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A Conversation with Mary E. Thompson

Rhonda J. Rosychuk

Abstract. Mary E. Thompson (née Beattie) was born September 9, 1944, in Winnipeg, Manitoba, Canada. She obtained a B.Sc. in Mathematics from the University of Toronto in 1965, and earned M.Sc. (1966) and Ph.D. (1969) degrees in Mathematics from the University of Illinois at Urbana-Champaign. She joined the Department of Statistics at the University of Waterloo as a Lecturer in 1969 and became an Assistant Professor in 1971. In 2004, she was awarded the honour of University Professor and in 2011 became Distinguished Professor Emerita at the University of Waterloo. She has served in many leadership roles including Chair of the Department of Statistics and Actuarial Science, Acting Dean of the Faculty of Mathematics, President of the Statistical Society of Canada (SSC) and Chair of the COPSS Presidents' Award Committee. She chaired the Development Committee for the Canadian Statistical Sciences Institute (CANSSI) and was its founding Scientific Director.

Thompson has received numerous honours and awards including the SSC's Gold Medal, the Elizabeth L. Scott Award, the Waksberg Award of Survey Methodology and the Governor General's Innovation Award. She is an elected member of the International Statistical Institute, an Honorary Member of the SSC and is a Fellow of the American Statistical Association, the Institute of Mathematical Statistics, the Royal Society of Canada and the Fields Institute.

Thompson has made fundamental contributions to several areas in statistics including sampling theory and the analysis of surveys. She is the author of two books in these areas: *Theory of Sample Surveys* (1997) and *Sampling Theory and Practices* (2020 with C. Wu). She has also made key contributions in estimation theory and stochastic processes. As the author of over 150 published, refereed papers, Thompson has influenced the theory and practice of statistics.

The following conversation took place virtually in September 2022 with interviewer Rhonda J. Rosychuk of the University of Alberta.

Key words and phrases: University of Waterloo, Statistical Society of Canada, Canadian Statistical Sciences Institute, sampling theory, survey methodology, estimation theory, stochastic processes.

1. EARLY LIFE

Rosychuk: It is a privilege to have this conversation with you. Let's start at the beginning. What was your childhood and family life like?

Thompson: When I was born in 1944, my father was serving overseas, and my mother was staying with her parents in Winnipeg. In 1945, we moved to Toronto, where my father became a teacher at a private school. My three younger brothers were born in the next few years, necessitating a new position for our father at the Hydro Electric Power Commission of Ontario (Ontario Hydro), and a new house in Scarborough on the east side of Toronto. Most of my elementary and all of my secondary schooling took place in Scarborough. I graduated from R.H. King Collegiate Institute in 1961.

Our mother was skilled in mathematics and science. Although she had wanted to become a doctor, she had studied household science at Macdonald College, McGill University, and had worked as a dietitian before marriage. She was a fine bridge player, a good shot with bow and

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arrow or rifle, a downhill skier and a superb driver. She hated housework, but cooked beautifully and made clothing with talent and flair. None of these ancillary gifts were passed on to me! But I think her sense of responsibility and passion for social justice have left their mark.

Our father had been brought up in straitened circumstances in Saskatchewan and in Nelson, BC. He was a natural scholar, but his university education had been delayed, first by the early years of the Depression, and then by his service in World War II. He attended graduate school part-time on returning, and earned a Master's degree in History from the University of Toronto. He spent as much time with us as he could, given his very long working days, and he would take us on outings, and teach us to swim, skate and play baseball. From him, we inherited a love of music and drama, a love of order and respect for time and perhaps also the ability to dream and to make the best of difficult conditions.

Rosychuk: Did you like going to school? What was your favourite part of school?

Thompson: *Going* to school in Scarborough involved lengthy walks, sometimes in too much of a hurry, sometimes through hostile territory, but I liked *being* in school well enough. I was a couple of years younger than most of the other students. In elementary school, I was quick to learn the basics but struggled with those aspects requiring coordination: handwriting, art, athletics.

Secondary school at R.H. King represented a big change. We were now learning how to study, and some of our teachers were among the best in their profession. I particularly enjoyed music, languages and literature, and mathematics. My class was fortunate to be taught mathematics for four of our five years by J.I.R. McKnight, a superb teacher and a true gentleperson. We learned from him that mathematics could be a calling. In those days, the Ontario curriculum included a thorough grounding in Euclidean geometry. As early as grade 10, we were exposed to the notions of axiom, lemma and proposition, and the concept of proof. We were challenged to solve fascinating and intriguing problems. Almost the whole grade 12 year was devoted to Euclid, up to parts of Book V. Immensely interesting.

Grade 12 was the year we were supposed to decide whether or not to apply to a university, and if so what we wanted to study. I had assumed it would be modern languages, and remember very vividly the moment when I suddenly realized that it should be mathematics instead. It was something of a shock to family and friends, and even to myself. I accordingly signed up for all the math and science examinations in grade 13, as well as all the modern language ones (in case I changed my mind), and applied to Mathematics, Physics and Chemistry (MPC) at the University of Toronto.

Rosychuk: Did you think you had been "called" to do mathematics?

Thompson: I do think that it was something very like that. It was not the outcome of deliberate and rational decision making.

Rosychuk: When did you take an interest in statistics?

Thompson: I'd have to say that in secondary school I had no idea of statistics, or even probability. The latter was touched upon fleetingly in some enrichment classes. I liked reading about science, but that was mainly about theories and mechanisms rather than experimentation and data. I was introduced to probability in Feller Volume 1 as an undergraduate, in second year, and was immediately fascinated. A strong interest in the practice of statistics came much later, beginning when I was asked to teach what is now STAT 231 at the University of Waterloo, using an early version of the textbook by James G. (Jim) Kalbfleisch.

Rosychuk: What was your first job?

Thompson: When I was at university, my father was able to obtain summer jobs for me at Ontario Hydro. I worked at first in the department that produced statistics on peak electricity loads and total energy generated, but later, for three successive summers, in the computing department. The latter was where I learned to code, first using machine language and a higher-level language called SMALGOL (small ALGOL), and then Fortran. I was actually assigned to use statistical methods to evaluate a model for the flow of water through Lake Erie, when all I knew of techniques at the time was multiple linear regression.

2. UNIVERSITY TRAINING

Rosychuk: You did an undergraduate degree in mathematics at the University of Toronto. Did you take any statistics classes as an undergraduate?

Thompson: Yes. In second year as mentioned above, we were required to take a term of probability taught by Daniel B. DeLury. This was followed by a term course in basic statistics. In third year, we had an introduction to stochastic processes and a further statistics course that included multiple linear regression. In our final year, we could take design of experiments (I did not), statistical inference (from Fisher's *Statistical Methods and Scientific Inference* [3]) and multivariate analysis.

We were very privileged to be taught the courses in basic statistics and inference by Donald A.S. Fraser, and I believe now that what he taught us strongly influenced the way I think about statistics. As an undergraduate, I was more interested in mathematics, and found stochastic processes, taught by Muni S. Srivastava and Mustafa A. Ackoglu, most engaging. Another excellent third year course was real analysis, taught by H. Chandler Davis, a recent arrival from the US. A year later, as I was applying to graduate schools, wanting to pursue probability theory, I happened to meet Professor Davis on campus, and asked

his advice. He encouraged me to try for the University of Illinois, because of their strength in probability and analysis and the nonzero chance that they might accept me—which they did.

Rosychuk: Was there a class in your undergraduate or graduate studies that you found particularly challenging?

Thompson: There were many. The undergraduate Mathematics, Physics and Chemistry program was well known for its high failure rates. Professor DeLury, who was Head of the Mathematics Department, addressed us the first day, and said: "Most of you will have heard it said that this is the hardest program in the University. If the work is the kind that you are very good at, it is the easiest program in the University." There were *some* students in the latter category—perhaps 25 in a class of 250. For the rest of us who survived, it took most of the first year to get used to the fast pace and the higher level of sophistication in all subjects. A key fog-lifting moment occurred in calculus study hall one morning in mid-March when I constructed an epsilon-delta proof for the first time! Otherwise, for me by far the most challenging parts were the labs, and I was glad to be able to turn away from physics and chemistry by third year.

Rosychuk: What motivated you to get a Ph.D.?

Thompson: Essentially, it was that many of my undergraduate classmates were headed in that direction, thinking that a career in university teaching seemed attractive. We were enjoying being at university, and were interested to see how much more we could learn by carrying on for a few more years (Figure 1).

Rosychuk: Your dissertation supervisor was Joseph L. Doob at the University of Illinois at Urbana-Champaign and your dissertation title was *Some Aspects of Optimal Stopping Theory* [16]. How did you choose to work with Doob and your dissertation topic? What was it like to work with Doob?

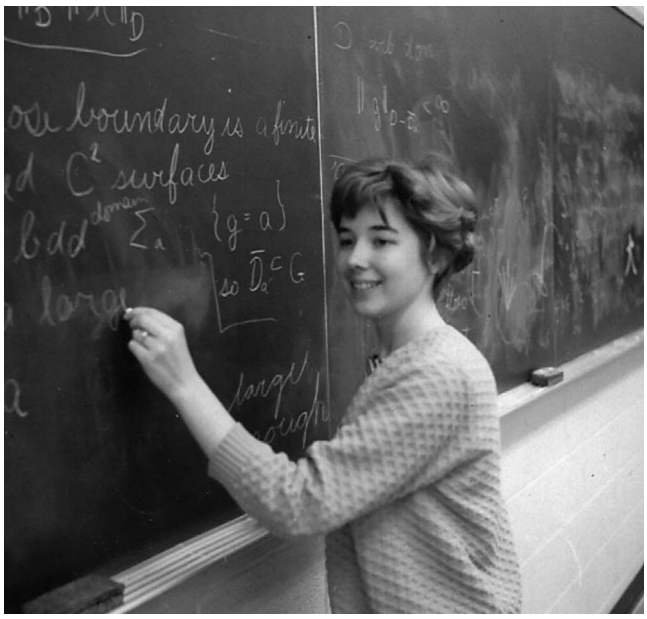

FIG. 1. *Mary Beattie as a Ph.D. student, May* 1967.

Thompson: I found upon arriving that there were several highly regarded probabilists at Illinois. But I liked Professor Doob's way of thinking and teaching. My office mate was one of his students, and she encouraged me to approach him—in fact, she told him I would be asking him! I was only able to summon up the courage to ask him to *suggest* a supervisor, but he kindly said right away that I could work with him. After we had met weekly, a few times he suggested the dissertation topic, and I went away and worked on it. It turned out to be a very good topic for me, both at the time and in terms of how I was able to draw upon it later. I would report in once or twice a term, and receive further comments and suggestions. In those days, this was quite a lot of attention: it was sometimes said by those of a minimalist persuasion that the duties of a supervisor were to know the student's name, and to read and sign off on the thesis!

We were required to attend colloquia, and to participate in a probability seminar every other week. The seminars were followed by a pizza lunch at a local restaurant. The discussion was always lively and interesting. Looking back, my experience as a Ph.D. student is still a cause for much appreciation and gratitude.

Rosychuk: Do you have any other special memories about your time as a graduate student? Who was there at the time?

Thompson: I do have a number of special memories, particularly of the faculty in the Mathematics Department. In my first term, I took a very interesting course on recursive function theory (a branch of logic) with Kenneth Appel, who later in 1976 with Wolfgang Haken proved the four colour theorem. There were three women who made strong impressions on me when I was there: Alexandra Ionescu Tulcea, who was working at the intersection of probability and functional analysis; the probabilist, Catherine Doléans-Dade, who proved fundamental results in semimartingale theory and stochastic differential equations; and Esther Seiden, a pioneering researcher in combinatorics and design of experiments and at the time a sabbatical visitor from Michigan State. I had some good conversations with Professor Seiden then, and later when she visited my colleague Kirti Shah at Waterloo. Maurice R. Heins taught us advanced complex analysis, and took several of us to the Séminaire de mathématiques supérieures (a summer school) at the Université de Montréal in 1967. That was the summer both of Expo 67 and of the visit by French President Charles de Gaulle when he declaimed "Vive le Québec libre!" at the end of a speech. We had been given time off to listen to a simultaneous broadcast, and thus participated in that historic moment!

Rosychuk: That is indeed a very interesting part of Canadian history.

Thompson: Yes, it was a time of many important events. The last part of the sixties was also a very significant period for the United States, of course, and I was immersed in it. But living and studying in Montréal for a few weeks felt like the beginning of preparation to come back.

Rosychuk: When you were ready to leave Illinois, what was your academic job search like?

Thompson: My husband, Carl Thompson, also from Toronto, was working on his Ph.D. in Civil Engineering, and we thought we should try to come to a Canadian university that was strong in both Civil Engineering and Mathematics. By the time we were applying in 1969, Waterloo had that reputation. Carl went to see the Waterloo Civil Engineering Department early in the year, and was offered a position as a Research Assistant Professor. A couple of months later, Professor Doob told me it was time for him to find me a job, and asked to what places he should write. (That is how it was done in those days!) I asked him to write to the Faculty of Mathematics at Waterloo. He did so and received the reply that they were not interested in hiring someone with my qualifications, but that I could come around and say hello when we had moved to Waterloo at the end of August.

Rosychuk: That must have been a surprise.

Thompson: The tone of it certainly was! When I had gotten over the initial sharp disappointment, I told Professor Doob that I'd like to try following the suggestion, no need to write anywhere else for now, and indeed, it eventually worked out. Carl and I were very fortunate, of course, that our "two-body" problem was so easily resolved. Back in 1969, the University of Waterloo was something of a trailblazer in having no issue with hiring both members of a couple.

Thus my first academic position was the Lecturer position at Waterloo, with an office and a sessional, and I have stayed here all my life so far!

3. UNIVERSITY OF WATERLOO

Rosychuk: What were your thoughts of the recently formed Department of Statistics at the University of Waterloo? Who were your contemporaries?

Thompson: When I first arrived, David A. Sprott was both Dean of Mathematics and Chairman [sic!] of the Department of Statistics. He was about to leave for a sabbatical in England, leaving Jim Kalbfleisch as Acting Chairman. By today's standards, the faculty were all relatively young. I believe Acting Dean, William F. Forbes, at 45, was our most senior member. Other statistics faculty included Vidyadhar P. Godambe, Kirti R. Shah, Greg W. Bennett, Jim B. Whitney, J. Clif Young, Jack C. Robinson, Winston H. Cherry and Jane F. Gentleman. Jerry F. Lawless and Jack D. Kalbfleisch had just obtained their Ph.D.s at Waterloo and had left to begin their careers elsewhere for a few years. The department very much reflected Dave Sprott's vision: strength in Fisherian statistical inference and associated theory; an emphasis on applications, particularly in biometry and biostatistics and an expanding undergraduate program in actuarial science. Jim Kalbfleisch was in the process of designing a first-rate undergraduate curriculum. There were master's students and a small number of Ph.D. students, and opportunities to help supervise almost immediately.

At Waterloo, the mathematics, statistics, actuarial and computing programs had been designed with the aims of recruiting and educating top notch undergraduates. A signature achievement had been the development in 1965 of WATFOR, a student-friendly Fortran compiler, by a group of four undergraduates. Accordingly, faculty recruitment in the 1960s was mainly about teaching, with eminence in academic research a more distant goal, albeit a very real one.

When I arrived in the Fall of 1969, preparations were underway for the Waterloo Symposium on the Foundations of Statistical Inference, organized by Professors Godambe and Sprott. The symposium was held in 1970, and attended by some of the most prominent researchers in foundations and theoretical statistics. It helped to put statistics at Waterloo on the map. Helping with the arrangements and the proceedings and participating in the symposium were formative experiences.

Rosychuk: Why did you stay at Waterloo?

Thompson: Probably the most important reason was family considerations. Carl and I were both employed here, our children were born and brought up here, and in fact they are all still here. Perhaps our grandchildren will move farther afield!

On the professional side, I can say that it took many years for me to grow into the position and to feel at home and accepted at Waterloo, but after a while I noticed that causes for dissatisfaction or disappointment were typically temporary—the institution itself is perpetually changing! There has always been a "can do" ethos at Waterloo. There have been losses as star faculty have moved to other places, but the connections with them that remain enrich us. And we still attract very capable new people. The Department of Statistics and Actuarial Science remains very collegial, with lots of exciting work going on. The students, both undergraduate and graduate, are wonderful.

4. STATISTICAL RESEARCH

Rosychuk: What do you feel are your favourite and/or most important publications?

Thompson: I have enjoyed many paper-writing collaborations over the years. I have only a handful of single author papers. Of those, I have two favourites that I wrote while on sabbatical in 1978–1979:

- Model and design correspondence in finite population sampling. *Journal of Statistical Planning and Inference* **10** (1984) 323–334 [11].

The idea of this first one was that if there is an accepted model for the variable y of interest, the sampling-design-based inference for (say) the finite population mean of y should match an appropriate model-based statement of inference. This provides a guide to use of conditioning in design-based inference. It underlies much of my work as a practitioner.

- The likelihood principle and randomization in survey sampling. *Data Analysis from Statistical Foundations*. Nova Science Publishers, New York (2001) 9–25 [13].

In this second one, I argued that design-based sampling inference did not violate the likelihood principle to the extent that was often supposed. The statement of inference in estimating (say) a population mean does not purport to rely on information from the sample about values of the response variable for unseen units.

I loved thinking about the foundations of inference in survey sampling, but I did not seem to have the drive to compel people to listen to me. Consequently, these two papers took a long time to appear! In fact, the second was a non-refereed invited paper for a conference in honour of Professor Fraser.

My 1997 book has also been quite influential in some ways, I think [12]. Part of the idea of the book was to try to convey that despite its origins in worldly applications and its multitude of formulae, survey sampling can be a deep and beautiful subject.

Rosychuk: Yes, your book has been influential and I would like to ask more about your books a bit later. Your 1986 *International Statistical Review* paper [7] is a highly influential paper as it provided the way to use statistical models for the analysis of survey data. Did you have any idea of how influential it would become? What led you to the ideas presented in the paper?

Thompson: Back then, working with V.P. Godambe, I was more and more interested in analytic uses of survey data, as opposed to the descriptive uses that are what most of the surveys of official statistics are about. A key influence was a 1983 paper by David Binder of Statistics Canada and the use of estimating functions for the parameters of GLMs [1]. I believe Dr. Binder approved of and on occasion would cite our exposition of the relationship between inference for a superpopulation (model) parameter and the corresponding finite population parameter, and the use of the estimating function theory framework. We presented a way of thinking of the model and design relationship in terms of a kind of double robustness.

Rosychuk: I think your 1989 quasi-likelihood paper has become your most highly cited paper [8]. Why has that paper become highly cited?

Thompson: It might be because what we were proposing was not very practical! At that time, Godambe was very interested in optimal combinations of estimating functions, and we were applying the theory to construction of optimal versions of quasi-score functions. This required knowledge of third and fourth moments of the response that in many cases would not be available.

Rosychuk: Did you think more about practicality later on?

Thompson: Yes, I think that experience was a trigger for thinking less about optimality and more about robust approximations to it.

Rosychuk: What motivated your first collaboration with Professor Godambe?

Thompson: When I first came to Waterloo, Professor Godambe had been there for a couple of years. At the time, he was deeply engrossed in trying to understand the implications of a 1962 paper by Allan Birnbaum called "On the Foundations of Statistical Inference" [2]. This paper put forward the Significance Principle (information in the data about the parameter(s) of a model is contained in the significant statistic), a Conditionality Principle and the (strong) Likelihood Principle (information in the data about the parameter(s) of a model is contained in the likelihood function). Birnbaum showed that the first two together implied the last. Godambe talked with me about this and I, too, thought it was a very beautiful result. Imagine statistics being subject to principles that had logical relationships! Godambe was also trying to write a textbook on survey sampling using the notation that he had invented in the 1950s to explain why, for a finite survey population, the population mean has no best unbiased estimator in general [4]. He asked me to read the draft of the first few chapters of the textbook. This theory, too, I found very appealing, because of the careful construction from first principles using consistent notation in a mathematical manner. The connection between these two topics later became clear: Godambe [5] had shown that survey sampling inference appeared to violate the Likelihood Principle, because in his formulation the likelihood function was flat over the possible values of the parameter (the unseen values of the y variable), yet it seemed that because of the randomness of the sample, nontrivial inference about functions of the y variable was possible.

Sometime later, Godambe asked if I would collaborate in a paper that he had started but never completed, called "Bayes, fiducial and frequency aspects of statistical inference in regression analysis in survey sampling." This was a difficult paper to finish, but when it was done he was pleased with it, and as he was about to go on sabbatical in England for 1970–1971, he submitted it to JRSS-B, hoping it could be a discussed paper. That did indeed come to pass. Professor George A. Barnard seemed to have liked and recommended the paper, as he proposed the vote of

thanks. In those days, controversy about the foundations of inference was often very passionate, and the seconder was highly critical. The discussion that followed was quite contentious. And I was there! I did not yet have a grant, but the Math Faculty supported my travel to go to England and help present the paper [6].

Rosychuk: What was it like to work with Godambe? What made your collaborations successful?

Thompson: It was very interesting to work with Godambe. He was a scholar through and through, very knowledgeable about history and philosophy of science. He liked to work with people who were mathematically inclined, because he had a strong theoretical intuition about methodology, which needed proofs or other kinds of validation. In that way, I brought complementary skills to the collaboration. Even as our work diverged, we remained good friends, until his death at the age of 90 in 2016.

Rosychuk: Do you revisit any of your early papers and think about contemporary applications or "twists" to them?

Thompson: I think it's more that contemporary problems or applications will sometimes remind me of work I did long ago, or papers that I have read long ago. It helps in supervising students who may not have much familiarity with the work of the 60s, 70s, 80s and 90s—the second half of the last century!

Rosychuk: How do you find research questions and how do you choose what to work on next?

Thompson: I have never been able to formulate what I think of as "the grand design". Very often, my research is about a problem someone has brought to me, but sometimes it is that my curiosity about a new technique or idea has been piqued and I want to see how far it can be extended or exploited. One example was learning from a workshop by the probabilist Richard Durrett about cellular automata and wanting to apply the idea to data on the evolution of spatial phenomena.

My own research interests in statistical theory evolved something like this. I started out with interests in (i) the foundations of inference in (descriptive) survey sampling and in (ii) applied probability—the application of stochastic process theory and models to real world phenomena that exhibit randomness in some way. The first evolved into thinking about analytic uses of survey data, and eventually all the apparatus connected with that, while the second became involvement in the theory and practice of inference from stochastic process data. Inference from stochastic processes has of course many aspects depending on the applications, from situations of high volumes of data with full observation to cases where an underlying process is postulated but only imperfectly observed.

The two threads came together in the study of stochastic models for social or contact networks and their applications. The 2002–2004 outbreak of SARS combined with increased computing power had made many researchers interested in realistic modeling of the spread of disease in contact networks. My student Leticia Ramírez Ramírez studied the mathematics of disease spread in the case of random graph networks, in particular, the distribution of outbreak size in the case of a disease like influenza [10]. After her Ph.D., she was employed as a post-doc to develop an agent-based model of influenza spread using a realistic representation of the contact network of an Ontario municipality. Sampling theory later came into the work, as we then began a collaboration with Yulia Gel and Vyacheslav Lyubchich on problems of estimating network parameters using link tracing or snowball sampling [14]. These past three years, a recent Ph.D. student, Cong Jiang, co-supervised with Michael Wallace, has studied estimation of the effects of Dynamic Treatment Regimes in personalized medicine when the outcome of a patient may be influenced by not only own treatment but also treatments of others in their network [9].

FIG. 2. *Mary Thompson as Chair, Waterloo*, 1996.

Rosychuk: How did your books come about? Do you like writing books?

Thompson: The first book, *Theory of Sample Surveys* [12], came about because I had been teaching a graduate course in sampling for a few years and thought it would be interesting to turn the notes into a book. As is often the case with such books, I wanted also to write about related research that I had been involved in or was interested in pursuing. I forget how it happened that I mentioned the idea to D. R. Cox, and as editor of the Chapman and Hall statistics series, he encouraged me to pursue it. As sometimes happens, it took me about 10 years to finish it. The first part was relatively easy because of the notes, and the next parts were sort of in my head, but teaching, administration, conference organization and family life were all-consuming. I remember being 70% done and thinking it was hopeless, and Professor Cox telling me he thought it was going to be very good, and then with that encouragement at long last being able to finish.

Rosychuk: That is a very important anecdote that shows how important encouragement is at any career stage.

Thompson: For the second and very recent book, *Sampling Theory and Practice*, my colleague Changbao Wu is the lead author [17]. This book also took a lot longer than we had originally intended. I had to do only a small amount of the first drafting, and found this project very enjoyable to work on.

Rosychuk: What research activities have been a recent focus?

Thompson: In a couple of ways, I have come back to early subjects. The last two Ph.D. students I have worked with have addressed topics involving dynamic programming, which in a sense is the basis for optimal stopping theory. As well, a paper from a recent collaboration aims to contribute again to the foundations of inference in analysis of survey data, and in particular what I would call the Bayesian-frequentist dialogue, in the context of a simple multilevel model [15].

5. INTERDISCIPLINARY RESEARCH

Rosychuk: You (and colleagues Geoffrey T. Fong and David Hammond) have been recognized for the International Tobacco Control Policy Evaluation (ITC) Project with a 2021 Governor General's Innovation Award. How did you become involved in that project?

Thompson: I had worked with John Goyder of our Department of Sociology to found the Survey Research Centre at Waterloo in 1999, and Geoffrey Fong had been an early supporter of that venture. He came to me in 2002 with a request to help him with the first wave of the ITC survey, to be administered to adult cigarette smokers in Canada, the US, the UK and Australia. I was on sabbatical at the time, so had a bit of bandwidth, and I found the idea for the survey and the conceptual model for impact of the WHO Framework Convention on Tobacco Control policies on smoking cessation to be very intriguing. The project grew—we now have data from 31 countries—and has lasted longer than I ever dreamed it would.

Rosychuk: That's amazing! Has that project influenced any of your statistical research agenda?

Thompson: Yes, certainly. It rekindled my interest in causal inference from observational data. It led me to think even more intensively about analytic uses (as opposed to descriptive uses) of survey data, and how to construct and to justify the use of survey weights in analysis. It has led to thinking about how to design survey questions to facilitate the combination of data from multiple sources and to improve representativeness of the final resource. Most recently, trying to apply event history analyses to longitudinal survey data presents many challenges in terms of how far the models can be simplified and still remain useful.

Rosychuk: What aspects of the project do you find particularly interesting and rewarding?

Thompson: The people I work with are very dedicated—people with a mission! The other statisticians and data analysts on the project are excellent. Constructing sampling designs under all kinds of protocols and conditions presents really interesting challenges. We have opportunities to learn from and to build capacity in many research groups around the world.

Rosychuk: I'd like to pick up on your building capacity comment. What roles have you had in fostering interdisciplinary research?

Thompson: First of all, this would be through student supervision. In our department, although we do celebrate a really fine theoretical thesis, we also try to involve most of our graduate students in real applications, where they spend quite a bit time becoming aware of another field in science, health/medicine, social science or finance. Second would be actually collaborating with researchers in other fields such as hydrology, water quality engineering, social psychology and geography. Third would be the work on setting up the Canadian Statistical Sciences Institute (CANSSI, www.canssi.ca), of which the flagship program is Collaborative Research Teams, furthering the statistical sciences in collaboration with researchers in other disciplines and sectors.

Rosychuk: I'm glad you brought up CANSSI and we will talk about that more in our discussion about leadership. I would also like to know why interdisciplinary research has been important to you?

Thompson: I love mathematics and statistical theory, and I think those are still the basis of what I can contribute, but when I came to Waterloo, I found it easy to embrace the idea of studying models or working in frameworks that contribute to the larger research enterprise. This often leads to research that can be called interdisciplinary.

Rosychuk: Do you have any advice for junior statisticians seeking interdisciplinary research projects?

Thompson: Assess your own strengths and interests, and watch for opportunities to learn about research in other fields where your knowledge may be useful. There are almost too many such opportunities these days! If you are open to collaborations, in many places they will actually find you. It is important for your own career development to come to these collaborations as a research partner of equal status rather than as providing service or consultation, especially early on. And if you want to be an academic statistician, there should be a way that the collaborations will feed into the development of your methodological research program.

Rosychuk: Very sage advice. It is easy to have service or consultation work overwhelm one's activities.

6. LEADERSHIP

Rosychuk: You have held many leadership roles. Have you always been interested in leadership?

Thompson: No, it came to me gradually. My first such position was as Associate Chair, Undergraduate when Jerry Lawless became Chair in 1979. I drafted teaching assignments and chaired the Curriculum Committee. From the fact that my youngest son was born in 1980, you can tell that the position could not have been extremely onerous! For the next few years, I did take on more committee assignments, reasoning that in that way I could still contribute even though with three young children I was too tired to do much deep thinking. The next official position was becoming Associate Dean for Graduate Studies in 1988. That was a very nice introduction to administration. Later, in 1993, Jack Kalbfleisch was Dean of the Math Faculty, and he asked me to start up the Women in Mathematics Committee, which continues to this day.

Rosychuk: That committee certainly benefited many women and I'll ask you more about your other advocacy activities a bit later. I want to next ask about your time as Chair and if you had a specific agenda.

Thompson: I became Chair of the department in 1996 (Figure 2), just as the University had implemented an early retirement program in response to provincial funding cuts. We were no longer a very young department, and quite a few of our faculty members had taken the package. For the first year, the priority was to try to make sure that every class had a teacher—well, that's the priority every year—but it was quite challenging that first year. There eventually arose opportunities to hire new faculty, and then the aim was to try to hire the best possible people. NSERC had stopped funding consulting services, and I conceived the idea of adding a survey research centre to try to bring in more "business" and perhaps funding from other sources. New research funding programs had come up, in the form of Networks of Centres of Excellence, the Canada Foundation for Innovation, the Ontario Research and Development Challenge Fund and Canada Research Chairs, and we put a lot of effort into trying to attract some of those funds. Apart from those kinds of things, the overriding objective was to make things run smoothly so that faculty, staff and students could get their best work done. In that respect, when I started as Chair, there were six difficult situations that I identified that I was hoping to find solutions to. When I ended my term, two of them had dissolved quite naturally, and the other four remained!

Rosychuk: You were the President of the Statistical Society of Canada (www.ssc.ca) in 2003/2004. What agenda did you advance there?

Thompson: I had thought going in that I would like to establish stronger relations with the societies of other disciplines, cognate and otherwise, and I actually started to try to do this. I was going to try to increase the interest in collaboration between statisticians and social scientists. However, what actually happened was that my attention was taken up by some changes at the SSC office and by work with Judy-Anne Chapman and others on preparation for establishing the accreditation program, which actually came into being the next year when Nancy Reid was President. So, I was just one link in the chain of Presidents, but I do believe that time was well spent!

Rosychuk: You led the creation and initial scientific direction of CANSSI. Why was it important to you to create this virtual institute?

Thompson: I had been heartened by the previous effort to establish an institute for statistical science, namely the National Program on Complex Data Structures, undertaken by James Stafford in 2003. Disappointingly, it was not renewed, but in 2011 a new opportunity arose. This was through the deliberations of the NSERC Steering Committee on a Long Range Plan for Mathematical and Statistical Sciences, chaired by Nancy Reid. SSC President John Brewster asked me to chair a Development Committee which the SSC Executive would set up. I had retired as a regular faculty member in 2009, and with previous service on the SSC Executive, the Natural Sciences and Engineering Research Council of Canada (NSERC) Statistical Sciences Grant Selection Committee, and the Board of the Fields Institute, I felt that I knew how to carry out the groundwork. I had a sense that the community was ready for something like CANSSI.

Rosychuk: What challenges did you have to overcome to create such an institute?

Thompson: The community did in fact respond very well. Some universities signed on as institutional members right away, and others needed more time, budgets being perennially tight. Nowadays, the university of almost every department with statisticians is an institutional member. And most of the programs of CANSSI have been well subscribed.

NSERC staff were very helpful with respect to our inclusion in a 2013–2014 competition for support of institutes, and we were awarded funding through the grants to the regional mathematical sciences institutes: Centre de recherches mathématiques (CRM), the Fields Institute for Research in the Mathematical Sciences (Fields) and the Pacific Institute for the Mathematical Sciences (PIMS). The biggest challenge that I faced was to start working out relationships with the institutes just mentioned and the Atlantic Association for Research in the Mathematical Sciences (AARMS). There is an obvious complementarity with these institutes as well as a number of common interests. However, all have different policies and procedures and aspirations, and work under different provincial jurisdictions. We made some headway, but much remained to be done.

Now CANSSI is no longer virtual, as it has a physical "head office" at Simon Fraser University, and various

regional centres. It has its own NSERC grant rather than being funded through the other institutes. The challenges of today are now those of a much bigger and multifaceted organization!

7. TRAINING AND MENTORING

Rosychuk: What has been your philosophy on supervising, teaching and mentoring statistical trainees and junior faculty?

Thompson: In supervising, I like to try to work with the interests and strengths of the trainees, pushing in new directions where necessary. If a student comes with an idea of what they would like to do or explore, I would try to guide them in that exploration. If not, I would start further back and suggest a few possibilities and see which ones seem to suit.

Mentoring is a more subtle thing than supervising and teaching, I would say. I'm thinking of it as addressing more than just learning about the subject and how to be a practitioner or researcher. It goes further: how to make choices, how to seek opportunities, how to find what are the best fits. How to deal with such obstacles as writer's block or an annoying co-worker. Work-life balance. I think I have mostly attempted mentoring only where it was requested, and looking back, I know sometimes my advice was not of the best. For me on the receiving end, the best advice and mentoring often came from unexpected sources. On work-life balance, "Don't feel guilty about paying for all the help you'll need," was one maxim that I passed on to several others.

Rosychuk: What do you think it takes to be a good mentor? Did you have good mentors?

Thompson: I think a good mentor in the sense of an advisor has to have experience, wisdom, an ability to listen, an ability to advise and an ability to inspire confidence. I did not have formal mentors (as opposed to teachers and supervisors and collaborators). I learned how to be an administrator by watching the more experienced colleagues of my own generation to see how it was done, and adapting accordingly.

I had quite a lot of support of another kind, that is, being recommended or put forward for publication or presentation opportunities. That aspect of mentoring is really important, especially at times of relatively low self-confidence.

Rosychuk: Very true. What are your thoughts about the training of statisticians today?

Thompson: I am excited by the new data analytic techniques and approaches that students are being taught to use or to invoke. At the same time, sometimes I think these make it harder to develop a stochastic consciousness, and a reliable understanding of how to quantify uncertainty. I am glad that the basic principles of design and inference haven't quite gone the way of Euclidean geometry!

Rosychuk: You have supervised more than 50 graduate students. What aspects do you find most rewarding working with graduate students?

Thompson: This has certainly been my favourite part of being an academic. It is thrilling to see someone progress from being a beginner at research to first taking charge of their topic, then inventing ways of attacking the problems and finally becoming, at least for a time, an authority with respect to their contribution area. [A list of Ph.D. students appears at the end of the article.]

8. ADVOCACY

Rosychuk: During your training and early career, were there other women students and/or faculty?

Thompson: Yes, and I have mentioned some earlier. By the time I came along, there were still barriers to the participation of women, but a lot of the time for my generation these impediments could be ignored. For those of the previous generation, or for my contemporaries who were truly pioneering, single-minded or exceptionally brilliant, things could be tougher.

Rosychuk: You have been a superb role model and advocate for women. How do you feel the field has changed over your career in terms of equity for women?

Thompson: In terms of the numbers at the junior levels, I feel statistics is no longer male dominated. We are well represented in graduate programs, in new faculty appointments at many universities, and in important service roles. There are more women who are capable of serving as role models and advocates. In some ways, the spotlight has shifted to other equity-seeking groups, which I think actually benefits women in the long run. There will probably always be barriers associated with stereotypes and pre-judgments of who are very capable and who are less so, and we need to keep working at being conscious of them.

Rosychuk: Despite advances, women continue to be underrepresented in the mathematical sciences. What more can be done to encourage women to join our field and to minimize inequities?

Thompson: A very good question. Clearly influential role models and mentors are key. Thinking of this interview, and thinking of the multiple pathways that have brought us and our colleagues to the mathematical sciences and to statistics, I would say providing experiences is also important. A young person needs to be able to find their own capabilities and abiding interests, and it is hard to do that without experience. Coding camps, science fairs, math competitions are good for young people. For those who are a little older, participation in group scientific efforts can open new doors. Being challenged to think in new ways, and suddenly realizing a hidden capacity, can be quite inspiring.

FIG. 3. *Elizabeth L. Scott and Mary Thompson, Delhi ISI meeting, December* 1977.

9. FINAL REFLECTIONS

Rosychuk: Do you have any proud moments in your professional or personal life that you would like to share?

Thompson: I have been blessed to have quite a number of proud moments. Receiving the Elizabeth L. Scott Award in Vancouver in 2010 was certainly a high point. Even to be thought of for that award is a great compliment, and I'm very grateful to all of you who worked on the nomination. I was fortunate to have met Professor Scott in 1977 (Figure 3), and admired both her statistical work and her leadership.

Rosychuk: The award was well deserved. Has there been any opportunity that you regret not taking?

Thompson: I don't think so, not in professional life. Perhaps there are initiatives that I could have undertaken but did not recognize as opportunities!

Rosychuk: What are your talents and interests outside of statistics?

FIG. 4. *Mary Thompson, Waterloo, May* 2021.

Thompson: I am the matriarch now, very proud of our three sons and their families, which include four young grandchildren. I enjoy genealogy research, an art history project and keeping in touch with extended family and friends. Playing piano when I can. I spend quite a bit of time volunteering as well.

Rosychuk: Do you have any thoughts about the progress of the field of statistics in Canada (or beyond) during the course of your career?

Thompson: I am really excited at how the field has progressed in Canada and beyond, with the numbers of excellent contributors and contributions growing all the time. However, I am not sure that nothing important is being lost, given the vast amounts of data and sophisticated tools for dealing with them that we now possess. For the best statisticians I've known, statistics is not solely a technology. Making the data speak also involves art and intuition.

Rosychuk: What drives you to continue to be active in the statistics profession today? What's next for you?

Thompson: I am gradually decreasing my responsibilities now. Soon it will be just the work with longitudinal surveys, and corresponding on a one-to-one basis. I hope to keep on attending meetings when conditions are right. It's been a very enjoyable career.

Rosychuk: Thank you so much Mary for sharing your reflections on your career and life. You have made so many contributions to statistics and probability. You are an inspiring scholar and outstanding role model. Thank you for all you have done and continue to do.

Ph.D. students (* = co-supervised)

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