
“The whole women thing”

Nancy M. Reid

*Department of Statistical Sciences
University of Toronto, Toronto, ON*

It is an honor and a pleasure to contribute to this celebratory volume, and I am grateful to the editors for their efforts. The temptation to discuss non-technical aspects of our profession and discipline has caught me too, and I have, with some trepidation, decided to look at the past, present and future of statistical science through a gender-biased lens. In the past fifty years, a great deal has changed for the better, for the position of women in science and in statistical science, but I believe we still have some way to go.

20.1 Introduction

The title of this chapter is a quote, as I remember it, from a dear friend and colleague. The occasion was a short discussion we had while rushing in opposite directions to catch talks at a Joint Statistical Meeting, probably in the early 1990s, and he asked me if I might consider being nominated to run for election as President of the Institute of Mathematical Statistics (IMS). I was completely surprised by the question, and my immediate reactions were to be honored that we were discussing it, and to assume that the question was rhetorical. He said no, this was within the realm of possibility, and I should give it careful consideration, for all the reasons one might expect: an honor for me, a chance to influence an organization I cared about, etc. He ended by saying “plus, you know, there’s the whole women thing. I guess you’d be the first.” In fact, Elizabeth Scott was the first woman President of the IMS, in 1978.

For various reasons, a number of unconnected events recently got me thinking about “the whole women thing.” Despite many years of on-and-off thinking about issues surrounding gender and a professional career, I find I still have a lot of questions and not many answers. I have no training in social science, nor in womens’ studies, nor in psychology, and no experience of what

seems to me the difficult world outside academia. I will present a handful of anecdotes, haphazardly chosen published studies, and personal musings. My vantage point is very North American, but I hope that some of the issues resonate with women in other countries as well.

20.2 “How many women are there in your department?”

In September, 2012, the small part of the blogosphere that I sometimes wander through lit up with an unusual amount of angst. A study on gender bias (Moss-Racusin et al., 2012a,b) appeared in the *Proceedings of the National Academy of Sciences* (PNAS), not in itself so unusual, but this one got us rattled. By “us” I mean a handful of internet colleagues that worry about issues of women in science, at least some of the time. I was alerted to the article through Isabella Laba’s blog (Laba, 2012a, 2013), but the story was also picked up by many of the major news organizations. The PNAS paper reported on a study in which faculty members in biology, chemistry and physics departments were asked to evaluate an application for a position as a student laboratory manager, and the participants were told that this was part of a program to develop undergraduate mentoring. From Moss-Racusin et al. (2012b):

“Following conventions established in previous experimental work..., the laboratory manager application was designed to reflect slightly ambiguous competence, allowing for variability in participant responses... if the applicant had been described as irrefutably excellent, most participants would likely rank him or her highly, obscuring the variability in responses to most students for whom undeniable competence is frequently not evident.”

In other words, the applicant would likely not be at the top of anyone’s short list, but was qualified for the position. Faculty were asked to evaluate the application as if they were hiring the student into their own lab. The applications were all identical, but for half the scientists the student was named “John,” and for the other half, “Jennifer.”

The headline story was that scientists rated applications from a male student higher than those from a female student. Scores assigned to qualities of competence, hireability, and mentoring, were systematically higher for the male student application, and

“The mean starting salary offered the female student, \$26,507.94, was significantly lower than that of \$30,238.10 to the male student [$t = 3.42, P < 0.01$]” (Moss-Racusin et al., 2012a)

Many more details about the methods for the study, the relevant literature, and the results, are available from the original publication (Moss-Racusin

et al., 2012a), and the accompanying supplementary material (Moss-Racusin et al., 2012b). A particularly concerning result was that female scientists exhibited the same gender bias as their male counterparts.

These results reverberated because they felt real, and indeed I felt I recognized myself in this study. During my many years on search committees, and during my five-year tenure as department chair, efforts to hire female research-stream faculty were not successful. It took me a surprisingly long time to come to the conclusion that it was easy to decide to make an offer to the *best* female candidate in any given hiring season, but much, much harder for females in the next tier ‘down’ to be ranked as highly as the men in the same tier. Our intentions were good, but our biases not easily identified. With reference to the PNAS study, Laba says:

“The scientists were not actively seeking to discriminate... They offered similar salaries to candidates that they perceived as equally competent, suggesting that, in their minds, they were evaluating the candidate purely on merit. The problem is that the female candidate was judged to be less competent, evidently for no reason other than gender, given that the resumes were exactly identical except for the name. [...] I’m sure that most of the participants, believing themselves unbiased, would be shocked to see the results.” (Laba, 2012a)

I’ve presented this study in two talks, and mentioned it in a number of conversations. The reaction from women is often to note other related studies of gender bias; there are a number of these, with similar designs. An early study of refereeing (Goldberg, 1968) involved submitting identical articles for publication with the author’s name either Joan or John; this study featured in the report of an IMS committee to investigate double-blind refereeing; see Cox et al. (1993). A more common reaction is to speculate more broadly on whether or not women self-select out of certain career paths, are genuinely less interested in science and so on. This deflects from the results of the study at hand, and also diffuses the discussion to such an extent that the complexity of “the women thing” can seem overwhelming. Here is Laba in a related post:

“Let’s recap what the study actually said: that given identical paper-work from two hypothetical job candidates, one male and one female, the woman was judged as less competent and offered a lower salary. This is not about whether girls, statistically speaking, are less interested in science. It’s about a specific candidate who had already met the prerequisites... and was received much better when his name was John instead of Jennifer.” (Laba, 2012b)

We all have our biases. The ABC News report (Little, 2012) on the paper described a “small, non-random experiment,” but the study was randomized, and the authors provided considerable detail on the size of the study and the response rate. The authors themselves have been criticized for their bar chart

of the salary differential. By conveniently starting the y -axis at \$25,000, the visual appearance suggests a three-fold salary differential.

That the biases are subtle, and often unconscious, is much better than what many of the pioneers faced. Elizabeth Scott’s first ambition was to be an astronomer, but she soon realized that this was a hopeless career for a woman (Billard and Ferber, 1991). We’ve heard the jaw-dropping stories of blatant sexism from days gone by, and to the extent that this is behind us, this is progress of a sort. But biases that we don’t even recognize should concern us all.

How to move forward? I hope this study will help: by highlighting biases that seem to be operating well below the surface, perhaps the next search committees will work even harder. Genuine efforts are being made at my university, and my department, and I believe at universities and departments around the world, to increase the number of women hired, and to treat them well. There is progress, but it seems to be slow and imperfect.

20.3 “Should I ask for more money?”

This might be the most common question I am asked by our graduating students who are considering job offers, in academia or not. Of course uncertainty about how to negotiate as one starts a career affects men and women, and there are many aspects to the dialogue between a candidate and prospective employer, including the hiring landscape at the time, the trade-off between salary and other aspects of the position, and so on.

When I arrived at the University of Toronto in 1986, both the government of Canada, and the government of Ontario, had passed pay equity laws, enshrining the principle of “equal pay for work of equal value.” This is broader than “equal pay for equal work,” which had already been in force for some years in most jurisdictions in Canada. The laws led to a flurry of work on pay equity at that time, and one of my first consulting projects, undertaken jointly with Ruth Croxford of our department, was to review the salaries of all faculty at the University of Toronto, with a view to identifying pay equity issues.

I was at the time unaware of a strong legacy for statistical analyses of faculty salaries initiated by Elizabeth Scott (Gray and Scott, 1980; Scott, 1975), who led the charge on this issue; see Billard and Ferber (1991). Lynne Billard made important follow-up contributions to the discussion in 1991 and 1994 (Billard, 1991, 1994). Lynne’s 1994 paper asked: “Twenty years later: Is there parity for academic women?”; her answer was “no” (the title referred to a US government law, Title IX of the Education Amendments, enacted in 1972). This continues to be the case. For example, the University of British Columbia (UBC) recommended in October 2012 an across-the-board salary increase of

2% to all female faculty (Boyd et al., 2012). The detailed review of university practices on this issue in the UBC report noted that many universities have implemented ongoing reviews and adjustments of female faculty salaries on a regular schedule.

As with hiring, it is easy to get distracted in the salaries debate by potential factors contributing to this. One is rank; it continues to be the case that women are under-represented in the professorial rank; the London Mathematical Society has just published a report highlighting this fact in mathematics (London Mathematical Society, 2013). A point very clearly explained in Gray and Scott (1980) is that systematic differences in rank are themselves a form of gender bias, so not appropriate defence against salary remedies. Even setting this aside, however, the UBC report concluded that after adjusting for rank, departmental unit, merit pay and experience, “there remains an unexplained female disadvantage of about \$3000” (Boyd et al., 2012).

It may be the case that on average, women are less aggressive in negotiating starting salaries and subsequent raises, although of course levels of skill in, and comfort with, negotiation vary widely across both genders. Other explanations, related to publication rate, lack of interest in promotion, time off for family matters, and so on, seem to need to be addressed in each equity exercise, although this seems to me to be once again “changing the subject.” As just one example in support of this view, the UBC report, referring to an earlier salary analysis, concluded: “our assumptions would be supported by a more complete analysis, and... parental leave does not alter the salary disadvantage.”

Over the years I have often met statistical colleagues, usually women, who were also asked by their university to consult on an analysis of female faculty salary data, and it often seemed that we were each re-inventing the wheel. The pioneering work of Gray and Scott (Gray and Scott, 1980) touches on all the main issues that are identified in the UBC report, and it would be good to have a central repository for the now quite large number of reports from individual universities, as well as some of these key references.

20.4 “I’m honored”

The Elizabeth L. Scott Award was established by COPSS in 1992 to honor individuals who have “helped foster opportunities in statistics for women.” The first winner was Florence Nightingale David, and the second, Donna Brogan, said in her acceptance speech that she looked forward to the day when such awards were no longer needed. While women are well-represented in this volume, I think that day is not here yet.

I was involved in a number of honor-related activities over the past year or two, including serving on the Program Committee for a major meeting,

on an *ad hoc* committee of the Bernoulli Society to establish a new prize in statistics, and as Chair of the F.N. David Award Committee.

On the Program Committee, the first task for committee members was to create a long list of potential candidates for the plenary lecture sessions. In a hurry, as usual, I jotted down my personal list of usual suspects, i.e., people whose work I admire and who I thought would give interesting and important presentations. I examined my list more critically when I realized that my usual suspects were all about the same age (my age or older), and realized I'd better have another think. Some on my list had already given plenary lectures at the same meeting in earlier years, so off they came. I'm embarrassed to admit that it took me several passes before I realized I had no women on my list; another round of revisions was called for. At that point I did some research, and discovered that for this particular meeting, there had been no women plenary speakers since 1998, which seemed a pretty long time.

Then things got interesting. I sent an email to the Program Committee pointing this out, and suggesting that we should commit to having at least one female plenary lecturer. Email is the wrong medium in which to rationalize opposing views, and it turned out there were indeed opposing, as well as supporting, views of this proposal. Extremes ranged from “I do not consider gender, race or any other non-scientific characteristics to be relevant criteria” to “I do find it important for the field and for the meeting that female researchers are well represented.” Without the diplomatic efforts of the Chair, we might still be arguing.

What did I learn from this? First, we all have our biases, and it takes some effort to overcome them. The more well-known people are, the more likely they are to be suggested for honors, awards, plenary lectures, and so on. The older they are, the more likely they are to be well-known. Statistical science is aging, and we have a built-in bias in favor of established researchers, that I think makes it difficult for young people to get the opportunities and recognition that I had when I was young(er). Second, our biases are unintentional, much as they surely were for the scientists evaluating lab manager applications. We are all busy, we have a lot of demands on our time, and the first, quick, answer is rarely the best one. Third, it is important to have women on committees. I wish it were not so; I have served on far too many committees in my career, and every woman I know says the same thing. It turned out I was the only woman on this particular Program Committee, and while I had good support from many members, I found it lonely.

The Bernoulli Society recently established the Wolfgang Doeblin prize in probability (see Bernoulli Society (2012)), and I chaired an *ad hoc* committee to consider a new prize in statistics. Wolfgang Doeblin died in 1940, just 25 years old, and shortly before his death wrote a manuscript later found to contain many important ideas of stochastic calculus (Göbel, 2008). The award is thus given to a single individual with outstanding work, and intended for researchers at the beginning of their mathematical career.

A parallel to this could be a prize for statisticians at the beginning of their career, and my personal bias was to restrict the award to women. On discussion with colleagues, friends, and members of the committee, it became apparent that this was not quite as good an idea as I had thought. In particular, it seemed likely that a prize for women only might have a negative connotation — “not a ‘real’ prize” — not among the curmudgeonly senior colleagues of the awardees, but among the potential awardees themselves. In fact I am sure I would have felt that way myself.

On to the next challenge. We decided to recommend naming the prize after a female statistician, no longer living. Well, we already have the E.L. Scott prize, the F.N. David Award, and the Gertrude Cox scholarship. Quick, how many can you name? How many of your colleagues will recognize the name?

We discovered Ethel Newbold (1882–1933), the first woman to be awarded a Guy Medal in Silver from the Royal Statistical Society, in 1928. We also discovered that the second woman to be awarded a Guy Medal in Silver was Sylvia Richardson, in 2002. Get nominating, ladies! We needn’t feel smug on this side of the Atlantic, either; see Gray and Ghosh-Dastidar (2010) and Palta (2010).

The F.N. David Award is the only international award in statistical sciences that I am aware of that is restricted to women. It was established jointly by COPSS and the Caucus for Women in Statistics in 2001. The nominees this year were amazing, with nomination letters and *vitae* that could induce strong feelings of inadequacy in any reader. But a side remark from one nominator got me thinking. The nominator pointed out that the selection criteria for the award were daunting indeed, although his nominee did indeed fulfill all the criteria, and then some. I had a more careful look at these criteria, and they are

“Excellence in the following: as a role model to women; statistical research; leadership in multidisciplinary collaborative groups; statistics education; service to the profession.”

Hello Caucus! We are *much* too hard on each other! But perhaps I’m being unfair, and the intention was “one of,” rather than “all of.” I can say though, that our leading female colleagues do seem to manage to excel in “all of.” Here’s Laba again on a similar point:

“The other way to make progress, of course, is for women to be ‘twice as good,’ [...] That’s what many women in science have been doing all along. It takes a toll on us. It’s not a good solution. Unfortunately, sometimes it’s the only one we’ve got.” (Laba, 2012b)

20.5 “I loved that photo”

The 1992 Joint Statistical Meetings coincided with our first daughter’s first birthday, so we joined the legions of families who combine meetings with children. If you’ve done this you’ll know how hard it can be, and if you haven’t, well, be assured that it is an adventure. George Styan snapped a picture of me with Ailie in a back carrier, and this photo ended up being printed in the *IMS Bulletin*. At the time I was quite embarrassed by this — I thought that this photo would suggest that I wasn’t taking the meeting, and by extension research, seriously enough. But in fact I received so many emails and notes and comments from colleagues, expressing the sentiment in the section heading, that in the end I was, and am, grateful to George for his sixth sense for a good snapshot.

For me the most difficult aspect of the discussion around women and academia is children. Decisions around having and raising children are so deeply personal, cultural, and emotional, that it often seems better to leave this genie in the bottle. It is also the most disruptive part of an academic career, and by and large still seems to be more disruptive for women than for men. It risks being a two-edged sword. If differences in opportunities are tied to child-rearing, then is there a temptation to assume that women without children face no hurdles, or that men who choose to become more involved in child care should be prepared to sacrifice advancement at work? Again it is easy to get distracted by the complexity and depth of the issues, and lose the main thread.

The main thread to me, is the number of women who ask me whether or not it is possible to have an academic career in a good department and still have time for your family. When is the ‘best’ time to have children — grad school? Post-doc? Pre-tenure? If I wait until I have tenure, will I have waited too long? What about promotion to full professor? I don’t know the answer to any of these questions, but I do know women who have had children at each of these stages, and who have had, and are having, very successful academic careers.

I can only speak for academia, but exceptionally talented and successful women are speaking about government and industry: Anne-Marie Slaughter, (Slaughter, 2012) and Sheryl Sandberg (Sandberg, 2013), to name just two.

Slaughter, a Princeton professor who spent two years in a high profile position in Washington, DC, writes:

“I still strongly believe that women can ‘have it all’ (and that men can too). I believe that we can ‘have it all at the same time.’ But not today, not with the way America’s economy and society are currently structured. My experiences over the past three years have forced me to confront a number of uncomfortable facts that need to be widely acknowledged — and quickly changed.” (Slaughter, 2012)

Happily for most readers of this article, Slaughter contrasts the flexibility and freedom she has with her academic appointment with the demands of a high-profile position in government. While the very heavy demands on her time at Princeton would make most of us weep, “I had the ability to set my own schedule most of the time. I could be with my kids when I needed to be, and still get the work done” (Slaughter, 2012). This article is a great reference to provide to your graduate students, if they start wondering whether an academic career is too difficult to combine with family life. However, much of what she describes as barriers to women in high-level government positions resonates in a thoughtful analysis of the difficulties faced by women moving into the leadership ranks of universities; see Dominici et al. (2009).

Sandberg has been criticized for implying that at least some of the barriers for advancement of women are created by the womens’ own attitudes, particularly around family, and she exhorts women to make sure that they are aggressively pursuing opportunities. The position set out in her book (Sandberg, 2013) is much more nuanced than that, but the notion that women are sometimes their own worst enemies did resonate with me. In an interesting radio interview with the BBC (BBC News, 2013), Sandberg suggested that the phrases “work-life balance” and “having it all” should *de facto* be mistrusted, as they are themselves quite gender-specific.

Recently I visited the lovely new building that is now home to the Department of Statistics at North Carolina State University. As it happened, there was a career mentoring event taking place in the department at the same time, and over coffee I met an enthusiastic young woman who is completing a PhD in statistics. Her first question was about balancing career and family in a tenure-stream position; I think I relied on the rather bland “advice” mentioned above. But the most encouraging part of the day was the tour of the department. There, between the faculty offices, department lounge, seminar rooms, and banks of computer terminals, was a wonderful sight: a Baby Room! I imagine that Gertrude Cox would be surprised to see this, but I hope she would also be proud of the department she founded.

20.6 Conclusion

The position of women in academia is vastly improved from the days when Elizabeth Scott was discouraged from studying astronomy, and from the days when my probability professor could state in class that “women are not suited for mathematics.” Determined and forceful pioneers through the 1950s and 1960s, followed by much larger numbers of female students from the 1970s on, has meant that women do have many opportunities to succeed in academic work, and many are succeeding on a number of levels.

I find it difficult to discuss all these issues without seeming plaintive. I write from a privileged position, and I can say without hesitation that I personally do not feel disadvantaged; my career has coincided with a concerted effort to hire and promote women in academia. And yet I’ve felt the energy drain from trying to tackle some of the issues described here. I’ve experienced the well-documented attrition through the ranks: although my undergraduate statistics class had nine women in a class of 23, and my graduating PhD class had four women and three men, I continue to be the only female research stream faculty member in my department. While I enjoy my colleagues and I love my job, I believe this stark imbalance means our department is missing out on something intangible and important.

So while I don’t stress about gender issues all the time, I do find that after all these years there still are many things to discuss, to ponder, to wonder over, and with luck and determination, to solve.

Acknowledgements

I was fortunate to meet as an undergraduate three (then future) leaders of our discipline: Lynne Billard, Jane Gentleman, and Mary Thompson; this is my personal proof that role models are essential. I would like to thank them for their contributions to, and achievements for, our profession.

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