



Remembering Ross Leadbetter: some personal recollections

Tailen Hsing¹ · Holger Rootzén²

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Abstract

Ross Leadbetter had had a broad and deep influence on the development of probabilistic and statistical theory of extreme values and on the application of extreme-value methods. He has been an inspiration and a friend for many of us. This editorial collects thirteen personal recollections of Ross and his work. An account of his career and some of his work can be found in the IMS Obituary “Ross Leadbetter 1931–2022”.

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1 Tailen Hsing and Holger Rootzén: introduction

Ross has been important for us two, TH and HR who put together this editorial. We start with some memories from us.

TH: I first met Ross in August of 1980 when I arrived in Chapel Hill as a new graduate student. Ross was the professor that advised me on what courses to take and was also the instructor of my measure-theory class. I had a blast in that class, in which the only other student was Doug Simpson (now at UIUC). Throughout the semester, the three of us mostly sat at a table and went through Ross’ notes with Stamatis Cambanis. The notes, which are now included in a book published by Cambridge University, were fantastic, and, along with Ross’ easy-going style, made me feel I really enjoyed and could master the topic. That experience greatly affected my career. After all these years, my heart still warms whenever I explain

✉ Tailen Hsing
thsing@umich.edu

Holger Rootzén
hrootzen@chalmers.se

¹ University of Michigan, Ann Arbor, MI, USA

² Chalmers and Gothenburg University, Gothenburg, Sweden

to students the $\pi - \lambda$ theorem, not only because it's magical but also it reminds me of the special time I had in the class with Ross.

After a failed attempt to work with Walter L. Smith, Ross rescued me and took me in as an advisee. He gave me a reading list containing some papers on the extreme values of dependent observations, and proposed a research problem that would be the starting point of my research. Luckily, I was able to make progress on the problem and we published a paper with Jürg Hüsler some years later. Ross' approach in advising me was as easy going as it was in teaching the measure theory class. While I continued to address him as Professor Leadbetter until my graduation, he treated me as a peer rather than a rudderless kid fresh out of college. He was usually more interested in listening to me than giving me instructions. In that comfortable relationship, however, his comments/suggestions were often perceptive and insightful, and really helped me grow as a researcher. Ross especially emphasized the importance of rigor and clarity, which were hallmarks of all of his work. I have taken that to heart and tried to live up to (while for sure not achieving) his high standards.

I owe a great deal of my career to Ross. Not only did he jump start my research, he imparted on me so much knowledge on the essence of being a teacher and researcher. Through Ross, I also met quite a number of colleagues who directly/indirectly helped me in my career and a few even became collaborators and friends.

HR: I first met Ross as a very new graduate student when he gave a talk in the Mathematics Department in Lund, Sweden. After the talk I asked a question which I thought was quite incisive. But, I was wrong, and as was his custom Ross explained it in a very friendly and clear way and I learned a lot, both about the question and on how one ought to answer questions. My thesis was in another area, central limit theory, but my contact with Ross developed and resulted in me going to UNC for a postdoc year after my PhD. It was a fabulous year with daily lunches with Ross and discussions in his office about mathematics and everything else under the sun and getting to meet the famous and interesting people who worked at his department.

As a result of the year, extreme values became a main research interest of mine. It led to more visits (all in all 2 ½ more years) to UNC and the Center for Stochastic Processes there. The Center was run by Ross, Gopi Kallianpur and Stamatis Cambanis and often gathered 10–15 researchers from all around the world at the same time. It broadened all our views and had a big influence on us – and it was great fun to be there! It also led to many longer and shorter visits by Ross to my departments in Lund, Copenhagen and Gothenburg. During all these periods our habit of having lunch and talking together continued uninterrupted. I enjoyed it very much. Ross and I have written eleven papers and one book together. During the writing I learned much from working with him, about extreme value theory; point processes; measure theory; always searching for minimal assumptions and the simplest proofs possible; how to write better; the list goes on.

Ross was extremely generous and interesting to work and be with. He was a great friend and had a big influence on my life. I have very many good memories of him and miss him very much.

2 Richard A. Davis, Columbia University

Upon hearing the news of Ross's passing, a memory from 45 years ago came flooding back. I was in my second year of graduate school at UC San Diego and upon the advice of my office partner, I enrolled in a year-long course on mathematical statistics taught by Murray Rosenblatt. This was a risky call as I had never taken a course in statistics or probability even at the undergraduate level. Murray suggested I prep for the course over the summer by studying Harold Cramér's book, *Mathematical Methods of Statistics*. I was overwhelmed in semester 1 and having recovered some footing in semester 2, Murray approached me and wondered if I would be interested in having a look at a paper by Leadbetter. This paper (Leadbetter 1978), which is one you probably have never seen, is referenced below. I was completely naïve about mathematical research and in particular about research papers and the whole process of how publications worked. It turned out that Murray was editing a book for MAA consisting of invited review papers, which would include the Leadbetter contribution. So, in effect, Murray was using me as a referee without explicitly saying so. I think it may also have been a screening strategy to see if I was up to the task and a potential advisee. I studied every detail of the Leadbetter paper and met periodically with Murray to discuss various aspects of the paper. He would probe to check my understanding. Eventually, Murray asked me if I was interested in this research area and having him as an advisor. The answer was yes and yes! I was just so happy that someone took an interest in me. But I can't help but think how the Leadbetter paper influenced me. Like many of Ross's papers, it was extremely well written with so much polish that a novice like me could understand the overarching ideas that were supplemented with sufficient detail to grasp the proofs. My first research article involved a conjecture from this paper, a converse to the $D+D'$ condition: if the maxima of the stationary sequence converge, then so do the maxima of the associated IID sequence. Murray put me in touch with Ross, who welcomed me into the extreme-value community and provided the connections that facilitated my research career. Who would have guessed that I would still be thinking about extremes of dependent sequences some 45 years later!

3 M. Ivette Gomes, CEUL and DEIO, FCUL, Universidade de Lisboa

My main scientific connection with Ross is obviously related to *dependence* conditions and the *extremal index*. While in Sheffield, where I was a Ph.D. student in the period 1975–1978, I recall reading the book that Ross wrote together with Harald Cramér (Cramér and Leadbetter 2013), in 1967, a classical work on stochastic processes. I have also enthusiastically read Ross' influential 1974 paper. Despite not including any research on the topic in my Ph.D. thesis, and having worked only sporadically in this area, I have always been very much interested in the theme. Also, my first Ph.D. student, M. Teresa Alpuim, now a Full

Professor at the *Department of Statistics and Operations Research* (DEIO), had Ross as a mentor, and has even stayed for a while in North Carolina (Chapel Hill), in the late eighties. And I had several PhD students who worked and still work deeply in this interesting area, where, without doubt, Ross is a **King**.

When I got to know, through Winsome Leadbetter, and exactly on February 26, about the death of Ross, I really felt deeply sad. The last time I met Ross was in October 2018, in North Carolina. I had been invited to a plenary talk at the *International Conference on Advances in Interdisciplinary Statistics and Combinatorics*, in Greensboro, USA. Since Greensboro is in North Carolina, I contacted Ross to see whether it would be possible to meet them. Ross and Winsome then decided to come to Greensboro, so that we could spend a few hours together, and they even both attended my talk. At the time, Ross was already very frail. He had a lot of difficulties walking, and was quite different from the person I had met before. But his brain was still very sharp.

I have several memories of Ross from which I recall a few:

1. The first time I met Ross in person was at the NATO Advanced Statistical Institute on *Statistical Extremes and Applications*, which took place in Vimeiro, almost 40 years ago, in the summer of 1983. This was an event currently recognized as a milestone in the affirmation of this area and in the launch of what I dare to call the “*Portuguese School of Extremes and Applications*” (PORTSEA), due to the work of Portuguese “extremists”, which Ross, with his sense of humor, used to call the “Portuguese Gang.” I recall the musical instrument Ross had built and brought with him from the US. Also, Ross’ second book, written jointly with Georg Lindgren and Holger Rootzén (Leadbetter et al. 2012), was presented to us during the Vimeiro meeting. And this book is indeed a landmark in the field of Extremes, with over 5000 citations.
2. We met several times after 1983, but I mention our participation at the Oberwolfach meeting in 1987, *A Conference on Extreme Value Theory*, organized by Jürg Hüsler and Rolf-Dieter Reiss. This was a very “intimate” meeting, and I had several fruitful discussions with Ross, mainly related to the supervision of some of my PhD students.
3. We have both attended almost all EVA Conferences since 1998 and prior to 2017, but I also clearly recall our stay at Gothenburg, in 2005, during the IVth *International Conference on Extreme Value Analysis*. Apart from a very intensive scientific participation, we also had the possibility of visiting Liseberg Amusement Park, and Ross and I have recalled several times such an enjoyable and radical event.
4. And in 2013, when Ross was already over 80, we had the opportunity of meeting three times:
 - In Lisbon, during the *Symposium on Recent Advances in Extreme Value Theory* honoring Ross Leadbetter, related to the award to Ross of an Honorary Doctorate Degree at Faculty of Sciences, University of Lisbon (ULisboa). I

thus again would like to mention that Ross Leadbetter honored ULisboa by accepting, at the request of DEIO, the distinction of Doctor Honoris Causa of ULisboa, because without a doubt when the university honors researchers of this importance it is also honoring itself.

- In Shanghai, at EVA 2013, FuDan University, Ross was one of the invited speakers in the Session, “EV—*Extremes and Vimeiro*”, I was invited to recall the meeting in Vimeiro 1983.
- And, again in Portugal in September, but now in Vimeiro, Ross was also a very active participant in another of PORTSEA’s major milestones, the “EVT 2013—*Extremes in Vimeiro Today*”, organized by my colleagues and great friends, Antonia Amaral Turkman, Isabel Fraga Alves and Manuela Neves, to commemorate the 30 years of the Vimeiro meeting in 1983.

I am indeed missing Ross dearly. In her e-mail of February 26, Winsome says that “. . . *we have a photo of you in our sitting room so you always kept an eye on Ross!*” Ross was a true friend of his friends, among whom I am, and I will go on keeping an eye on him. It is our hope that present and future generations of statisticians will foster Ross’ scientific legacy. Ross had a huge soul and was (is) one of the giants in the field of *Extremes*, having been interviewed about his career in the prestigious journal *Extremes* in 2015. Ross is undoubtedly greatly missed, but his work will always be present and available for present and future generations!

4 Laurens de Haan, Erasmus University Rotterdam and University of Lisbon

My first contact with Ross Leadbetter was his 1967 book with Cramèr (Cramèr and Leadbetter 2013): Stationary and related stochastic processes. The book gave me in a magistral way a first taste of dependence modeling in stochastic processes. The concept of dependence in stochastic processes became the leading subject of the research of Ross. The book with Lindgren and Rootzén (Leadbetter et al. 2012) monopolized the subject in extremes for a long time. They were able to obtain close analogs of extreme value results for i.i.d. random variables under mixing conditions only for the tail as well as many other results.

For me Ross was a wonderful more senior colleague, almost a father figure. I have had the good fortune to have been a research visitor of the Center of Stochastic Process (they forgot the plural in the plaque) in Chapel Hill several times. Thanks to Ross these were very beneficial times for me, leading to the many contacts and talks about research, not only in extremes.

Ross and Winsome were perfect hosts for me and my son. Ross was always looking for ways to please visitors. I am very grateful for what Ross did for me.

5 Juerg Huesler, University of Bern

Ross Leadbetter's work on extremes of stationary sequences and processes introduced me to the world of Extremes in the 1970's.

I met Ross the first time at the seminal Vimeiro meeting 1981 on Extremes in Portugal. My first attempt to meet him in 1978 was not successful, when I travelled from Pittsburgh, where I was a visiting assistant professor, down to Chapel Hill. The conference in Vimeiro provided a lot of time to talk to each other and to discuss our research. I was heavily supported and encouraged by Ross, the leader of extremes, to follow my way on extreme-value research. During the following years our collaboration and friendship continued. During my visits to the research center at Chapel Hill and Ross' and Winsome's visits to my university in Bern. During one of my visits in Chapel Hill, Ross took me to his house in the mountains where he also planted and cared for Christmas trees. Since Ross was also well known for playing the dulcimer, and I was interested in learning to play it, he drove me to a shop in the mountains where I could buy a kit to build my own one. The finished instrument is still hanging in my study to remind me of Ross, his numerous collaborations, and his great generous support during my career and research.

6 Olav Kallenberg, Auburn University

I got to know Ross Leadbetter quite well, through numerous visits to Chapel Hill. Thus, on his invitation, I visited the Statistics Department in 1973–74, and then the Center for Stochastic Processes in 1985–86, followed by countless shorter visits during subsequent summers. My visits to the Center were especially inspiring, with a steady stream of prominent visitors in all areas of probability theory. When thinking of Leadbetter, the first thing that comes to my mind was his extraordinary generosity and hospitality. He had a special apartment with his personal furniture, where I could often stay with my family during my visits, and once or twice he even allowed us to spend a weekend in his cabin up in the Smoky Mountains.

I first met Ross when he came up the elevator with his entire family to our seminar room at Chalmers University. (He never failed to comment on the Swedish word "hiss" for elevator.) My first visit to Chapel Hill overlapped with that of Ildar Ibramigov from Leningrad, who was one of the first scientists allowed to leave the Soviet Union during the Cold War, leaving his family back home as hostages. During that stay, the three of us would go at lunchtime to a hamburger restaurant. Ross was very fit, even athletic, and he was once shocked when asked at the counter whether he was by any chance entitled to a senior discount. He responded by asking if he really looked that old, and the next day he would show up in short pants and a baseball cap, looking no more than 25–30. On my later visits, I would come in late while he was an early riser, and when I came to my office in the morning, the first thing was a phone call from Ross where he proposed that we meet for lunch. He would then come jogging, or rather sprinting, to our meeting place.

Ross had a good sense of humor, and he would never resist the opportunity of a joke, sometimes based on a Bible quotation. (During all these years, he taught Bible study classes in his church, though he never tried to convert a stubborn heretic like me.) Once, at a small and intimate conference, he decided to break all records of making jokes at a conference talk. He then managed to make a joke in practically every sentence. Though there wasn't much room left for mathematics, we surely all enjoyed it. Ross and his wife Winsome had four children who were all married. Once he was asked if he had any grandchildren, to which he answered "Oh no, I am too young!"

7 Georg Lindgren, Lund University

At the ISI congress in London 1969 I met Ross for the first time. Harald Cramér introduced me to him as "my young friend." And there they were, the authors of my favorite book from my PhD reading course. Ross had given an invited lecture on crossings with applications and I had contributed with my first scientific paper on random waves, inspired by Ross' work on conditioning on maxima. To my surprise Ross asked if I wanted to come to Chapel Hill for a year! A life-changing moment!

Ross became official opponent to my PhD defense 1972 and he was back in Lund in 1973 to give a series of lectures on statistical extremes -- the start of the joint book on "Extremes and related properties ...", which appeared in print ten years later after uncountable Atlantic crossings between Chapel Hill, Lund, Copenhagen, and Umeå by Ross, Holger Rootzén and myself (with families).

Seen from a Swedish perspective, very few, if any, international statistician has had such an impact on a single research theme and PhD education as Ross Leadbetter. With Holger Rootzén and myself as a zeroth generation and Jacques de Maré, Igor Rychlik and Patrik Albin as first, one can count more than 20 Swedish PhD descendants of Ross on extreme value theory and applications. They work as university professors in statistics in Cyprus, Scotland, Sweden, as professors or statistics experts in the marine or car manufacturing industry or as safety or climate experts in France, Norway, Sweden and other countries. Ross' experience from the New Zealand navy and his interest in marine safety certainly influenced his Nordic descendants.

In recognition of his path-breaking methods for handling statistical extremes and his indefatigable work to spread the word to practical people and areas, Lund University made him Doctor of Philosophy, *Honoris Causa*, in 1991.

Episode two dates from 1968. It took place on board the ferryboat between Malmö and Copenhagen, when I was on my way to listen to a seminar by Felix Pollaczek on waiting times. With me to read on the trip I had brought a paper by Ross on local maxima of stationary processes. It was magic! A clear and simple introduction, in typical Ross Leadbetter style, on how to condition on a maximum.

Inspired by Ross' method I managed to solve the problem on Gaussian random loads that I had gotten from the new professor in Solid mechanics in Lund, K. Bertram Broberg, and I could finish my first paper and submit it to the *Annals of Mathematical Statistics*. After a friendly anonymous referee report on the paper (guess by whom!) I dared to send it for a contributed presentation at the ISI meeting in London 1969. And there he was, Ross Leadbetter, giving an invited talk.

It was time for episode three in my encounter with Ross. After the lectures, in the corridor outside the big lecture hall, there were Harald Cramér and Ross Leadbetter. Cramér introduced me to Ross as his “young friend.”

It became even more life-changing when my wife Kerstin said “Yes, let’s go” when I returned home. And so we went, the five of us, to a place down south in USA. Ross always liked to remind me of the moment he saw us disembarking the airplane at Raleigh-Durham airport dressed in our warm Swedish winter coats -- September 1970 was hot in North Carolina. Soon we learned how to live in a southern American university town, gently advised by Ross and Winsome. We learned to appreciate public service on radio and TV, only WUNC and Channel 4 PBS were worth listening to and watching, warned Winsome. Kerstin learned about “statistics wives party”, a dizzying experience for a Swedish professional.

Back in Lund I edited the Annals paper plus the four papers I had worked on during the year in Chapel Hill into a PhD thesis, old Swedish style, to be publicly defended with a university appointed opponent — Ross Leadbetter — and with Cramér in the audience.

8 Susan Murphy, University of Michigan

I first met Ross Leadbetter when I arrived from Louisiana at Chapel Hill in 1981. I was only in Chapel Hill for the fall semester and really only met Ross through his notes with Stamatis Cambanis on probability and measure theory. These notes were (and are — see the book, *A Basic Course in Measure and Probability: Theory for Applications* by Leadbetter et al. 2014) glorious! The clarity and precision of the exposition was so satisfying and beautiful. Measure theory is beautiful. I learned this fact through Ross and Stamatis’s notes.

When I returned to Chapel Hill (this time with husband in tow) in 1984 I had the chance to take Ross’s class on random measures. My experience was similar to that of reading his notes on probability and measure theory. Each of his lectures on random measures was clear, logical and very gratifying. Around this time I fell “in love” with martingales and point processes. So I and another student, Nandu (S. Nandagopalan) convinced Ross to offer an additional course, this time on point processes. We were so very fortunate.

Because I was mainly interested in the use of martingales and point processes in survival analysis I did not work on my PhD with Ross; however, I was fortunate that Ross agreed to be on my PhD committee. Subsequently Ross introduced me to Alan Karr (then at Johns Hopkins) and recruited Alan to be on my PhD committee as well. Ross was not obligated to help me but he did and he went out of his way to do so. By the time I started looking for a job in academics, I knew that I really wanted to visit Richard Gill in the Netherlands. Ross introduced me to Richard and spoke sufficiently highly of my work so that by the time I won an NSF postdoc, Richard had agreed to allow me to visit him! Thank You Ross for everything.

9 Vladas Pipiras, University of North Carolina-Chapel Hill

I knew Ross as a colleague and a friend from 2002 when I joined the Statistics faculty at the University of North Carolina-Chapel Hill. We collaborated just on a few academic projects, including the measure theory and probability book, some grants, but no papers. We have instead had a lot of informal interactions, both at work and outside it, some elements of which I would like to share with the readers.

Ross had a great, often quite poignant sense of humor. When I complained about not being able to engage students in class, Ross suggested the following solution that worked well in his classes. If students seem disconnected in class, ask them to stand up, and when they do, ask them to turn around and shake the hand of the person behind them. I sometimes wonder what he would have suggested as a solution for the Zoom world. Sometimes with humor or plainly directly, Ross was also known for being suspicious of any authority, and made his feelings well known.

I had an opportunity to visit Ross in a nursing facility about two weeks before his passing. He was physically ailing, but his mind was amazingly sharp as ever. When a quickly passing time came up in the conversation, he used the expression “Time flies like an arrow; Fruit flies like a banana.” Look up on Wikipedia if you do not understand or want to learn more about it. Perhaps because of his upbringing, Ross was full of such English grammar curiosities, as well as rules. I still remember him teaching me that it is either Fubini’s Theorem or the Fubini Theorem, but not another combination of the apostrophe and article “the”.

A lot of my interactions with Ross were full of what one might consider rare events. When on leave from Chapel Hill and living in Porto, Portugal, for few years, I had to go one day for some business to the capital, Lisbon. When in the city, I saw someone who looked like Winsome (Ross’s wife), and believe it or not, it was her. Ross was nearby as well. They both were visiting Lisbon for a few days. Neither of us knew of other’s plans. Now, what are the chances of that meeting? Another day, when driving them around, we got confused and accidentally drove into police headquarters.

Ross was an avid collector of vintage scales. His passion may have faded away in recent past, but scales loomed large on his mind before that. He and Winsome would go to scale conventions. He would seek out antiques shops that possibly carried scales when coming to places for professional meetings. He would tell stories of how he acquired them, the difficulties with shipping them home, the different weight systems they represented, and so on. I do not quite remember how it all started for him, but I am not too surprised. Ross had always been very practical, down to Earth. Did you know that he also grew fir trees in NC mountains for sale every year before Christmas? I doubt he was doing it for the money.

10 Sidney I. Resnick, Cornell University

It is difficult to remember when I first met Ross. He is one of those people you feel you have always known. My PhD thesis and early papers were in Extreme Value theory, so I was certainly aware of Ross’ influence in the field. My earliest memory

of personal contact was at Stanford where I worked from 1972–‘78. One summer, mid ‘70s, Ross visited and gave a lecture series on point processes. Presumably between Ross’ visits to Sweden and visitors to Chapel Hill, Ross became interested in developing a non-topological approach to a general theory of point processes. He lectured on this and handed out detailed mimeographed notes (Remember getting that blue ink on your hands?). The lectures were very clear, precise and, sometimes formal but, of course, Ross could read from a telephone book and make it entertaining. He always conveyed friendly enthusiasm and warmth for the subject. Both Ross and the lectures were impossible not to like.

After the Stanford lectures, the next vivid memory of (indirectly) interacting with Ross that bubbles up in my brain is a surprising one. In 1978 I moved to Colorado State and a few years later in 1983 the Springer book on Extremes by Leadbetter, Lindgren and Rootzen (Leadbetter et al. 2012) (affectionately known as LLR) was published. Several glowing book reviews followed. However, in 1985, a peevish review appeared claiming, among other things, that LLR contained “the list of references from ... “and that this “reproduction” was done without acknowledgement (Just to be clear for nervous readers, this was not the review by Richard Davis that I came across while googling to refresh my memory). I recall being incensed enough about the unfairness of the reviewer’s comment that I wrote the journal editor inquiring how this bizarre comment made it past an editor’s scrutiny and into print. History and memory do not seem to record the response or if a response was forthcoming. Somehow Ross found out about my letter to the editor — I probably mentioned it years later when Ross expressed indignation about this review — and this certainly did not hurt our ongoing friendship.

Compared to the Colorado location, when I moved to Cornell in 1987 I was just around the corner from Chapel Hill. I spent parts of two sabbaticals at UNC Chapel Hill as well as a couple of weeks one summer (maybe 1997?) and yes, in the summer, it was hot but my son went to soccer camp anyway. I also commuted one semester spending alternating weeks at SAMSI and Cornell. The location of SAMSI separated from both UNC and Duke presented some social and intellectual challenges which turned out not to matter since I was too busy fuming at USAIR which managed to screw up each and every flight I took to and from Raleigh-Durham Airport and Ithaca. Of course, USAIR was Ross’ favorite airline since one of his off-spring worked there and extended privileges to him for bargain flying. USAIR was acquired by American Airlines which just announced cessation of service to Ithaca so my lack of fondness for USAIR->AA was one of the few things Ross and I had serious disagreements about.

Many people will fondly remember and reminisce about the Center for Stochastic Processes and its enormous stimulating effect on the field and on young people’s research progress. Sadly, by the time of my extended visits, it was past its heyday. Set off-campus in an office park/shopping area it was physically separate from the (then) Department of Statistics at UNC. Its desirability as office space depended on a critical mass of researchers being resident. When I was there it was pretty empty though one could see evidence of past glory in the books and workstations. (Remember workstations? Laptops did not come down from Mount Sinai along with the tablets.) It was humbling to identify the who’s who of past visitors. Bowing to reality, Ross helped arrange office space for me within the Department. The

office was memorable for the window air-conditioner that made it possible to dry off after the morning bike commute up Columbia Street (The name of the town is NOT Chapel Flat).

Visits to Chez Leadbetter were always incredibly warm and lively affairs. It was impossible not to be charmed by Winsome and Ross' hospitality, enthusiasm and yarns. They enjoyed hosting and, like countless visitors and friends, we enjoyed being hosted. Of course there was some weird stuff lying around the house. All those scales! Physical evidence was everywhere and this evidence was accompanied by stories of hunting through shops in multiple countries and cities in search of examples to add to the scale collection. Then there were the stories of the do-it-yourself projects that Ross undertook around the house over the years. Creating the (very) long driveway! Really? Fortunately for me and the bushes, the long driveway led up to a flat and paved parking area near the house entry that contained sufficient room to turn one's car around before heading out. I am one of the world's worst car backer-uppers (a legend really) so this sufficient parking area allowed me to not modify the landscaping when I left to descend the long driveway.

We are all better for Ross' presence in our community and we all miss that active presence. If we all stand on the shoulders of giants, then surely Ross' shoulders are among the support.

11 Igor Rychlik, Chalmers and Gothenburg University

During 1988–1990, I stayed at Fort Collins, Colorado. I was a postdoc at CSU and had generous access to the university supercomputer, CDC Cyber 205. So I could test and improve my algorithms for estimation of sea wave characteristics distributions. Nowadays the algorithms can be run on any laptop.

In the summer 1989, I drove to Chapel Hill NC. I was invited by Prof. Stamatis Cambanis to visit the Center for Stochastic Processes, and there I met Prof. Ross Leadbetter. I knew him from the two classical books which I had studied in detail as a PhD student in Lund, Sweden. At that time Ross had several grants from the US Navy and later from the US Coast Guard to work on problems related to safety of vessels operating in harsh seas. We talked about “slams” and I met his PhD student Spaniolo, and slowly became a “member” of his team. More importantly, Winsome and Ross became very close friends of my family.

Later on Ross supported my visits and work from his US Coast Guard grant. Our joint research resulted in eight scientific papers. The first paper appeared in 1993 and the last 2019. Working with Ross was inspiring and fun, from my side, but I must acknowledge that he had a lot of extra work to polish the parts I wrote.

Next, I will shortly describe our work, starting with a sea surface model. As customary, the spatial variability of sea surface was modelled as a Gaussian field. The temporal changes of the field were defined by wave dispersion, which means that harmonics of different wavelengths travel at different speeds. Hence, the sea was modelled by the spatio-temporal Gaussian field with a “degenerate”

spectrum. Consequently, wave characteristics encountered by a vessel will depend on the ship's speed/azimuths and the "apparent" wave movement.

The first problem was to characterize sea conditions and ships speeds when risk for "slams" is not negligible. Slams occur when a ship proceeds at certain speeds in rough head seas and the front part of the hull bottom sustains large forces as the result of impact with the sea surface. Such events result in transient stresses of high amplitude, which causes fatigue damage in ships details. For a cargo vessel the captain may change ships speed/azimuth to avoid further slams. It may not be an option for navy ships or coast guard vessels.

The second problem was studies of risks when a vessel is sailing in a following sea. Then a large overtaking wave may trigger an undesired response which may end in capsize. There are several ways the capsize event may develop, one of these referred to as broaching and which results in sudden change of heading. In moderate sea states, a vessel is likely to broach if it runs at high speed and is slowly overtaken by steep and relatively long waves. However, it may also occur at lower speeds if the waves are very steep. In order to assure safe operation of vessels a recommendation is needed for their headings and speeds in terms of sea conditions encountered during a mission, so that the risk of capsizing during a year is small, e.g. 0.001 or smaller.

Both projects resulted in interesting mathematical results (Alberg et al. 2008) which had practical applications. For example one of the deliveries for the "risk for capsizing" project was a software, developed in EXCEL, to estimate the risks for capsizing (Rychlik et al. 2009; Leadbetter et al. 2019).

I am very grateful for having the opportunity to work with Ross and Professors Georg Lindgren and Holger Rootzén (Leadbetter et al. 1983), who were encouraging and supportive of the direction of my applied research.

12 Robert J. Serfling, University of Texas at Dallas

I always greatly admired Ross Leadbetter, first encountering him as a student in one of his classes. As his second doctoral student, I was really knocked off my chair when right from the start he insisted that we be on a first name basis. I never had imagined such a thing. But it greatly impressed me and I continued that tradition with my own students. It worried Ross a bit when I never came to him with questions as I worked on my dissertation, except once. I was of the generation raised by always being told "Figure it out" whenever I asked a question, so I was doing my dissertation independently, for better or worse. The one question I did ask was when I was going through Doob's Stochastic Processes. I had followed the whole thing except for one step in the middle of a proof. Finally I swallowed my pride and went to Ross, and he instantly explained the step. That impressed me enormously. On top of all that, he was a really fun guy who liked to joke around.

13 Jonathan Tawn, Lancaster University

I started my PhD on extreme sea level estimation in October 1985 and commenced my journey into understanding extreme value theory through first reading the books of Galambos (1978) on extreme values in applied probability and on order statistics via David (1970). By that stage I felt I knew everything there was to know about extreme value theory. It was only when I then read the recently published, and beautifully written, Leadbetter, Lindgren and Rootzén (1983) that I realized there was so much more to learn, research, and that there was such exciting structure to be investigated from the seemingly innocent asymptotic results. The book revealed fascinating insights into how subtle all the theory of extremes for stochastic stationary processes was, let alone the added sophistication when considering continuous time processes. The power of the $D(u_n)$ and $D'(u_n)$ conditions seemed amazing. I was certainly puzzled by that fact that the extremal index was equal to 1 for such a wide class of processes and was found in several of the examples studied in the book, and that an extremal index of 1 seemed the more likely, not the other way around. I was convinced that in applications having an extremal index less than one would be most usual. As sea-levels had clear temporal dependence, I looked at naively estimating the extremal index as a constant in Tawn (1992), and was pleased to obtain values less than 1, although with fits that were not ideal for sea-level short return levels particularly. However, the wide spread statistical belief at that time was that the $D'(u_n)$ condition holding meant we could treat extremes of dependent series as if they were independent in practice, this worried me. This was very much a driver for understanding the role, and nature, of asymptotic independence in multivariate, spatial and temporal dependence through my career, such as with the separate collaborators Ledford, Heffernan and Wadsworth.

I had the pleasure of first meeting Ross in Chapel Hill in the early 1990s. As an early career academic, it was very exciting to meet someone that I had read lots of their work, as having read LLR I followed this up by going through many of Ross' papers. Ross was especially easy to talk to, interested, and very welcoming. He very kindly gave me his ticket to see the UNC College basketball team play a visiting Russia team; I heard later this was very usual of Ross to welcome visitors this way! Of course, over a career you meet academics in your area at several events, but I was especially proud and privileged to be invited to contribute to the Symposium on Recent Advances in Extreme Value Theory honoring Ross Leadbetter in 2013 in Lisbon, which tied in with Ross receiving an honorary doctorate from the University of Lisbon. It was a joyous meeting, and it was great to have Ross, Georg, Holger, as well as Winsome, in the audience. I spoke there about work with Eastoe (2012) where we looked at extending Ross' work that the cluster maxima were also asymptotically distributed with the same GPD distribution as for the marginal distributions. Our work exploited sub-asymptotic results about the extremal index, essentially developed by using the $D'(u_n)$ property. We were pleased that we could join two distinct contributions of Ross' together.

Unfortunately, I didn't see Ross again after that meeting. But I would like to take this chance to 'tell him' that in an a recent update of the extreme sea-level methods,

with D'Arcy, we do now find an extremal index of 1, but with a sub-asymptotic extremal index which captures the dependence in the less extreme values in the series, and that this fixes the short return period problem. It seems like Ross, and LLR, were possibly right all along!

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