

Terence's Stuff: *How to do Statistical Research*

Terry Speed gave an address at the IMS New Researcher's Conference at York University in Toronto, in August, with lots of advice. Here's a summary:



Statistical research, for me, usually begins with either trying to find a half-reasonable to a question, where I have found no prior approach exists, or trying to find a 60% reasonable answer based on something that is already half-reasonable. In brief, doing something where there is currently nothing, or doing a little better, where there is currently something. If what already exists is pretty good, I'll use it.

This takes place in a context (data, questions). I lost interest in context-free statistical research long ago, partly because any "standard" or "routine" method, model, tool or technique is likely to need modification or extension, in a new context. Therein lies the chance to do some research, if that interests you. If not, use something "off-the-shelf", and hope it does the job. (In my experience, finding out whether a given method, model, tool or technique does the job is frequently a research problem itself.) If there is no "standard" or "routine" method, model, tool or technique, go for it, and hope nobody notices till you are done!

A strategy I discourage is: "develop theory/model/method, seek application". Developing theory, a model or a method suggests that you have done some context-free research; already a bad start. The existence proof (is there a problem?) hasn't been given. If you then seek an application, you don't ask "What is a reasonable way to answer this question, given this data, in this context?" Instead you ask "Can I answer

this question with this data, in this context, with my theory, model or method?" Who then considers whether a different (perhaps simpler) answer would have been better?

The ideal research problem in statistics is 'do-able', interesting, and one for which there is not much competition. My strategy can be summed up as:

Consulting: a very large amount

Collaborating: quite a bit

Research: some

Why? A very large amount of consulting means meeting many people and many problems, learning a lot, including finding out where we are ignorant. Then we might spot some low hanging fruit. Quite a bit of collaboration gives you an in-depth knowledge of something, rubs your nose in our ignorance, and perhaps motivates you to reduce it a little. Research keeps the brain active and is fun. It also helps careers (fame, fortune), but you know that.

A clarification: For many – perhaps most – of you, the way to do statistical research is to get more data (in context, with questions), through consulting and collaborating. However, for a few of you, it may be to get less data, that is, seek the opportunity to focus on research more, and do less consulting and collaborating.

I say do a great deal of consulting. How can you make this happen, with whom, and how much is "a great deal"? Naturally, the answer depends on your situation. If you are at a university or other research institution, you should have no real difficulty. If you are somewhere else, it can be harder.

I say collaborate a lot. How do you find collaborators, how do you choose them, and how much is "a lot"? The answer here also depends on your situation. Collaboration can arise out of consulting. Collaborate on a topic in which you are interested; with people in the field you like; who are good at

what they do; who are conveniently located, so you can see them frequently, and become part of the team. And if you're asking how much is enough, you can do more! You'll know. Talk it over with your mentor.

Mentors can help a lot. Help you to get started, help you to carry on, help you know when to stop. Find one! Similarly, your boss can help. S/he should support your efforts; understand your aspirations; accommodate your needs, see that your efforts are recognized. You may not always be so lucky!

As for actually *doing* statistical research...

Most of what I have talked about is arranging the conditions for research opportunities to present themselves: this is by far the major part of the problem. Doing the research is also important. So I offer some quotes and comments (guess the sources!), and some of my own experience.

- ✧ *Research is 1% inspiration and 99% perspiration.*
- ✧ *Develop your technique.*
- ✧ *If at first you don't succeed, try, try again. (Then quit. No use being a damn fool about it.)*
- ✧ *Keep it "as simple as possible, and yet no simpler".*
- ✧ *Chance favours prepared minds.*
- ✧ *My method of overcoming a difficult problem is to go around it.*
- ✧ *An approximate answer to the right question is worth a good deal more than the exact answer to an approximate problem.*
- ✧ *Never stop listening to and learning from others.*
- ✧ *Use all the resources available: CIS, PubMed, etc.*
- ✧ *Research is the process of going up alleys to see if they are blind.*
- ✧ *Emulate the masters and mistresses, i.e. copy (but with attribution!).*