Article

Sleeping with the enemy: Science and the humanities still pass each other like ships in the night*

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Many complex policy problems will yield to the latest science, so policy wonks need more face time with science nerds, writes Roger Bradbury.

You've seen them all before, likely next to those ghastly management guru books in the airport bookshop. I'm talking about the books that popularise the latest scientific breakthroughs and tell you how they will revolutionise your business. And if your business is policy-making, they promise to revolutionise that too.

Like the endless supply of pop psychology books, they promise you an edge. And like them, thankfully, they have a short shelf life.

We've been promised policy nirvana over the years with catastrophe theory, chaos theory, fractal theory, complexity theory and, more recently, network theory. Malcolm Gladwell[1] made hay with tipping points for a few years in the noughties. We've even had a recycling of sorts, with neural network theory of the 1980s re-emerging as artificial intelligence today.

'Cocktail maths', my mathematician friends call them, and they're right. Good for some banter and one-upmanship over drinks but, ultimately, just froth and bubble.

Such books trade on the twin anxieties of many policymakers: that they have only a faltering grip on their subject matter and that, out there, there might just be someone – usually a Science, Technology, Engineering and Mathematics (STEM) nerd – who actually knows how to handle their problem. If only, they think in their darkest, deepest moments, I had paid more attention in maths class instead of deconstructing Shakespearean sonnets; if only I had done more physics and less ancient history.

Sadly that's not the way of the world. Physics – or history, for that matter – ain't for everyone. But if cocktail maths is next to useless, what's a policy wonk to do?

The answer is simple, even if its execution may have its moments: work across the two cultures of the humanities and sciences. As C P Snow[2] famously elaborated, it can be daunting. It was W H Auden who said, 'When I find myself in the company of scientists, I feel like a shabby curate who has strayed by mistake into a drawing room full of dukes.'

So, shabby curate or not, your first task is to find a drawing room. The drawing rooms are there and the doors are open. The best are the news and commentary pages of the two top science journals, *Nature* and *Science*. There you'll find a lively – and accessible – rolling discussion of the latest science.

Engaging in this way instantly puts you at least a decade ahead of those airport books, and gets you closer to the scientists and mathematicians who might help you with your problem – your second and ultimate task.

Now had you been in these drawing rooms in recent times you would have seen the first glimmerings of a major scientific breakthrough[3] that has huge implications for policymakers. Some very clever scientists discovered that complex systems[4] – the very stuff of policy – show distinctive behaviours well before they change state. But these behaviours are subtle and easily missed.

In the real world, complex systems like traffic networks suddenly jam; financial markets or ecosystems suddenly collapse; people have epileptic seizures or heart attacks; individuals suddenly radicalise into lone wolf terrorists; bushfires surge out of control – and policymakers need to know what to do. In at least some of these cases, the scientists were saying that there would be early warnings of the impending change of state, warnings that would allow pre-emptive policy action that could avert the change.

*First published in *APPS Policy Forum*, 4 August, 2017, https://www.policyforum.net/sleeping-with-the-enemy/
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This was an astonishing discovery. Before this, we could see some systems reaching a tipping point and changing quickly from one state to another. But we could only be confident a flip might occur once the system had entered a 'tipping zone', by which time intervention was pretty well too late.

It was as if we could only become aware of the waterfall ahead when our canoe was right at the lip of the falls. The new science showed that we could become aware of the waterfall well before we could feel its final pull.

Breathtaking as this discovery is, it turns out that it applies only to a subset, albeit a large subset, of complex systems – those that have alternative stable states. But there are many complex systems that simply might just collapse under unsustainable pressures, and then be replaced by essentially new systems. Think catastrophic climate change or the collapse of the European Union. We need to ask: Do *all* complex systems show early warning of a change of state?

This is known as the *Cassandra problem* in complex systems science – how to foretell a coming catastrophic change in a system when everything appears to be going smoothly. And in a new book, *Introduction to Transfer Entropy*, Terry Bossomaier[5] and his colleagues provide an elegant and definitive answer. They discuss a new way of measuring the behaviour of complex systems – a measure, in their jargon, called transfer entropy – that allows just such prediction.

This takes the tipping point story to its next stage. It is indeed 'tipping points for the rest of us', and so is necessarily of great import for policymakers. But it is also necessarily a highly technical work – we are dealing with complexity in all its richness after all. So I can't recommend it to the average policy wonk.

Instead, I urge you to make an offering across the two cultures: buy a copy of the book for a friendly scientist or mathematician, and get into a discussion on how this new approach might help you get a grip on your policy problems. It could be the most exciting thing you do all year.

Footnotes

1. Malcolm Gladwell (2000). *The Tipping Point: How little things can make a big difference*. Little, Brown and Company. ISBN-13: 9780316316965
2. Snow, Charles Percy (2001) [1959]. *The Two Cultures.* London: Cambridge University Press. p. 3. ISBN 0-521-45730-0
3. Marten Scheffer *et al.* (2009). Early-warning signals for critical transitions *Nature 461 (03 Sept)*: 53–59.
4. New England Complex Systems Institute. http://www.necsi.edu/
5. *See* https://www.amazon.com/Introduction-Transfer-Entropy-Information-Complex-ebook/dp/B01N00HCCN