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Netflix

This is how Netflix's top-secret recommendation system works

Netflix splits viewers up into more than two thousands taste groups. Which one you're in dictates the recommendations you get

By LIBBY PLUMMER

22 Aug 2017

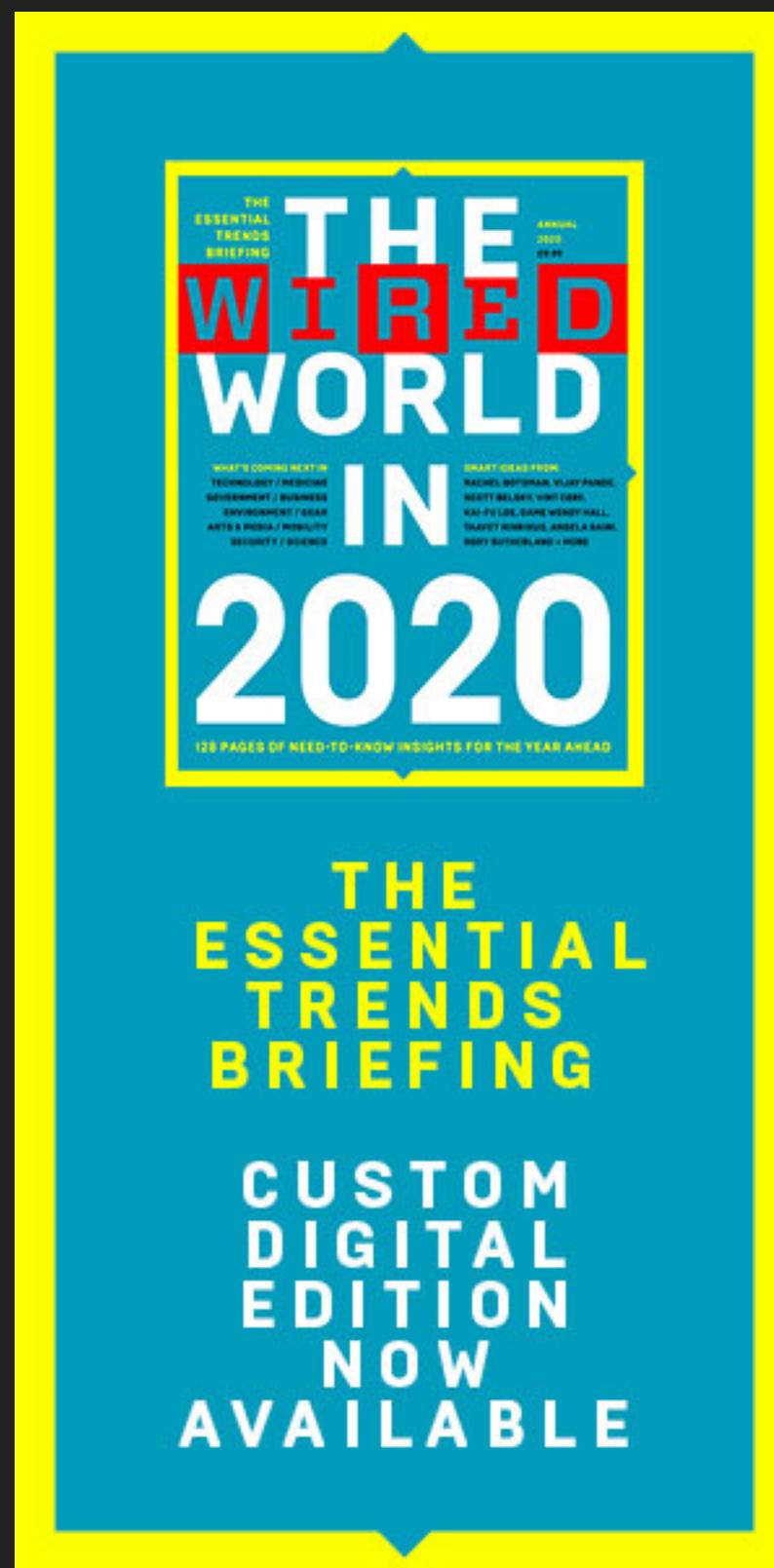


Credit David Giesbrecht

More than 80 per cent of the TV shows people watch on Netflix are discovered through the platform's recommendation system. That means the majority of what you decide to watch on Netflix is the result of decisions made by a mysterious, black box of an algorithm. Intrigued? Here's how it works.

Netflix uses machine learning and algorithms to help break viewers' preconceived notions and find shows that they might not have initially chosen. To do this, it looks at nuanced threads within the content, rather than relying on broad genres to make its predictions. This explains how, for example, one in eight people who watch one of Netflix's Marvel shows are completely new to comic book-based stuff on Netflix.

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To help understand, consider a three-legged stool. "The three legs of this stool would be Netflix members; taggers who understand everything about the content; and our machine learning algorithms that take all of the data and put things together," says Todd Yellin, Netflix's vice president of product innovation.

While Netflix has over 100 million users worldwide, if the multiple user profiles for each subscriber are counted, this brings the total to around 250 million active profiles. "What we see from those profiles is the following kinds of data – what people watch, what they watch after, what they watch before, what they watched a year ago, what they've watched recently and what time of day". This data forms the first leg of the metaphorical stool.



Credit **Netflix**

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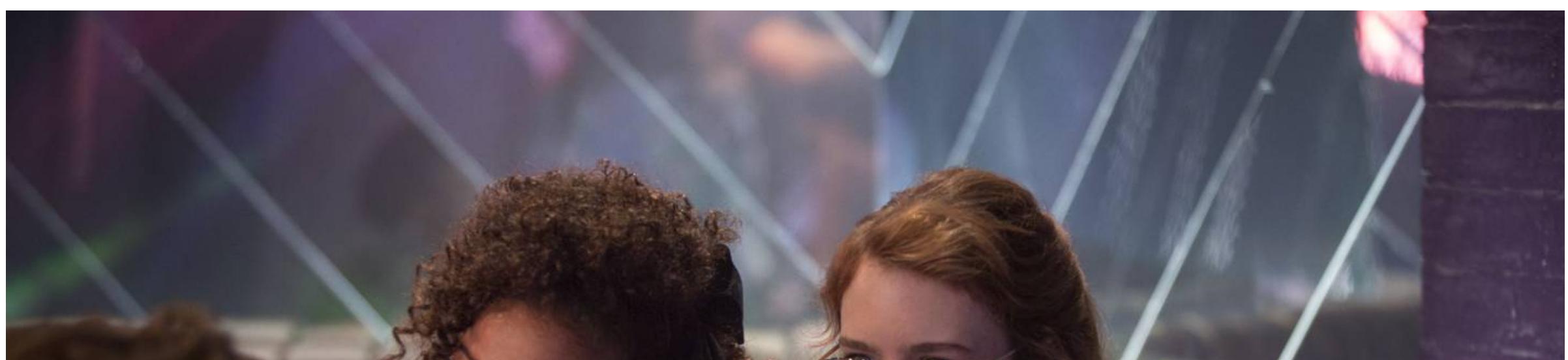
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This information is then combined with more data aimed at understanding the content of shows. The latter – the second leg of the stool – is gathered from dozens of in-house and freelance staff who watch every minute or every show on Netflix and tag it. The tags they use range massively from how cerebral the piece is, to whether it has an ensemble cast, is set in space, or stars a corrupt cop.

"We take all of these tags and the user behaviour data and then we use very sophisticated machine learning algorithms that figure out what's most important - what should we weigh," Yellin says. "How much should it matter if a consumer watched something yesterday? Should that count twice as much or ten times as much compared to what they watched a whole year ago? How about a month ago? How about if they watched ten minutes of content and abandoned it or they binged through it in two nights? How do we weight all that? That's where machine learning comes in. What those three things create for us is 'taste communities' around the world. It's about people who watch the same kind of things that you watch."





Credit **Netflix**

Viewers fit into multiple taste groups – of which there are “a couple of thousand” – and it’s these that affect what recommendations pop up to the top of your onscreen interface, which genre rows are displayed, and how each row is ordered for each individual viewer. The tags that are used for the machine learning algorithms are the same across the globe. However, a smaller sub-set of tags are used in a more outward-facing way, feeding directly into the user interface and differing depending on country, language and cultural context. “These have to be localised in ways that make sense,” Yellin says. “For example, the word ‘gritty’ [as in, ‘gritty drama’] may not translate into Spanish or French.”

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The data that Netflix feeds into its algorithms can be broken down into two types - implicit and explicit. "Explicit data is what you literally tell us: you give a thumbs up to *The Crown*, we get it," Yellin explains. "Implicit data is really behavioural data. You didn't explicitly tell us 'I liked *Unbreakable Kimmy Schmidt*', you just binged on it and watched it in two nights, so we understand that behaviourally. The majority of useful data is implicit."

To illustrate how all this data comes together to help viewers find new things to watch, Netflix looked at the patterns that led viewers towards the Marvel characters that make up [*The Defenders*](#). While there were some more obvious trends, such as series with strong female leads - like *Orange is the New Black* - steering characters towards *Jessica Jones*, there were also a few less obvious sources, like the smart humour of *Master of None* and the psychological thrill of *Making A Murderer* driving people towards the wise-ass private detective. Meanwhile, "shows that expose the dark side of society" were shown to drive viewers to *Luke Cage*, such as the question of guilt in *Amanda Knox* and the examination of technology in *Black Mirror*.

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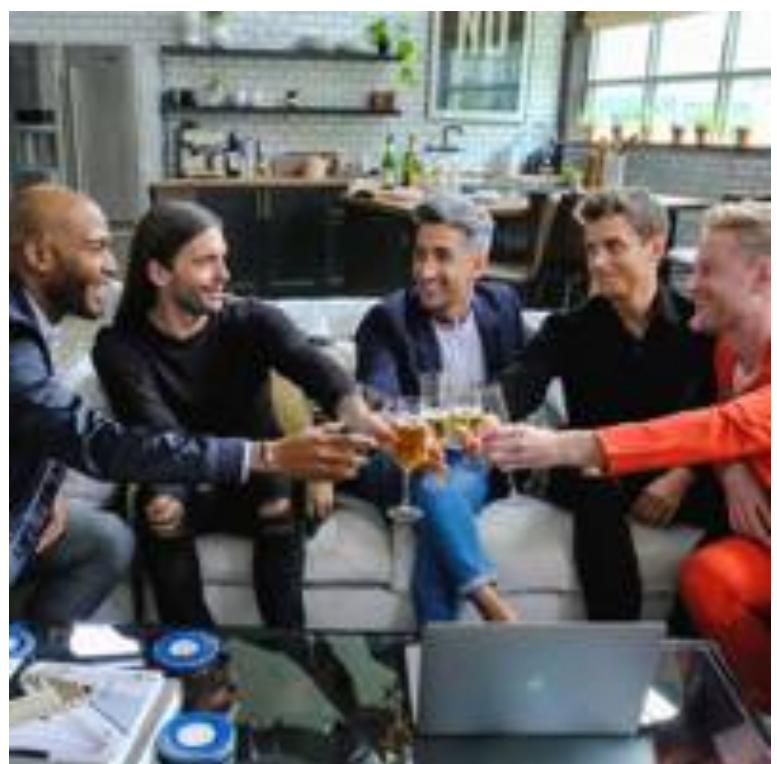
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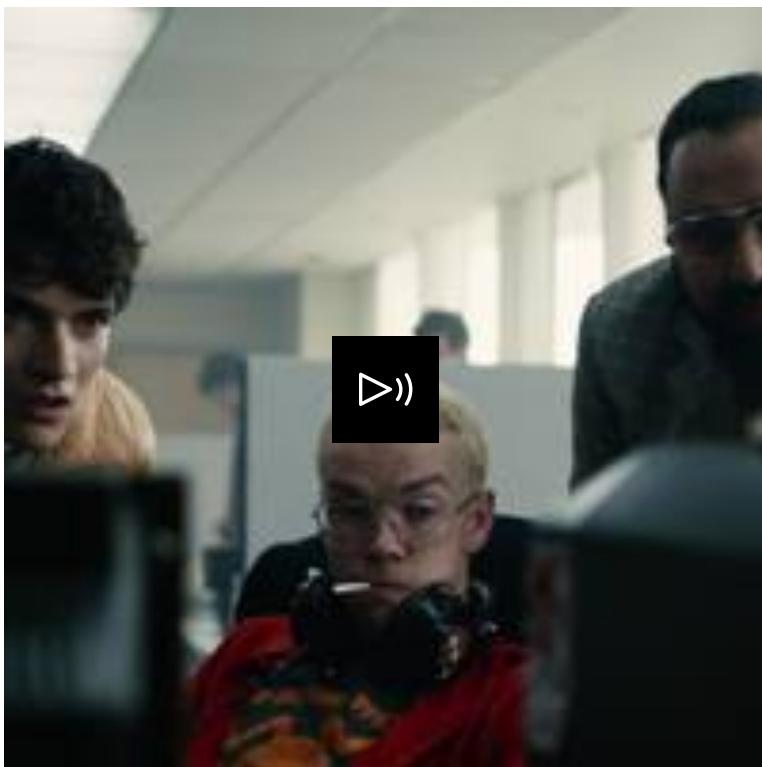


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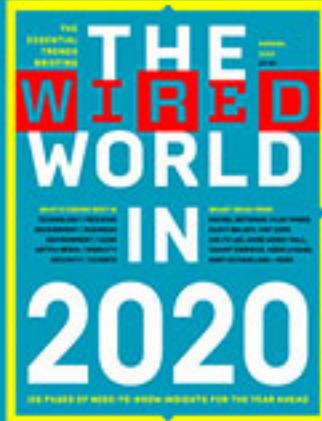
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We must all act to protect the fragile world we live in. Coronavirus proves it. And so do the goats

By JAMES TEMPERTON

1 day ago



A mountain goat surveys the streets of Llandudno during the coronavirus lockdown

As the humans hid in their homes, the goats descended from the Great Orme to feast on their gardens. “There isn’t anyone else around so they probably decided they may as well take over,” Carol Marubbi, a councillor for the picturesque Welsh coastal town of Llandudno, [told the BBC](#). With nobody else around, Llandudno is now overrun with more than 120 magnificent, horned Kashmiri goats. “They are curious, goats are,” Marubbi said.

From Llandudno to Lopburi and Barcelona to Bergamo, the global [coronavirus lockdown](#) has given the natural world a chance to reclaim what we have taken from it. In northern Italy, wild boar now roam the streets in search of food. Boar have also taken up residence on Barcelona’s normally bustling Avinguda Diagonal, snuffling and trotting around where gridlocked traffic once jostled for position. In Japan, the sika deer of Nara’s vast temple complex have sprawled out across the city. Life tends to find a way.

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The natural world’s invasion of our urban spaces has provided a brief moment of distraction from the pandemic. Goats! Pigs! Deer! It’s like looking out your window at a scene from some macabre Disney fantasy. It’s also supreme social media fodder and a brief and much-needed reminder that, amongst the daily death tolls and unending feeling of existential dread, goats still exist.

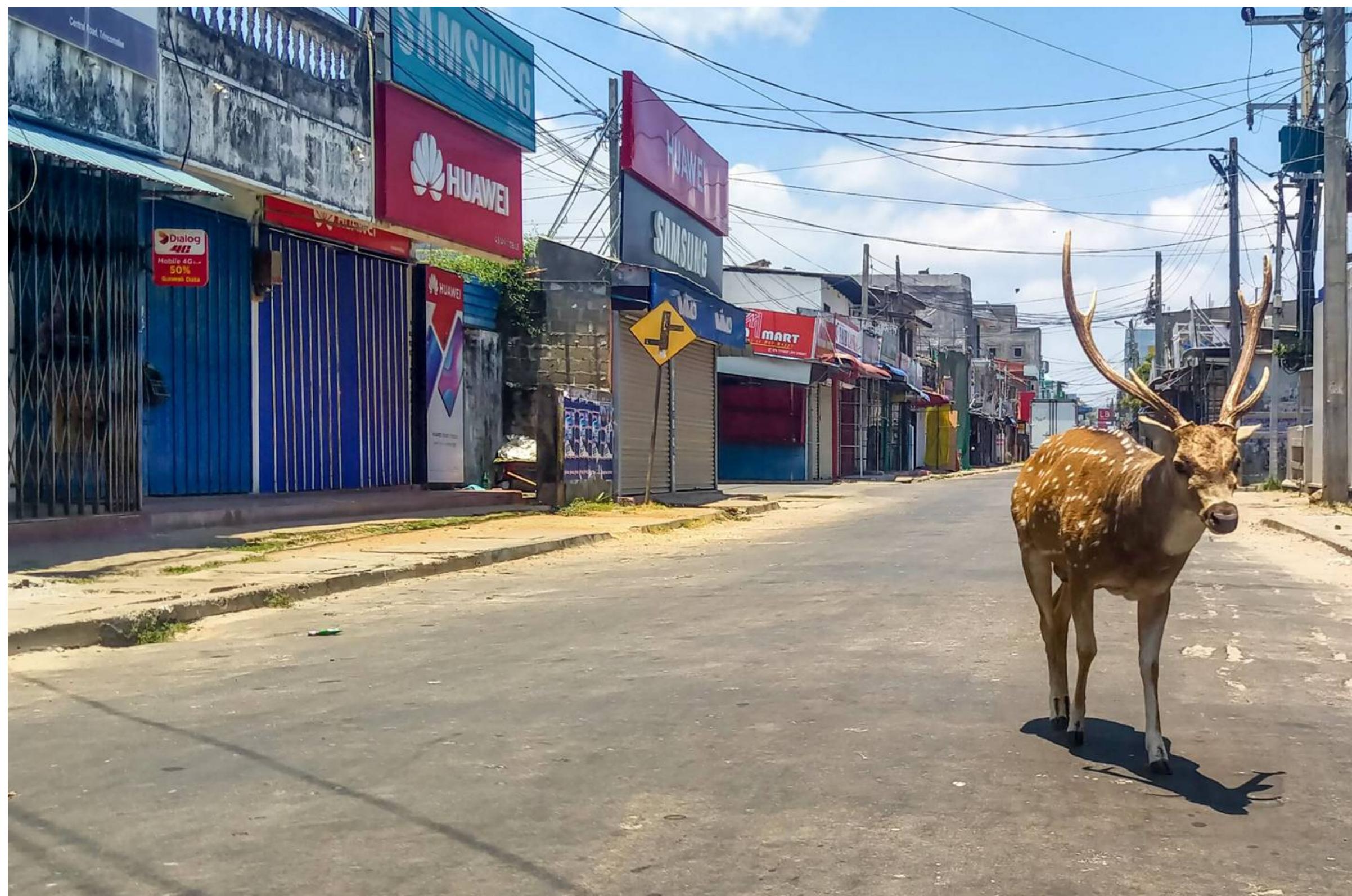
The world’s metropolises, normally bashing and clanging with the sounds of human progress, are now silent save for the strange duet of birdsong and sirens. It would be almost beautiful were it not for the sheer volume of human suffering. We are still in the first act of this crisis and it has already claimed more than

42,000 lives. That number has doubled in just seven days. In many countries – the United States, the United Kingdom, Germany, Belgium, Brazil, Turkey, the list goes on – the number of deaths is doubling [every four days](#). The United Nations is now calling the coronavirus pandemic the worst crisis humanity has faced since World War Two. We are living our lives in a constant, ever-worsening car crash.

In this crisis, life has slowed down. Right down. So much so that the Earth itself now moves differently. Just as earthquakes shake our world, so too do vibrations caused by 7.53 billion people living their lives. In Belgium seismologists have noticed human-based vibrations [fall by one-third](#) since the coronavirus lockdown came into effect. For researchers, this makes the science of listening to the vibrations of our planet easier. Celeste Labedz, a geophysics PhD student at Caltech in Pasadena, California, [tweeted](#) that the drop in noise she had detected was “seriously wild”. We once lived in the great acceleration. Right now we are living through the great pause.

Compared to the cacophony of that unending rush, the sound of survival – of staying home, saving lives – is a whisper. But there are moments of song, of nightly applause for healthcare workers, of spontaneous human creativity. For artists, this intriguing new normal is an opportunity to explore the world as it has never looked or sounded before. We are all trapped in [Edward Hopper paintings](#). Cities and Memories, a collaborative art project, is encouraging people to share audio recordings of their own changing soundscapes. Often, this is simply the sound of near-total silence and birdsong.

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A wild deer roams the deserted streets of the Sri Lankan port city of Trincomalee

Credit STR/AFP via Getty Images

Just as human life feels the squeeze, the natural world suddenly has more space to breathe. And, when it does breathe, the very air that fills its collective lungs is different. In Madrid, average nitrogen dioxide levels decreased 56 per cent week-on-week after the nationwide lockdown was tightened on March 14. Across China, CO₂ emissions fell by at least 30 per cent between February 3 and March 1. This alone is the equivalent of [200 million tons of carbon dioxide](#). In London, average air pollution levels are now at their lowest since records began in the year 2000. The numbers are so low that the London Air Quality Network registered the readings as a fault.

It would be easy to think just that: we are living through a glitch, a planetary anomaly. Hubris could, somehow, persuade us that this isn't the apocalypse [we were looking for](#). Make no mistake, it is. While our individual lives are on hold, the nation states we live in have transformed themselves almost beyond recognition. We now live in a world where more than half a billion children are no longer in school. In America alone, 3.3 million people filed for unemployment in one week. Homeless people are being told to stay in hotels free of charge. All social gatherings are banned. Governments pay people not to work. The UK has nationalised the railways and legalised at-home abortions.

At the centre of this hurricane of change is a simple, calm truth: around the world, billions of people are staying at home and washing their hands. We are fighting, in a very prosaic way, to survive. Apocalypse porn told us our fight for survival at the end of the world would be full of guns and flames and robots and muscle and shouting. It is actually full of cups of tea and Zoom calls and kindness and, yes, the tragic deaths of so many people we love. It is a different, far more human kind of bravery. As [webcomic xkcd joked](#), we seem "determined to protect each other" – and we have a lot of pasta.

If the climate crisis is so slow it feels like it almost isn't happening at all, the coronavirus pandemic is so fast it has recalibrated life on Earth overnight. Yet the latter shows a way forward for tackling the former. The spread of the coronavirus has been accelerated by the way we live our lives and will, eventually, force us to think about how we must change our ways. As the journalist David Wallace-Wells argued in *The Uninhabitable Earth*, it is easy to think that the climate crisis is a crisis of the "natural world" and not the human one; to think, somehow, that these two things are distinct and that we live outside or beyond nature. We don't. The virus proves it. The goats also prove it.

Activists led by Greta Thunberg have heaped scorn on political leaders for failing to act decisively to tackle the climate crisis. "The eyes of all future generations are upon you. And if you choose to fail us, I say – we will never forgive you," Thunberg told the UN Climate Summit in New York in September 2019. That was just over six months ago. It feels more like six years. Compared to our climate crisis inaction, the swiftness of our response to coronavirus – despite the many missteps and faults – has been remarkable.

"The Covid-19 pandemic has unleashed humanity's instinct to transform itself in the face of a universal threat and it can help us do the same to create a livable planet for future generations," said Christina Figueres, a diplomat and former executive secretary of the United Nations Framework Convention on Climate Change in a [recent interview with Carbon Brief](#). Faced with our imminent destruction, humanity has adapted to survive. But we must continue adapting. Our fight against coronavirus is a fight without an end. There will be another pandemic. And, soon, we will have to reckon with how we must change our world in response to this new reality. The climate crisis is still roaring, just out of earshot. Antarctica, the only continent on Earth without a single case of coronavirus, recently recorded a temperature of 20.75 degrees Celsius [for the first time](#). A heatwave in a land of snow and ice.

The coronavirus pandemic did not appear out of nowhere. It seemingly originated in Hunan Seafood Wholesale Market, in Wuhan, China, where live and dead animals are sold and eaten in close proximity. This is a zoonotic pandemic, the ugly result of habitat loss and humanity's disregard for the natural world. This is also a disease that has spread at breakneck speed, propelled to 203 countries and territories by a vast global transportation network. It has been thrown around the world by the great acceleration. The only way to stop it, to stop the exponential growth in cases and deaths, is to slow down.

The word apocalypse means exactly this: an event resulting in great destruction and violent change. As the weeks turn into months and the months into years, and the death toll, tragically but seemingly inevitably, ticks into the hundreds of thousands, we will be forced to consider the outcome of that change. The need for

a slower, fairer world. One where we, as individuals, understand more than ever the impact our actions can have on those around us. And how we must all act to protect the fragile world in which we live. The virus proves it. And so do the goats.

James Temperton is WIRED's digital editor. He tweets from [@jtemperton](#)

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