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Topic (ii) Statistical literacy

**TAKING A HORSE TO WATER – AND GIVING IT A BOTTLE**

**Invited Paper**

Submitted by Office for National Statistics, United Kingdom<sup>1</sup>

**I. INTRODUCTION**

1. A curious title, you might think. But let it paint a picture in your mind. We've all heard the saying that you can 'take a horse to water, but you can't make it drink'; well imagine leading your horse along and then giving it water in a bottle, which to most horses is useless.

2. Apply this analogy to some attempts to communicate statistics to the public. We have the information they want and we show them where it is but then we contrive to make it difficult for the user to make the most of; or, worse, lead them to misuse it.

3. A common reaction then is to blame the user for their inability to make sense of something which to most of us is quite straightforward. To use that picture again, we humans manage fine with a bottle of water, why can't the stupid horse?

4. Without doubt, internet and other electronic systems have created unprecedented access to statistical data and in many countries it is completely free. The delivery systems are generally good and well understood. But still we fret at the way data are often used. The fact is that good data and good delivery systems simply are not enough. We are falling at the final fence. The 'bottle' we are giving our 'horse' is the language and methods with which we try to communicate our statistics.

**II. IDENTIFYING THE STATISTICAL GULF**

5. The problem is the gulf in understanding between many statisticians and much of the wider community including many people who use statistics in their daily working lives such as politicians, lobbyists, students and journalists. There is a lack of 'statistical literacy' in the general public.

6. Many statisticians find this frustrating and fret at the stupidity of people who deliberately or unwittingly draw wrong conclusions from their statistics. There are two reasonable courses of action:

- Substantial programmes to make people 'statistically literate'.
- Or, present more easily understandable material to the public, and, as a result, reduce the opportunity for misunderstanding and misinterpretation.

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<sup>1</sup> Prepared by David Marder ([david.marder@ons.gsi.gov.uk](mailto:david.marder@ons.gsi.gov.uk)) Views expressed are personal and to stimulate discussion; they do not necessarily represent policy of ONS.

7. The answer almost certainly lies with a combination of the two but are either realistically achievable? Mass statistical education has been on the agenda for generations but only makes a small dent on lack of public understanding. If we can assume only the most basic of statistical literacy in the public, what more can producers and communicators of the statistics do to bridge the gulf? Secondly, we must remember ‘statistical literacy’ is something different from being brilliant with the numbers; so what is it?

#### A. What is ‘statistical literacy’?

- a. Defining ‘statistical literacy’ is not simple. Firstly, I’ll draw from Iddo Gal who in 2002 wrote<sup>2</sup> *“Statistical literacy is a key ability expected of citizens in information-laden societies, and is often touted as an expected outcome of schooling and as a necessary component of adults’ numeracy and literacy. Yet its meaning and building blocks have received little explicit attention. . . . Statistical literacy is the ability to interpret, critically evaluate, and communicate about statistical information and messages.”*
- b. It is clear that ‘statistical literacy’ is different from ‘being good at doing statistics’. Another eminent statistics teacher, Milo Schield suggests, *“Statistical literacy focuses on making decisions using statistics as evidence just as reading literacy focuses on using words as evidence. Statistical literacy is a competency just like reading, writing or speaking.”*
- c. So you can be ‘statistically literate’ without having a deep understanding of how to prepare and produce statistics. However, you can’t be ‘statistically literate’ without at least having some degree of numeracy and interpretative ability. Can the converse apply? Is it possible to be ‘statistically illiterate’ while still having a deep understanding of the processes of producing statistics? I’ll let this question lie.
- d. As we all know, a little knowledge can sometimes be a dangerous thing and there are many people who would say they are confident of their statistical understanding who still make a hash when they try to use them – policy-makers and journalists among them.
- e. Evidence-based policy is a mantra of many governments. Talking on the subject David Halpern of the UK Prime Minister’s Strategy Office said: *“Statistical literacy would be nice. It is not that widespread and is a serious limitation, not just in terms of being able to interpret a logistic progression but also being able to understand a mindset of a whole body of work.”*
- f. Past president of the Royal Statistical Society (RSS), Professor Andy Grieve, said at the time of the General Election in the UK during 2005: *“Anyone living in the UK in April 2005 cannot fail to appreciate the need for statistical literacy. The election campaigns of the major political parties are dominated by argument and counter argument based on statistics. Voters should be able to understand both good and bad uses of statistics.”*
- g. He was speaking at the production of a report urging greater importance for statistics within the school curriculum to help students gain an appropriate level of statistical literacy. The RSS Working Group prepared a detailed report with far-reaching recommendations for UK schools’ core curriculum for 14-19 year olds. It said: *“An understanding of statistical literacy should form a part of the common educational entitlement for every school pupil.”*

### III HOW WE EDUCATE THE YOUNG

9. So we can say ‘statistical literacy’ is a ‘good thing’. It is an educational entitlement; it is essential for democracy to work; and it is vital for producing and understanding evidence-based policy.

10. At ONS we have taken a proactive position in trying to help schools and colleges in their effort to improve statistical literacy. The 2001 Census involved ONS in running a parallel – mainly for fun – ‘census in school’ and this coincided with ONS joining with the international ‘**CensusAtSchool**’ project

to which I will refer later (<http://www.censusatschool.ntu.ac.uk/>). ONS has also gone on to develop 'stats4schools' (<http://www.stats4schools.gov.uk/>). Its stated aim is to help teachers and pupils get more from statistics. For pupils, there are datasets that can be downloaded and included in projects, free. For teachers there are lesson plans and worksheets to use in class, also free. The data used in 'stats4schools' come not only from the ONS but from across the UK government.

11. There are 15 lesson plans on the 'stats4schools' site and they feature topics that are likely to hold the attention of a class. For example, "how many people put 'Jedi' as their religion in the 2001 census?" through to "How much do you think your family spend in a week?". Each subject includes a lesson plan, worksheet and the data required.

12. The datasets for pupils similarly aim for subjects that are relevant. For example, "What does the nation read and who reads more, men or women?". The pupils are given a decoded dataset, an explanation of the questions asked in the survey, and the type of responses given. They are then asked to read the material carefully and decide on some hypotheses to investigate. In addition, there is a useful set of links to help teachers and pupils alike find other reliable sources of information.

13. CensusAtSchool is an international project which includes data from the UK, Canada, New Zealand, South Africa, Queensland (Australia) and South Australia (work is going on with the Australian Bureau of Statistics to produce an Australia-wide dataset). The project is sponsored by the RSS Centre for Statistical Education and has the broad aim of encouraging children to get involved with data-handling and improve their statistical skills. The international element allows children to compare their results with children from across the world.

14. The project is run from Nottingham Trent University in the UK and is seeking more countries to join (This can be done by email to [censusatschool@ntu.ac.uk](mailto:censusatschool@ntu.ac.uk) or phone +44 115 848 8408).

15. A review of CensusAtSchool suggested the project "provides an excellent focus within which children can experience the excitement of discovery, as well as achieve the aims and objectives of the national curricular. It can help them realise the need to become statistically literate, and help them get used to making evidence-based decisions".

#### IV BUT WHAT ABOUT THE REST OF US?

16. There is good work going on to educate the young but it is only scratching the surface of the lack of 'statistical literacy'. It may be true that there is a platoon of well-educated youngsters coming through the system armed with the ability to make the right interpretation of the masses of statistical data that surround them. But, given the recidivist nature of humankind, it is very likely that even this platoon will lose many of the skills not many years into adulthood unless something is done to keep it alive.

17. Iddo Gal <sup>2</sup> looked at what basic knowledge people needed to retain in order to have a foundation for 'statistical literacy'. He argues: "*Almost all authors concerned about the ability of adults or of school graduates to function in a statistics-rich society do not discuss what knowledge is needed to be statistically literate, but usually focus on what needs to be taught in schools and argue that all school graduates should master a range of statistical topics, assuming that this will ensure learners' statistical literacy as adults.*"

18. He suggests that many authors' lists of knowledge required to guarantee statistical literacy may be 'overspecified'. Basic knowledge depended on the functional demands of the context and culture. He went on to argue that it was not at all clear that learning statistical facts, rules, and procedures, or gaining personal statistical experience through a data-analysis project in a formal classroom context can in itself lead to an adequate level of statistical literacy.

19. There are many opportunities for adults to learn once they have moved on from compulsory and even university education. Most people though are lazy when it comes to understanding statistical material; the effort required to question the data is usually considered too much in a time-poor, convenience society. It is easier just to accept what is being fed to you even if it is of dubious provenance.

20. Some organisations are happy to make use of this laziness, but for the majority of groups with serious purpose there is a duty, or, at least, a responsibility to help their users. This applies to public and private agencies, media organisations and journalists, advertisers, and, of course, national statistical institutes.
21. For those that want to learn, the Internet offers a wealth of opportunity from numerous sites worldwide. For example, there is ‘Statistical Literacy’ at [www.statlit.org](http://www.statlit.org), which says it ‘studies statistics used as evidence in everyday arguments’.
22. ‘Checking out the facts and figures behind the news’, [stats.org](http://stats.org) is a breath of fresh air. Its deconstruction of the many attempts by the media to make mincemeat out of data makes either grim-reading or high-entertainment depending on your mood at the time.
23. [Stats.org](http://stats.org) also makes an attempt to explain some simple concepts in statistics and how they should be used and how they are often misused. Taking a simple example, in talking about percentages it says: “Another common trap is: suppose the homicide rate in a city went down by 50 per cent in one year and by another 30 per cent the following year, does this mean it has reduced by 80 per cent over two years? No!”. It then goes on to explain how the calculation should be done. This may seem ridiculous to many but I have spent time trying to explain the same thing to a puzzled journalist.
24. In the UK there is [www.numberwatch.co.uk](http://www.numberwatch.co.uk) which provides a list of sites which it claims are ‘the leaders of the resistance against the new orthodoxy’ but more usefully the BBC runs a regular radio series called ‘More or less’ ([http://news.bbc.co.uk/1/hi/programmes/more\\_or\\_less/](http://news.bbc.co.uk/1/hi/programmes/more_or_less/)). This is supported by an excellent link with the Open University ([www.open2.net/moreorless/](http://www.open2.net/moreorless/)). It takes a look at and explains a few common areas such as averages and probability and has a stab at explaining some confusing statistical terms such as ‘significant’.
25. The BBC also attempts to explain the way it selectively uses statistics. Economics Editor, Evan Davies, sifted through a pile of National Statistics releases and decided on what story he wanted to tell. There were eight fairly standard releases all with descriptive rather than news titles (for example, *Mushroom production and sales survey* and *UK official holdings of international reserves*). He, though, decided the most important release was called *Revisions to Public Sector Finances – road maintenance and repair* which he admitted sounded as dull as the rest.
26. Yet, Davies argues, this apparently technical matter made it easier for the UK Chancellor to meet his self-imposed fiscal rules and make tax cuts in his next budget. This was clearly very convenient for the Chancellor particularly just ahead of a budget.
27. “Would it be biased of me to point out the convenience of the timing to the Chancellor? Or would it be remiss of me not to? Good reporting is not about broadcasting the noise of data on to the public. It is about making judgements as to the significance of available facts, and the pattern that fits them together,” he says.
28. Journalists make judgements all the time, he says. And merely to report the figure would be of no use at all, leaving the vast bulk of viewers in the dark as to what the figures mean.
29. Evan Davies is an example of a statistically literate reporter who has become renowned for his attempts to explain arcane economic and business stories in a way that the ordinary person can understand. However, I’ll leave aside the fact that the implication of his story was that the ONS produced its data to help the Chancellor politically which we definitely didn’t!
30. Davies makes an important point that impartiality doesn’t mean just sticking to the facts. To help statistically literacy in the media and other areas all NSIs need to strive more to explain what they do and what their data mean in the language of the ordinary person.
31. It’s not impossible. As a good example I have chosen something from Cancer Research UK which sees the need to help its supporters and readers to understand the difference between ‘absolute risk’

and 'relative risk'. It leads on from there to explain 'what does increase in risk really mean'.

(<http://info.cancerresearchuk.org/cancerandresearch/risk/communicatingrisk/absoluteandrelativerisk/>)

32. From there it attempts to help people separate fact from fiction. "When we hear about a particular risk factor in the media, how should we react? How do we decide whether a risk is 'real' or not?" It looks at study type, study size, previous studies and source. The explanations are simple and easy to understand and a great example of how to de-mystify statistics for the ordinary person and thus spread statistical literacy.

#### IV WHAT ELSE WE CAN DO

33. In preparing this paper, I looked back at the last time this work session featured the subject of 'statistical literacy' (Perugia, 1999). Many NSIs had active programmes to engage and the media and public, and Portugal had created an interactive page on the Internet for the advancement of statistical literacy. But how well are we making it stick?

34. In the UK the Statistics Commission and ONS last year carried out research into trust in official statistics. Among the conclusions were the needs to 'increase explanation' and 'enhance public education'. Using focus groups and interviews with the public and some key users, they came up with a number of comments made to them and some ideas of how to deal with them.

35. These ideas might be a starting point for how we should throw away the metaphorical 'bottle' and give the 'horse' what it needs – 'water in a drinking trough'.

36. To wrap up I will summarise some of the comments made by the public and users:  
([http://www.statscom.org.uk/media\\_html/reports/report\\_024/pt\\_2\\_s4\\_stakeholder\\_suggestions.asp](http://www.statscom.org.uk/media_html/reports/report_024/pt_2_s4_stakeholder_suggestions.asp))

- The simplicity of visual presentation could reduce misrepresentation of the data.
- A more proactive role in explaining the figures; at least highlighting areas that are interesting.
- There are huge amounts of social data thrown out raw and they mean nothing because they need interpretation. How about an 'independent interpreter'?
- Use new Internet technology to provide more background information.
- The Journalists' Union should insist journalists have training to understand how to interpret statistics.
- Long-term measures to improve general education.
- Equip people with 'the tools to examine data critically'.
- Encourage people to turn away from 'personal experience' towards a 'broader view'.
- Present statistics in a less intimidating way (provide a small widely available leaflet giving a picture of the country drawn from the statistics).
- Promote a regular TV programme with a popular presenter.
- Popularise statistics to remove the 'fear fact' and the 'geek factor'.

Reference: Gal, I (2002). Adults' Statistical Literacy: Meanings, Components, Responsibilities. *International Statistical Review* (2002), 70, 1.