

## **There's madness in my method**

***By David Hearne, Researcher, Centre for Brexit Studies***

Something has become increasingly apparent in both my academic work as well politics and the media: the importance of methodology. Fundamentally, both empirical work and policy must be pragmatic.

This pragmatism has led me to believe that, whilst there is typically some empirical “truth” that we wish to get to (even if it is often loosely defined), the most useful way to think about problems is often what might loosely be termed Bayesian. Moreover, I would argue that Bayesian statistics promotes a way of thinking that is useful even outside a formal statistical setting.

Let me outline what I mean. There are many textbooks on Bayesian statistics, which the interested reader is referred to for definitions of varying degrees of mathematical formality. All are written by people with far greater expertise than me and, in any event, blogging about maths on a Friday is poor form!

Rather, what I suggest is an extremely informal approach that might be loosely termed “Bayesian” in origin. Specifically, most of us approach problems or questions with certain beliefs or preconceptions. We are then exposed to new information and update our beliefs in response to this.

In other words, our new beliefs are a product of both our old beliefs and the new information that we have been exposed to. Bayesian statistics simply formalises this approach mathematically. However, even without mathematical detail, knowledge of this allows us to derive useful insights.

Most of us hold our prior beliefs with varying degrees of conviction. I don't think it will rain tomorrow – let's say I put the chance of rain at 5%. However, this is Britain so I'm not very confident about that! It wouldn't take much new information to change my mind.

On the other hand, I'm reasonably confident that it's going to be warm – say a peak temperature of at least 12 degrees Celsius. I also put the chance of a cold day at 5%, but it would take quite a lot of new information to change my mind significantly.

In other words, our new beliefs are a product of both how strongly we hold our preconceptions and how much new information we are exposed to. Enough new information will usually convince all but the most hardened sceptic. If I wake up tomorrow and there's snow on the ground – however, unlikely in June – then I will revise my beliefs about the probable maximum temperature!

Of course, weather is a classic example precisely because it's largely innocuous. However, this approach is also useful to understand much more contentious issues – for example the probable impact of Brexit on GDP.

Let me give an example. There has been a lot of debate about the prevalence of COVID-19 in schools and particularly the extent to which children in school are likely to spread it. Note that within this I also include things like getting to school (typically via bus or walking with close friends) and activities associated with school (unavoidable mixing during lunch breaks and when walking home after the end of the school day).

Last year, during the summer, it was suggested that COVID did not spread in schools. In part, this was related to research done in UK schools at the time. However, there were significant challenges associated with the research – namely that only a small number of children were attending school at

the time (and therefore the frequency of contact was hugely reduced and the distance between pupils was dramatically increased, particularly in secondary schools).

The correct way to interpret this study is not to dismiss it outright – for that would be throwing information away – but rather to acknowledge that it is extremely weak evidence and is therefore dominated by whatever preconceptions we might have. If your prior belief is that schools are not significant contributors to the spread of COVID then this might make you very, very slightly more confident in that belief. If, however, your prior belief is that schools are potentially significant contributors to the spread of COVID then such weak evidence will do almost nothing to change your mind.

Larger and more thorough work on the same subject was later carried out looking at two things. Firstly, did schools have higher rates of infection to nearby communities and secondly were teachers more likely to catch COVID than other professions. There were notable difficulties in the interpretation of these data.

Specifically, the assertion that there is no evidence of higher prevalence amongst school staff is evidence of one of the challenges facing frequentist statistics. Specifically, the 95% confidence intervals include the possibility that school staff are no more (or less) likely to catch COVID than other key workers during the period. If we start from a different position – assume that school staff are more likely to catch COVID than other key workers – then we can't reject this hypothesis either.

However, what we (the public) are interested in is not whether there is sufficient evidence to reject one hypothesis or the other but rather how what limited data available might cause us to change our beliefs. In particular, this depends on what one's prior beliefs are.

The data that I have seen represent very modest evidence in favour of the prior that secondary schools are potentially locations where transmission occurs. However, this is the crux of the matter: if you have a strong belief that schools are not vectors of transmission then I personally have not seen any evidence that would convince you otherwise and vice-versa. In other words, your beliefs after seeing the evidence are going to be extremely closely related to your beliefs before seeing it.

This approach to information is quite general, even in settings where it cannot be formalised. It is useful because it forces us to be explicit about our preconceptions and acknowledge their impact. In many settings, our conclusions will naturally be critically dependent on our prior assumptions. That's something to be honest about and welcomed.