

▶ Intelligent machines that combine these abilities can do things that individual humans cannot. “Already, an AI system can outperform an experienced military pilot in simulated air-to-air combat,” notes Kenneth Payne of King’s College London. In February, the Defence Advanced Research Projects Agency (DARPA), the Pentagon’s blue-sky-thinking branch, conducted the latest test of a six-strong drone swarm capable of collaborating in a “high-threat” environment, even when cut off from human contact.

For all that, most such systems embody intelligence that is narrow and brittle—good at one task in a well-defined environment, but liable to fail badly in unfamiliar settings. So existing autonomous weapons are comprised of either loitering missiles that smash into radars or quick-firing guns that defend ships and bases. Useful, but not revolutionary—and neither requires the fancy machine-learning techniques pioneered in recent years.

Enhance. Enhance. Enhance

It would be a mistake to think that AI is useful only for battlefield drudgery. Robots, killer or otherwise, must act on what they see. But for many military platforms, like spy planes and satellites, the point is to beam back raw data that might be turned into useful intelligence. There is now more of that than ever before—in 2011 alone, the most recent year for which there are data, America’s 11,000-or-so drones sent back over 327,000 hours (37 years) of footage.

Most of that has lain unwatched. Luckily, the second major application for AI in the armed forces will be in processing data. In lab-based tests, algorithms surpassed human performance in image classification by 2015 and nearly doubled their performance in a tougher task, object segmentation, which involves picking out multiple objects from single images, between 2015 and 2018, according to Stanford University’s annual index of AI progress. Computer vision is far from perfect and can be exploited in ways that would not fool a human observer. In one study, altering 0.04% of the pixels in an image of a panda—imperceptible to humans—caused the system to see a gibbon instead.

Those weaknesses notwithstanding, by February 2017 the Pentagon itself concluded that deep-learning algorithms “can perform at near-human levels”. So it established the “Algorithmic Warfare” team, known as Project Maven, which uses deep learning and other techniques to identify objects and suspicious actions, initially in footage from the war against Islamic State and now more widely. The aim is to produce “actionable” intelligence—the sort that often ends with bombs falling or special forces kicking in doors.

An insider with knowledge of Project

Maven says that the benefits to analysts—in terms of time savings and new insights—remain marginal for now. Wide-angle cameras that can see across entire cities throw up large numbers of false positives, for instance. “But the nature of these systems is highly iterative,” he says. Progress is rapid and Project Maven is just the tip of the iceberg.

Earth-i, a British company, can apply machine-learning algorithms from a range of satellites to identify different variants of military aircraft across dozens of bases with over 98% accuracy (see main picture), according to Sean Corbett, a retired air vice-marshal in the Royal Air Force (RAF) who now works for the firm. “The clever bit”, he says, “is then developing methods to automatically identify what is normal and what is not normal.” By watching bases over time, the software can distinguish routine deployments from irregular movements, alerting analysts to significant changes.

Algorithms, of course, are omnivorous and can be fed any sort of data, not just images. “Bulk data combined with modern analytics make the modern world transparent,” noted Sir Alex Younger, the head of MI6, Britain’s spy agency, in December. In 2012 leaked documents from the NSA, America’s signals-intelligence agency, described a programme (reassuringly called Skynet), which applied machine learning to Pakistani mobile-phone data in order to pick out individuals who might be couriers for terrorist groups. Who, for instance, had travelled from Lahore to the border town of Peshawar in the past month—and turned off or swapped their handset more often than usual? “It’s beginning to shift intelligence from the old world, where commanders asked a question and intelligence agencies used collection assets to find the answer, to a world where answers are in...the cloud,” says Sir Richard Barrons, a retired general who commanded Britain’s joint forces until 2016.

Indeed, the data in question need not

always come from an enemy. JAIC’s first project was neither a weapon nor a spying tool, but a collaboration with special forces to predict engine failures in their Black Hawk helicopters. The first version of the algorithm was delivered in April. Air-force tests on command-and-control planes and transporters showed that such predictive maintenance could reduce unscheduled work by almost a third, which might allow big cuts in the \$78bn that the Pentagon currently spends on maintenance.

Coup d’AI

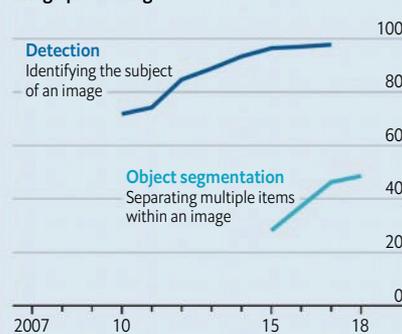
The point of processing information, of course, is to act on it. And the third way AI will change warfare is by seeping into military decision-making from the lowly platoon to national headquarters. Northern Arrow, a tool built by UNIQAI, an Israeli AI firm, is one of many products on the market that helps commanders plan missions by crunching large volumes of data on variables such as enemy positions, weapon ranges, terrain and weather—a process that would normally take 12 to 24 hours for soldiers the old-fashioned way by poring over maps and charts. It is fed with data from books and manuals—say, on tank speeds at different elevations—and also from interviews with experienced commanders. The algorithm then serves up options to hurried decision-makers, along with an explanation of why each was chosen.

These “expert system” platforms, such as Northern Arrow and America’s similar CADET software, can work far quicker than human minds—two minutes for CADET compared with 16 person-hours for humans, in one test—but they tend to employ rule-following techniques that are algorithmically straightforward. By historical standards this would be considered AI, but most use deterministic methods, which means that the same inputs will always produce the same outputs. This would be familiar to the soldiers who used the outputs of ENIAC, the world’s first electronic ▶▶

Learning curves

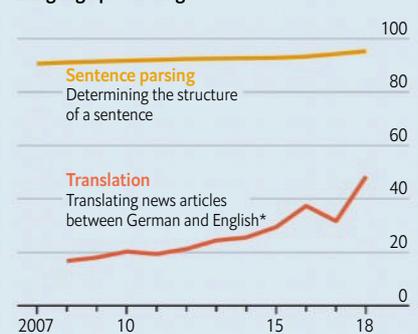
Success rate of best available AI system, %

Image processing

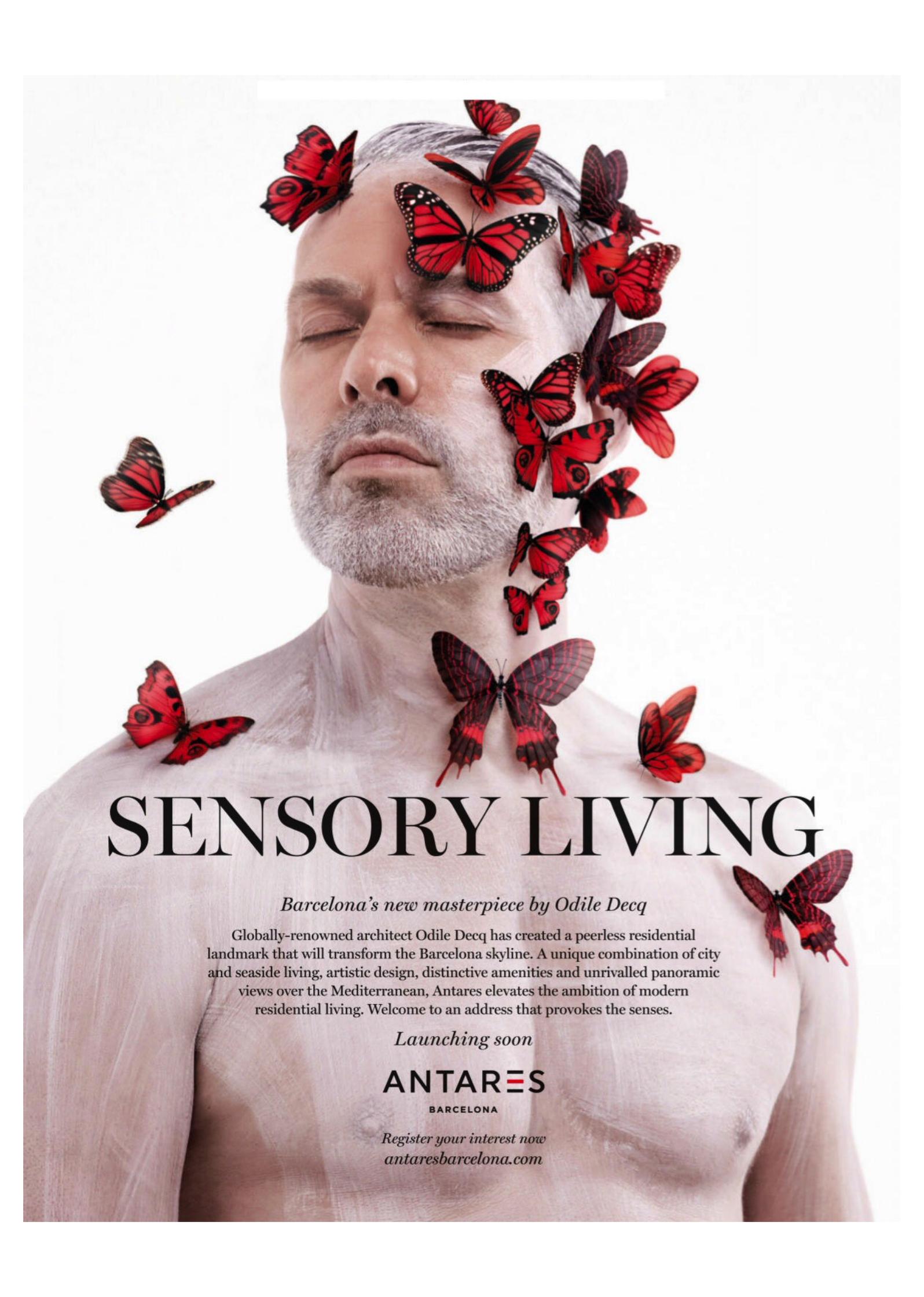


Source: Stanford University Artificial Intelligence Index 2018 annual report

Language processing



*BLEU score (% similar to a human-made translation)



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▶ general-purpose computer, which generated artillery firing tables in 1945.

In the real world, randomness often gets in the way of making precise predictions, so many modern AI systems combine rule-following with added randomness as a stepping stone to more complex planning. DARPA's Real-time Adversarial Intelligence and Decision-making (RAID) software aims to predict the goals, movements and even the possible emotions of enemy forces five hours into the future. The system relies on a type of game theory that shrinks down problems into smaller games, reducing the computational power required to solve them.

In early tests between 2004 and 2008, RAID performed with greater accuracy and speed than human planners. In simulated two-hour battles in Baghdad, human teams were pitted against either RAID or other humans; they could tell them apart less than half the time. The retired colonels drafted to simulate Iraqi insurgents "got so scared" of the software, notes Boris Stilman, one of its designers, that "they stopped talking to each other and used hand signals instead". RAID is now being developed for army use.

The latest deep-learning systems can be the most enigmatic of all. In March 2016, AlphaGo, a deep-learning algorithm built by DeepMind, beat one of the world's best players in Go, an ancient Chinese strategy game. In the process it played several highly creative moves that confounded experts. The very next month, China's Academy of Military Science held a workshop on the implications of the match. "For Chinese military strategists, among the lessons learned from AlphaGo's victories was the fact that an AI could create tactics and stratagems superior to those of a human player in a game that can be compared to a war-game," wrote Elsa Kania, an expert on Chinese military innovation.

Shall we play a game?

In December 2018 another of DeepMind's programs, AlphaStar, trounced one of the world's strongest players in StarCraft II, a video game played in real-time, rather than turn-by-turn, with information hidden from players and with many more degrees of freedom (potential moves) than Go. Many officers hope that such game-playing aptitude might eventually translate into a flair for inventive and artful manoeuvres of the sort celebrated in military history. Michael Brown, director of the Defence Innovation Unit, a Pentagon body tasked with tapping commercial technology, says that AI-enabled "strategic reasoning" is one of his organisation's priorities.

But if algorithms that surpass human creativity also elude human understanding, they raise problems of law, ethics and trust. The laws of war require a series of judgments about concepts such as propor-



Crowd mentality

tionality (between civilian harm and military advantage) and necessity. Software that cannot explain why a target was chosen probably cannot abide by those laws. Even if it can, humans might mistrust a decision aid that could outwardly resemble a Magic 8-Ball.

"What do we do when AI is applied to military strategy and has calculated the probabilistic inferences of multiple interactions many moves beyond that which we can consider," asks wing-commander Keith Dear, an RAF intelligence officer, "and recommends a course of action that we don't understand?" He gives the example of an AI that might propose funding an opera in Baku in response to a Russian military incursion in Moldova—a surreal manoeuvre liable to baffle one's own forces, let alone the enemy. Yet it might result from the AI grasping a political chain of events that would not be immediately perceptible to commanders.

Even so, he predicts that humans will accept the trade-off between inscrutability and efficiency. "Even with the limitations of today's technology, an AI might support, if not take over, decision-making in real-world warfighting" by using a "massive near-real-time simulation".

That is not as far-fetched as it sounds. Sir Richard Barrons points out that Britain's defence ministry is already purchasing a technology demonstrator for a cloud-based virtual replication of a complex operating environment—known as a single synthetic environment—essentially a military version of the software that powers large-scale online video games such as "Fortnite". It is built by Improbable, a gaming company, and CAE, known for its flight simulators, using open standards, so everything from secret intelligence to real-time weather data can be plugged in. "It

will revolutionise how command and control is done," says Sir Richard, as long as there are plentiful data, networks to move it and cloud computing to process it. That would allow a "single synthetic command tool from the national security council down to the tactical commander".

Automatic without the people?

Western governments insist that humans will be "on the loop", supervising things. But even many of their own officers are not convinced. "It seems likely humans will be increasingly both out of the loop and off the team in decision-making from tactical to strategic," says Commander Dear. The expectation that combat will speed up "beyond the capabilities of human cognition" recurs in Chinese writing, too, says Ms Kania. The result would not only be autonomous weapons, but an automated battlefield. At the outset of a war, interconnected AI systems would pick out targets, from missile launchers to aircraft-carriers, and choreograph rapid and precise strikes to destroy them in the most efficient order.

The wider consequences of that remain unclear. The prospect of accurate and rapid strikes "could erode stability by increasing the perceived risk of surprise attack", writes Zachary Davis in a recent paper for the Lawrence Livermore National Laboratory. But AI might equally help defenders parry such blows, by identifying the telltale signs of an impending strike. Or, like America's sensor-scattering spree in the Vietnamese jungle in the 1960s, such schemes could wind up as expensive and ill-conceived failures. Yet no power wants to risk falling behind its rivals. And here, politics, not just technology, may have an impact.

The Pentagon's spending on AI is a fraction of the \$20bn-30bn that was spent by large technology firms in 2016. Although many American companies are happy to take defence dollars—Amazon and Microsoft are nearing a \$10bn cloud-computing contract with the Pentagon—others are more skittish. In June 2018 Google said it would allow its \$9m contract for work on Project Maven to lapse this year, after 4,000 employees protested the company's involvement in "warfare technology".

In China, on the other hand, firms can be easily pressed into the service of the state and privacy laws are a minor encumbrance. "If data is the fuel of AI, then China may have a structural advantage over the rest of the world," warned Robert Work, a former US deputy secretary of defence, in June. Whether civilian data can fuel military algorithms is not clear, but the question plays on the minds of military leaders. JAIC director General Jack Shanahan expressed his concerns on August 30th: "What I don't want to see is a future where our potential adversaries have a fully AI-enabled force and we do not." ■

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Memoirs and manifestos

Campaigning in prose

WASHINGTON, DC

Even when they say nothing new, candidates' books can be revealing

VOTERS DO NOT care much about policy. They pick candidates because they like them, and feel they care. Skilful politicians know how to deploy policy to signal affinity between themselves and their audience. "Build a wall" did not mean simply, "I'm going to erect an impenetrable barrier along our southern border"; it was also Donald Trump's way of telling voters that, like some of them, he preferred an America with fewer immigrants. Similarly, "Medicare for all" does not just mean, "I will immediately abolish all private insurance and move people to a state programme"; it is a way for Bernie Sanders and Elizabeth Warren to communicate that they aspire to a more activist government. As well as liking and aligning with candidates, ideally voters should feel they know them well, too.

Political-campaign books are a sign of seriousness to activists and donors. In the best ones, candidates tell voters what they think, who they are, where they come from and what they want to do in office. Rallies,

debates and adverts reach more people, but books give politicians space. They can introduce themselves and their ideas without interruption and at length. These works all follow certain conventions: parents and teachers are praised, every remembered interaction offers a lasting lesson, obstacles are overcome and doubters vanquished. But each is also an artefact of the candidacy it promotes.

Each chapter in Bernie Sanders's book, for instance, is headlined with a date. "Where We Go From Here" reads as though, on those particular dates, he turned on the recording function on his smartphone, shouted into it for a while, and then got an intern to transcribe everything. Most candidates edit and present their earliest memories. Not Mr Sanders. In passing readers learn that he has children, grandchildren and a brother, and that he first ran for the Senate as a third-party candidate in 1971. During a visit to Missouri, a colleague slept in a bed that Margaret Thatcher had

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used, whereas Mr Sanders "opted for a room across the hall" (whether out of principle or for convenience is unclear).

Mr Sanders's aversion to personal details extends beyond his own. He says he got "goose-bumps" from talking to a D-Day veteran, and "will never forget" meeting him, but fails to note what the man actually said. In his world there are no individuals, just victims of malign historical forces that must be defeated through revolution. Readers will learn nothing about him that they did not already know. That itself tells them something valuable: like President Trump, Mr Sanders is a factional candidate uninterested in expanding his base. He will happily accept more votes, but from people whose eyes have become unscaled. The grubby business of persuasion and compromise is beneath him.

By contrast, Ms Warren, Mr Sanders's rival on the left of the Democratic field, turns out to be quite good at persuasion. It is not an endorsement of her policies to note that she is conspicuously better than any other candidate at explaining why she favours them, and why they matter to ordinary people. She has a rationale for running: she wants to rebuild the American middle class by reviving New Deal regulations and adding more. In "This Fight Is Our Fight", she connects everything back to that mission.

She turns her upbringing into a discourse on wage stagnation. Gina, a woman ▶▶

▶ Ms Warren met soon after she began writing her book, exemplifies the struggles of middle-class Americans. People are individuals, not oppressed, indistinguishable masses (Gina is “the kind of woman who talks to people around her in the grocery-store line and who knows every clerk by name”). At times, Ms Warren’s political platform seems a sort of leftist Trumpism, with corporations rather than immigrants as the villains responsible for all ills. But if Democratic primary voters decide they want a fighter rather than a conciliator or sloganeer, she might be the choice.

The other front-runner, Joe Biden, leads with his heart. Mr Biden has suffered terrible loss: when he was 30, just weeks after he was first elected as a senator, his wife and infant daughter died in a car crash. “Promise Me, Dad” centres on his last years as vice-president, when he was deciding whether to run in 2016 and his older son, Beau, was struggling with the cancer that ultimately killed him. Even Mr Biden’s most ardent opponents might find themselves moved, though the most emotive section is the eulogy for Beau delivered by Barack Obama—a reminder, like the rest of these books, that no president, except perhaps Ulysses Grant, has written as well as Mr Obama.

Speak, memory

By contrast, readers of “The Truths We Hold” by Kamala Harris are at no risk of an emotional response. Ms Harris is for all the good things and against all the bad ones. She has a lawyer’s gift for framing debates. Her slogan, “We must speak truth”, implies that other politicians do not. She became a prosecutor, she claims, not out of political ambition—though that is no sin, as unambitious politicians tend not to win, and they certainly do not run for president—but “to be on the front lines of criminal-justice reform...to protect the vulnerable.” Throughout, her thoughts are farther left than her actions, which will strike some readers as prudent and others as insincere.

Her fellow ex-prosecutor, Amy Klobuchar, has produced a much stranger book. She calls herself (and her book) “The Senator Next Door”, which, like the cover image of her with a cup of coffee and a newspaper, is meant to convey everyday relatability. And indeed, Ms Klobuchar did have a modest upbringing. Yet her prose seems most alive when she is listing the impressive jobs held by her friends or rehashing old grievances. Readers will learn the names of the school principal who sent her home in fourth grade for wearing trousers, of the neighbours who failed to chain their scary dog and of a teacher who predicted an average future because young Amy coloured in a bunch of grapes poorly.

Pete Buttigieg, Cory Booker and Marianne Williamson have written kinder

books. Mr Buttigieg says he would have been a novelist had he not run for office, and it shows in his eye for character and detail in “Shortest Way Home”. Mr Booker defies literary conventional wisdom: making nice people interesting is notoriously hard, and even harder when the nice person himself is narrating, but in “United” Mr Booker comes across as both generous and a shrewd observer. He seems to lack ruthlessness, which speaks well of him as a man but less so as a contender.

Ms Williamson does not lack ruthlessness so much as experience, attention to detail and (in “A Politics of Love”) an ability to speak in anything other than patchouli-scented clichés. “Spirituality is the path of the heart” and “love is the nutrition of the gods” are phrases more worthy of a fortune cookie than of a would-be president. As for her plea to “break free of the rationalism constraining our politics”, the current occupant of the White House has accomplished that neatly already. ■

Metafiction

Tilting at windmills

Quichotte. By Salman Rushdie. *Random House*; 416 pages; \$28. *Jonathan Cape*; £20

UPROOTING THE action of Miguel de Cervantes’s 17th-century picaresque “Don Quixote” to present-day America, Sir Salman Rushdie’s characteristically busy new book follows Sam, an Indian novelist who lives in New York. Sam draws on his own family strife to write the fantastical tale of a salesman, Ismail, out to woo Salma, an Indian-American talk-show host and “Oprah 2.0”.

A talking gun and mastodons in New Jersey are among the oddities that Ismail, known as Quichotte, encounters during the road trip at the heart of this tricky narrative. It is “the Age of Anything-Can-Happen!” Quichotte thinks, when a teenage son, Sancho (recalling Quixote’s comrade, Sancho Panza), magically appears to join him. “I’m a projection of your brain, just in the way that you started out as a projection of [your father’s],” a cricket tells Sancho, à la Pinocchio.

A metafictional romp doubling as an oblique portrayal of the post-truth zeitgeist (and this week shortlisted for the Booker prize), “Quichotte” ought to be fun. Yet its teeming subplots fail to spark. Storylines about Salma’s secret opioid addiction, or a social-media storm that engulfs Sam’s estranged sister—a British politician accused of racism—seem to arise only from a desire to be topical. The dialogue and narration often sound like a vessel for the author’s views on matters from Brexit to the veil; the cast features a technology guru resembling Elon Musk and a Big Pharma boss caught in a #MeToo scandal.

“Quichotte” expends a great deal of energy going nowhere in particular. A reference to a character’s “kindliness” carries a footnote explaining that he is “by no means kindly in all matters. As we shall see. As we shall presently see.”



Salma’s past goes unmentioned, “out of respect for her privacy”, before a back-track: “the privacy rights of fictional characters are questionable—to be frank, they are nonexistent—and so we hereby abandon our modesty.” It turns out the hesitation was redundant: Salma has spoken openly “on many nationally syndicated television talk shows”, so “we are not probing very deeply into her personal matters by revealing them.”

As the book’s real and invented worlds collide, there are affecting moments. Sancho falls for a woman to whom—being a figment of imagination—he is invisible. Sam creates a scene in which Ismail and Sancho witness a deadly racist attack, only for the incident to recur in Sam’s own life, forcing him and his son to intervene. But ultimately Sir Salman’s games feel more bloated than bountiful. When he excuses yet another digression by saying that “so many of today’s stories are and must be of this plural, sprawling kind”, it sounds like special pleading.

Forgotten history

A killing field

First to Fight: The Polish War 1939. By Roger Moorhouse. Bodley Head; 400 pages; £25

EVERYONE AGREES that the second world war was seismic. Ask when it started, however, and views differ, revealingly. For Chinese, it was the Japanese attack of July 1937. Soviet and Russian histories mark June 22nd 1941, when the perfidious Nazi invasion began. Britain and France regard the period between the declaration of hostilities in 1939 and May 1940 as the “phoney war”, or *drôle de guerre*.

But as Roger Moorhouse, a British historian, notes, there was nothing phoney about the war in Poland. The opening five weeks of slaughter were a gory template for the 300 that followed: 200,000 people died, the overwhelming majority of them Poles, and mostly civilians. Poles would be “exposed to every horror that modern conflict could devise”, including indiscriminate aerial bombing, and massacres of civilians and POWs.

Yet the campaign fought by Nazi Germany from September 1st 1939, the associated Soviet invasion on September 17th, and the brave, chaotic and doomed defence launched by Poland, are strangely absent from standard histories, in any language. The last serious British study of this aspect of the war was published in 1972. The biggest television history of the conflict, “The World at War”, a 26-part documentary broadcast in 1973, interviewed most of the surviving decision-makers—but did not include a single Polish contributor.

Mr Moorhouse’s book remedies that gap, weaving together archival material, first-hand accounts, perceptive analysis and heartbreaking descriptions of Poland’s betrayal, defeat and dismemberment. Pre-war Poland was a big country, with the world’s fifth-largest armed forces. But it was an economic weakling. The combined Polish defence budget for the five years before the outbreak of war was just one-tenth of the Luftwaffe’s allocation for 1939 alone. The Poles had courage, flair and grit. But they lacked the decisive elements: armour and air-power. Military planning was plagued by secrecy and mistaken assumptions. Some of the top commanders were notable duds.

Despite that, Hitler’s stuttering war machine was repeatedly halted, bloodied and on occasion even defeated by the Polish defenders. The myth of invincible Blitzkrieg was burnished, self-interestedly, by the Nazis themselves. For their part, the

Western allies, Britain and France, portrayed Poland as a hopeless cause to justify their defence of their ally “using vowels and consonants alone”. One of many striking anecdotes on this score concerns Britain’s reluctance to bomb Germany—on the ground (seriously) that it risked damaging private property.

Kremlin self-interest skewed the story, too. Stalin’s march into eastern Poland, under a secret deal with Hitler, was justified on the (fictitious) basis that the Polish state had already ceased to exist, and that only Soviet intervention could restore order. In fact, the savagery of the Soviet occupiers matched, and sometimes even exceeded, that of the Nazis. Both invaders, writes Mr Moorhouse, applied a “brutal, binary, totalitarian logic: a racist binary in the German case, a class binary in the Soviet.” In the eyes of the Nazis, a circumcised penis

justified execution. For the Soviets, a soft, uncallous palm signalled an intellectual who ought to be eliminated. In all, 5.5m Polish citizens (including 3m Jews), or a fifth of the entire pre-war population, would perish.

The surrender of Poland’s regular forces on October 6th did not mark the end of the fighting. A well-organised underground army, reporting to the government-in-exile in London, continued the struggle until the further and final betrayal of Poland’s interests by the Western allies at Yalta. It all deserves more than the simplistic but widespread caricature of a country which met the invading tanks with a cavalry charge. As Mr Moorhouse admirably explains, Poland’s cavalry was in fact remarkably effective. The blame for defeat, and for the subsequent distortion and neglect of Poland’s story, lies elsewhere. ■

Tradecraft and stagecraft

Laughter in the dark

A bold new play about the assassination of Alexander Litvinenko

A MAN LIES in a hospital bed, dying. But in his final days, he helps unravel his own murder; the solution links his grim fate to a lurid world of violence and corruption. With its ticking clock, and mix of private agony and grand themes, the case of Alexander Litvinenko was inherently theatrical. Now, in “A Very Expensive Poison”, it has been ingeniously reimaged on the stage of the Old Vic in London.

In an operation so inept it might be comic were it not so cruel, in 2006 two Russian assassins poisoned Litvinenko with polonium in a London hotel, leaving a trail of radioactive smears. Under guard, their victim accused Vladimir Putin of orches-

trating the hit. The play by Lucy Prebble, who turned another twisty news saga into zany drama in “Enron” (2009), begins with Marina Litvinenko pondering a push for a public inquiry into her husband’s death, in the face of obstructive British ministers. “It will stop it happening again, yes?” she asks—ironically, given the botched poisoning of Sergei Skripal in Salisbury in 2018. “I was really struck by the bald-faced lies and denials [from Russia],” Ms Prebble says, but also “by the shabby cowardice of the British response...There was something in it that was a harbinger for now.”

Her play traces Litvinenko’s past as an agent of the FSB, Russia’s main security service, and his family’s flight to London after he alleged, among other things, that his colleagues had schemed to kill Boris Berezovsky. (The oligarch sought refuge in Britain, too, and died murkily in 2013.) At the same time it dramatises the sleuthing that led to the culprits. “He has to work harder to be trusted, because he’s seen as too trustworthy,” notes a detective grappling with the FSB’s warped code, in which honesty is a liability—speaking for the many Britons who were stunned by the irruption in their capital of these reckless conspiracies.

“A Very Expensive Poison” weaves a moving portrait of a marriage—“You’re in a bad mood because you’re hungry,” Marina tells Alexander—with self-referential jokes and escalating high-jinks. Berezovsky sings a vaudeville number; the origins of ▶▶



Every story is a lie

Johnson Wars of words



When language is the pursuit of politics by other means

THE MUSEUM that honours Johannes Aavik in Kuressaare, a small town on an Estonian island, may not seem impressive. Outside, the national flag is desultorily tangled in a tree. Inside the small building, an attendant jumps up in surprise to turn on the lights for the only visitor. Of the two rooms, just one is devoted to Johannes (the other deals with his brother Joosep, a musician).

Yet Aavik deserves his museum. Few people have ever coined more words that subsequently came to be used. Over the centuries Estonia was dominated by Danes, Germans, Swedes and Russians. It is estimated that a third of its vocabulary is borrowed. So in the early years of the 20th century, when Estonia was still part of the Russian empire—and then after it declared its independence in 1918—Aavik set about coining Estonian replacements for some of those borrowings. Some he took from rural dialects; others were created on the model of Finnish (which, unlike most European languages, is related to Estonian).

But quite a few, he simply made up. A modern scholar thinks he might have coined *roim*, “crime”, with the English word at the back of his mind. Aavik himself claimed that he merely sought short words that sounded beautiful and seemed Estonian, even though they were, at least at the moment he invented them, nonsense.

Aavik was part of a wave of linguistic purism that was then sweeping Europe. In the medieval period, Latin had been thought the only language worth writing. But gradually authors in France and Italy began to see their own tongues—descendants of Latin—as worthy of literature, too. The trend was boosted by Protestantism, which preached that everyone should have access to scripture

in their own languages. The “vernaculars” became respectable.

Or some of them did. A few big languages, backed by states, gained kudos. Small, stateless ones were still belittled. Only Russian and German could be spoken at Aavik’s school. Little wonder that the atmosphere nurtured a nationalist.

Aavik’s efforts mostly predated independence. Other language reformers have begun their work only after they had a state at their disposal. The new republic of Turkey, under Kemal Atatürk, had lost many of the Ottoman empire’s provinces; its pride was wounded and its population now far more Turkish. Atatürk decreed a switch from the Arabic to the Latin alphabet and, in an extraordinary purge, sought to get rid of Arabic and Persian borrowings, replacing them with new coinages. One scholar calls this a “catastrophic success”: modern Turks need special training to read the Turkish of a hundred years ago.

Purist engineering has also been used to distance a language from an overly close relative. Standard Norwegian was once too

similar to Danish for some Norwegians; hence the creation of “new Norwegian” (*nynorsk*), cobbled together from dialects and avoiding Danish echoes, which today is co-official alongside the older Dano-Norwegian (*bokmal*). Hindi and Urdu are close enough that some consider them a single language, but since Indian and Pakistani independence, new Hindi coinages and borrowings have tended to come from Sanskrit, Urdu ones from Arabic and Persian. The languages are growing apart.

In fact, places that accept foreign words with a live-and-let-live attitude are the exceptions. Centuries ago, English, which seems undogmatic, itself experienced the “inkhorn controversy”, in which some intellectuals freely coined words from Greek and Latin, such as “educate” and “ostracise”. (Some, such as “suppediate”, meaning “to supply”, never made it.) Aavik-like, purists fought back, coining terms like “witcraft” to replace borrowings like “reason”. Their attitude was exemplified by Sir John Cheke, who in 1557 wrote: “I am of the opinion that our tung should be written cleane and pure, vnmixt and vnmangled with borrowing of other tungs.”

Most of the inkhornisms survived. These days, English has become so robust that it is no longer the polluted but the polluter. That it now lacks a purist tendency of its own may be less because the British are naturally laissez-faire liberals than because English is the world’s top linguistic dog. It exports words around the globe, often to the alarm of nationalists overseas. They might take some comfort from the fact that English thrived after its controversial mangling. Objectively, borrowing does no harm. But then, such worries are rarely objective to begin with.



▶ polonium are outlined in verse. The antics are meant “to capture how overwhelming and tonally inconsistent life feels,” the playwright says. “Just like on your social-media feed; a funny cat next to a terrorist attack next to a dear friend’s depression.” The helter-skelter spectacle is also an insightful commentary on the way power is now wielded, in Russia and beyond.

Apart from the Litvinenkos, the main character is Mr Putin, who emerges as a kind of sinister ringmaster. His creepy persona reflects the winking mendacity and distracting stunts that typify his real-life

rule. Stagecraft mimics statecraft—which is itself a distorted form of entertainment. In a bold scene, the Putin of the play recounts the theatre siege in Moscow in 2002 in which 130 hostages died. “As soon as anyone starts telling a story,” he warns, “they start telling a lie.” The role is “an expression of how easy it is to manipulate and control a population,” says Ms Prebble. “In this case, an audience.”

It was over nine years before a judge in the eventual public inquiry found that Mr Putin had “probably” approved Litvinenko’s murder. As Luke Harding, a jour-

nalist who wrote the gripping book on which the play is based, says, there is no prospect that the assassins will be extradited from Russia (where one is an MP). But art, he thinks, offers its own form of justice.

If so, the reckoning will continue next year, when an opera about the case opens at Grange Park Opera in Surrey. It will allude to Tchaikovsky and Russian football chants, says Wasfi Kani, the company’s boss. And, like the play, it will invoke the “love and betrayal and jeopardy” that all drama craves—and that make Litvinenko’s story enduringly tragic. ■