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A Conversation with Piet Groeneboom

Geurt Jongbloed

Abstract. Petrus (Piet) Groeneboom was born in Scheveningen in 1941 and grew up in Voorburg. Both villages are located near The Hague in The Netherlands; Scheveningen actually being part of The Hague. He attended the gymnasium of the Huygens lyceum. In 1959, he entered the University of Amsterdam, where he studied psychology. After his "candidate" exam (comparable to BSc) in 1963, he worked at the psychological laboratory of the University of Amsterdam until 1966. In 1965, he took up mathematics as a part-time study. After having obtained his master's degree in 1971, he had a position at the psychological laboratory again until 1973, when he was appointed to the Mathematical Center in Amsterdam. There, he wrote between 1975 and 1979 his Ph.D. thesis with Kobus Oosterhoff as advisor, graduating in 1979. After a period of two years as visiting professor at the University of Washington (UW) in Seattle, Piet moved back to the Mathematical Center until he was appointed full professor of statistics at the University of Amsterdam in 1984. Four years later, he moved to Delft University of Technology where he became professor of statistics and stayed until his retirement in 2006. Between 2000 and 2006 he also held a part-time professorship at the Vrije Universiteit in Amsterdam. From 1999 till 2013 he was Affiliate Professor at the statistics department of UW, Seattle. Apart from being visiting professor at the UW in Seattle, he was also visiting professor at Stanford University, Université Paris 6 and ETH Zürich.

Piet is well known for his work on shape constrained statistical inference. He worked on asymptotic theory for these problems, created algorithms to compute nonparametric estimates in such models and applied these models to real data. He also worked on interacting particle systems, extreme value analysis and efficiency theory for testing procedures. Piet (co-)authored four books and 64 papers and served as promotor of 13 students. He is the recipient of the 1985 Rollo Davidson prize, a fellow of the IMS and elected member of the ISI. In 2015, he delivered the Wald lecture at the Joint Statistical Meeting in Montreal.

Piet and his wife Marijke live in Naarden. He has two sons, Thomas and Tim, and (since June 12, 2018) one grandson, Tarik. This conversation was held at Piet's house in Naarden, on February 28 and April 24, 2018.

Key words and phrases: University of Amsterdam, Mathematical Center (CWI), Delft University of Technology, violin playing.

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1. THE EARLY DAYS

Geurt: Piet, it is a pleasure for me to have this conversation with you. Can you, as a starter, say something about your family background?

FIG. 1. *Three generations of Groenebooms on the day that Piet's father had his Ph.D. defense at the Faculty of Law of the University of Utrecht*, 1941.

Piet: My father, who had the same first name as I have, started as an attorney and later became judge. My mother, Betty Ruffelse, studied German and worked as a secretary in the United States before she married my father. My grandfather, also named Piet Groeneboom, had a position as professor of ancient Greek and Latin at the University of Groningen. There is a nice picture with "the three of us"; see Figure 1. I also have a sister, Carla, who lives in the UK and a half-brother, Harold Hvistendahl, who lives in Australia.

Geurt: You were born during the second World War. Do you have memories of that period?

Piet: Not particularly. But I was told often that I shouted, being two or three years old, "Ha, soldiers!" when my father entered my bedroom, accompanied by two German soldiers who were supposed to put him on the train to Germany. This could have been the last time that I would see my father; he had come into my room to say goodbye. Fortunately he was able to escape from the transport to Germany by convincing a lower German officer, when they were waiting in front of a lifting bridge (being up), that, because of his age, he did not belong to the group being transported to Germany to work in the factories. This officer hesitated at the request and told him that he should perhaps consult a higher officer who was already past the bridge. My father's decisive and spirited move was that he asked the officer supervising his bunch of people: "Haben sie kein selbständiges Kommando?" ("Don't you have a command of your own?"). This was apparently exactly the right thing to say to the German officer and he was then allowed to go. First slowly and a lot faster after being around the corner of the street. All this on the same day as my "Ha, soldiers!"

This anecdote is also described in the book Meihuizen (2010), on attorneys during World War II. My father is in particular mentioned in this book in connection with the so-called "Test sentence". He argued before the Supreme Court on October 27, 1941 that the judge had the authority to challenge the regulations of the occupying force on the basis of the regulation prescribed for a country at war, the decree of the Führer and the first regulation of the government commissioner. When the Supreme Court later denied the possibility of contesting rules issued by the German government, the Netherlands followed what was the rule in Germany and Italy too.

Geurt: Can you say some more about your grandfather?

Piet: Looking at his picture (Figure 1), you may not expect this, but he was really witty. At the time I attended the gymnasium, after 4th grade I had to make a choice whether to take the "alpha part" (languages, no physics or chemistry and almost no mathematics) or take the "beta part" (which had all these subjects, but also French, German, English, Latin and Greek).

When I once visited my grandfather with my father, my father announced: "I have bad news: Pietje will take the beta part". My grandfather answered: "Very good, only stupid pupils still go to alpha!" With his background as professor of ancient languages, he was of course the prototypical alpha (not to be confused with the "alpha male"). Also when my father once thought he would make my grandfather happy by saying that I was going to read Livy, my grandfather answered:

"He rather than me". He was not so keen on Latin and would say about Virgil's hero Aeneas: "Virgil, with his clown Aeneas". In Dutch it's a rhyme: Virgil's "pias Aeneas".

2. MEDICINE, PSYCHOLOGY AND . . . MATHEMATICS

Geurt: It does not seem you inherited your interest in mathematics from your parents. How did you get interested?

Piet: Indeed, mathematics was not a subject at home. During my second year at the gymnasium, I bought with my pocket money the book "Introduction to Logic" (Tarski, 1941). Although the gist of what was going on in the book escaped me with its "If you solve that problem, I will eat my hat" as an example of a material and not a formal implication and the true statement "If 2 times 2 is 5, then New York is a small city", it intrigued me. Later on, but I will say more on that later, I got back to this book and it played an important role for me to start studying mathematics.

After the gymnasium, I decided to study medicine at the University of Amsterdam, despite my father's insistence that I should study law. In the back of my mind, I had the idea I could perhaps become a psychiatrist. But after a couple of months, it was clear medicine was not what I should do. Especially the "practical work" was terrible. . . . Then, I continued at the University of Amsterdam, but now studying psychology. That went quite well and was interesting.

I decided to drop the traditional course on Henri Bergson and similar philosophers by professor Oldewelt, a friend of my grandfather. Instead, I followed a course on logic taught by the analytic philosopher Else Barth,[1] who had a position at the mathematical institute. She was assistant of professor Evert Beth, a very nice man whom I met not long before he died. The course was about the book Tarski (1941) which I had bought with my pocket money at school. So finally I would be able to understand what this book was about! I still remember doing the exercises similar to the exercises in Tarski's book at the exam at her home, where I was also tested for my reading of the book "The Rise of Scientific Philosophy", Reichenbach (1951).

Another thing I remember clearly is that during her lectures, she would fulminate about the phenomenological approach to philosophy. In particular about the so-called "eidetic definitions". There was a book on "the woman's essence" (Buytendijk, 1951) which had particularly roused her anger. I could very much sympathize with that!

Geurt: Your interaction with Else Barth made you decide to study mathematics?

Piet: It was important, but I did not change studies immediately. I finished the psychology study at the "candidate" level, comparable to a BSc. After that, I was invited to take a job at the psychological laboratory of the University of Amsterdam, as an assistant in the project "Thought and Memory" on machine simulation of human thought and memory. An invitation I accepted. I was in the "memory" part. A mathematics student, Lambert Meertens,[2] was student assistant in the project. He wanted to learn to play the treble recorder, being a great admirer of the famous Frans Brüggen, and I wanted to learn about differentiation and integration. The latter subjects were in my time not part of the curriculum at the gymnasium. We decided to have a teaching exchange. Both of us learned a lot during that time, but I think I actually learned more than Lambert did. I read Edmund Landau's introduction to the number system Landau (1951), I think following an advice from Lambert. My interactions with Else Barth and Lambert Meertens made me decide to study mathematics.

Geurt: Can you sketch the situation at the mathematical institute of the University of Amsterdam during that time?

Piet: There was a considerable number of full professors. At that time I guess the most famous one was geometrist Nico Kuiper.[3] Another famous member was the topologist Johannes de Groot. I actually became his assistant and learned a lot of topology during that time. Professors of stochastics were Theo Runnenburg in probability and Jan Hemelrijk in statistics. I enjoyed a lot the lecture notes on martingales and Brownian motion written by Runnenburg and was the first to take an exam on that course. I remember him saying: "Are you sure you want to do that? It is very difficult, Mr. Groeneboom!". Still, I appreciate Runnenburg's attitude towards students. He really appreciated me going through his notes critically, pointing out mistakes and suggestions for improvement. My education in analysis came from Henk Jager. He was a very good teacher, open to critical comments. I would hope that people

[1]Else Barth later became professor of Analytic Philosophy at Groningen University.

[2]Lambert Meertens later became professor of Computer Science at Utrecht University.

[3]He also introduced a goodness of fit test in Kuiper (1960).

FIG. 2. *Piet at primary school.*

in the judicial system would at some point of time develop a similar attitude towards sensible arguments from outside their profession, but I am not very optimistic in this respect ...

Geurt: You decided to specialize in statistics. How did this happen?

Piet: My interest in statistics was not primarily roused by the course I took in the mathematics curriculum. Actually, during my time at the psychological laboratory, I had to use quite some statistical tests, wondering about the deeper issues related to it. During that time I also studied Feller (1957). When De Groot asked me what courses I was going to follow, I told him that I wanted to follow courses on probability and statistics. He answered: "Don't tell me that you want to be a statistician?", as if this was the worst that could happen to a mathematician. I realized that it sounded wonderful to my ears, but did not say that. In this respect De Groot was rather unlucky, because his other assistant at that time, Albert Verbeek, also became a statistician. Of course Tukey also started as a topologist. "Tukey's lemma" is listed, together with Zorn's lemma, the axiom of choice and other such statements as equivalent to the well-ordering principle in Kelley (1975). It was during that period that I also read another great book, Barlow et al. (1972) on order constrained statistical inference. Unfortunately many years later I lost this book in the train, coming back from Oberwolfach. It is out of print now.

3. TOWARDS A PH.D.

Geurt: And then you started doing your Ph.D.

Piet: Well... not immediately. After having obtained my master, I returned to working at the psychological laboratory. There I started teaching statistics and mathematical psychology. Nevertheless, I contacted Hemelrijk who was also affiliated with the Mathematical Center[4] as head of the department of statistics there. I told him I would like to work there. Unfortunately, there was no position at the time, but Hemelrijk told me he would keep me in mind. At the psychological laboratory, I had a doctoral student, Jan van Santen,[5] and I wrote a research proposal for him and me, involving among other things isotonic regression as introduced in Barlow et al. (1972) and the theory of measurement in psychology. In order to increase the probability of success, I was advised to send it to Willem van Zwet and I visited him in connection with this proposal. He did not want to support the application. He thought that the combination of the subjects of the proposal was not convincing and clearly only meant to help Jan van Santen, which was true of course. Without me knowing it at the time, though, he had phoned Hemelrijk to get some information on me. Van Zwet then seems to have said to Hemelrijk something of the sort: "You should hire this guy; he will die if he stays with these psychologists". And indeed Hemelrijk phoned me shortly after and asked: "Do you still want this position at the Mathematical Center? If

[4]Dutch research institute, currently named CWI, Centrum Wiskunde & Informatica.

[5]Jan van Santen is currently professor of Biomedical Engineering and Computer Science & Engineering at at Oregon Health & Science University.

so, go there and fill out a form; you can start immediately". That was how things went those days. Then I moved from the tenured position at the psychology laboratory to a temporary position at the Mathematical Center. Still then, there was no mentioning of doing a Ph.D. But I was at an institute with many inspiring people, interesting guests, groups reading books, and doing consultations and research.

Geurt: The perfect environment to do a Ph.D.?

Piet: Yes. Frits Ruymgaart, Richard Gill and Laurens de Haan were working at the Center. Also Kobus Oosterhoff and Willem van Zwet were advisors and present every Wednesday. There were also always visitors around. One of those, Don Truax from Eugene, Oregon, gave a series of talks on large deviations and efficiencies. I also gave presentations on Bahadur efficiencies in that seminar.

It was decided that the Mathematical Center would give a course for Ph.D. students and colleagues on the matter. For that, also Paul Janssen came over from Belgium. My knowledge of topology, partly gained as assistant to professor De Groot, turned out to be very fruitful for this subject. Several people, like Hoeffding, Bahadur, etc., had noted that "there are some difficulties with Sanov's proof" of a large deviations result relevant for Bahadur efficiency. When I used the what I called τ-topology on the set of probability measures, I was able to remove these difficulties. This topology is non-metrizable, so my later colleague Carel Scheffer said after my Ph.D. defence that this topology would never become very popular with probabilists. He was wrong about that.

When Van Zwet returned from a visit to Moscow around 1976, he told me: "You are the talk of the town in Moscow". My correction of Sanov's proof was a Mathematical Center Report and had been read by the people he had just met in Moscow. In 1979 I got my Ph.D. with Kobus Oosterhoff at the VU University in Amsterdam. My father was present at the occasion.

4. VISITING THE U.S.

Geurt: Having obtained your Ph.D. degree at the age of 38, what would be the next step?

Piet: I was offered a permanent position at the Mathematical Center. This was very attractive. Lots of time for research, some for mathematical consulting, no teaching and a minimum of organizational burden. Also, I got the opportunity to go on leave for one year. Oosterhoff and Van Zwet urged me to spend a year in the U.S. I had two options. The first was Eugene, Oregon, an invitation from Don Truax. The other Seattle, Washington, an invitation from Galen Shorack. Galen had also been a guest at the Mathematical Center for a year. I chose to visit the UW in Seattle. With Galen Shorack, I wrote a paper on Bahadur efficiency of goodness of fit tests (Groeneboom and Shorack, 1981). Interestingly, the weighted form of the Kolmogorov–Smirnov test, weighted by $\sqrt{\mathbb{F}_n(1-\mathbb{F}_n)}$, where $\mathbb{F}_n$ is the empirical distribution function, which has good Pitman efficiency, has Bahadur efficiency zero. During that year, I was also invited to visit Bahadur in Chicago. He was a really nice person. I was allowed to hold the rope of one of his kites bought in India, at a meeting on Sunday afternoon in a park in Chicago. Patrick Billingsley, whose book Billingsley (1968) I really liked, was also present.

Geurt: Which other mathematicians and statisticians did you meet during that year?

Piet: Actually, thanks to Roelof Helmers of the Mathematical Center and Michael Perlman of the UW, my period was extended to two years. I met many other interesting colleagues. At the UW I gave a presentation in the probability seminar, where Ron Pyke, Bob Blumenthal and Bruce Erickson were among the listeners. The second year at the UW turned out to be a really important turning point in my research. Fritz Scholz suggested that Ron Pyke and I should work on an isotonic regression problem that he and also Konrad Behnen had been studying in their dissertation. More specifically, on the limit behavior of the L_2-norm of the difference between the derivative of the least concave majorant of the empirical distribution function and the uniform density for samples from the uniform distribution. Ron Pyke and I wrote a paper on this, Groeneboom and Pyke (1983), which relies on the behavior of uniform spacings, Ron's specialty. I developed an alternative approach, coming from the properties of the concave majorant of Brownian motion and wrote a paper on the latter approach myself, Groeneboom (1983). Jack Kiefer read my UW report on this and invited me to Berkeley. Later I was invited to La Jolla by James Koziol where I met Ronald Getoor. The latter first walked out during my lecture because of problems with his eye sight, but after my lecture asked me to explain to him what I had been talking about. He then contacted Jim Pitman on this research. Jim wrote an interesting paper on the matter, using the "path decomposition" ideas of David Williams. I later talked with Jim about it when I was at MSRI in 1983.

5. BACK IN THE NETHERLANDS

Geurt: Then, in 1981, you returned to Amsterdam.

FIG. 3. *Jon Wellner, Chris Klaassen, Ildar Ibragimov, Kacha Dzhaparidze, Richard Gill and Piet Groeneboom* (*from left to right*) *at the Mathematical Center around* 1983.

Piet: Yes. In the meantime the Mathematical Center had moved outside the city center, to the current location of CWI. I could continue doing research and consulting. But then I got an invitation to spend an academic year at MSRI in Berkeley in the first year of its existence (1982–1983). Having been on leave from the Mathematical Center in the first two years of my permanent employment, from which I had just returned, they did not want to let me go for another year. In the end I was allowed to spend half a year at MSRI (January–July, 1983). Lucien Birgé, Rudi Lerche, Chris Klaassen, Iain Johnstone, David Donoho and David Pollard were there as well. I shared the office with Steve Lalley and Tom Sellke. I really made progress in that period on the analytic characterization of the Chernoff distribution, leading to Groeneboom (1985).

Lucien Le Cam had a Thursday afternoon seminar where the visitors of MSRI gave talks. At the final session of that seminar Le Cam asked the audience to thank all the speakers with an applause, and "ourselves", the audience, for having endured all these talks. In my talk I spoke on the result with Ron Pyke, who liked very much an early paper of Le Cam. I mentioned this paper in my talk as a kind of courtesy. After the seminar, Lucien asked me: "Where did this paper of mine appear? I have no knowledge of such paper". After I had looked up where it was published, he answered: "Oh yes, that was published without my permission".

After that half year at MSRI, I returned to the Mathematical Center to continue working there.

Geurt: During that time, you also met Jon Wellner.

Piet: Richard Gill already knew Jon. In the early eighties, Jon spent a year in Germany and visited the Mathematical Center. We had had short contact on a very applied project on modelling traffic flow. In the same period, the reading group at the Mathematical Center studied the then very recent paper Begun et al. (1983). They had saved Jon's contribution on the information calculations for me to talk about. I think Richard Gill, Chris Klaassen, Sara van de Geer and Aad van der Vaart were also in that reading group.

Geurt: That sounds like good company!

Piet: It definitely was. Nevertheless, my stay at the Mathematical Center did not last long, as there were two full professorships in statistics available in The Netherlands. One at my "alma mater", the University of Amsterdam and the other at Delft University of Technology. Peter Rousseeuw got the position in Delft and I the one in Amsterdam. There, my former teachers became my colleagues. Among them Guus Balkema and Theo Runnenburg. People were very friendly. I supervised half of the masters students graduating in mathematics at that time, including Rik Lopuhaä, Annoesjka Cabo and Ronald Geskus.

Geurt: But then you moved to Delft.

Piet: Peter Rousseeuw left Delft and Carel Scheffer convinced me to apply to Delft. Mike Keane was also supportive. I had given a presentation on convex hulls of random sets and people were very interested. After my talk, we had dinner in my birth village Scheveningen and I was impressed by the lively atmosphere among colleagues. This had a rather strong appeal for me.

Geurt: At the mathematics department of TU Delft, there was already a group of statisticians when you arrived.

Piet: In fact, in view of the large number of students I had as masters students at the University of Amsterdam, this aspect appealed somewhat to me. I hoped that this would enable me to distribute supervision tasks a bit over a group of people so that I would have more time for other things.

Geurt: Did it work out like that?

Piet: Not really. The statistics group consisted of six permanent staff members, none of whom had a Ph.D. They did a lot of teaching, also outside the mathematics department, but they could not supervise masters theses. The number of students that wanted to graduate in statistics in Delft was smaller anyway, so that turned out not to be a too big problem. But I must say that managing the statistics group was not easy. I was also reunited with Rik Lopuhaä, who was a Ph.D. student supervised by Peter Rousseeuw. Other positive things in Delft were discussions with Carel Scheffer, who was really more of a pure mathematician with knowledge of a wide area of mathematics. Also the interaction with Mike Keane was inspiring. We started reading groups on subjects like empirical processes, using Pollard (1984), the bootstrap, using Hall (1992), but also on censored data and the bootstrap using my own lecture notes.

Geurt: It was actually during that time we first met. I was a second year student when I followed your course on Mathematical Statistics, using Peter Rousseeuw's lecture notes. Annoesjka Cabo, then your Ph.D. student with Adrian Baddeley and currently a colleague of mine again at Delft, was your assistant. For me, your lectures were really inspiring. You asked questions in front of the blackboard. Also you thought about solving these aloud, mentioning possible problems with easy solutions. In the courses that followed, to me statistics became an area where intuition was turned into formal mathematics where theorems could be proved, rather than a cookbook suggesting which method to use in what situation. What has your relation been towards teaching during your career?

Piet: Not everybody appreciated my way of teaching. My former student Marloes Maathuis once told me I should preferably only teach courses for more advanced students and I think she may be right... It fits better with how I like to teach. I taught several mathematics courses for psychology students. The questions I got from the students really confused me. I tried to figure out how people could come up with such far fetched questions... That took a lot of energy. At some point I had the feeling that I could not think properly about mathematical problems anymore, because I was continually thinking: "How am I going to explain this to the non-comprehending students?". By the way, do you know I used to be really nervous before delivering a lecture?

Geurt: No, I did not know that. And, as I said, I really liked the course... But nevertheless, you did teach many more advanced courses than introductory courses and once said that your best preparation for such a lecture is no preparation.

Piet: Yes, that is my experience. For other people that will be different. Saying that the best preparation is no preparation should definitely not be interpreted as an absolute statement.

6. CENSORING AND SHAPE CONSTRAINTS

Geurt: Let us return to your research interest. You worked a lot on censoring models since the end of the eighties. How did this start?

Piet: In 1987, Richard Gill was member of a Ph.D. committee at the University of Dortmund in Germany. At that time, right censoring models were really hot and a lot of progress was made. The Ph.D. thesis also considered interval censoring models and posed conjectures on asymptotic properties of maximum likelihood estimators of the survival function. Those conjectures were clearly based on experience with right censoring, and were incorrect. I also attended a meeting in Freiburg, where I met Niels Keiding who worked on interesting medical statistical problems involving different types of censored data. I had started working on the current status model and derived rates of convergence and minimax bounds for estimating aspects of the distribution function. There were clear relations with my earlier work on monotone densities. Then I submitted my paper on these matters to *The Annals of Statistics*.

When I told a colleague from medical statistics about my results, he said all these things were already well known and that the real challenges were models where the patient was inspected more than once. I should have asked further, especially for references, but instead withdrew my paper. I can say now that this was a mistake... The results may have been known or intuitively clear to the person I talked with, which I somewhat doubt now, in particular for the minimax results I obtained, but they were definitely not in the literature at that time. An important aspect of statistical problems in general, but of interval censoring problems in particular, is that one cannot directly observe what one wants to observe. Information is only available via possibly corrupted data. Answers seem out of reach, or just around the corner. One then has to be smart and construct a strategy to extract as much information as possible to come up with the right answers.

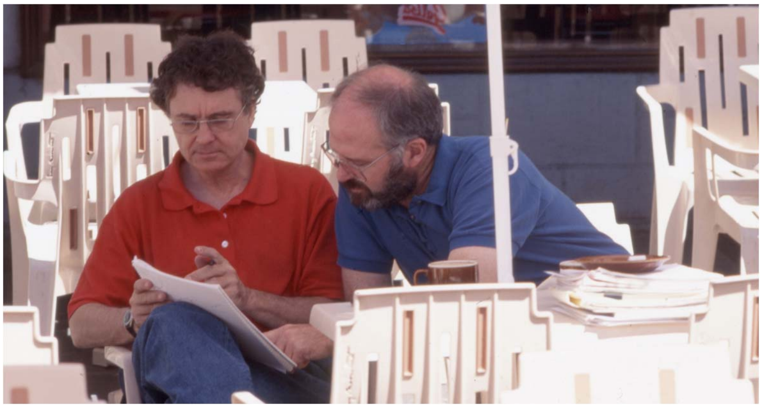

FIG. 4. *Piet and Jon Wellner in St Flour*, 1994.

Geurt: Apart from the connections to your work on monotone function estimation, there were also different challenges in shape constrained statistics, for example, computational.

Piet: Computational issues were indeed challenging at times. Thinking of algorithms to compute estimators, constructing and implementing these has taken me quite some time and effort. I have always been interested in programming, though, and learned the relevant programming languages (Fortran, Algol, Pascal, C, C++, and even objective C, which I used to create GUI version of my programs, using menus, progress bars, etc.). Currently I am also using R, somewhat less enthusiastically. Fortunately, there is Rcpp by which one can transfer most of the real computing to C++ and still use R.

By the way, another challenging aspect of shape constrained models is the asymptotic theory for smooth estimators. The paper van der Vaart (1991) on smooth functionals clearly explains the essential difference between right censoring and interval censoring, a difference that first got me into censoring models.

7. THOUGHTS ABOUT THE PROFESSION

Geurt: What is it that really attracts you in statistics?

Piet: In short, the interesting mathematics that is involved as well as the relation to the real world, its strength to contribute to solutions of real problems. For me relations with probability theory, the theory of special functions and integral equations have also been very interesting. Concerning the applied side of statistics, I am interested the whole process of modeling and analysis of data. Sometimes, the modeling is quite straightforward, at other times it is not. Recently, I worked with Richard Gill and Peter de Jong on data related to a judicial case in The Netherlands, in Gill, Groeneboom and De Jong (2018). Other people have analyzed the same data, but the answer is heavily influenced by what exactly is considered as population and sample. A quite classical statistical issue. It is also important whether one acknowledges heterogeneity of nurses and introduces a random parameter for that. Estimates of a probability range from one over 342 million to 1/9(!), using the same data but another model. As statisticians, we have to take responsibility in pointing to these issues, as answers can have highly undesirable consequences.

Geurt: Besides the relations to fields as probability that you mention, relations with computer science get stronger.

Piet: That is a good thing. Actually, already at an early stage in my career, using the computer was very fruitful for me. It started with the X8-system at the Mathematical Center with punch tapes and punch cards. Often, simulation studies really yielded surprising results which pushed me in the right direction. Quite recently, I discovered that the pointwise limiting distribution of the MLE of a convex decreasing density studied in our paper with Jon Wellner, Groeneboom, Jongbloed and Wellner (2001), is not symmetric. Something I really did not expect, but turns out to be the case. Computer simulations can really be convincing in such situations. Convincing, of course not a proof. It is important though to not view this move towards computer science and computer learning separate from the more classical connections of our field. In deriving the density of the Chernoff distribution, initial attempts to numerically approximate the density failed. Mathematical understanding of instabilities was indispensable to arrive at the final expression.

FIG. 5. *University of Amsterdam, with Theo Runnenburg (left) and Guus Balkema (right)*, 1987.

FIG. 6. *With Mike Keane, Rudolf Grübel (whose face is half visible) and Carel Scheffer after the Ph.D. defense of Rik Lopuhaä*, 1990.

Geurt: You mentioned a lot of names already, also with appreciation. Are there people you met who inspired you?

Piet: Apart from people already named, I must say that I gained a lot of inspiration from working with Ph.D. students.

Geurt: More specifically, were there presentations that really impressed you?

Piet: Yes. To start with a presentation by David Freedman, whose presentations I always liked, in Seattle during my stay there in 1980 or perhaps 1981 on the bootstrap. At that time, I thought this approach could not lead to sensible results, but this presentation made me turn around completely. Also, somewhere around 2005, I attended a presentation in Seattle by Timothy Gowers on Szemeredi-type theorems. That was extremely interesting. At the workshop that was organized on the occasion of my retirement at the Lorentz Center in 2006, I liked in particular the presentations of Steve Lalley and Timo Seppäläinen. Last but not least, a talk by Richard Gill at the yearly meeting of the Statistical Society in The Netherlands on the judicial case of nurse Lucia de Berk made me join him in the attempt to get Lucia de Berk out of jail.

Geurt: You also mentioned some books that you were influenced by. Are there more?

Piet: Definitely. When I was still at school, I read Schuh (1951).[6] It was great. After having read this, I could beat everybody with the Nim game, although of course everything is determined by the starting position in this game. In his book, Schuh even had suggestions on how one could lay down the matches inconspicuously according to the binary number system, which

[6]Fred Schuh was at that time affiliated to what is now called Delft University of Technology.

is the key here. Later, I enjoyed the books Dieudonné (1960) and Dieudonné (1968). In particular because of the originality of the proofs that can be found there. Recently, I read Green and Silverman (1994). This book is very well written.

Geurt: What would be your advice for young colleagues.

Piet: Make sure to communicate on your work, with "the right people". Attending interesting conferences and seminars is an important activity to really get in touch with people working in the same field. Also, do not expect immediately to understand a paper and not be afraid to first skip some details. It is my experience that re-reading a paper the next day, thinking about it, talking about it, makes things happen subconsciously. At some point you just start understanding it.

8. MUSIC

Geurt: Playing the violin has always been important for you. You even decided to work part-time the last couple of years before your retirement.

Piet: I have played the violin since I was eleven years old. From 2010 to 2014 I was coached by Saskia Viersen, who is a winner of the Dutch national violin competition. At my "audition" with her I played the Paganini caprice number 20 and this did not go so badly for once. I went through all 24 Rode caprices with her. She often said: "Oh, how nice are these Rode caprices!" I am myself particularly fond of the 18th Rode caprice, for which Jacques Thibaud wrote a transcription for violin and piano which he plays with great freedom and virtuosity on an old recording.

Marloes Maathuis said in her speech for my farewell party at Delft University that I have "Heifetz number 2", because I had lessons in Seattle from Ron Patterson, who is a pupil of Jascha Heifetz, for whom I have an immense admiration. Ron Patterson has a very gifted pupil Sarah Hall, who can be heard and seen on youtube, for example playing Milstein's Paganiniana, which I play too now, having listened to her inspiring performance.

Geurt: You also played with quite some colleagues.

Piet: Indeed. For example in Oberwolfach, with Götz Kersting and Hermann Dinges. We played Bach's three-part inventions and even a version of Bach's Goldberg variations for violin, viola and cello. Götz played viola and Hermann cello. These transcriptions

FIG. 8. *Piet with Neville Schaefer at the piano at Paul Janssen's retirement party*, 2017.

FIG. 7. *Participants of the week, organized in* 2006 *for Piet by Eric Cator, Geurt Jongbloed, Cor Kraaikamp, Rik Lopuhaä and Jon Wellner in the Lorentz Center, Leiden. Lectures held here are in Cator et al.* (2007).

FIG. 9. *Group picture of participants of the recent BIRS workshop Shape-Constrained Methods*: *Inference*, *Applications*, *and Practice*, *organized by Hanna Jankowski*, *Mary Meyer*, *Richard Samworth and Bodhi Sen in* 2018.

are fantastic! I learned about their existence for the first time in Oberwolfach.

I also played with colleagues such as Henry Daniels, Carel Scheffer, Hans van der Weide, Annoesjka Cabo and Frank Redig. Recently, for the retirement ceremony of Paul Janssen at Hasselt University, I was invited to play in the breaks between lectures. I played there with pianist Neville Schaefer, who was also the piano partner of Saskia Viersen at several violin competitions. Saskia conceived a nice program of short pieces for us to play there. We made a recording of it, and two pieces, Schumann's intermezzo in the so-called F-A-E ("Frei aber einsam") sonata and "Pièce en forme de habanera" by Maurice Ravel, are in my blog[7] on internet.

Geurt: Do you see connections between mathematics and music?

Piet: Definitely. A first is in the process of "getting into it". Starting to practise a piece, thinking it might be too hard. Trying and practising again. And then suddenly, everything goes. This is very similar to doing research in mathematics.

Another interesting issue to mention is related to Lambert Meertens, the student assistant at the psychological laboratory in Amsterdam. He composed an algorithmically conceived Haydn-like string quartet, based on the first "two-level grammar for a non-context-free language". I heard it performed by humans[8] at the festivities for the 60 years existence of the Mathematical Center. Persi Diaconis received the "Van Wijngaarden[9] award" on this occasion. Lambert's string quartet was published as Meertens (1968).

9. CURRENT ACTIVITIES

Geurt: You retired in 2006 but have been quite productive since then.

Piet: In the Netherlands, one has to retire at a certain age; back then it was 65. Interest in the field and research cannot be forced to stop. Currently, I am very much interested in single index models. Some years ago I gave a presentation at Hasselt University in Belgium and Paul Janssen introduced me to one of the students at his department, Kim Hendrickx. With her, I have been working on these issues since then. Within that project, we also produced an R package, which I enjoyed doing. We read Wickham (2015) to that purpose. I do like the fact that now I can choose to do the things I like and find interesting and that I do not have many outside obligations.

Geurt: Piet, it was a pleasure and interesting to have this conversation with you. Just taking the time

[7] https://pietg.blog/

[8] In the sense of "not robots".

[9] Van Wijngaarden was the director of the Mathematical Center, a famous numerical analyst and one of the founders of the Algol computer language.

FIG. 10. *Piet with his wife Marijke*, 2018 *in the Sherlock Holmes pub*, *London*.

to go through your life in chronological order, talking about personal things and the profession, brought new insights to me. Even after having known you for about thirty years now! I want to thank you for your lectures (also the introductory one!), your guidance during my period as Ph.D. student and various phases that followed. Also your humor (inherited from your grandfather?) and friendship over all those years. I look forward to continuing our collaboration in the future.

Piet: I want to thank you very much Geurt, and also hope to have more collaboration in the future.

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