



Chance, Risk & Health

Reinventing Statistics

Voice-over

Scientists are on the verge of understanding the human genome, the complete genetic map for a human being. During the last century one human being in particular helped to pave the way.

Quotes

"Fisher is the greatest of them all, he's the number one, you can't really think of anybody who's more important in the history of statistics."

"It's a general rule in biology that if you have a bright idea, that's 9/10th's of a chance it's in Darwin, and if it isn't, then it's 9/10th's of a chance that it's in Fisher."

"The whole of modern research in agriculture, in medicine, and to a large extent industry as well, is based on the principles which Fisher laid down."

Voice-over

Even someone as far-sighted as Ronald Aylmer Fisher might have been surprised by his legacy, yet today few people beyond the scientific community have heard of him. Joan Box has devoted much of her life to the quest to uncover more about Fisher.

Joan Fisher Box

R.A. Fisher, yes, he was my father. I was the closest of the family to him, and I felt I wanted to connect anything that was known of him and keep it, to preserve it.

Voice-over

Now living in the United States Joan has returned to Britain on a journey into the past.

Joan Fisher Box

I should imagine the first impression people would have would be of an untidy person, scruffy looking, an untidy beard, strong glasses, really he couldn't see very well at all and in his late years was practically blind. But he had more important things to do than worry about his appearance.

Voice-over

On the outskirts of Harpenden is the world's longest-running centre for agricultural research. It was here at Rothamsted that as a statistician Fisher was at his most creative.

Man

We only have a small herd of cattle now.

Joan Fisher Box

Oh, is that right? So you keep them just for farmyard manure?

Man

Just for the farmyard manure, that's it, yeah. You'll remember the manor house, of course.

Voice-over

A hundred and fifty years ago its founder, Sir John Lawes, believed he could make his fortune by investing in a new discovery, artificial fertilisers. He needed the money for the upkeep of the manor house, the Lawes' ancestral home dating from the 17th century. Anxious to secure his investment he began a series of fertiliser experiments. Lawes divided some of his fields into strips, each one using a different treatment. Rothamsted became particularly important

when the First World War increased the need to improve British food production. Fisher became chief statistician here in 1919.

Man

So here we are, Joan, at Broadbalk.

Joan

Broadbalk, is it, it's a long time since I saw it.

Man

Aha. Well it's been in winter wheat since 1843.

Voice-over

Wheat has been grown on Broadbalk Field for over one hundred and fifty years using a variety of fertilisers.

Man

So we'll go and have a look at the section that has never had any weed killer. We put two or three herbicides on this area during the year.

Voice-over

The results had been monitored continuously and Fisher's first challenge was to re-examine the mass of accumulated data, raking over the muck heap, as he later described it.

Man

35 tons of farmyard manure every year goes on here.

Joan Fisher Box

That's splendid.

Man

Yeah.

Voice-over

But in terms of the numbers required for reliable statistics, even this mass of data didn't amount to much. Fisher was nevertheless able to devise groundbreaking ways of working with it.

Michael Healy, Rothamsted, 1947-1965

Fisher's time at Rothamsted was fundamental to the growth of statistics as we know it today. Statistics grew up in this country, if you like, in the early 1900's under Carl Pearson. Pearson liked to deal with large numbers, but this simply doesn't happen. You have an experiment on the farm at Rothamsted which might have 32 field plots and you've got to make the most of it. And this is what Fisher did in his pioneering work in the twenties. He developed the methodology which we all use today for extracting the information from a limited amount of material, and to do this he had to reinvent the discipline of statistics.

Voice-over

He did this by re-emphasising the importance of involving the statistician right at the start of an experiment and devised methods for designing experiments which are still widely used today.

Stephen Senn, University College, London

Fisher once said that if you called a statistician in at the end of an experiment he could perform a post mortem, he could tell you what the experiment died of, and what he really showed was that you had to call statisticians in at the beginning if you wanted to get the most out of your data.

Voice-over

The winter wheat experiment will discover the fertility of different types of wheat treated with different amounts of fertiliser but it must also take into account additional factors, such as the levels of fertility in different parts of the field. Fisher pioneered ways of working across a range of factors and exploring how they influence each other.

Stephen Senn, University College, London

Often nature won't reveal her secrets if we vary factors one at a time, we often have to vary them together, but in a plan which has been carefully chosen.

Voice-over

The modern design of winter wheat, based on Fisher's ideas, incorporates numerous blocks, accounting for different combinations of background factors.

Michael Healy, Rothamsted, 1947-1965

Fisher was always the sort of personality who liked measurement, who liked certainty, but who appreciated the fact because he worked in a biological environment like Rothamsted that there is no such thing as certainty in scientific research and this, I think, was what drove Fisher psychologically, if you like, the quest for certainty in the presence of uncertainty.

Stephen Senn, University College, London

Fisher, like all scientists, was driven by a quest for certainty. He was faced with variable experiments all his life and he showed that that didn't provide the scientist with a reason for despair; he could, in fact, marshal the data, he could deal with variability in such a way that nevertheless at the end reasonably certain conclusions would be reached.

Voice-over

He was determined to understand the unpredictability of nature, to measure the unmeasurable.

Stephen Senn, University College, London

It was well known that the fertility of plots could vary from plot to plot, and so methods had to be found of taking account of this. What Fisher showed was that you also had to carry this through to the analysis.

Voice-over

Nowadays researchers analyse the data with computers using methods Fisher himself invented at Rothamsted. An instant analysis of variants can be produced displaying the interaction between the varieties of wheat and fertiliser in a style very similar to Fisher's own.