

Consulting: Real Problems, Real Interactions, Real Outcomes

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Abstract

The Pullman meeting of IMS/WNAR had, as one of its themes, “Statistical consulting”. In this overview of the case-studies presented there, an attempt is made to draw together some of the lessons of these papers, showing the diverse role of the statistician in collecting, analyzing and presenting the information contained in the data.

1 The Pullman sessions

The papers in the Pullman panel discussion were presented by invitation at the IMS/WNAR meeting held at Washington State University in June 1996.

I organised this session. I have, over the years, organised and participated in a number of such sessions at conferences both in the US and in Australia, and it is clearly a perennial topic for statistical meetings, only perhaps rivalled by sessions on the gap between ‘academic’ and ‘practical’ statisticians, or sessions on how to teach undergraduate service courses in our notoriously uncharismatic subject.

This time I was asked to organise the session in order to atone for, or perhaps amplify, some comments I had made on the role of consultants some years previously. In [2], I wrote that the comments on consulting of the Committee on New Researchers [1] were “glib”: in particular, I disagreed rather strongly with the Committee statement that “... unless you need the data analysis experience your role [as a consultant] is to dispense advice. The client should be responsible for the actual analysis.” This seemed to

me to be very optimistic, or perhaps very pessimistic depending on one’s viewpoint. In almost any interaction I have ever been involved with, a statistician, especially a new researcher, is not usually seen by clients as a guru on a mountaintop. Statisticians will not go far if they adopt that role, at least not in a real consulting situation where it is critical to understand a variety of client-consultant interactions that will influence the requirements for effective consultation: see the Appendix for numerous views on the real complexity of the consulting role.

Moreover, the article [1] advises that “... if you have put in substantial effort, in terms of time or developing new techniques, you should ask to be a co-author” on the paper that is assumed to be the end-product of consulting. I felt that this also indicated a serious misapprehension about what most consulting was about, even for those whose role was to be “new researchers” rather than full-time consulting statisticians. (Of course, one might be justifiably cynical about the reasons for these statements: given the prevailing criteria for promotion in academia in particular, the New Researchers may have been more realistic than one might wish in their advice.)

Even so, in the belief that consulting is valuable to academic and perhaps more particularly non-academic statisticians, with Deb Nolan and LuAnn Johnson (the conference organisers at Pullman) a double-barrelled session was organized: the first half would describe some real consulting problems that might illustrate the range of activities that consultants face, of interest in their own right as well as illustrative of the many facets of our profession beyond mere advising and coauthorship; and the second part would be a panel discussion, giving anecdotes and advice and insights, with (we hoped) strong audience participation.

This worked out surprisingly well, and the papers that follow are from the first part of the session: regrettably, the insight, experience and wit of the second part is lost to all but those who were there,

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although the bibliography and WWW resources appended will enable interested readers to delve further into the available literature on this topic, and share at least one of the more tangible bits of advice from the panel.

2 The participants

In what follows you will see four articles from four rather different perspectives. When inviting speakers, we looked for a spectrum of statistical backgrounds: the participants represent the experiences of graduate students, University faculty, and statisticians working fulltime as consultants in academia, in-house with a government instrumentality, and in a private sector capacity.

Karl Broman, a PhD student from UC Berkeley, illustrates the best of the classic "on-campus" interactions: a good scientific collaboration (even a potential co-authorship!), some new techniques needed and developed, and an outcome of academic value to both parties. This is very much in the mould of the projects envisioned in [1], but even here the consultant is doing the analysis, not just assuming the client will carry it out.

Jennifer Hoeting, a new researcher now at Colorado State, describes the role of the academic statistician as funded advisor/consultant on a project. She illustrates the way in which careful investigation of the data sources is vital for any analysis to be meaningful (and lack of knowledge of the data collection, or a limited client understanding of the data under study, can cause a well-planned analysis to be inappropriate).

Sue Taylor describes the sort of rare project where the statistician is actually involved early enough to be able to influence data collection and enhance the ability to analyze. As a consultant to the Australian Longitudinal Study of Ageing, she was able to ensure (with much work) that analysis would actually be carried out on reasonably clean and reliable data, thus saving a large amount of later work in analysis.

Missing is the paper from Bob O'Brien from Battelle. From the perspective of an in-house consultant, he described a major environmental problem, and one where much of the consultant's role lay in trying to determine what the real goals and constraints were, since there were very many stakeholders in the problem: statistical analysis would provide the answers if only the questions were clear. This omission reveals again the priorities of many consultants: his on-going

duties preclude even the writing of a sole-authored paper.

Lastly, wearing an oldish hat as a private sector consultant, I describe a situation where modelling does work, and an appropriate analysis yields a counter-intuitive and effective solution - but yet again, only after the data are re-visited and the whole context of the problem is understood.

3 Conclusions

Most statisticians will find something familiar in these case-studies.

We know that understanding our data and the questions of the client are of paramount importance: it is reassuring to see an example where the statistician can control that process (Taylor). We know that close examination can reveal far more than the client originally told us (Hoeting). We know that problems are rarely standard, and that at its best statistical thinking can come up with new ways to cope with new problems (Broman), or perhaps more typically we can see the role of our assumptions and decide how well the old ways fit (Tweedie).

However, in the end, these case studies, and many other war-stories that many of us tell or have heard, all illustrate two things overwhelmingly.

Firstly, no matter what subject areas we enter, statistics can contribute something that was not there previously, and we have much to offer to almost everyone. These examples cover bench research problems, social surveys, management practices, and environmental problems on a local and a global scale. Without statistical thinking, none of them would be solvable. Moreover, they show that it is often the mere fact of such thinking, rather than the specific technical input, that proves invaluable. It is hard to overestimate how powerfully our discipline trains us to think about complicated issues in ways that allow us to quickly diagnose difficulties in esoteric disciplines to which we have had only several minutes of introduction, a fact reinforced by these examples and even further by the referees of this collection.

But secondly, for that contribution to be truly at its best, the statistician must enter into the context of the problem, not just as an "advisor", but as someone prepared to understand the data, analyse the data, interact with those who really own the questions being asked, and consider the impact of statistics within

the real context of the problem. The Pullman case-studies show many of these attributes, but also illustrate vividly the problems we have in achieving such an idealistic state.

References

- [1] New Researchers Committee of the IMS. Meeting the needs of new statistical researchers. *Statistical Science*, 6:163-174, 1991.
- [2] R.L. Tweedie. New researchers report: Comments. *Statistical Science*, 7:263-264, 1992.

RESOURCES APPENDIX

Bibliography for consultants

One of the most useful tools for consultants is a bibliography of information put together by other consultants. The papers below do not pretend to be exhaustive: they represent those that I have found of most use in my professional practice.

They also contain pointers to other material covering a wider range if needed. Those references marked with an * contain an extensive list of statistical consulting references which are not duplicated here.

ASA Ad Hoc Committee on Professional Ethics (1983). Ethical guidelines for statistical practice: Report of the Ad Hoc Committee on Professional Ethics. *The American Statistician*, 37, 5-20.

*Baskerville JC (1981). A systematic study of the consulting literature as an integral part of applied training in statistics. *The American Statistician*, 35, 121-123.

Boen JR (1972). The teaching of interpersonal relationships in statistical consulting. *The American Statistician*, 26, 30-31.

Boen JR and Fryd D (1978). Six-state transactional analysis in statistical consulting. *The American Statistician*, 32, 58-60.

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Chatfield C (1988). *Problem Solving: A Statistician's Guide* London: Chapman and Hall.

Chatfield C (1991). Avoiding statistical pitfalls. *Statistical Science*, 6, 240-268.

Ellenberg JH (1983). Ethical guidelines for statistical practice: A historical prospective. *The American Statistician*, 37, 1-4.

Hand DJ and Everitt BS (1987). *The Statistical Consultant in Action* Cambridge: Cambridge University Press.

Hunter WG (1981). The practice of statistics: the real world is an idea whose time has come. *The American Statistician*, 35, 72-76.

Hyams L (1971). The practical psychology of biostatistical consultation. *Biometrics*, 27, 201-211.

*Joiner BL Consulting, Statistical in Johnson NL and Kotz S (1961). *Encyclopaedia of Statistical Sciences*, New York, Wiley, 147-155.

Jowell R (Chairman) (1986). International Statistical Institute declaration on professional ethics. *International Statistical Review*, 54, 227-242.

Kirk RE (1991). Statistical consulting in a university: dealing with people and other challenges. *The American Statistician*, 45, 28-34.

Rustagi JS and Wolfe DA (1982). *Teaching of Statistics and Statistical Consulting* New York: Academic Press.

Sloan JA (1992). How to consult with a statistician. *The Statistical Consultant*, 9, 3-4.

*Woodward WA and Schucany WR (1977). Bibliography for statistical consulting. *Biometrics*, 33, 564-565.

Zahn DA and Isenberg DJ (1980). Non-statistical aspects of statistical consulting. *1979 Proceedings of the Section on Statistical Education*, American Statistical Association, Washington DC, 67-72.

Electronic resources

A search of the World Wide Web as at October 1996 revealed a large number of sites of relevance to consultants. The following are just a few of these: we have found them to be useful entry points, although they are by no means intended to cover the growing information resource available on the World Wide Web.

The World-Wide Web Virtual Library: Statistics

<http://www.stat.ufl.edu/vlib/statistics.html>

Statistics on the Web:

<http://www.execpc.com/~helberg/statistics.html>

Statistics Resources on the Web:

http://www.stats.gla.ac.uk/cti/links_stats.html

A Guide to Statistical Computing Resources on the Internet

http://asa.ugl.lib.umich.edu/chdocs/statistics/stat_guide_home.html

An 'Essential Book List', and useful if a year or two older than desirable:

<http://www.stat.wisc.edu/statistics/consult/statbook.html>

A very useful and up to date document, the 'List of Statistics Lists' is also available by sending the one-line message:

'send minitab list-of-lists'

to:

mailbase@mailbase.ac.uk

or by pointing your Web browser at:

<http://www.mailbase.ac.uk/lists-k-o/minitab/files/list-of-lists>

This document contains details of all current statistics-related email lists, including subscription information. These enable consultants to share information or conduct discussions on a timely basis.