in a death squad. Both are right. But what is indisputable is that Mr Fujimori broke the law. He was found guilty in trials that were legally impeccable. His imprisonment was a landmark for Latin America, a message that all should be equal before the law in a region where the norm has too often been impunity for the rich and powerful.

Mr Fujimori has served more than ten years in jail (though that is less than half his sentence). He is 79, has a heart condition and is in remission from cancer of the tongue. Mr Kuczynski's government has been dogged by the vengeful attitude of Keiko Fujimori, Alberto's daughter, who narrowly lost the past

two elections and who was behind the (disproportionate) attempt to impeach the president.

In principle a humanitarian pardon could have been part of a coherent plan of national reconciliation. But that was not Mr Kuczynski's approach. The pardon was rushed, and backed by questionable medical evidence (there is no reason to think that Mr Fujimori is at death's door). The government made no effort to consult the victims of Mr Fujimori's rule, nor to seek a genuine apology from him. Alternatively, a pardon could have been more Machiavellian: a bargaining chip that Mr Kuczynski might have traded for *fujimorista* support for the institutional reforms—of the judiciary, the civil service and the political system—that Peru badly needs. There is no sign of that either. Instead, it looks like a sordid bargain to let the president survive.

A hostage of the Fujimoris

From the start, Mr Kuczynski, a businessman and economist, was an accident waiting to happen. He has neither political skills nor, seemingly, any awareness of his lack of them. He won office only because of anti-*fujimorista* sentiment; in defending himself from impeachment he railed against a *fujimorista* "coup". Yet he has now made himself the *fujimoristas'* hostage: few of his original supporters will now defend him, especially if it transpires that his dealings with Odebrecht involved more than an undeclared conflict of interest. He would have done better to resign and trigger an early election.

The pardoning of Mr Fujimori came days after a similar effort by Michel Temer, Brazil's stand-in president. He abused the traditional Christmas exercise of presidential indulgence to try to free political cronies jailed for corruption, but the supreme court stood in his way. Thanks to the efforts of prosecutors and judges in places like Brazil and in cases like Mr Fujimori's, Latin America is starting to enjoy the rule of law. Presidents should not use the power of pardon to undermine it. ■

Protests in Iran

Berating the tyrants of Tehran

Iranians demand, and deserve, a less oppressive regime



BIG things often have small beginnings. In the case of the protests engulfing Iran, it was a steep rise in the price of eggs. That was why hundreds of people first took to the streets in Mashhad, Iran's second city, on December 28th. They demanded the resignation of Hassan Rouhani, the reformist president, for failing to bring prosperity to most Iranians.

The protests quickly spread to more than 70 towns and cities, attracting a broader swathe of malcontents, mostly young (see page 30). Over 20 people have been killed; hundreds more

have been arrested. The authorities have shut down messaging apps and social-media websites. They have blamed foreigners, absurdly, for the unrest and they are threatening a violent clampdown. Protesters are now calling not only for Mr Rouhani to go, but for Iran's clerical leaders, who hold far more real power, to surrender it. They also denounce the regime's armed protectors, the Islamic Revolutionary Guards. Iranians are fed up with rising living costs, endemic corruption, and political and social repression.

Is this the start of something even bigger? It is impossible to know. But it is already clear that the protests hold three damning messages for Iran's regime. The first concerns its aggressive foreign policy. The Guards have spent billions of dollars in re-

cent years supporting armed groups in Gaza, Lebanon and Yemen, as well as propping up a blood-soaked dictator in Syria. As Iran has filled the vacuum created by America's unwillingness to exert hard power in the Middle East, it has extended its influence and tormented its big Sunni rival, Saudi Arabia.

To many outsiders this policy has seemed a stunning success. However, the protests are a blow to Iran's adventurism. A draft budget leaked last month would increase funding for the Guards, while slashing subsidies for the poor. The protesters are having none of it: "Leave Syria, remember us!" they shout. "Not Gaza, not Lebanon, my life for Iran!" The regime is not about to pull back from its region but, increasingly, its ambitions face limits at home.

The second blow is to the reformist faction headed by Mr Rouhani—and to all those who have pinned their hopes on him as the architect of a sort of Iranian *glasnost*. Optimists always think that Iran is about to behave better. When the regime signed a deal in 2015, under which it curbed its nuclear programme in exchange for a partial lifting of sanctions by America and other foreign powers, Barack Obama's aides predicted that this would empower Iranian reformers. Mr Rouhani himself heralded it as a fresh start. Yet the deal was about curbing Iran's illicit nuclear ambitions, not curing its oppressive state (one reason President Donald Trump should even now not pull America out of the nuclear accord). The easing of sanctions helped the Iranian economy grow, but enough of them remain to make outsiders wary of dealing with it. The promised economic benefits have not trickled down. By one estimate, average Iranians have become 15% poorer over the past decade.

To fix the economy Mr Rouhani would need to confront the Revolutionary Guards, who loom over everything from car-making to construction and who use their political power to enrich their commanders and impoverish Iranians. Many

charities and firms connected to them ignore the taxman and refuse to open their books to government scrutiny.

Yet the demonstrations leave Mr Rouhani in a sort of no-man's-land. On the one hand, he is too weak to prevail over the Guards or to defeat his powerful conservative enemies in the regime, who may have encouraged the original marches in Mashhad. On the other, he and his failing economic policy have lost the confidence of working-class Iranians, who gave him crucial support in last year's election.

Baseejed

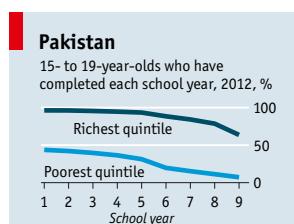
Optimists note that complaints about corruption, unemployment and the lack of prospects fuelled the "Arab spring" uprisings in 2011. Unlike the Green Movement, which rocked Iran's clerical establishment in 2009 with huge rallies in the capital demanding the overturning of a fishy presidential election, today's demonstrations have sprung up in rural provinces, long viewed as more conservative. And though they have been smaller than in 2009, they have been more intense. "Death to [Ayatollah Ali] Khamenei," chant some—risking harsh punishment for disrespecting the supreme leader.

All the same, they may well fail. The regime has all the guns and all the torture cells, and is not squeamish about using them. The Green Movement was crushed by the Revolutionary Guards' brutal baseej militia and mass arrests and torture by the secret police. But the third lesson of today's protests—and the hardest for the regime to accept—is that repression cannot quell popular anger permanently. The last crackdown was only eight years ago, and already Iranians are out on the streets again. Mr Trump, who seldom seems to care much about human rights, was right to call the regime "brutal and corrupt" and to suggest that Iran needs a change. Iranians are far more moderate than the rulers who rob and oppress them. Some day, they may get the government they deserve. ■

Education

Pupil power

Pakistan's school reforms hold lessons for other developing countries



WHEN Pakistan's schools attract global attention, it is often as a backdrop to violence. In October 2012 a masked gunman from the Tehreek-e-Taliban Pakistan boarded a school bus and shot Malala Yousafzai in the head, neck and shoulder. Two years later, and six days after Ms Yousafzai received the Nobel peace prize, terrorists from the same umbrella group killed 141 people, nearly all pupils, at an army-run school in Peshawar, one of the deadliest attacks on a school in any country. According to the Global Terrorism Database kept by the University of Maryland, 867 educational institutions were attacked by Islamists between 2007 and 2015, often because these places had the temerity to teach science—or worse, educate girls.

Such attacks have added to problems that schools in Pakistan, the world's sixth-most-populous country, share with those in other poor states—irrelevant curriculums, high rates of dropout as children (especially girls) get older, and woeful

teaching. Yet the spectre of violence may have obscured another development: the emergence of Pakistan as perhaps the world's largest laboratory for education reform (see page 13).

Pakistan has long been home to a flourishing market of low-cost private schools, as parents have given up on a dysfunctional state sector and opted instead to pay for a better alternative. In the province of Punjab alone the number of these schools has risen from 32,000 in 1990 to 60,000 by 2016. (England has just 24,000 schools, albeit much bigger ones.)

More recently, Pakistani policymakers have begun to use these private schools to provide state education. Today Pakistan has one of the largest school-voucher schemes in the world. It has outsourced the running of more government-funded schools than any other developing country. By the end of this year Punjab aims to have placed 10,000 public schools—about the number in all of California—in the hands of entrepreneurs or charities. Although other provinces cannot match the scope and pace of reforms in Punjab, which is home to 53% of Pakistanis, Sindh and Khyber Pakhtunkhwa are implementing some similar changes on a smaller scale. ►

► The results are promising—and they hold lessons for reformers in other countries. One is that “public-private partnerships” can improve children’s results while costing the state less than running schools itself. A paper published in August by the World Bank found that a scheme to subsidise local entrepreneurs to open schools in 199 villages increased enrolment of six- to ten-year-olds by 30 percentage points and boosted test scores. Better schools also led parents to encourage their sons to become doctors not security guards, and their daughters to become teachers rather than housewives.

Other new research suggests that policymakers can also take simple steps to fix failures in the market for low-cost private schools. For example, providing better information for parents through standardised report cards, and making it easier for entrepreneurs to obtain loans to expand schools, have both been found to lead to a higher quality of education.

Another, related lesson is that simply spending more public money is not going to transform classrooms in poor countries. The bulk of spending on public education goes on teachers’ salaries, and if they cannot teach, the money is wasted. A re-

vealing recent study looked at what happened between 2003 and 2007, when Punjab hired teachers on temporary contracts at 35% less pay. It found that the lower wages had no discernible impact on how well teachers taught.

Such results reflect what happens when teachers are hired corruptly, rather than for their teaching skills. Yet the final and most important lesson from Pakistan is that politicians can break the link between political patronage and the classroom. Under Shahbaz Sharif, Punjab’s chief minister, the province has hired new teachers on merit, not an official’s say-so. It uses data on enrolment and test scores to hold local officials to account at regular high-stakes meetings.

Must try harder

Shifting from “the politics of patronage” to “the politics of performance”, in the words of Sir Michael Barber, a former adviser to the British government who now works with the Punjabis, would transform public services in poor countries. Pakistan’s reforms have a long way to go. But they already have many lessons to teach the world. ■

American politics

In praise of state-ism

Less centralised government promises to be better government



CALIFORNIA’S new laws liberalising cannabis are a good idea, but some of their provisions read like a parody of 21st-century liberalism. To right an injustice—that brown people were more likely than white ones to be charged when the police found marijuana on them—Los Angeles plans to help those with marijuana convictions set up pot shops. This experiment may turn out to be a foolish mistake (see page 26). But that, in a way, is the point. Congress finds it notoriously hard to pass meaningful laws and finds it almost as hard to undo legislation that has been on the books for a long time. Statehouses, governors and mayors are more nimble.

Sure enough, the Golden State is greeting 2018 with a host of innovations. Firms with at least 20 employees will have to offer them 12 weeks’ unpaid parental leave. Schools in poor areas will have a legal duty to feed pupils whose parents cannot afford meals. Elsewhere, Tennessee has a new law protecting free-speech rights on campus. Washington now requires employers to provide paid sick leave. Such state-level energy is welcome, partly because it generates useful policy innovation, partly because it mitigates the trauma of a divided country. But to succeed it demands a change of attitude from both parties.

Take 300mg of lithium

State activism is often confused with an argument that sounds similar but is fundamentally different. To many American ears, the notion that states should do their own thing has an echo of secession, the “states’ rights” defence of slavery made before the civil war and the resistance to federal civil-rights laws in the 1960s. To be clear: states do not have an innate right to resist federal laws, which is why California’s position on im-

migration enforcement, which comes close to non-compliance with the federal government, is mistaken. The federal government does often need to step in on questions of fundamental importance, such as who can vote in elections.

But in many areas, particularly in social policy, it makes sense for the states to have plenty of leeway. When mistakes are made, as they inevitably will be, the damage is limited to the state or city that did the experimenting. When new laws do succeed, they can be copied across the country.

To this classic case for American-style federalism add a second, newer benefit. On presidential polling days America remains almost a 50-50 nation, and the two halves grow further apart every year. A highly centralised government cannot legislate for such a place happily. Presidential elections have come to resemble bipolar disorder. Half the country feels elated for four or eight years; then the other lot win, and a deep depression sets in. Decentralisation works better, because more voters get more of what they want for more of the time.

Yet for this idea to work calls for a sacrifice. Republicans, most of whom claim to favour decentralisation when a Democrat is in the White House, often then try to use federal power to stop Democratic cities from doing as they please. Likewise, Democrats often think that the federal government should force people in Republican-leaning states to submit to social change. Inconsistency and self-interest abound. Plenty of people who hold, rightly, that California should be able to set its own climate-change policies simultaneously object, wrongly, to the Republicans’ incoming tax changes, which limit the federal rebates the rich in California and other states get on state and local taxes (see page 24).

State-ism has risks. Statehouses are cheaper and easier to lobby than Congress is. America will become more complicated. But, at a time when voters feel that government fails them, it offers an inkling of progress. ■

China's diplomatic approach

Your article on China's "Sharp power" (December 16th) was based on the outdated belief that international relations is a zero-sum game. By describing China's normal economic co-operation and cultural exchanges with other countries as "subversion, bullying and pressure" you turned a blind eye to the abundant opportunities brought about by China's pursuit of peaceful development. This sheer prejudice is utterly unacceptable.

In the New Era of Socialism with Chinese Characteristics, China has increased the options for developing countries to achieve modernisation. Nevertheless, China will always respect other nations' choice of development model and will never impose its will upon others. President Xi Jinping declared solemnly in the report of the 19th National Congress that China's development is no threat to other countries and that China will never seek expansion. China opposes the old concept that strength leads to hegemony. Instead, China is committed to blazing a trail, building a new type of international relations and a community with a shared future for mankind based on mutual respect, equity, justice and win-win co-operation.

Countries are increasingly more interconnected and interdependent. Peaceful development is an irreversible trend. We wish that China-watchers would replace presumptuous speculation and arbitrary defamations with a positive, healthy and peaceful approach to China's development, which would contribute to greater mutual trust and co-operation between China and Western countries.

ZENG RONG
Spokesperson of the Chinese embassy
London

It is a mistake to accept so readily the National Endowment for Democracy's term "sharp power", as applied to China's approach to diplomacy ("At the sharp end",

December 16th). We already have an adequate and better-known label: "soft power". Countries deploy soft power in the form of cultural attraction and familiarity in the belief that to know us is to love us. That said, we should not assume that soft power is benign by definition.

Soft power can have hard characteristics, and this is demonstrated most clearly in China's case. Culture and values can and often do create resentment and conflict. For a society that sees a Hollywood movie or programmes that promote democracy as agents of a foreign power's propaganda or as cultural imperialism, soft power is far from non-coercive and non-threatening. In fact soft power can be more insidious than hard power precisely because it can be embedded and hidden within cultural products and aims to influence thought and behaviour. In this case, to know us may be to hate us or fear us.

In other words, China's behaviour as described in your article is soft power. It aims to influence, persuade, change opinion and behaviour, and to do so without resorting to the instruments of "hard" power. We do not need yet more terms (not so long ago the fashionable phrase was "smart power"), but we do need to recognise, as China clearly does, the hard potential of soft power.

GARY RAWNSLEY
Professor of public diplomacy
Aberystwyth University

Dr Carson is doing well

I don't agree with your assessment that Ben Carson has "stayed inconspicuous and inscrutable" since taking up the job of secretary of the federal housing department ("Dr Carson's operation", December 2nd). Although Dr Carson has not engaged in the headline-hogging grandstanding of his predecessor, Julian Castro, he has been busy meeting state and municipal housing leaders around the country to get a first-hand view of the many problems facing the

housing market. Furthermore, he has been very clear about fixing the dysfunctional nature of the Department of Housing and Urban Development, which has spent too many years allocating too much money with too few results.

Dr Carson wisely realises that HUD needs an overhaul in how it approaches the housing market, but he knows better than to rush for a quick-fix solution to a complex matter. It is refreshing to have a cabinet secretary who is willing to take his time to get the right diagnosis rather than a career politician who only wants to call attention to himself.

PHIL HALL
Managing editor
National Mortgage Professional
Fairfield, Connecticut

History repeating itself

You were right to recommend David Goodhart's "The Road to Somewhere" as one of your books of the year (December 9th). But I was recently struck while reading "Howard's End" how well E.M. Forster captured more than a hundred years ago the emerging liberal, "anywhere" intelligences in the form of the Schlegel family, with their international, cosmopolitan outlook and commitment to justice, gender equality and mobility.

The contrast with the conservative Wilcox family, with their passion for empire and belief in English superiority, shows that the anywhere/somewhere tensions run long and deep. It was published in the early 20th century, but "Howard's End" offers refreshingly modern insights of great relevance today.

PAUL KEEN
Sheffield

The meaning of meat

The companies trying to ban "meat names" from plant-based food are simply demonstrating how threatened they are ("I can't believe it's not meat", December 2nd). Consumers are choosing animal-free versions of meat that provide the fat, salt, flavour, familiarity and texture without the cruelty. Shoppers know the difference between a veggie version and an animal-flesh one. Words change, context matters.

More than that, the etymology of these words reveal that they have less to do with the animals than we think: schnitzel comes from a Germanic root, meaning "to cut, slice"; wurst comes from the same Germanic, meaning "to mix up"; sausage derives from the Latin word for "salted". Even the original connotation of "meat" was "food in general". We still use that sense today, in sweetmeat, coconut meat, the meat of a nut, and so on.

COLLEEN PATRICK-GOUDEAU
Oakland, California

Political botany

It could well be true, according to a recent book, that people working in the Trump campaign "wouldn't know the difference between a caucus and a cactus" (Lexington, December 9th). But that distinction was once clearly articulated by a man who lived among both: the late Mo Udall, a congressman from Arizona.

Upon losing a leadership vote at a caucus of Democratic members of Congress, he stated clearly to reporters that he had indeed learned what the difference is: on a cactus, all the pricks are on the outside.

PROFESSOR ROBERT LOUIS
POWELL III

University of California, Davis ■

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Executive Focus



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Due to the expected volume of applications, OFID would only enter into further correspondence with short-listed candidates.



Stepping up

KARACHI AND LAHORE

Pakistan is home to the most frenetic education reforms in the world

EVERY three months, Shahbaz Sharif, the chief minister of Punjab, gathers education officials around a large rectangular table. The biggest of Pakistan's four provinces, larger in terms of population (110m) than all but 11 countries, Punjab is reforming its schools at a pace rarely seen anywhere in the world. In April 2016, as part of its latest scheme, private providers took over the running of 1,000 of the government's primary schools. Today the number is 4,300. By the end of this year, Mr Sharif has decreed, it will be 10,000. The quarterly "stocktakes" are his chance to hear what progress is being made towards this and other targets—and whether the radical overhaul is having any effect.

For officials it can be a tough ride. Leaders of struggling districts are called to Lahore for what Allah Bakhsh Malik, Punjab's education secretary, calls a "pep talk". Asked what that entails, he responds: "Four words: F-I-R-E. It is survival of the fittest." About 30% of district heads have been sacked for poor results in the past nine months, says Mr Malik. "We are working at Punjabi speed."

Pakistani education has long been atrocious. A government-run school on the outskirts of Karachi, in the province of Sindh, is perhaps the bleakest your correspondent has ever seen. A little more than

a dozen children aged six or seven sit behind desks in a cobwebbed classroom. Not one is wearing a uniform; most have no schoolbags; some have no shoes. There is not a teacher in sight.

Most Pakistani children who start school drop out by the age of nine; just 3% of those starting public school graduate from 12th grade, the final year. Girls from poor families are least likely to attend (see chart on next page); Pakistan's gap between girls' and boys' enrolment is, after Afghanistan's, the widest in South Asia. Those in school learn little. Only about half of Pakistanis who complete five years of primary school are literate. In rural Pakistan just over two-fifths of third-grade students, typically aged 8 or 9, have enough grasp of arithmetic to subtract 25 from 54. Unsurprisingly, many parents have turned away from the system. There are roughly 68,000 private schools in Pakistan (about one-third of all schools), up from 49,000 in 2007. Private money currently pays for more of Pakistan's education than the government does.

It is in part the spread of private options that has spurred politicians like Mr Sharif into action. The outsourcing of schools to entrepreneurs and charities is on the rise across the country. It is too early to judge the results of this massive shake up, but it

seems better than the lamentable status quo. If this wholesale reform makes real inroads into the problems of enrolment, quality and discrimination against girls that bedevil Pakistan, it may prove a template for other countries similarly afflicted.

There are many reasons for the old system's failure. From 2007-15 there were 867 attacks by Islamist terrorists on educational institutions, according to the Global Terrorism Database run by the University of Maryland. When it controlled the Swat river valley in the north of the country, the Pakistani Taliban closed hundreds of girls' schools. When the army retook the area it occupied dozens of them itself.

Poverty also holds children back. Faced with a choice between having a child help in the fields or learn nothing at school, many parents rationally pick the former. The difference in enrolment between children of the richest and poorest fifth of households is greater in Pakistan than in all but two of the 96 developing countries recently analysed by the World Bank.

Yet poverty is not the decisive factor. Teaching is. Research by Jishnu Das of the World Bank and colleagues has found that the school a child in rural Pakistan attends is many times more important in explaining test scores than either the parents' income or their level of literacy. In a paper published in 2016, Mr Das and Natalie Bau of the University of Toronto studied the performance of teachers in Punjab between 2003 and 2007 who were hired on temporary contracts. It turned out that their pupils did no worse than those taught by regular ones, despite the temporary teachers often being comparatively inexperienced and paid 35% less.

► Teachers' salaries account for at least 87% of the education budget in Pakistan's provinces. A lot of that money is completely wasted. Pakistan's political parties hand out teaching jobs as a way of recruiting election workers and rewarding allies. Some teachers pay for the job: 500,000 rupees (\$4,500) was once the going rate in Sindh. At the peak of the problem a few years ago, an estimated 40% of teachers in the province were "ghosts", pocketing a salary and not turning up.

"Pupils' learning outcomes are not politically important in Pakistan," says the leader of a large education organisation. Graft is not the only problem. Politicians have treated schools with a mix of neglect and capriciousness. Private schools have been nationalised (1972) and denationalised (1979); Islam has been inserted and removed as the main part of the curriculum. The language of instruction has varied, too; Punjab changed from Urdu to English, only to revert to Urdu. Sindh, where teachers who are often Sindhi speakers may struggle to teach Urdu, announced in 2011 that Mandarin would be compulsory in secondary schools.

Getting schooled

It is against this background that organisations like The Citizens Foundation (TCF) have developed. The charity runs perhaps the largest network of independently run schools in the world, educating 204,000 pupils at not-for-profit schools. It is also Pakistan's largest single employer of women outside the public sector; in an effort to make girls feel safer in class, all of TCF's 12,000 teachers are female. At its Shirin Sultan Dossa branch near a slum on the outskirts of Karachi, one girl is more than holding her own. At break-time on the makeshift cricket pitch she is knocking boys' spin-bowling out of the playground.

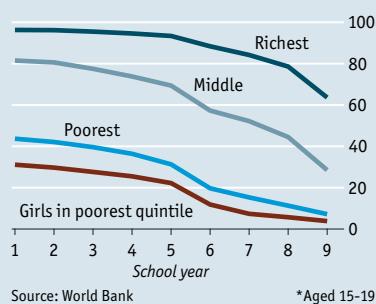
In 2016 TCF opened its first "college" for 17- and 18-year-olds at this campus in an attempt to keep smart poor pupils in school longer. Every day it buses 400 college pupils in from around the city. It builds schools using a standard template, typically raising about \$250,000 for each of them from donors; it recruits and trains teachers; and it writes its own curriculums.

Since 2015 TCF has taken over the running of more than 250 government schools in Punjab, Sindh and Khyber Pakhtunkhwa. It gets a subsidy of around 715 rupees per month per child, which it tops up with donations. So far it has increased average enrolment at schools from 47 to 101 pupils, and test results have improved.

The outsourcing of state schools to TCF is just one part of the Sindh government's recent reforms. "Three years ago we hit rock bottom," says a senior bureaucrat, noting that 14,000 teaching jobs had been doled out in one year to supporters of the ruling Pakistan Peoples Party. Since then it

Dropping out

Pakistan, youths* who have completed each school year, by wealth quintile, 2012, %



has used a biometric attendance register to cut 6,000 ghost teachers from the payrolls, and merged 4,000 sparsely attended schools into 1,350. Through the Sindh Education Foundation, an arms-length government body, it is funding "public-private partnerships" covering 2,414 schools and 653,265 pupils. As well as the outsourcing programme, schemes subsidise poor children to attend cheap private schools and pay entrepreneurs to set up new ones in underserved areas.

This policy was evaluated in a paper by Felipe Barrera-Osorio of Harvard University and colleagues published last August. The researchers found that in villages assigned to the scheme, enrolment increased by 30% and test scores improved. Parents raised their aspirations—they started wanting daughters to become teachers, rather than housewives. These results were achieved at a per-pupil cost comparable to that of government schools. "Pakistan's education challenge is not underspending. It is misspending," says Nadia Naviwala of the Wilson Centre, a think-tank.

While Sindh has pioneered many policies, Punjab has taken them furthest. The Punjab Education Foundation (PEF), another quasi-independent body, oversees some of the largest school-privatisation and school-voucher programmes in the world. It has a seat with the ministers and administrators at Mr Sharif's quarterly meetings. The Punjab government no lon-

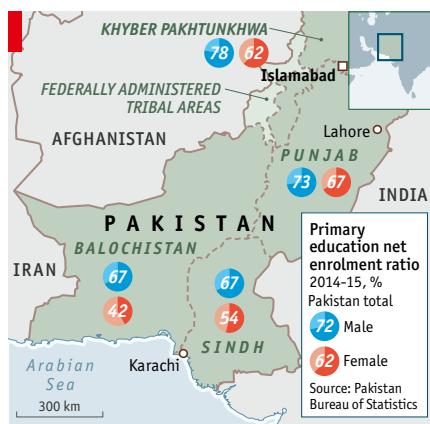
ger opens new schools; all growth is via these privately operated schools. Schools overseen by PEF now teach more than 3m children (an additional 11m or so remain in ordinary government-run schools).

This use of the private sector is coupled with the command-and-control of Mr Sharif, who is backed by Britain's Department for International Development, which helps pay for support from McKinsey, a consultancy, and Sir Michael Barber, who ran British prime minister Tony Blair's "Delivery unit". The latest stocktake claimed an "unprecedented" 10% increase in primary-school enrolment since September 2016, an extra 68,000 teachers selected "on merit", and a steady increase in the share of correct answers on a biannual test of literacy and numeracy.

Some are concerned about the stress on meeting targets in this "deliveryology" model. For one thing, independent assessment of the system's claimed success is hard. Mr Das argues that there is no evidence from public sources that support Punjab's claims of improved enrolment since 2010. Nor is the fear provoked by Mr Sharif always conducive to frank self-appraisal: some officials may fudge the numbers. Ms Naviwala points out that two of the worst-performing districts in spring 2015 somehow became the highest performers a few months later. She suggests that similar data-driven reforms in Khyber Pakhtunkhwa may have a better chance of success, since they are less dependent on the whims of a single minister. For their part Punjab and its international backers insist that the data are accurate, and that the other publicly available data are out of date.

No one thinks that everything is fixed. Around the corner from that parlous primary school on the outskirts of Karachi is another, privately run school hand-picked for your correspondent's visit by civil servants. In maths classes pupils' workbooks have no entries for the past fortnight. What sums there are show no working; answers were simply copied. The head teacher seems to care most about his new audio-visual room, the screen in which is not for pupils, but for him: a bootleg Panopticon, with six CCTV feeds displayed on a wall-mounted screen. This is an effective way of dealing with ghosts. But as the head explains how great his teachers are, one of them strolls up to a boy in the front of her class and smacks him over the head.

Even if there is bluster aplenty and a long way to go, though, the fact that politicians are burnishing their reputations through public services, rather than patronage alone, is a step forward. And if there is a little Punjabi hype to go with the Punjabi speed, then that may be a price worth paying. For too long Pakistani children have suffered because politicians have treated schools as political tools. They deserve much better. ■





Religion in South-East Asia

Escalators to heaven

BANDUNG AND SINGAPORE

The Chinese of South-East Asia are turning to evangelical Christianity

WHEN Pastor Jimmy Parade took over at the Indonesian Reformed Evangelical Church in Bandung, on the island of Java, five years ago, around 180 people came to services each week. Now the church—in a nondescript building in an outdoor shopping complex—is packed with around 450 each Sunday. “People keep coming,” Mr Parade shrugs.

Some 1,000 miles away, up several sets of escalators at a shopping mall in Singapore, thousands of people take part in a two-hour service on a Saturday evening at the City Harvest Church, which has a weekly attendance of just under 16,000. The service involves a rock group leading the congregation in devotional songs, several instances of speaking in tongues, and testimony from Emily, a young Singaporean who converted her father to Christianity. “My Dad has become a much happier man,” she declares, to huge applause.

Evangelical and Pentecostal Christianity is growing more quickly in Asia than most parts of the world, with over 200m adherents in 2015, up from 17m in 1970. The largest congregations are in South Korea and the Philippines, where dazzlingly large mega-churches hold tens of thousands of people. But Christian zeal is also increasing in other parts of the continent, including Indonesia and Malaysia, where proselytis-

ing among the Muslim majority is well nigh impossible, but where Buddhists, Confucians and Christians of other denominations, almost all of them ethnically Chinese, are proving receptive.

In Singapore, which is sandwiched between Indonesia and Malaysia but is mainly Chinese, evangelicalism first took off in the 1980s, recalls Terence Chong of the ISEAS-Yusof Ishak Institute, a think-tank. Mega-churches began springing up in the early 1990s. These grew quickly, despite the fact that the Singaporean government is wary of proselytisers potentially stirring up religious tensions. Evangelicals, includ-

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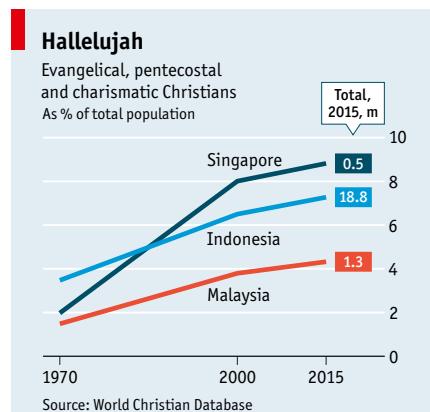
ing many Pentecostals, made up 8% of the population in 2015, up from 2% in 1970.

Evangelical churches are flourishing in Malaysia and Indonesia in even less promising circumstances. Roughly a tenth of the population of both countries is Christian, but bureaucrats make life difficult for churches, largely for fear that they will attempt to convert members of the Muslim majority. Over 1,000 churches were closed in Indonesia between 2006 and 2014, says Andreas Harsono of Human Rights Watch, a pressure group.

Mr Parade’s church is in an outdoor shopping complex because it doesn’t need a licence to operate there, and getting one elsewhere is difficult. In Malaysia, meanwhile, it is illegal for a Muslim to convert to Christianity, even though the constitution theoretically enshrines freedom of religion. Malaysia also has Islamic police to make sure Muslims do not marry adherents of other religions or deviate in other ways. Yet even in this forbidding setting, the proportion of the population that is evangelical has grown rapidly (see chart).

The growth of evangelical churches in the three countries also shows how they are “increasingly connected”, says Max Jeaganathan of the Zacharias Trust, a Christian organisation based in Britain. Christians across the region support each other financially, he says; several churches in Singapore have helped “plant” others in Malaysia or elsewhere. City Harvest declares that it provides training and “spiritual oversight” to locals keen to start their own churches. It now has over three dozen affiliated churches abroad.

Most evangelicals see the growth of their churches as God’s work. But it also seems to have an aspirational element to it. ►



► “It is the de facto middle-class religion right now,” says Mr Chong. According to a study he conducted in 2013, over 50% of mega-church-goers had a university degree, a higher proportion than Christians of other sorts. That was in spite of the fact that mega-church Christians were more likely to have lived in public housing and to come from working-class backgrounds. They were also more likely to speak Chinese and to come from families which were not previously Christian.

Many of South-East Asia’s mega-churches preach an American-style “prosperity gospel”: although there is lots of talk of charity and good works, wealth is celebrated as a gift from God. At City Harvest one preacher tells the story of a businessman who attended the church—and donated generously to it—whose sales went up by 40% in a year and whose profits doubled. Presentation is often slick: at the New Creation Church, another mega-church in a mall in Singapore, first-time visitors are given a pop-up book telling the story of the venue. The 30,000 worshippers there have to book online on a Wednesday to reserve a seat for the Sunday service.

Friendly ushers and peppy slogans (“too blessed to be stressed”) make the churches appealingly accessible. They are also good spots for making business connections. Churches in Singapore are places where people network with those they trust, says Thomas Harvey of the Oxford Centre of Mission Studies, a British charity. The feeling is that “these are people we know, these are people of integrity, character, education,” he says.

Integrity, alas, is sometimes lacking. In 2015 Kong Hee, the founder of City Harvest Church, and five other church leaders were found guilty of misappropriating S\$50m (\$37m) in church funds, partly to fund the music career of Mr Kong’s wife, Ho Yeow Sun. (The devotional element of the song “China Wine”, in the video for which a scantily clad Ms Ho “grinds it up” with assorted rappers, is hard to fathom.) In 2009 a well-publicised spat broke out at the Calvary Church in Kuala Lumpur, with congregants demanding more transparency over church funds. At other churches pastors have been accused of accumulating unseemly riches.

This has hurt some churches. At City Harvest the congregation is around a third smaller than it used to be, estimates Sam, a 36-year-old interior designer who has been going to the church for 15 years. But on the whole churches have been able to “isolate incidents”, says Mr Chong, putting the blame on the individual rather than the whole church or community. “With enough prayer,” the argument goes, he says, “the Church will be able to right itself.” And if not, there are plenty of competitors to take in disenchanted members of another flock. ■

Feudalism in Pakistan

Quail, cotton and contumacy

BAHAWALNAGAR

The power of the landlords is fading, but painfully slowly

PANICKED from its nest, a quail scuds low across a cotton-field. The hunters spin round and blast away. As the bird drops from the sky, a gang of poor boys in plastic flip-flops races through the mud, fighting to pick up the kill. This vignette of feudal life has hardly changed in a century, except for one thing, says Ehtesham Laleka, a puckish 30-year-old, whose family owns 7,000 acres of land in this southern region of Punjab province. “In my grandfather’s day we would have had hundreds of beaters like them.”

Feudalism, a curse that has lingered since independence in 1947, is often seen as the biggest blight on Pakistan’s development. In the old days the *zamindars* (landowners), empowered by British rule, lorded over great tracts of land, housing serfs and often abusing them in return for sharecropping and other forms of menial labour. Whereas independent India rid itself of much of that feudal class, Pakistan’s feeble attempts at land reform were ruled un-Islamic by its Supreme Court in 1990. The landowners turned their economic power into political authority, coercing their tenants to vote for them. In 1970 feudal landlords held 42% of the seats in the national parliament.

Modern feuds like to portray themselves as benevolent paternalists, but this does not stretch far. Feudal areas have the lowest literacy in Pakistan. On the estate of one family, many of whose members were educated in the West, the village children’s

teeth are black and rotten. Families like the Lalekas, and 101 others listed in one catalogue, still pop up frequently as villains in soap operas.

Yet their power is wilting. By one count, feudal representation in parliament has dropped to around a quarter, drawn mainly from rural areas in south Punjab and the province of Sindh. On a stroll through his family stables, Mr Laleka shakes his head at the cost of maintaining dozens of buffalo and horses, on which little more than status rides. “You can get cheaper milk in the markets,” he sighs. “And you don’t have to clean up their shit.” This shows how the economy is changing. Agriculture’s share in GDP has dived from 53% in 1947 to 20%. Rapid urbanisation is drawing millions away from areas like south Punjab.

Meanwhile feuding has become a pastime of the feudal class, as Islamic inheritance laws requiring an equal split among male heirs fragment estates. “Eighty per cent of my friends have taken out loans,” mourns one landowner, himself indebted, to keep themselves in the finery to which they are accustomed. In 1960 farms smaller than five acres made up 19% of the total. By 2010, that figure had soared to 65%.

The landlords’ power over labourers is dwindling, too. Cash is replacing the old informal system of payment in kind. Erstwhile serfs are now paid around \$170 a month at harvest time. Violence against them has become harder to get away with. When a feudal lord threw a ten-year-old boy into a thresher in 2013, severing both his arms, the outcry on social media led to his arrest, although not his conviction. Allahdad, a landlord built like a giant, fondly recalls the days when he beat lorry drivers and shaved their moustaches as a punishment. “If you cannot beat them, they steal,” he says, laughing. But a neighbour whispers that Allahdad can no longer retain a cook or guard, as the staff he used to ➤



If you can't beat them, pay them

► slap around can now use their cash wages to escape.

Feudal politicians also have to work harder for their constituents' votes. A young politician from a landed family glumly describes his view of the job. "Poli means many and tics means bloodsuckers," he laments. When he is not glad-handing the masses at weddings or funerals, he must badger local administrators on behalf of his voters. Despite his help, he says, "they may have to bribe a policeman, but not as much."

Nonetheless, the feudal rump in parliament has been able to prevent the extension of the minimum wage to agricultural labourers, among other things. Imran Khan, a leader of the opposition, blames feudalism for the country's "grossly unfair social system", but is now wooing the feudal barons in his bid for power in next year's election. And even feudalism's slow death may not lead to much change.

Though the power of the landlords is fading, more than half the members of Punjab's assembly have inherited their seats from relatives, more than twice the rate in India's parliament. The cannier "feudals", says Badar Alam, editor of a current-affairs magazine, have long since morphed or married into the rising industrial class. These new rich families may not differ much from their landed predecessors. Noting how they like to copy the old feudal style, with big cars, browbeaten servants and brazen tax avoidance, Mr Laleka calls them "pseudo-feudals". ■

Japan's broadcaster

Snoringly boring

TOKYO

NHK extracts a hefty fee from all viewers for dull fare many don't watch

TRY saying you don't live there, suggests one website. Pretend you don't have a television, says another. Such is the advice swapped online on how to avoid paying the "reception fee" that every home that owns a television must pay to NHK, Japan's public-service broadcaster. The excuses may have to get more inventive: on December 6th Japan's highest court ruled that the fee is constitutional, and found against a man who had refused to pay for the past 11 years.

Almost 80% of households paid last year, stumping up ¥13,990 (\$125) for an ordinary television or ¥24,770 for one with a satellite dish. That is a rise of nine percentage points compared with a decade ago, thanks in no small part to NHK's army of private collectors, who are schooled in the art of strong-arm tactics to go door-to-door.



Look: another mid-ranking official!

Many people refuse to pay because they don't watch NHK, often out of distaste for its pandering to the government.

NHK, whose initials stand for Japan Broadcasting Corporation, has hardly changed since Ellis Krauss, an academic, spent years researching it in the 1990s. He described its news as "the world's most boring". It still reports facts with scant analysis—its officious interpretation of neutrality—and gives dreary attention to bureaucrats and politicians. Journalists who try to be too independent or inventive are cold-shouldered; those who go too far can expect to be sent to the archives.

The corporation hit a nadir in 2013 when Katsuto Momii was appointed as its head. In his first press conference he remarked that Japan's use of wartime sex slaves in territories it conquered was not unusual. He appeared to see NHK as a public-relations agency for the authorities. "We cannot turn left when the government says right," he memorably opined. NHK was criticised particularly for its toady reporting of the government's line after the meltdown of the Fukushima nuclear power plant in 2011. Anti-nuclear protests were all but ignored.

Then came a raft of prominent reporters being removed. Kensuke Okoshi, the liberal-minded anchor of the evening news, left in 2015 after questioning the government's love of nuclear energy. A year later Hiroko Kuniya, presenter of "Close Up Gendai", a popular news programme, met a similar fate, presumably thanks to her daringly robust questioning of the government spokesperson.

Things have improved since Mr Momii's term expired at the start of 2017, but "it takes a long time for wounds to heal", says a former NHK journalist. The underlying causes of NHK's often timorous reporting

remain, says Yasuo Onuki, who retired a few years ago after four decades there.

One reason for its cosy relations with government is that Japan, uniquely among democracies, has been ruled by the same lot, the Liberal Democratic Party, for all but three years of the past six decades. "They have tamed the media," says Kaori Hayashi of Tokyo University. Chummy agreements between the government and reporters' clubs have led to access to press events being restricted to the big domestic media, with foreigners and freelances generally excluded.

In theory NHK is independent. Unlike Britain's BBC, it collects the reception fee itself. Its boss is appointed by its board of governors. But the prime minister appoints the board and Japan's parliament approves its budget. In 2013 Shinzo Abe chose a clutch of governors with distinctly conservative views of women and Japan's wartime history. The UN and Reporters Without Borders, a French-based organisation that promotes freedom of the press, now repeatedly chastise Japan for its media's lack of independence. Officials put out by NHK's coverage sometimes summon its staff to berate them. It is still taboo for the organisation to question the monarchy or Japan's wartime deeds.

As much to blame, says Ms Hayashi, is the way Japanese journalism is practised. The country has a large and noisy mass media, but from their origin after the second world war they have co-operated with the government in promoting national development rather than acting as the fourth estate. Self-censorship is common. NHK's style book for its international TV and radio tells journalists to avoid certain terms when discussing "comfort women"—those forced to have sex with Japanese soldiers. They should refer to the Rape of Nanjing by Japanese troops in 1937 as an "incident", not a "massacre", though the death toll rivalled those of the atomic bombs dropped on Hiroshima and Nagasaki.

In that sense NHK hardly differs from other Japanese media. All the same, the country would be poorer without it, says the former journalist. It makes excellent documentaries. It had the scoop in 2016 of a video in which the emperor hinted at wishing (much to the government's chagrin) to step down. It remains the country's most trusted outlet. It is the go-to station in times of natural disasters, the sole broadcaster of sumo and the source of the most accurate exit polls.

But Japanese disapprove of the broadcaster's attempts to subject ever more people to its fees. It now wants those who watch its content online to cough up, drawing criticism even from former officials. If NHK cannot persuade people to pay voluntarily for its programmes (for example, by making more interesting ones), why should they be forced to? ■

Child abuse in the Philippines

Caught in the web

MANILA

The archipelago is a global hub for child pornography

AT FIRST he was very kind, just like an angel," says a 19-year-old of the man who recruited her into the Philippines' cybersex industry, "but at the end he was evil." The end took five years to come. One of a dozen siblings, she left her poor family on the island of Mindanao with a pimp who had promised her an education. Instead, she was made to cavort in front of web cameras. "I didn't know that I would be a cybersex model," she says. Six other children were part of the den, two of them just toddlers. Sent to schools where they improved their English, the children received money for beauty products and treatments, so as to present themselves more alluringly to "customers".

Similar stories abound in the Centre of Hope, a clean, bright shelter for children just outside Manila. It is adorned with lanterns and trees for Christmas; teachers, social workers and psychologists are among those who attend its festive parties. Residents, most of them teenagers, sleep in bunk beds in dormitories that they tidy themselves. The shelter lies hidden behind an unmarked gate. This is so that criminal gangs and, in some cases, family members who have made money by exploiting the 50 girls and one boy who live at the facility cannot find it.

Sherryl Loseno of the Visayan Forum Foundation, the charity that runs the centre, says the problem of online exploitation is worse than ever before. Of the billions of online searches for pornography that occur around the world each month, those involving children account for just a tiny proportion. But that still creates a lucrative business opportunity for the immoral.

Hans Guyt from Terre des Hommes, a Dutch charity which researches online sexual abuse, says that accurate information on the number of victims in the Philippines is impossible to obtain. But he believes that the situation is growing more serious in the country, not least because the content being made there is more depraved than ever. Photographs, videos and live-streaming now more commonly feature animals, toddlers and sometimes even babies.

Experts believe the Philippines is a global hub for the production of such material. Historical, technological and social factors help to explain why. The high level of proficiency in English, a relic of the country's time as an American colony, means that both children and those abusing them

can communicate easily with clients. The swift spread of the internet, to which 55% of Filipinos now have access, up from 9% in 2009, means cybersex dens can operate in increasingly remote areas. Widespread mistrust of the police discourages both cybersex victims and those who suspect wrongdoing from asking for their help. And a higher proportion of people in the Philippines use methamphetamines or amphetamines than in any other country in Asia. Those addicts are sometimes willing to resort to abhorrent means to fund their habit.

The problem is too big to be solved through arrests alone. The police break up big cybersex dens to much fanfare every few months, but smaller operations carry on without being detected. Some youngsters even want to enter the business independently; there are cybercafés that willingly host them. Another means of stopping the exploitation is to pursue those paying for horrific content. Many come from rich countries such as Australia and America. After online encounters arranged by her father, one woman at the Centre of Hope was eventually sold abroad to a Danish man, who tortured her by burning her with cigarettes.

Technology allows the authorities better ways of tracking down consumers in faraway places. Terre des Hommes, for example, has created an online avatar of a child using artificial intelligence. The idea

is to allow police to use it to ensnare would-be customers in chat rooms. Mr Guyt says that a recent six-week pilot project conducted by the Philippine police was a big success. The Australian authorities and Interpol, a group through which the world's police forces co-operate, are interested too. But once wrongdoers have been identified with the help of the avatar, legal complexities stemming from the international nature of the online interactions mean that the police can only issue a warning message.

Several countries, including America, Britain, Canada and Israel, as well the Philippines, are modifying their laws in response to the jurisdictional morass of online horrors. Indeed, lawmakers around the world are taking the problem of child pornography increasingly seriously. In 2006 just 27 countries had enacted strong legislation to combat it. That number had risen to 82 a decade later, according to the International Centre for Missing and Exploited Children, a charity.

There is much more to do. The age of sexual consent in the Philippines, for instance, is just 12. Raising it to 16 would also allow those creating pornography involving young teenagers to be punished for rape rather than prostitution (which carries less severe penalties). Congress is considering just such a measure.

But it is more humble interventions that the former victims at the Centre of Hope consider most useful. They say raising awareness among young people, by visiting schools and giving talks, makes a big difference. They also set store by attempts to suppress demand. Some of them have travelled to rich countries to help draw attention to the problem. One enjoyed a trip to America to tell her story so much that she now wants to be a flight attendant. Not all victims escape with such optimism. ■



The ones that got away

Banyan | Peninsular wars

Though sanctions may bite at last in 2018, they will not bring Kim Jong Un to heel



IT'S not a mere threat," Kim Jong Un, North Korea's dictator, announced to the world in his new-year address, "but a reality that I have a nuclear button on the desk in my office. All of the mainland United States is within the range of our nuclear strike." That is a terrifying thought to most Americans—and one made no less terrifying by Donald Trump's tweet in response: "I too have a Nuclear Button, but it is a much bigger & more powerful one than his, and my Button works!"

The Punch-and-Judy posturing would be comical if it did not itself heighten the risk of conflict. In a febrile atmosphere, two thin-skinned leaders might easily misconstrue the other's intentions, even if neither intended war. Or either might feel face is at stake (Mr Trump, after all, vowed that the North would not be allowed to develop nuclear weapons that could hit America).

Mr Trump might also believe that a military strike would have limited consequences. Some of his advisers appear to think so, and this is a truly dangerous idea. America has little or no good human intelligence inside North Korea, so a surgical pre-emptive strike would probably fail in its objective, whether that was to knock out the North's nukes or the Kim regime itself. Such a strike would risk starting a nuclear war that would kill millions, and a conventional one that would devastate South Korea. If ever there was a time for cool heads to prevail, it is now.

The good news, for now, is that Mr Kim appears to view his nuclear capability as a deterrent, not a tool for aggression. "In no way would the United States dare to ignite a war against me and our country," he rasped in a tobacco-inflected voice in his speech. As for Mr Trump, the link between his words and deeds is always tenuous, and he would not be the first American president to make threats he did not carry through.

Yet the dangers are there. Mr Kim appears confident, if not cocky. As well as a series of increasingly successful missile launches last year, in September the North set off a presumed hydrogen bomb underground with a good 15 times the destructive force of the one America dropped on Hiroshima.

The confidence Mr Kim expressed in his speech about his military capabilities seemed at times to extend to the economy. The "great historic achievement" of building nuclear weapons, he said, has now "opened up bright prospects for the building of a

prosperous country". Mr Kim has long promoted a strategy of *byungjin*—pursuing military and economic development at the same time. Arguably, this has worked until now, with annual economic growth reckoned to be around 4%. Yet Mr Kim warned of "difficult living conditions" this year.

Economic trouble seems all too likely, thanks partly to tightened sanctions which the UN Security Council passed, at American urging, on December 22nd. To date, a decade's worth of sanctions imposed on North Korea have done nothing to curb its nuclear programme. Above all, sanctions have not worked because China, more concerned about the prospect of instability next door than the North's nuclear activities, has got around them. Four-fifths of all North Korea's trade is with China.

Alarmed that the risk of conflict has risen, China may now be changing its calculations. The latest UN resolution renders most North Korean exports illegal, including the workers it sends abroad. That looks likely to cut scarce hard-currency earnings sharply. As for imports, shipments of crude oil have been capped, while the quota for refined oil products has been slashed. China seems to be enforcing the sanctions much more tightly than before. Andrei Lankov of Kookmin University in Seoul describes them as a full-scale economic blockade. To add to Mr Kim's isolation, several countries are expelling North Korean diplomats or restricting the size of North Korean embassies, which act chiefly as moneymaking enterprises for the regime.

The bleaker economic outlook may have something to do with the most striking part of Mr Kim's speech—an overture towards South Korea, with which it has had no formal communication for nearly two years. Responding to an invitation to send North Korean athletes to the Winter Olympics in the South next month, Mr Kim called for "urgent" dialogue. Moon Jae-in, South Korea's president, welcomed the idea, no doubt guessing that the North will not disrupt the games with missile antics if its athletes are competing. More broadly, Mr Moon has long argued that dialogue would help ease tensions on the peninsula.

As for Mr Kim, he may hope for South Korean support for sanctions to be rolled back. His regime used to earn crucial foreign currency from the Kaesong industrial zone on the border with the South, where South Korean companies made use of North Korean labour. But Mr Moon's predecessor pulled out of Kaesong in early 2016. Many South Koreans argue for its reopening. That would displease America.

Wedge of tomorrow

Indeed, some Americans see Mr Kim's overture as an attempt to drive a wedge between South Korea and its protector. It probably is, but it will not work. South Korea's president may not get along with Mr Trump, but he is no fool. He understands that the Kim regime is the real problem, and that South Korea needs American military support to deter it. His government backs UN sanctions, in recent weeks seizing two Chinese-linked ships suspected of illegally supplying North Korea with oil.

The story in 2018 may be that sanctions bite harder: Mr Lankov thinks a return of famine in parts of the countryside is possible. But do not imagine this will bring Mr Kim to heel. He will not be too troubled if his people starve. And even if China enforces the sanctions strictly enough to endanger Mr Kim's regime, that is unlikely to change his calculus on nuclear weapons. With his back to the wall, nukes become more important to Mr Kim, not less. Expect this year to be as nerve-racking as 2017, if not more. ■



Internet controls

Virtual panic

BEIJING

The great firewall is rising. How high will it go?

BEFORE he was jailed, few people had heard of Wu Xiangyang. But when news of his conviction appeared in a state newspaper in late December, internet users across China took note. A small trader from the southern province of Guangxi, Mr Wu's crime was to sell cheap and commonly used software that enables people to circumvent China's draconian internet controls. His five-and-a-half-year prison sentence is the toughest-known penalty imposed for such "illegal business".

Motivated Chinese have long found it fairly easy to acquire such software, which provides access to what is known as a virtual private network (VPN). Through this kind of connection, a user in China can reach the thousands of websites that are blacklisted by the government—including almost all Google services, many news sites and most foreign social networks. Many people use VPNs several times each day to jump the country's "great firewall", as its system of online censorship is often called in English (Chinese netizens have adopted the acronym GFW). Foreigners in China depend on VPNs to reach sites they routinely need: everything from Gmail and Dropbox to Facebook and Instagram.

Many observers believe that the great firewall's porousness is a feature, not a bug—that its architects see benefit in a barrier that does not completely alienate entrepreneurs, academics and foreign residents, but which most Chinese web-users will not have the energy, or the finances (VPNs usually require subscriptions), to

surmount. But doubts are growing about this interpretation. For the past year the government has been trying to make it harder to find, and use, VPNs—the most common form of firewall-leaping tool. Mr Wu's punishment was clearly intended as a harsh warning to others in China not to try selling such services to ordinary consumers. Speculation is growing that even tougher curbs will be imposed in 2018.

Such fears may prove unwarranted, but the government has been doing little to allay them. Limiting the sale and use of VPNs is one aim of a "clean-up" of the internet industry that began last year and is supposed to be complete by the end of March. Several popular providers based in China have folded under government pressure. Those that remain are aimed at business users. Mr Wu's sentencing followed that of another man accused of a similar offence who was jailed in March for nine months.

Piling on the bricks

As well as closing down suppliers based in China, the government has made it more difficult for people in China to buy foreign VPN services. In July Apple dismayed civil-rights campaigners when it agreed to wipe VPN products from its Chinese app store. The company pulled down more than 600 of them. They are also disappearing from Android stores, though more slowly. Meanwhile most of the public places that used to offer unfiltered internet—such as hotels with many foreign guests—now provide the expurgated kind.

Also in this section

21 Good news for nature?

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Subscribers to the best-known foreign VPN services are still able to use their accounts in China. But they were rattled in July when Bloomberg, citing anonymous sources, reported that telecoms companies had been told to block access to unauthorised "personal" VPNs, presumably including foreign ones, by February 1st 2018. China's internet providers may well have the ability to do so: during sensitive political events foreign VPNs often become cumbersome or even impossible to use, apparently because of government-ordered efforts to throttle them. The ministry in charge of cyber affairs issued a confusing rebuttal of Bloomberg's story. Foreign diplomats in Beijing say they are finding it difficult to get straight answers from the government about how far it intends to go.

This is worrying not just for people who want to surf the web without annoying obstructions. Many firms use their own in-house VPN systems or similar technologies to enable staff to gain secure access to corporate networks remotely. Officials say that tighter controls over VPNs will not impede such usage. But businesses worry that they may be forced instead to use government-authorised methods, including officially approved VPNs and leased lines, that are less reliable and easier to spy on than their own systems.

Those fears will only grow if a new law on encryption, presently being drafted, limits the extent to which companies are permitted to scramble sensitive communications—as some observers fear it might. Businesses have good reason to feel nervous. A cyber-security law that took effect in June allows authorities to review data, such as customer records, that firms wish to send to headquarters abroad.

As China's increasingly autocratic leader, Xi Jinping, tightens his grip on power, it is becoming harder to remain optimistic that he will continue to tolerate circumvention of the firewall. He shows little ➤

► sympathy with the complaints of foreign businesses about the difficulties they face in China. And he is clearly determined that the internet in China be made dissent-free, even if his sweeping efforts to achieve this irk members of the middle class on which the Communist Party depends for support. Last year regulators shut down many celebrity-gossip blogs and some sites that stream live events such as concerts, apparently because they could be used as platforms for embarrassing the party.

In part as a result of tightening censorship, China's online chatter has been gradually migrating from public microblogs to instant-messaging apps such as WeChat, where users can create private groups up to 500 strong. But even in these forums, throwaway criticisms and jokes about the party get people in trouble. The government is trying to make ordinary web users act as censors themselves. In September it said it would start holding the creators of all private chat groups jointly responsible if they fail to police discussions to the authorities' satisfaction.

The party is still haunted by the social-media-fuelled protests of the Arab spring early this decade (recent anti-government protests in Iran have been an unsettling reminder of that period: censors have ordered media not to report on them). But officials may have failed to appreciate the cost to China's image abroad, and to the party's at home, should it deny access to services that make online life liveable behind the great firewall. Most Chinese citizens who regularly visit forbidden websites are people who have benefited from China's growing prosperity and who have little if any desire to challenge the party's rule. Angering them may prove risky. ■

The environment

Tusks, skins and waste recycling

BEIJING

The natural world may have less to fear than expected from China's rise

UNTIL the end of 2017, carved elephant tusks were still sold legally in China. International trade in ivory had been banned by the government since 1990, but not domestic transactions. At a shop in a glitzy mall in Beijing, the manager showed off his prize exhibit: a carving the size of a football of 30 ivory spheres, one inside the other, each moving separately and intricately carved. It was an example of an ancient craftsmanship, and one that has no future. On January 1st China banned ivory sales. The last ivory-carving factories and shops (including the one in Beijing) closed.

Environmentalists have long fretted



Though they're disapprovin'

about the impact that a rising China will have on the natural world. They worry not only about carbon emissions but also that, one day, the last tiger will be killed so its penis can be turned into an ineffective aphrodisiac or the last elephant slaughtered so its tusks can be carved into a gift. Yet as China has grown richer, it has changed. Three pieces of news at the start of 2018 suggest that some of the worst environmental fears are not being realised.

The closure of the domestic ivory business (the first of the changes) goes back to a deal between Barack Obama, then America's president, and Xi Jinping, his Chinese counterpart, in 2015. They promised a "nearly complete ban" on ivory sales. America duly banned transactions in 2016, except for those of century-old antique pieces. China closed a third of its ivory-carving workshops in early 2017 and the rest in the past few days. Illegal sales will doubtless continue. In 2017 officials in Hong Kong seized over seven tonnes of illegal ivory, the largest haul for 30 years. Hong Kong's ivory market, which is regulated separately, remains open, but it is due to be phased out by 2022.

China's actions seem to be having the desired effect. A study for Save the Elephants, a charity in Kenya, found that the average price of a kilogram of good-quality elephant tusk in China had fallen from \$2,100 in 2014 to \$730 in 2017 (see chart). The ban that has just taken effect is likely to drive prices down further. Elephants are still being slaughtered in vast numbers. It is even possible that the fall in the price of ivory may cause poachers to slaughter more beasts, since they need more tusks to make the same amount of money. But eventually, making ivory worth less should reduce the incentive to poach.

This is not the only case in which the government has sought to moderate the environmental consequences of Chinese tastes. A campaign led by a former basketball star, Yao Ming, helped slash demand for shark's fin soup, a delicacy. Imports of dried fins fell from 4,800 tonnes in 2004 to 20 tonnes in 2014. The government also banned shark's fin soup from official banquets and the sale of any edible product from endangered species, such as pangolin, whose scales are used in traditional Chinese medicine.

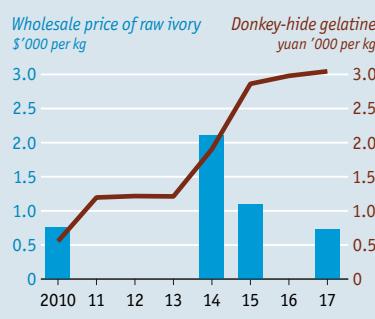
China is far from an animal-welfare paradise. By coincidence, on the day ivory sales were banned, the country cut the duty on imported donkey skin from 5% to 2%, the second of this year's changes. Gelatine from boiled donkey hide is another ingredient in traditional medicine (skins, probably destined for the Chinese market, are pictured in Kenya). Campaigners say the action threatens the world's donkey population, though it is hard to see how, given that there were 44m donkeys in 2016 and their numbers are rising. All things being equal, more demand from China ought to translate into more donkeys raised. But it is certainly pushing up the price of donkey-hide gelatine (see chart).

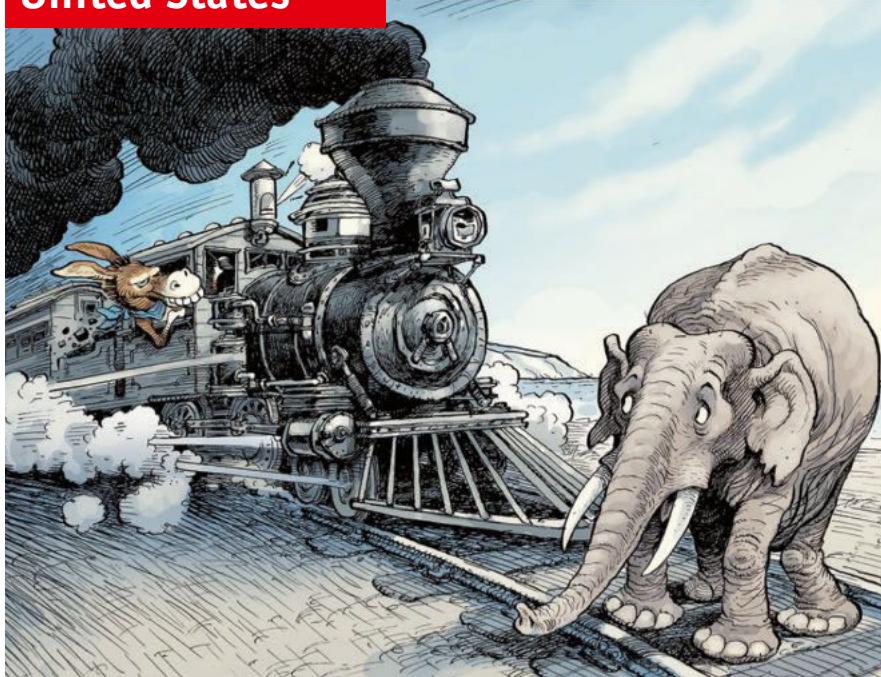
Indeed sometimes it is China's modernisation that has the biggest environmental impact—as the third of the recent changes shows. China is not only the world's biggest emitter of carbon, but the world's largest recycler, treating just over half of exported plastic waste. Recycling, for all its benefits, is a filthy business. In one town that specialises in recycling used electronics, 80% of children were found to have excess lead in their blood. On January 1st China banned the import of 24 categories of waste, including household plastics. This should improve its own environment but is a problem in countries such as Britain which send China rubbish for processing. The head of the UK Recycling Association called it "a huge blow for us".

If it is a shock, it is a pleasant one. As China gets richer it is taking the environment more seriously (see page 51). On balance, that benefits everyone. ■

Wallets are affected, too

China





Congress

The polarising express

WASHINGTON, DC

Blue-state Republicans could become almost as rare as white southern Democrats

I OPERATE under the principle of justified optimism," says Deep Sran, as he shows off the school he founded—based, he says, on his reading of Plato's "Republic". If voters elected representatives based on their cvs, Mr Sran would cakewalk into Congress. A lawyer with a doctorate in human development-turned teacher and entrepreneur, Mr Sran is the son of immigrants, raised in the suburbs of Washington, DC. He is one of 11 Democrats champing at the bit to replace Barbara Comstock, a Republican who has represented Virginia's diverse, wealthy 10th congressional district for two terms. She is one of 23 Republicans representing districts that Hillary Clinton won in 2016. Democrats think they can flip them all, and more: the Democratic Congressional Campaign Committee (DCCC) has 91 districts in its sights, the lion's share of them in states that Mrs Clinton won or barely lost.

They are, of course, unlikely to win them all. But an upset election, as this year's midterms in November could easily be, will break first and hardest in those states—which would leave the Republican congressional caucus smaller and more strident, and risks making Congress even more dysfunctional.

Republicans from liberal states were not always on the endangered list. Rockefeller Republicans, the party's fiscally con-

servative, socially liberal wing, took their name from New York's Republican governor. But as the party grew more uniformly conservative, its centre has moved steadily westward and southward. Just as Barack Obama's unpopularity in the South hastened, but did not cause, the near extinction of white southern Democrats, so President Donald Trump's unpopularity looks likely to sharply reduce the number of Republicans from liberal states.

Before attempting to predict the outcome of this year's mid-terms, a couple of caveats apply. First, the elections are still ten months away. Much can change in that time. Second, the mid-terms are not a single contest, but hundreds, each with its own unique set of candidates and circumstances. Challengers who look good on paper will have feet of clay; incumbents deemed all but dead will find reserves of strength and cunning.

That said, Democrats are not wrong to feel confident. More than two dozen Republican congressmen, many from competitive districts, have announced their retirements. Democrats hold a nearly 13-point lead on a generic ballot. They won only two of seven special federal elections last year, but they outperformed expectations in most of them. Victories in Alabama and Virginia's gubernatorial election showed that Democrats are energised,

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Lexington is on holiday

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while Republicans are not. They also showed Democrats performing strongly in the suburbs, home to many moderate Republicans, particularly in liberal states.

Going back to 1934, a new president's party has lost an average of 23 House seats in the mid-terms after his election (Democrats need 24 to win back the House). The Republican gerrymanders of 2010 may make it harder for Democrats to translate votes efficiently into seats, but strong Democratic turnout could dampen the gerrymanders' effect.

And Mr Trump is uniquely unpopular. Around 56% of voters disapprove of his performance—more by far than any president dating back to Harry Truman at this point in their tenure. Republicans hope that a booming economy, low unemployment and the extra money voters will see from tax reform will provide favourable headwinds. But the president's unpopularity makes that less likely. "When you dislike someone, you're unlikely to think they're responsible for anything good that happens, while you blame them for everything bad," says Larry Sabato, a political scientist at the University of Virginia.

Blue-state Republicans have the added albatross of the tax bill signed into law late last year. Previously, taxpayers could deduct many state and local taxes (SALT) from their federal income taxes. The new bill caps that deduction at \$10,000—much less than many residents of high-tax, high-cost-of-living states such as California, New York and New Jersey pay. Their voters may conclude that Republicans weaponised the tax code to punish states that did not vote for Mr Trump. Some blue-state Republicans voted against the bill; how much that will matter to voters eager for revenge will be tested in November.

► Republicans counter Democratic optimism by pointing out that their members who have hung on in liberal districts have done so for a reason: competitive districts tend to produce battle-tested candidates used to tough contests. And the time for Democratic surprises is over: "If a Republican incumbent is caught off-guard" after last year's elections, says Nathan Gonzales, a campaign analyst, "it's their own foolishness." Even comfortable Republican incumbents—such as Rodney Frelinghuysen, who has represented New Jersey's rich 11th district since 1995 and has never won less than 58% of the vote—have raised their campaign game.

Democratic enthusiasm has a downside: big, messy primaries that either pull candidates too far to the left for swing districts or reproduce the 2016 Republican primaries, in which a bunch of indistinguishable moderates split most of the vote, thus empowering an extreme candidate with a small but devoted fan base. And even a Democratic thumping will not eliminate every liberal-state Republican. Chris Smith in New Jersey, Chris Collins in New York, Devin Nunes and Kevin McCarthy in California and Cathy McMorris Rodgers in Washington, for instance, all come from districts that Mr Trump won handily. But last year's elections showed that Democrats excel at boosting turnout in Democratic-leaning areas, which will improve their chances in swing districts.

That is why, even with all the caveats in place, a thinning out of Republican ranks in Democratic states looks likely. That would leave Republicans from safe seats—notably the hard-right members of the Freedom Caucus—proportionately more powerful. The 12 highest-scoring Republicans on the Lugar Bipartisan Index—which measures how well legislators work with members of the opposite party—all come from Democratic-leaning or swing states; the top three are all New Yorkers.

If a significant number of them were to lose their seats as part of a wave big enough to give Democrats a majority in the House, that would not much matter: Democrats will presumably be as unlikely to reach across the aisle for Republican votes as Republicans have been to seek Democratic ones.

But if Democrats fall just short of a majority, Paul Ryan's days as Speaker could be numbered: a more hard-right caucus would want harder-right leadership. Democrats will find it difficult to retake the Senate: they would have to successfully defend all 26 of their seats, including ten in states that Mr Trump won, and also steal two from Republicans. In that scenario, finding something that could pass both the House, with a more powerful Freedom Caucus and less of a counterweight, and the more moderate Senate would become even harder than it is already. ■

Life expectancy

Not great, again

Why life expectancy is down for the second year in a row

JUST as Americans headed home for the year-end holidays, the Centres for Disease Control and Prevention (CDC) issued its annual report on mortality—which had no news to celebrate. According to the report, published on December 21st, life expectancy in America fell in 2016, for the second year in a row. An American baby born in 2016 can expect to live on average 78.6 years, down from 78.9 in 2014. The last time life expectancy was lower than in the preceding year was in 1993. The last time it fell for two consecutive years was in 1962-63.

Other statistics suggest that this alarming trend is caused by the epidemic of addiction to opioids, which is becoming deadlier. Drug overdoses claimed more than 63,000 lives in 2016. Two-thirds of these deaths were caused by opioids, including potent synthetic drugs such as fentanyl and tramadol, which are easier to overdo by accident and are becoming more popular among illegal drug users.

According to the CDC, the leading causes of death in 2016 remained heart disease and cancer. But a category called "unintentional injuries", which includes drug overdoses, climbed to third place—from fourth place in 2015 and fifth place in 2012. Although unintentional injuries caused just 6% of deaths in 2016, they claim mostly people in the prime of their lives. A young person's death cuts average life expectancy by more than the death of an older person.

The steepest rise in mortality was among 25- to 34-year-olds. In that age group deaths per 100,000 people from any cause increased by 11% from 2015 to 2016. Mortality from drug overdoses in the same age group shot up by 50% from 2014 to 2016.

At the same time, the decrease in mortality from heart disease and cancer—



Long day's journey

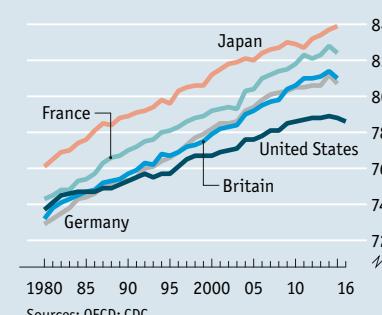
which has been a chief driver of the steady increase in life expectancy—has begun to level off. As a result, further increases in overdose deaths would probably push life expectancy down again. A decline for three straight years was last seen in America a century ago, when the Spanish flu pandemic ravaged the world.

This outcome seems likely. According to CDC officials, provisional data for the first half of 2017 suggest that overdose deaths continued to rise. Foot-dragging by President Donald Trump's administration has not helped matters. On the campaign trail in 2016, Mr Trump promised to take on the opioid epidemic as a priority. So far, his administration has not produced a plan or appointed a "drug tsar" to oversee a strategy to curb addiction. Nor has it asked Congress to allocate the billions of dollars needed to treat the estimated 2m people hooked on opioids. The national Public Health Emergency Fund has just \$57,000 on hand, because it has not been replenished for years. States and local authorities are setting up addiction-treatment services. But without new money from federal sources, their efforts will buckle under the weight of the problem.

A continued decline in life expectancy would leave America trailing even farther behind other rich countries. Lives in America are already two years shorter than the average in the OECD group of 35 rich and soon-to-be-rich countries: life expectancy is closer to Costa Rica's and Turkey's than to that of Britain, France and Germany. If the administration cannot reverse this then—at least when it comes to longevity in the Western world—its policy might be described as America Last. ■

Wrong turn

Average life expectancy at birth, years



Congress

Hell's laundry list

WASHINGTON, DC

After ignoring everything but tax, Congress has much to do and little time

BLAME it on the sand traps: President Donald Trump returned to work after seven straight days of golf enraged. Even by his own standards, his Twitter fury on January 2nd was extraordinary. The president boasted that he has a “much bigger” nuclear button than North Korea’s despotic ruler, Kim Jong Un; announced a mysterious “**MOST DISHONEST & CORRUPT MEDIA AWARDS**” event and called, on a whim, for a political rival to be jailed.

The next day excerpts from a forthcoming book on the Trump campaign began to circulate. In one juicy nugget, Steve Bannon, the chief of that victorious campaign, described a meeting that Donald Trump junior and Jared Kushner held in Trump Tower with a Russian national offering help as “treasonous”. Don junior would “crack like an egg” under the pressure of the investigation into election meddling, Mr Bannon supposedly said. Cue fury from the president, who said Mr Bannon had “lost his mind” and “doesn’t represent my base—he’s only in it for himself.” A lawyer for Mr Trump threatened legal action. Hello 2018.

Meanwhile, the list of things left undone by the federal government is long and unpleasant for Republican leaders in Congress (one privately calls it a “shit sandwich”). It includes funding a popular health-insurance programme for children, ensuring that the upcoming census is sound, renewing a key surveillance tool and perhaps most important, striking a spending deal to keep the government open past January 19th. Because Republi-

cans are no longer using special procedures to avoid filibusters, the fixes will need to be bipartisan.

To date, the worst casualty of congressional dysfunction has been the Children’s Health Insurance Programme, which provides coverage for poor families that make too much to qualify for Medicaid. Congress let funding for the scheme, which insures 9m children, expire in September. States, which administer the programme, were forced to resort to emergency measures. Some have already frozen enrolment. An estimated 1.9m children would have lost coverage in January had Congress not, just before going on holiday, passed a short-term fix funding the programme until March.

Operating procedure for Congress has been to practise brinkmanship and issue apocalyptic warnings right up to deadlines, fail to come to any agreement, and then pass short-term fixes that keep existing policy, no matter how ill-conceived, on autopilot. But some matters, like the census, which must be taken every ten years by constitutional mandate, cannot be so easily put off. The Census Bureau typically increases spending in the critical years before the 2020 count, which will determine new election boundaries and the annual distribution of \$600bn in government funds. But Congress has not given the agency proper funding, forcing it to cancel two of its three dress rehearsals. The bureau also lacks permanent leadership, which the Trump administration appears to be in little hurry to fill.

Civil-rights groups are worried that this will dilute the political representation of minorities, who are less likely to respond to census-takers. A recent request by the Department of Justice to add a citizenship question to the census, would, if approved, probably depress response rates among immigrants. “If you have fear and non-response among large swathes of the public,

you will get an inaccurate census, and that’s a failed census,” says Vanita Gupta, president of the Leadership Conference on Civil and Human Rights.

Congress must also renew a provision of the Foreign Intelligence Surveillance Act known as Section 702, which lets spies intercept communications. Under current law intelligence agencies cannot directly target Americans. Privacy advocates worry that the agencies still sweep in too many phone calls and e-mails involving citizens. This issue scrambles the usual partisan allegiances of Congress: civil libertarians from both parties want more checks and protections; national-security hawks would like a clean reauthorisation.

Jumbled coalitions—and the sheer number of unresolved matters—make grand bargains unlikely. Congressmen may attempt horse-trading: children’s health insurance in exchange for unfettered surveillance; Obamacare funds for military spending. Such efforts could well fail, leaving Congress to pass another short-term reprieve and repeat the same struggle in a month’s time. ■

High-tax states

Tax replanning

WASHINGTON, DC

How states may try to circumvent the new tax law

DEMOCRATS usually lament efforts by the rich to avoid paying taxes. Yet the bill President Donald Trump signed into law on December 22nd may spur Democratic-leaning states to concoct such schemes. The reform capped at \$10,000 the deduction, from federally taxable income, of state and local taxes (the “SALT” deduction). As a result, those who pay large local levies are likely to pay more federal tax in 2018. The change is particularly bad for high-earners living in big houses in states like New York and California, which impose high taxes. These states—which tend to see the reform as Republicans shaking down their political opponents—may yet put up some resistance.

Just under one-in-three taxpayers made use of the SALT deduction in 2015. On average, they knocked about \$12,500 off their federally taxable income, according to the Government Finance Officers Association—only a little above the new cap. Yet the deduction has been much more valuable than that to some. Those earning over \$1m who took the SALT deduction used it to reduce their federally taxable income by about \$275,000.

Individuals and states alike are thinking about how to circumvent the new cap. ►



Sandwich o’clock

In late December, huge queues formed at tax offices in places such as Fairfax County, Virginia—the third-richest county in America—as residents sought to prepay their property taxes for 2018. They hoped to deduct the early payments on their federal tax returns for 2017, before the cap came into force. But the IRS mostly scuppered these hopes when, on December 27th, it said that only taxes that had been “assessed” before the end of 2017 would be deductible. Those prepaying estimates of their 2018 taxes will be out of luck.

In any case, this avoidance strategy would only have worked for one year. Some, like Andrew Cuomo, the governor of New York, hope to find a longer term dodge. One idea is to let taxpayers make charitable contributions to state coffers, in exchange for a one-for-one reduction in their state tax bills. Because charitable contributions remain deductible without limit, this would circumvent the cap.

It would also invite legal challenges. Taxpayers are not meant to receive benefits in exchange for their deductible contributions. Remarkably, there is some legal uncertainty over whether credits towards state taxes count. Charity typically already confers tax benefits at a state level, but federal authorities do not see this as invalidating the federal deduction. Some hope, optimistically, that the courts would take this logic to its extreme, and allow even a complete tax credit for contributions made to the state itself.

Another idea is that states could raise a higher proportion of their revenues from payroll taxes on employers. Such levies, which are invisible to workers, remain fully deductible for firms. The main drawback of this plan is that firms would probably want to respond by cutting wages. In theory, workers should not mind, if their state income taxes fall commensurately. In practice, they would probably object.

Some fear that if neither of these strategies works, high-earners may take a more rudimentary route to tax avoidance: relocation. This worry is probably overblown. A study in 2016 of the geographic mobility of workers earning more than \$1m from 1999 to 2011 found very little migration in response to tax rates. This probably helps explain why state tax rates vary so much in the first place. Historically, states have not structured their tax systems to maximise the SALT deduction, notes Jared Walczak of the Tax Foundation, a right-leaning think-tank. For example, taxpayers must choose between deducting their income taxes and deducting their sales taxes. Yet rather than specialising in one or the other, most states levy both.

Unless Democrats come to power and restore the SALT deduction, rich people in Democratic states will probably have to learn to live with higher taxes. But expect some grumbling in the meantime. ■



The Supreme Court and voting rights

Use it or lose it

NEW YORK

An Ohio voter-purge case with national implications comes before the justices

POLITICAL apathy worried Jean-Jacques Rousseau. In a healthy republic, he wrote in “The Social Contract” in 1762, citizens “fly to the assemblies” and take an active role in public affairs. He would frown on America’s voter turnout, which hovers at 40% for mid-term elections and seldom goes much higher than 55% for a presidential race. But he might have been even more alarmed by laws that sideline infrequent voters from politics.

On January 10th a rule that has disenfranchised hundreds of thousands of Ohioans comes under the Supreme Court’s microscope. *Husted v Philip Randolph Institute* concerns what the League of Women Voters and the Brennan Centre for Justice call the most restrictive approach to winnowing voter rolls found anywhere in America. Since 1994, in addition to nixing people who have died or moved—which all states do—Ohio has sent a postcard to voters who have not voted for two years. If they fail to return the address confirmation and then miss two more federal elections, they are taken off the rolls.

Ohio says its “supplemental process” for trimming voter lists is authorised by two laws: the National Voting Rights Act (NVRA) of 1993, which demands “accurate and current voter registration rolls”, and the Help America Vote Act (HAVA) of 2002. Challengers reply that Ohio’s procedure clashes with the primary mission of the NVRA: protecting the “fundamental” right of American citizens to vote. When the Sixth Circuit Court of Appeals considered

Husted in 2016, it sided with the plaintiffs by a 2-1 vote. Inactivity, the majority found, is an illicit basis for wiping registered voters from the rolls. According to the NVRA, no individual may be removed from state lists “by reason of the person’s failure to vote”. In their brief to the justices, lawyers for the American Civil Liberties Union explained why Congress insisted on this caveat: “While voting is a right, people have an equal right not to vote,” a Senate report declared, “for whatever reason.”

The core of Husted involves a tricky detail of statutory interpretation: how to read a line in HAVA barring states from removing individuals from voter lists “solely by reason of a failure to vote”. The challengers and the Sixth Circuit majority contend that Ohio de-registers voters based only on inactivity—and thus falls foul of the law. Ohio’s Republican secretary of state, Jon Husted, and the dissenting Sixth Circuit judge, counter that the erasure results from that fact and another omission: the individual’s failure to confirm his address by sending the postcard.

For decades, the Department of Justice (DOJ) understood the law the way the challengers do. But in a rare about-face the DOJ under Donald Trump now embraces Ohio’s position. Samuel Bagenstos, a law professor at the University of Michigan who served in Barack Obama’s DOJ, laments, in an *amicus* brief drafted for 13 former DOJ lawyers who served in Democratic and Republican administrations, that the department’s “longstanding view” has been “abandoned”.

Mr Bagenstos’s brief examines the legal bases for voter purges. If Ohio wants to remove people who have moved, the brief notes, it is a better idea to consult post-office or motor-vehicle records than to guess from voting history. People may opt to stay at home on election day because they dislike the candidates, feel their vote won’t make a difference or are dissuaded by voter-ID laws: inactivity is not a reliable “indication that someone has moved”.

A study by Reuters found that about twice as many Democrats as Republicans were purged from the rolls in Ohio before the election of 2016. This partisan context may presage an ideologically split Supreme Court ruling, but Rick Hasen, an expert in election law, thinks Mr Bagenstos’s brief has a chance of swaying the court’s newest conservative, Neil Gorsuch. “I think if Justice Gorsuch is true to his textualist proclamations, his vote could well be in play,” Mr Hasen says. Elizabeth Wydra of the Constitutional Accountability Centre agrees. Justice Gorsuch insists that courts “must not rewrite federal laws under the guise of interpreting them”, she says, which bodes well for the plaintiffs. “States may not disenfranchise voters simply because they have failed to exercise their right to vote in the past.” ■

Cannabis laws

California inhales

LOS ANGELES

The state's new cannabis regulations are almost comically progressive

ON A hazy January morning, scores of cannabis enthusiasts queued outside MedMen's elegant West Hollywood store to celebrate the first day they could legally purchase the drug without a medical licence. As they took their place behind a man covered in piercings and dragon tattoos, two women in Spandex leggings and designer sunglasses chatted about what they would buy. When, an hour later, they were invited in, they picked up a shopping basket and sought out a "budtender" to help them choose between marijuana flowers, THC-infused citrus soda, and cannabis chocolate. "My dad has really bad back pain," one explained, as the pair stood in front of shelves displaying cannabis bath bombs, marijuana lotions and hemp-oil dog treats. "But he's an old conservative white male. What can I buy him that won't freak him out?"

California pioneered the legalisation of marijuana for medical use in 1996. But until this year the state's cannabis industry has been largely unregulated. In November 2016, following residents of other states such as Colorado, Washington and Oregon, Californian voters resoundingly approved Proposition 64, a measure to allow the sale of recreational marijuana. After a year of planning, on January 1st it became legal for licensed dispensaries to sell marijuana for recreational use.

Besides California, seven other states and the District of Columbia have legalised recreational marijuana. But California is different in two ways. First is its size. With legalisation, California—the world's sixth-largest economy—instantly became its largest legal market for recreational marijuana. A study by the University of California Agricultural Issues Centre at the University of California, Davis predicts that sales from recreational cannabis will eventually reach \$5bn a year. The state already sells marijuana worth more than \$2bn a year for medical purposes. For comparison, Colorado sold \$1.3bn in total, for recreational and medical use, in 2016. Since the federal prohibition means business cannot be conducted across state lines, Californian companies will be able to reach a scale that businesses in other states lack.

Second, perhaps unsurprisingly for a state seen as a Petri dish for socially liberal policy, California's new regulations are notably progressive. For a start, they allow residents convicted of drug offences that would not be crimes under the new order

to have their records expunged. Between November 2016, when Proposition 64 was passed, and September 2017, 4,885 Californians petitioned to reduce or void their convictions. Donnie Anderson, chairman of the California Minority Alliance, which champions people who have been harmed by drug criminalisation, applauds this initiative. "In the past, if you were white and caught with marijuana you would be let off. If you were black or Latino, you were not," he says. A study by the American Civil Liberties Union, an advocacy group, found that between 2001 and 2010 African-Americans were more than three times as likely to be arrested for marijuana possession as white Americans, despite similar consumption rates.

California's law also allows those convicted of past marijuana crimes to enter the cannabis industry. Jolene Forman of the Drug Policy Alliance, a pressure group, says this is ideal for two reasons. First, it allows people who have been operating black-market cannabis businesses to become legal. Second, it gives people harmed by the war on drugs the chance to profit in the legal cannabis industry.

With the revenue raised from recreational marijuana sales, California hopes to reduce some of the harms of criminalisation. After deductions for cannabis research and community programmes in the areas most affected by past marijuana policies, among other things, three-fifths of tax revenues from the purchase of recreational marijuana will go towards anti-addiction programmes and education about drug

abuse. A fifth will go towards cleaning up environmental damage caused by illegal cannabis-growing. For comparison, the largest share of tax revenues in Oregon, another deeply progressive state, goes to a general education fund.

Some cities in the Golden State are taking things even further. In Los Angeles, residents with past marijuana convictions will not only be allowed to buy licences to sell the drug, but will be given priority. Under the city's "social-equity programme", low-income Angelenos who have previous marijuana convictions or who have lived in areas with disproportionately high rates of arrest for marijuana offences will be given preference when licences to open marijuana retail businesses are granted. Oakland, San Francisco and Sacramento have introduced similar initiatives.

California has been widely criticised for its sloppy management of the medical marijuana industry. That raises questions about whether it can do better with the recreational stuff. John Hudak of the Centre for Effective Public Management at Brookings, a think-tank, is cautiously confident. "California was the first state to legalise medical marijuana—it didn't have the benefit of experience of what works and what doesn't," he says. "Now it does."

Legalisation seems unlikely to create a new group of heavy potheads, as seems to have happened in other states where pot has been legalised (nationwide, about 80% of the stuff is consumed by just 20% of users). Obtaining a medical licence to use marijuana in California has long been as easy as applying online and paying around \$40. Getting the stuff illegally has not been hard, either. When a preppy man in loafers waiting to enter MedMen was asked if he had previously used a medical licence to buy marijuana, he said no. When asked if he used the drug regularly he nodded. Most Californians who want to consume heavily already do so. But now the state can tax them for it. ■



Wake up and smell the THC



Peru

The presidential hostage

LIMA

The way Peru's president pardoned Alberto Fujimori has weakened him

IT WAS a strange video announcing a rash decision. In a taped message President Pedro Pablo Kuczynski, in a dimly lit room and with the harrowed look of a kidnap victim, told Peruvians that the pardon he had issued to Alberto Fujimori, a jailed former president, was “perhaps the most difficult decision of my life”. He had taken it because Mr Fujimori should not be allowed to “die in prison—justice is not revenge”. He called on Peruvians to move on from “negative emotions inherited from the past”. His unspoken hope was that, having barely survived an attempt by congress to impeach him, the pardon would steady his shaky presidency. But to many, it looks as if his presidency has been taken hostage.

The pardon on December 24th was the culmination of a turbulent fortnight that began when a congressional committee received documents from Odebrecht, a Brazilian construction company at the heart of a vast corruption scandal across Latin America, showing that it had awarded consultancy contracts to companies linked to Mr Kuczynski. This contradicted the president's written testimony in October that he had no links, either direct or indirect, to Odebrecht, which received many padded public contracts in Peru and has admitted paying \$29m in bribes in the country.

Westfield Capital, a boutique investment bank wholly owned by Mr Kuczynski, received \$782,000 from Odebrecht for providing consultancy starting in 2004,

when he was economy minister. Another firm, First Capital, owned by Gerardo Sepúlveda, a manager at Westfield, received \$4m from Odebrecht between 2010 and 2013. The contracts were legal and above-board, Odebrecht stated. In successive, stumbling explanations Mr Kuczynski insisted that Mr Sepúlveda was in sole charge of Westfield when he was in government, though he admitted he received “some money” in “dividends” from the Odebrecht contract. His only link to First Capital was a fee it paid him for a consultancy job when he was not in government.

This was enough for Mr Kuczynski's foes to pounce. Chief among them is Keiko Fujimori, Alberto's daughter, who lost the election in 2016 by just 41,000 votes and has seemingly never got over it. Her Popular Force party has 71 of the 130 seats in congress, whereas the president's party won only 18. Having forced out several of his ministers, Popular Force backed a motion for impeachment on the grounds of “permanent moral incapacity” (an inheritance from 19th-century constitutions intended to deal with dementia in a president).

Many neutral observers saw impeachment, without thorough investigation, as disproportionate. In defending himself, Mr Kuczynski admitted he had been “insufficiently forthcoming” but denied he was corrupt. He accused Popular Force of mounting a parliamentary coup. Defeat seemed inevitable, prompting several min-

isters to urge the president to resign. Yet the opposition fell short of the two-thirds majority required, because Kenji Fujimori, Keiko's estranged brother, led ten Popular Force deputies in abstaining.

Three days later Mr Kuczynski announced the pardon for Alberto Fujimori, Peru's president from 1990 to 2000 and its most divisive figure. While many Peruvians credit Mr Fujimori with saving Peru's economy from hyperinflationary chaos and eliminating the threat from Shining Path, a Maoist terrorist group, he governed as an autocrat and presided over systematic bribery and corruption. After being extradited from Chile, he was convicted on four charges of corruption and one of complicity in a death squad. He was sentenced to 25 years in prison. Peru's past two presidential elections have been contests between Keiko Fujimori and anti-fujimorismo—the country's strongest political current.

Not always divine

On December 24th Mr Kuczynski summoned his ministers and congressmen “to inform, not consult” them on the pardon, according to one who was there. Few believe official claims that it was because of fears for Mr Fujimori's health, and not a political deal struck with Kenji. Mr Kuczynski's pardon extends to a pending case of complicity in murder.

He had trailed the possibility of the pardon for months, but in a non-committal way. A poll by Ipsos found that 56% favoured the pardon. But 40% did not, and many of them voted for Mr Kuczynski. Three ministers and three of his congressmen resigned in protest, as did a number of mid-level officials. Tens of thousands of Peruvians demonstrated on December 28th and more protests are planned. While Mr Fujimori admitted that he had “let ►

Also in this section

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► down [some] compatriots" after his pardon and asked for their forgiveness, that was less than the full-blown apology for his crimes many would like.

Starting with a reshuffle of his cabinet, the president hopes to relaunch his government and seek a national consensus. Ipsos found a slight bump in his approval rating since mid-December, from 19% to 25%. But his situation now looks perilous, for three reasons.

Having forfeited much of his original support, he has thrown himself on the uncertain mercies of the *fujimoristas*. Popular Force is an extension of the Fujimori family saga. Seemingly fearful of being overshadowed by her father, Keiko did nothing to speed his release. That task fell to Kenji, who Ipsos finds is now slightly more popular than his sister. Whether the Fujimoris unite or continue to fight among themselves is an open question. Alberto Fujimori expressed gratitude to Mr Kuczynski, but even the slightest attempt on his part to return to political life would hurt the government. Keiko faces two judicial investigations into Popular Force's finances which, unless halted, could see her jailed. One concerns a text message on Marcelo Odebrecht's phone in which the construction tycoon, now under house arrest, appeared to order an illegal \$500,000 donation to her election campaign in 2011.

Then there is Mr Kuczynski's own relationship with Odebrecht. In a new revelation, Mr Odebrecht is said to have told Peruvian prosecutors in November that Mr Kuczynski gave talks to the company's board. The president, who answered questions from an anti-corruption prosecutor for four hours on December 28th, may also be required to give evidence to a congressional committee looking into Odebrecht, one of whose managers is due to give further testimony.

In the eyes of many former supporters, the president has forfeited the benefit of the doubt. "Before, many people thought...he was an upright figure," *El Comercio*, Peru's establishment newspaper, wrote after the impeachment vote (which it opposed) but before the pardon. Now "few people don't believe he has lied many times to the country about his past with Odebrecht." It added that he should "reflect on how little he has achieved".

That is his third weakness. Mr Kuczynski is 79, and has far more experience in banking and business than in politics. His government has been largely aimless. Its only tangible achievements are a welcome but minor reduction in paperwork for public services and an active foreign policy. It has largely failed to get big public projects going, as it promised. It commissioned a report on creating a universal health, pensions and social-protection system only to shelve it. "I made many criticisms of Kuczynski but I never thought he would have

no idea of what to do when he got to the presidency," says Alfredo Barnechea, a defeated rival in the election in 2016.

There are few disagreements between Mr Kuczynski and Keiko Fujimori on macroeconomic policy. But Peru needs much more than a stable economy. Some of those who voted for the president did so because they thought he believed in the need for independent institutions and more professional public agencies. These are things that Alberto Fujimori destroyed.

The president is right that Peru needs to move on from its disagreements about Mr Fujimori. But Mr Kuczynski's chance of doing anything useful by the end of his term in 2021 now looks vanishingly small. ■

Emeralds in Colombia

Prospectors, barons and suits

MUZO

Evil multinationals are giving miners steady jobs

AT THE bottom of a muddy basin surrounded by verdant mountains, Dora Alicia Hernández combs through black sludge and rock in the faint hope of finding an emerald valuable enough to lift her out of poverty. "All we need is one shiny stone," she says, as rainclouds smother the mountains overhead. "Then we can get out of here."

Alicia is seeking fortune near Muzo, a mountain town north of Bogotá that has attracted *guaqueros* (prospectors) from across Colombia since pre-colonial times. The region is renowned for both the quali-

ty and size of its emeralds. Of the 20 that have sold at auction for more than \$100,000 a carat, 19 were from Muzo or nearby. *Guaqueros* speak reverently of Fura, an 11,000-carat rock named after a mythical philandering wife who wept emeralds. Victor Carranza, who had started out as a *guaquero* and became Colombia's emerald tsar, found it in 1999. As far as anyone knows, it has never been sold.

A *guaquero*'s odds of making a Carranza-like fortune, never high, have become fainter. That is not because there are no other \$100,000-a-carat emeralds somewhere in the mountains near Muzo, but because the hunt is being taken over by multinational companies. They offer regular jobs rather than a tantalising chance of riches. But not every *guaquero* can get one, and some prefer the thrill of the hunt to a pay cheque.

Before corporatisation came chaos. Carranza employed his own army to fight rivals for control of the most productive mines in the "green wars" of the 1960s and 1980s. Perhaps 6,000 people died. "We all lost family and friends," says William Nándar, the flamboyant director of Mina Real, a locally owned mine. The winners managed to legalise their claims. Drug-traffickers tried to launder money through emerald mining. Mr Nándar recalls, "but they never made it past the private armies."

Guaqueros found opportunities amid the turmoil, sifting waste extruded by the mines and panning for stones in the Itoco river. Those who worked for the mining barons had livelihoods that were barely more secure: instead of wages, they were paid a cut of what they found.

Things calmed down after the barons made peace in 1990, Mr Nándar reminisces while sitting beside an outdoor hot tub at ►



Better than a pay cheque

his hilltop mansion. Then came the suits. Charles Burgess, an American, was the first to step out of a helicopter in 2009. He went into business with Carranza, set up a company called MTC and brought in machinery to widen the mines, making them more productive. After Carranza died in 2013, MTC acquired his mines.

Other foreign companies hope to emulate MTC. In Cosecuez, 15km (ten miles) from Muzo, a Dubai-based firm, Fura Gems, recently bought a mine from a Colombian businessman. Mina Real is seeking foreign backers.

Miners employed by corporations work regular hours and make at least the minimum wage of 781,242 pesos (\$270) a month. Dina Luz Poveda earns nearly double that as a safety inspector in a mine that extends 1,000 metres into the side of a mountain. That is a vast improvement from her earlier job as an intermediary between *guaqueros* and visiting buyers. "Now I can think about feeding my family," she says. "I don't worry that all my money gets spent on fuel because I know how much money comes in."

Elin Bohórquez, Muzo's mayor, thinks the change is indisputably for the better. "In the old days, as soon as *guaqueros* earned the money with a big find, they spent it on liquor, on women, and whatever else," he says. The companies maintain roads in an area largely neglected by the state and claim to care about safety. "We want to really focus on the safety of our mine," says Dev Shetty, Fura Gem's Indian-born director.

But many *guaqueros*, still dwelling in mountainside shacks perched above mineshafts, are unimpressed. In part that is because there are not enough jobs for all of them. MTC employs 800 people; Fura Gems says it has hired "hundreds". But nearly 80% of Muzo's workforce, including *guaqueros*, is without formal employment.

Greener and cleaner than the emerald barons, the companies leave less behind for *guaqueros* to sift through. "Gallery mines" bored into mountainsides have replaced open-cast mines, which have been outlawed in Muzo. Rather than leave debris for the *guaqueros*, the firms sift through it themselves and pack it back into the mines. "They are mosquitos, sucking our blood," complains Henry Pamplona, an elderly *guaquero*, as he shovels picked-over grime into a wheelbarrow.

Guaqueros have protested sporadically. In 2013 more than a thousand started digging on MTC's land; three died when some tunnels collapsed. A *guaquero* who calls himself Caballo (Horse) wants at least to force mining firms to leave some rubble behind. He thinks organised protest can bring that about. "We just need a leader who says the right things," he thinks. He is probably wrong. In Colombia's emerald hills, the day of the *guaquero* is over. ■



Canada

Shaming and renaming

OTTAWA

The country is erasing European names from its maps

JEFFERY AMHERST, who commanded British troops in North America during the Seven Years War in the mid-18th century, described indigenous people who fought for France as an "execrable race". He called for their "total extirpation" and suggested using dogs to hunt them down.

Yet Amherst (pictured) was commemorated in Canada (and in the United States) mainly for establishing British supremacy in North America. Schools, towns and streets bear his name. That has started to change in both countries. Amherst College in Massachusetts no longer celebrates Lord Jeff as its mascot (but is keeping its name). Canadians are scrubbing the names of Amherst and of other colonial-era heroes off street signs, school buildings and maps, often replacing them with names drawn from indigenous history. Montreal, the largest city in French-speaking Quebec, plans to erase a "stain on our history" by renaming Amherst Street, a 15km (0.9 mile) thoroughfare, which was given its name by British conquerors 200 years ago. The city is looking for an indigenous substitute.

About 30,000 of Canada's 350,000 place names have indigenous origins, including that of the country itself. Canada comes from the Iroquoian word for "village". As indigenous groups grow more assertive, and politicians become more supportive of them, maps are being rewritten. Justin Trudeau, Canada's Liberal prime minister, has promised to implement the UN declaration on the rights of indigenous peoples, which acknowledges their right to keep indigenous names for communities and places. More than 600 indigenous

place names were added to the national registry in 2017, compared with 358 five years earlier. In some cases, they are supplanting European-origin names.

Name-swapping is not easy. Local governments, which normally make such decisions, must consult residents, who often disagree with one another. Provinces also have a say. When Ottawa, named after the Odawa indigenous group, merged with surrounding municipalities in 2001, it found itself with 80 streets that shared their names with at least one other. Canada's capital saw that as a chance to give more recognition to the region's indigenous peoples. Some residents resisted. As a result, it took the city until last November to settle on Onigam Street, whose name was drawn from the Algonquin word for "portage", as the replacement for one of its River Streets. The job is still not done.

A decision may not end a dispute. A city councillor in Edmonton, Alberta's capital, objected that Maskekosihk ("people of the land of medicine") Trail is harder to pronounce than 23rd Avenue, its former name. Cree groups retorted that they have coped with tongue twisters ever since Europeans arrived. (Canada's longest one-word place name, Pekwachnamaykoskwawaypinwanik, or "the lake where wild trout are caught by fishing with hooks", in Manitoba, is a Cree confection.) The Northwest Territories nearly changed its own name to a much shorter one after part of it separated to form Nunavut in 1999. The government sought suggestions on a website for a new name; "Bob" came second.

The Stoney Nakoda want to rename Calgary, the largest city in Alberta, Wi-chispa Oyade, which means "elbow town". The Blackfoot prefer Mohkinstis-aka-piyosis, which means "many houses on the Elbow river". The province has shown no interest in calling Calgary, named after Scotland's Calgary Bay, anything else. The Northwest Territories dealt with competing names for the Mackenzie river by accepting all of them in 2015. It can now be called the Dehcho, the Deho, the Kuukpak, the Nagwichoonjik or the Grande Rivière, all of which mean "great river".

Mr Trudeau dropped the name of Hector-Louis Langevin, a founder of residential schools, which sought to sever indigenous children's links to their families and cultures, from the building that houses his office. That suggests the renaming trend is unlikely to abate. Indigenous groups want the Cornwallis river in Nova Scotia, named for a colonial governor who offered a bounty for the scalps of Mi'kmaq people, to be called something else.

Montreal's city council is debating who should replace Amherst. One possibility is Pontiac, an Odawa leader who rebelled against Amherst's rule. That dig at the British might please indigenous folk and French speakers alike. ■



Protests in Iran

When frustration boils over

TEHRAN

Iran is in turmoil, but the clerics and their allies remain as entrenched as ever

NO TO high prices!", "Down with embezzlers!", "People are paupers while the mullahs live like gods!" Are these the chants of foreign-sponsored insurrectionists trying to create anarchy, insecurity and intrigue in Iran? That is what the clerical regime would have you believe, as it ignores the economic grievances voiced by the thousands of Iranians who have taken to the streets in more than 70 towns and cities in the past week.

Incredibly, the unrest seems to have been started by religious hardliners, hoping to undermine the reformist presidency of Hassan Rouhani. Stoking their anger over the rising price of eggs, clerics in Mashhad, Iran's second city, urged hundreds of their followers to protest on December 28th. Many demanded the president's resignation and called for fresh elections—though Mr Rouhani was re-elected just last year.

They could not have known what they started. The protests quickly spread to other cities, and the tone also changed. It was not just Mr Rouhani who should give up power—so too should the ruling clerics and their armed protectors in the Islamic Revolutionary Guard Corps, said the new protesters. "No to conservatives and reformers alike," they chanted. Contrary to the regime's claims, no one seemed to be leading the rallies, some of which turned violent (though most have not).

Frustrations have been piling up since Mr Rouhani's victory in May. As a candidate he championed an inclusive, open and reformed Iran. But his new cabinet excluded women and Sunnis and contained few non-Persian minorities. Mr Rouhani got out the women's vote, but he has left most curbs on them in place, including a ban on their presence in stadiums.

Perhaps, some surmised, the hardliners' brief arrest of his brother had spooked him. A draft budget, presented to parliament in December, would bloat the coffers of the ayatollahs' foundations and the Guards, but cut subsidies for the poor. The hashtag *#pashimanam* (we regret [our votel]) went viral. Mr Rouhani's supporters say that by releasing an unusual amount of



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detail about the spending he aimed to embarrass the clerics.

It is mainly pent-up economic grievances, not the political sort, that are at the heart of the unrest. Even before the latest protests, factory workers had gone on strike over unpaid salaries and pensioners had marched against low payments. Those taking to the streets have wondered aloud why so much of the country's wealth has gone to support violent groups in Yemen, Lebanon and Gaza, and a dictator in Syria, while their mostly rural provinces are neglected. The unemployment rate is over 12% and at least one in four young people, who make up the bulk of the protesters, are without a job.

Egged on

The regime claims that the "sedition" is over, but many Iranians still seethe with resentment. Even so, a broader uprising does not appear to be in the offing. Tens of thousands of people responded to the clerics' call to counter-demonstrate on January 3rd. Most of Tehran, the capital and epicentre of past upheaval, has remained calm, as the police arrest potential troublemakers and patrol the streets. Hundreds of students have come out, but the middle class, and even reformists, have so far sat on the sidelines. Some fear a repeat of the brutal crackdown that ended the Green Movement, which challenged a dubious presidential election in 2009. Others worry that the protests, which lack organisation, could get out of control. Indeed, they did in a few towns, where police opened fire. Over 20 people have been killed.

Once again, the Guards have proved that they are the regime's backbone. The authorities switched off messaging apps, such as Telegram (which has 40m Iranian subscribers and was the protesters' main ➤

way of communicating), and VPNS, which had offered a backdoor to the internet. The Guards hope to exploit the discontent with Mr Rouhani to secure political gains. Living standards, they remind Iranians, have fallen under this president, but improved when their man, Mahmoud Ahmadinejad, was in office (during a time of high oil prices). When the 78-year-old supreme leader, Ayatollah Ali Khamenei, dies, they will probably have the whiphand in determining who succeeds him.

Mr Rouhani, by contrast, has been weakened. The unrest has tarnished his image and dented his own hopes of replacing

ing Mr Khamenei. He seems stumped by Iran's economic problems and may try to buy his way back into the good graces of the public with increased spending. His greatest success, the nuclear deal of 2015, has brought oil-based growth, but not the kind of broad development that he promised. Under the agreement, Iran agreed to curb its nuclear programme in exchange for America and other foreign powers lifting most economic sanctions. But America has maintained some (many relating to Iran's missile programme), which scare away foreign banks and investors. The unrest has also not helped. France, which

seemed keen to engage Iran, is now more hesitant. President Emmanuel Macron, who was planning a visit, has called off a trip by his foreign minister.

Over the past two years, millions of voters, who had sat out elections since 2009, returned to the ballot box and chose would-be reformers. Their victories seemed to make Iran the Middle East's most vibrant democracy (apart from Israel). But the inability of Mr Rouhani to improve their lot has, once again, left many feeling disillusioned. They are still trying to find a way to make their voices heard without facing the wrath of the Guards. ■

Yemen

Qat wrenching

MARIB

Famine in Yemen could be avoided by less chewing

YEVEN is on the brink of famine, say aid agencies, which often blame the civil war, Saudi Arabia's blockade of northern seaports and its bombing of vital infrastructure. The government's refusal to pay salaries to employees in rebel-held areas and the depreciation of Yemen's rial mean many cannot afford the food that is available. But one of the biggest causes of hunger often goes unmentioned: a leafy plant called *qat*.

The weed is Yemen's most popular drug: 90% of men and over a third of women habitually chew its leaves, storing the masticated greenery in their cheek until the narcotic seeps into their bloodstream. In the past Yemenis might indulge once a week and the practice was largely confined to the north-west mountains, where *qat* grows. But following

unification in 1990 it spread south. Now *qat* markets bustle all over the country.

Men spend far more feeding their addiction than their families: sometimes \$800 a month. Rather than searching for weapons and other contraband, soldiers extort bribes at checkpoints to pay for their habit, jacking up transport costs. And while the country runs out of basics, such as wheat, its best farmland is devoted to producing the crop, which is more lucrative. Cultivation of *qat* is said to be increasing by 12% a year.

Officials refer to it as Yemen's Viagra and encourage its use. Taher Ali al-Auqaili, the army's chief of staff, says it is "our whisky" and claims it gives his men strength to fight (see next article). Both sides feed it to their child soldiers.

When local governors in Hadramawt, the largest province, tried to revive an old ban on consumption in their offices, they were summoned to Riyadh to join Yemen's president, Abd Rabbo Mansour Hadi, for a communal chew. Only al-Qaeda in the Arabian Peninsula has had any success in banning it.

Northern Yemen is the region most under threat of famine, but the Houthi rebels who control it value their monopoly on *qat* as much as Mr Hadi does his hold on the country's oil- and gasfields. It keeps roads open across enemy lines. Dozens of trucks full of the harvest cross into Marib each day. Taxes on *qat* also earn both sides in the war big revenues. Recent data are scarce, but back in 2000 the World Bank estimated that *qat* accounted for 30% of Yemen's economy. Even the hungry cite an advantage: the drug suppresses their appetite. But the absurdity is not lost on all. In the words of a southern official, "We're fighting Houthis with our arms and funding them with our mouths."



Less jaw-jaw and war-war please

Yemen's war

The balance shifts

MARIB

Yemen's army is making gains against the rebels, but victory is still far off

TAHER ALI AL-AUQAILI, the chief of staff of Yemen's army, has a spring in his step. After a year of stalemate, his five fronts are moving again. As he darts between battlefields hundreds of kilometres apart, he speaks of victories in Beihan, which have reconnected the road from his headquarters in Marib to southern Yemen, and in the Jawf region (see map). Troops have also advanced 60km north along the coast from Mokha towards Hodeida, the main port of the rebels, called the Houthis. From bases in the desert and coastal lowlands, the alliance of forces arrayed against the rebels is edging its way into the mountains that shelter Yemen's capital, Sana'a, which is still in Houthi hands.

A string of events has led to the advance. In December the Houthis killed their erstwhile ally, Ali Abdullah Saleh, who had been Yemen's president from 1978 to 2012, so the Houthis now fight



► alone. Arrests, killings and houses demolished by tank shells in the capital have stoked resentment against the rebels. Thousands of Mr Saleh's people have fled.

Tales of rebel atrocities have spurred on the government's forces. Fleeing Yemeni journalists say the Houthis killed over 30 colleagues, including some who worked for Mr Saleh's media outlets. They say the rebels extorted money from relatives wanting to recover tortured bodies for burial. The Houthis, who claimed to champion the *mathlumeen*, or oppressed masses, may be turning into their oppressors.

As the rebels' following shrinks, the army's may be growing. The conflict has often been depicted as a sectarian one between the Iranian-backed Houthis, who follow the Zaydi branch of Shiism in the highlands, and Sunnis in the lowlands backed by their co-religionists in the Gulf. But the flight of hundreds of thousands of displaced Yemenis is changing the sectarian make-up in the army's ranks. General Auqaili is a Zaydi from Houthi-held Amran. The new security chief in Marib comes from Amran, too. Moreover, he is a *sayyid*, one of the scions of the Prophet Muhammad, a group that Houthis think should rule the roost.

Mr Saleh's death has also prompted the rancorous regional coalition assembled against the Houthis to bridge its differences. Muhammad bin Zayed, the de facto leader of the United Arab Emirates (UAE), had long distrusted Yemen's army. Many of its soldiers support Islah, which has ties to the Muslim Brotherhood, an Islamist movement that the UAE abhors. Prince Muhammad had hoped that Mr Saleh would switch sides and boot the Houthis from power.

But since Mr Saleh's death Prince Muhammad has reconciled with Islah. He has given army units loyal to the Islamists air support. Government forces are on the verge of breaking out of Taiz, Yemen's third-largest city, besieged by the Houthis for almost three years. They hope to recapture all of the coastal plain, where the Houthis have little support.

But this would still leave the army far from total victory. The Houthis would be hard to winkle out of the highlands. Their mines, snipers and anti-tank missiles make progress through the passes painfully slow, complains General Auqaili. Moreover, before the Houthis ditched Mr Saleh, they took control of an arsenal of tanks and missiles from his Republican Guard, much of it supplied by America when it saw Mr Saleh as a bulwark against al-Qaeda.

By contrast, General Auqaili complains that his pleas for heavier weapons to match the Houthis go unanswered. The morale of his men is sapped because they are nine months behind with their pay. Some get by, selling weapons or information to the Houthis or al-Qaeda. So flush

are arms bazaars that prices are 20% lower than before the war began in 2014.

Perhaps the biggest reason for the stalemate, however, is that many Yemenis benefit from it. Warlords and soldiers at checkpoints cream off humanitarian aid. Cities like Marib bask in the oil wealth and duties on electricity and imports that previously enriched the capital. Once notorious as a hotspot for kidnappings on behalf of al-Qaeda, it may now be Yemen's safest city. Banks and schools function. Wages are paid on time. An oft-cited Yemeni adage holds that one people's misfortune is another's gain. ■

Egyptian politics

Cometh the hour, cometh the ban

CAIRO

Several challengers could shake up the presidential race, if they are allowed to

THE most interesting man in Egyptian politics is trapped in a hotel. On November 29th Ahmed Shafiq announced that he would run for president. The former prime minister is best known for losing the presidential race in 2012 to Muhammad Morsi of the Muslim Brotherhood, who was himself toppled in a coup the following year. Hours after his announcement Mr Shafiq claimed that he was barred from leaving Abu Dhabi, where he lived in self-imposed exile. But his hosts said he was free to go—and then kicked him out.

After arriving in Cairo Mr Shafiq disappeared for a night. He resurfaced the next evening for a bizarre televised interview. "I'm not kidnapped or anything," he said. His home just needed renovations and the



Shafiq, a killer candidate

authorities arranged alternative accommodation, he explained. "I was taken to one of the most distinguished hotels in the area." It must be comfortable there, for Mr Shafiq has not been seen in public since. Journalists who tried to meet him were chased away by plain-clothed goons.

Egyptians expect that their presidential election this spring will be a rerun of 2014, when Abdel-Fattah al-Sisi won 97% of the vote. His only opponent finished third in the two-man race (invalid ballots came second). Though Mr Sisi has not formally announced his candidacy, a suspiciously well-funded "grassroots" campaign has plastered posters of his image all over Cairo. MPs talk of amending the constitution to extend his next four-year term to six, or to allow him a third.

Nevertheless, a list of would-be challengers is emerging. Start with the long shots, such as Khaled Ali, a liberal lawyer and activist, who hopes to save Egypt from what he calls its "dark destiny". Mr Ali was convicted of "public indecency" last year for making an obscene hand gesture. If the trumped-up case is not overturned on appeal, he is disqualified from running. The candidacy of Colonel Ahmed Konsawa, an obscure army officer, is in similar trouble. He was arrested within days of announcing his bid for expressing political views while in uniform.

It would be harder to silence Muhammad Anwar Sadat, a nephew of the slain former president. Mr Sadat is a genuine liberal, a rarity in Egyptian politics. A former MP, he was booted out of the legislature last year for being too critical of the government. The army has tried to recruit him to run, to give the election a sheen of legitimacy. But so far he has demurred.

That leaves Mr Shafiq. In 2012 he campaigned on public order, repeating the word *istiqraq* (stability) at every turn. On the stump he often seemed unstable, slurring his way through gaffe-prone speeches. During a televised debate, he offered a memorable summary of his service in the war against Israel in 1973: "I killed and was killed!" Still, he came within 900,000 votes of defeating Mr Morsi. He now claims to be a champion of human rights—an absurd turnaround for an ally of Hosni Mubarak, the long-serving dictator.

His candidacy has more to do with grumbling amongst the Egyptian elite, who are concerned about Mr Sisi's economic management. Army officers are unhappy with the struggling campaign against jihadis in Sinai.

Mr Sisi has the perks of incumbency: a pliant parliament, a repressive police force and an iron grip on the media. One MP wants to strip Mr Shafiq of his citizenship for "betraying his homeland". Last month three of his supporters were charged with harming national security. He may be in for a long stay at the Marriott. ■

The undemocratic Republic of Congo

Never-ending term

An embattled president survives another year of unconstitutional rule

ON THE streets of Kinshasa, the rau-
cous, ramshackle capital of the Demo-
cratic Republic of Congo (DRC), it is now
difficult for foreigners to walk through markets
without being accosted by secret poli-
cemen, nor to do so without also hearing
from shoppers and market traders how
much they hate Joseph Kabila, the coun-
try's president. As 2018 starts, Africa's
youngest head of state (Mr Kabila is only
46, despite having ruled for 17 years) is also
one of the continent's most embattled.

On New Year's Eve at least seven people
were killed in protests against the govern-
ment. Before the demonstrations the
Congolese government shut down much
of the mobile-phone network to hamper
their organisers. These were the first major
protests in Kinshasa in a year and were but
the latest in a string of problems for a presi-
dent who did not bother to organise elec-
tions and has continued to rule unconstitu-
tionally since his term of office ran out in
December 2016.

On December 21st the American gov-
ernment imposed sanctions on one of his
chums: Dan Gertler, an Israeli billionaire
with mining and oil interests across the
country. America's Treasury Department
said Mr Gertler had "amassed his fortune
through hundreds of millions of dollars'
worth of opaque and corrupt mining and
oil deals". On Christmas Day armed men
burned down one of Mr Kabila's palaces,
in North Kivu. A police officer was killed;
several vehicles were destroyed.

Mr Gertler, who once claimed that he
should get a Nobel prize for his work in
Congo, to which he commutes from Tel
Aviv weekly, has for years acted as a
middleman between multinational min-

ing firms and the state. According to the US
Treasury, between 2010 and 2012 the losses
to the Congolese state from the underpric-
ing of mines and mining licences handled
by Mr Gertler came to more than \$1.36bn.
By imposing sanctions on Mr Gertler,
America will make it more difficult for Mr
Kabila to raise money to keep his patron-
age machine well-oiled.

If Mr Kabila is to stay in power, he will
need to be able to dole out something. At
the end of 2016 the president narrowly
avoided huge street protests by agreeing to
a deal with the political opposition to stay
in power for one more year while elections
were organised. That year has now passed
and Mr Kabila is still in office, though inter-
national pressure is mounting. Nikki Haley,
Donald Trump's ambassador to the
UN, said in October after a meeting with
Mr Kabila that America would withhold
support for a UN peacekeeping mission in
the country if he did not commit to holding
elections in 2018. Since then Corneille Nangaa,
the president of the electoral commis-
sion, has said that voter registration is pro-
ceeding and an election will be held on
December 23rd.

In the meantime, the president has to
hold on to his territory. The attack on his
compound in North Kivu is merely the lat-
est evidence of worsening security in the
east, the birthplace of his father's Rwandan-spon-
sored rebellion against Mobutu Sese Seko in 1997. Earlier in December, 15
UN peacekeepers were killed in a single at-
tack blamed on the Allied Democratic Forces, a brutal rebel group that has its
origins in Uganda. Fighting has also intensi-
fied in South Kivu. In September, a militia
launched an audacious marine assault on
Uvira, a large city on Lake Tanganyika.

In the first half of 2017, 1m people were
displaced by conflict. Hundreds of thou-
sands of children are at risk of starvation in
Kasai because of fighting. And yet Mr Ka-
bila holds on, getting ever weaker, but
seemingly without any exit plan or any
hope of reasserting control. His country is
at risk of falling back into civil war for the
third time in two decades. ■



Gambia

Waiting for Jammeh

BANJUL

The former dictator's victims hope for justice

YAHYA JAMMEH, who ruled Gambia
from 1994 to 2017, claimed he could cure
people of HIV with his bare hands. The
probability of such faith-healing working
is zero. Today the law is trying to lay hands
on Mr Jammeh. At first glance, the chance
of it succeeding is only slightly higher.

In January 2017, two months after losing
an election, he agreed to step down, hav-
ing been warned by fellow west African
leaders that he would be removed by force
if he clung to power any longer. In return
for going without a fight, he was given asyl-
um in Equatorial Guinea, an even worse
African dictatorship. Teodoro Obiang, its
president for the past 38 years, has never
signed up to the International Criminal
Court (ICC), which means that Mr Jammeh
(pictured) cannot be extradited for trial. He
passes his time farming on one of Mr
Obiang's grace-and-favour estates.

For those who were beaten with metal
pipes or had plastic bags put over their
heads by Mr Jammeh's goons, the only
hope for justice is either to persuade Mr
Obiang to hand him back, or to wait for a
more human-rights-friendly government
to take over in Equatorial Guinea. Neither
seems likely. However, campaigners such
as Amadou Scattred Janneh, who was
once jailed by Mr Jammeh for printing t-
shirts calling for his downfall, argue that all
is not lost. Where international justice is
concerned, good things can come to those
who wait.

In 2016 Chad's ex-despot, Hissène Ha-
bré, was jailed for life by a court in Senegal ►



More of the same

► for the murder of perhaps 40,000 people in the 1980s. Again, the case was beset by political obstacles, not least from the Senegalese government, which arrested Habré in 2000 but then dragged its feet. Senegal's then president, Abdoulaye Wade, heeded other African politicians, who whispered that prosecuting Mr Habré would set an unwelcome precedent that people like themselves could be held accountable. However, in 2012 Mr Wade was replaced by Macky Sall, who thought that setting such a precedent was an excellent idea.

Some of Mr Habré's victims, who had campaigned relentlessly to prevent the world from forgetting about his crimes, are now advising Mr Jammeh's victims, who have formed their own campaign group and are gathering evidence. "We know it's not going to be easy, but we are ready for a long struggle," says Mr Janneh. Meanwhile, Gambian police have opened 35 investigations into alleged killings by Mr Jammeh's regime, one of which has already reached court.

Separately, a special commission into Mr Jammeh's financial dealings has uncovered further evidence that he embezzled on a massive scale. Staff from the Gambian Central Bank and the National Petroleum Corporation have told how he used the organisations as if they were his personal cash machines, withdrawing up to \$2m at a time. A watertight criminal case against Mr Jammeh, though, will not be enough to get him in the dock. A convincing political case will have to be made, too.

Under the new presidency of Adama Barrow, Gambia has already rejoined the ICC, from which his predecessor had withdrawn. But if he were prosecuted, Mr Jammeh, like Mr Habré, would probably go before a specially convened local court, in order to make justice look African.

Setting up such a tribunal is costly. Moreover, before it went ahead, fellow African leaders would first have to lean heavily on Mr Obiang to hand Mr Jammeh over. Right now, there is little sign of any of them wanting to do so. Sources within the Economic Community of West African States (ECOWAS), the main regional power bloc, say that prosecuting Mr Jammeh is not a priority. Nor is it one for Mr Barrow's government, which fears the risk of ructions from Mr Jammeh's old supporters.

Still, the victims' groups may be able to cultivate a few powerful allies. Mr Sall, Senegal's president, is no friend of Mr Jammeh, who sheltered armed separatists from Senegal's Casamance region. Likewise, Ghana is under pressure to bring justice for 44 Ghanaian migrants allegedly murdered in 2005 by Mr Jammeh's security forces (who mistook them for mercenaries). If enough people with enough scores to settle get together, this may one day ensure that Mr Jammeh, the dictator-turned-farmer, finally reaps what he sowed. ■

Liberia

The new skipper

The election marks Liberia's first democratic transfer of power since 1944

FOOTBALLING superstar George Weah has scored again. As the only African footballer to have been awarded both FIFA's World Player of the Year and France's Ballon d'Or, Mr Weah, a Liberian, is used to winning. However, one prize had evaded him—until this year.

On December 26th the former Chelsea, AC Milan and Paris Saint-Germain player triumphed in the second round of Liberia's presidential election. Mr Weah defeated the current vice-president, Joseph Boakai, with 62% of the vote. He won all but one of Liberia's 15 counties.

Mr Weah's victory is a big milestone for the nascent democracy. Liberia suffered two brutal civil wars between 1989 and 2003. An estimated 250,000 people died and perhaps 90% of the economy was wiped out. In 1997, during a period of peace, Charles Taylor, a warlord, became president, having made it clear that he would go back to war if not elected. Supporters chanted, "He killed my ma, he killed my pa, but I'll vote for him."

When Mr Weah's term kicks off in January, by contrast, it will be Liberia's first peaceful transfer of power from one elected president to another since 1944. The runoff vote was delayed by a legal challenge to the first round of the election (in which Mr Weah came first with 38% of the vote to Mr Boakai's 29%). The second round eventually proceeded with no violence, though turnout was only 56%, compared with 75% in the first round in October.

Mr Weah is idolised, particularly among the young—and more than half the electorate is under 33. He lost to the current president, Ellen Johnson Sirleaf, in 2005. A former World Banker, she generated a surge of enthusiasm for having neither blood on her hands nor loot in her pockets. However, she failed to curb corruption adequately or fix Liberia's woeful schools and clinics. Voters cried foul.

The incoming vice-president, Jewel Howard-Taylor, is a popular senator who once tried to make homosexuality punishable by death. She is also Mr Taylor's ex-wife, which helped attract voters who still support the former tyrant (who is now in prison in Britain for war crimes committed in neighbouring Sierra Leone).

For Mr Boakai, incumbency was a disadvantage. The 73-year-old tried to shrug off his association with Ms Johnson Sirleaf. He compared himself to a "race car in the garage", the potential of which was yet to be realised. However, his reputation for falling asleep in public earned him the nickname "Sleepy Joe". Mr Weah darted past. Tellingly, Ms Johnson Sirleaf, a winner of the Nobel peace prize, did not campaign with her deputy and even inaugurated a road along with Mr Weah just days before the election.

Yet there are doubts about the kind of leader Mr Weah will be. Since his election as a senator in 2014, he has rarely attended parliament. Nor has he introduced or co-sponsored any legislation. Mr Weah's relative lack of education, though, only seems to make him more popular. His supporters see the former slum-dweller as one of them—a champion from their streets.

Much will depend on the ministers and advisers with whom he surrounds himself. Liberia needs better roads and schools, more jobs and electricity, and a thousand other things. Presidents, unlike footballers, must aim at multiple goals. ■



Capping this

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BRAIN-COMPUTER INTERFACES

Thought experiments



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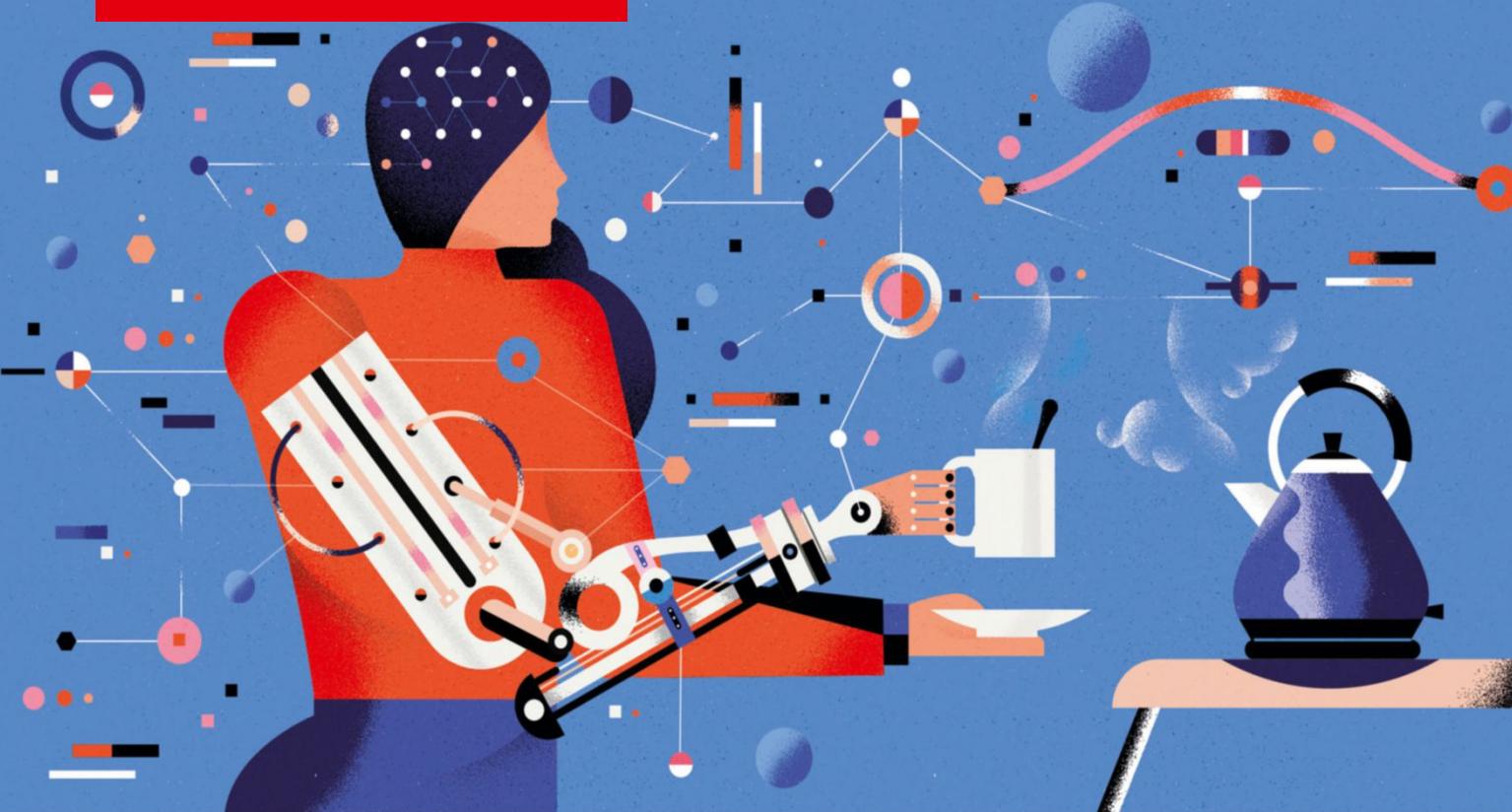
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Brains and machines

Thought experiments

Brain-computer interfaces sound like the stuff of science fiction. Andrew Palmer sorts the reality from the hype

IN THE gleaming facilities of the Wyss Centre for Bio and Neuroengineering in Geneva, a lab technician takes a well plate out of an incubator. Each well contains a tiny piece of brain tissue derived from human stem cells and sitting on top of an array of electrodes. A screen displays what the electrodes are picking up: the characteristic peak-and-trough wave forms of firing neurons.

To see these signals emanating from disembodied tissue is weird. The firing of a neuron is the basic building block of intelligence. Aggregated and combined, such “action potentials” retrieve every memory, guide every movement and marshal every thought. As you read this sentence, neurons are firing all over your brain: to make sense of the shapes of the letters on the page; to turn those shapes into phonemes and those phonemes into words; and to confer meaning on those words.

This symphony of signals is bewilderingly complex. There are as many as 85bn neurons in an adult human brain, and a typical neuron has 10,000 connections to other such cells. The job of mapping these connections is still in its early stages. But as the brain gives up its secrets, remarkable possibilities have opened up: of decoding neural activity and using that code to control external devices.

A channel of communication of this sort requires a brain-computer interface (BCI). Such things are already in use. Since 2004, 13 paralysed people have been implanted with a system called BrainGate, first developed at Brown University (a handful of others have been given a similar device). An array of small electrodes, called a Utah array, is implanted into the motor cortex, a strip of the brain that governs movement. These electrodes detect the neurons that fire when someone intends to move his hands and arms. These signals are sent through wires that poke out of the person’s skull to a decoder, where they are translated into a variety of outputs, from moving a cursor to controlling a limb.

The system has allowed a woman paralysed by a stroke to use a robotic arm to take her first sip of coffee without help from a caregiver. It has also been used by a paralysed person to type at a rate of eight words a minute. It has even reanimated useless human limbs. In a study led by Bob Kirsch of Case Western Reserve University, published in the *Lancet* this year, BrainGate was deployed artificially to stimulate muscles in the arms of William Kochevar, who was paralysed in a cycling accident. As a result, he was able to feed himself for the first time in eight years.

Interactions between brains and machines have ►

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changed lives in other ways, too. The opening ceremony of the football World Cup in Brazil in 2014 featured a paraplegic man who used a mind-controlled robotic exoskeleton to kick a ball. A recent study by Ujwal Chaudhary of the University of Tübingen and four co-authors relied on a technique called functional near-infrared spectroscopy (fNIRS), which beams infrared light into the brain, to put yes/no questions to four locked-in patients who had been completely immobilised by Lou Gehrig's disease; the patients' mental responses showed up as identifiable patterns of blood oxygenation.

Neural activity can be stimulated as well as recorded. Cochlear implants convert sound into electrical signals and send them into the brain. Deep-brain stimulation uses electrical pulses, delivered via implanted electrodes, to help control Parkinson's disease. The technique has also been used to treat other movement disorders and mental-health conditions. NeuroPace, a Silicon Valley firm, monitors brain activity for signs of imminent epileptic seizures and delivers electrical stimulation to stop them.

It is easy to see how brain-computer interfaces could be applied to other sensory inputs and outputs. Researchers at the University of California, Berkeley, have deconstructed electrical activity in the temporal lobe when someone is listening to conversation; these patterns can be used to predict what word someone has heard. The brain also produces similar signals when someone imagines hearing spoken words, which may open the door to a speech-processing device for people with conditions such as aphasia (the inability to understand or produce speech).

Researchers at the same university have used changes in blood oxygenation in the brain to reconstruct, fuzzily, film clips that people were watching. Now imagine a device that could work the other way, stimulating the visual cortex of blind people in order to project images into their mind's eye.

If the possibilities of BCIs are enormous, however, so are the problems. The most advanced science is being conducted in animals. Tiny silicon probes called Neuropixels have been developed by researchers at the Howard Hughes Institute, the Allen Institute and University College London to monitor cellular-level activity in multiple brain regions in mice and rats. Scientists at the University of California, San Diego, have built a BCI that can predict from prior neural activity what song a zebra finch will sing. Researchers at the California Institute of Technology have worked out how



Ultimately it may be possible to meld together human and artificial intelligence

cells in the visual cortex of macaque monkeys encoded 50 different aspects of a person's face, from skin colour to eye spacing. That enabled them to predict the appearance of faces that monkeys were shown from the brain signals they detected, with a spooky degree of accuracy. But conducting scientific research on human brains is harder, for regulatory reasons and because they are larger and more complex.

Even when BCI breakthroughs are made on humans in the lab, they are difficult to translate into clinical practice. Wired magazine first reported breathlessly on the then new BrainGate system back in 2005. An early attempt to commercialise the technology, by a company called Cyberkinetics, foundered. It took NeuroPace 20 years to develop its technologies and negotiate regulatory approval, and it expects that only 500 people will have its electrodes implanted this year.

Current BCI technologies often require experts to operate them. "It is not much use if you have to have someone with a masters in neural engineering standing next to the patient," says Leigh Hochberg, a neurologist and professor at Brown University, who is one of the key figures behind BrainGate. Whenever wires pass through the skull and scalp, there is an infection risk. Implants also tend to move slightly within the brain, which can harm the cells it is recording from; and the brain's immune response to foreign bodies can create scarring around electrodes, making them less effective.

Moreover, existing implants record only a tiny selection of the brain's signals. The Utah arrays used by the BrainGate consortium, for example, might pick up the firing of just a couple of hundred neurons out of that 85bn total. In a paper published in 2011, Ian Stevenson and Konrad Kording of Northwestern University showed that the number of simultaneously recorded neurons had doubled every seven years since the 1950s (see chart). This falls far short of Moore's law, which has seen computing power double ev-

Let me think



Brain-computer interface components

Signal acquisition

The action potentials of neurons are recorded. Non-invasive recording techniques include electroencephalograms and near-infrared spectroscopy; invasive techniques typically use implanted electrodes

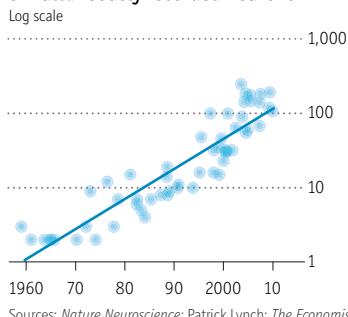
Decoding

Brain signals are processed, usually with machine-learning techniques. Pattern recognition leads to the generation of a control signal

Application

The control signal causes a change to an external device. Brain-computer interfaces can also be used to stimulate the brain

Simultaneously recorded neurons



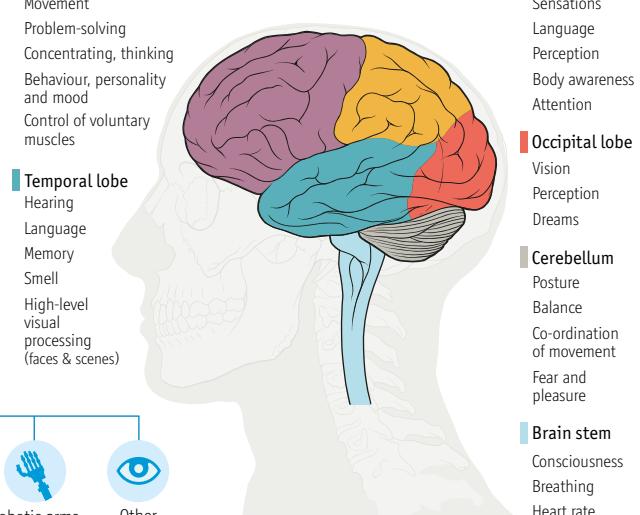
Frontal lobe

Movement
Problem-solving
Concentrating, thinking
Behaviour, personality and mood
Control of voluntary muscles

Temporal lobe

Hearing
Language
Memory
Smell
High-level visual processing (faces & scenes)

Functional areas of the brain



▶ ery two years.

Indeed, the Wyss Centre in Geneva exists because it is so hard to get neurotechnology out of the lab and into clinical practice. John Donoghue, who heads the centre, is another of the pioneers of the BrainGate system. He says it is designed to help promising ideas cross several “valleys of death”. One is financial: the combination of lengthy payback periods and deep technology scares off most investors. Another is the need for multidisciplinary expertise to get better interfaces built and management skills to keep complex projects on track. Yet another is the state of neuroscience itself. “At its core, this is based on understanding how the brain works, and we just don’t,” says Dr Donoghue.

Me, myself and AI

This odd mixture of extraordinary achievement and halting progress now has a new ingredient: Silicon Valley. In October 2016 Bryan Johnson, an entrepreneur who had made a fortune by selling his payments company, Braintree, announced an investment of \$100m in Kernel, a firm he has founded to “read and write neural code”. Mr Johnson reckons that the rise of artificial intelligence (AI) will demand a concomitant upgrade in human capabilities. “I find it hard to imagine a world by 2050 where we have not intervened to improve ourselves,” he says, picturing an ability to acquire new skills at will or to communicate telepathically with others. Last February Kernel snapped up Kendall Research Systems, a spinoff from the Massachusetts Institute of Technology (MIT) that works on neural interfaces.

Kernel is not alone in seeing BCIs as a way for humans to co-exist with AI rather than be subjugated to it. In 2016 Elon Musk, the boss of SpaceX and Tesla, founded a new company called Neuralink, which is also working to create new forms of implants. He has gathered together an impressive group of co-founders and set a goal of developing a BCI for clinical use in people with disabilities by 2021. Devices for people without such disabilities are about eight to ten years away, by Mr Musk’s reckoning.

Neuralink is not saying what exactly it is doing, but Mr Musk’s thinking is outlined in a lengthy post on *Wait But Why*, a website. In it, he describes the need for humans to communicate far more quickly with each other, and with computers, if they are not to be left in the dust by AI. The post raises some extraordinary possibilities: being able to access and absorb knowledge instantly from the cloud or to pump images from one person’s retina straight into the visual cortex of another; creating entirely new sensory abilities, from infrared eyesight to high-frequency hearing; and ultimately, melding together human and artificial intelligence.

In April it was Facebook’s turn to boggle minds as it revealed plans to create a “silent speech” interface that would allow people to type at 100 words a minute straight from their brain. A group of more than 60 researchers, some inside Facebook and some outside, are working on the project. A separate startup, Openwater, is also working on a non-invasive neural-imaging system; its founder, Mary Lou Jepsen, says that her technology will eventually allow minds to be read.

Many BCI experts react to the arrival of the Valley visionaries by rolling their eyes. Neuroscience is a work in progress, they say. An effective BCI requires the involvement of many disciplines: materials science, neuroscience, machine learning, engineering, design and others. There are no shortcuts to clinical trials and regulatory approval.

In all this, the sceptics are right. Many of the ambitions being aired look fantastical. Still, this is a critical moment for BCIs. Vast amounts of money are pouring into the field. Researchers are trying multiple approaches. Mr Musk in particular has a track record of combining grandiose aspirations (colonising Mars) and practical success (recovering and relaunching rockets via SpaceX).

To be clear, “The Matrix” is not imminent. But BCIs may be about to take a big leap forward. For that to happen, the most important thing is to find a better way of connecting with the brain. ■



Non-invasive devices

Headache

Can the brain be deciphered without opening up the skull?

PATRICK KAIFOSH'S left hand lies flat on the table in front of him. Occasionally his fingers twitch or his palm rises up slightly from the surface. There is nothing obvious to connect these movements with what is happening on the tablet in front of him, where a game of asteroids is being played. Yet he is controlling the spaceship on the screen as it spins, thrusts and fires.

What enables him to do so is a sweatband studded with small gold bars that sits halfway up his left forearm. Each bar contains a handful of electrodes designed to pick up the signals of motor units (the combination of a motor neuron, a cell that projects from the spinal cord, and the muscle fibres it controls). These data are processed by machine-learning algorithms and translated into the actions in the game. Dr Kaifosh, a co-founder of CTRL-Labs, the startup behind the device, has learned to exercise impressive control over these signals with hardly any obvious movement.

Some say that the claims of Dr Kaifosh and Thomas Reardon, his co-founder, that CTRL-Labs has created a brain-machine interface are nonsense. The sweatband is nowhere near the brain, and the signals it is picking up are generated not just by the firing of a motor neuron but by the electrical activity of muscles. “If this is a BCI, then the movement of my fingers when I type on a keyboard is also a brain output,” sniffs one researcher, Krishna Shenoy, who directs the neural prosthetics systems lab at Stanford University and acts as an adviser to the firm, thinks it is on the right side of the divide. “Measuring the movement of the hand is motion capture. They are picking up neural activity amplified by the muscles.” ➤

► Whatever the semantics, it is instructive to hear the logic behind the firm's decision to record the activity of the peripheral nervous system, rather than looking directly inside the head. The startup wants to create a consumer product (its potential uses include being an interface for interactions in virtual reality and augmented reality). It is not reasonable to expect consumers to undergo brain surgery, say the founders, and current non-invasive options for reading the brain provide noisy, hard-to-read signals. "For machine-learning folk, there is no question which data set—cortical neurons or motor neurons—you would prefer," says Dr Reardon.

This trade-off between the degree of invasiveness and the fidelity of brain signals is a big problem in the search for improved BCIs. But plenty of people are trying to find a better way to read neural code from outside the skull.

The simplest way to read electrical activity from outside is to conduct an electroencephalogram (EEG). And it is not all that simple. Conventionally, it has involved wearing a cap containing lots of electrodes that are pressed against the surface of the scalp. To improve the signal quality, a conductive gel is often applied. That requires a hairwash afterwards. Sometimes the skin of the scalp is roughened up to get a better connection. As a consumer experience it beats going to the dentist, but not by much.

Once on, each electrode picks up currents generated by the firing of thousands of neurons, but only in the area covered by that electrode. Neurons that fire deep in the brain are not detected either. The signal is distorted by the layers of skin, bone and membrane that separate the brain from the electrode. And muscle activity (of the sort that CTRL-Labs looks for) from eye and neck movements or clenched jaws can overwhelm the neural data.

Even so, some EEG signals are strong enough to be picked up pretty reliably. An "event-related potential", for example, is an electrical signal that the brain reliably gives off in response to an external stimulus of some sort. One such, called an error-related potential (Errp), occurs when a user spots a mistake. Researchers at MIT have connected a human observer wearing an EEG cap to an industrial robot called Baxter as it carried out a sorting task. If Baxter made a mistake, an Errp signal in the observer's brain alerted the robot to its error; helpfully, if Baxter still did not react, the human brain generated an even stronger Errp signal.

If the cap fits

Neurable, a consumer startup, has developed an EEG headset with just seven dry electrodes which uses a signal called the P300 to enable users to play a virtual-reality (VR) escape game. This signal is a marker of surprise or recognition. Think of the word "brain" and then watch a series of letters flash up randomly on a screen; when the letter "b" comes up, you will almost certainly be giving off a P300 signal. In Neurable's game, all you have to do is concentrate on an object (a ball, say) for it to come towards you or be hurled at an object. Ramses Alcaide, Neurable's boss, sees the potential for entertainment companies like Disney (owner of the Star Wars and Marvel franchises) to license the software in theme parks and arcade games.

Thorsten Zander of the Technische Universität in Berlin thinks that "passive" EEG signals (those that are not evoked by an external stimulus) can be put to good use too. Research has shown that brainwave activity changes depending on how alert, drowsy or focused a person is. If an EEG can reliably pick this up, perhaps surgeons, pilots or truck drivers who are becoming dangerously tired



It is not reasonable to expect consumers to undergo brain surgery

can be identified. Studies have shown strong correlations between people's mental states as shown by an EEG and their ability to spot weapons in X-rays of luggage.

Yet the uses of EEGs remain limited. In a real-world environment like a cockpit, a car or an airport, muscle activity and ambient electricity are likely to confound any neural signals. As for Neurable's game, it relies not solely on brain activity but also deploys eye-tracking technology to see where a player is looking. Dr Alcaide says the system can work with brain signals alone, but it is hard for a user to disentangle the two.

Other non-invasive options also have flaws. Magnetoencephalography measures magnetic fields generated by electrical activity in the brain, but it requires a special room to shield the machinery from Earth's magnetic field. Functional magnetic resonance imaging (fMRI) can spot changes in blood oxygenation, a proxy for neural activity, and can zero in on a small area of the brain. But it involves a large, expensive machine, and there is a lag between neural activity and blood flow.

If any area is likely to yield a big breakthrough in non-invasive recording of the brain, it is a variation on fNIRS, the infrared technique used in the experiment to allow locked-in patients to communicate. In essence, light sent through the skull is either absorbed or reflected back to detectors, providing a picture of what is going on in the brain. This technique does not require bulky equipment, and unlike EEG it does not measure electrical activity, so it is not confused by muscle activity. Both Facebook and Openwater are focusing their efforts on this area.

The obstacles to a breakthrough are formidable, however. Current infrared techniques measure an epiphenomenon, blood oxygenation (the degree of which affects the absorption of light), rather than the actual firing of neurons. The light usually penetrates only a few millimetres into the cortex. And because light scatters in tissue (think of how your whole fingertip glows red when you press a pen-torch against it), the precise source of reflected signals is hard to identify.

Facebook is not saying much about what it is doing. Its efforts are being led by Mark Chevillet, who joined the social-media giant's Building 8 consumer-hardware team from Johns Hopkins University. To cope with the problem of light scattering as it passes through the brain, the team hopes to be able to pick up on both ballistic photons, which pass through tissue in a straight line, and what it terms "quasi-ballistic photons", which deviate slightly but can still be traced to a specific source. The clock is ticking. Dr Chevillet has about a year of a two-year programme left to demonstrate that the firm's goal of brain-controlled typing at 100 words a minute is achievable using current invasive cell-recording techniques, and to produce a road map for replicating that level of performance non-invasively.

Openwater is much less tight-lipped. Ms Jepsen says that her San Francisco-based startup uses holography to reconstruct how light scatters in the body, so it can neutralise this effect. Openwater, she suggests, has already created technology that has a billion times the resolution of an fMRI machine, can penetrate the cortex to a depth of 10cm, and can sample data in milliseconds.

Openwater has yet to demonstrate its technology, so these claims are impossible to verify. Most BCI experts are sceptical. But Ms Jepsen has an impressive background in consumer electronics and display technologies, and breakthroughs by their nature upset conventional wisdom. Developer kits are due out in 2018.

In the meantime, other efforts to decipher the language of the brain are under way. Some involve heading downstream into the peripheral nervous system. One example of that approach is CTRL-Labs; another is provided by Qi Wang, at Columbia University, who researches the role of the locus coeruleus, a nucleus deep in the brain stem that plays a role in modulating anxiety and stress. Dr Wang is looking at ways of stimulating the vagus nerve, which runs from the brain into the abdomen, through the skin to see if he can affect the locus coeruleus.

▶ Others are looking at invasive approaches that do not involve drilling through the skull. One idea, from a firm called SmartStent, using technology partly developed with the University of Melbourne, is to use a stent-like device called a “stentrode” that is studied with electrodes. It is inserted via a small incision in the neck and then guided up through blood vessels to overlie the brain. Once the device is in the right location, it expands from about the size of a matchstick to the size of the vessel and tissue grows into its scaffolding, keeping it in place. Human trials of the stentrode are due to start next year.

Another approach is to put electrodes under the scalp but not under the skull. Maxime Baud, a neurologist attached to the Wyss Centre, wants to do just that in order to monitor the long-term seizure patterns of epileptics. He hopes that once these patterns are revealed, they can be used to provide accurate forecasts of when a seizure is likely to occur.

Yet others think they need to go directly to the source of action potentials. And that means heading inside the brain itself. ■

Implants

Inside intelligence

The hunt for smaller, safer and smarter brain implants

TALK to neuroscientists about brain-computer interfaces (BCIs) for long enough, and the stadium analogy is almost bound to come up. This compares the neural activity of the brain to the noise made by a crowd at a football game. From outside the ground, you might hear background noise and be able to tell from the roars whether a team has scored. In a blimp above the stadium you can tell who has scored and perhaps which players were involved. Only inside it can you ask the fan in row 72 how things unfolded in detail.

Similarly, with the brain it is only by getting closer to the action that you can really understand what is going on. To get high-resolution signals, for now there is no alternative to opening up the skull. One option is to place electrodes onto the surface of the brain in what is known as electrocorticography. Another is to push them right into the tissue of the brain, for example by using a grid of microelectrodes like BrainGate’s Utah array.

Just how close you have to come to individual neurons to operate BCIs is a matter

of debate. In people who suffer from movement disorders such as Parkinson’s disease, spaghetti-like leads and big electrodes are used to carry out deep-brain stimulation over a fairly large area of tissue. Such treatment is generally regarded as effective. Andrew Jackson of the University of Newcastle thinks that recording activity by ensembles of neurons, of the sort that gets picked up by electrocorticography arrays, can be used to decode relatively simple movement signals, like an intention to grasp something or to extend the elbow.

But to generate fine-grained control signals, such as the movement of individual fingers, more precision is needed. “These are very small signals, and there are many neurons packed closely together, all firing together,” says Andrew Schwartz of the University of Pittsburgh. Aggregating them inevitably means sacrificing detail. After all, individual cells can have very specific functions, from navigation to facial recognition. The 2014 Nobel prize for medicine was awarded for work on place and grid cells, which fire when animals reach a specific location; the idea of the “Jennifer Aniston neuron” stems from research showing that single neurons can fire in response to pictures of a specific celebrity.

Companies like Neuralink and Kernel are betting that the most ambitious visions of BCIs, in which thoughts, images and movements are seamlessly encoded and decoded, will require high-resolution implants. So, too, is America’s Defense Advanced Research Projects Agency (DARPA), an arm of the Pentagon, which this year distributed \$65m among six organisations to create a high-resolution implantable interface. BrainGate and others continue to work on systems of their own.

But the challenges that these researchers face are truly daunting. The ideal implant would be safe, small, wireless and long-lasting. It would be capable of transmitting huge amounts of data at high speed. It would interact with many more neurons than current technology allows (the DARPA programme sets its grant recipients a target of 1m neurons, along with a deadline of 2021 for a pilot trial to get under way in humans). It would also have to navigate an environment that Claude Clément of the Wyss Centre likens to a jungle by the sea: humid, hot and salty. “The brain is not the right place to do technology,” he says. As the chief technology officer, he should know.

Da neuron, ron, ron

That is not stopping people from trying. The efforts now being made to create better implants can be divided into two broad categories. The first reimagines the current technology of small wire electrodes. The second heads off in new, non-electrical directions.

Start with ways to make electrodes smaller and better. Ken Shepard is a professor of electrical and biomedical engineering at Columbia University; his lab is a recipient of DARPA funds, and is aiming to build a device that could eventually help blind people with an intact visual cortex to see by stimulating precisely the right neu-



rons in order to produce images inside their brains. He thinks he can do so by using state-of-the-art CMOS (complementary metal-oxide semiconductor) electronics.

Dr Shepard is aware that any kind of penetrating electrode can cause cell damage, so he wants to build "the mother of all surface recording devices" which will sit on top of the cortex and under the membranes that surround the brain. He has already created a prototype of a first-generation CMOS chip, which measures about 1cm by 1cm and contains 65,000 electrodes; a slightly larger, second-generation version will house 1m sensors. But like everyone else trying to make implants work, Dr Shepard is not just cramming sensors onto the chip. He also has to add the same number of amplifiers, a converter to turn the analogue signals of action potentials into the digital os and 1s of machine learning, and a wireless link to send (or receive) data to a relay station that will sit on the scalp. That, in turn, will send (or receive) the data wirelessly to external processors for decoding.

The device also has to be powered, another huge part of the implantables puzzle. No one in the field puts faith in batteries as a source of power. They are too bulky, and the risk of battery fluid leaking into the brain is too high. Like many of his peers, Dr Shepard uses inductive coupling, whereby currents passing through a coiled wire create a magnetic field that can induce a current in a second coil (the way that an electric toothbrush gets recharged). That job is done by coils on the chip and on the relay station.

Over on America's west coast, a startup called Paradromics is also using inductive coupling to power its implantable. But Matt Angle, its boss, does not think that souped-up surface recordings will deliver sufficiently high resolution. Instead, he is working on creating tiny bundles of glass and metal microwires that can be pushed into brain tissue, a bit like a Utah array but with many more sensors. To stop the wires clumping together, thereby reducing the number of neurons they engage with, the firm uses a sacrificial polymer to splay them apart; the polymer dissolves but the wires remain separated. They are then bonded onto a high-speed CMOS circuit. A version of the device, with 65,000 electrodes, will be released next year for use in animal research.

That still leaves lots to do before Paradromics can meet its DARPA-funded goal of creating a 1m wire device that can be used in people. Chief among them is coping with the amount of data coming out of the head. Dr Angle reckons that the initial device produces 24 gigabits of data every second (streaming an ultra-high-definition movie on Netflix uses up to 7GB an hour). In animals, these data can be transmitted through a cable to a bulky aluminium head-mounted processor. That is a hard look to pull off in humans; besides, such quantities of data would generate far too much heat to be handled inside the skull or transmitted wirelessly out of it.

So Paradromics, along with everyone else trying to create a high-bandwidth signal into and out of the brain, has to find a way to compress the data rate without compromising the speed and quality of information sent. Dr Angle reckons he can do this in two ways: first, by ignoring the moments of silence in between action potentials, rather than laboriously encoding

them as a string of zeros; and second, by concentrating on the wave forms of specific action potentials rather than recording each point along their curves. Indeed, he sees data compression as being the company's big selling-point, and expects others that want to create specific BCI applications or prostheses simply to plug into its feed. "We see ourselves as the neural data backbone, like a Qualcomm or Intel," he says.

Meshy business

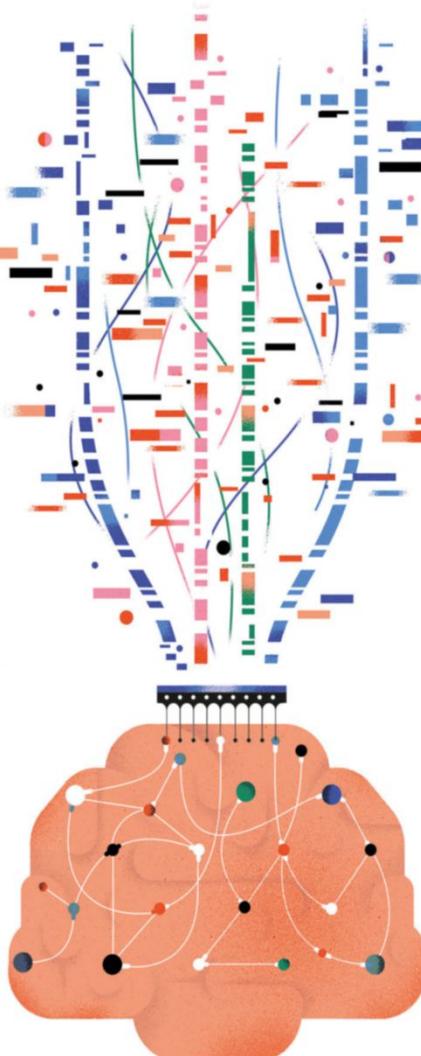
Some researchers are trying to get away from the idea of wire implants altogether. At Brown University, for example, Arto Nurmikko is leading a multidisciplinary team to create "neurograins", each the size of a grain of sugar, that could be sprinkled on top of the cortex or implanted within it. Each grain would have to have built-in amplifiers, analogue-to-digital converters and the ability to send data to a relay station which could power the grains inductively and pass the information to an external processor. Dr Nurmikko is testing elements of the system in rodents; he hopes eventually to put tens of thousands of grains inside the head.

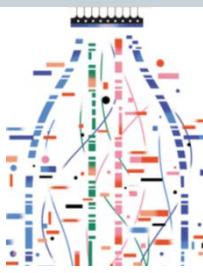
Meanwhile, in a lab at Harvard University, Guosong Hong is demonstrating another innovative interface. He dips a syringe into a beaker of water and injects into it a small, billowing and glinting mesh. It is strangely beautiful to watch. Dr Hong is a post-doctoral fellow in the lab of Charles Lieber, a professor of chemistry; they are both working to create a neural interface that blurs the distinction between biology and electronics. Their solution is a porous net made of a flexible polymer called su-8, studded with sensors and conductive metal.

The mesh is designed to solve a number of problems. One has to do with the brain's immune response to foreign bodies. By replicating the flexibility and softness of neural tissue, and allowing neurons and other types of cells to grow within it, it should avoid the scarring that stiffer, solid probes can sometimes cause. It also takes up much less space: less than 1% of the volume of a Utah array. Animal trials have gone well; the next stage will be to insert the mesh into the brains of epilepsy patients who have not responded to other forms of treatment and are waiting to have bits of tissue removed.

A mile away, at MIT, members of Polina Anikeeva's lab are also trying to build devices that match the physical properties of neural tissue. Dr Anikeeva is a materials scientist who first dived into neuroscience at the lab of Karl Deisseroth at Stanford University, who pioneered the use of optogenetics, a way of genetically engineering cells so that they turn on and off in response to light. Her reaction upon seeing a (mouse) brain up close for the first time was amazement at how squishy it was. "It is problematic to have something with the elastic properties of a knife inside something with the elastic properties of a chocolate pudding," she says.

One way she is dealing with that is to borrow from the world of telecoms by creating a multichannel fibre with a width of 100 microns (one micron is a millionth of a metre), about the same as a human hair. That is denser than some of the devices being worked on elsewhere, but the main thing that distinguishes it is that it can do ►





Introducing tiny, flexible materials into the brain creates a "wet noodle" problem

stimulation of cells in the inner ear of mice has been used to control hearing.

Dr Anikeeva is also toying with another way of stimulating the brain. She thinks that a weak magnetic field could be used to penetrate deep into neural tissue and heat up magnetic nanoparticles that have been injected into the brain. If heat-sensitive capsaicin receptors were triggered in modified neurons nearby, the increased temperature would cause the neurons to fire.

Another candidate for recording and activating neurons, beyond voltage, light and magnets, is ultrasound. Jose Carmena and Michel Maharbiz at the University of California, Berkeley, are the main proponents of this approach, which again involves the insertion of tiny particles (which they call "neural dust") into tissue. Passing ultrasound through the body affects a crystal in these motes which vibrates like a tuning fork; that produces voltage to power a transistor. Electrical activity in adjacent tissue, whether muscles or neurons, can change the nature of the ultrasonic echo given off by the particle, so this activity can be recorded.

Many of these new efforts raise even more questions. If the ambition is to create a "whole-brain interface" that covers multiple regions of the brain, there must be a physical limit to how much additional material, be it wires, grains or motes, can be introduced into a human brain. If such particles can be made sufficiently small to mitigate that problem, another uncertainty arises: would they float around in the brain, and with what effects? And how can large numbers of implants be put into different parts of the brain in a single procedure, particularly if the use of tiny, flexible materials creates a "wet noodle" problem whereby implants are too floppy to make their way into tissue? (Rumour has it that Neuralink may be pursuing the idea of an automated "sewing machine" designed to get around this issue.)

All this underlines how hard it will be to engineer a new neural interface that works both safely and well. But the range of efforts to create such a device also prompts optimism. "We are approaching an inflection-point that will enable at-scale recording and stimulation," says Andreas Schaefer, a neuroscientist at the Crick Institute in London.

Even so, being able to get the data out of the brain, or into it, is only the first step. The next thing is processing them. ■

▶ multiple things. "Electronics with just current and voltage is not going to do the trick," she says, pointing out that the brain communicates not just electrically but chemically, too.

Dr Anikeeva's sensor has one channel for recording using electrodes, but it is also able to take advantage of optogenetics. A second channel is designed to deliver channelrhodopsin, an algal protein that can be smuggled into neurons to make them sensitive to light, and a third to shine a light so that these modified neurons can be activated.

It is too early to know if optogenetics can be used safely in humans: channelrhodopsin has to be incorporated into cells using a virus, and there are question-marks about how much light can safely be shone into the brain. But human clinical trials are under way to make retinal ganglion cells light-sensitive in people whose photoreceptor cells are damaged; another of the recipients of DARPA funds, Fondation Voir et Entendre in Paris, aims to use the technique to transfer images from special goggles directly into the visual cortex of completely blind people. In principle, other senses could also be restored: optogenetic

Data processing

Translation required

Once data have been extracted from the brain, how can they be used to best effect?

FOR those who reckon that brain-computer interfaces will never catch on, there is a simple answer: they already have. Well over 300,000 people worldwide have had cochlear implants fitted in their ears. Strictly speaking, this hearing device does not interact directly with neural tissue, but the effect is not dissimilar. A processor captures sound, which is converted into electrical signals and sent to an electrode in the inner ear, stimulating the cochlear nerve so that sound is heard in the brain. Michael Merzenich, a neuroscientist who helped develop them, explains that the implants provide only a crude representation of speech, "like playing Chopin with your fist". But given a little time, the brain works out the signals.

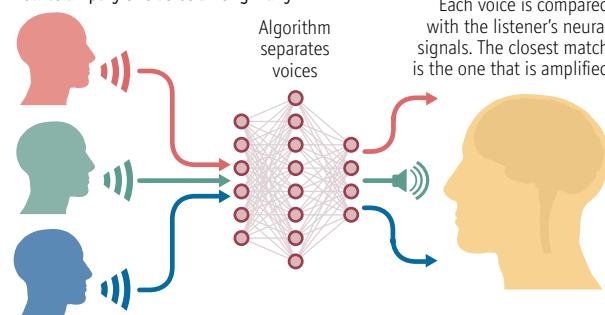
That offers a clue to another part of the BCI equation: what to do once you have gained access to the brain. As cochlear implants show, one option is to let the world's most powerful learning machine do its stuff. In a famous mid-20th-century experiment, two Austrian researchers showed that the brain could quickly adapt to a pair of glasses that turned the image they projected onto the retina upside down. More recently, researchers at Colorado State University have come up with a device that converts sounds into electrical impulses. When pressed against the tongue, it produces different kinds of tingle which the brain learns to associate with specific sounds.

The brain, then, is remarkably good at working things out. Then again, so are computers. One problem with a hearing aid, for example, is that it amplifies every sound that is coming in; when you want to focus on one person in a noisy environment, such as a party, that is not much help. Nima Mesgarani of Columbia University is working on a way to separate out the specific person you want to listen to. The idea is that an algorithm will distinguish between different voices talking at the same time, creating a spectrogram, or visual representation of sound frequencies, of each person's speech. It then looks at neural activity in the brain as the wearer of the hearing aid concentrates on a specific interlocutor. This activity can also be reconstructed into a spectrogram, and the ones that match up will get amplified (see diagram).

Algorithms have done better than brain plasticity at enabling paralysed people to send a cursor to a target using thought alone. In research published earlier this year, for example, Dr Shenoy and ▶

The cocktail-party problem

How to amplify one voice among many



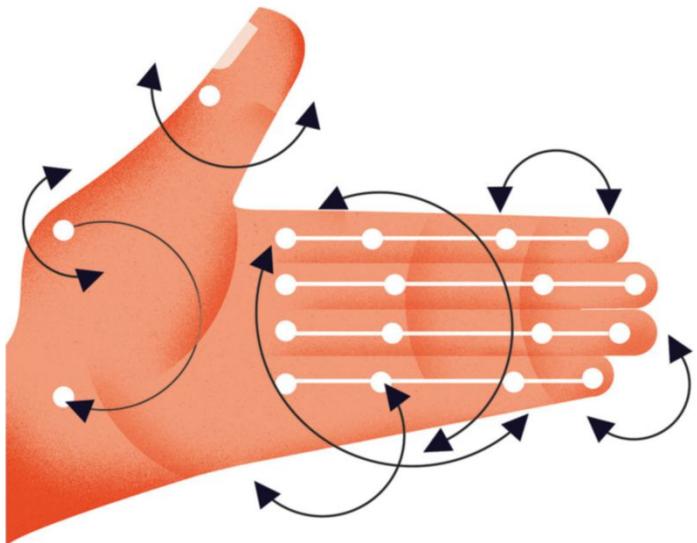
Source: Nima Mesgarani, Columbia University

► his collaborators at Stanford University recorded a big improvement in brain-controlled typing. This stemmed not from new signals or whizier interfaces but from better maths.

One contribution came from Dr Shenoy's use of data generated during the testing phase of his algorithm. In the training phase a user is repeatedly told to move a cursor to a particular target; machine-learning programs identify patterns in neural activity that correlate with this movement. In the testing phase the user is shown a grid of letters and told to move the cursor wherever he wants; that tests the algorithm's ability to predict the user's wishes. The user's intention to hit a specific target also shows up in the data; by refitting the algorithm to include that information too, the cursor can be made to move to its target more quickly.

But although algorithms are getting better, there is still a lot of room for improvement, not least because data remain thin on the ground. Despite claims that smart algorithms can make up for bad signals, they can do only so much. "Machine learning does nearly magical things, but it cannot do magic," says Dr Shenoy. Consider the use of functional near-infrared spectroscopy to identify simple yes/no answers given by locked-in patients to true-or-false statements; they were right 70% of the time, a huge advance on not being able to communicate at all, but nowhere near enough to have confidence in their responses to an end-of-life discussion, say. More and cleaner data are required to build better algorithms.

It does not help that knowledge of how the brain works is still so incomplete. Even with better interfaces, the organ's extraordinary complexities will not be quickly unravelled. The movement of a cursor has two degrees of freedom, for example; a human



hand has 27. Visual-cortex researchers often work with static images, whereas humans in real life have to cope with continuously moving images. Work on the sensory feedback that humans experience when they grip an object has barely begun.

And although computational neuroscientists can piggyback on broader advances in the field of machine learning, from facial recognition to autonomous cars, the noisiness of neural data presents a particular challenge. A neuron in the motor cortex may fire ►

Brain scan | Eberhard Fetz

The man who helped launch brain-computer interfaces in 1969 has not finished yet

BCIs have deep roots. In the 18th century Luigi Galvani discovered the role of electricity in nerve activity when he found that applying voltage could cause a dead frog's legs to twitch. In the 1920s Hans Berger used electroencephalography to record human brain waves. In the 1960s José Delgado theatrically used a brain implant to stop a charging bull in its tracks. One of the field's father figures is still hard at work in the lab.

Eberhard Fetz was a post-doctoral researcher at the University of Washington in Seattle when he decided to test whether a monkey could control the needle of a meter using only its mind. A paper based on that research, published in 1969, showed that it could. Dr Fetz tracked down the movement of the needle to the firing rate of a single neuron in the monkey's brain. The animal learned to control the activity of that single cell within two minutes, and was also able to switch to control a different neuron.

Dr Fetz disclaims any great insights in setting up the experiment. "I was just curious, and did not make the association with potential uses of robotic arms or the like," he says. But the effect of his paper was profound. It showed both that voli-

tional control of a BCI was possible, and that the brain was capable of learning how to operate one without any help.

Some 48 years later, Dr Fetz is still at the University of Washington, still fizzing with energy and still enthralled by the brain's plasticity. He is particularly interested in the possibility of artificially strengthening connections between cells, and perhaps



forging entirely new ones.

As an example, he points to research in which the recording of an action potential in the brain prompts not only the normal firing of a motor neuron in the spinal cord but also a parallel stimulus from a BCI delivered to the same site. The idea is to take advantage of a relationship made famous in an aphorism by a Canadian psychologist, Donald Hebb: "Neurons that fire together, wire together." This reinforced stimulus strengthens the connection between the original action potential and the motor neuron, which could help recovery from spinal-cord injuries. Such stimulation might also encourage stronger bonds in the brain itself—between the speech-processing area of a stroke victim's brain, say, and the region that controls movements of the lips and mouth.

Asked to explain the slow rate of progress since his breakthrough paper, Dr Fetz points to the technical difficulties of recording from single cells and the high hurdle to doing this sort of work in people. But he does not think there is a need to find out much more about the brain in order to make further advances: "I have had a lot of progress by just jumping in."

► at a rate of 100 action potentials a second when someone thinks about moving his right arm on one occasion, but at a rate of 115 on another. To make matters worse, neurons' jobs overlap. So if a neuron has an average firing rate of 100 to the right and 70 to the left, what does a rate of 85 signify?

At least the activities of the motor cortex have a visible output in the form of movement, showing up correlations with neural data from which predictions can be made. But other cognitive processes lack obvious outputs. Take the area that Facebook is interested in: silent, or imagined, speech. It is not certain that the brain's representation of imagined speech is similar enough to actual (spoken or heard) speech to be used as a reference point. Progress is hampered by another factor: "We have a century's worth of data on how movement is generated by neural activity," says BrainGate's Dr Hochberg dryly. "We know less about animal speech."

Higher-level functions, such as decision-making, present an even greater challenge. BCI algorithms require a model that explicitly defines the relationship between neural activity and the parameter in question. "The problem begins with defining the parameter itself," says Dr Schwartz of Pittsburgh University. "Exactly what is cognition? How do you write an equation for it?"

Such difficulties suggest two things. One is that a set of algorithms for whole-brain activity is a very long way off. Another is that the best route forward for signal processing in a brain-computer interface is likely to be some combination of machine learning and brain plasticity. The trick will be to develop a system in which the two co-operate, not just for the sake of efficiency but also for reasons of ethics. ■

Looking for serendipity

Grey matter, red tape

How obstacles to workable brain-computer interfaces may be overcome

NEUROTECHNOLOGY has long been a favourite of science-fiction writers. In "Neuromancer", a wildly inventive book by William Gibson written in 1984, people can use neural implants to jacked into the sensory experiences of others. The idea of a neural lace, a mesh that grows into the brain, was conceived by Iain M. Banks in his "Culture" series of novels. "The Terminal Man" by Michael Crichton, published in 1972, imagines the effects of a brain implant on someone who is convinced that machines are taking over from humans. (Spoiler: not good.)

Where the sci-fi genre led, philosophers are now starting to follow. In Howard Chizeck's lab at the University of Washington, researchers are working on an implanted device to administer deep-brain stimulation (DBS) in order to treat a common movement disorder called essential tremor. Conventionally, DBS stimulation is always on, wasting energy and depriving the patient of a sense of control. The lab's ethicist, Tim Brown, a doctoral student of philosophy, says that some DBS patients suffer a sense of alienation and complain of feeling like a robot.

To change that, the team at the University of Washington is using neuronal activity associated with intentional movements as a trigger for turning the device on. But the researchers also want to enable patients to use a conscious thought process to override these settings. That is more useful than it might sound: stimulation currents for essential tremor can cause side-effects like distorted speech, so someone about to give a presentation, say, might wish

to shake rather than slur his words.

Giving humans more options of this sort will be essential if some of the bolder visions for brain-computer interfaces are to be realised. Hannah Maslen from the University of Oxford is another ethicist who works on a BCI project, in this case a neural speech prosthesis being developed by a consortium of European researchers. One of her jobs is to think through the distinctions between inner speech and public speech: people need a dependable mechanism for separating out what they want to say from what they think.

That is only one of many ethical questions that the sci-fi versions of brain-computer interfaces bring up. What protection will BCIs offer against neural hacking? Who owns neural data, including information that is gathered for research purposes now but may be decipherable in detail at some point in the future? Where does accountability lie if a user does something wrong? And if brain implants are performed not for therapeutic purposes but to augment people's abilities, will that make the world an even more unequal place?

From potential to action

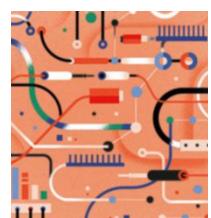
For some, these sorts of questions cannot be asked too early: more than any other new technology, BCIs may redefine what it means to be human. For others, they are premature. "The societal-justice problem of who gets access to enhanced memory or vision is a question for the next decades, not years," says Thomas Cochrane, a neurologist and director of neuroethics at the Centre for Bioethics at Harvard Medical School.

In truth, both arguments are right. It is hard to find anyone who argues that visions of whole-brain implants and AI-human symbiosis are impossible to realise; but harder still to find anyone who thinks something so revolutionary will happen in the near future. This report has looked at some of the technological difficulties associated with taking BCIs out of the lab and into the mainstream. But these are not the only obstacles in the way of "brain mouses" and telekinesis.

The development path to the eventual, otherworldly destination envisaged by organisations like Neuralink and Kernel is extremely long and uncertain. The money and patience of rich individuals like Elon Musk and Bryan Johnson can help, but in reality each leg of the journey needs a commercial pathway.

Companies such as CTRL-Labs and Neuralable may well open the door to consumer applications fairly quickly. But for invasive technologies, commercialisation will initially depend on therapeutic applications. That means overcoming a host of hurdles, from managing clinical trials to changing doctors' attitudes. Frank Fischer, the boss of NeuroPace, has successfully negotiated regulatory approval for his company's epilepsy treatment, but it has been a long, hard road. "If we tried to raise money today knowing the results ahead of time, it would have been impossible to get funded," he says.

Start with regulation. Neural interfaces are not drugs but medical devices, which means that clinical trials can be completed with just a handful of patients for proof-of-principle trials, and just a couple of hundred for the trials that come after that. Even so, ensuring a supply of patients for experiments with invasive interfaces presents practical difficulties. There is only one good supply of these human guinea pigs: epilepsy patients who have proved unresponsive to drugs and need surgery. These patients have already had craniotomies ►



Brain-computer interfaces may redefine what it means to be human



► and electrodes implanted so that doctors can monitor them and pinpoint the focal points of their seizures; while these patients are in hospital waiting for seizures to happen, researchers swoop in with requests of their own. But the supply of volunteers is limited. Where exactly the electrodes are placed depends on clinical needs, not researchers' wishes. And because patients are often deliberately sleep-deprived in order to hasten seizures, their capacity to carry out anything but simple cognitive tasks is limited.

When it comes to safety, new technologies entail lengthier approval processes. Harvard's Dr Lieber says that his neural mesh requires a new sterilisation protocol to be agreed with America's Food and Drug Administration. Researchers have to deal with the question of how well devices will last in the brain over very long periods. The Wyss Centre has an accelerated-ageing facility that exposes electrodes to hydrogen peroxide, in a process that mimics the brain's immune response to foreign objects; seven days' exposure in the lab is equivalent to seven years in the brain.

The regulators are not the only people who have to be won over. Health insurers (or other gatekeepers in single-payer systems) need to be persuaded that the devices offer value for money. The Wyss Centre, which aims to bow out of projects before devices are certified for manufacturing, plans with this in mind. One of the applications it is working on is for tinnitus, a persistent internal noise in the ears of sufferers which is often caused by overactivity in the auditory cortex. The idea is to provide an implant which gives users feedback on their cortical activity so that they can learn to suppress any excess. Looking ahead to negotiations with insurers, the Wyss is trying to demonstrate the effectiveness of its implant by including a control group of people whose tinnitus is being treated with cognitive behavioural therapy.

That still leaves two other groups to persuade. Doctors need to be convinced that the risks of opening up the skull are justified. Mr Fischer says that educating physicians proved harder than expected. "The neurology community does not find it natural to think about device therapy," he says.

Most important, patients will have to want the devices. This is partly a question of whether they are prepared to have brain sur-

gery. The precedents of once-rare, now-routine procedures such as laser eye and cosmetic surgery suggest that invasiveness alone need not stop brain implants from catching on. More than 150,000 people have had electrodes implanted for deep-brain stimulation to help them control Parkinson's disease. But it is also a matter of functionality: plenty of amputees, for example, prefer simple metal hooks to prosthetic arms because they are more reliable.

Waiting for Neuromancer

These are all good reasons to be cautious about the prospects for BCIs. But there are also reasons to think that the field is poised for a great leap forward. Ed Boyden, a neuroscientist at MIT who made his name as one of the people behind optogenetics, points out that innovations are often serendipitous—from Alexander Fleming's chance discovery of penicillin to the role of yogurt-makers in the development of CRISPR, a gene-editing technique. The trick, he says, is to engineer the chances that serendipity will occur, which means pursuing lots of paths at once.

That is exactly what is now being done with BCIs. Scientific efforts to understand and map the brain are shedding ever more light on how its activity can be harnessed by a BCI and providing ever more data for algorithms to learn from. Firms like CTRL-Labs and Neuralink are already listening to some of the more accessible neural signals, be it from the peripheral nervous system or from outside the skull. NeuroPace's closed-loop epilepsy system creates a regulatory precedent that others can follow.

Above all, researchers are working hard on a wide range of new implants for sending and receiving signals to and from the brain. That is where outfits like Kernel and Neuralink are focused in the short term. Mr Musk's four-year schedule for creating a BCI for clinical use is too ambitious for full clinical trials to be concluded, but it is much more realistic for pilot trials. This is also the rough timeframe to which DARPA is working with its implantables programme. With these and other efforts running concurrently, serendipity has become more likely.

Once a really good, portable, patient-friendly BCI is available, it is not hard to think of medical conditions that affect a large number of people and could potentially justify surgery. More than 50m people worldwide suffer from epilepsy, and 40% of those do not respond to medication. Depression affects more than 300m people worldwide; many of them might benefit from a BCI that monitored the brain for biomarkers of such mental disorders and delivered appropriate stimulation. The quality of life of many older people suffering from dysphagia (difficulty in swallowing) could be improved by a device that helped them swallow whenever they wanted to. "A closed-loop system for recording from a brain and responding in a medically useful way is not a small market," says Dr Hochberg.

That may still bring to mind the aphorism of Peter Thiel, a Silicon Valley grandee, about having been promised flying cars and getting 140 characters. There is a large gap between dreamy talk of symbiosis with AI, or infrared eyesight, and taking years to build a better brain implant for medical purposes. But if a device to deliver a real-time, high-resolution, long-lasting picture of neural activity can be engineered, that gap will shrink spectacularly. ■

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Italy

Their generation

FLORENCE

As Italy prepares to vote, young people are fed up with the traditional parties

FOR the first time in its brief history, Italy's maverick Five Star Movement (M5S) is going into a general election campaign as the front-runner. On December 28th President Sergio Mattarella dissolved parliament, clearing the way for a vote on March 4th. The latest polls give the M5S, which advocates direct, internet-based democracy and a hotch-potch of left- and right-wing policies, a lead of more than three points over the centre-left Democratic Party (PD), the dominant partner in Paolo Gentiloni's coalition government. The inexperienced M5S, founded less than nine years ago, could thus get first crack at forming a government—a prospect that troubles markets already worried by Italy's huge public debt (132% of GDP at the end of 2016).

Like other populist groups in Europe, the M5S thrives on frustrated expectations. In Italy disillusion is most intense among the young and educated. Two-and-a-half years after graduating, Valentina Fatichenti works six months in every 12 helping students at an American university campus in her native Florence. Otherwise, she scrapes a precarious living teaching English in primary schools, translating and, occasionally, waitressing.

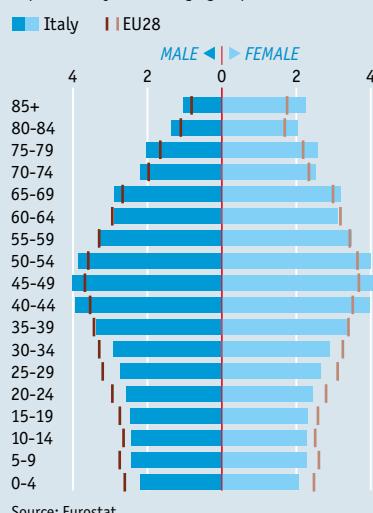
She has decided to vote for the M5S. Its appeal? "New faces," she says. The M5S chooses its candidates in online polls of its members. Its candidate for prime minister, Luigi Di Maio, is 31, just three years older

than Ms Fatichenti (the better known Beppe Grillo, M5S's founder, is ineligible to run for parliament due to a conviction for manslaughter, in a car accident).

Nando Pagnoncelli of Ipsos, a pollster, says 25- to 34-year-olds are the group most likely to support M5S: four points above the average. Young voters are also more likely than their elders to back other radical parties such as the Brothers of Italy (FdI),

The Italian exception

Population by sex and age group, 2016, % of total



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which has neo-fascist roots, and the Northern League, which wants less immigration and more autonomy for northern Italy.

Young Italians resent the older generations, but not their parents, says Alessandro Rosina, who co-ordinated a recent study for the Fondazione Bruno Visentini, a think-tank. They are hostile to mainstream parties, trade unions and an ill-defined "ruling class", which they blame for the vast gap between their incomes, job prospects and pension pots and those of their elders. The Intergenerational Foundation's most recent "intergenerational fairness index" ranks Italy second from bottom in Europe, ahead of only Greece.

In 2014, the last year for which comparative data are available, what the government spent on Italy's past (ie, on pensions) was more than four times what it spent on its future (ie, on education and training). But then, as Mr Pagnoncelli notes, it is the elderly who have the electoral clout. Voters over 55 make up 41% of the electorate, compared with 22% under 35—the effect of a steep decline in the birth rate dating back to the 1970s (see chart).

Many of the causes of Italy's generation gap can be found in political choices made in the past 20 years that have favoured the old over the young. Italy's low birth rate, coupled with disappointing economic growth, has prodded successive governments into pension reforms. But the way in which these have been carried out has placed on younger, generally lower-earning, workers the burden of providing not only for their own pensions, but also for those of the already retired. Labour reforms in 1997 and 2003 made it easier for bosses to hire new workers on short-term contracts, but did little to erode the job security of those already in permanent employment. And since the latter, along with

pensioners, make up the bulk of trade-union membership, the unions have been keener to defend the privileges of those with jobs for life than to campaign for a more equitable distribution of benefits.

Ms Faticheni's family is typical: her father toiled in the same factory for 40 years, her mother was a janitor. Ms Faticheni has a university education. Yet her take-home pay in the six months when she is under contract is €300 a month less than that of her boyfriend, who works in a street market. "A lot of employers don't want graduates because they don't have any practical experience," she says. That points to a weakness stressed in Mr Rosina's report: a lack of connection between education and the labour market. Italy has the EU's highest proportion of under-35s not in education, employment or training: 30.7% in 2016, compared with 12.4% in Germany.

A big informal economy allows young workers to *arrangiarsi* (get by, with odd

jobs). And Italy's EU membership lets them search for work in 27 other countries. An estimated 600,000 Italians live in Britain; not even the prospect of Brexit has stemmed the flow. In the 12 months to mid-2017, whereas the number of Poles entering the British labour market dropped by 26%, the number of Italians rose by 2%. A third factor easing the plight of the young is family support. Italian parents let their children live with them far longer than other European parents. In 2016 only a third of 18-35s had left their parental homes, compared with 63% in France.

Though changes to pension and employment rules could go some way towards closing Italy's generation gap, what is really needed, reckons Mr Rosina, is a change of outlook, both among teachers, who should equip young Italians with life skills, and employers, who need to start seeing them not as easily disposable cheap labour, but as sources of innovation. ■

said he would return to Catalonia if he won (although he would almost certainly face arrest as soon as he arrived). His supporters are now suggesting that he could govern virtually from Brussels. That is "absurd", scoffed Mr Rajoy. "It's as if I wanted to be prime minister of Spain while living in Lisbon."

In all, five of those elected for the separatist parties are in self-imposed exile and three are in jail. All except Mr Puigdemont and Mr Junqueras may resign to allow their replacement and thus preserve the separatist majority in parliament when it sits. If not, Ciudadanos will press for the job of parliamentary Speaker.

The bigger question is what the new government will do. Catalan business is desperate for the separatists to renounce the unilateral road to independence. The events of October have prompted more than 3,200 firms to move their legal domicile out of the region. Although a claim by Luis de Guindos, Spain's economy minister, of a €4bn hit to Catalonia's economy may be exaggerated, unemployment has edged up and retail sales have slowed. "Confidence has been lost" and the new government "will have to work very hard to recover it," says Jordi Alberich of the Cercle d'Economia, a business group.

There is palpable weariness in the independence movement. Its priority now is an amnesty for its leaders, though there is little appetite for that elsewhere in Spain. "It's a moment to insist on the third way" between independence and the status quo, says Mr Alberich.

But there is little short-term incentive for Mr Rajoy to do so. His People's Party was crushed in the election, outflanked by Ciudadanos, which is against any concessions to Catalan nationalism. The likelihood is that in 2018 the Catalan case will mutate from acute to chronic. ■

Spain

Local difficulties

MADRID

Catalonia will have a new separatist government, but what will it do?

AFTER his final cabinet meeting of 2017 Mariano Rajoy, Spain's prime minister, admitted that it had been "an extraordinarily difficult year". The economy purred along, unemployment and the deficit are falling, but there was a shadow, he said: the "instability generated by politics in Catalonia". The problem is that the outcome of last month's snap election in Spain's rebellious north-eastern region suggests that 2018 may not be much easier.

The election was called by Mr Rajoy in October after he assumed extraordinary constitutional powers to suspend self-government in Catalonia after a unilateral declaration of independence issued by the

separatist regional administration headed by Carles Puigdemont. That in turn came after an unconstitutional independence referendum, which was further marred by police violence.

The contest took place in bizarre circumstances, with Mr Puigdemont campaigning by video link from Brussels, where he had fled to avoid a charge of rebellion. With a record turnout of 79%, the vote proved to be a qualified triumph for him and for the pro-independence coalition. On the one hand, in a symbolic blow to their cause, Ciudadanos, a centre-right anti-separatist party, became the largest political force, but with only 25% of the vote. On the other hand, the three separatist parties won a combined 47.6% of the vote, down only marginally since the last election in 2015. Because the electoral system gives a bit of extra weight to rural areas, the separatists won 70 of the 135 seats in the Catalan parliament (down from 72, but still enough for a slender majority).

Mr Puigdemont's "Together for Catalonia" list narrowly outpolled Esquerra (Republican Left), the party of his jailed former coalition partner, Oriol Junqueras. Mr Puigdemont is demanding his restoration to the Generalitat, the seat of the Catalan government. Yet that "is not simple", as Sergi Sabrià of Esquerra, which also has its eye on the presidency, said this week.

During the campaign Mr Puigdemont

Still separatist

Spain, parliament of Catalonia
Election results 2017, seats



Rajoy's pain continues



Russia

Cardboard Kremlin

Vladimir Putin bars his main challenger

TWO leading politicians delivered their new year's greetings to the Russian public this week. One was the president, Vladimir Putin, who has been in power for 18 years and is planning to stay for at least another six following an election due in March. The other was Alexei Navalny (pictured), the only truly independent opposition leader. He is also the person who poses the biggest challenge to Mr Putin, and has consequently been barred from standing. Both men were speaking using the Kremlin as a backdrop; but in Mr Navalny's case, it was drawn on a board.

The latter image carried a message: the upcoming election, in which only candidates approved by the Kremlin will be allowed to run, is a cartoon; and genuine politics are unfolding outside the castle's walls and beyond its control. As part of this process Mr Navalny has called for a nationwide strike on January 28th to launch a boycott of the poll.

Neither Mr Navalny's ban, announced on December 25th, nor his call for a boycott came as much of a surprise. Ever since he galvanised huge street protests in Moscow against rigging in the legislative elections of 2011, the Kremlin has sought to neutralise the threat he poses by engineering fraud charges against him and slapping him with a criminal conviction to disqualify him from running for the presidency. Mr Navalny has successfully appealed to the European Court of Human Rights, though the court has no power to enforce its judgment. He has also staged an election campaign that has drawn large crowds across the country, despite being interrupted a

Obesity in France

Body positive

PARIS

A campaign against fat-shaming gets under way

FRANCE has only a few plump heroes, real or imagined. There was King Louis the Fat, who ruled from 1108 to 1137, pacified unruly barons, centralised power and won several wars. Gargantua, a giant created by François Rabelais, drank the milk of 17,913 cows each day. Gérard Depardieu (pictured), France's best-known modern actor, is hefty enough to play Obelix, France's best-known overweight cartoon Gaulish warrior, on the screen.

In general, however, the French see themselves as gourmets, not gourmands. And indeed they are thinner than people in most other rich countries: only 15.3% of them are obese, compared with an OECD average of 19.5%. Worryingly, though, this has risen from less than 6% in 1990, while the share of adults who are overweight has risen from 30% to over 46%. Growing appetites for processed food and more sedentary lives are leading to bigger waistlines.

For policymakers, this is a problem. Obesity leads to sickness—rates of diabetes are rising, for example. The state estimates that the overweight population already requires extra health and other spending of some €20bn a year. Weight is closely correlated with poverty: a French study last year suggested that children of parents classed as "non-professional" are four times likelier to be obese than those of professionals. To discourage overeating, France taxes sugary drinks, bars junk food in schools and has rules on nutritional labelling.

At the same time, officials want people to be kinder to their plus-sized compatriots. Anne Hidalgo, the mayor of Paris, hosted a conference last month on gros-

few times by the detentions of Mr Navalny himself and of his campaign chief.

But just as Mr Navalny refuses to recognise Mr Putin as an irreplaceable leader, Mr Putin conspicuously refuses to acknowledge Mr Navalny as a legitimate challenger. He pretends not to notice him and avoids mentioning him by name. When Ksenia Sobchak, a liberal-minded TV journalist and presidential candidate, asked Mr Putin why Mr Navalny was excluded from the ballot, Mr Putin said he would not allow "the figures you mentioned" to "destabilise our country".

Gleb Pavlovsky, a political analyst and a former adviser to Mr Putin, says that Mr Navalny has already seized the political initiative. Although the Kremlin can keep him off the ballot paper, it cannot keep him

sophobie (fat-shaming), including a fashion show with larger models. (France has previously held several "Miss Ronde" contests.) The event was partly inspired by the success of a memoir by a trainee teacher, Gabrielle Deydier, who describes daily humiliations she endures as a fat person in France, such as being mocked for what she buys at the bakery.

The difficulty for official campaigns against grossophobie, however, is that contradictory messages are louder, glossier and better funded. Despite pledges by fashion and luxury houses not to use skeletal-looking models when promoting their goods, billboards and magazines remain crammed with skinny figures. Activists say this promotes both eating disorders among the thin and misery among the plump.



Nothing to be ashamed of

away from street politics, unless it decides to arrest him yet again. Far from neutralising Mr Navalny as a threat, the ban and the ensuing boycott may have made him even more dangerous. For all of Mr Putin's authoritarianism, he still relies on the consent of the public and of Russia's various elites, and derives what legitimacy he has from popular support. The election is meant to be a way of demonstrating to the elite that the public still recognises him as their only possible leader.

Although Mr Putin's victory in March is assured, the success of the election is not. The purpose of Mr Navalny's efforts, which include the boycott, agitation against the election and the monitoring of its results, is to present the whole procedure as a flop, to minimise the turnout and ►

► to expose any attempts to rig it. "The aim of our strike is to cause maximum political damage to Putin, his party and his cronies," Mr Navalny told his supporters in another recent broadcast. Backed by 200,000 volunteers across Russia, he hopes to create a widespread public perception that the election is a fraud.

Ms Sobchak, who says she is campaigning "against everyone", dismisses Mr Navalny's tactics, arguing that the system is too powerful to be tackled head on and can only be changed from within—which is what she says she is trying to achieve. Mr Navalny's plans, however, reflect his conviction that Russia has passed the point when power can change as a result of an orderly election. The irony is that by barring him, Mr Putin has tended to confirm this analysis. ■

Turkey's economy

Firing on all cylinders

ISTANBUL

But for how long?

THESE have been testing times for Emin Taha and his Turkish transport company. The war against the so-called Islamic State has reduced much of Mosul, Iraq's second city and a big market for Turkish goods, to rubble. Trade with Iraqi Kurdistan ground to a halt when the federal government in Baghdad reacted furiously to an independence referendum in September. (It deployed troops to the contested city of Kirkuk, seized the nearby oilfields and closed Kurdish airspace to international flights.) Mr Taha, whose company relies on trade with Iraq for the bulk of its revenues, refused to give up. "We told our customers not to worry, to keep selling to Iraq, and that we would stand by them," he says. A 20m lira (\$5m) loan backed by Turkey's credit guarantee fund (KGF) helped the company regain its footing and complete work on a number of projects, including new warehouses in Iraq.

Like Mr Taha's business, Turkey's economy is doing surprisingly well. In the third quarter of 2017 GDP surged by 11.1% year-on-year, outperforming all major countries. This is partly because Turkey did so badly in the same period in 2016, when the economy shrank by 0.8% after a failed coup. But it owes more to a wave of easy credit that has washed over the country, helping thousands of companies cope with the effects of a sharp drop in tourism, the imposition of emergency law, and a government crackdown that has cost 60,000 people their freedom. Under the recently expanded KGF, the government has

provided 221bn lira in loans to small and medium-sized businesses, Mr Taha's included. Tax breaks have helped trigger an increase in household spending, which shot up by 11.7% in the year to the third quarter.

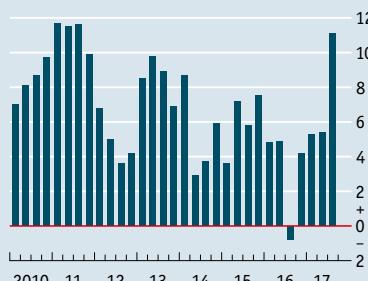
Yet the outlook is not entirely rosy. Turkey's current-account deficit has swelled from \$33.7bn at the end of 2016 to \$41.9bn (4.7% of GDP) now. Foreign direct investment is roughly half what it was a decade ago. Stirred by the credit boom, the spectre of high inflation, which haunted Turkey from the 1970s until the early 2000s, has returned. Prices surged by 13% in the year to November, the highest rate in 14 years, and more than double the central bank's target. Without fiscal and monetary restraint, a prolonged bout of double-digit inflation may be in store, says William Jackson of Capital Economics, a London consultancy.

Years of political turmoil, terror attacks, rows with allies, and most recently fears of American fines against Turkish banks suspected of violating sanctions against Iran, have also taken their toll on the country's currency. The lira has lost about a tenth of its value against the dollar since the start of 2017 and nearly 40% since early 2015. For Turkish companies, especially small ones, saddled with foreign-currency debt worth a total of \$21bn, this is bad news. In early December the government announced it would take measures to prevent 23,000 of the weakest businesses from taking out more foreign-currency loans.

Scared stiff by Turkey's authoritarian and growth-obsessed president, Recep Tayyip Erdogan, the country's central bank has done little to help, preferring to make cosmetic adjustments to its byzantine system of lending rates, instead of the decisive increase needed to bring inflation under control. At its last meeting on December 14th, the bank raised its key rate from 12.25% to 12.75%, much less than markets expected. Investors reacted by dumping the lira,

Turkey's bounce-back

GDP, % change on a year earlier



Source: Turkish Statistical Institute

which immediately nosedived, before recovering slightly. The bank is stuck between a rock and a hard place, says Murat Ucer, an economist. "If they do nothing they risk a market backlash, and if they move sharply they face a political one," he says. Mr Erdogan may pile on even more pressure to keep rates low ahead of parliamentary and presidential elections in 2019.

Either way, a slowdown this year looks inevitable. Turkey's banks lack the funding base needed for another mass injection of credit under the KGF, analysts say. Its companies have borrowed from abroad at a faster rate than any emerging market save China's. Global tightening will make it harder for them to keep doing so. Officials in Ankara predict growth of about 7% for the whole of 2017, but expect a return to more modest levels this year. Hatice Karahan, a presidential adviser, and one of the few voices of economic orthodoxy in Mr Erdogan's circle, says Turkey needs to kick its addiction to debt and to invest in sustainable growth. That is easier said than done. Turkish ministers have been promising economic reforms for a decade, and have failed to deliver each time. The economy was firing on all cylinders in 2017. It is beginning to run out of gas. ■



On the move

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The National Health Service

A thinning front line

SPALDING

As hospitals struggle with a winter crisis, a longer-term problem is brewing in primary care

IN PLOIESTI, just north of Bucharest, Daniela Margaritescu had a grand house, a big car and her own surgery. But when she set eyes on the Beechfield Medical Centre in Spalding, Lincolnshire, it was “love at first sight”. The 46-year-old Romanian was hired last year as part of a pilot scheme to recruit more foreign doctors to fill chronic vacancies in primary care. For Dr Margaritescu it is a “perfect” deal. She learns new skills, her three children attend good schools and her pay has roughly doubled. For their part, the people of Lincolnshire—who voted heavily to leave the European Union in the referendum of 2016—are happy to have new doctors at last.

As people return spluttering from their Christmas holidays, the National Health Service is entering its busiest time of the year. On January 3rd Jeremy Hunt, the health secretary, apologised to patients after non-essential operations were suspended until the end of the month to ease the pressure on hospitals. Senior doctors took to Twitter to lament the “third-world” conditions on wards. But although the scenes in hospitals, where patients have been left waiting on trolleys in corridors for hours, are dramatic, a less-noticed crisis is under way on the front lines of the NHS. General practitioners (GPs), patients’ first port of call and the gatekeepers of most health services, are a dwindling army.

Take Lincolnshire. Before the arrival of Dr Margaritescu and 24 other doctors from

eastern Europe, 104 of the county’s 434 potential spots for GPs were vacant. The Beechfield practice ran three recruitment rounds without finding a suitable candidate. “People drive past [Lincolnshire] on the way to Scotland, and then again on the way back to London,” says Kieran Sharrock, medical director of the local body that represents GPs. There is no medical school in the county, depriving it of a pipeline of talent. Doctors balk at joining remote practices with lots of old patients; in some Lincolnshire surgeries, half the patients have at least four chronic diseases.

Lincolnshire’s woes are particularly severe, but across the board the NHS is struggling to hire and retain GPs. It recently changed how it counts them, so deciphering trends is tricky, but the number of GPs has probably been falling since at least 2009, during which time the number of hospital consultants has risen by a third. In 2016 Simon Stevens, the chief executive of NHS England, pledged to recruit 5,000 more GPs over the next five years. But the count has fallen further, reaching the equivalent of 33,302 full-time GPs in September, 1,290 fewer than two years earlier. The number of surgeries has dropped to 7,674, from 8,451 a decade ago. Some towns face losing most of theirs; last year seven of the eight practices in Folkestone, on the south coast, said they intended to close.

Even before the creation of the NHS in 1948, family doctors played an outsized

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role in providing health care in England. Their pivotal position was described in the novels of Anthony Trollope and George Eliot. Today Mr Stevens calls the GP arguably the most important job in Britain. They decide when to refer patients for hospital care, and provide a wider range of services than their peers in many countries (Polish doctors in Lincolnshire note that back home they rarely saw children or dealt with gynaecological cases). And their role is set to become even more important: the government wants more patients with chronic conditions to be cared for outside hospital, which will require GPs to co-ordinate treatment.

What seems to be the problem?

The shortage of GPs partly reflects a change in the workforce. In 2006, 43% of GPs were women; a decade later the share was 55%. It is set to rise further, since male GPs are closer to retirement age, on average. Because only one-fifth of female GPs work full-time, compared with half of male GPs, more of them are needed. A recent analysis by Imperial College London suggests that an additional 12,000 GPs will be required by 2020—more than twice the NHS’s target.

Another reason is that the job has become less attractive. GPs complain of having to do more work for less pay—and they have a point. The English population has grown by 4.3m in the past decade, and patients are seeking help more often than they used to. The number of consultations per patient increased by about 10% between 2007 and 2014, according to a study in the *Lancet*, a medical journal. A survey of GPs in 11 countries by the Commonwealth Fund, a think-tank, found that 92% of British GPs reported typically spending less than 15 minutes with a patient, compared with 27% of GPs in other countries. British GPs were also the most likely to say ➤

they were stressed.

One London-based GP describes a "light day": 25-30 scheduled appointments; five to ten emergency ones; one or two home visits; 30-50 replies to be written to hospital doctors, plus a similar pile of pathology reports to read; and 10-20 repeat prescriptions to process. Some feel like secretaries, writing referrals for ungrateful patients. It is a lonely job, without the camaraderie of a hospital ward.

Over the past decade GPs' pay has fallen. In 2004 the Labour government agreed on a contract that raised the average pay of a partner in an English surgery to £136,665 (\$185,000) in today's prices. Since then partners' pay has slipped to £104,900, as successive governments have made the contract less generous. Salaried GPs earn an average of £63,000, less than hospital doctors with similar experience. And, unlike those clinicians, GPs pay thousands of pounds a year in indemnity insurance.

In an ordinary labour market, employers could raise pay to fill vacancies. But the NHS, the world's fifth-largest employer (behind the American and Chinese armed forces, Walmart and McDonald's) does not operate in an ordinary labour market. In effect, pay is set at a national level. The number of doctors to be trained in each specialism is determined centrally years in advance. Since it typically takes ten years to train a GP, failures of planning mean shortages that take a decade or more to fix.

The government has said it will increase the number of places at medical schools by 25% from September. (Unlike other degrees, there is a cap on places to study medicine, because the course is heavily subsidised.) But that will take time to translate into more GPs. It will also require universities to improve the reputation of general practice; for a certain type of thrusting medical student, only dentists are viewed with more disdain than would-be GPs.

With no end to the staffing problem in sight, some surgeries are adapting. They are employing more paramedics, nurses and pharmacists to see patients. Several surgeries are becoming mega-practices, spreading the GPs they have across many sites. Others will increasingly rely on doctors from overseas. Britain already employs a higher share of foreign doctors (27%) than the average across the 28 members of the OECD club (17%). Of the 12,771 doctors who registered in Britain in 2016, 44% had qualified overseas.

According to research by Aneez Esmail of the University of Manchester, and colleagues, foreign-trained GPs are more likely than British ones to work in poor areas, earn less money and work longer shifts. But doctors trained abroad also score lower on postgraduate medical exams, and are more often subject to complaints. In Lincolnshire the doctors recognise they have a

lot to learn. Accordingly, for their first two years they get twice as much time to spend with patients as other GPs do.

Those running the pilot believe that it will continue after Britain leaves the EU, given the need for GPs. The NHS has said it wants the programme to be scaled up to attract 2,000 foreign GPs. Tomasz Grela, a genial new Polish doctor in Spalding, is not too worried about Brexit. "The medical system needs us," he says. And although he readily concedes that he needs to get up to speed with the British system, he is showing signs of acclimatisation. Asked what frustrates him most about the NHS, he gives the same response as most British doctors: "Bureaucracy." ■

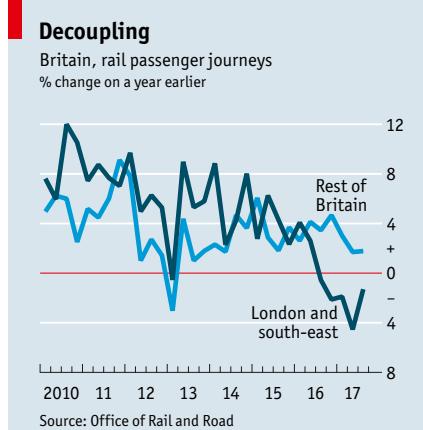
Train travel

Off the rails

Rising fares and poor service prompt more commuters to work from home

ALONG with 3m other workers, Eamonn, a civil servant, used to commute into London daily. It was once an easy jaunt of 30 minutes by train from Coulsdon South to Victoria. But after years of strikes and driver shortages at Southern Rail, the operator on that line, getting to work became a lottery—a train running on time felt like a "luxury for special occasions only," he groans. With Southern cancelling up to 350 trains a day, in one three-week period last autumn he managed to get to the office on only two days. Eventually he moved to Liverpool to escape his awful commute.

Many other Londoners are changing the way they work because of the railways' poor, pricey service. On January 2nd rail fares across Britain rose by an average of 3.4%, the largest increase since 2013. Over the past decade fares have risen twice as fast as salaries. Falling subsidies mean that



passengers now pick up 70% of the rail network's costs, up from 50% ten years ago.

Until now, passengers have put up with it. Since the industry was privatised in the mid-1990s, the number of rail journeys in the south-east has soared by 130%, though fares have risen by 45% in real terms. But that seems to be changing. The year to April 2017 saw the first big drop in passenger numbers in the south-east outside a recession (see chart).

Many rail executives blame a Brexit-induced slowdown for falling traffic. But that doesn't explain why the drop-off has been highest in the south-east. Indeed, since the referendum in June 2016, output in London has grown faster than in any other British region and employment has risen.

More likely it is high fares and unreliable service that are persuading commuters to change how they work, says Stephen Joseph of the Campaign for Better Transport, a pressure group. In the six months to September, journeys made on season tickets—which save money for daily commuters—fell by a tenth, while journeys made using single-use tickets continued to rise. The trend is strongest in the south-east, where fares are highest and services heavily disrupted. With more part-time jobs and technology that lets people work from home, going to the office every day is falling out of fashion. Employers, facing high rents, are keen to encourage this. The amount of space per employee in the City of London has fallen from 17 square metres (183 square feet) in the 1990s to just 11 now.

The fall in passenger numbers creates a financial headache for ministers. Train operating companies can claim compensation if they undershoot revenue forecasts. So "one way or another" the government will take the hit, says Gerald Khoo, a rail analyst at Liberum, a bank. On December 29th Lord Adonis resigned as chairman of the National Infrastructure Commission and called for the transport secretary, Chris Grayling, to quit for "bailing out" private rail operators, which he denies.

If the government ends up forking out more for the everyday running of the railways, its investment plans may be dented. Track-electrification schemes could be further scaled back. Transport for London, which runs the Tube, has shelved upgrades to the Jubilee and Northern lines, following falling ticket sales.

The government is considering limiting fare increases more strictly in the future. That would cut train operators' revenue further. Mr Joseph suggests that moving to a simpler fare structure, with season tickets for part-time commuters, could lure more people back onto trains, as such schemes have elsewhere in Europe. Londoners may not be willing to wait. As Eamonn notes, in Liverpool getting to work costs only £15 (\$20) a week—and even on strike days the trains get him to work on time. ■

Bagehot | Drama and drift

Three predictions for British politics in 2018



THIS will be a year of two halves in British politics. The first six months will be dominated by drift. Theresa May will hold on as prime minister despite backbench discontent. Brexit will slouch ahead despite a growing sense of angst. The second half of the year will bring the possibility of high drama—of Parliament voting against Mrs May's draft deal with the European Union, of the government collapsing, and of Jeremy Corbyn entering Downing Street. This column will offer two firm predictions for the era of drift and a more tentative one for the era of drama.

The first prediction is that the House of Lords will play a more prominent role than it has since before the first world war, when the Lords tried to block the Liberal government's reforms and David Lloyd George, the chancellor of the exchequer, mocked them as “five hundred men accidentally chosen from among the ranks of the unemployed”. The Lords have a constitutional duty to scrutinise the EU withdrawal bill, which is making its way through the Commons. But the scrutiny could easily flare into a political crisis, given that a majority of peers strongly oppose Brexit.

Some leading Lords are spoiling for a fight with the government. Andrew Adonis, a Labour peer, has resigned as chairman of the government's infrastructure commission to devote himself to stopping Brexit. Michael Heseltine, a Tory, has said that he regards Jeremy Corbyn's Labour Party as less of a threat to the country than Brexit. Others worry that the withdrawal bill hands vast powers to the executive, which will use them to water down employment and other rights currently enshrined in EU law.

All this means that, oddly, the unelected House of Lords will have a more profound debate on the biggest change in Britain in half a century than will the elected House of Commons. The Lords include articulate, experienced people on both sides: John Kerr, for instance, knows as much as anybody about Article 50 of the EU treaty, since he was its principal author. The Lords are also freer to speak out than MPs, since for the most part they have already bagged what patronage they want. Conventional opinion will be turned on its head, as liberals rediscover the virtues of a revising chamber of experienced public servants (the meritocracy incarnate!), while conservatives rant about doddery old fools frustrating the will of the people.

The Lords will probably send the withdrawal bill back to the

Commons several times. They may even defeat the government on matters of detail. But after a display of rhetorical fireworks they will shy away from constitutional conflict. It is impossible for even the best-run unelected chamber to prevail in a struggle with an elected one. And, as the *Daily Mail* will no doubt point out, the House of Lords is far from well run. It is the second-largest legislative body in the world, after the Chinese National Congress, with more than 800 members, scores of whom avail themselves of the £300 (\$400) daily attendance allowance and free parking in central London without opening their mouths.

Nothing could be more British than the House of Lords. But the second prediction is the further Americanisation of British politics. For the past 30 years American politics has been consumed by “culture wars”, as questions of identity have replaced questions of economics at the heart of the political divide. Donald Trump, a billionaire Republican, did strikingly well among “deplorable” voters in the Rust Belt, while Hillary Clinton piled up votes in wealthy New York and California. Brexit is pushing Britain in the same direction, as the Conservative Party becomes the party of Leavers, who are concentrated in poor and rural areas, and Labour becomes the party of Remainers.

The past month has already seen a heated battle in the culture wars, with the Home Office's announcement that it is planning to restore Britain's supposedly iconic “blue” passports (Bagehot has his old passport to hand and has no doubt that it is black). A great deal more can be expected, with the wars following the same pattern. Leavers will seize on some icon of national identity and independence, such as the Royal Yacht Britannia; Remainers will denounce the icon as cheesy or irrelevant; and Leavers will denounce the Remainers as metropolitan snobs. The danger is that these wars will shift from safe subjects like passports and yachts to fraught ones such as refugees.

Fireworks and damp squibs

The more tentative prediction is that the high drama of the second half of the year won't change very much. Parliament will not vote down the bill to leave the EU. Mrs May's government won't fall. Mr Corbyn will not become prime minister (yet). And Britain won't hold a referendum on the terms of Brexit. The only real chance of reversing Brexit is if the British people change their minds, and so far there is no sign of this happening. The establishment is doing an even worse job of fighting to overturn Brexit than it did to resist it in the first place. An astonishing proportion of anti-Brexiters seem to come adorned with titles and company directorships. Mr Corbyn continues to equivocate. Adding to the sense of inevitability is the fact that the governing party is overwhelmingly one of Brexiteers. A new survey by Queen Mary University of London and YouGov reveals that only 14% of Tory party members want a second referendum and only 25% support continued membership of the single market (the figures for Labour members are 78% and 87%).

“Darkest Hour”, a new film about Winston Churchill, is a reminder that the direction of history can always be changed provided that politicians possess enough will and courage. The Remainers may yet find a hero. Mr Corbyn may get off the fence. But it seems much more likely that the drift that will characterise the first half of the year will characterise the second half as well. “It's always darkest before the dawn,” John McCain, an American senator and former presidential candidate, likes to point out. “And then you get punched in the face.” ■



The world's worst airports

The departure gates of hell

An informal survey of the most horrible places to be lost in transit

LIKE expensive watches that never break, the world's best airports can be boring. You land, breeze through passport control and check into a hotel within minutes. The experience is pleasant, but not memorable. The worst airports have more character. To adapt Tolstoy, lovely airports are all alike, but every wretched airport is wretched in its own way.

Consider Juba. The airport in South Sudan's capital is a sweltering tent next to a festering puddle. Planes are often late, so passengers must sweat for hours. The departure lounge has no toilets, no food and no queuing system. Lucky is the traveller who finds a chair that is only half-broken. Since dirty water and tropical diseases are common, so are upset stomachs. Tough luck. Travellers should have thought twice before eating salad.

Security is haphazard. Big important people's flunkies carry their bags, which are ostentatiously passed round, not through, the scanner. Since the machine seldom works, little people are in effect upgraded to big important status by not having their bags scanned for guns and explosives, either.

South Sudan is at war, so many UN planes take off from Juba carrying aid workers and emergency supplies. Aggressive officials in sunglasses take pleasure in

obstructing them. When your correspondent was booked on a UN flight, he was assured by the government that his papers were in order. Yet at the airport he was told to get a fourth permit, as well as the three pricey ones he had already obtained. This required a trip across town and a tedious haggle. Predictably, he missed his plane.

Juba has three terminals, but only one is in use. After South Sudan became independent in 2011, the government planned to build an airy structure of glass, steel and concrete. Work started in 2012, but stopped when the bills were not paid. In 2016 the government decided to build a more modest terminal. But it, too, stands half-completed and empty, next to the tented camp that people actually have to use. Travellers are advised to bring a good, long book.

All are bored

Working out which is the world's worst airport is not easy. The best rough-and-ready attempt is the Guide to Sleeping in Airports, a website that publishes an annual survey based on voluntary submissions from irate travellers. It ranks airports by qualities such as discomfort, poor service, bad food, cumbersome immigration procedures and how hard it is to grab forty winks while waiting for a connection.

Overall, Juba was rated worst in 2017.

Since photographing any airport in South Sudan will get you arrested, the description of its "horrific smells and filth" is accompanied by an artist's impression which makes the departure lounge look far nicer than it is.

The ranking is inevitably skewed by sampling bias. It misses truly awful places that hardly anyone visits, and over-emphasises less egregious ones that handle more people. Juba won its "worst in the world" ranking not only on demerit but also because so many foreign charity workers pass through and complain about it. Jeddah, in Saudi Arabia, comes second not because it is really the second-worst in the world but because it is swamped with *hajj* pilgrims every year and cannot cope.

Because gripes spring from disappointment, expectations matter. Travellers in the rougher parts of the world applaud wildly when a plane lands without crashing; more pampered types are enraged if the Wi-Fi is slow. It was the mismatch between expectation and reality that doubtless propelled three Greek hubs (Crete, Santorini and Rhodes) into the Sleeping in Airports worst ten. Hordes of northern Europeans flew to Greece for a cheap holiday in 2017, where they encountered strikes, delays and other indignities to which they were unaccustomed. Many reached for their smartphones and complained.

To illuminate some of the gaps in existing rankings of bad airports, *The Economist* conducted an unscientific, anecdotal poll of its globe-trotting correspondents. It attracted more, and more passionate, responses than nearly any other internal survey we have done. Here are some of our reflections from the departure gates of hell.

Several airports in war zones are worse ➤

than Juba. Our Africa editor cites **Bangui**, in the Central African Republic: "The fence around it has been stolen, so when big jets come in to land the pilots keep their hands on the throttle so they can pull up if they see people trying to run across the runway (which lies between a refugee camp and the city, and so has lots of crossing traffic). On the plus side it has sandbagged bunkers on its roof and was designated the final fallback position by French forces during the civil war, so if you are in it you are about as safe as you can be."

Although each awful airport is unique, four themes recur: danger, bullying by officials, theft and delay. Sometimes, all these reinforce each other. For example, it takes ages to get through **Lubumbashi** airport (in the Democratic Republic of Congo) because truculent security officials slow things down in the hope that passengers will give them "un cadeau" to hurry up. If you hand over \$1, they let you board without your bags getting checked at all. Such transactions are often referred to as "bribes", but are really a form of extortion with menaces. They make air travel in places like Congo slower, riskier, costlier and much more unpleasant.

Air travellers make tempting targets for thieves. They are rich enough to afford an air ticket, which in many places makes them rich indeed. They carry luggage, some of it valuable. They are often far from home and unfamiliar with local rules. Finally, airports are full of choke points through which travellers must pass if they are to board their planes, creating opportunities for crooked officials to fleece them.

The ones in **Manila** are especially creative. Some have been known to plant bullets in luggage so they can "find" them and demand bribes not to have the owners arrested. This scam is known in Tagalog as "laglag bala" ("drop bullet").

In **Johannesburg** the pilfering is covert but rampant. Our correspondent grumbles: "Despite packing absolutely nothing of value in my checked bags they are regularly rifled through and were twice slashed open (they weren't even locked). Once I found someone else's sunglasses case in my bag; mislaid, perhaps, by luggage handlers in a looting frenzy."

Some travellers are harassed by officials who seem to fear that, if they do not look busy, they will be replaced by machines, as many have been at modern airports. The magnificently uniformed functionary in **Delhi** who demands to see your papers—despite having just watched another functionary inspect them—falls into this category. Other officials harass travellers for the sheer fun of wielding power. Our former Cairo bureau chief writes, of Saudi immigration procedures: "The queues are subtly divided by nationality and caste. If you happen to be a Baloch labourer, your lot is to sit on the floor for hours, getting barked

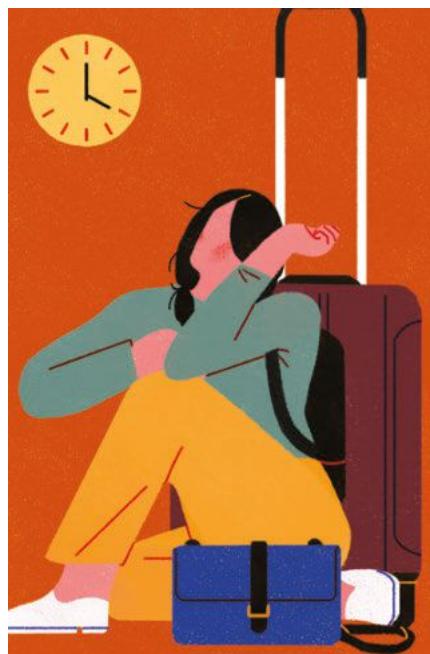
at and swatted by swagger-stick-wielding Saudi policemen. Anyone who falls asleep risks a thrashing."

Rules change at borders, and some airport officials enforce them mindlessly. One correspondent recalls that in **Santiago**, Chile: "I once got detained for two hours for failing to declare an unopened, sealed bag of almonds. I then had to write a declaration expressing my contrition for bringing the nuts. When I failed to do so without cracking up I was threatened with arrest. The lady next to me was being interrogated for smuggling in a lone banana."

The worst airports reflect the vices of the governments that regulate them. **Pyongyang** has a totalitarian vibe. A correspondent writes: "The plane played rousing music when we flew over the border into North Korea, and we were handed copies of the national newspaper and asked not to fold it, since it had a photo of Kim Jong Il on the front page." The only consolation is that the airport has a chocolate-fondue fountain.

Venezuela's half-Marxist, half-gangster, wholly incompetent government, which has prompted much of the middle class to emigrate, does not make the journey easy or pleasant. Our Bello columnist grumbles of **Caracas**: "Your hand baggage will be searched in detail twice (by the National Guard, who are drug smugglers who claim to be fighting drugs)." Our organised-crime correspondent also has miserable memories: "The departures board showed our flight as delayed up to the moment when it showed it as closed. I waited endless hours for the next flight in a fast-food restaurant, the only place with seats, and watched a mange-ridden dog licking out the polystyrene containers strewn on the floor."

Poor countries have an excuse for poor



airports. Rich countries do not, which is perhaps why travellers are particularly irked to find grottness in, say, **Brussels**, the heart of the European Union and a noted centre of gastronomy. Our Charlemagne columnist writes of Charleroi, its second airport: "It is grim, grimy and cramped, and has atrocious food. The planes leave and land at ungodly hours. And the only real way into town is a coach that runs every 30 minutes and is frequently overbooked: more than once I've queued in the rain only to see it drive off as I reach the front." Many correspondents moaned about **Berlin**, where a new, unfinished terminal is six years late. Another European airport that elicits howls is **Luton**, which claims, fancifully, to be close to London. An intern writes: "Going on holiday and returning to Luton is like having a wonderful dream and waking up to find yourself in a puddle under a railway bridge."

Airports all around the world have to cope with growing crowds. The number of passengers has roughly doubled since 2005, to an estimated 4bn in 2017. Some have done so brilliantly, harnessing technology and smart design to usher more people swiftly through. Singapore, Seoul and Munich score highly on this measure.

American airports, by and large, do not. This is not simply because security has grown tighter since 2001—that is true everywhere. It is because security and immigration screening are far more hassle-some than they need to be. Border officials are rude, and there are too few of them. Surveys suggest that every year millions of tourists shun the world's greatest country because getting in is so horrible. A "trusted traveller" programme speeds things up a bit, but only for a handful of passengers.

Idiotic bureaucracy abounds. Travellers from Europe to Latin America who change planes in the United States must pass through immigration control, thus running the risk of missing their connection. What is the point of asking people who do not wish to enter the United States why they wish to enter the United States? Transit passengers in Singapore or Nairobi do not have their time wasted like this.

Our overall judgment (readers are invited to visit our travel blog, Gulliver, to dispute it) is that, adjusted for national income per head, several busy American airports would be contenders for worst in the world. **Washington Dulles** has the worst-designed ground transport: travellers must enter and leave a mobile pod by the same door, so everyone crowds round in the hope of getting off first, thus blocking it. **JFK** is the main gateway to the world's capital of consumerism, yet scarcely any retail therapy is available to treat travellers' boredom. But **Miami** is surely worst of all. The queues at passport control take nearly as long to navigate as Leif Erikson took to cross the Atlantic in a longboat. ■



Business in South Korea

Diary of a sniper

SEOUL

South Korea's antitrust tsar has a shot at getting the chaebol to respect the law

AS KIM SANG-JO was preparing last May to make the switch from snappy shareholder activist to a regulatory role as South Korea's fair-trade commissioner, he had a simple message for the country's big conglomerates: "Please do not break the law." Not one to make bosses quake in their brogues, exactly. And yet the *chaebol*, as the country's family-controlled empires are known, are responding to his call for reform. Addressing complaints about governance, a few have brought far-flung businesses into a simpler holding-company structure. Others have set up funds to provide support to suppliers, which have long accused the giants of treating them badly. Another group is paying out record dividends to once-disregarded shareholders.

Mr Kim was preaching, if not yet to the converted, then to the disconcerted. The *chaebol* have had a bruising couple of years. Nine of South Korea's most powerful bosses, some rarely seen in public, were grilled on television by politicians in December 2016 as part of an investigation into collusion. All denied that they had sought favours in return for the billions of won they paid into charitable foundations controlled by Choi Soon-sil, once a confidante of Park Geun-hye, a former president ousted in March. (Her father, Park Chung-hee, helped the *chaebol* flourish with state money when he ruled in the 1960s and

1970s.) Both women are now behind bars on charges of corruption—as is the country's most prominent business scion, Lee Jae-yong of Samsung.

Mr Lee, presumed heir to the electronics-to-theme-park giant, has been Samsung's de facto boss since his father fell ill in 2014. In August he was sentenced to five years in prison, charged with bribing Ms Park in order to win support for an \$8bn merger of two affiliates, Samsung C&T and Cheil, which tightened his hold over the group. (He denies any wrongdoing and is appealing; a first judgment is due in the coming weeks.)

To many, all this marks a watershed in *chaebol* history; Mr Kim agrees. Mr Lee's father, for instance, twice received presidential pardons, after convictions for bribery

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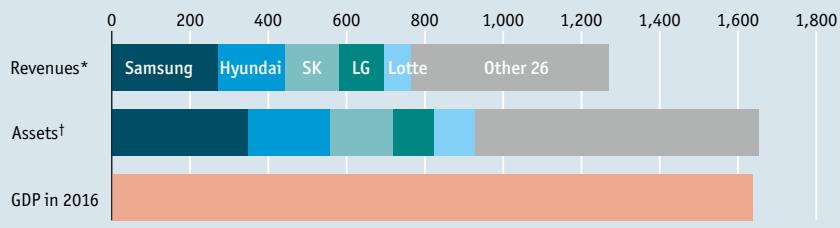
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in 1996, and embezzlement and tax evasion in 2008. In 2015 and 2016 Ms Park released from prison early the bosses of SK Group, the third-biggest conglomerate, and CJ Group, another *chaebol*. Most have been let off because of their firms' importance to the economy. The total asset value of the five biggest *chaebol*, measured in April 2016, reached over half of the country's GDP for the year (see chart).

Moon Jae-in, the left-of-centre president who won by a landslide in a snap election in May, is the first to promise an end to politically-motivated amnesties. He has pledged, too, to abandon what he calls South Korea's "chaebol-focused growth strategy". Small and medium-sized enterprises (SMEs) feel squeezed by the national champions, to which many say they are beholden as suppliers or by which some are gobbled up, often for valuable machinery or technology. Innovation and entrepreneurship suffer as a result.

Mr Moon's resolve to help SMEs means that Mr Kim, whom he appointed, has stronger political backing than perhaps any previous fair-trade commissioner. As an activist, Mr Kim was once turfed out of a meeting of Samsung shareholders for ha-

Too big to play fair

South Korea, 31 major *chaebol*, 2016, won trn

Sources: Korea Fair Trade Commission; Nikkei Asian Review; KOSIS

▶ ranguing executives about rumoured illegal political donations. Now that Mr Kim is working in Mr Moon's graft-busting government, the two men, says Mr Kim, are "totally in agreement".

His mandate is popular, too. Over four-fifths of adults work in often unproductive SMEs. An advocate for them says that Mr Kim has "a real understanding of the build-up of unfairness". The Korea Fair Trade Commission regulates monopolies and upholds consumer rights. It found that Lotte, a shopping-and-cinema empire, broke national law on fair competition most frequently in the 18 months from April 2016, on no fewer than 33 counts. During that time Hyundai paid the highest total fines, of 85bn won (\$74m). Close to two-thirds of cases handled by the commission involving the ten biggest chaebol were breaches of the fair-trade act's provisions.

Under Mr Kim, who seems wholly unafraid to live up to his public sobriquet as the "chaebol sniper", penalty fees are set to double for businesses who break fair-trade rules. A new fine can be meted out to firms that fail to hand over documents requested by the commission; non-compliance is now a criminal offence.

Lee Jae-hyung, an expert on corporate governance at the Korea Development Institute, a think-tank, says such measures matter greatly, because they raise public awareness. Past leniency towards badly-behaved bigwigs means South Koreans have often been oblivious to the seriousness of their infractions. Public pressure is needed to help pass proposed laws on chaebol reform, since Mr Moon's party lacks an absolute majority. Mr Kim has also raised the possibility of stronger measures against cross-shareholdings.

In the sights

The sniper would rather his targets surrender willingly and is encouraging "voluntary" reform. That approach might last longer than big, forced changes, observers reckon. Mr Kim is also counting on the fact that the younger, third generation of chaebol bosses "sees change as inevitable", as Chinese competition gnaws at profits and as investors demand a bigger slice of what is left. Fatter shareholder returns should be the yardstick for progress, he says. Simplifying corporate structures, often more complex than a semiconductor circuit, would also help correct the "Korea discount": the low valuation of firms relative to developed-country peers, thought to stem from investors' perceptions that they have next to no say in decisions. This year's shareholder-meeting season, in March, will be a key test of whether the chaebol are moving in the right direction.

Change is undoubtedly in the air. In 2016 Samsung promised to start returning half its free cashflow to investors. Not long ago this was an "unimaginable" step, says

Mr Kim. In his first meeting with the "big four"—Samsung, Hyundai, LG and SK—in June, he asked their professional managers to reform supply-chain pyramids (to avoid any whiff of collusion, he does not meet the owner-families). That chain of relationships is widely thought of as an example of *gapjil*, a term for the bullying of firms lower in the hierarchy. SK Group has since announced a 160bn-won fund to pay second- and third-tier subcontractors directly if a first-tier supplier is temporarily cash-strapped. Mr Kim is confident he can convince the chaebol that the costs of engaging

in unfair trade outweigh the benefits.

Some anti-chaebol types carp that Mr Kim now seems to be more *chaebol*-sympathiser than sniper, and that a disarming approach will get firms to play nice only as long as it takes for the government's reformist fervour to cool. That is unfair, but it is true that obstacles to change remain in a country where the *chaebol*'s glittering success has given them sway over politics, media, the judiciary and academia. The economy is strong, but future weakness would put pressure on Mr Moon to release *chaebol* bosses from prison. Dozens of reform-►

Ant Financial and MoneyGram

Blocked transfer

NEW YORK

China's Ant Financial is forced to abandon a big American acquisition

“THE geopolitical environment has changed considerably since... a year ago.” That was the explanation given this week by Alex Holmes, chief executive of MoneyGram International, a Dallas-based American money-transfer firm, for Ant Financial abandoning its \$1.2bn deal to buy his firm. Ant, the online-payments affiliate of Alibaba Group, a Chinese e-commerce giant, had outbid Euronet, an American rival, in 2017 and secured the approval of MoneyGram's board for the acquisition. In normal times, Ant would have secured the prize.

But it is up against a rising tide of anti-China sentiment in Washington, D.C. Donald Trump has often argued that China does not play fair in global commerce. The sense that China and its companies are not to be trusted is spreading on Capitol Hill, too. Ant's bid was blocked by the Committee on Foreign Investment in the United States (CFIUS), a government body reporting to the Treasury. It reviews such deals for national-security implications. Two congressmen claimed that approving Ant's purchase of MoneyGram might allow “malicious actors” to get hold of financial data belonging to American soldiers and their families.

Alibaba seemed the least likely of Chinese firms to encounter a backlash in America. Alipay, Ant's online-payment offering, has already entered into partnerships with Verifone and First Data, two American payments firms, and is accepted at some 175,000 locations in the country. In January 2017 Jack Ma, its charismatic boss, met with then President-elect Trump and promised to create a million American jobs through cross-border e-commerce. News of the deal for MoneyGram came shortly afterwards.

This week's decision is not just a blow for Alibaba. It is another sign of a deteriorating



It didn't mean jack

environment for Chinese firms in America. The Ant deal is the most prominent transaction blocked by CFIUS recently, but it is not the only one. In September Mr Trump sided with CFIUS to stop China's Canyon Bridge Capital Partners, a government-backed investment firm, from acquiring America's Lattice Semiconductor, a tech firm. In November, China Oceanwide Holdings said that it would delay the deadline for closing its \$2.7bn takeover of Genworth Financial, an American insurer, until April due to problems with CFIUS.

A thaw looks unlikely. Bipartisan efforts are now under way in Congress to grant CFIUS broader powers still to block foreign investment in American companies, especially by Chinese investors. Euronet, meanwhile, which hails from nearby Kansas, has seen its warnings about the dangers of handing American data to Chinese companies pay off. It may now rebid for MoneyGram.

▶ing bills languish in parliament. They range from introducing electronic proxy voting rights for shareholders (because conglomerates often schedule simultaneous meetings) to putting limits on the use of treasury shares in mergers, which owner-families often sell to allies (as in the merger of Samsung affiliates).

As for existing laws, loopholes abound, says Park Sangin of Seoul National University: although four of the ten biggest conglomerates have moved to a holding-company structure, dozens of their affiliates remain outside it. According to an estimate by Bloomberg, a financial-information provider, tax-exempt chaebol foundations hold about 13trn won in shares between them; through these, sons and daughters secure shares in key affiliates but dodge inheritance tax. A court ruled in October that Samsung's \$8bn merger was in fact lawful,

because "strengthening the control of an individual is not banned by law". (This ruling does not affect the case against Mr Lee.)

Mr Kim has no intention of giving the chaebol "a completely new face", he says. That is "not only impossible" in his three-year term, but "not worthwhile" as the firms are a "precious resource" for South Korea. Samsung Electronics, that conglomerate's darling, thrived in 2017, clocking up record profits, contributing to a surge in exports for the year, all while Mr Lee has been cooped up on criminal charges. Unharmed corporate performance has in the past been taken as a sign that misconduct is so commonplace in South Korean conglomerates that investors do not care. But with Mr Kim now minding the shop, it could just as well be taken as a sign of something better: that the chaebol are becoming more than just a family affair. ■

utation for being boringly well-run, Canada is an unlikely haven for crooks and tax avoiders. But it has long had a reputation as a place to snow-wash money. In 2009 the national police force estimated that up to C\$15bn (\$12bn) was being laundered in the country each year (an estimated annual \$2trn is laundered globally). One attraction is that establishing a company is so easy—tougher identity checks are required to get a library card than to form a private firm, as Jon Allen of Transparency International Canada noted before a parliamentary committee in December.

Not all corporate ownership is opaque. Publicly traded firms are subject to securities laws which require major shareholders to be disclosed. The problem lies with firms that are not listed on a stock exchange. An anti-money-laundering law passed in 2000 directs banks, securities dealers, life-insurance firms and other financial entities to make "reasonable efforts" to identify the owners of firms they do business with; left to carry the load, they do their best to collect information on all counterparties, but it is not enough.

A review in 2016 of Canada by the Financial Action Task Force, an intergovernmental body set up in 1989 to combat money-laundering, concluded that only a fraction of the country's 2.5m legal entities "had accuracy checks performed with respect to beneficial ownership". It also catalogued a wide range of ways in which Canadian front companies were being used to purchase assets, including property, or to move money in and out of the country "to layer and legitimise unexplained sources of income".

Political and legal authorities increasingly recognise a need for change, but progress has been glacial. When finance ministers from the federal government, the ten provinces and three territories met to discuss the issue last month, they went no further than agreeing to encourage firms to keep a record of their ultimate owners, ready to give to authorities if they request it. Part of the problem is that jurisdiction is split between national and sub-national governments, with only a tenth of Canada's companies incorporated at the national level. Any agreement to change the rules has to reconcile differences in how provinces define beneficial ownership and collect such information.

Canada's existing money-laundering and terrorist-financing legislation also contains a gaping hole: lawyers are not covered, because they successfully argued in court that turning over such information violated solicitor-client privilege. One Ontario lawyer bragged to a police undercover agent in 2002 that this victory meant it was 20 times safer for a lawyer to launder money in Canada than in the United States—not the sort of contrast that the Great White North relishes. ■

Money-laundering in Canada

Snow-washing

OTTAWA

Loose rules on private-company formation are aiding money-launderers

WHEN reports surfaced in 2016 of foreign students with no known income buying homes worth millions of dollars in Vancouver, locals said it was yet more evidence that foreigners were inflating prices in Canada's dearest property market. It was also evidence of a home-grown problem. The students turned out to be figureheads for anonymous firms whose ultimate owners cannot be identified because the information is not legally required by the land registry. Canadian authorities are concerned about the abuses caused by such opacity. The property market may well be attracting foreign criminals and corrupt officials seeking to laun-

der dirty money, notes David Eby, the attorney-general of British Columbia.

Other countries have taken steps to make sure that anonymous ownership of firms does not help criminals. In 2014 G20 leaders agreed to make the ultimate ownership of legal entities more transparent. Britain, for example, set up a searchable, public database of beneficial or ultimate owners of all firms, limited-liability partnerships and Societas Europaea (firms based and regulated in the European Union as a whole). All EU states will eventually have to do the same under a 2015 anti-money-laundering directive.

With not a palm tree in sight and a rep-



Software-as-a-service

The tower of Benioff

SAN FRANCISCO

Salesforce has reached great heights. Can it keep climbing?

VISIBLE from nearly every corner of San Francisco and from up to 30 miles away, the new skyscraper that will be the headquarters of Salesforce, a software giant, stands 1,100 feet (326 metres) tall, making it the highest building in America west of Chicago. On January 8th, after four years of building, workers will start moving in.

Those who know Salesforce's founder, Marc Benioff, find his firm's new digs fitting. As creator of a firm that caters to salespeople, he is himself a fiercely ambitious salesman. In its 2018 fiscal year, which ends on January 31st, Salesforce is expected to reach \$10bn in annual revenue for the first time. It plans to more than double that figure over the next four years. Even that is not enough. In 20 years Mr Benioff's "dream" is \$100bn of revenue, he muses.

Can his towering expectations be met? Founded in 1999, Salesforce claims a combination of longevity and size that few tech companies have achieved; its market capitalisation is \$76bn. It is the largest tech firm with headquarters in San Francisco and the world's fourth-largest software firm, after Microsoft, Oracle and Germany's SAP, which were all founded in the 1970s.

Mr Benioff was early to spot an opportunity in delivering software as a service, meaning that software can be accessed remotely by users through the cloud, rather than being installed on firms' computers on their premises. This mode of delivery needs no upfront investment by companies for software that may go unused; instead subscribers pay a fee for employees that access it each month. Salesforce's "cus-

tomer relationship management" software, which helps companies keep track of their clients and manage prospective leads, is its main product, but it also offers tools for customer service, marketing, analytics and digital commerce.

Mr Benioff is a key element of the product too; a mix of showman, digital guru, political activist and philanthropist. Those close to him call it "marc-eting". Seeing firms struggling to adapt to technology trends, he puts himself forward as a digital consigliere, travelling globally to advise bosses. Each autumn Salesforce spends an estimated \$30m to put on Dreamforce, drawing some 170,000 participants to San Francisco with a promise of parties and prominent speakers.

Not everyone appreciates his salesmanship. He has taken many public positions, often through Twitter—for example, on gay rights and equal pay for women. "As political leaders become weaker, chief executives have to become stronger," says Mr Benioff. To date the firm has given \$168m in philanthropic grants. Many customers like to feel they are not only buying software but doing good for the world, says Keith Weiss of Morgan Stanley. But Salesforce's annual "10-K" securities filing lists its political positions as a risk for shareholders. According to former executives, Mr Benioff's fondness for setting policy by tweets, such as cancelling events in states that have issued anti-gay laws, can sometimes cause organisational chaos.

That is not the only drawback. Gerhard Gschwandtner, boss of a firm that publish-

es a magazine, *Selling Power*, calls him "a merchant of hope" but also cautions that "selling the future can attract focus away from weaknesses in the present moment". Only around a quarter of his firm's sales come from outside the Americas. Its business generates plenty of cash—in its 2017 fiscal year it produced around \$2.2bn—but its operating profits have been persistently low. That is in large part because it spends so lavishly on sales and marketing—a total of \$10bn between 2015 and 2017.

Investors reckon Salesforce's business will keep generating lots of cash as it expands into new areas of software. But there is a risk that marketing costs stay high and that Salesforce splurges on deals in order to grow. In recent years it has diversified its business lines mainly through acquisitions. Some purchases, such as Demandware, a cloud-based provider of e-commerce services that it bought for \$2.9bn in cash in 2016, were sensible, but others, such as Buddy Media, a social-media firm it acquired for around \$750m in 2012, are viewed as expensive mistakes. Mr Benioff also flirted with buying Twitter in 2016 but backed off when shareholders protested. They also worried when Salesforce bid for LinkedIn, a professional social network; Microsoft bought it for \$26.2bn.

As for organic growth, Salesforce was later than Microsoft and some other firms to invest properly in artificial intelligence (AI), which is expected to make software more predictive and useful. In 2016 it bought an AI startup, MetaMind, for around \$33m, and is using the talent it scooped up in the deal to put together an AI offering, called Einstein, which aims to make Salesforce's software feel more personalised and insightful. Yet some wonder whether it can close the AI gap on rivals.

Salesforce may dominate sales-management software, but in newer areas of business, such as digital commerce and marketing, it faces stiff competition. Google and Amazon, for example, have an edge in the two fields, and enormous resources. Nor are Salesforce's existing competitors, Oracle, Microsoft and Adobe, showing any inclination to surrender in the battle over sales software. LinkedIn gives Microsoft access to valuable sales-lead data. Startups could yet beat Salesforce on price or innovation.

Indeed, while Mr Benioff's pitch is all about supersized future revenues, some people wonder if Salesforce will always remain independent. Its market value means it is neither a giant like Microsoft or Oracle nor a nimble startup. It is not easy to be a midsized publicly listed software company facing competition from tech giants. In 2015 Microsoft reportedly considered buying Salesforce, but a price could not be agreed. If a potential deal were once again to present itself, who better than a master salesman to see it through? ■



Benioff's guide to upselling

Schumpeter | The year of the incumbent

In 2018 conventional firms will give Silicon Valley a run for its money



ACCORDING to Ginni Rometty, IBM's boss, the digital revolution has two phases. In the first, Silicon Valley firms make all the running as they create new markets and eviscerate weak firms in sleepy industries. This has been the story until now. Tech firms have captured 42% of the rise in the value of America's stockmarket since 2014 as investors forecast they will win an ever-bigger share of corporate profits. A new, terrifying phrase has entered the lexicon of business jargon: being "Amazoned".

The second phase favours the incumbents, Ms Rometty believes, and is starting about now. They summon the will to adapt, innovate to create new, digital, products and increase efficiency. The schema is plainly self-serving. IBM is itself fighting for survival against cloud-based tech rivals and most of its clients are conventional firms. Yet she is correct that incumbents in many industries are at last getting their acts together on technology.

Enough time has elapsed for even the dopiest to see the threat. It is 11 years since Netflix began streaming video and five since Tesla unveiled the Model S. The evisceration by tech firms of some mid-sized businesses, such as department-store retail, has concentrated minds. Lagging share prices have helped. In 2017 Ford fired its boss, Mark Fields, despite near-record profits. Its board concluded he was complacent about technological change.

Taking a sample of America's 20 most valuable non-tech firms, 14 now have a digital dimension to their strategies. Some blue-chip firms are mixing fashionable cocktails of e-commerce, big data and artificial-intelligence (AI) initiatives. But others are making comprehensive, multi-billion-dollar bets. General Motors is developing a suite of electric and autonomous vehicles. Walmart is in the midst of a massive online shopping push. Investors view such initiatives as central to these firms' prospects.

A round of mergers and acquisitions has kicked off as firms respond to the threat from Silicon Valley. On December 14th Walt Disney said it would spend \$66bn buying most of 21st Century Fox. One motivation for the deal is to counter the menace of streaming video services, most notably those of Netflix and Amazon. In 2019 Disney will stop distributing new films through Netflix and launch its own streaming services. On December 12th Westfield and Unibail, a pair of huge operators of shopping malls, joined forces with two main aims: to bulk up in response to

e-commerce and to build a global brand with a digital presence.

Incumbents have lots going for them. They own 80% of the commercial world's data, as Ms Rometty has noted. If AI is set to change civilisation by using data to make better decisions, most of the historical data-sets about, say, jet-engine performance or clothing supply chains belong to established firms, beyond the reach of Amazon and Facebook. Incumbents have vast resources: among S&P 500 firms, their total cashflow is four times that of tech firms' and 18 times what venture capitalists invest each year.

Established giants also enjoy barriers to entry such as strong brands and lobbying skills, the latter being especially crucial in America's money-driven political system. Also on December 14th, American regulators abolished "net neutrality" rules requiring telecoms carriers to treat all internet traffic equally—a victory for conventional telecoms and cable firms. Silicon Valley faces a global regulatory "techlash" over issues such as privacy and tax.

A typical approach by conventional firms is a blend of bolt-on acquisitions of startups and organic investment in new technologies. GM has invested in Lyft, a ride-sharing firm, and developed electric engines. On December 13th, Target, which operates discount stores, bought Shipt, a online-delivery platform. Walmart has bought Jet.com, an e-commerce firm. Western banks have been busy buying fintech firms, although the cleverest incumbents in finance are Asian. Ping An, a Chinese insurance firm, has 265m users for its app. DBS, South-East Asia's biggest lender, has set up online banks in both India and Indonesia.

A few firms are opting for huge deals. On December 3rd CVS, a drugstore and health-care benefits manager, said it would pay \$77bn for Aetna, a health-insurance company. The idea is to bulk up and lock in customers before Amazon enters the business of selling medicines. Within the tech industry, IBM is not the only mature firm trying to adapt. In March Intel bought Mobileye for \$15bn—it specialises in chips and software for driverless cars.

Conventional wisdom says incumbent firms are timid about technological change, scared to cannibalise profits and trapped in an unimaginative mindset. In 1997 Clayton Christensen laid out this view in "The Innovator's Dilemma". Kodak, which folded after failing to see that camera film would become obsolete, is the classic example. Yet for every Kodak there is a Marconi, that goes too far, too fast. Formerly called GEC, it was Britain's largest industrial firm in the 1990s but collapsed after wrecking its balance-sheet with acquisitions of fashionable but flaky tech firms in 1999.

The stakes get higher

A few firms have already been indisciplined. John Flannery, General Electric's new boss, has axed some digital projects after judging them extravagant. But no one is yet making existential wagers. Taking a sample of eight incumbents, on average their digital initiatives are worth 14% of the size of the firm (using a range of metrics, including sales, investment and market value). So for example, e-commerce eats up only a fifth of Walmart's investment budget. Even Disney-Fox's existing initiatives are small. Hulu, a streaming service that it will control, makes losses equivalent to less than a tenth of its parents' annual spending on content.

Conventional firms' digital bets will only grow larger, as more bosses note the rising share prices of pioneers such as Walmart and GM. Overall this makes sense, even if plenty of companies make an utter hash of things. For large incumbents, in 2018 digital strategy will stop being about trendy experiments and start being a matter of life and death. ■

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Environmental economics in China

Towards a greener future

TIANJIN

China's anti-pollution campaign may crimp growth by less than feared

LEO YAO thought he had nothing to fear from the environment ministry. Before, when its inspectors visited his cutlery factory, he says, they generated “loud thunder, little rain”. After warning him to clean up, they would, at worst, impose a negligible fine. Not so this time. In August dozens of inspectors swarmed over his workshop in Tianjin, just east of Beijing, and ordered production to be halted. His doors remain shut today. If he wants to go on making knives and forks, he has been told that he must move to more modern facilities in a less populated area.

Mr Yao's company, which at its peak employed 80 people, is just one minor casualty in China's sweeping campaign to reduce pollution. For years the government has vowed to go green, yet made little progress. It has flinched at reining in dirty industries, wary of the mass job losses that seemed likely to ensue. But in the past few months it has taken a harder line and pressed on with pollution controls, hitting coalminers, cement-makers, paper mills, chemical factories, textile firms and more.

Tens of thousands of companies—mostly smaller ones, like Mr Yao's—have been forced to close, according to Chen Xing-dong, an economist with BNP Paribas. In the region around Beijing this winter, the government has ordered steel mills to run at half-capacity and aluminium-makers to cut output by nearly a third. Implementation, half-hearted in the past, has if any-

thing been heavy-handed. In Hebei, a northern province, a ban on coal heating left thousands of residents shivering because the replacement, a switch to natural gas, was not yet ready.

For the wider economy, the question is how steep the cost will be. A sharp tightening of environmental rules in the world's biggest polluter has the potential to be a shock, both to China and the global economy. Two worries are commonly heard: that it will drag down growth; and, at the same time, cause inflation as production cuts boost prices. Jiang Chao, an economist with Haitong Securities, a broker, says it could end up making for “classic stagflation”. So far, though, these worries are unfounded: growth has been solid and infla-

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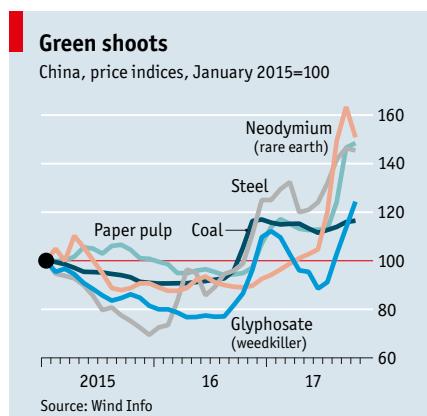
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tion subdued. A possible explanation is that the economic impact is lagging behind the pollution controls. Another is that, contrary to received wisdom, China may be able to raise its environmental standards without paying a high price.

One thing is clear: China's shift on pollution is real. True, some extreme measures are temporary, especially those aimed at keeping Beijing's sky blue this winter. But many others will be lasting. As part of a “war on pollution” declared in 2014, China has detailed targets for cleaning up its air, water and soil. On January 1st it introduced an environmental-protection tax, replacing a patchwork of pollution fees. Last month it launched a market for trading carbon emissions, which, though scaled back from early plans, will be the world's largest. Most crucially, the environment ministry, previously a political weakling, has clout at last—as Mr Yao's cutlery business found to its chagrin. Besides fining companies, inspectors have disciplined some 18,000 officials for laxity over pollution.

The tougher tactics have already made a big dent in specific industries. Just 60% of steel blast-furnaces are now in use, down sharply since October and near a five-year low. Thermal-power output is now actually declining year by year, evidence of weakening demand. Companies are also feeling the pinch. Schaeffler Group, a German car-parts maker, warned in September that pollution controls would knock out its supplier of needle bearings. Taiwanese chipmakers in the city of Kunshan, an electronics hub not far from Shanghai, say the abrupt tightening of water-quality rules may lead them to move.

Upward pressure on production costs has been intense. A surge in coal and steel prices has attracted most attention, as China has pushed companies to cut capacity (see chart). But similar trends affect a range ➤



of smaller industries. In July China banned imports of 24 kinds of waste such as paper and plastic; the ban came fully into effect on January 1st, but demand (and prices) for raw pulp quickly jumped. Restrictions on the chemicals industry have fuelled a 50% increase in the price of glyphosate, a popular weedkiller, over the past few months. Prices of rare-earth metals, notably two used in electric magnets, have also soared.

Yet the biggest economic surprise of China's environmental campaign so far is not that it has had an impact; it is how muted that impact has been. Yes, industrial production has recently been weaker than

forecast, but it is still expanding at more than 6% year on year. And yes, some commodity prices have shot up, but this has had very little effect on general inflation.

Three factors suggest that this benign trend may endure. First, despite the common assumption that industries such as steel or coal are vast, they in fact account for a small, shrinking share of the Chinese economy. Minsheng Securities, a broker, calculates that the full complement of industries affected by the pollution measures adds up to just 7% of total national investment. China has reached a stage of development where manufacturing is fading

in importance. Nearly 4m people may lose jobs as a result of cuts in industrial capacity, but strong demand for labour in the services sector, from restaurants to health care, is cushioning that blow.

Second, price increases have been concentrated and show little sign of spreading widely. Prices of coal and steel, the first to heat up, are already levelling off, making the increases seem big one-off changes rather than the start of inflationary spirals. For the economy as a whole, it amounts to a redistribution of resources. Companies that use commodities as inputs face higher costs. But producers benefit. And since ►

Buttonwood | Taking off the training wheels

Central banks are reducing support, but investors are sanguine

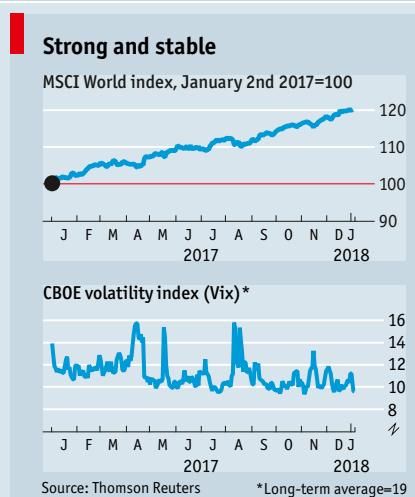
AFTER a bumper year for financial markets in 2017, can 2018 be anything like as good? Much will depend on the global economy. The rally in stockmarkets stretches back almost two years, to the point when worries about an era of "secular stagnation" started to diminish.

The first pieces of economic data to be published in January—the purchasing managers' indices (PMI) for the manufacturing sector—were pretty upbeat. In the euro zone the index recorded its highest level since the survey began in 1997. China's PMI was stronger than expected, and America's index showed new orders at their highest level in nearly 14 years.

The obvious question is whether the markets have anticipated the good news about growth, and pushed share prices to a level from which returns can only be disappointing. The cyclically adjusted price-earnings ratio of the American market, which uses a ten-year average of profits, is 32.4; it has been higher only in September 1929 (just before the Wall Street crash) and during the dotcom bubble.

A regular poll of global fund managers in December by Bank of America Merrill Lynch (BAML) found that a net 45% thought that equities are overvalued, the highest level in the more-than-20 years the survey has been conducted. But a net 48% of investors still have a higher exposure to stockmarkets than normal. The discrepancy can be explained by their attitude to the other highly liquid asset class: government bonds. A net 83% of managers think they are overvalued.

Given the very low level of bond yields (which fall as prices rise), it is hardly surprising that investors are chary about the asset category; a net 59% of managers have a lower weighting in bonds than normal. But partly because of the better news on the global economy, they are



more hopeful about equities: stronger growth should mean higher profits. By the third quarter of this year, investors are expecting S&P 500 companies to show annual profits growth of 11.9%. Another factor is the American tax package just approved by Congress; the BAML survey found that more than 70% of fund managers thought tax cuts would cause shares to rise.

What was remarkable about 2017 was not just that stockmarkets rose. It was that they did so in such a steady manner. The MSCI World index rose in almost every month, and the volatility index, or Vix, stayed at remarkably low levels (see chart). None of the political headlines—the tensions between America and North Korea, the investigation into President Donald Trump's election victory, the inconclusive German elections—seemed to bother investors for very long.

Politics could still sandbag the markets in 2018, particularly if another war broke out in Asia or the Middle East. But the more immediate concern for investors will be

monetary policy. The Federal Reserve has been steadily pushing up interest rates, and the European Central Bank is reducing its monthly bond purchases. The combination of low rates and quantitative easing (QE) has been helpful for markets ever since the financial crisis. Like anxious parents, central banks are taking the training wheels off their children's bicycles and hoping they won't crash.

David Bowers and Ian Harnett of Absolute Strategy Research, a consultancy, have a different worry. They fear that investors may be caught out by a slowdown in China. In 2017 Chinese interest rates rose; this may start to have an economic impact in the current year. The effect will not be dramatic (they think global growth will slow to 3.3%) but it will be enough to disturb the rosy consensus.

Messrs Bowers and Harnett conduct their own survey of fund managers, and they find some inconsistencies in the outlook. Though investors expect equities to perform well, they are not enthusiastic about high-yield bonds. Normally conditions that are good for the former also boost the latter. And investors also expect the Vix to rise, an event that usually coincides with poor equity performance.

These contradictions can best be explained by assuming that investors are making the understandable bet that the current year will look much like the previous one. Extrapolating from the past is a well-known bias, and often applies to economic forecasts as well. But that is to ignore the nagging feeling that the events of 2016 may have marked a historic turning-point, and that the new era will be much more turbulent than before. To misquote Mr Micawber: "Something unpleasant will turn up."

metals and mining companies are heavily indebted, the rebound in revenues is helping to fortify their balance-sheets and, in the process, easing Chinese financial risks.

Lastly, green restrictions can themselves generate growth and jobs. China's drive for cleaner energy sources has gained momentum. Estimates suggest it installed nearly 55 gigawatts of solar-power capacity in 2017, more than the existing capacity of any other country at the start of the year. China accounts for about two-fifths of global production of electric cars. And in more established industries, companies feel pressure to upgrade. To stay in business, Mr Yao says he will move his cutlery factory to a new industrial park, where waste-disposal standards are higher.

If the economic downside from China's clean-up remains relatively mild, it prompts an obvious question: why did it take the government so long to get tough on pollution? One big reason is surely the uneven distribution of pain. Smokestack industries are based in a small number of provinces such as Shandong in the east and Shanxi in the north. So long as enforcement was in local hands, officials had little incentive to act. None wanted to throttle companies in their own backyard. But from a national perspective, the economic trade-offs of greener growth ought to be easier to stomach. China will both pay a price and reap dividends. ■

Islamic finance

Sukuk and see

Doctrinal arguments threaten the future of the Islamic-bond market

STOCKMARKETS in the Gulf do not observe Christian holidays, but still had a generally quiet day on December 25th. Shares in Dana Gas, an exploration business listed in Abu Dhabi, however, did make some noise, leaping by 13.2% on Christmas Day, to complete a buoyant six months for the stock (see chart). The surge may owe something to the company's recent arbitration victory against the regional government of Iraqi Kurdistan, over \$2bn it and its consortium partners are owed in overdue payments. But it also hints at shareholders' belief that Dana will not be forced soon to satisfy its own creditors. They have been up in arms since the firm refused to honour a \$700m Islamic bond, or *sukuk*, that matured in October.

Dana says it has received legal advice that the security no longer complies with *sharia*, the body of Koranic law, and so the bond is "unlawful" in the United Arab Emirates (UAE). In July, facing liquidity dif-

ficulties, it stopped redeeming coupons (to "distribute profits"—the *sukuk* equivalent of interest payments). In November a British court ruled that the company had to pay. The judges said that, because the bond was issued under English law, it had to be viewed on its merits under that law alone. The risk of non-compliance in the UAE, they argued, must fall squarely on Dana.

The Islamic-finance industry cheered this ruling. Since *sharia* forbids the receipt of interest, *sukuk* are backed by assets. Investors get paid an agreed share of profits, before being returned the principal at maturity. Yet there is a host of possible arrangements, and no final authority for deciding which bonds are *sharia*-compliant. Issuers instead rely on the opinions of scholars, who do not always agree. Dana's refusal to pay had led investors to fear struggling issuers would start using such squabbles as an excuse to renege on dues. After the ruling the industry feels "70% comfortable", says Mohammed Khnifer of the Islamic Development Bank, a multilateral lender based in Saudi Arabia.

The victory, however, may prove pyrrhic. To get hold of Dana's domestic assets, creditors need a new ruling from the UAE courts. The outcome is unpredictable. A first hearing on the legality of the transaction was due to be held on December 25th itself, but adjourned until May. Seizing Dana's overseas assets, located in Egypt, Kurdistan and Bahrain, may be just as hard. Egypt is locked in a legal dispute with the company. Iraq and Bahrain are not known as easy places to enforce court rulings.

Time is on Dana's side. The company has said it will appeal against the British judgment. The losing party in the UAE ruling, whenever that comes, will probably do the same. Proceedings could thus take years. The legal fees incurred by the creditors, led by BlackRock and Goldman Sachs, will soon mount. Stuart Ure of Clifford Chance, a law firm, suspects *sukuk* holders will eventually be forced to the negotiating table. Precedent suggests they will probably have to accept some loss on the bond's face value. The fear among analysts in the UAE is that if other delinquent issuers start

using *Islamic* and local law as a "shield" the whole *sukuk* market might shrivel.

For now, overall demand for *sukuk* remains strong. But appetite for non-rated or sub-investment-grade issuers in emerging markets could easily weaken. In recent months, the industry has reacted to the Dana case by tightening the language of *sukuk* contracts, notably through clauses that waive borrowers' rights to challenge an arrangement's *sharia* compliance. David Miles of Covington & Burling, a law firm, welcomes such provisions, but says they do not solve the enforcement problem. Nor will it be possible for all new *sukuk* to be governed solely by English law. Some will be backed by tangible assets, such as property, located in other jurisdictions. The Dana saga is a reminder not just that Islamic finance still lacks shared standards, but also that court judgments help creditors only when they are enforceable. ■

American banks and tax reform

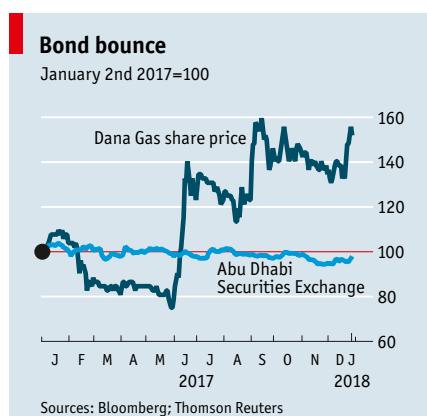
Deferred gratification

Despite immediate accounting losses, tax cuts should benefit banks

WHEN Donald Trump won America's presidential election 14 months ago, banks' share prices leapt. One reason for that was the prospect of lower corporate taxes, which would both benefit banks directly and (investors hoped) ginger up the economy. Like Mr Trump's legislative agenda, their shares were becalmed for much of 2017, but they perked up late in the year when the Tax Cuts and Jobs Act looked likely to become law—as it duly did when the president signed it on December 22nd.

Yet several banks expect the act to make deep dents in fourth-quarter profits. On December 28th Goldman Sachs said it was braced for a \$5bn hit. A week before, Bank of America (BofA) announced a \$3bn write-down. Early in the month, on fairly accurate assumptions about the law's final form, Citigroup put the cost at a whopping \$20bn. Foreign banks are also assessing the damage: £1bn (\$1.4bn), says Barclays; SFr2.3bn (\$2.4bn), reckons Credit Suisse.

These one-off hits have two main causes. First, many banks carry "deferred tax assets" (DTAs) on their balance-sheets, largely past losses—a legacy, for many, of the financial crisis—carried forward to set against future taxes. The higher the tax rate, the more these assets are worth. So the new law, by cutting the federal corporate-tax rate from 35% to 21%, slashes their value. Citigroup, with \$43.2bn of American DTAs on the books, and BofA, with \$7bn, according to Mike Mayo of Wells Fargo, have the



► biggest piles. Reduced DTAs account for the bulk of their write-downs, as well as for those at Barclays and Credit Suisse.

Second, cash repatriated from abroad will be taxed at 15.5%—below the main rate, giving banks an incentive to bring it home. This accounts for around two-thirds of Goldman's \$5bn; JPMorgan Chase has said repatriation could cost up to \$2bn. Foreign banks face a further niggle: the law taxes payments from American entities to foreign affiliates—a measure called the base erosion and anti-abuse tax, or BEAT. Credit Suisse says it is “likely to be affected” by BEAT; Barclays thinks negative effects are “possible”. Neither has named a figure.

Though banks expect the biggest blows, they are not alone. BP and Royal Dutch Shell have announced DTA write-downs too. (Some companies, notably Berkshire Hathaway, have deferred tax liabilities, so should get a fillip.) Plenty more American

firms have billions stashed abroad.

Still, the short-term damage is not as bad as it looks. Because supervisors largely disregard DTAs anyway, Citigroup expects its main regulatory measure of capital to fall by only \$4bn, from \$162bn. And looking ahead, the tax cut should indeed be a boon. Mr Mayo says that American banks' effective tax rate in the first half of 2017 was 31% (including state levies); that may fall by around eight points. Granted, some gains may be passed on to customers; and, under the new law, big banks' deposit-insurance premiums are no longer tax-deductible. Even so, Mr Mayo expects earnings per share to rise by 5-10%.

Regional lenders, with little business abroad, should gain more than Wall Street firms. They also have lower DTAs, meaning less pain now. But big banks, despite the chunky write-downs, should benefit too. Dry those tears. ■

and requires investment banks to start charging separately for research, among myriad other provisions. It is perhaps the biggest regulatory change to European financial markets since the financial crisis.

For all the jitters, the first hours of trading under the new regime went fairly smoothly, though trading volumes were lower than usual. Financial firms had collectively spent \$2.1bn preparing for MiFID 2 in 2017 alone, according to one estimate by Expand, part of the Boston Consulting Group, and IHS Markit, a data provider.

Some banks had people up all the night before the 3rd. The preparations paid off. But regulatory reprieves also helped. In late December the European Securities and Markets Authority (ESMA), an EU regulator, granted a six-month reprieve from the requirement that every counterparty to a trade must have a “legal-entity identifier”, a unique number, after many firms failed to obtain these in time. It also let trading continue across the EU even though 17 of its members had not yet fully transposed the rules into national law. And ESMA clarified that trading on non-EU venues could continue while it finishes its assessment of which jurisdictions will be deemed “equivalent”. This avoided a worst-case scenario, in which European traders suddenly lost access to the New York Stock Exchange, say, or the Chicago Mercantile Exchange.

Early on January 3rd itself, Germany's and Britain's regulators allowed three large futures exchanges—Eurex Clearing in Frankfurt, and ICE Futures Europe and the London Metal Exchange in Britain—to delay implementation of “open access” provisions until mid-2020. These rules, divorcing the execution of futures contracts from the clearing of them (they now occur at the same exchange), were contentious when passed, with Britain reportedly a strong proponent and Germany staunchly opposed. A London lawyer thinks the long delay, to past the date in 2019 when Britain is to leave the EU, may well mean these provisions “never see the light of day”.

Significant as they may be for parts of the market, such reprieves do not amount to a delay of the overall law, says Jonathan Herbst of Norton Rose Fulbright, a law firm. Nonetheless, a disaster-free implementation day does not mean the end of the worries. As Enrico Bruni of Tradeweb points out, market participants will adjust their trading patterns over time, and emerging problems will need to be resolved. It will take even longer to see if the structural changes the new framework is forecast to encourage—such as consolidation among brokers or asset managers—materialise. And the law may yet play a role in the Brexit negotiations. Its rules on financial-market access for third countries, after all, will apply to Britain. There are many more days of the MiFID to come. ■



MiFID 2

Day zero

Sprawling new European financial regulations enter into force at last

After years of rule-drafting, industry lobbying and plenty of last-minute wrangling, Europe's massive new financial regulation, MiFID 2, was rolled out on January 3rd. Firms had spent months dreading (in some cases) or eagerly awaiting (in others) the “day of the MiFID” when the law's new reporting requirements would enter into force. One electronic-trading platform, Tradeweb, even gave its clients a “MiFID clock” to count down to it.

Apprehension was understandable. The new EU law, the second iteration of the Markets in Financial Instruments Directive (its full, unwieldy name), affects markets in

everything from shares to bonds to derivatives. It seeks to open up opaque markets by forcing brokers and trading venues to report prices publicly, in close to real time for those assets deemed liquid. It also requires them to report to regulators up to 65 separate data points on every trade, with the aim of avoiding market abuse.

The changes are greatest for markets, like those in bonds and derivatives, that are now largely conducted “over the counter” (ie, not on exchanges). But the law also restricts share trading in “dark pools” closed to retail investors, provides for access to European markets for non-EU firms,

Free exchange | Many happy returns

A new data trove helps reshape how the economy is understood

DATA-GATHERING is the least sexy part of economics, which is saying something. Yet it is also among the most important. The discipline is rife with elaborate theories built on assumptions that turned out to be false once someone took the time to pull together the relevant data. Accordingly, one of the most valuable papers produced in 2017 is an epic example of data-retrieval: a piece of research that spells out the rates of return on important asset classes, for 16 advanced economies, from 1870 to 2015. It is fascinating work, a rich seam for other economists to mine, and a source of insight into some of today's great economic debates.

Rates of return both influence and are influenced by the way firms and households expect the future to unfold. They therefore find their way into all sorts of economic models. Yet data on asset returns are incomplete. The new research, published as an NBER working paper in December 2017, fills in quite a few gaps. It is the work of five economists: Oscar Jordà of the San Francisco Fed, Katharina Knoll of the Bundesbank, Alan Taylor of the University of California, Davis, and Dmitry Kuvshinov and Moritz Schularick, both of the University of Bonn. (Messrs Jordà, Schularick and Taylor have spent years building a massive collection of historical macroeconomic and financial data.) For each of the 16 economies, they craft long-term series showing annual real rates of return—taking into account both investment income, such as dividends, and capital gains, all net of inflation—for government bonds and short-term bills, equities and housing. Theirs is the first such data set to gather all of that information for so many countries over so long a period.

As such, the authors establish some new basic economic facts. They conclude, for instance, that over the very long run it is housing, rather than equities, which provides the best return (see chart): both asset types have yielded about 7% a year on average over the 145 years, but equity returns are much more volatile. It is important to note that, though homeowners might cheer this news, it is not necessarily a reason to leap into the housing market. Rental yields account for about half of the long-run return on housing, and owning a diversified portfolio of rent-yielding property is not the same bet as borrowing to house the family.

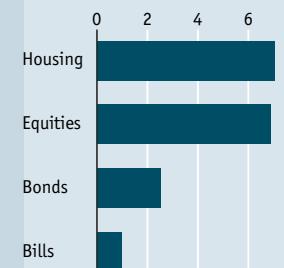
The new old normal

Besides offering these baseline findings, the authors' work helps to answer several pressing economic questions. One example is the puzzle of declining interest rates. The falling rates of the past few decades distress some economists, who worry they beaken weak growth and complicate central bankers' ability to manage the economy. Yet the long-run data reveal that the high rates of return on government debt seen in the 1980s were an anomaly. The real return on bonds and short-term bills is normally relatively low—and can even be negative for long periods of time—as some other economists (such as Carmen Reinhart of Harvard University and Belen Sbrancia of the IMF) have also found. Recent declines therefore represent a return to more typical conditions.

That, in turn, suggests that central bankers who hope to "normalise" interest rates may be in for a rude surprise. But low rates of return also mean that government-debt burdens may prove easier to manage than thought—and perhaps that government borrowing could be used more aggressively in times of economic weakness to make up for central-bank impotence. Nor do low rates of return on government debt imply that the world is entering a period of "secular stagnation", or chronically weak growth. Low rates have in the past been as much a feature of rip-roaring

Home economics

Annual global rates of return*
By asset, 1870–2015, %



Ten-year moving average†, %



Source: National Bureau of Economic Research

*16 countries unweighted
†16 countries weighted by GDP

economies—eg, in the 1950s and 1960s—as of the more stagnant ones experienced recently.

More bracing still are the data's implications for debates on inequality. Karl Marx once reasoned that as capitalists piled up wealth, their investments would suffer diminishing returns and the pay-off from them would drop towards zero, eventually provoking destructive fights between industrial countries. That seems not to be true; returns on housing and equities remain high even though the stock of assets as a share of GDP has doubled since 1970. Gravity-defying returns might reflect new and productive uses for capital: firms deploying machines instead of people, for instance, or well-capitalised companies with relatively small numbers of employees taking over growing swathes of the economy. High returns on equity capital may therefore be linked to a more tenuous status for workers and to a drop in the share of GDP which is paid out as labour income.

Similarly, long-run returns provide support for the grand theory of inequality set out in 2013 by Thomas Piketty, a French economist, who suggested (based in part on his own data-gathering) that the rate of return on capital was typically higher than the growth rate of the economy. As a consequence, the stock of wealth should grow over time relative to GDP. And because wealth is less evenly distributed than income, this growth should push the economy towards ever higher levels of inequality. Mr Piketty summed up this contention in the pithy expression “r > g”.

In fact, that may underestimate the case, according to the newly gathered figures. In most times and places, “r”, which the authors calculate as the average return across all assets, both safe and risky, is well above “g” or GDP growth. Since 1870, they reckon, the average real return on wealth has been about 6% a year whereas real GDP growth has been roughly 3% a year on average. Only during the first and second world wars did rates of return drop much below growth rates. And in recent decades, the “great compression” in incomes and wealth that followed the world wars has come undone, as asset returns persistently outstrip the growth of the economy.

In such ways does the painstaking collection of data fundamentally reshape understanding of the way economies work. It is a shame that data-gathering does not carry higher status within the profession. It would raise the status of economics itself. ■



The search for MH370

Many scanners, very deep

DURBAN

A swarm of autonomous submarines launched from a fantastical mother ship is out to find a missing airliner

ON JANUARY 2nd, at 8pm local time, a strange vessel cast off and sailed out of the Port of Durban, in South Africa, heading east. Her hull was orange. Her superstructure bristled with antennae—some long and pointy, some sleek, white and domed. Her stern sported a crane and also a strange gantry, known to her crew as the “stinger”. Her bow looked so huge and ungainly as to be on the point of tipping her, nose first, into the depths. And below deck, invisible to those on shore, she carried eight autonomous submarines called HUGINS, each six metres long, weighing 1,800kg, and containing a titanium sphere to protect the sensitive electronics therein from the pressure of the ocean’s depths.

The strange ship’s name is *Seabed Constructor*. She is a Norwegian research vessel, built in 2014 and owned by Swire Seabed, a dredging and surveying firm in Bergen. At the moment, though, she is leased to Ocean Infinity, a company based in Houston, Texas. And the task Ocean Infinity has hired her for is a hard one: to find whatever is left of flight MH370, a Boeing 777-200ER that left Kuala Lumpur on March 8th 2014 with 239 people on board and vanished over the Indian Ocean.

The disappearance of MH370 is one of the great mysteries of modern civil aviation. The aircraft was bound for Beijing, but changed course suddenly over the South China Sea and broke off radio contact. It was last detected by radar near the north-

ern tip of Sumatra, heading west-north-west into the open ocean. Subsequent transmissions to a communications satellite suggested that it crashed somewhere along an arc between 1,500km and 2,700km west of Australia.

The search that followed was the largest in aviation history. It was mounted by Fugro, a Dutch firm, and paid for by the Malaysian, Chinese and Australian governments. Over the course of three years Fugro managed to scan 120,000 square kilometres of seabed. But it found nothing. The plan is for Ocean Infinity’s search to be paid for, on a “no find, no fee” basis, by Malaysia alone. Contracts have yet to be signed, but Oliver Plunkett, Ocean Infinity’s boss, has decided to go ahead anyway, to take advantage of the window of good weather that opens in the southern Indian Ocean in January and February.

Ocean Infinity aims to cover the ground much faster than Fugro did. In prior cruises in the Atlantic, the firm has, according to Josh Broussard, its technical director, managed to scan 890 square kilometres a day using six autonomous submarines. With eight, Mr Broussard thinks that the new mission will be able to manage 1,200 a day—enough to have covered the original search area in just 100 days.

The new search area, 25,000 square kilometres of sea floor chosen by investigators from the Australian Transport Safety Bureau (ATSB), is just north of the old one

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(see map on next page). Fugro could infer MH370’s crash site only from its final, rather shaky, satellite signals. Ocean Infinity’s effort has been guided as well by wreckage washed ashore on the coasts of Africa and several islands in the Indian Ocean—hence the more northerly starting point. *Seabed Constructor* will reach that starting-point, which is about 35°S, and 2,200km off the coast of Western Australia, on or about January 17th, her crew having conducted a few final tests and calibrations of the HUGIN system *en route*, using remote-controlled robots to place dummy debris on the sea floor in order to see if the subs can find it. If searching the patch of ocean designated by the ATSB reveals nothing, then the ship will head farther north, towards the 30th parallel, which some independent experts believe is a better bet.

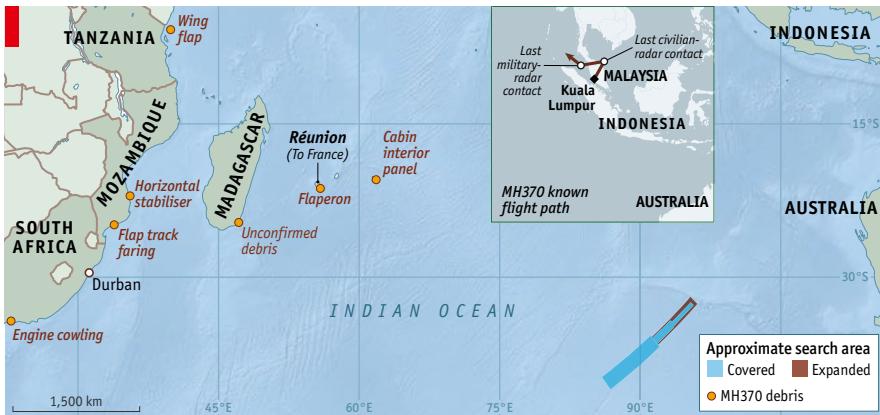
An ocean of interest

Fugro’s search used but a single autonomous submarine, and this was unable to dive below 4,000 metres, meaning it was not always close to the seabed. The HUGINS carried by *Seabed Constructor* can, however, go as deep as 6,000 metres. That permits them to reach most of the sea floor comfortably. And the fact that there are eight of them means different areas can be searched in parallel, and that some submarines will always be at sea.



The Richard Casement internship

We invite applications for the 2018 Richard Casement internship. We are looking for a would-be journalist to spend three months of the summer working on the newspaper in London, writing about science and technology. Applicants should write a letter introducing themselves and an article of about 600 words that they think would be suitable for publication in the Science and Technology section. They should be prepared to come for an interview in London or New York. A stipend of £2,000 a month will be paid to the successful candidate. Applications must reach us by January 26th. These should be sent to: casement2018@economist.com



► The HUGINS will be launched by the stinger, which extends out over the ship's stern. Once underwater, the robot craft will communicate with the ship using an acoustic modem. The ship's own modem, which will receive these signals, is fixed to the end of a long pole that extends down through her hull into the water.

Each HUGIN comes with a 300kg lithium-polymer battery pack, good for a tour of duty lasting up to 60 hours. A downward-pointing sonar will map the contours of the seabed beneath the craft, but most of the searching will be done by side-mounted sonars scanning the bed on either side of the craft. These send out pings and measure the intensity with which they are reflected. Sand reflects less sound than metal does, meaning metal objects such as aircraft debris are easy to distinguish. And if something apparently metallic is detected, its nature can be confirmed using an on-board magnetometer.

The HUGINS' search patterns are set by people, but the craft will actually navigate with little reference to their mother ship. Every so often, the ship will send out a corrective ping to keep them on course. Mostly, however, they will employ dead reckoning, based on data from accelerometers, to steer themselves autonomously. They are also capable of picking their way without assistance over sheer underwater cliffs and mountains, and past crevices and gullies, using on-board cameras and machine-vision software.

After its tour of duty, a HUGIN will be lifted back on-board ship and the data it has collected (up to two terabytes, recorded on a waterproof hard drive) downloaded into the ship's data centre and turned into human-readable maps, a process that takes six hours. The HUGIN's battery will be replaced with a fully charged one, any necessary repairs made, and the craft then sent back out into the ocean.

A team of geologists and hydrographers will then pore over the maps, looking for signs of the missing plane. Surprisingly, for such a high-tech operation, this stage of the search will be entirely manual. Every block of sea floor that the HUGINS map

will be examined by three sets of human eyes. Together, this survey team will come up with a list of possible targets, ranked from "E" to "A" ("nothing" to "that's it"), to present to their bosses. If the data look good, a HUGIN will be sent down for a second, closer look, cameras at the ready.

What happens next, if Ocean Infinity does locate what is left of the missing aircraft, is unclear. Friends and relatives of

those aboard it will doubtless derive relief from knowing where the flight ended up. But merely finding the wreckage will not explain what happened on board the plane. That will require the discovery of the aircraft's flight recorder.

That object is therefore Ocean Infinity's ultimate target. If it is found on this mission, Mr Broussard says the firm plans to bring it to the surface and then deliver it for analysis to the Australian authorities, who have the technical competence to assess it. A follow-up trip to examine the wreckage, and even bring it to the surface, would require further authorisation from the Malaysian government.

Seabed Constructor is the most advanced civilian survey vessel on the planet today. If its array of technology cannot find MH370, then it is likely that nothing will, and that the mystery of MH370 will remain unsolved. Either way, though, the advance of technology may mean that it is the last such mystery. As the oceans are watched with ever closer scrutiny, from space and the depths, it is increasingly difficult for anything to get lost in the first place. ■

Digital assistants

Losing face

Sometimes, computer programs seem too human for their own good

DIGITAL assistants such as Siri and Cortana are increasingly common on phones and computers. Most are designed to give their users the impression that a humanlike intelligence lies behind the program's friendly voice. It does not, of course. But dozens of experiments over the years have shown that people readily build strong bonds with computerised helpers which are endowed with anthropomorphic features, whether visual or vocal.

Developing an emotional relationship with a piece of software can, however, cut both ways. As a study published in *Psychological Science* by Park Daeun, of Chungbuk National University in South Korea, and her colleagues, shows, one emotion sometimes involved in machine-human interaction is embarrassment. This, Dr Park has discovered, makes some users reluctant to ask for help from their artificially intelligent pals. Apparently, they are sheepish about doing so.

Dr Park and her team recruited 187 participants into their study. To start with each was presented with a series of statements on the malleability of intelligence. These included, "you have a certain amount of intelligence, and you can't really do much to change it", and "you can always sub-

stantially change how intelligent you are". Participants rated their responses to these statements on a six-point scale, on which one meant "strongly disagree" and six meant "strongly agree". The reason for this initial test was that Dr Park knew from previous work that, in academic settings, those who believe intelligence to be malleable are comfortable asking for assistance while those who believe it to be fixed often feel ashamed to do so.

The initial test done, the researchers presented their volunteers with a second, which involved looking at 16 sets of three words and trying to think of a fourth word that linked them. For example, when offered "room, blood, salts" a correct answer would be "bath". Sometimes the first three words were accompanied by an unrequested hint (in the example given, this was "tub"). Sometimes they were not.

Hints appeared as the written form of the word in question, accompanied by a computer-shaped icon. For half of participants this icon had a humanlike face, and the hint was placed inside a speech bubble originating from that face, thus anthropomorphising the presentation to some degree. For the other half the icon lacked a face and there was no speech bubble. After

► the final set of words had been displayed, participants were asked to agree or disagree with follow-up statements about their experience, such as "it was embarrassing to receive help during the task", and "others might think I am incompetent because I received help during the task". This time, they quantified their feelings on a seven-point scale, with higher scores representing greater feelings of unease.

The researchers found that participants who believed intelligence to be unchangeable felt more embarrassed and more incompetent after the tests. Specifically, those whose level of belief that this is true was more than one standard deviation above the mean score on the six-point scale for perceptions of intelligence flexibility (in other words, the top sixth of the sample), averaged 3.2 when measured for

feelings of shame and embarrassment if the computer icons they had seen giving the hints had had faces and speech bubbles, but only 2.7 if not. In contrast, people who strongly believed that intelligence could be changed over time (the bottom sixth of the sample) felt the same level of discomfort (around 2.5) whether or not the icons had been anthropomorphised.

A second experiment, in which a different set of participants were allowed to ask for help rather than having it thrust upon them at random had similar results. Dr Park therefore concludes that some people do, indeed, seem to wish to avoid losing face by seeking help from an icon that has, well, a face. And that in turn suggests there are circumstances when the relentless pseudo-humanisation of machine-human interactions could usefully be curbed. ■

use a robotic manipulator to send it on its way into orbit around Earth.

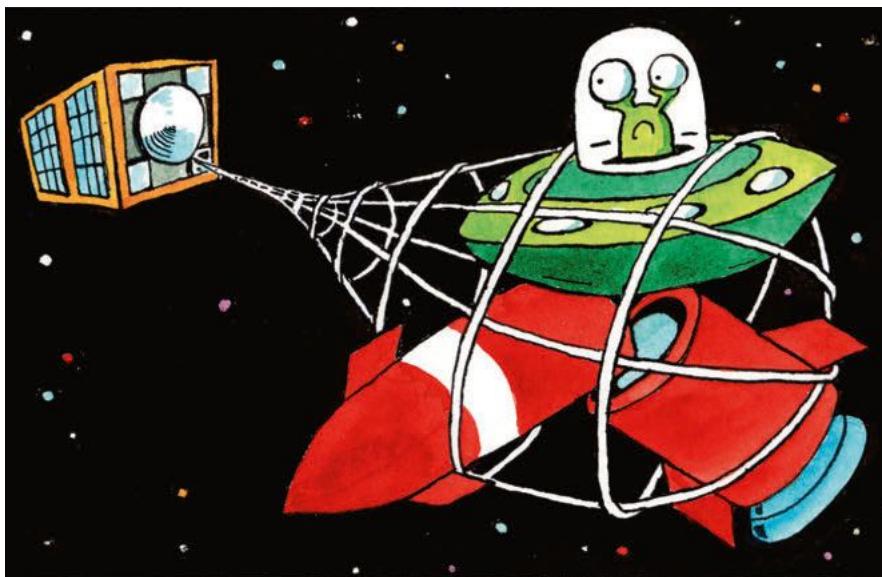
Removedebris has been designed and built by Surrey Satellite Technology, a British manufacturer of small satellites spun out of the University of Surrey in 1985, which is now majority-owned by Airbus. Mission Control for the Removedebris project is the Surrey Space Centre at the university. The plan is for Removedebris to carry out four experiments. The first two will involve launching from it a pair of CubeSats (mini-satellites 10cm across). These will play the role of space junk.

Once launched, the first CubeSat will inflate a balloon-like structure a metre across, to which it will remain attached, in order to create a bigger target. The mother ship will then approach to a distance of seven metres and fire a net at the balloon. This net is designed to unfurl and wrap itself around the target. Once the target is entangled, a cable connecting the net to the mother ship will be tightened, closing the neck of the net. It will then be hauled in, like catching fish.

The second CubeSat will test the sensors of Removedebris. This trial will use cameras and a lidar (an optical version of radar) aboard the mother ship to build up a detailed three-dimensional image of the object. If that works it will permit future clean-up vehicles to recognise what they are dealing with, and react appropriately.

In the third experiment, Removedebris will extend a 1.5-metre-long arm that holds a 10cm-square target. It will then fire a harpoon at the target. The idea is that harpoons could be used to pierce some items of space debris and, like the net in the first experiment, then haul them in. The final experiment is intended to ensure that Removedebris and its captured items do not themselves become space junk. The mother ship will deploy a ten square-metre plastic membrane, supported by four carbon-fibre booms, to act as a "dragsail" that will employ the limited atmosphere at this altitude to pull the craft downward to the fiery death of re-entry.

If space-debris capture systems like this succeed, then future missions could start to go after some of the most worrying bits of junk. Such ventures could be commercial, according to Guglielmo Aglietti, director of the Surrey Space Centre, if governments (probably acting collectively) were willing to pay to keep space clean so as not to damage their own activities and those of their citizens. There are already guidelines to try to limit the accumulation of space junk. Defunct satellites should be disposed of within 25 years, either by being tipped into re-entry or parked in an out-of-the-way "graveyard" orbit. But the rules are not always followed and a lot of older debris remains in orbit. A bounty on removing the most threatening hulks might even see the launch of a new space business. ■



Space debris

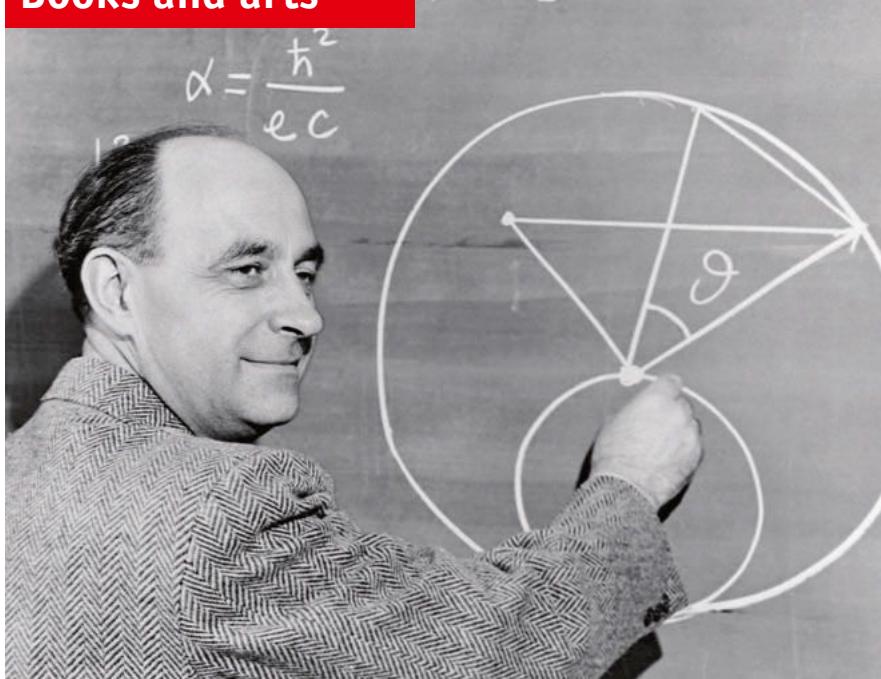
Junk hunting

A new satellite will test ways to capture detritus circling Earth

THERE is an awful lot of junk in space. The latest data from the European Space Agency suggest some 7,500 tonnes of it now orbits Earth. It ranges from defunct satellites and rocket parts to nuts, bolts, shards of metal and even flecks of paint. But something as small as a paint fleck can still do serious damage if it hits a working satellite at a speed of several thousand kilometres an hour. There have already been more than 290 collisions, break-ups and explosions in space. Given the likelihood that thousands of small satellites, some only a few centimetres across,

will be launched over the next decade, many worry that large volumes of space near Earth will soon be rendered risky places for satellites (especially big, expensive ones) to be.

What is needed, then, is a clean-up. Various ideas about how to do this have been proposed, and some are about to be put to the test. In February a resupply mission to the International Space Station will also carry a satellite, about the size of a domestic washing machine, called Removedebris. Once this has been unpacked and prepared by the station's crew, they will



History of physics

Clever calculator

Enrico Fermi, champion nuclear researcher, mathematician and educator

JUST before daybreak on July 16th 1945 Enrico Fermi lay down in the open desert of New Mexico. At 05:30, the world's first nuclear explosion took place ten miles (16km) away. He counted off the seconds after the flash, anticipating the arrival of the blast-wave. With preternatural calm, Fermi stood up and let some strips of paper flutter away as the wave passed. They flew about eight feet. The Trinity nuclear test, he pronounced after making some quick calculations, had released the equivalent of about 10 kilotonnes of TNT.

Fermi was, by that stage, already a celebrity among physicists. An obvious mathematics prodigy as a child in Italy, he had devoured texts written for adults. Throughout his life he kept few books, preferring to derive conclusions from first principles whenever he felt the need.

As he took up different posts in academic research in Italy and abroad, Fermi showed himself to be not only a theorist with unparalleled insight but also adept as an experimentalist (a rare combination) across every kind of physics. He had an uncanny knack for rough-and-ready calculations to obtain approximate answers for damnable difficult questions (the Trinity bomb, later analysis revealed, released 18 kilotonnes of TNT, which was surprisingly close to Fermi's desert estimation).

He eschewed complexity, preferring to

The Last Man Who Knew Everything: The Life and Times of Enrico Fermi, Father of the Nuclear Age. By David Schwartz. Basic Books; 451 pages; \$35 and £27.99

tackle only a problem's essentials, discard any distracting elements and ruthlessly squeeze what remained. Such back-of-the-envelope calculations, which became known as "Fermi problems", were such good examples of critical thinking that recruiters nowadays test applicants' mettle by setting them as interview questions. Fermi's solutions were so often right that his colleagues in Rome called him "the pope". His boss recognised that he could help raise the reputation of Italian science.

Fermi's discovery of how slow-moving neutrons helped to make some atoms radioactive won him the Nobel prize in 1938. He used the trip to Stockholm to abscond with his family from his increasingly fascist homeland. Once in America he became involved in the Manhattan Project, which led to the first nuclear bomb, bringing him renown well beyond the physics community.

Fermi was an inveterate showman. In Chicago, on the day he demonstrated the world's first controlled nuclear chain reaction—a prerequisite for the uncontrolled kind in a nuclear weapon—he ran the

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show like a circus ringmaster, ramping up the tension by calling for lunch just as things literally heated up.

David Schwartz, the author of "The Last Man Who Knew Everything", is the son of another Nobel-winning physicist. His father left some intriguing correspondence on Fermi, which inspired Mr Schwartz to learn more. He interviewed many of Fermi's students and colleagues, shedding light also on Fermi the educator (his lectures were so renowned that even notes taken by his assistants were a bestseller).

Mr Schwartz deftly conveys the aesthetic beauty of Fermi's insights without getting mired in their minutiae. His book includes only enough scientific detail to explain each discovery as it happened. Fermi is depicted as a natural leader—in the laboratory, on hiking trails near his workplaces in Rome and New Mexico, and in the square-dances he came to love in America. Yet for all his gregariousness Fermi tended to reveal little of his emotions in conversations or correspondence, even as he worked on the team to develop humanity's most terrible weapons. Laura, his wife, did not know until after the bombs fell just what her husband had really been up to in his laboratory.

As a result, Mr Schwartz tussles with many of the same questions that have dogged previous Fermi biographers. Did he stay so long in Italy, joining Benito Mussolini's vaunted Accademia d'Italia, just for the funds and freedom to pursue his precious research? Did he participate in the Manhattan Project out of patriotism for his adopted country, or was he dragged along because of his expertise in nuclear physics? Or was he just insatiably curious about whether the bomb could indeed be made?

It would be easy to depict Fermi as a ➤

► standard reticent genius who solved every problem as if he had, as one student put it, “an inside track to God”. But Mr Schwartz’s sleuthing also reveals how science works in its proper context: how each finding builds on the last; how identical ideas can occur to more than one person when the intellectual conditions are right; how an insight into nature arises not from a vacuum but from hard-won experience and, usually, some clever calculating.

Fermi was once described by a student as the last man who knew everything. He went on to make important discoveries in particle physics, geophysics and even the science of the stars. And he never stopped calculating. Even on his deathbed, he used a stopwatch to determine exactly how much fluid he was receiving from his intravenous drip. It was a simple problem, really, if you focused on the essentials. ■

Economics and dieting

Quantitative eating

The Economists’ Diet: The Surprising Formula for Losing Weight and Keeping It Off. By Christopher Payne and Rob Barnett. Touchstone; 288 pages; \$25

DO YOU indulge in QE (quantitative eating)? Do you have a high marginal propensity to consume chocolate? Then you might be piqued by a diet book from two self-described “formerly obese economists” on how to lose weight.

To be honest, the economics within this book is very much a side order rather than the main course. A diet is described as a “self-imposed eating-austerity programme”. There is some discussion of people’s general failure to give enough weight to the long term consequences of their actions; a phenomenon known as hyperbolic discounting. And there is some neat use of the concept of diminishing returns. Eat a wide variety of foods and you may always get pleasure from trying something different. But limit your diet and you will soon tire of eating more.

But the “surprising formula” promised by the book is scarcely a shocker: eat less. The authors think this is more important than exercise since the latter tends to make you hungry; it is easy to undo all the good work of a cycle ride with a snack.

Eating less requires you to confine yourself to one square meal (defined as some grilled meat and two side portions of vegetables) a day. The other meals should be very light; a non-creamy soup, a salad or a bowl of non-sugary cereal. If you do end up splurging on a big meal or

University education

Three years and score

A University Education. By David Willetts. Oxford University Press; 432 pages; \$32.50 and £25

IN 1945 there were 500 universities across the globe. Today there are more than 10,000. As universities continue to displace apprenticeships and the armed forces as the main path to adulthood in the rich world, scrutiny of higher education has increased. In England critics see universities as hotbeds of anti-Brexit provocation and places where censorious students stifle debate. Complaints about hefty fees



Elastic demand

a treat, then the other meals should be skipped altogether.

But the authors are not too prescriptive. The aim is to find a diet that works for each individual. And the best way of achieving that is to weigh yourself every day. Only then can you see whether the diet is working.

The book is full of perfectly sensible advice, such as avoiding faddy diets, the lure of “low-fat” foods and the temptation to drink all your calories in the form of fizzy drinks, alcohol and sugary coffees. At nearly 300 pages, however, it is rather repetitive. But, as experienced economists, the authors may have realised that, when it comes to diet plans, demand is almost infinite.

and lacklustre teaching are common.

David Willetts, Britain’s higher education minister in the Conservative-Liberal Democrat coalition and now a Tory peer, argues against those who say the answer is to turn the clock back by cutting student numbers. “A University Education” is not the mix of gossip and *post hoc* justification normally churned out by former ministers. Instead, Lord Willetts provides something more valuable: an examination of the state of English universities, a defence of the value of a university education and an argument that the provision of higher education should be expanded further.

This may seem curiously egalitarian stuff for a former Conservative minister. Yet Lord Willetts views a university education as akin to home ownership—both are good for society and something that every parent hopes their child will grow up to possess. He cites evidence that graduates are healthier, happier and less inclined to a life of crime. He notes that the graduate wage premium has held up even as the number of students has grown. Attempts by graduates to restrict access to university, he writes, are little more than “educational Nimbyism”.

As a minister Lord Willetts was best known for nearly trebling tuition fees to £9,000 (\$14,000) a year in 2012. Some worried that this would dissuade poor pupils from applying. However, thanks to generous government loans, their numbers continued to grow. In policy circles, the debate has moved on to whether the new arrivals benefit from university study, which is often in less research-orientated institutions, or whether the money would be better spent on other forms of education.

Here Lord Willetts is no less trenchant. He argues that these institutions, which tend to languish near the bottom of research-focused league tables, simply perform a different role. They may produce few bankers, judges or Nobel prizewinners, but that reflects their intake, rather than poor tuition. They often add as much value as more prestigious institutions. A recent analysis of graduate salaries by *The Economist* reached a similar conclusion.

Yet Lord Willetts is far from Panglossian. He traces many flaws in England’s system to the gates of its grandest universities, Oxford and Cambridge. In a brisk history, he tells how, even as the university flourished in Europe, its spread was halted in England by protective measures put in place at the behest of Oxbridge. It was not until the creation of University College London in 1829 that England gained its third university, six centuries after the second.

Oxbridge still provides the metric by which other English universities are judged. This leads to excellent research and strong protection of institutional autonomy. It also means universities draw their students from across the country, control ►

► their own admissions procedures and compete for the best students. Partly as a result, getting into a prestigious university just about guarantees the student a good job, since mere entry is proof of academic ability. Students thus may have less incentive to work hard, writes Lord Willetts, which allows universities to focus on research. And since universities have so much sway over admissions, the school-leaving curriculum has been narrowed to

meet their specialised needs.

A reader may wish for a more thorough investigation of potential solutions to these problems. But "A University Education" is nevertheless an admirably clear analysis of English higher education. To its credit, it is an inversion of most writing about English universities, which tends to be laudatory of the Oxbridge model and unduly sceptical of others. Lord Willetts's book is all the more interesting for it. ■

chest. Moreover, whereas Western drummers work with the wrist, these men and women drum with their whole body: they are athletes as well as aesthetes. These days they have swapped their traditional Japanese headbands and (for the men) loincloths for less nationally specific garb, but they still move with a beauty which is quintessentially Japanese.

Taiko drumming may be rooted in Shinto and Zen, but Kodo's often lighthearted art has no explicit connection with religion, or with the fanaticism of the Den years; indeed, they wince at any mention of "demon". When drummers leave the ensemble now, it tends to be on amicable terms. Some players eventually find the Kodo style too restricting. Some cross over into jazz and other forms, as Ryutaro Kaneko, their former hand-cymbal virtuoso, has done. He is now a star in his own right in America.

Perhaps because of its roots, there is something spiritual about Kodo's art. Sixty-seven year old Yoshikazu Fujimoto, who has spent his entire adult life first with Ondekoza and then with Kodo, speaks with profound reverence of his earth-shaking daily encounter with the giant drum: "Before I start drumming, I pray, 'Please let me play you.' And I am told, 'OK, you may play me.' We become one. And as I play, I feel at peace. I become the sound."

Asked about his earliest musical experience, Mr Kaneko gave this mystical reply: "It came when I was three. I was under a cherry-blossom tree, and the leaves were fluttering in the spring wind. I know this may not sound like music to Westerners." As with other Kodo players, his dreams were musical: "In my best dream I was falling through space in bright light, and singing very loudly." Mr Kaneko looked at his muscular forearms: "I was singing with every limb. My whole body was singing." ■

Japanese drumming

The kudos of Kodo

Japan's traditional drumming ensemble sets off a mighty bang

THREE is a felicitous double meaning to Kodo, the name of the celebrated Japanese drumming ensemble. Its written characters mean "drum child". But an infinitesimally different stressing of the second syllable will give you the character which means "heartbeat". The company regards this accidental ambiguity as a symbolic blessing, and drumming does indeed go way back. It is one of humanity's most elemental forms of musical communication, at once both mystical and—because it can span great distances—highly practical.

The *taiko* ("fat drum") tradition was imported from Tang-dynasty China. It took root in the Japanese court, and in temples and shrines, in forms which have scarcely changed over 1,000 years. Over the course of the 20th century, however, it lost its appeal at home, though it was popular with the Japanese diaspora on the west coast of America. In the 1960s, as Japan threw itself

into modernisation, drumming came to be seen once more as a symbol of continuity. Taiko ensembles proliferated, with one named Ondekoza ("demon drummers") hitting the headlines in 1975 when its members ran the Boston marathon. At the end, they picked up their drumsticks and launched into a thunderous riff.

Based on the remote island of Sado in the Sea of Japan, Ondekoza was a commune run on ferociously Spartan lines by a visionary named Tagayasu Den. After 12 years, most of his drummers rebelled against the constraints—no smoking or alcohol, no marrying—and set up Kodo as a rival group. They stayed on the island and (slightly) relaxed their regime. Players still had to carve their own drumsticks and each day began at 5am with a ten-kilometre run. Their fame grew as they issued recordings and went on tour. The annual Earth Celebration on Sado attracts ensembles from all round the globe. And they teach, spreading the word through workshops to such effect that there are now hundreds of amateur taiko groups, both in Japan and in America.

But what precisely is that "word"? Audiences in Britain and across Europe will soon have a chance to find out when Kodo begins its next major tour on January 30th. Kodo programmes are sometimes interlarded with Japanese folk music on flute and zither, but this time their show will reflect a return to basics.

Drumming, pure and simple, makes for a memorable aural and visual experience. Taiko drums come in several sizes, ranging from the sharply resonant little *shimedaiko* to the giant *odaiko* (pictured). Six feet (1.8 metres) high and three feet wide, it is hollowed out of a single block of wood and takes six men to hoist into place. Kodo's rich sound-world ranges from woodland susurations to a thundering which makes you feel as if you've been struck in the



Drum roll

American fiction

Reading tea leaves

The Immortalists. By Chloe Benjamin.

Putnam; 346 pages; \$26. Tinder Press; £16.99

SOME novels are portraits, some are page-turning puzzles. Still others are meditations on the mysteries of life. "The Immortalists", a family story with a twist, is a bit of all of those. The tale of four siblings marked in childhood by a terrible prophecy, it careers through time and tragedy with the reader in tow, as deft and dizzying as a high-wire act.

Chloe Benjamin, an American writer, sets out a startling premise: what if you were told the date of your own death? ►

► Varya, Daniel, Klara and Simon Gold, four siblings in a Jewish immigrant family, visit a fortune-teller in 1969 on the Lower East Side of New York. From the moment each is told when his or her life will end, they are irrevocably altered. Suspense mounts as the reader learns each character's fate in individual portraits, starting with the youngest. What links them beyond the irrational power of the long-ago prophecy is the deeper question that it raises: what role does belief—or luck or destiny or even magic—play in shaping a life?

Ms Benjamin cannily withholds information, leaving readers eager to see how

each new story tops the last. The four lives span a wide range of settings and themes. The youngest, Simon, races through the sexual hedonism of San Francisco's gay scene in the late 1980s. Klara is a magician whose life is spent perfecting an act she will perform in Las Vegas. Daniel, a doctor, faces loss on many levels in upstate New York, while Varya is a scientist researching longevity in a primate lab.

Juggling so many pieces has its risks. The rapid-fire plot at times feels rushed and contrived. The portrayal of the AIDS epidemic is predictable, while some of the other developments seem wildly improb-

able. Yet, as the novel deepens, the reader is beguiled with unexpected twists and stylish, crisp prose. In a novel centred on magic and mystery, Ms Benjamin uses misdirection to frustrate as well as entertain. Meanwhile, the mystery of the human mind that is the novel's true subject lingers long after the riddles are solved. Information can implant itself like a virus, the older Gold children note. Whether true or false, genuine or placebo, Varya knew "stories did have the power to change things: the past and the future, even the present." Unwittingly, this ambitious, unorthodox tale may change you too. ■

Johnson | Word-birth

How words come to be used tells you a lot about different cultures

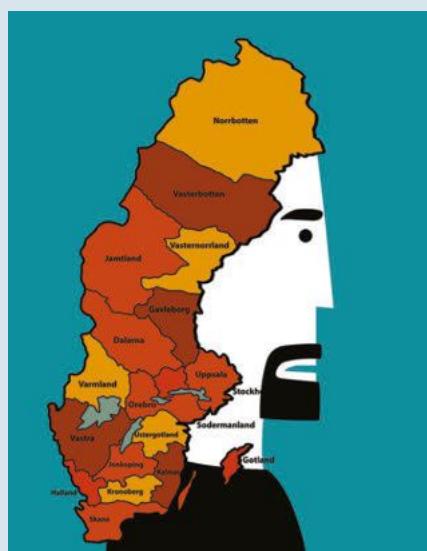
WHENCE do new words come from? Few are purely invented, in the sense of being coined from a string of sounds chosen more or less at random. Most tend to be existing words given new meaning ("to tweet"). In other cases, a word changes its parts of speech ("to Photoshop", "to Facebook"). And in some of the most creative instances, people chop words and recombine them to make new ones (as in "sexting").

New words mostly become embedded through use. A few countries have official academies that declare when a word has been accepted, but they have little actual influence over how people speak. Which words make their way into a language says a lot about where phrasing comes from today.

One such official regulator is the Dansk Sprognævn, which has the humble task of determining official spelling in Danish. Many Danes take the body's decision to include this or that word in its spelling dictionaries as a sign that it is a "real" word. "New Danish Words, With Origin" a book by Jørgen Norby Jensen, shows how rarely new Danish forms are created by Danes from Danish roots for specifically Danish circumstances. Instead, the great majority come, one way or another, from English.

The obvious examples are those that are borrowed wholesale. Mr Jensen offers "foodie", "selfie", "clickbait", "blog", "Brexit" and "twerking" (a kind of bottom-wagging dance). Only slightly more disguised are those words whose spelling has been changed, like *metroseksuel*. Some are altered for Danish grammar norms, like *oute*, the verb "to out someone as gay". (Danish verbs mostly require an "-e" at the end.)

Words of more exotic origin include "emoji" and "barista", which have their



origins in Japanese and Italian. But these too, Mr Jensen writes, come via English, not directly from those languages. This route is more common, it seems, than that of "quinoa", which was borrowed directly from Spanish (which itself took the word from Quechua).

In another category are "English" words and expressions that are unknown to Anglophones. Danes have long said that someone who is fresh and ready to go is "fit for fight". Another is "facerape", which means to hack someone's social-media profile in order to fiddle with its personal-information settings or to post fake status updates. Such faux-anglicisms are common in other languages too: the German *Handy* (mobile phone) or *Kicker* (table football), or the French *tennisman* and *tenniswoman*. Linguistic experts in these countries decry these words—it is bad enough to have to borrow English words, but even worse to counterfeit them, they reckon. But

they cannot seem to stop them.

But the book of new Danish words shows an even deeper kind of influence. Even where words appear Danish, they are often simply part-for-part translations of English words: *vejvrede* is "road rage", *undskyld mit franske* is "pardon my French", and *svingvælger*, "swing voter". This shows that globalisation is not only in the surface traffic of words, but in the deeper exchange of concepts.

This is not to say that other languages do not creatively coin their own words anymore. In Denmark an *amagernummerplade* or "Amager number-plate" is a tattoo on the lower back, named after a once-tatty bit of Copenhagen. *Svenskerhar* and *bundesligahar*, "Swede hair" or "Bundesliga hair", both refer to the cut known in English as a mullet. And *curlingforældre*, "curling parents", is an interesting twist on "helicopter parents": rather than hovering over their children, they sweep all obstacles out of their way, as in the eponymous sport.

So English borrowing is not entirely replacing native creativity, even if the heavy thumbprint of English on virtually every language in the globalised world is increasingly clear. This is not because English is particularly supple, wonderful or flexible in itself; it is more to do with the influence of innovations from the Anglosphere, from the good (blogs) to the ridiculous (twerking).

It may be that the spread of concepts from English out, rather than the other way round, is in fact to the discredit of the English-speaking world. Words spread from English because people learn English; cultural secrets from quinoa to *hygge* are more likely to be buried in other cultures where outsiders cannot find them. Perhaps the Anglophones are the real losers in this exchange.



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The State Insurance Company of Mauritius Ltd (SICOM) is inviting local and international Consultancy Firms for an Expression Of Interest (EOI) for the preparation of a medium to long term Strategic Plan for the SICOM Group.

The services of the Consultancy Firm will be required for the consultancy works as more fully described in the EOI which is available on the website of the company at www.sicomgroup.mu.

Proposals in sealed envelopes clearly marked "Expression Of Interest – Consultancy Services for The Preparation of Strategic Plan" and indicating the corresponding Procurement Reference Number: SICOM-EOI/STR 2018 should be addressed to the Ag. Group Chief Executive Officer, State Insurance Company of Mauritius Ltd, SICOM Building 1, Sir Célicourt Antelme Street, Port Louis, Mauritius and deposited in the Tender Box located at the Ground Floor at SICOM Building 1 or sent by registered post or courier services or sent to the following e-mail address: strategy@sicom.intnet.mu to reach SICOM not later than 22nd January 2018 up to 12.00 hours (local hours) at latest.

Late EOIs will not be considered.



State Insurance Company of Mauritius Ltd
SICOM Building 1, Sir Célicourt Antelme St,
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Date : 5th January 2018

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Economic data

% change on year ago

	Gross domestic product			Industrial production latest	Consumer prices latest	Unemployment rate, %	Current-account balance		Budget balance % of GDP 2017†	Interest rates, % 10-year gov't bonds, latest	Currency units, per \$ Jan 3rd	Currency units, per \$ year ago
	latest	qtr*	2017†				latest 12 months, \$bn	% of GDP 2017†				
United States	+2.3	03	+3.2	+2.2	+3.4 Nov	+2.2 Nov	+2.1	4.1 Nov	-452.5 Q3	-2.5	-3.5	2.43
China	+6.8	03	+7.0	+6.8	+6.1 Nov	+1.7 Nov	+1.6	4.0 Q3§	+121.6 Q3	+1.3	-4.3	3.88§§
Japan	+2.1	03	+2.5	+1.5	+3.7 Nov	+0.5 Nov	+0.5	2.7 Nov	+198.8 Oct	+3.5	-4.4	0.04
Britain	+1.7	03	+1.6	+1.5	+3.5 Oct	+3.1 Nov	+2.7	4.3 Sep††	-118.1 Q3	-4.0	-3.0	1.25
Canada	+3.0	03	+1.7	+3.0	+4.6 Oct	+2.1 Nov	+1.5	5.9 Nov	-45.8 Q3	-2.9	-1.8	2.05
Euro area	+2.6	03	+2.4	+2.2	+3.7 Oct	+1.5 Nov	+1.5	8.8 Oct	+393.8 Oct	+3.1	-1.3	0.45
Austria	+3.2	03	+1.4	+2.7	+4.4 Oct	+2.3 Nov	+2.1	5.4 Oct	+8.5 Q3	+2.2	-1.0	0.57
Belgium	+1.7	03	+1.0	+1.7	+6.7 Oct	+2.1 Dec	+2.2	6.9 Oct	-3.9 Sep	-0.3	-2.1	0.69
France	+2.3	03	+2.3	+1.8	+5.5 Oct	+1.2 Nov	+1.1	9.4 Oct	-22.5 Oct	-1.5	-2.9	0.76
Germany	+2.8	03	+3.3	+2.4	+2.7 Oct	+1.7 Dec	+1.7	3.6 Oct†	+279.0 Oct	+7.9	+0.6	0.45
Greece	+1.3	03	+1.2	+1.3	+0.4 Oct	+1.1 Nov	+1.1	20.6 Aug	-1.2 Oct	-0.6	-0.8	4.08
Italy	+1.7	03	+1.4	+1.5	+3.1 Oct	+0.9 Nov	+1.4	11.1 Oct	+54.6 Oct	+2.6	-2.3	2.07
Netherlands	+3.0	03	+1.6	+3.2	+3.9 Oct	+1.5 Nov	+1.3	5.4 Nov	+80.7 Q3	+9.7	+0.4	0.56
Spain	+3.1	03	+3.1	+3.1	+7.0 Oct	+1.2 Dec	+2.0	16.7 Oct	+23.0 Oct	+1.4	-3.0	1.50
Czech Republic	+4.7	03	+1.9	+4.5	+10.4 Oct	+2.6 Nov	+2.5	2.6 Oct†	+0.9 Q3	+0.7	+0.7	1.69
Denmark	+1.4	03	-1.9	+2.2	+0.2 Oct	+1.3 Nov	+1.1	4.3 Oct	+27.6 Oct	+8.3	-0.6	0.51
Norway	+3.2	03	+3.0	+2.1	+4.2 Oct	+1.1 Nov	+1.9	4.0 Oct‡‡	+21.1 Q3	+4.9	+5.2	1.65
Poland	+5.1	03	+4.9	+4.6	+9.0 Nov	+2.0 Dec	+2.0	6.5 Nov§	+1.4 Oct	+0.1	-3.3	3.30
Russia	+1.8	03	na	+1.9	-3.8 Nov	+2.5 Dec	+3.8	5.1 Nov§	+32.7 Q3	+2.3	-2.1	8.13
Sweden	+2.9	03	+3.1	+3.0	+6.0 Oct	+1.9 Nov	+1.9	5.8 Nov§	+21.1 Q3	+4.4	+1.0	0.80
Switzerland	+1.2	03	+2.5	+0.9	+8.7 Q3	+0.8 Nov	+0.5	3.0 Nov	+66.4 Q3	+9.7	+0.8	-0.10
Turkey	+11.1	03	na	+5.0	+8.9 Oct	+11.9 Dec	+10.0	10.6 Sep§	-41.9 Oct	-3.5	-2.0	11.74
Australia	+2.8	03	+2.4	+2.4	+3.5 Q3	+1.8 Q3	+2.0	5.4 Nov	-22.2 Q3	-1.4	-1.7	2.68
Hong Kong	+3.6	03	+2.0	+3.7	+0.3 Q3	+1.5 Nov	+1.6	3.0 Nov††	+14.8 Q3	+6.4	+1.7	1.87
India	+6.3	03	+8.7	+6.5	+2.2 Oct	+4.9 Nov	+3.4	5.0 2015	-33.6 Q3	-1.5	-3.1	7.32
Indonesia	+5.1	03	na	+5.1	+6.4 Oct	+3.6 Dec	+3.9	5.5 Q3§	-13.3 Q3	-1.6	-2.8	6.30
Malaysia	+6.2	03	na	+5.8	+3.4 Oct	+3.4 Nov	+3.9	3.4 Oct§	+9.2 Q3	+2.5	-3.0	3.92
Pakistan	+5.7	2017**	na	+5.7	+8.7 Oct	+4.6 Dec	+4.1	5.9 2015	-14.5 Q3	-4.9	-5.9	7.93†††
Philippines	+6.9	03	+5.3	+6.6	-6.6 Oct	+3.3 Nov	+3.2	5.0 Q4§	-0.5 Sep	-0.3	-2.1	5.55
Singapore	+3.1	04	+2.8	+3.1	+5.3 Nov	+0.6 Nov	+0.6	2.2 Q3	+57.4 Q3	+18.3	-1.0	2.04
South Korea	+3.8	03	+6.3	+3.1	-1.6 Nov	+1.5 Dec	+2.1	3.2 Nov§	+81.9 Oct	+5.5	+0.8	2.51
Taiwan	+3.1	03	+6.8	+2.4	+0.9 Nov	+0.3 Nov	+0.6	3.7 Nov	+74.1 Q3	+13.6	-0.1	0.93
Thailand	+4.3	03	+4.0	+3.6	+4.2 Nov	+0.8 Dec	+0.7	1.1 Nov§	+47.4 Q3	+11.6	-2.4	2.27
Argentina	+4.2	03	+3.6	+2.8	-2.5 Oct	+22.3 Nov	+25.2	8.3 Q3§	-26.6 Q3	-3.9	-6.1	3.72
Brazil	+1.4	03	+0.6	+0.8	+5.2 Oct	+2.8 Nov	+3.4	12.0 Nov§	-11.3 Nov	-0.7	-8.0	8.62
Chile	+2.2	03	+6.0	+1.4	+2.3 Nov	+1.9 Nov	+2.2	6.5 Nov§††	-4.6 Q3	-1.3	-2.7	4.50
Colombia	+2.0	03	+3.2	+1.6	-0.3 Oct	+4.1 Nov	+4.3	8.4 Nov§	-11.1 Q3	-3.6	-3.3	6.35
Mexico	+1.5	03	-1.2	+2.1	-1.1 Oct	+6.6 Nov	+5.9	3.5 Nov	-16.1 Q3	-1.9	-1.9	7.52
Venezuela	-8.8	04~	-6.2	-12.5	+0.8 Sep	na	+931	7.3 Apr§	-17.8 Q3~	-0.7	-19.4	8.24
Egypt	nil	03	na	+4.2	+25.0 Oct	+26.0 Nov	+26.8	11.9 Q3§	-12.2 Q3	-6.4	-10.8	na
Israel	+1.9	03	+3.5	+3.6	+2.5 Oct	+0.3 Nov	+0.3	4.3 Nov	+10.5 Q3	+2.7	-1.8	1.66
Saudi Arabia	-0.7	2017	na	-0.7	na	+0.1 Nov	-0.3	5.6 2016	+12.4 Q3	+3.3	-6.6	3.68
South Africa	+0.8	03	+2.0	+0.7	+1.1 Oct	+4.6 Nov	+5.3	27.7 Q3§	-7.3 Q3	-2.3	-3.9	8.61
												12.5
												13.8

Source: Haver Analytics. *% change on previous quarter, annual rate. †The Economist poll or Economist Intelligence Unit estimate/forecast. §Not seasonally adjusted. ‡New series. ~2014 **Year ending June. ††Latest 3 months. ††3-month moving average. §§5-year yield. †††Dollar-denominated bonds.

The Economist 1843

December 17/January 18 issue on newsstands now including our
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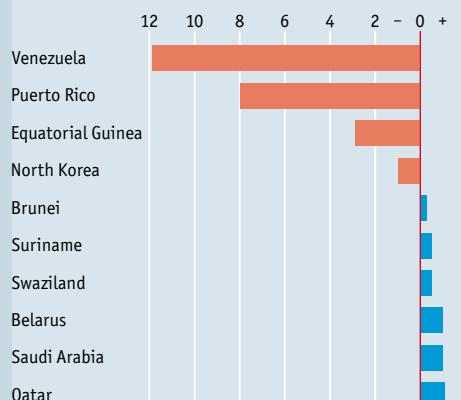
Markets

	% change on			
	Index Jan 3rd	one week	Dec 30th 2016 in local currency terms	in \$
United States (DJIA)	24,922.7	+0.6	+26.1	+26.1
China (SSEA)	3,528.4	+2.9	+8.6	+16.0
Japan (Nikkei 225)	22,764.9	-0.6	+19.1	+23.6
Britain (FTSE 100)	7,671.1	+0.7	+7.4	+17.4
Canada (S&P TSX)	16,371.6	+1.0	+7.1	+14.6
Euro area (FTSE Euro 100)	1,214.0	-0.8	+9.2	+24.4
Euro area (EURO STOXX 50)	3,509.9	-1.1	+6.7	+21.6
Austria (ATX)	3,487.4	+1.7	+33.2	+51.8
Belgium (Bel 20)	4,005.6	+0.1	+11.1	+26.6
France (CAC 40)	5,331.3	-0.7	+9.6	+25.0
Germany (DAX)*	12,978.2	-0.7	+13.0	+28.9
Greece (Athex Comp)	817.3	+1.0	+27.0	+44.8
Italy (FTSE/MIB)	21,904.6	-1.3	+13.9	+29.8
Netherlands (AEX)	549.3	+0.1	+13.7	+29.6
Spain (Madrid SE)	1,021.3	-0.5	+8.2	+23.4
Czech Republic (PX)	1,086.8	+0.3	+17.9	+42.4
Denmark (OMXCB)	933.2	+0.4	+16.9	+33.0
Hungary (BUX)	39,604.4	+1.1	+23.8	+41.3
Norway (OSEAX)	912.4	+0.4	+19.3	+26.6
Poland (WIG)	63,896.3	nil	+23.5	+49.2
Russia (RTS, \$ terms)	1,183.1	+3.0	+2.7	+2.7
Sweden (OMX30)	1,587.6	-0.5	+4.6	+16.4
Switzerland (SMI)	9,478.9	+0.5	+15.3	+20.0
Turkey (BIST)	116,052.1	+3.5	+48.5	+38.7
Australia (All Ord.)	6,175.3	+0.1	+8.0	+17.2
Hong Kong (Hang Seng)	30,561.0	+3.3	+38.9	+37.8
India (BSE)	33,793.4	-0.3	+26.9	+35.6
Indonesia (JSX)	6,251.5	-0.4	+18.0	+18.0
Malaysia (KLCSE)	1,792.8	+1.2	+9.2	+22.1
Pakistan (KSE)	41,544.3	+3.5	-13.1	-17.9
Singapore (STI)	3,464.3	+2.1	+20.3	+30.7
South Korea (KOSPI)	2,486.4	+2.0	+22.7	+39.2
Taiwan (TWI)	10,801.6	+3.0	+16.7	+27.2
Thailand (SET)	1,778.5	+1.5	+15.3	+27.8
Argentina (MERV)	31,476.3	+7.8	+86.1	+60.0
Brazil (BVSP)	77,995.1	+2.5	+29.5	+29.6
Chile (IGPA)	28,227.9	+2.0	+36.1	+50.2
Colombia (IGBC)	11,560.9	+1.7	+14.4	+18.1
Mexico (IPC)	49,782.2	+2.3	+9.1	+15.6
Venezuela (IBC)	1,261.9	-0.1	-96.0	na
Egypt (EGX 30)	14,833.7	-0.5	+20.2	+23.0
Israel (TA-125)	1,382.6	+1.6	+8.3	+20.7
Saudi Arabia (Tadawul)	7,224.3	+0.3	-0.2	-0.1
South Africa (JSE AS)	59,629.6	+1.3	+17.7	+30.1

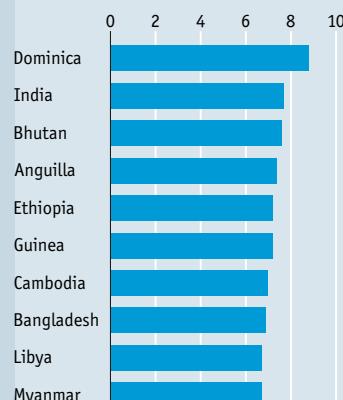
GDP forecasts

2018, % change on a year earlier

Worst-performing



Best-performing



Source: Economist Intelligence Unit

Other markets

	% change on			
	Index Jan 3rd	one week	Dec 30th 2016 in local currency terms	in \$
United States (S&P 500)	2,713.1	+1.1	+21.2	+21.2
United States (NAScomp)	7,065.5	+1.8	+31.3	+31.3
China (SSEB, \$ terms)	345.4	+2.1	+1.1	+1.1
Japan (Topix)	1,817.6	-0.7	+19.7	+24.2
Europe (FTSEurofirst 300)	1,533.5	-0.1	+7.4	+22.4
World, dev'd (MSCI)	2,125.6	+1.1	+21.4	+21.4
Emerging markets (MSCI)	1,184.2	+3.5	+37.3	+37.3
World, all (MSCI)	519.2	+1.4	+23.1	+23.1
World bonds (Citigroup)	949.9	+0.4	+7.5	+7.5
EMBI+ (JP Morgan)	836.7	+0.2	+8.4	+8.4
Hedge funds (HFRX)	1,275.6 [§]	nil	+6.0	+6.0
Volatility, US (VIX)	9.2	+10.5	+14.0 (levels)	
CDSs, Eur (iTRAXX) [†]	44.3	-2.4	-38.6	-30.0
CDSs, N Am (CDX) [†]	46.8	-5.0	-30.9	-30.9
Carbon trading (EU ETS) €	7.8	-4.6	+18.3	+34.8

Sources: IHS Markit; Thomson Reuters. *Total return index.

†Credit-default-swap spreads, basis points. [§]Dec 29th.Indicators for more countries and additional series, go to: Economist.com/indicators

The Economist commodity-price index

2005=100

	% change on		
	Dec 19th 2017	Dec 26th 2017	Jan 2nd 2018*
	one month	one year	
Dollar index			
All items	144.9	147.7	150.9
Food	146.7	147.6	149.6
Industrials			
All	143.1	147.9	152.3
Nfa [†]	134.6	136.8	138.0
Metals	146.7	152.6	158.4
Sterling index			
All items	197.9	201.0	202.1
Euro index			
All items	153.2	154.8	155.8
Gold	\$ per oz	1,254.7	1,282.5
		1,313.1	+3.9
West Texas Intermediate	\$ per barrel	57.3	60.0
		60.4	+4.8
			+15.4

Sources: Bloomberg; CME Group; Cotlook; Darmenn & Curl; FT; ICO; ISO; Live Rice Index; LME; NZ Wool Services; Thompson Lloyd & Ewart; Thomson Reuters; Urner Barry; WSJ. *Provisional

[†]Non-food agriculturals.



O mio nonno caro

Simonetta Puccini, the last direct heir of the Maestro and keeper of his flame, died on December 16th, aged 89

WHEN visitors came to Torre del Lago, Giacomo Puccini's villa on the shores of a lake overlooking the Apuan Alps, Simonetta Puccini would sometimes meet them at the gates. All smiles, she would lead them through gardens thickly planted with palms, shrubs and roses, into the hall. There hung the Maestro's oilskin coat, the one he wore to go out snipe-hunting on the lake, beside his shotguns and boots. In the living room stood the black Forster upright on which he had composed "La Bohème", "Tosca" and "Madame Butterfly", while ash from his continuous cigarettes fell upon the keys. His pencils and spectacles lay on the desk; his operas played in the background. She had arranged all this, with the greatest care, as if he was still there, and would greet her round the corner with a grandfatherly kiss.

She had done it, too, to make the point that she was his heir and no one else. It took decades, battling one counter-claim after another through the Italian courts. She gained a reputation for being *tosta*, a real piece of work. So she was, despite the smiles and the pearls, and so she had to be.

The fundamental problem was her grandfather's wild love-life, especially with girls from below stairs. She was annoyed when guides and books romped around in this: religious herself, she pre-

ferred to dwell on his creative, spiritual side. Time and again, however, she had to face the fact that her nonno had left not only a fortune, still estimated in 1975 at 24bn lire (\$36m), but also illegitimate children whose heirs were demanding a share.

Her own lineage was not straightforward. Her father was Puccini's only legitimate child, Antonio, but her mother (an amour before Antonio's marriage to Rita) was a village girl, Giuseppina Giurumello. Giuseppina bravely brought her up alone, despite the shame of it. Her father did not recognise her officially, since Rita could not bear the very thought of her; but he paid for her education as far as university, came to see her, and wrote letters ending *il tuo caro babbo*. He also talked to her of the Maestro: his love of cars, the telephone, the phonograph, speedboats, and how he had worked at night, with dampers on the keys, so the family could sleep. Simonetta never knew him, for he died five years before she was born. But these images, and the passionate sweep of his music, brought her securely under his spell. She grew up feeling, knowing, she was a Puccini—even though the name she grew up with, and later taught literature and history under, was Giurumello.

When her father died the Puccini estate went to the scornful Rita. Simonetta got

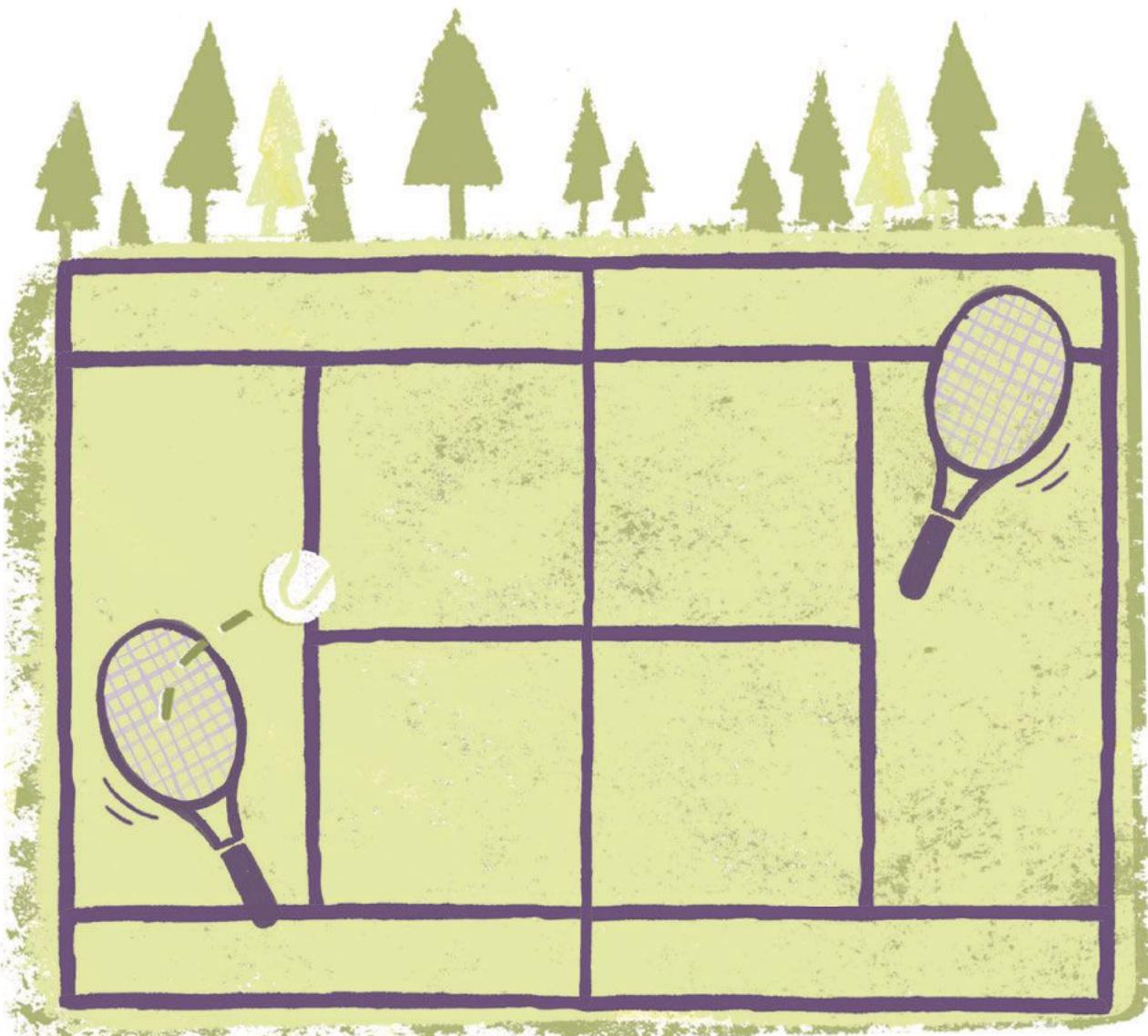
merely a monthly stipend, but at 17 and illegitimate she had no power to object. She struggled while others revelled. When Rita died in 1979 the estate went to her bachelor brother, Count Livio dell'Anna, who blew much of it in Monte Carlo before his butler-lover began to fritter away the rest. But since 1974, when she was 45, Simonetta had been on the case. For in 1973 a new family law in Italy had done away with the concept of illegitimacy, and in 1980 Italy's highest civil court agreed that she could take the name Puccini. She did so at once; it turned her into a force to be reckoned with.

Madame Gadfly

Gradually she acquired a share of the money and, more important, control of the houses at Torre del Lago and Lucca. They were falling apart, so she raised money to repair them. As chatelaine of Torre del Lago the first thing she did was to fire Giacomo, the caretaker, who shambled round the villa drunk, prattling of the Maestro's *donne*. The caretaker's father, Claudio, claimed to be one of the by-blows, even born in the house. Now that illegitimacy no longer mattered, he demanded a DNA test to prove he was the rightful heir. She refused, of course. Such a test would mean opening Puccini's green marble tomb in the chapel there, disturbing his sacred remains. The challenge withered, as did another DNA request in 2008 from the granddaughter of one Giulia Manfredi, said to be Puccini's lover. Simonetta's furious posters went up all round Lucca, appealing to people to protect Puccini's memory against "inventions" and "local gossip".

Some people never believed her own claim, calling her a fortune-hunter, and cruelly pointing out how much the Manfredi menfolk looked like the Maestro. It was extremely annoying, too, that Rita had set up a Puccini Foundation to sponsor research and protect the sites. That was her job, as the bearer of the Name, and in 1979 she started the Institute of Puccini Studies (from 2005, the Simonetta Puccini Foundation) to do the same thing in a completely separate way. She edited two volumes of his letters and, in "The Puccini Companion", co-written with William Weaver, laid out the true family history for all to see. Sadly the operas were no longer in copyright, but she kept close watch, objecting loudly when the 1904 version of "Madame Butterfly", disowned by the Maestro, was staged in 2016 at La Scala. Her beloved nonno would never have wanted that.

Several times a year she held masses for the dead at Torre del Lago, and kept the chapel full of fresh flowers. Her own funeral requests were simple, but emphatic. A string quartet would play "Crisantemi", her favourite Puccini piece. Then her ashes would join him, protectively, definitively, behind the green marble wall. ■



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