

A world without statistics

How would science, society and technology have evolved if we did not have statistics?

Andrew Gelman imagines what might have been.

Not so long ago, I was asked by a reporter for a quote regarding the importance of statistics. This got me thinking: Is statistics really that important? Would a world without statistics be much different from the one we have now?

What would be missing? Science would be pretty much OK. Newton did not need statistics for his theories of gravity, motion, and light, nor did Einstein need statistics for the theory of relativity. Thermodynamics and quantum mechanics are fundamentally statistical, but lots of progress could have been made in these areas without statistics. The second law of thermodynamics is an observable fact; ditto the two-slit experiment and various experimental results revealing the nature of the atom.

What about the A-bomb and, almost certainly, the H-bomb? Maybe these would never have been invented without statistics – but, on balance, I think most people would feel that the world would be a better place without these particular developments.

At a more applied level, statistics helped to win the Second World War – most notably in cracking the Enigma code, but also in various operational research efforts. And it is my impression that “our” statistics were better than “their” statistics. So that is something.

But where would civilian technology be without statistics? I am not sure. Without statistics we would not have modern quality control, so maybe we would still be driving around in AMC Gremlins and the like. That is a scary thought, but not a huge deal.

In a world without statistics, would the study of quantum physics have progressed far enough so that transistors were invented? That would make a difference in my life. No transistors means no blogging – and I guess we could forget about other unequivocally beneficial technological innovations such as modern pacemakers, hearing aids, cochlear implants, and Microsoft’s Clippy.

Modern biomedicine uses lots of statistics, but would medicine be so much worse without it? I do not think so – at least not yet. You do not need statistics to see that penicillin works, nor to see that mosquitoes transmit disease and that nets keep mosquitoes out.

Without statistics, I assume that various mistakes would get into the system – ineffective treatments that people think are effective. But, on balance, I doubt these would be huge mistakes, and the big ones would eventually get caught with careful record-keeping – even without statistical inference and adjustments.

Of course, without statistics, biologists would not be able to sequence the gene, and I assume they would be much slower at developing tools such as tests that allow you to check for chromosomal abnormalities *in amnio*. I doubt all these things add up to much yet, but I guess there is promise for the future.

Statistics is also necessary for a lot of drug development – right now my colleagues and I are working on a pharmacodynamic model of dosing – but, again, without any of this, it is not clear the world would be so much different.

Take another one: polling. You cannot do that well without statistics. But would a world without polling be so horrible? I think polling is generally a good thing – I agree with George Gallup that measurement of public opinion is an important part of the modern democratic process – but I would not want to hang too much of the benefits of statistics on this one use.

A deeper understanding

Perhaps the most important contribution of statistics comes not from the direct use of statistical methods in science and technology, but rather in helping us learn about the world. Statisticians from Francis Galton and Ronald Fisher onwards have used statistics to give us a much deeper understanding of human and biological variation. I cannot see how any non-statistical, mechanistic model of the world could reproduce that level of understanding. Forget about *p*-values, Bayesian inference, and the rest: here I am simply talking about the nature of correlation and variation.

For a more humble example, consider the baseball historian and statistician Bill James. Baseball is a silly example, to be sure, but the point is to see how much understanding has been gained in this area through

statistical measurement and comparison. As James so memorably wrote, the alternative to good statistics is not “no statistics” but “bad statistics”. James wrote about baseball commentators who would make asinine arguments which they would back up by picking out numbers without context. In politics, the equivalent might be a proudly humanistic pundit such as *New York Times* columnist David Brooks supporting his views by just making up numbers or featuring various “too good to be true” statistics and not checking them.

Maybe the A-bomb and H-bomb would never have been invented – but I think most people would feel that the world would be a better place without them

So here is one strong benefit to the formal study of statistics: without statistics, there would still be numbers, along with people trying to interpret them.

When I started writing this article, I was leaning towards the view that statistics does not really matter, but I think that is because I was focusing on the more highly publicised but less beneficial applications of statistics: the use of statistical experimentation and inference to get *p*-values for tabloid-bait scientific papers; its use by Google and Amazon to perfect their techniques for squeezing money out of their customers; or, at best, to test a medical treatment that increases survival rate for some rare disease by two percentage points.

But statistics is central to how we think about the world. I still think that it is much less significant to our lives than, say, chemistry. But it ain’t nothing.

Andrew Gelman is a professor of statistics and political science and director of the Applied Statistics Center at Columbia University. He blogs at andrewgelman.com.