

EVOLUTIONS AND REVOLUTIONS IN GOVERNMENT STATISTICS, AND WHAT WE NEED TO TEACH AND LEARN

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Over the last two centuries, statistics have increasingly been behind public, community and business activities that shape our lives. The way information is gathered has changed through public attitudes, as well as scientific and technological endeavours. What it is needed for has been shaped by political and social influences. The paper will highlight these changes, and their impact on what we need to learn, and teach, and how we do that. Experiences and developments in New Zealand, the United Kingdom and elsewhere will be drawn on.

INTRODUCTION

Statistics play a critical part in public affairs, perhaps more noticeably through official statistics, weather forecasting, but also in validating evidence in courts, evaluating scientific research, and audit selection. The immediacy of the internet, the all pervasiveness of the news media, and an increasing capacity for measurement have brought a dramatic shift in the capacity to record, access, transfer and challenge information and experiences. This can often place the statistician in the hot seat. Are statisticians being equipped for managing the public or political consequences when they judge the limits to measurability? Has the increased specialisation of statistical work diminished the flexibility of practising statisticians? The presentation considers these and other questions, to provide some basis for finding ways to better develop statisticians for these developing challenges, and so retain both our relevance, and the trust of the public. Many of these concerns make the task of statisticians more difficult, but there is much to gain from sharing the experiences that are faced by different groups of statisticians.

STATISTICAL PRACTICE AS A MAJOR INFLUENCE IN PUBLIC AFFAIRS

In the United Kingdom of the 19th century, there was a significant shift in the extent to which statistics were used to challenge received wisdom. Some 200 years ago, Quetelet noted that the task of the statistician was “to study humanity and report when things are not as they should be”. Somewhat later, Florence Nightingale said of statistics, that it was “the most important science in the whole world because upon it depends the practical application of every other science”. By the last quarter of the 20th century, decades of government led initiatives in all fields were supported by a rich array of social and economic statistics, and growth continued in the private, academic and community organisations involved in statistics in public life. Keynes noted that “There is nothing a politician likes so little as to be well informed; it makes decision-making so complex and difficult”.

A good century after Florence Nightingale, Lionel Jospin, and a recent Prime Minister of France said in 1989, of professional statisticians, “The right to information has become one of the fundamental rights of the twentieth century citizen. In a society where information and the media play a considerable part, your (professional statisticians) action helps safeguard a fundamental human liberty. The working methods you use are complex, the data you deal with difficult to evaluate. An effort to explain (to the public) is necessary. This effort is required by democracy. All citizens must be in a position where they can understand and assess the policies followed by governments.”

Statisticians now have a huge capacity to obtain, store, analyse and communicate results, at high speed, in many highly visible fields of endeavour (meteorology, finance and commodity markets, communications and transport, environment). This shift in capacity to obtain, store, analyse and communicate results, at high speed, will be for the 21st century statistician as significant as the shift from radar to GPS has been for the navigator, and all who are involved in recording and analysing spatial information, and making decisions about location. Perhaps it is even more so, because the capacity for statistical analysis magnifies the capacity for decision-making and progress in all other fields of science, as well as law, medicine and politics.

All in all, perhaps these perspectives reflect a dilemma we see in other fields as well, about the nature of statistics as a science. For all citizens to need to understand elements of the scientific basis behind complex decisions made on their behalf, by government, business and other citizens, we perhaps need more extensive training than for the situation where we need to ensure that leaders and decision-makers in all fields remain statistically competent. If all citizens need to understand elements of statistics, then we need to train statisticians not only in statistics, but also to be educators and communicators to large audiences. We also need a strong collective sense of ethics and standards, and a means of continually ensuring the relevance of the competence of specialist practitioners, and our collective ethics and standards. Also, scientists, policy analysts and experts in all fields that think quantitatively need to accept and believe in these standards. Our task in statistical education is not one of developing statisticians alone, but of advancing the statistical literacy of the community and statistical thinking of professionals in other fields from science, the law and medicine, through to politics.

SOME FEATURES OF THE TIMES WE ARE IN

There are huge changes underway in how economies function, how societies change, in the place of government, and in community concern for the state of the world. We see around us reducing trust in governments alongside a greater demand for the statistics most often produced by government. There is a high expectation of the capacity to explain statistical results and practice in ordinary terms, and to relate statistical results to anecdote and experience—tying together the information people have from quite diverse origins. A high speed is wanted rather than waiting for results, with conclusions provided with a precision that is rarely likely to ever exist given the budgets available for statistical work.

In the UK in particular, there has been a desire to quantify political goals and to direct the measurement of them through performance targets. This has generated a quest for comparison at richly detailed levels e.g. school results, hospitals, doctors, without the scientific basis for measurement being established in advance. An intense focus on short term performance reduces the emphasis on ensuring that we can know that we have made the best decisions, which is especially critical as so many public programmes bring benefits and costs long past the fiscal management planning period of governments.

Over the past three decades, in many places there has been a huge shift in what we want to measure. In public policy we have seen a shift from universal to targeted social programmes and a change in the political assessment of the performance of the government of the day. Globalisation has led to an economic and finance policy more based on managing inflationary expectations, rather than income stabilisation and industry protection. We have much lower fertility and are now living longer, while many complex patterns of immigration have led to national populations having multiple residences and forms. Until now, growing limitations in the capacity to measure populations have not been significantly offset by statistical improvements.

Technological innovation has brought a new emphasis on risk assessment in biotechnology, DNA testing, isotope tests, environment and genetics. Even in cricket we have the Duckworth Lewis rule for working out who wins an abandoned game. If the experiences of official statistics in the United Kingdom are a forerunner of trends elsewhere, then statisticians in the future will have a larger role in explaining the limits of measurability. In official statistics, being able to convey the limits to measurability is as critical as having good measures.

THE EFFECTS OF A MORE INFORMED COMMUNITY

Perceptions and attitudes may make people more or less risk adverse. The net effect may be uncertain, and may differ across the community. We need to better understand how the differences in perceptions that people have can affect the success of policy. We are not clear on what makes people decide things, even where we think that they have very sound information. We may only fully understand the limits to the quality of some information, such as life expectancy projections, some decades after it has been critical in making a long term choice in public policy. Individuals vary greatly in how they learn what are regarded as facts, and how far they qualify their trust in them by their own experience. Personal experiences may remain etched in the memory, regardless of contrary evidence. In the areas of retirement provision and savings, there is some

evidence that these effects can be quite substantial. For example, we know that those in poorer economic situations often have lower life expectancy than average, but even then people in this group may still underestimate their true life expectancy, and hence undervalue the benefits from personal saving.

The information and communication technologies, through the internet, mobile phones and the immediacy of news reporting have put the world on the doorstep, and the community has new ways of engaging on matters of world concern, most especially world poverty, the environment, human rights, and war. The accumulation of that concern is seen in ways of making comparisons, including statistical measures, often prepared outside governmental bodies.

In daily living, the higher incomes of most, and the expectation of living longer, has generally given each cohort more opportunity than its predecessor to engage in leisure, extended education and personal care and development. A growing share of the population has employment income that enables retirement to come with choices not available to their parents' generation. The extended choices between consumption or investment embrace decisions about health, education and family as well as savings and home investment. People now have to balance their own life time expectations, and rely on information about life expectancy, quality of life and health from statistics, because the observation of those older who are around us has far less relevance for future generations.

Understanding health inequalities, broader measures of savings and retirement provision, and observing the changing patterns of the life-cycle are becoming quite critical if we are to assess reliably the capacity of individuals within an ageing population to adapt. We may expect cohort differences, including in attitudes and understanding that have a huge impact on the effectiveness of policy.

INFLUENCING THE PLACE OF THE STATISTICIAN WITHIN INSTITUTIONS

There has been a substantial decline in capacity of separate departments of statistics in universities to recover from the loss of place that has occurred over the past two decades. There are some exceptions such as Southampton and Auckland Universities, which have maintained less fragmentation of statistical staff and consequentially consistently provide a strong broad range of statistics courses.

In many other places, the teaching of statistics has been generally associated with a mushrooming of courses in quantitative studies quite explicitly tied to specific fields including health, geography, psychology, business, economics and finance. These sub disciplines of statistics speak the language of their field rather than that of the community or politics. We need to question whether with this fragmentation, we risk reducing the capacity of statistics as a science, for it to be able to generalise the solutions that work in particular fields, at a time when quantification of experiences is critical to the effective use of new knowledge. Alongside this shift in how statistics is taught and organised in universities, within government we are increasingly seeing statistics in a role as technical support rather than partner in decisions. As university departments of statistics diminish in size, it may well be that the balance of teaching is shifting from applied statistics to mathematical statistics. Employers now have a greater need for teaching about sample survey design, and other methodology. This reduces the part that university departments can play in the wider community and professional education of statistical literacy and thinking. Where statistical training is usually contained within other disciplines, it may well be that the received wisdom of the day of the discipline also influences not only the depth and breadth of statistical teaching, but also the extent to which ethics and standards of statistical practice and method are advanced. There seem to be few good examples of where university statistics departments have managed to develop collaborative mechanisms for building up a critical mass of statisticians that reflects the overall mix of statisticians within the institution, rather than simply those contained in an especially designated department. Does this suggest that the future of statistics may be more certain if it is placed in the hands of other sciences?

DEVELOPMENT NEEDS THAT COULD INFLUENCE THE PLACE AND IMPACT OF STATISTICIANS

Both to counter the fragmentation of statistical teaching, and to provide a strengthened capacity to advance national competence in statistical thinking, we need to find ways to build up some collective professional standing and authority as the fields of statistics mushroom. In other fields, food, environment, housing, the community has become used to having standard setting bodies. Certainly, the initial British experience with a Statistics Commission in the field of official statistics suggests that this may not be a relevant model for statistics generally, although the UK Statistics Authority will be a better guide to thinking about this.

Advancing the statistical competence and confidence of the general community will be dependent on the capacity of all professional statisticians to be able to communicate not only their results, but their methods. Teaching these skills will require a major shift in emphasis in what is valued, whilst retaining the weight given to scientific excellence in thinking and analysis. We need to empower and enable statisticians of all fields to be able to advocate the place of statistics, through understanding the value we bring in decision-making and managing uncertainty and risk.

We need an advanced capacity for continual regeneration of skills not only as a result of the ageing of significant cohorts of statisticians recruited in the peak decades of the 1960's and 1970's, but in response to the huge shifts of last decade in the use of statistics in all fields. Alongside this, it continues to be necessary to get statisticians at the top tables.

THE STATISTICIAN AND "EVIDENCE BASED POLICY"

The main concern of statisticians in the area of public policy analysis must be driven by the extent to which public policies still continue of necessity to be developed and presented with or without empirical evidence. The difference is that where public policies are not able to be based on statistical or empirical evidence, then the policy choices faced by the public are usually extremes and selectively based on some dogma. Such policies are usually difficult to implement and the absence of analysis at the evaluation stage means that there is no framework for monitoring the effectiveness of the policies on their implementation. Dogma and emotion only allow us to choose between extremes while statistical studies which describe, summarise and analyse situations may allow us to perceive discontinuities and nonlinearities in the benefits and costs of policies that span extreme points.

If statisticians are to have a vital place for statistics in informing decisions, then our methodologies and results need to be as open to public communication as the dogma that they challenge. It is therefore important that conferences such as ICOTS are forums for increasing the capability of statisticians in communication of results and research methods, rather than to inspire the elitism of a few. Statisticians must continually ask: "who are they talking to?"

- Firstly, their communications should be understood by their peers in their field.
- Secondly, those who need the analyses must themselves be able to articulate them.
- Thirdly, those for whom your work is a relevant example must also be able to cite the communications, e.g. teachers.
- Fourthly, those who communicate information - the media, scientific commentators - must be able to relate the content of the work.

Finally, because of the vital role statisticians play in challenging the relevance of dogma and eternal truths in public policy, science and society, it is critical that they be most open about their own dogma. This must in the end be an essential role for a conference such as ICOTS, to make transparent those elements of our work where methodology is underpinned by judgment. As an example, critical to trust in government statistics outputs is the transparency of methodology and the ability to replicate and validate measures that are produced. There are no proprietary methodological elements of a national statistical system and the processes of validation of methodologies themselves need to be public. The management and understanding of the processes of error in the data published by a national statistical office are an important element in ensuring confidence.

LOOKING AHEAD TO 2020

ICOTS 10 should in its form and content reflect the capacity of the statistical community to respond to contemporary needs. We might expect a fully web based international conference, that makes it possible for electronic attendance everywhere, either simultaneously or later. We might expect a strong sense of action oriented innovation, readily application quite quickly. We may have created more effective processes for the ongoing cross fertilisation of quantitative professions that are based on statistical theory, to draw on the best presentation practices.

The obligation to publish statistical results in such a way that their objectivity can be assured may well need to be placed in regulation or law, for field of scientific or other endeavour that draw on quantitative analysis for decisions that affect the community. This would mean that not only statisticians, but scientists, judges, medical experts and politicians in government would be called to account. This will perhaps be easier to achieve where certification processes such as for drugs and foodstuffs are involved. It may be more difficult, but not impossible to periodically test how far the election manifesto of an elected government was delivered on. The more universal the standards, the less they need individual courage to act in accordance with them.

We will want to recognise that the massive shifts in the basis of decision-making in all fields, and the huge shift in the accessibility of information of all forms has created for statisticians, perhaps more than all other professions, a new place in decision making, in public life, and their capacity to contribute to a better world. It is so important to adapt, that if we do not, it will done for us by others.

The impact on mathematicians of these issues will be similar. Given the generally richer continuing interaction that statisticians have with other scientists of the practical application of statistics to scientific problems, these pressures should lift the value that mathematicians perceive from collaborating with statisticians in universities where joint departments of mathematics and statistics exist.

CONCLUSION

The rapid growth in the breadth and depth of information about almost all aspects of peoples' lives and transactions brings new challenges of methodology, ethics and roles for statisticians. This affects statisticians in all fields, in government, commerce or in academic settings, yet the fragmented context in which many statisticians work may impair our capacity to lead the profession as a whole through such change, although the discipline of statistics will itself of necessity evolve because of the intense need for our work. We can recognize now how we can address many of these challenges.