

The expert view: the importance of counterfactual thinking

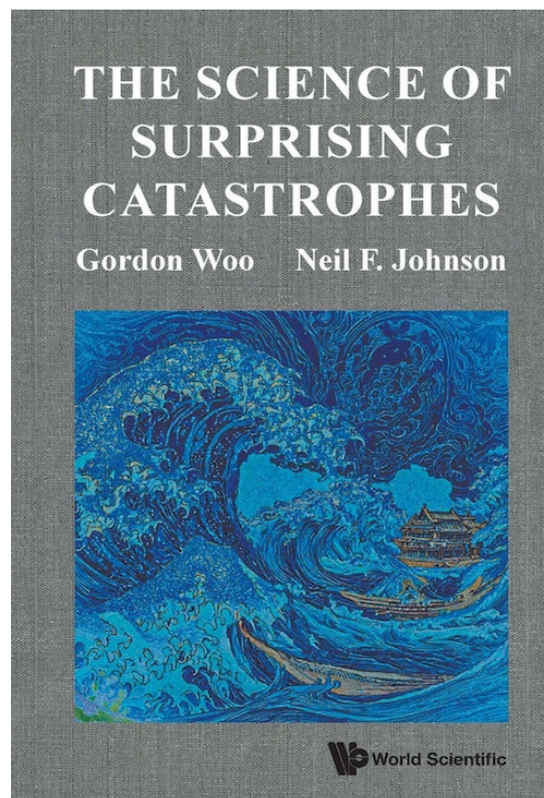
Interviewers: [Gareth Byatt](#) – Principal Consultant, [Risk Insight Consulting](#)
Interviewee: [Gordon Woo](#), Catastrophist

October 2026

Gordon,

Thank you for making the time to talk with us about your research on disaster risk and how we can all benefit by using counterfactual thinking. I am looking forward to hearing your views about actions we can, and should, take to reduce risk and what can and should be done to ensure disasters are avoided.

We are delighted to mention your latest book, [The Science of Surprising Catastrophes](#), which you have co-authored with Neil Johnson. I know the book provides many examples of surprising catastrophes, including earthquakes, tsunamis, volcanic eruptions and landslides, global pandemics, financial market collapses, terrorism, cyberattacks, solar storms, adverse impacts of artificial intelligence, and species extinctions. Especially relevant in our modern times, it covers conflicts and geopolitical ruptures.



What was the genesis of writing this book?

Gordon: *Ever since Nassim Taleb's book, *The Black Swan*, was published in 2007, I have been researching ways in which surprising disasters and catastrophes can be anticipated. This research has culminated in the book, *The Science of Surprising Catastrophes*, which emphasises counterfactual analysis, as well as the physics of tipping points, as a way to help achieve this.*

Gareth: Thanks for this context, Gordon. How is your book about catastrophes unique?

Gordon: *This is a multi-disciplinary book, combining important insights from psychology, physics and history. Through these insights we seek to offer a new and different perspective on catastrophes, and how they can be avoided.*

Gareth: I'm intrigued by the message behind the book's title. What do you define as a surprising catastrophe?

Gordon: *Neil and I define a surprising catastrophe (or disaster) as an unprecedented extreme event that defies imagination. The sinking of the Titanic in April 1912 is a famous example. No one thought it could happen, but it did. The Nepal glacier collapse, landslide and flood in August 2026, is a recent, different example. This event took a great many people by surprise. Many other surprising catastrophes exist, and we discuss a range of such examples in the book.*

Gareth: You mention the world-famous sinking of the Titanic, and I know this is an example you talk about in the book. I have learned that, in fact, there is a precedent near miss – of a different ship that struck an iceberg in the Atlantic, which did not result in a sinking – which occurred several decades before the Titanic sunk.

Is this one of perhaps too many examples of how we fail to learn from the past, including from near misses as well as major and catastrophic events that occur? Is the story of the Titanic, along with perhaps many others, an example of how counterfactual thinking would have been relevant to, and significant for, this infamous ship?

Gordon: *This is absolutely the case. The Titanic sank after it struck an iceberg in 1912 (a great deal has been written about it and made into documentaries and films, of course). You are right, that back in 1879, the SS Arizona liner (an older and smaller liner than the Titanic) struck an iceberg in the Atlantic head on, and it stayed afloat with no loss of life. It was a near miss.*

Of course, various aspects about this near miss were different to the Titanic. Nonetheless, counterfactually, the SS Arizona could well have sunk, which would have concentrated the minds of ocean liner businesses and their captains on iceberg risk.

Captain Smith of the Titanic joined the White Star line in 1880, the following year after the SS Arizona near miss occurred. The Merchant Shipping Act of 1894 set a maximum requirement of 16 lifeboats for large ships deemed unsinkable. This safety requirement would surely have been strengthened if the SS Arizona had sunk in 1879.

Gareth: This is very interesting to find out about, Gordon. It makes me wonder about many other examples of near misses and events that have occurred in the past, and how they may have influenced the future, including the possibility of avoiding disasters. I am thinking about the large number of near misses and events, from those that impact businesses through to those impacting societies in cities and towns, and in remote locations and small islands.

You and I have discussed so-called Black Swans before, the term popularised by Nassim Nicholas Taleb in his celebrated book [The Black Swan](#) (which you mentioned earlier). Do you have an example of how people, in their context, can in fact identify what they perceive as Black Swans in advance by using downward counterfactual analysis?

Gordon: Yes, and as I mentioned, this way of thinking was a prime motivation for the research underlying the book. The main examples given by Nassim Taleb in his book on the Black Swan can be identified through downward counterfactual analysis. Take 9/11. There was no precedent for plane hijackers to take control of a plane and deliberately fly it into a large building. But this might have happened in 1994, when a suicidal hijacker, Auburn Calloway, almost took over a FedEx plane, with the aim of crashing it into the FedEx HQ. He was eventually subdued by the tenacious pilot and co-pilot, and the plane landed safely.

Gareth: I know that your book is packed with examples of, and information about, events and near-events and near misses that we can learn from and help to practice our thinking (including counterfactual thinking) about what could happen in future and how to prepare for possible events. Could you give an example of a notable recent surprising event that the book explains in an innovative and perhaps counterintuitive way?

Gordon: One example in the book that we can consider is the Hamas terrorist attack on Israel on October 7, 2023. This attack can be explained using the structure of complex systems (my co-author, Neil Johnson, is a leading expert on complexity). The clustering of the different terrorist groups within the Iranian axis of resistance amplified the attack capability which took the Israeli military by surprise. Israeli intelligence officials thought that the plan to attack Israel was just aspirational.

Gareth: Continuing on the theme of complex systems and complexity, is the much-discussed matter of AI, including how it might lead to some major changes in future, something that can be reviewed with the methods you discuss in the book?

Gordon: *It can indeed. Ideas from statistical physics can explain how a large language AI model can suddenly tip over from a good state to a bad state. Such Jekyll-and-Hyde behaviour is an increasing global concern (and has been much publicised recently as such). [The July 2026 Hugging Face incident](#) is an alarming example of how AI agents can cluster together in a self-organised and surprising manner. There is some interesting information about this incident available online, and Netflix has released an interesting documentary which relates to it.*

Gareth: Bearing all of this in mind, and linking to our earlier point about how events can be surprising to us whereas perhaps they should not be so surprising, should we more imaginative in thinking about the types of major and extreme events that can and might occur? Part of my work is in the field of urban resilience, and we continue to see examples of events, shocks and stresses that occur in the world's cities, towns and municipalities, as well as in more remote areas. I also work with businesses on business resilience, and history shows us many examples of major events that have significantly impacted businesses and corporations, which I think we can continue to learn important lessons from.

Gordon: *I definitely think this should be the case. Psychologists have demonstrated that there is a fundamental link in the brain's hippocampus between memory and imagination; the better our memory of the past, the better will be our imagination of the future.*

Consider the case of people who forget things very quickly. Sir Demis Hassabis, AI pioneer at Google, did his PhD in neuroscience on this subject at UCL. He undertook interviews with amnesiacs. Asked what they did yesterday, an amnesiac would reply: I can't remember. Asked what they plan to do tomorrow, an amnesiac may reply: I have no idea.

We need to make the time to learn from the past, near and from long ago, to help us use our imagination.

Gareth: It's interesting that you talk about imagination as being an important part of thinking about the possibility of extreme events and catastrophes. [I have interviewed Ed Finn of Arizona State University](#) about how we can and should encourage people to use their imagination to achieve good outcomes. How does the science of psychology help in analysing historical events, and to use our imagination more effectively?

Gordon: *Psychologists introduced the term "downward counterfactual", meaning a thought about the past where things turned for the worse. Exploring downward counterfactuals of historical events can provide new insights into surprising catastrophes, and it can help us to imagine different possibilities. Most explorations of the past focus on upward counterfactuals, how things might have been better.*

Gareth: Thanks for raising the important clarification about downward and upward counterfactuals; I have appreciated co-authoring articles with you on this subject in the past. We have talked before about how many people find it easier to look at the “upward counterfactual” to an event that happens, and that thinking about a downward counterfactual is harder. How can people get better at looking at how things could have been worse, after a near miss or an event?

Gordon: *This is one of the aims of the book, which shows the value of exploring downward counterfactuals in many different risk domains. By drawing attention to the underlying science behind reimagining history, readers should appreciate more the importance of downward counterfactuals.*

Gareth: The world continues to evolve. Amongst the changes we see, we seem to be constantly told about the influence of climate change on all manner of things, sometimes with good scientific evidence, sometimes not. Can the ideas you put forwards in the book help us to prepare for climate change in a meaningful way, which might include not always “pinning events that happen” to it?

Gordon: *Historical extreme weather events might be worse still with the impact of progressive climate change. Climate scientists use storylines to imagine future extreme weather scenarios. Downward counterfactuals are storylines based on actual historical events. As an example, in Nepal, which I mentioned earlier, severe historical floods might have been catastrophic with glacier melting induced through global warming.*

Gareth: What light does this way of thinking shed on the disasters avoided agenda?

Gordon: *Numerous examples are given of extreme complex phenomena, where disasters were avoided because of near misses. In the context of ecological catastrophe, the concept of backcasting from the present is introduced as an instructive exercise in horizon broadening. This is a counterfactual mode of backcasting: the better we are at backcasting from the present, the more capable we should be at backcasting from the future and so avoid disasters.*

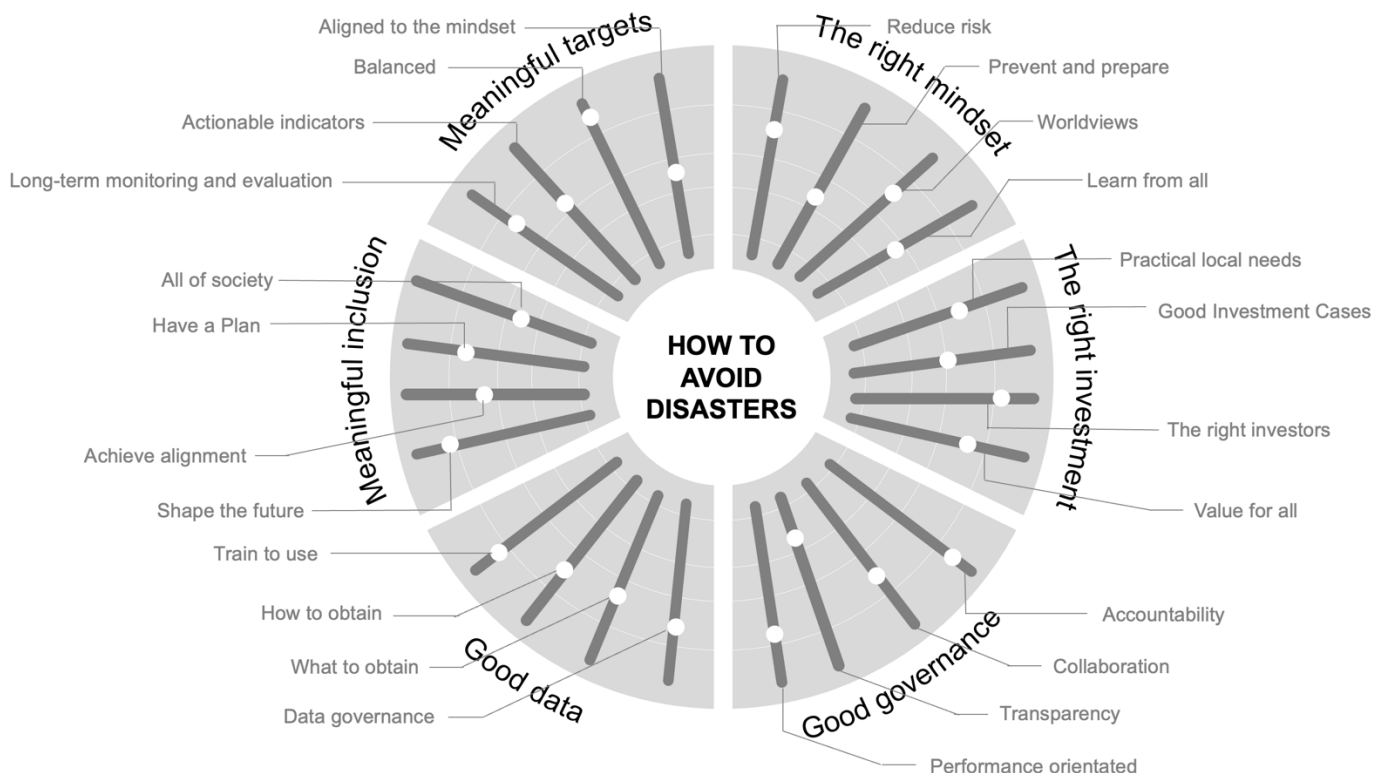
Gareth: Our discussion about disasters avoided brings me onto our Disasters Avoided model, which is described below. I'd be interested in your view on this model, which we have developed following research we have been undertaking since September 2022. We have been “unpacking” the six factors about it in [Newsletter editions during 2026](#).

The Disasters Avoided model has emerged from our research into disasters and their root causes, and disasters that have been avoided. We have drawn on excellent research and work by many groups and organisations, and discussions and interviews with many people who are making a difference in the world.

We hope the model can inspire and shape action by governments, multilateral organisations, local authorities, communities, businesses, and all other groups and organisations to ensure meaningful action is taken at the right time to prevent disasters from happening.

The Disasters Avoided model contains six interlinked factors:

1. The right mindset
2. The right investment
3. Good governance
4. Good data
5. Meaningful inclusion
6. Meaningful targets



[The Disasters Avoided model](#): © G Byatt, I Kelman & A Prados

Gordon: *The Disasters Avoided Model is an ambitious innovative framework for accounting for all the various interlinked factors that contribute to disasters. The factor of good governance, which I see as being informed by good data, can play an important role in how people use counterfactual analysis and thinking to inform decisions. Who is engaged in counterfactual analysis links to the factor of meaningful inclusion, and it can surely inform the right investment to make.*

Gareth: Thank you very much for your time, Gordon. We look forward to continuing to follow your work.