JERZY NEYMAN (1894–1981)

BY

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I am greatly pleased and honoured to be speaking to this distinguished audience about the work and life of Professor Jerzy Neyman at this conference* commemorating the 100th anniversary of his birth. There have already appeared numerous papers on Neyman's revolutionary contributions to statistics and on his many activities in the area of scientific planning and organization. All of the authors also write about his devotion to work, his great hospitality, generosity, and the special attention he paid to the youngest students and researchers. Some of the authors are: G. A. Barnard [1], M. S. Bartlett [11], R. Bartoszyński [2], [3], W. Bühler [4], K. Doksum [5], S. E. Fienberg [7], [8], D. G. Kendall [9]–[11], K. Krickeberg [17], L. LeCam [19], [20], E. L. Lehmann [20]–[24], K. Urbanik [13], [34], and W. Zonn [14]. C. Reid [29] has written a biography: *Neyman from Life.*

Most of these articles cover the English and American periods of Neyman's career and activity. An exception is the article by D. G. Kendall et al. [11]. These authors write about Neyman's family and Neyman's early years. They also give a fairly complete list of Neyman's publications. I hope that it will be approved if I also concentrate on both the Russian and the Polish-English periods in Neyman's life that lasted from his birth till 1938.

Jerzy Neyman was born on the 16th of April 1894 in a small town Bendery, which lies at the river Dniester about 100 km away from Odessa. He was a son of Czesław Spława Neyman and his wife Kazimiera Lutosławska. Neyman's father was a judge in Bessarabia. He was also a historian, member of the Cracow Academy of Sciences (Krakowska Akademia Umiejętności). He died when Jerzy Neyman was twelve years old. Czesław Neyman was a son of Hermogenes whose wife was Chrząszczewska. They had 12 sons. All of them, except Czesław, the youngest one, participated in the insurrection of Polish patriots against Russian occupation in 1863 and because of that they were sent to Siberia.

Jerzy Neyman published only his earliest scientific articles under the name of Jerzy Spława Neyman. Latter he dropped Spława and used the name Jerzy Neyman or J. Neyman.

Spława is a coat of arms granted in 1775 to Mateusz Neyman, great-grand father of Jerzy Neyman, by Stanisław August, King of Poland. In the book on Polish coats by J. Ostrowski [28] published in 1897–1906, Spława has the following entry:

SPŁAWA: Nadany wraz z nobilitacją Mateuszowi Neymanowi,
właścicielowi dóbr Sierosław w poznańskim,
26 października 1775 roku
przez Stan. August. króla polskiego.

I have been told by Barbara Neyman-Zoltt, a cousin of Jerzy Neyman, now residing in Wrocław, that Neyman's family came to Poland in the 17th century either from Germany or the Netherlands. They settled in the western part of Poland — called Wielkopolska. In the 18th century, during the Napoleon era, some of them bought real estates in the Ukraine. They started the eastern line of the Neyman family, to which Jerzy Neyman belongs.

Jerzy Neyman was educated as a mathematician at the University of Kharkov during the years 1912–1916. He took courses given by the probabilists Sergei Bernstein and C. K. Russyan whom he greatly admired. In Kharkov Neyman become interested in Lebesgue's work and obtained his first new results in mathematics.

From 1917 to 1921 Neyman was Lecturer at the Institute of Technology in Kharkov. During the period of the Russian Revolution Neyman was arrested as an enemy alien (a citizen of Prussia). After the treaty signed in Riga in 1921 that ended the war between Poland and the Soviet Russia, Poles living on the territory of Soviet Russia were allowed to move to Poland. Neyman's family used this opportunity, and settled in various parts of Poland. Jerzy Neyman settled in Warsaw to be close to W. Sierpiński whose outstanding research aroused Neyman's interests in pure mathematics. His intention was to join the Warsaw group of mathematicians that worked at that time in the field of set theory, topology and measure theory. Although Neyman was in close contact with Sierpiński and published a paper in Fundamenta Mathematicae [25], he could not obtain university job in Warsaw. This must have been a great disappointment for Neyman. Because he urgently needed to earn a living, he accepted a job at the Agricultural Institute in Bydgoszcz, located about 200 km west from Warsaw. His duty was to study statistical methods of treating agricultural trials. Although he admitted that he had to learn these problems from scratch, he wrote in Bydgoszcz a number of remarkable papers, among other the paper on modelling the agricultural experiments [30], which became a milestone in statistics. It has been recently partly translated from Polish into English and published in Statistical Science. In Poland at that time, statistics was being applied to agricultural research by quite a few scholars. However,

I was not able to find evidence whether he was in contact with them or whether he worked in isolation.

It may be surprising that Neyman had only incidental contacts with H. Steinhaus. In the twenties Steinhaus was already a Professor at Lwów University. His work on functional analysis at that time gained him an international recognition. However, Steinhaus was also interested in formulation of the foundations of probability theory, later on crowned by Kolmogorov [15] in his *Grundbegriffe der Wahrscheinlichkeitsrechnung*, and various practical problems of biology, medicine, geography and sometimes engineering. Thus one could expect some cooperation between Neyman and Steinhaus. But this was not the case. In his memories Steinhaus [33] mentions Neyman several times, but only one statement, a negative one, concerns the Neyman–Pearson theory. I could also find no reference to Steinhaus' work in Neyman's writing, although he must have known Steinhaus' publications on probability and statistics, in particular the paper *Probability, credibility, possibility* published in the journal Zastosowania Matematyki in Polish [31] in 1954 and in English [32] in 1963. In this paper he presented his views on probability and statistics that he claims differ from those by K. Pearson, R. A. Fisher, J. Neyman and E. S. Pearson as well as by W. Feller. He writes: "In effect, practically all serious mathematicians have left Bayes' camp; the only ones that have remained are those who have not understood the objections of the new school. Only Norbert Wiener has had the temerity to call it *a terminology trick*." It would be interesting to have a closer look at Steinhaus' papers and to confront them with the views of Neyman and the views that are gaining an increasing number of supporters today.

The years 1921–1938 were one of the most scientifically active periods in Neyman's life. In 1923 he received a doctor's degree in mathematics at the University of Warsaw. He remembered that Sierpiński was a member of his Ph.D. examination commission. He spent the academic year 1925 in London as a postdoctoral fellow from the Polish National Culture Foundation, studying K. Pearson's work on statistics; and the academic year 1925/26 in Paris as a Rockefeller Fellow. In Paris he attended the lectures of Lebesgue and Hadamard and became involved together with E. S. Pearson in "delineating the contents of mathematical statistics as a proper discipline" [26]. He became deeply involved in this field and that caused him finally to abandon a career in pure mathematics. His contacts with pure mathematics had, however, a beneficial effect. Due to his mathematical education he could supply statistical problems with mathematical rigor so that they could be formulated as certain mathematical extreme problems, and this opened a new chapter in mathematical statistics and outlined the trends for its further development in the following decades.

While being in Poland he lectured on statistics at the University of Warsaw, at Jagiellonian University in Cracow and at the School of Agriculture

in Warsaw. He cooperated with the Central Statistical Office of Poland and with various agricultural institutes. He developed an especially lively activity as the head of the Statistical Laboratory of the M. Nencki Institute of Experimental Biology. He also found time to supervise Ph. D. theses. Two of his best known students were Stanisław Kołodziejczyk, whose thesis [16] on general linear hypotheses paved the way for further developments by other authors, and Wacław Pytkowski who first asked the question how to characterize undogmatically the precision of an estimated regression coefficient that led Neyman to build the theory of confidence intervals [26]. His other students and co-authors of his papers were, e.g., K. Iwaszkiewicz, T. Matuszewski, E. Pijanowski, A. Przyborowski, J. Słupińska, B. Tokarska, and L. Ubysz-Borucka.

In that period he wrote the fundamental papers on sampling human population which Professor S. E. Fienberg [7] considers to be ones of the most important papers of this century, a book on social insurance, the fundamental paper on confidence intervals, and collaborated with Egon Pearson on the foundation of statistics. Obviously, all this is well known, but without mentioning this any talk of Neyman's achievements would not be complete. A fact that seems to be not known so well to a broader audience is that it is possible to identify the exact place in Warsaw where Neyman discovered the correct way of formulating the problem of testing a simple hypothesis against a simple alternative. To quote Neyman's own account from paper [26], quoted already a few times, *A glance at some of my personal experiences in the process of research,* which appeared in the Festschrift in honour of Herman Wold in 1970, it happens thus:

> I can point to the particular moment when I understood how to formulate the undogmatic problem of the most powerful test of a simple statistical hypothesis against a fixed simple alternative. At the present time, the problem appears entirely trivial and within reach of a beginning undergraduate. But, with a degree of embarrassment, I must confess that it took something like half a decade of combined effort of E. S. P. [Egon S. Pearson] and myself to put things straight. The solution of the particular question came on an evening when I was sitting alone in my room at the Statistical Laboratory of the School of Agriculture in Warsaw, thinking hard on something that should have been obvious long before. The building was locked up and, at about 8 p.m., I heard voices outside calling me. This was my wife, with some friends, telling me that it was time to go to a movie. My first reaction was that of annoyance. And then, as I got up from my desk to answer the call, I suddenly understood: for any given critical region and for any given alternative hypothesis, it is possible to calculate the probability of error of the second kind; it is represented by its particular integral. Once this is done, the optimal critical region would be the one which minimizes this same integral, subject to the side condition concerned with the probability of the error of the first kind. We are faced with a particular problem of the calculus of variation, probably a simple problem.
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> These thoughts came in a flash, before I reached the windows to signal to my wife. The incident is clear in my memory, but I have no recollections about the movie we saw. It may have been Buster Keaton.

I met Neyman for the first time in Wrocław in 1958. This was Neyman's second visit to Poland after the Second World War. The first one was in 1950. He gave a talk at the Institute of Mathematics on the expansion of the universe. I was then a graduate student working on my Ph. D. thesis dealing with some problems of population genetics. A year later he invited me to Berkeley to work on some problems of carcinogenesis. From that time on I had a number of encounters with Neyman in Berkeley. The last one in 1978. I always received in Berkeley a wonderful warm welcome from Jerzy Neyman and Elizabeth Scott.

Neyman frequently used to invite young researchers from all the corners of the globe providing opportunities for them to deepen their knowledge and to strengthen their enthusiasm and fondness for research. In the 1970's most frequently invited were three of his former Ph. D. students: Wolfgang Bühler from Germany, Peter Clifford from England and Prem S. Puri from India, who — after receiving his Ph. D. degree — settled in Purdue. We all participated in his seminars on Wednesday afternoons that seemed to me to be run similarly to seminars in Poland.

I was pleased to find out during my stay in Berkeley that Neyman was very much interested in what was happening in Poland and to see his joy when he could travel to Poland. At one time he was even considering whether to accept a position (offered to him by E. Krasowska, vice-minister of Education of Poland) of Professor of statistics at Jagiellonian University in Cracow after his retirement from the University of California in Berkeley. Only after the university administration in Berkeley agreed to his request that during his life he will be the Director of the Statistical Laboratory, an independent unit from the Department of Statistics, he did reject this offer.

As the 500th anniversary of Nicholas Copernicus' birth was drawing close, Neyman made a number of suggestions how to celebrate it best. One of them was to buy a large modern telescope and to install it in Poland. To his great disappointment the institutions and people he had approached did not support this enterprise and the project collapsed. He was, however, successful in convincing the Council of the National Academy of Sciences of the U.S. to publish the book [27] *The Heritage of Copernicus* to celebrate the 500th anniversary of the birth of Copernicus. Neyman became the principal editor of this volume. It contains 25 articles written by scholars of established reputation (some of them having been rewarded by the Nobel Price) presenting revolutionary developments in their disciplines similar in character to the Copernican revolution. The book was supposed to present what Neyman valued most in his life — fight with dogmatic assumptions. Copernicus was his hero, he called him the first modern scientist, not so much because he provided evidence to the idea that the Earth moves around the Sun, but because he had the courage to abandon the centuries long Ptolemaic system backed by tradition and the authority of the Catholic Church.

Neyman gained high recognition in Poland. He was elected an honorary member of the Polish Mathematical Society and an ordinary member of the Polish Statistical Association. Neyman received a honorary doctoral degree of the University of Warsaw and was elected a Foreign Member of the Polish Academy of Sciences. In 1974 an International Symposium to honour Jerzy Neyman was organized in Warsaw and a special volume of the presented papers was published.

I think my talk would not be complete if I would not mention the many meetings I had with Neyman during which we recited Polish poems. He was a great admirer of Adam Mickiewicz's and Julian Tuwim's poetry. He also had his beloved Russian poets. Sometimes I was a little embarrassed when he corrected me much more frequently than I would like when I was reciting.

I would like to close my talk with a story I was told by Neyman himself, which can be also found in K. Kuratowski's book [18] on the history of Polish mathematics.

After a seminar given by W. Sierpiński in Berkeley, A. Tarski asked all those participants who were his students to stand up. A number, among them Neyman, stood up. This was, according to Neyman, the 1st generation of students. Next all those who were students of students belonging to the 1st generation were asked to stand up, and so on. It turned out that already at the 3rd generation most of the participants of the seminar were standing. A large proportion of the statisticians in the world would find their place on this tree if it were extended up to the present days. I am proud to belong to this tree too.

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