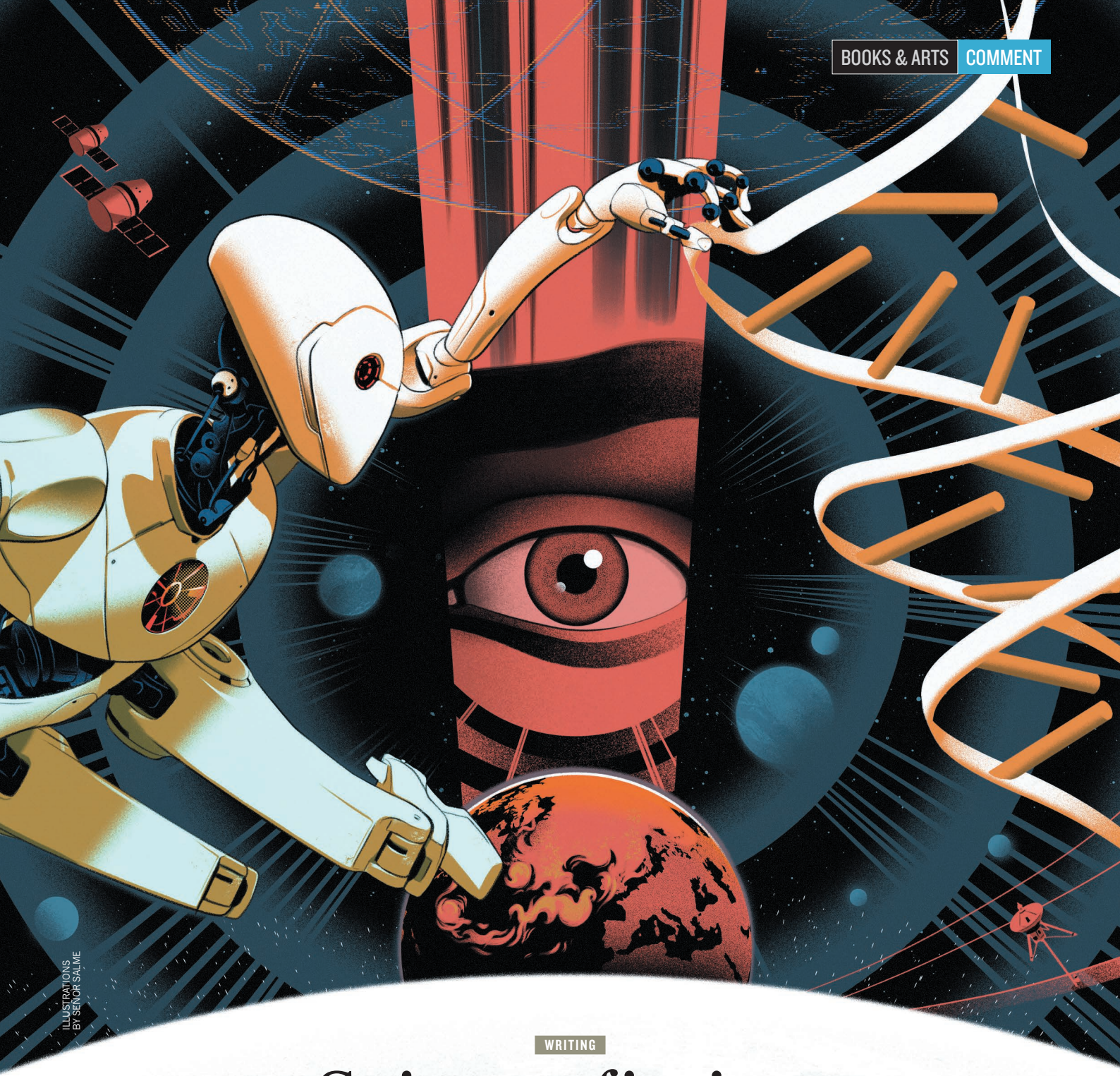


ILLUSTRATIONS BY SEÑOR SALME

WRITING

Science fiction when the future is now

Six authors parse the implications of our unhinged era for their craft.

AlphaGo, fake news, cyberwar: 2017 has felt science-fictional in the here and now. Space settlement and sea-steading seem just around the bend; so, at times, do nuclear war and pandemic. With technological change cranked up to warp speed and day-to-day life smacking of dystopia, where does science fiction go? Has mainstream fiction taken up the baton?

Nature asked six prominent sci-fi writers — Lauren Beukes, Kim Stanley Robinson, Hannu Rajaniemi, Ken Liu, Alastair Reynolds and Aliette de Bodard — to reflect on what the genre has to offer at the end of an extraordinary year.

LAUREN BEUKES
The power of Afrofuturism

Lauren Beukes's latest volume is Slipping, *a collection of short stories and essays.*

Is science fiction relevant in an age of catastrophic climate change, the refugee crisis and the rise of the far right? Yes: not for what it predicts about the future of the world, but for how it unpacks who we are in it.

In her 1973 short story 'The Ones Who Walk Away From Omelas', novelist Ursula K. Le Guin wrote about a fictional utopia that came at a terrible cost everyone knew about: a single child tortured in a room underneath the city, in the filth and the dark, to pay for their happiness.

For me, Omelas is a compelling way of understanding the world I grew up in, as a white South African under apartheid. White people make up only around 9% of the population, but, until 1994, they held the rest of the country hostage under a racist, inhumane and violent regime that forced people of colour into indentured labour and inferior schools, and responded to resistance with tear gas and shootings, hit squads and torture farms.

Science fiction allows us the distance to circumvent issue fatigue in our very troubled times. We can play out ideas and scenarios because we are creatures of parable and myth and allegory, TED talks and ethical trolley problems. Fiction is how we grapple with ourselves. By imagining the unimaginable, it's possible to make reality more bearable.

Afrofuturism is an artistic, aesthetic and philosophical movement that combines science fiction, magic, traditional beliefs, black history and culture. Take, for instance, Nigerian-American novelist Nnedi Okorafor's genre-straddling works; Senegalese director Selly Raby Kane's 2017 virtual-reality film *The Other Dakar*; Kenyan director Wanuri Kahiu's "AfroBubbleGum" art; Malawian writer Shadreck Chikoti's sinister utopia, *Azotus the Kingdom* (Malawi Writers Union, 2015). All these are preoccupied with the unique social issues of developing countries and the creative, alternative and unexpected ways in which people living in them respond.

The most exciting aspect of Afrofuturism is perhaps how it dares to imagine a future for what has been historically, abhorrently dismissed as 'the dark continent'. It's not necessarily about imagined alternative cities, but about the real ways in which disruption and decolonization are happening across the continent now.

The 1997 democratic constitution of South Africa was based on the African philosophical principle of *ubuntu*: a person is a person because of other people. It's the rational humanist theory that we are all interconnected and interdependent. The most interesting science fiction examines what it means to be human through the lens not only of what technology does to us, but also of what we do with it. And in South Africa, with our unique challenges and lack of resources, we make a plan, we hustle. In Xhosa, the term is *vuku'nzenzele* — get up and do it for yourself.

Innovation in Africa is a do-it-yourself magpie: we steal the best bits from different disciplines and traditions to create interventions that work for our unique circumstances. Indigenous and social knowledge has to sit alongside conventional science and medicine. Examples range from developing pioneering smartphone payment apps such as Mpesa to building kites to use as camera drones for geographical surveys, and sending text-message reminders to people on tuberculosis and HIV medication. The Vimba app connects rape survivors with crisis organizations; researchers at Stellenbosch University near Cape Town have developed nanofibre tea bags to filter water in rural areas.

> ***"The stories we tell ourselves about ourselves shape who we are — and who we can be."***

But our uniqueness also lies in how we tell our stories. That includes the discovery of the 250,000-year-old hominin *Homo naledi*. An all-women team of "underground astronauts" descended into the "cave of stars" near Johannesburg to exhume the remains, using the language of astronomy to break away from a history of human palaeontology that had been used to prop up racism.

All of this is why we need science fiction in Africa. The stories we tell ourselves about ourselves shape who we are — and who we can be.

KIM STANLEY ROBINSON
3D glasses on reality

Kim Stanley Robinson's latest book is New York 2140.

We are now living in a science-fiction novel that we are all writing together. The present feels dangerous and volatile, and which future will actually happen is radically uncertain. It could be a good life for future humans in a shared and interdependent biosphere. It could be extreme climate change, a mass-extinction event, agricultural collapse and intense deadly conflicts among desperate human groups, including nuclear war.

To grapple with this bizarre breadth of possible futures, I tend to take it one story at a time. And I deploy a set of organizing ideas.

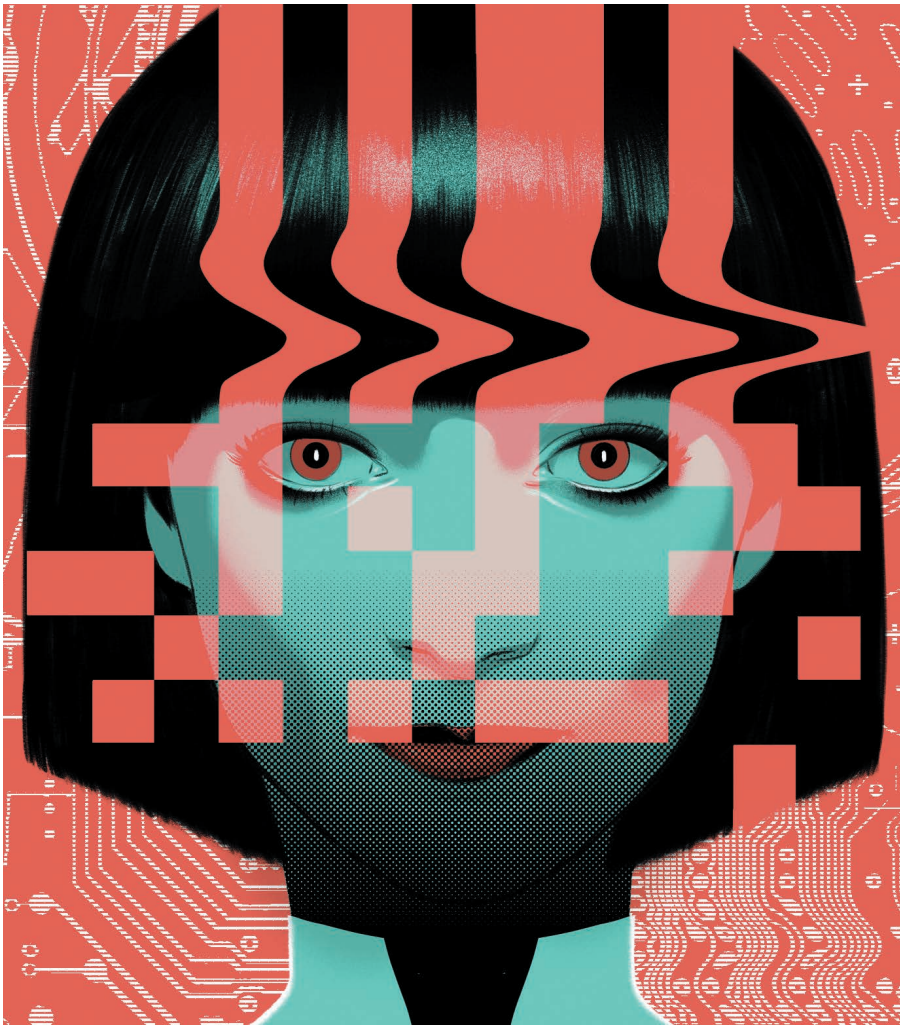
Science fiction is the realism of our time. It describes the present in the way a skeet shooter targets a clay pigeon, aiming a bit ahead of the moment to reveal what is not yet present but is already having an impact. This gives us metaphors and meaning-systems to help conceptualize our moment. So, as with any other realist art, you pluck just one strand out of the fabric of the total situation, and follow where it leads.

Because a novel is not a world. Even if it is about a world. It's just one story among millions that could be told, so it doesn't have to describe everything.

We read fiction to have two science-fictional experiences: time travel and telepathy. Fiction takes us to other times and places (Regency England, the Ice Age, the moons of Jupiter), and it takes us inside people's heads, where we hear their thoughts and feel their feelings.

And science fiction can describe any time, from tomorrow to billions of years hence. That's a big spread, and it creates a number of subgenres, each with its own qualities. Space operas set in the distant future use the whole Universe as a story space, sometimes to spectacular effect. Near-future science fiction is the proleptic realism I describe above. In between these, say from about one to three centuries from now, there exists a less-populated story zone that I find interesting. You could call it future history. Stories set in this zone resemble nineteenth-century social novels: the characters interact not just with each other, but with their societies and even their planets. Possibly, confronted with the mind-boggling complexity of our present, describing events a century from now allows us to de-strand chosen elements for closer examination.

Here's how I think science fiction works aesthetically. It's not prediction. It has, rather, a double action, like the lenses of 3D glasses. Through one lens, we make a serious attempt to portray a possible future. Through the other, we see our present metaphorically, in a kind of heroic simile that says, "It is as if our world is like this." When these two visions merge, the artificial third dimension that pops into being is simply history. We see ourselves



and our society and our planet "like giants plunged into the years", as Marcel Proust put it. So really it's the fourth dimension that leaps into view: deep time, and our place in it.

Some readers can't make that merger happen, so they don't like science fiction; it shimmers irreally, it gives them a headache. But relax your eyes, and the results can be startling in their clarity.

KEN LIU

Staying human in the cataclysm

Ken Liu's latest book is The Wall of Storms, *the second entry in his critically acclaimed silkpunk series Dandelion Dynasty.*

Watching *Blade Runner 2049*, it struck me that this was a future that — just as in the film's 1982 precursor, *Blade Runner*, set in 2019 — was dominated by flying cars. Science fiction, even the sort that takes the idea of 'futurology' seriously, hasn't been very good at predicting reality. Look around: where are the moon colonies or cranial ports for wandering the Matrix?

I spent a considerable part of my career as a sort of historian of technology (primarily for the benefit of litigants in patent and trade-secret disputes). My own diagnosis is that our attempts to imagine the future are thwarted by the fact that the evolution of technology is dominated by false starts, chance encounters and path dependence. No one who saw the first HTML page by World Wide Web inventor Tim Berners-Lee could have predicted Tumblr and Twitter, or have imagined that applying filters to selfies would become a multibillion-dollar business. 'Black swans' interrupt every smooth extrapolation curve.

Yet we cannot accept our essential fallibility in the face of the unpredictable future. We must devise unverifiable theories and tell just-so stories that retroactively construct a sensible narrative; this then makes the path that we did take seem ordained.

We humans are trapped by the narrative fallacy. The physical world may be irreducibly random, but our minds have evolved to assign causation to correlation, to see patterns in noise, to comprehend history not as one damned thing after another, but as the unfolding of some grand plan — perhaps the work of an Author.

The pace of invention seems to be speeding up, and advancing technology amplifies the power of every individual in our complex world, for good and ill. It's possible now for a single person to bring the world to its knees with a well-designed bit of computer code; soon, someone may engineer a biological virus and slaughter millions. The world has grown only more random and unpredictable.

Science fiction has reacted with ever more imaginative predictions. Will genetic engineering allow us to live for hundreds of years? Will we be uploaded into the cloud to live as digital gods? Will a super artificial intelligence enslave us? Or will we devise a post-scarcity creative economy so that aliens will finally show up to welcome us to the Galactic Republic?

Chances are, none of these futures will transpire. They are too easily derived from the trajectory of the present. Reality doesn't follow a constructed plot or fulfil character arcs: the future we experience will be both stranger and more mundane than these visions.

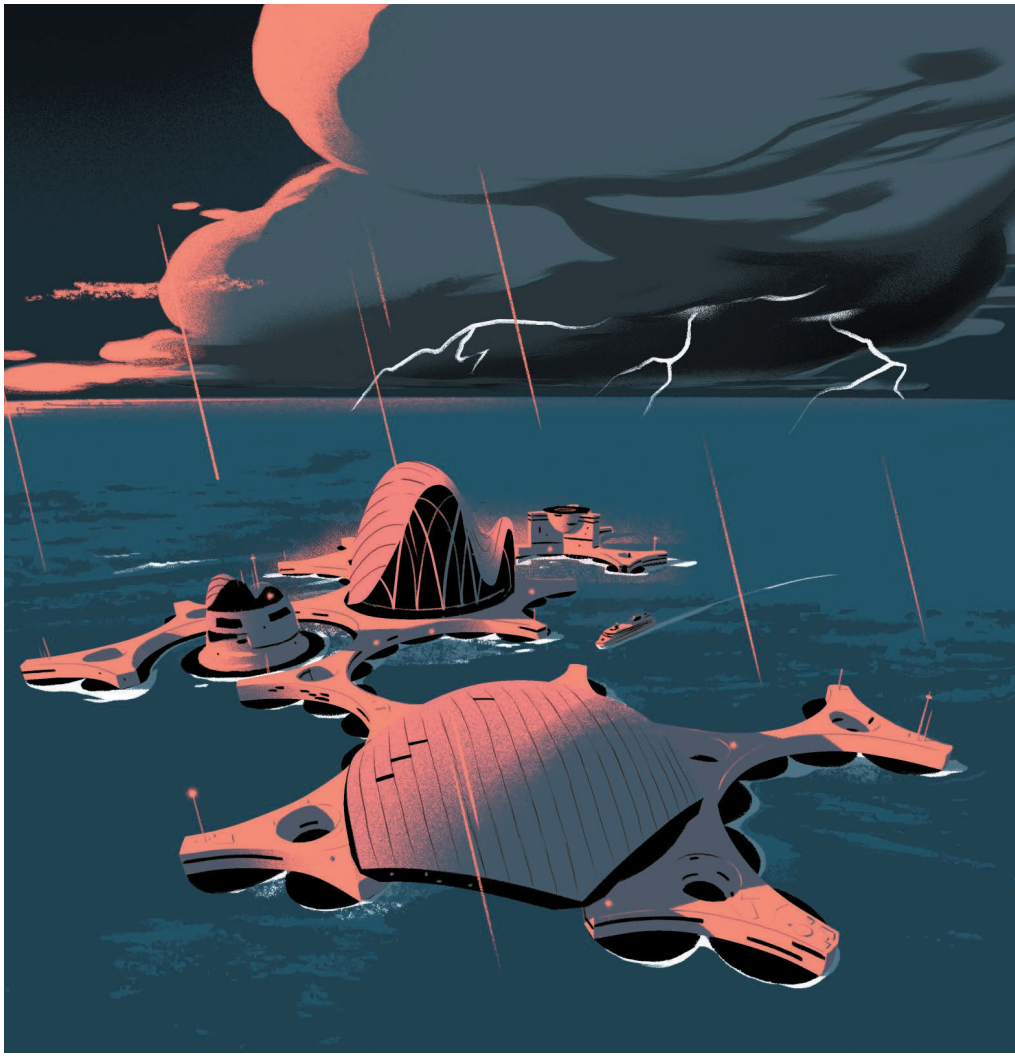
Although science fiction isn't much use for knowing the future, it's underrated as a way of remaining human in the face of ceaseless change. The real world of mass surveillance and corporate propaganda may be much more sinister and complicated than the worlds imagined by George Orwell in *1984* and Aldous Huxley in *Brave New World*. But these novels' heroes turned to our past in search of core humanistic values as a bulwark against overwhelming technological oppression and the opiate of distraction. That remains timeless. Cyberpunk may not have predicted much of our world of always-on mobile network connections or augmented reality realized through smartphones instead of goggles and implants. It did, however, give us a vocabulary for thinking about virtual presence as an essential part of technology-mediated human relationships. Through social media and rich chat platforms, I can now maintain meaningful friendships in cyberspace, although I rarely embody an avatar as envisioned by cyberpunk writers.

The science fiction that ages well has always centred on constructing humanistic narratives — or souls, if you want to use that word — in the face of cataclysmic change. I sense, although I cannot predict, that this is one skill we'll increasingly need in the coming uncertainties.

HANNU RAJANIEMI

Making stranger worlds

Hannu Rajaniemi's next book will be the alternative-history thriller Summerland.



In the Netflix programme *Stranger Things*, a nostalgia-tinged small town in 1980s America is attacked by supernatural forces. To make sense of what is happening, the preteen protagonists turn to the classic game Dungeons & Dragons and name the invading monsters after creatures from it.

Our world, too, is undergoing an invasion of the strange. An algorithm became capable of defeating the best human players of 2,500-year-old board game Go after three days of playing itself. Gene drives may soon spread population-suppressing genes to malaria-carrying mosquitoes. And at least one Silicon Valley plutocrat has a good chance of being buried on Mars. It's not surprising that the media calls on iconic sci-fi figures to describe these developments — a recurring cast that includes the Terminator, Frankenstein and Iron Man.

Working scientists scoff at such comparisons, knowing how fragile early experiments and nascent technologies can be. Some scientists I've come to know in both my academic and biotechnology start-up careers develop a gag reflex to science fiction, weary of trying to describe their work against a backdrop of preconceived notions. Yet science fiction can help both scientists and non-scientists to comprehend each other and make sense of our topsy-turvy era.

To understand how, we must look beyond sci-fi's worn tropes, to how we read it. In science fiction, as in all fiction, you get to be someone else — but the imaginary world around you is also unfamiliar, inviting you to learn its rules from the inside. The reader has to engage in active sense-making, with the author's implicit assurance that there is a discoverable underlying order. When that happens, there is often a transcendent, goosebumpy moment that opens still greater vistas beyond the page, in the reader's imagination.

This sense of wonder is the closest you can get to the joy of scientific discovery without actually doing science. That is of immense value to the public understanding of science. Teaching researchers to imagine a new technology's impact from a first-person perspective is a more powerful way to give them a sense of responsibility than is any consultancy report or statistic. As we contemplate social paralysis in the face of overwhelming change — future shock, as coined by author Alvin Toffler in the 1970s — science fiction can shield us.

So the genre must now work harder to make its worlds stranger. Its recent embrace of diverse voices across the globe helps. And to craft scientific and technological metaphors for our complex era, we must turn to sciences of complexity. Biology, neuroscience and economics are still woefully underused in modern science fiction — although the work of authors such as Johanna Sinisalo and Nancy Kress, among others, shows their power and wonder. These novels teach us empathy for characters caught in the unravelling of intricate human, technological and ecological systems: one might call it systems fiction.

Just as research is starting to embrace openness and citizen scientists, some creators are experimenting with collaborative science-fictional world-building. Mark Watney, hero of *The Martian* (2011) would not have been able to "science the shit out of" his predicament on Mars without the help of author Andy Weir's online beta readers, who obsessively checked every technical detail. Keeping sci-fi relevant is also changing how we write it.

What ultimately allows the heroes of *Stranger Things* to triumph is not Dungeons & Dragons' static lore, but the lessons learnt from playing it: working together to map the unknown, avoid its traps and bring treasure home. When we return from the journey, the world may not be any less strange or shocking. But it may just be more wondrous.

ALASTAIR REYNOLDS

The bards of turbulence

Alastair Reynolds's most recent novel is Revenger. *His next,* Elysium Fire, *will be published in January 2018.*

In a science-fictional present, thinking about futures can feel difficult. This year, when the AlphaGo algorithm designed by Google's DeepMind beat the world's

best human Go player — something long assumed to be beyond the capabilities of artificial intelligence — it was hard not to feel that a corner had been turned. And so much else has become normalized: human–pig hybrid embryos, commercial spaceflight, neuroprosthetics, cyberwarfare. Not far off loom wild cards from global pandemics to head transplants, hyperloops and sea-steading.

With a present this intractable, some might say that science fiction as a serious speculative enterprise has had its day.

Consider, however, the science-fiction writer of a century ago, surveying her world at the cusp of 1918 and trying to think cogently about the coming era. The preceding decades would have felt to her like an ever-accelerating stampede of scientific, technological and sociological upheavals.

Within living memory, steam power had vanquished the 'age of fighting sail'. Electricity had begun to supplant gas as the means of lighting cities. Cars and trucks were displacing horses; mechanized warfare was taking over on the battlefield (the tank first saw service in 1916). A transatlantic telegraph system — the first piece of global telecommunications infrastructure — had existed since 1858. But it was already looking old-fashioned next to the wireless telegraphy and radio developed by Guglielmo Marconi and others, including Reginald Fessenden, who first demonstrated wireless voice transmission in 1900. Albert Einstein's general theory of relativity would shortly pass its first experimental test, even as the quantum revolution gathered pace.

The writer would have been aware of other discoveries with daunting ramifications. Among these were subatomic structure, evidence of 500-million-year-old ecosystems in the Canadian Burgess Shale fossils, and chemist Fritz Haber's experiments in nitrogen fixation — as well as Thomas Hunt Morgan's explorations of genes as unique units of inheritance in fruit flies, and Alfred Wegener's revelation of continental drift. News on each emerged in dizzying succession.

The future could hardly have looked less assured, the present less tractable. Yet it is precisely this period of change and uncertainty that gave birth to science fiction as a mass cultural phenomenon.

Science fiction is at its least useful and least interesting when the pathway to the future is uncontroversial. For that, we have think tanks and institutes of futurology, plying a low-risk trade in respectable, sober-minded projection and extrapolation. They will generally be proved wrong, but they do at least provide some reassurance to governments and businesses.

Science fiction is not in the business of reassurance. It is instead dedicated to turbulence, transformation and unpredictability. In these turbulent times, we need it more than ever.

ALIETTE DE BODARD

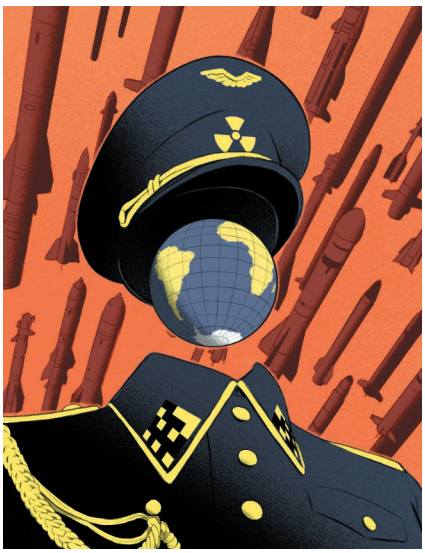
Our need for the stories of science

Aliette de Bodard's latest book is The House of Binding Thorns.

This year, I saw world order upended. Political upheavals and mass migration, newly politicized social networks, drones smuggling drugs, robotoid factory workforces. A similar age of turmoil, however, spawned modern science fiction — and vast socio-economic change, for good or ill.

The nineteenth century in the West saw successive upheavals, from major improvements in global health to industrialization. Many of the scientific and technological advances were achieved at great cost, as the gargantuan scale of emigration and inequality showed; the poor, the oppressed and the colonized largely failed to benefit.

Today, science is pervasive, from new vaccines against papillomavirus to omnipresent smartphones serving as personal assistants and payment terminals. And science fiction, now as in the past, constitutes the stories of science. Stories, in turn, shape the rules of reality: they are our baseline for making sense of the world, and making it change. So at a time of great challenges, they give us strategies for meeting them. For those of us who write science fiction, daunting challenges can also be stimulating — a call to arms in both writing and real life.



Science fiction can tell us what research will lead to. It can tell us what kind of societies, what kind of lives, we are shaping. It can tell us about the use of science, about conscience and ethics and the larger purpose and vision behind discoveries, which are important incentives in making such discoveries. It also tells us about the vast inequities between those who benefit from scientific advances and wealth, and those left behind.

Science fiction can deliver cautionary tales. Malka Older's *Infomocracy* (Tor, 2016), for instance, takes apart democracy and gives us ideas on how to make it stronger. Ann Leckie's *Ancillary Justice* (Orbit, 2013) shows us applications of artificial intelligence and what sense of self would mean for a distributed AI. Yoon Ha Lee's *Raven Stratagem* (Solaris, 2017) tells us about the malleability and subjectivity of the passage of time in different environments — even how it can be weaponized in certain temporal configurations.

"Science fiction can risk losing its outlandish feel, even as other fictional forms borrow its tropes."

Science fiction has moved into the mainstream in step with the infusion of science into the everyday; thus, it can risk losing its outlandish feel, even as other fictional forms borrow its tropes. Television series such as *The Expanse*, adapted by Mark Fergus and Hawk Ostby from James S. A. Corey's sci-fi novels, are now hugely popular with viewers who might not read the genre regularly. That, I feel, is a sign of the ever-greater relevance and vitality of science fiction. As the pace of scientific discovery accelerates and its impact on us deepens, I see sci-fi and mainstream fiction becoming ever more entangled, borrowing tropes, images and ideas from one another. Whether they play out in literary fiction, sci-fi or both, we'll need the stories of science more than ever.

That is because, then and now, science can benefit society selectively or be misused as often as used for good. Cheap, high-powered laser pointers, for instance, have been repurposed as weapons with which to blind pilots. We need to remember what science can do, from horrors to wonders — and to show this writ large in the stories we consume.

As I raise my children, wondering about the world they will inherit, I think of the scale of change over time. I choose to see this year not as a definitive upheaval, but rather as a turn of the wheel. And I hope that the future, shaped from the stories of today, will bring better things. ■