Communication about professional statisticians within and outside the profession: key messages to key audiences

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Abstract

There is massive ignorance in the community about statisticians and Statistics, let alone the need for professionalism in the practice of Statistics. Some of it is almost deliberate (*e.g.* the chemist and physicist Ernest Rutherford, "If your experiment needs statistics, you ought to have done a better experiment"; or the geophysicist Fred Vine, "I never touch statistics. I just deal with the facts"), but for the most part it simply reflects a failure of education systems around the world (both school and university), and the failure of statisticians in publicising the essential nature of their work. As a consequence, others are invading statistical territory, sometimes to the great detriment of the people with the data. Statisticians are the people best placed to know why Statistics is important, and with the greatest awareness of the perils to society of poor statistical practice. So it is incumbent upon us, as a profession, to find the best ways to communicate this information. We need to act professionally, not just in the practice of Statistics, but in how we go about ensuring that this communication is done well. Effective communication will necessarily involve engaging professionals from other areas, not least, from Marketing. As promoters of our discipline, we have a long and proven track-record as being ... terrible. At a most trivial level, all the sexy terminology comes from invaders – Big Data, Data Mining, Artificial Intelligence, Machine Learning, Neural Nets, ... to take but a few examples. And how do we counter this? Large and Complex Data Sets. Multivariate Analysis, ... What should we be doing, with whom, to whom, and how?

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1. What's the problem?

There is massive ignorance in the community about statisticians and Statistics, let alone the need for professionalism in the practice of Statistics.

Some of it is almost deliberate, *e.g.* the chemist and physicist Ernest Rutherford: "If your experiment needs statistics, you ought to have done a better experiment", quoted by Bailey (1967); or the geophysicist Fred Vine (1968): "I never touch statistics. I just deal with the facts". More recently, A. F. M. Smith, in his Presidential Address to the Royal Statistical Society quoted *The Times* newspaper report of a judgment of the Court of Appeal, Criminal Division:

> "Evidence of the Bayes Theorem or any similar statistical method of analysis in a criminal trial plunged the jury into inappropriate and unnecessary realms of theory and complexity, deflecting them from their proper task ... ."

So apparently it's quite acceptable to present DNA evidence, or facial recognition evidence, or speed-gun evidence, the jury presumably being completely *au fait* with Genomics or Image processing or Laser technology, but not evidence based on statistical technology.

On the other hand, there are also those who do want, or need, to learn. At an RSS meeting between statisticians and people from the legal profession RSS meeting, a lawyer made the following comments:

> "I am the idiot boy here today ... large parts of the things that have been said here are absolute gobbledegook to me. I could not make head nor tail of most of

it. Bear in mind . . . that the average lawyer cannot even work out figures with a computer. We are dealing in a field which we simply do not understand.

It therefore behoves you, if you want us to accept your views, to put them in a simple language which we do understand ... it is not a question of the lawyers coming to terms with your field of expertise ... .

You ... are coming into our field. If you are coming to us, unhappily, it is for you to adapt to us, and not for us to adapt to you ... lawyers, in general, tend to distrust expert evidence ... for the same reason that most people also distrust expert knowledge — because they do not understand it. When we do not understand something it is very difficult to accept it as the basis for forming judgement."

And Smith (*op. cit.*) remarked:

I believe that an important aspect of appearing relevant involves taking seriously the problem of relating our subject to the individual. When individual members of the public are confronted by arguments about health or environmental issues, the question most likely to be asked is: "How does this affect me or my immediate family?"

Actually, I beg to differ from Professor Smith. Sometimes people can't even get to the point of asking how it affects them. They are stuck on something that they can't conceptualise, even though they understand each word in the sentence. One need only recall Richard Feynman's renowned contribution to the Challenger disaster:

"It appears that there are enormous differences of opinion as to the probability of a failure with loss of vehicle and of human life. The estimates range from roughly 1 in 100 to 1 in 100 000. The higher figures [1 in 100] come from the working engineers, and the very low figures from management. What are the causes and consequences of this lack of agreement?

Since 1 part in 100 000 would imply that one could put a Shuttle up each day for 300 years expecting to lose only one, we could properly ask: 'What is the cause of management's fantastic faith in the machinery?'

It would appear that, for whatever purpose, be it for internal or external consumption, the management of NASA exaggerates the reliability of its product, to the point of fantasy."

To which I would add: "Er, not to the point of fantasy, Mr Feynman, just to the point at which people were unable to conceptualise something, in this case, '1 in 100 000' ... until you made it meaningful." (Subsequent statistical analysis of data available pre-launch showed that the actual risk of disaster was 8 – 12%; see Dalal, Fowlkes, & Hoadley 1989.)

For the most part, this ignorance about statisticians and Statistics simply reflects a failure of education systems around the world (both school and university), and the failure of statisticians in communicating effectively the essential nature of their work.

The fact is, thinking statistically is a life skill, like being able to speak your native language. You express your qualitative reasoning in Chinese / English / French / Swahili / whatever, ...; and you express your quantitative reasoning (by and large) in statistical terms ... whether or not you realise it! You can't avoid having to think statistically, whether or not you can do it well.

Returning to Adrian Smith's RSS Presidential Address,

> "An evidence-based society requires not just evidence and some form of consensus about what constitutes evidence but also open access to and communication of that evidence, in a form which can be understood and acted on, either by individuals, institutions or public policy makers. The evidence must be communicated in a form which is meaningful to the intended audience.
>
> This seems to me to be an issue which we need to take much more seriously. Communication only takes place if people are listening and the message is understandable."

Others are invading statistical territory, sometimes to the great detriment of the people with the data. Statisticians are the people best placed to know why Statistics is important, and with the greatest awareness of the perils to society of poor statistical practice. So it is incumbent upon us, as a profession, to find the best ways to communicate this information. We need to act professionally, not just in the practice of Statistics, but in how we go about ensuring that this communication is done well.

So, what should we be doing, with whom, to whom, and how?

2. Who needs to know about professional accreditation?

The short answer is: everyone. People in
   a) Government
   b) Business & Industry
   c) Political life
   d) Media
   e) Programs of study at school and university
as well as
   f) other statisticians (!)
and more generally,
   g) people from all walks of life simply trying to live their lives as enjoyably as possible in the presence of uncertainty.

3. What do they need to know about professional accreditation?

For people in groups (a) – (d), a lot of their decisions are critically dependent on sound analysis and interpretation of suitable data or, more generally, on sound statistical – including probabilistic – reasoning. (As an example of the use of probability to bring a cold shower of common sense to a debate, one can do no better than to read Burton Richter's (2000) article. Richter, who won the Nobel Prize for Physics in 1976, used elementary probability to demonstrate that the Strategic Defence Initiative known as "Star Wars" couldn't possibly work.) This raises the obvious questions: *How can they gain assurance about the quality of the advice, and what's the role of the profession in helping them gain such assurance?*

To paraphrase Richter, the answer to this isn't rocket science. If they want high-quality legal advice, or dental work, or brain surgery, or anything requiring professional expertise, they automatically seek out a professionally qualified individual: indeed, for many of these activities and many others (designing a skyscraper, building a bridge, ...) the law dictates that *only* a professional is allowed to engage in this work. Do we hold what we do, as statisticians, in such low regard that

we don't think that our work calls for high-level skills, knowledge and knowhow? Of course not. *Ergo*, it is incumbent upon us to do a number of things:

1. Define what we mean by a properly qualified – or professional – statistician.
2. Institute processes for accrediting people as professional statisticians, so that others who have need of statistical work can distinguish the professional statistician from the para-statistician.
3. Communicate (1) and (2) to all interested parties.

For students at school and university, we need to think more broadly.

Firstly, our goal needs to be that everyone acquire a basic understanding of statistical reasoning as a life skill. Most people, once they leave school, are unlikely to require any more than the most basic mathematical reasoning in their lives. However, they will never be able to escape the need to reason statistically ... to live their lives managing uncertainty as best they can, whether it be interpreting opinion polls or understanding the risks associated with alternative medical treatments from which they have to select one. And while we're going about the business of teaching them basic statistical reasoning, we should take the opportunity to emphasize the existence of professional statisticians for the purposes of working with data, just as they learn about the other professionals.

Next, we need to encourage the more 'quantitatively able' students to pursue further studies in Statistics, and one of the lures for this will be to explain the possibilities of acquiring professional qualifications.

Which leads naturally into looking at group (f), and an immediate question: *Why are* other statisticians *included in this list?*

The most important reason is to make eligible statisticians aware of the full range of benefits. Another not unimportant reason is that there appears to be a widespread lack of understanding amongst academic statisticians about the meaning of professionalism in the *practice* of Statistics, as distinct from professionalism in the way one teaches or conducts research in Statistics. Possessing a PhD, a string of research publications, lecturing experience and, perhaps, a record of some occasional consulting work, may count for naught in terms of professional accreditation without substantial evidence of the ability to

- understand a client's problem
- solve that problem using good current practice, rather than solving the nearest publishable version of that problem
- presenting the results in a form that is understandable and actionable by the client
- at all stages of the interaction, acting in a professional manner (courteous, responsive, keeping the client informed of progress, meeting deadlines, no surprises, ...)
- handling financial aspects professionally, including not undercharging!

And finally, for group (g), the wider community, the general message remains the same: Statistics is an area of professional practice, and in an increasingly data-rich (data-drenched?) and data-dependent society, they should heeding the voice of the professional when it comes to interpreting data relating to specific issues (*e.g.* Climate change) rather than relying on persuasive media performers ... which means that the voice of the professional must be

- identifiable as such
- authoritative
- heard and understood.

4.   What do professionally accredited statisticians have to do?

The first thing that professional statisticians have to do is to recognise their limitations at communicating, marketing and selling. We have proven track-record as being ... terrible. At a most trivial level, all the sexy terminology comes from invaders – Big Data, Data Mining, Artificial Intelligence, Machine Learning, Neural Nets, ... to take but a few examples. And how do we counter this? Large and Complex Data Sets. Multivariate Analysis, ...

The next thing is to recognise that, just as we demand that others recognise the need for professionalism in the practice of Statistics, *so we should seek out professionals in the practice of Communication, Marketing and Sales*.   There is a well-known advertising bromide: *You can't bore people into buying*. Well, we should know this better than most, because it's been our only approach. Whether it's our web sites (*e.g.* http://www.isi-web.org/), our inability to use plain language, our lack of imagination in labelling our technology, our diffidence at self-promotion, our extreme care to avoid 'going beyond the data' in venturing opinions, or whatever, we do an excellent job of boring people into not buying ... from us! But they have to buy, so they go elsewhere, to their detriment and often to ours and to that of many other people. So, we must learn to act professionally in terms of recognising areas of professional practice *by others*. Let them formulate our messages in accessible language, let them design the public awareness campaigns and marketing campaigns, let them teach us how to communicate (people do want to hear the organ-grinder rather than the monkey).

There are now four or 5 active professional accreditation programs in national statistical societies. Now is the time for a coordinated attack on this issue. We have the raw data that the professionals would need to create and implement appropriate campaigns inside and outside the Statistics profession. Let the marketing and awareness-raising commence.

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