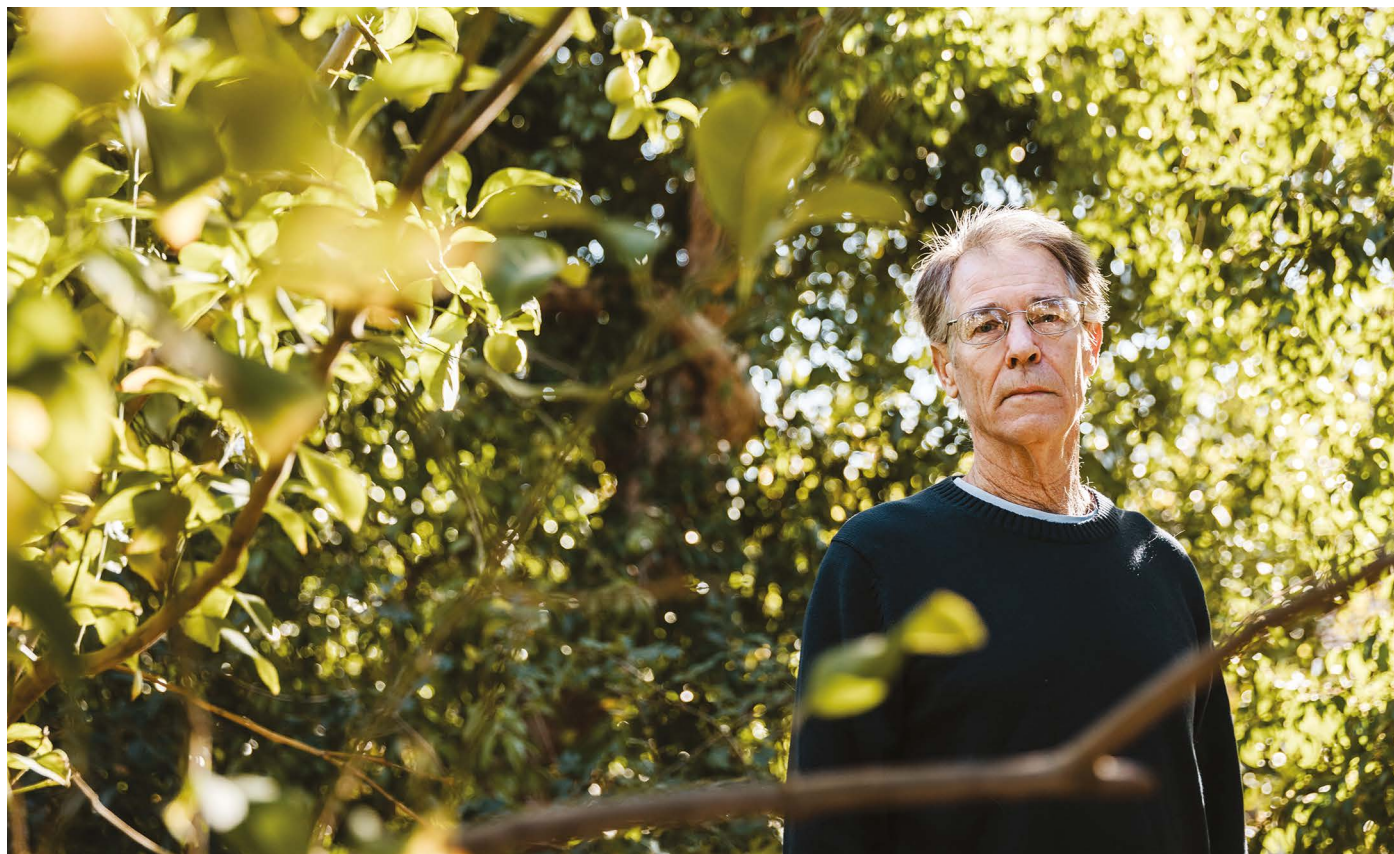# Books & arts

CAROLYN FONG/REDUX/EYEVINE

Kim Stanley Robinson is keen to focus on solving real-world problems.

Sci-fi icon Kim Stanley Robinson: 'anything can be climate work'

The influential writer talks about frighteningly accurate predictions, the creative act of reading, AI consciousness – and hope.

As climate change and artificial intelligence (AI) reshape the world, some say that reality is starting to look a lot like science fiction. A book that people often point to is Kim Stanley Robinson's *The Ministry for the Future* (2020).

The novel opens in 2025, with a deadly heatwave in India – a topic that turned out to be eerily prescient earlier this year, when the country faced extreme heat and humidity. In the book, the heatwave triggers a haphazard rallying of society to protect living creatures from climate catastrophe.

Robinson talked to *Nature* about how the climate crisis is causing younger generations anxiety, but also offering them existential meaning, and why he thinks that AI is a poor choice of name.

Why do you think *The Ministry for the Future* has garnered attention?

The novel is trying to say that, if we apply ourselves, we have the tools to avoid causing a mass-extinction event. And ordinary processes of humanity – science, diplomacy, treaties, the nation-state system, even capitalism itself – could be used to escape the crisis. That's a very reassuring message.

People are hungry for the feeling that everything could work out OK if we do things right. The book serves as a kind of encouragement, in the sense that it helps to give people courage.

At the same time, the start of the novel is so awful that it reproduces the feeling of climate dread. Really, I don't even like to look at those pages again. But it gets to a better place. And as people read the book, they co-create it with me.

Reading a novel is an intensely creative act. You have to look at black marks on a page, and events appear in your head that can be as

powerful as a real experience. If a passage has an emotional charge, it gets remembered as if it had really happened to you.

And how do you feel when events in your books actually happen?

I find it frightening and disturbing — but these were easy calls. I am no prophet.

If global average temperatures rise as much as they are expected to, there are going to be spikes in heat and humidity, and they will kill people. That was a finding by scientists looking at human adaptations to heat stress. They realized that the world might overcome our ability to shed excess heat by sweating when it's humid. The idea was new in around 2010; I came across it in around 2017, after it was spread by attentive scientists and journalists.

What do you tell young people who worry about climate change?

I often talk to undergraduates about climate dread. They are the people of the future, because they'll be here in 2075. Thinking about all the things that have to be accomplished by 2050 to avoid crossing tipping points into unavoidable catastrophe — of course you have climate dread.

So I try to tell them that it means that your life has a project, you have existential meaning. You are not caught in the nihilism of meaninglessness that was capitalist realism. In the 1980s, you saw bumper stickers on US cars that said 'he who dies with the most toys wins'. It was sarcasm, but it also pointed to a lack of meaning. Why live, what is it all about? Well, now we have that answered.

I also tell them: whatever you're interested in, whatever your personal interests are, that can become climate work. Arts, public policy, psychology, the sciences, engineering, the humanities, they can all become part of climate work. Just find your angle. But, at the same time, acknowledge that we're in an emergency, that something has to be done.

How do you research the science for your novels? It's often realistic.

It's cumulative — the research for one book adds knowledge to the next one. I probably read an hour or two of scientific journalism per day. That's just out of curiosity, to try to keep up with what's going on — and you can't keep up. I read widely, but I'm behind the curve. The world is moving really fast.

I'm also good at strip-mining books to get the content that's useful to me. And PhD dissertations — those are denser and more interesting, because they represent five to

ELAINE HOOD

Kim Stanley Robinson is working on a non-fiction book about Antarctica.

ten years of somebody's thinking.

Then I talk to scientists I know, and ask them: 'will you read this passage and tell me what you think of it?' I named some of the characters in *The Ministry for the Future* after my helpers.

Scientists are often the heroes of your novels — why is that?

Scientists are always generating new data, new stories and new interpretations. If you're attentive to that, it's a tremendous advantage. And discrepancies in the scientific enterprise and the scientific mind make for good stories.

> **"Scientists who say they don't like politics often don't understand that their work is political."**

When you trace the source of ideas for what we should do as a civilization, it tracks back to the scientific community. If, say, the political class wants to get re-elected and to make life better for people, they look to their staff for advice. The staff look to experts — the people who have the technical expertise to say, 'as a scientist, I think that this is how we could get a best result'.

Scientists who say they don't like politics often don't understand that their work is also political. Some get it, because of education and the intense politics in the sciences and in academic departments — micropolitics teaches them that everything is political, even

their own field, which they wish was pure.

I know glaciologists who have spent eight years of their lives studying ice behaviour on the ice in a tent, precisely because they prefer that to departmental politics. So that kind of scientist interests me.

I'm also married to a chemist, and my social circle is often made up of scientists. I've watched them with great pleasure — the attempt to be rational in a world of intense emotions. There's a comedy to science. If you're attentive to it as a novelist, you can always be doing comedy, which I like to add.

Is that one reason why you sent a psychologist to the red planet in your Mars Trilogy?

I had a lot of fun with Michel, the only French person and the only psychologist in the first group of 100 people to colonize Mars. Naturally, he goes crazy. He also realizes that going to Mars was an error of stupendous proportions and that he is very homesick. But by the time he gets home to Provence, he's homesick for Mars.

I think this double sense of alienation is a deep and important feeling to explore in stories. But nostalgia is probably a false consciousness, in that what you're really nostalgic for is your youth or the past. And because we're time-bound creatures, the pain of the lost home is just part of being human.

What are you working on now?

A non-fiction book about Antarctica. It will be part memoir and part historical stories — I especially want to cover a 1911 scientific

expedition to grab the eggs of emperor penguins (*Aptenodytes forsteri*) in midwinter, first detailed by Apsley Cherry-Garrard in *The Worst Journey In the World* (1922). I'm very proud to tell a new story about that well-worn old tale, from my own physical research on site.

And then maybe I'll tell a story about the plan to slow the melting of glaciers in Antarctica by drawing the water out from underneath them. It's now being investigated by a team of glaciologists, as well as governance and finance people, to make sure that it doesn't look like scientists coming in out of left field and telling people how to save the world.

What do you think about AI?

My feeling is that 'artificial intelligence' is a public-relations name that obscures what's really going on. It's artificial for sure. But as for intelligence — the term is so broad that you immediately get lost in it. So AI is a poor name. If it was called 'extremely rapid computation', or 'assisted data analysis' or 'cognitive prosthesis' then that would de-emphasize the magical portions of it. You would be talking about what to do with it, not about making up a human mind or a consciousness.

There's so much bad science fiction that anthropomorphizes AI to the point at which it has agency and malevolence. Machines are not going to get to consciousness using large language models, which is simply optimization. And it's easier to imitate human sentences than we thought it was because we're predictable. So, the Turing test turns out to be a relatively low bar. All you have to do is fool human beings, and we are very gullible.

I had a grand time writing *Aurora* (2015), about a journeying starship, written mainly from the perspective of an AI. The AI, called Ship, represents my thinking on how things might get interesting. It's running a starship and a human says to it: 'keep a narrative account of the trip'. The computer doesn't know what to do and has to figure it out.

It still might not be consciousness, but Ship is pretty eloquent by the end of the novel, pretty self-aware. Pretty much like human consciousness, with the starship as its body and its people like its gut microbiome. But we're talking 500 years from now with a quantum computer. What could happen? Well, one doesn't know.

Do you have a message for scientists?

Scientists need to speak as a group. When all the scientific institutions say, together, 'we, the scientific community, the ones who keep you alive, the ones who are your doctors and provide your food, say this has to be done', that's powerful.

Interview by Anne Pichon.
This interview has been edited for length and clarity.

Does probability exist?

Probably not — but it is useful to act as if it does.
By David Spiegelhalter

Life is uncertain. None of us know what is going to happen. We know little of what has happened in the past, or is happening now outside our immediate experience. Uncertainty has been called the 'conscious awareness of ignorance'[1] — be it of the weather tomorrow, the next Premier League champions, the climate in 2100 or the identity of our ancient ancestors.

In daily life, we generally express uncertainty in words, saying an event "could", "might" or "is likely to" happen (or have happened). But uncertain words can be treacherous. When, in 1961, the newly elected US president John F. Kennedy was informed about a CIA-sponsored plan to invade communist Cuba, he commissioned an appraisal from his military top brass. They concluded that the mission had a 30% chance of success — that is, a 70% chance of failure. In the report that reached the president, this was rendered as "a fair chance". The Bay of Pigs invasion went ahead, and was a fiasco. There are now established scales for converting words of uncertainty into rough numbers. Anyone in the UK intelligence community using the term 'likely', for example, should mean a chance of between 55% and 75% (see go.nature.com/3vhu5zc).

Attempts to put numbers on chance and uncertainty take us into the mathematical realm of probability, which today is used confidently in any number of fields. Open any science journal, for example, and you'll find papers liberally sprinkled with *P* values, confidence intervals and possibly Bayesian posterior distributions, all of which are dependent on probability.

And yet, any numerical probability, I will argue — whether in a scientific paper, as part of weather forecasts, predicting the outcome of a sports competition or quantifying a health risk — is not an objective property of the world, but a construction based on personal or collective judgements and (often doubtful) assumptions. Furthermore, in most circumstances, it is not even estimating some underlying 'true' quantity. Probability, indeed, can only rarely be said to 'exist' at all.

Chance interloper

Probability was a relative latecomer to mathematics. Although people had been gambling with astragali (knucklebones) and dice for millennia, it was not until the French mathematicians Blaise Pascal and Pierre de Fermat started corresponding in the 1650s that any rigorous analysis was made of 'chance' events. Like the release from a pent-up dam, probability has since flooded fields as diverse as finance, astronomy and law — not to mention gambling.

To get a handle on probability's slipperiness, consider how the concept is used in modern weather forecasts. Meteorologists make predictions of temperature, wind speed and quantity of rain, and often also the probability of rain — say 70% for a given time and place. The first three can be compared with their 'true' values; you can go out and measure them. But there is no 'true' probability to compare the last with the forecaster's assessment. There is no 'probability-ometer'. It either rains or it doesn't.

What's more, as emphasized by the philosopher Ian Hacking[2], probability is "Janus-faced": it handles both chance and ignorance. Imagine I flip a coin, and ask you the probability that it will come up heads. You happily say "50–50", or "half", or some other variant. I then flip the coin, take a quick peek, but cover it up, and ask: what's your probability it's heads now?

Note that I say "your" probability, not "the" probability. Most people are now hesitant to give an answer, before grudgingly repeating "50–50". But the event has now happened, and there is no randomness left — just your ignorance. The situation has flipped from 'aleatory' uncertainty, about the future we cannot know, to 'epistemic' uncertainty, about what we currently do not know. Numerical probability is used for both these situations.

There is another lesson in here. Even if there is a statistical model for what should happen, this is always based on subjective assumptions — in the case of a coin flip, that there are two equally likely outcomes. To demonstrate this to audiences, I sometimes use a two-headed coin, showing that even their initial opinion of "50–50" was based on trusting me. This can be rash.

Subjectivity and science

My argument is that any practical use of probability involves subjective judgements. This doesn't mean that I can put any old numbers on my thoughts — I would be proved a poor probability assessor if I claimed with 99.9% certainty that I can fly off my roof, for example. The objective world comes into play when probabilities, and their underlying assumptions, are tested against reality (see 'How ignorant am I?'); but