GrAIt expectations
Artificial Intelligence is spreading beyond the technology sector, with big consequences for companies, workers and consumers, says Alexandra Sutch Bass

LIE DETECTORS ARE not widely used in business, but Ping An, a Chinese insurance company, thinks it can spot dishonesty. The company lets customers apply for loans through its app. Prospective borrowers answer questions about their income and plans for repayment by video, which monitors around 50 tiny facial expressions to determine whether they are telling the truth. The program, enabled by artificial intelligence (AI), helps pinpoint customers who require further scrutiny.

AI will change more than borrowers’ bank balances. Johnson & Johnson, a consumer-goods firm, and Accenture, a consultancy, use AI to sort through job applications and pick the best candidates. AI helps Caras, a casino and hotel group, guess customers’ likely spending and offer personalized promotions to draw them in. Bloomberg, a media and financial information firm, uses AI to scan companies’ earnings releases and automatically generate news articles. Vodafone, a mobile operator, can predict problems with its network and with users’ devices before they arise. Companies in every industry use AI to monitor cybersecurity threats and other risks, such as disgruntled employees.

Instead of relying on gut instinct and rough estimates, cleverer and speedier AI-powered predictions promise to make businesses much more efficient. At Leroy Merlin, a French home-improvement retailer, managers used to order new stock on Fridays, but defaulted to the same items as the week before so they could start their weekend sooner. The firm now uses algorithms to take in past sales data and other information that could affect sales, such as weather forecasts, in order to stock shelves more effectively. That has helped reduce its inventory by 8% even as sales have risen by 2%, says Manuel Dairy of Vekis, the AI startup that engineered the program.

AI and machine learning tools that are often used interchangeably involve computers crunching vast quantities of data to find patterns and make predictions without being explicitly programmed to do so. Larger quantities of data, more sophisticated algorithms and sheer computing power have given AI greater force and capability. The outcomes are often similar to what an army of statisticians with unlimited time and resources might have come up with, but they are achieved far more quickly, cheaply and efficiently.

One of AI’s main effects will be a dramatic drop in the cost of mak-
up with novel solutions.

In private, many bosses are more interested in the potential cost and labour savings than in the broader opportunities at hand. Some think that it’s not worth the battle of wills that is certain not to go well, but ultimately, is it any good for business, "If you just cut costs and don’t increase value for customers, you’re going to be out of the game," he says. Some companies may not actually eliminate existing jobs but use technology to create new ones. And workers who keep their jobs are more likely to feel spurred on by their employers. Some firms already use AI to comb through their workers’ communications for messages that are clear enough to be used. The benefits of such practices will spread, raising privacy issues.

About 60% of companies say AI creates a virtuous circle or "flywheel effect," allowing companies that embrace it to operate more efficiently, generate more data, improve their services, attract more customers and offer lower prices. That sounds like a good thing, but it could also lead to more corporate concentration and monopoly power—AI has already happened in the technology sector.

**Supply chain**

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**DELIVERING 25 PACKAGES** by lorry or van may seem mundane task. But with a single day, it can become as complex as distributing 50,000 packages to a million homes.

The number of possible routes adds up to around 15 million trillion trillion, according to Goldman Sachs, an investment bank. Internationally, about 1.7 trillion dollars of goods are traded each year. That is the number of possible routes from a single location to another.

The challenge is how to make the process more efficient and profitable. The answer is to use algorithms and artificial intelligence (AI) to analyze data and make decisions. This approach has been used successfully in many industries, including manufacturing, retail, and finance.

**Artificial sweeteners**

**Get ready for a range of new and machine learning**

**Value $bn**

**Number of deals**

**Source: PitchBook**

Ballooning

Retailers' economic value created from AI for the next 20 years

**Management**

**Marketing**

**Operations**

**Supply chain**

**Value $bn**

**Source: McKinsey**

The Economist March 31st 2018

4
Customer service

How AI can make businesses more caring

> Your CALL IS IMPORTANT to us. a recorded voice tells re- signed customers as they wait endlessly to speak to a hu- man agent. But you wonder if they care. The problem is that the quality and consistency of their service in order to persuade customers that they do in fact care about them.

On average, a customer receives around 30,000 e-mails from customers every day and uses AI to detect the prevailing sentiment in them. It now recognizes over 1,000 most urgent ones first, and is planning to route complaints to agents with the most expertise in the relevant field. “Like other applications of AI, it’s about trying to make human service more efficient, not to take them out of the process entirely,” says Paul Clarke, Ocado’s chief technology officer. Between 2017 and 2018 the share of customer-service interactions worldwide handled entirely by AI will rise from 2% to 25%, and by 2020 at least 40% of such interactions will involve an element of AI, according to Guratao, a research firm.

AI will change customer service more than telephones did in its day. Before the phone started to spread in the early 20th century, companies handled cus- tomer inquiries by post or by visiting in person. Phones helped agents to become more productive, and AI will boost pro- ductivity even more dramatically, because it can handle large numbers of cus- tomer inquiries more quickly than humans can. This has become more im- portant as communications channels have multiplied to take in e-mail, mobile messaging apps and social media. And customers have got used to dealing with

automated services. Surveys suggest that around 40% of Amer- ican internet users would rather use digital customer services than speak to someone on the phone.

Virtual agents are on the rise. Some 30% of companies now offer standalone “bots” that can answer questions and solve prob- lems, although their range remains narrower than that of a hu- man. Many of these use some AI. They are trained on logs and transcripts of past customer interactions, and as they are fed more data they become better at solving more complex queries. Such bots enable businesses to deal with many more inquiries without hiring extra people. China Merchants Bank, a commer- cial bank, uses a bot on its popular Chinese app WeChat to han- dle 1.3m-2m queries every day, a workload equivalent to around 5,000 human staff. Caesars, the hotel and casino group, offers a virtual concierge at its hotels, which answers guests’ queries by text, many of them automatically if the inquiry is sim- ple to answer. This has reduced calls to the human-concierge desk by 30%.

AI will also enhance customer-service agents’ knowledge, performance and speed. The challenge is to ensure that agents are equipped with “voice-printing” technology which recognises client- es’ voices and alerts agents if a caller is a customer of another country. This will be especially helpful in financial services.

One Australian bank is experimenting with a standalone smart voice-controlled speaker to listen in on customers’ conver- sations about loans. If the agent forgets something or makes a mis- take, it jumps in. Some companies are also using AI to suggest re- sponses to customer queries which a human agent can approve or adapt before sending. Over the past year this has allowed KLM, the Dutch flag carrier, to double the number of text-based customer inquiries it handles to 120,000 a week while increasing the number of agents by only 10%. And a startup founded by Dmitry Akhunov of Digital Genius, a firm that helps automate customer support.

A few companies have started offering AI-enabled services that listen to calls to judge their quality and suggest improvements. One company, Cogito, who customers have included insurance firms such as Hu- mans and MetLife, focuses on recognizing “compassion fatigue” in agents. It takes in details such as how fast agents are talking and what words agents use. In one test customers were asked whether the interaction was going well. If there is a problem, it cues agents to act more empathetically. A tool like this can help large a ride-hailing firm, has built a system using AI to deal with e- mails from drivers (there is no telephone option). It sends the agent a link to a particular page of a driver’s feedback that AI can save the driver’s time.

One hope for AI is that it will free customer-service agents from routine tasks so they can sell customers other services and generate new revenue. KLM has been able to generate millions of dollars of extra sales since it started using AI because agents now have more time to help customers book upgrades and new flights, says Mr Akhunov of Digital Genius. But not all customers will appreciate more sales pitches.

AI will certainly change the way selling is done. Many firms are experimenting with developing AI-enhanced recommendation tools, like those used by Amazon and Netflix, to help sales- people with their jobs. Google, Facebook and Amazon have been working with travel agencies and hotels to offer extra services like flights with access to virtual assistants. But it now seems that agents with more conversational skills in just one click is set to become the new form of human service.

Hire education

AI is changing the way firms screen, hire and manage their talent

HUMAN RESOURCES (HR) is a poorly named department. It usually has few resources or can overworked staff, clunky technology and piles of employee handbooks. Hased recruiters have long seen applications that vastly outnumber the jobs available. For example, Johnson & Johnson (J&J), a consumer-goods company, receives 1.2m applications for 50,000 positions and its postgraduate systems can scan appli- cations far more quickly than humans and work out whether candidates are a good fit. Although the system can do a great job of matching candidates with positions, it is not perfect.

Oddly enough, they may also jeopardize more into hiring. According to Athena Karp of HireSolved, a startup that uses algorithms to screen candidates for jobs, only around 25-30% of applicants typically hold the right qualifica- tions for a job, but they are rarely re-jected by the system. J&J, are not they are pointed to more suitable jobs. Technology is helping “greet respect back to candidates”, she says.

If the system is seen as treating applicants with respect, and they can be more accurately. This can be done through a process called “reverse credentialism”, in which candidates who have the right skills and experience are given priority over those who don’t.

Some insurers, including Ping An of China, use AI to let cus- tomers buy insurance by accident, instead of having to call the insurance company and fill in lots of forms. Customers take photos of the damage to their car and submit them through an app for a quick quote for repairs. Building a tool like this is a technological challenge, but getting it in early is a good idea. Ser- vices that make customers happier are the ones that make custo-mers happier, who will provide more training data to make the AI sys- tems smarter. Ping An online group has sold 30,000 people a car and 30% of them on its app. “It takes an enormous amount of cost out of the system and puts customers in control,” says Jonathan Larsen, Ping An’s chief innovation officer. Such tools also re-define its “direct relationship” with its customers.
A will make workplaces more efficient, safer—and much more creative.

WALK UP A set of steep stairs next to a vegan Chinese restaurant in Palo Alto in Silicon Valley, and you will see the future, or at least one version of it. This is the local office of Humanyze, a firm that provides "people analytics". It counts several Fortune 500 companies among its clients (though it will not say who they are). Its employees mill around an office full of sunlight and computers, as well as beacons that track their location and interactions. Everyone is wearing an X Badge: the size of a credit card and the depth of a book of matches. It contains a microphone that picks up whether they are talking to one another; Bluetooth and infrared sensors to monitor where they are; and an accelerometer to record when they move.

"Every aspect of business is becoming more data-driven. There's no reason the people side of business shouldn't be the same," says Ben Walke, Humanyze’s boss. The company's staff are treated much the same way as its clients. Data from their employees’ badges are integrated with information from their email and calendars to form a full picture of how they spend their time at work. Clients get to see only team-level statistics but Humanyze’s employees can look at their own data, which includes metrics such as time spent with people of the same sex, activity levels and the ratio of time spent speaking versus listening.

We can see through you.

Such insights can inform corporate strategy. For example, according to Mr Walke, firms might see that a management team is communicating only with a couple of departments and neglecting others. If a main plant is being upgraded, so the space should be redesigned; that teams are given the wrong incentives; or that diversity initiatives are not working.

In a similar vein, a Japanese conglomerate sells a similar product, which it has cheekily branded a "happiness meter". Employee welfare is a particular challenge in Japan, which has a special word, karōshi, for death by overwork. Hitachi’s algorithms infer mood levels from physical movement and pinpoint business problems that might not have been noticed before, says Kazuo Yano, Hitachi’s chief scientist. For example, one manufacturing client found that when young employees spent more than an hour in a meeting, workplace morale declined.

Employers already have vast quantities of data about their workers. This company treats me like my family does," says Leihannen Evisbal of Workday, a software firm that predicts which employees are likely to leave, among other things. Thanks to the Internet, smartphones and the cloud, employers can already check who is looking at a document, where employees are working and who is talking to whom. But staying company files and contacts. As will go further, raising concerns about Orwellian snooping by employers on their workers. In January Amazon launched a pair of pendants with wristbands that monitor warehouse workers’ exact location and track their hand movements in real time. The technology will allow the company to gauge their employees’ productivity and accuracy. JD.com, the Chinese e-commerce firm, is starting to experiment with tracking which teams and managers are the most efficient.

Free of bias. But as AI becomes more prevalent, concerns will grow that algorithms could reinforce discrimination.

Recruitment is just one example of the technological disruption that will bring to the workplace. The number of recruiters will come down, because AI will handle many of the mundane tasks they used to do, and face-to-face interviews will become rare. At Unilever only shortlisted candidates are now interviewed, after several rounds of AI-enabled screening and recorded interviews through HireVue. For the remaining recruiters, though, AI will make work easier and more interesting.

It may even help some of the workers it displaces. Accenture is rolling out a custom-built tool called Job Buddy, which tells employees how vulnerable their job is to automation and predicts what training they might need so they can develop the right skills for the future. Ms Shook of Accenture says that around 80% of the people who have tried it are taking the advice it offers. But they may not have much choice.

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The Economist March 31st 2018

Future workplaces

Smile, you’re on camera.
and using algorithms to predict attrition among workers. The integration of AI into the workplace will offer some benefits to workers and might even save lives. Companies with a high-risk work environment are starting to use computer vision to check whether employees are wearing appropriate safety gear, such as glasses and gloves, before giving them access to a danger area. Computer vision can also help analyse live video from cameras monitoring factory floors and work environments to deter theft when something is amiss. Systems like this become, for example, as commonplace as CCTV cameras in shops, says Alastair Harvey of Connexis, a firm that specialises in building them.

Employees will also be able to track their own movements. Microsoft, the software giant, already offers a programme called MyAnalytics which puts together data from e-mails, calendars and so on to show employees how they spend their time, how often they are in touch with key contacts and whether they multi-task too much. It also aggregates the data and sends them to managers of departments so they can see how their teams are doing.

"It doesn't have that 'big brother' element. It's designed to be more productive," insists Steve Clayton of Microssa. The idea is that individuals' data are not given out to managers, though it is visible in the system. As part of a broader investment in AI, Microsoft is also starting to use the technology to translate the monthly question and answer session held by the company's boss, Satya Nadella, for its workers worldwide, and analyse employees' reactions.

It does not take much imagination to see that some companies, let alone governments, could take this information-gathering too far. Veriato, an American firm, makes software that registers everything that happens on an employee's computer. It can search for signals that may indicate poor productivity and malicious or sloppy computing, so stealing company secrets is easy enough to understand how sentiment changes over time. As voice-quality scores for the very same employee at work, they can be used to gather even more data.

This is of particular concern in authoritarian states. In China increasing numbers of firms, and even some cities, use computer algorithms to identify employees for the purpose of giving them access to public buildings. The government is open to a system that could populate a "social credit" score for all its citizens, pooling online data about them to predict their future behaviour.

All this may require a new type of agreement between employees and employers. Most employment contracts in America give employers blanket rights to monitor employees and collect data about them, but few workers are aware of that. Mr Weber of Human RightsWatch thinks this data should have better legal protection, especially in America (Europe has stronger privacy laws).

At Microsoft, the data collection is aimed at improving the experience of its users, a professor of computer science and crunch employee information, privacy concerns will increase, and employers may feel violating if they do not think they have their users' permission sharing that data. Companies like Google and Facebook, which have household names, have already faced significant headwinds.

In future tech firms will develop more specialised hardware that will help companies crunch enormous data piles more quickly. Google has a lead in this area; it has built some remarkable computer chips, called Tensor Processing Units (TPUs), and uses other customised accelerators to increase the processing power of its machines. The tech firms are also offering new open-source libraries to clients' machine-learning experts that can be used to design AI-enabled programs. This is "not altruistic", says Matt Turk of FirstMark Capital, a venture investor. Tech firms want to provide great tools in order to attract clients to their platforms and impress AI experts.

Microsoft has more experience than either Amazon or Google in catering to large firms' software needs, so it is well placed to serve in this need of help with AI. But Microsoft clearly recognises that such offerings still require a lot of customisation and technical work to make them useful, says Greg Enright of the Allen Institute for Artificial Intelligence, a non-profit research group.

The cloud providers are trying to fill the gap by offering consultation services. Google has opened an "Advanced Solutions Lab" that is part consulting service, part tech bootstrap. White-collar clients from small companies can come to acquire machine-learning skills and build customised systems alongside Google engineers. Courses typically last from four weeks to several months and are "very hands-on", says Vats Strivanan of Google Cloud, who is now hoping to roll this out much more widely. "We see this as a service that has been strong on technical infrastructure but light on people.

The cloud providers will increasingly compete with management consulting firms, which charge large fees for help clients navigate technological disruption. "The Googles, Amazon and Microsoft are more frontally in the market than the McKinsey, Boston Consulting Groups and Bains," says Roy Bahat of Bloomberg Beta, a venture-capital firm. "Consultancies are built for two-by-two mentors, and their business is about helping them with identity when they are in a race, consultancies with deep expertise in data and technology are better placed than those that focus on general strategy."

Strait from the horse's mouth

The genealogists say that they are vulnerable. McKinsey has been investing heavily to beef up its expertise in data, for example by buying FastMention, an advanced-analytics firm, for an undisclosed sum in 2013. But many clients seek advice direct from tech firms, which are themselves pioneering users of AI. "Algorithms are much easier to understand and to battle than they already are," they told The Economist. "We have the expertise there, we are an AI lab that delivers a product that is already gone live, and that is a good thing for clients to be prompt to the necessities.

Cloud providers try to differentiate their AI offerings in two ways: by ease of use, through a well-designed interface, and by offering better algorithms. Each of the tech giants draws on

External providers

Leave it to the experts

A thriving ecosystem has sprung up to offer AI expertise and technical help

MANY TECH FIRMS' offices boast luxurious perks such as nap pods, massages and soda fountains that offer employ- ees a choice of6 extravagantly sparkling water. Corporate bosses like to think that finding customised AI solutions is just as easy as selecting a fizzy drink with a hint of grapefruit. They are wrong. Buying AI takes time, can feel like hard work, and the results are not always perfect.

A number of vendors are sprouting up to compete with these traditional players. In the past, search engine firms like Google and Microsoft, which in the past have been a key point of new storage; Amazon, Google and Microsoft. Cloud computing is a vast market worth $200bn, and fiercely competitive. All these firms offer pre-trained models that corporate clients can use to build AI-enabled systems. For example, they all sell "vision" tools that enable customers to use computer vision to improve their existing services and build new ones. Uber, the ride-hailing firm, worked with Microsoft's toolset to design a system that can scan from facial features to confirm its identity when they go.

This is a shift. C-Span, a television network, used Amazon's vision system to compile a database of politicians so it can quickly name them when they appear on screen.

A bread range of tools is available to help mainstream companies build anything from AI and machine-learning engines to speech recognition and translation systems, customer service chatbots and more. Jeff Dean, director of research at Google, says the search giant's AI research arm, REDC, are used to AMO organisations in the world that have a problem that would be amenable to a machine-learning solution. They have the data but don't think they have the experts on staff.

The two biggest areas for AI software, hardware and services is used around $5bn by 2024, compared with $20bn last year, according to IDC, a research firm. Amazon has a clear lead in the broader cloud market, with 44% of the total share, compared with Microsoft's 27% and Google's 23%, but for AI tools the field remains open. Google's senior vice-president of Cloud, Vats Strivanan, an online grocer, says it can be good for clients to be prompt to the necessities and use the best tools from each. He thinks it un- likely to see one of the "counties" that have two faces loving in opposite directions. On one side, are the positives that AI will bring, enabling people to achieve more, far more quickly, by using technology to enhance their existing skill sets. The companies that have the best clients more easily, and customer-service staff will be able to handle queries faster than they had ever before, which could also lead to new roles and make professional lives more fulfilling and stimulating.

Consumers, too, will benefit from AI-enhanced services such as personalised recommendations and faster and more effi- cient delivery, as well as from radical changes in industries like health care and transport that could lead to new drug discoveries.

The story also suffers from the same problem as any tech firm other than Google, Amazon and Microsoft: it finds it hard to get hold of the best talent. None of the top doctoral candidates in AI goes to work for them, says Mr Domingos of the University of Washington. The old saying that "nobody ever got fired for buy- ing any" no longer applies in the era of AI.

Startups, too, are hoping to jump on the AI bandwagon. Many offer services like helping clean up and label data, and take on specific tasks that the big firms are not offering, like helping firms recruit, scan job descriptions and improve custom- er service. For large companies it makes sense to outsource most of their AI work, except where it directly affects their strategic edge. For example, MR would not build the AI tools to automate back office or its finance functions, but it would want to develop its own system for interpreting seismic imaging to detect oil, says Ms Watson.

If companies want to get products rolled out quickly, they have to work with multiple vendors, says Mr Lipton of Mettler. That may be good for startups, which can be nimble. But the in- house tech firm's size, computing infrastructure, proprietary data and balance-sheets give them an unassailable advantage. "Right now everyone thinks they can win. The field will become considerably less democratic," predicts Martin Reeves of Boston Consulting Group. Having used AI to boost their own fortunes, the incumbents will move on to exploit the technology to cus- tomers who may become AI-fuelled giants in their own right.
and treatments and safer ways to move around.

Look the other way, though, and there are plenty of potential pitfalls. Technological change always causes disruption, but AI is likely to have a bigger impact than anything since the advent of computers, and its consequences could be far more disruptive. Being both powerful and relatively cheap, it will spread faster than computers did and touch every industry.

**Sunny with a chance of thunderstorms**

In the years ahead, AI will raise three big questions for bosses and governments. One is the effect on jobs. Although chief executives publicly extol the broad benefits AI will bring, their main interest lies in cutting costs. One European bank asked Infosys to find a way of reducing the staff in its operations department from 50,000 to 500. This special report has shown that AI-enhanced tools can help pare staff in departments such as customer service and human resources. The McKinsey Global Institute reckons that by 2030 up to 37m people, or 14% of the global workforce, could have their jobs automated away. Bosses will need to decide whether they are prepared to offer and pay for retraining, and whether they will give time off for it. Many companies say they are all for workers developing new skills, but not at the employer’s expense.

A second important question is how to protect privacy as AI spreads. The internet has already made it possible to track people’s digital behaviour in minute detail. AI will offer even better tools for businesses to monitor consumers and employees, both online and in the physical world. Consumers are sometimes happy to go along with this if it results in personalised service or tailored promotions. But AI is bound to bring privacy violations that are seen as outrageous. For example, facial-recognition technology has become so advanced that it may be able to detect someone’s sexual orientation. In the wrong hands, such technology could militate against fair and equal treatment. Countries with a record of surveillance and human-rights abuses, such as China, are already using AI to monitor political activity and suppress dissent. Law-enforcement officials around the world will use AI to spot criminals, but may also snoop on ordinary citizens. New rules will be needed to ensure consensus on what degree of monitoring is reasonable.

The third question is about the effect of AI on competition in business. Today many firms are competing to provide AI-enhanced tools to companies. But a technology company that achieves a major breakthrough in artificial intelligence could race ahead of rivals, put others out of business and lessen competition. This is unlikely to happen in the near future, but if it did it would be of great concern.

More likely, in the years ahead AI might contribute to the rise of monopolies in industries outside the tech sector where there used to be dynamic markets, eventually stifling innovation and consumer choice. Big firms that adopt AI early on will get even bigger, attracting more customers, saving costs and offering lower prices. Such firms may also reinvest any extra profits from this source, ensuring that they stay ahead of rivals. Smaller companies could find themselves left behind.

Retailing is an illustration of how AI can help large firms win market share. Amazon, which uses AI extensively, controls around 40% of online commerce in America, helping it build moats that make it harder for rivals to compete. But AI will increase concentration in other industries, too. If, say, an oil company can use AI to pump 3% more efficiently, it can set prices 3% lower than those of a rival. That could force the competitor to shut down, says Heath Terry of Goldman Sachs. He thinks that AI has “the power to reshuffle the competitive stack.”

Janus, the Roman god, contained both beginnings and endings within him. That duality characterises AI, too.

It is too early to tell whether the positive changes wrought by AI will outweigh the perils. But leading a company in the years ahead is sure to be more challenging than at any time in living memory. AI will require bosses to rethink how they structure departments, whether they should build strategic technologies internally or trust outside firms to deliver them, whether they can attract the technical talent they need, what they owe their employees and how they should balance their strategic interests with workers’ privacy. Just as the internet felled some bosses, those who do not invest in AI early to ensure they will keep their firm’s competitive edge will flounder.

Janus, the Roman god, contained both beginnings and endings within him. That duality characterises AI, too. It will put an end to traditional ways of doing things and start a new era for business and for the world at large. It will be pervasive, devastating and exhilarating all at the same time. Look ahead.