

FROM COMPLEXITY TO CLARITY

In the first of a new series of in-depth interviews with influential thought leaders in the Home Office, and beyond, we speak to Bernard Silverman, the internationally-respected statistician and Chief Scientific Advisor to the Home Office.

It's hard to believe now, but for a brief golden period from the 1940s to the 1970s, British computer hardware led the world.

In the 1940s, Bletchley Park's Colossus, which cracked open Germany's encrypted wartime communications, was the world's first electronic digital programmable computer. Only a few years later, Lyons, the food conglomerate, ran the first regular office computer programme on Leo 1 at its Hammersmith headquarters.

So, when miniaturisation took off in the early 1970s, it wasn't surprising that Britain continued to trailblaze, this time with Clive Sinclair as one of its most visible leaders. A self-taught computer wizard and inventor, Sinclair recognised the importance of attracting the brightest mathematical minds to work with him if he was to realise his dream of producing the world's first pocket programmable calculator.

Among the young post-graduates he recruited to his team from the nearby University of Cambridge was Bernard Silverman. An outstanding scholar, who had won a Gold Medal in the International Mathematical Olympiad and a starred First Class degree in Mathematics at Cambridge, Bernard jumped at the opportunity. The result was the Cambridge Programmable, which was released in 1975. For the academically inclined, its four programme

booklets signalled a miraculous farewell to the era of the slide rule. For the kids swinging on their chair legs at the back of the class, there was the consolation of being able to spell out 'Esso' on the Programmable's red LED display.

Four decades later, Bernard Silverman is as fascinated by technology as he was in the 1970s and admits that he finds it "very amusing" when he meets anyone who says that it's only the current younger generation who live in the digital world. A genial, unpretentious man, Bernard is quite at ease telling jokes against himself and cheerfully relates an incident from the 1970s.

PRACTICAL APPLICATION

'One day, Clive Sinclair said to me, "You know, that chip we're working on, I think you could programme it up to make it into a personal computer." I looked at him and said: "Well, who would want one of those?" I just could not imagine the strides that computer technology would make.'

Bernard's foray into the world of computers was a logical extension of his desire to find a practical application for a love of mathematics which showed itself at an early age. The son of a Hackney optician – 'I don't come from an academic background at all' – in 1974 Bernard jointly scooped the prestigious Mayhew Prize. This is a prize awarded annually by the



BERNARD AT A GLANCE

- 2010** Chief Scientific Adviser to the Home Office since April 2010
- 1970** Gold Medal in the International Mathematical Olympiad
- 1974** Joint winner of the Mayhew Prize, University of Cambridge
- 1975** Developed the first programmable pocket calculator – the Cambridge Programmable
- 1991** Won the international award for "the outstanding statistician under the age of 40"
- 1997** Fellow of the Royal Society
- 2000** Ordained priest in the Church of England
- 2003** to 2009 – Master of St Peter's College, Oxford
- 2004** Awarded Doctorate of Science by the University of St Andrews in recognition of outstanding contributions to statistics

“The whole idea of modern government over the last couple of hundred years is underpinned by statistical data”

Faculty of Mathematics at the University of Cambridge to the student showing the greatest distinction in applied mathematics. Two years later he was joint winner of the Smith Prize, which is awarded to Cambridge research students working in mathematics, applied mathematics or theoretical physics.

PUSHING BUTTONS

In his subsequent career, Bernard held a number of key professorial roles as a statistician and academic including six years as Master of an Oxford College.

In January 2010, his career appeared to reach its apex when he was elected President of the Royal Statistical Society. Only a few weeks later, though, he suddenly stepped down when he was appointed as the Chief Scientific Adviser to the Home Office.

His resignation was essential to prevent a conflict of interest, but does not appear to have caused him too much soul searching. ‘This role in the Home Office really pushes all my buttons,’ he says, with visible relish. I find I gain energy from working on lots of different things at once.’

IMPARTIAL ADVICE

Home Office Science is an eclectic domain. DNA, fingerprinting, crime analysis and bio-security, are some of the key areas in its remit. As well as supplying the Home Secretary and ministers with impartial, expert advice, HOS is responsible for fostering links to industry and academia.

‘Many people are surprised that there’s any science in the Home Office all,’ he says. ‘In reality, to take my own scientific field of statistics as an example, the whole idea of modern government over the last couple of hundred years is underpinned by statistical data. Before then, governments did not even know how many births and deaths there were. The development of public health policy over the last two

centuries, for instance, is directly linked to the development of statistics.’

PIONEERING WORK

‘The reason I moved from pure maths into statistics and science is that I wanted to develop the practical application of theoretical concepts,’ he says. ‘The real importance of statistics doesn’t just lie in the numbers but in the way they reveal the structure that lies behind them. I feel a good scientist should be able to make complex things simple.’

One way Bernard has achieved this is through his pioneering work in computational graphics. Historically,

statistics have tended to bamboozle the lay person by both their abstract concepts and their avalanche of figures. By rendering this fathomless ‘back end’ of raw data and formulae into user friendly diagrams, computational graphics has given statistics an ‘at a glance’ dimension it previously lacked and hugely increased its day-to-day practical value in the workplace, as well as in education.

Bernard was also the instigator of another key area of research, now being pursued by statisticians across the globe, called “functional data analysis”. Put in its simplest form, this means analysing data where you don’t just observe numbers, but entire curves or images, to pull out certain characteristics or trends that might not be apparent at first glance. The process has really only become technically feasible since the growth of computerised data harvesting.

How long should DNA be retained for sexual/violent offenders who are arrested but not charged?

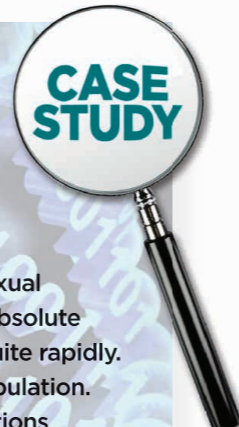
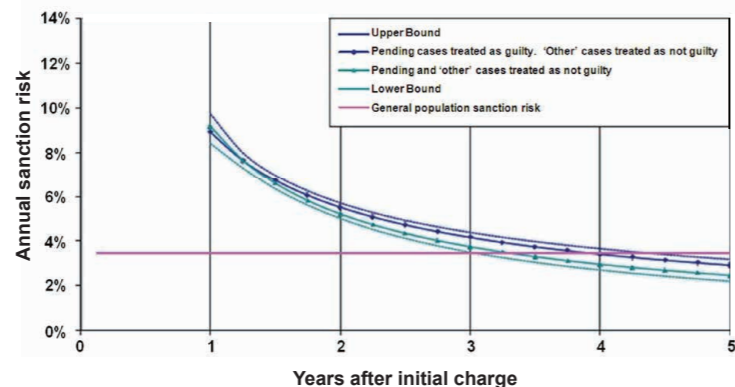
DNA retention from people who have not been charged is a sensitive issue touching on questions of privacy and civil rights.

Home Office Science set out to establish the likelihood of non-charged arrestees going on to commit a serious violent or sexual offence. Although analysis showed that this group had a higher absolute and relative risk of subsequently offending, this risk diminished quite rapidly. After three years, the offending risk falls to that of the general population.

■ The study related to offenders with no previous related convictions

Hazard rate curves: offenders with no prior sanction, arrested but not charged with a serious/violence offence

Arrest-to-sanction hazard rates and general population sanction risk for ‘CSA+’ offence list.



COLLABORATIVE PROJECTS

In the last three years, Home Office Science has successfully applied sophisticated statistical ideas to areas from Border Force’s management of queues to the retention of DNA provided by sexual offenders who were not proceeded against. (see panel) Bernard’s efforts to bring this kind of work into the Department has gained external approval. Earlier this year, he was conferred an honorary doctorate by St Andrews University. At the presentation ceremony Professor Rosemary Bailey, who gave the lauration address, said: ‘I cannot over-emphasise how important it is to have someone with Bernard Silverman’s level of statistical expertise and general scientific awareness working for the Home Office.’

In the age of austerity, one way Home Office Science has been able to get the more bang for its buck has been through developing contacts with other stakeholders, particularly in the United States.

CLOSE CONTACTS

With his reputation and close contacts in American academia, Bernard has been well placed to develop collaborative projects including a number of initiatives with the Department of Homeland Security. ‘This has been one of the most important parts of the job for me and has brought some very rewarding relationships,’ he says. ‘For quite small investments of time and money, we have been able to benefit from large amounts of very significant research.’

Bernard, unlike many other seeming workaholics, certainly can’t be accused of lacking a hinterland. His external commitments range across a wide savannah

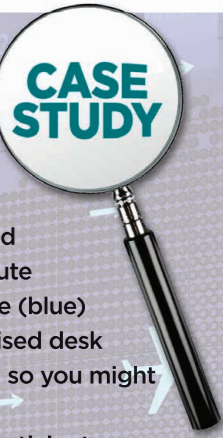
“For quite small amounts of time and money we have been able to benefit from large amounts of very significant research”

Cutting waiting times at the Border

Peak arrival times at Border Force checkpoints were leading to long queues building up and passenger frustration. Valuable staff hours were also wasted as staff manned posts when no passengers were around.

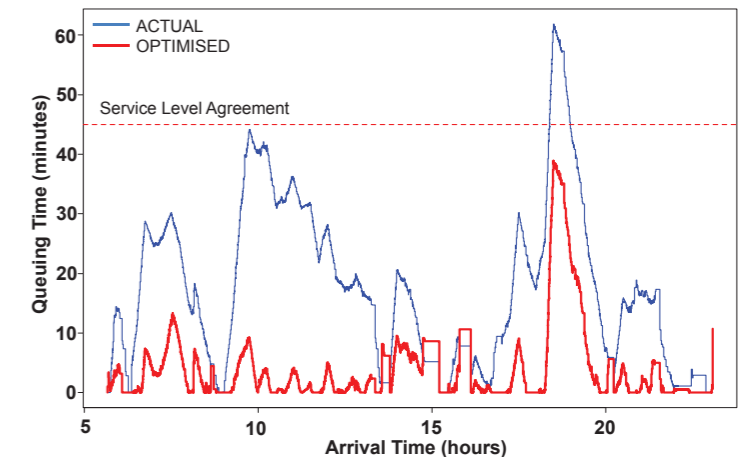
Home Office Science created an algorithm that used expected arrival times to give the optimum desk manning levels in 15 minute periods. The graph compares the previous average queuing time (blue) with the modelled reduced queuing time (red) under the optimised desk allocation policy - though obviously in practice “things happen” so you might not get all the way to the optimum.

Border Force is using this algorithm every day at airports to anticipate surges and lulls in arrivals, and move staff around so that queues do not build up. This has undoubtedly cut waiting times and improved staff productivity.



What difference does the new algorithm make?

Number of desks open at London Heathrow Terminal 4



land of committees and advisory groups including membership of the Arts and Humanities Research Council and the Policy Advisory Group of the British Academy. An on/off love affair with the piano has also seen him buy, wrestle with and subsequently sell three pianos down the years: ‘I have now promised my wife that I’m never going to buy another one.’

Perhaps the most surprising fact about the Chief Scientific Adviser is that, for a community of people just a few yards away from the Home Office, he enjoys an entirely different identity altogether. As Fr Bernard, an ordained Church of England minister, he sometimes ‘nips out’ at lunchtime to conduct a service in the High

Anglican splendour of nearby St Matthew’s, Sir George Gilbert Scott’s elaborate neo-gothic church in Great Peter Street. He also performs a similar function at an Oxford parish.

With a workload and commitments that could occupy and exhaust half a dozen full-time employees, most people would be looking forward to the prospect of retirement. But Bernard, who passed a significant birthday, not long ago, simply shrugs his shoulders: ‘I don’t intend to retire. My father worked in his optician’s shop until he was seventy eight. In fact,’ he leans forward and chuckles. ‘There’s someone who works in the building who bought a pair of glasses off him!’