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An insight into the life of Michel Loève through his correspondences with Paul Lévy, Maurice Fréchet and Jerzy Neyman

Marielle Simon

Abstract

In this paper, we look at the post World War II immigration and journey of a famous mathematician to the United States. Michel Loève, originally from Palestine, was a probabilist who studied mathematics at the Université de Paris under Paul Lévy. He ended his carrier in the Department of Statistics at Berkeley, with many other foreign mathematicians. Before and after his departure from France, he exchanged many letters with contemporary probabilists, among them Paul Lévy, Maurice Fréchet and Jerzy Neyman. We give an insight into Loève's life through these three correspondences.

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Introduction

During the last few years, there has been a growing interest in studying letters exchanged between famous mathematicians during their careers. Recent publications are showing that their correspondences reveal interesting aspects of their work, and even of their lives. The letters received by Michel Loève were recently given to historians uncovering three privileged correspondents: Paul Lévy, Maurice Fréchet and Jerzy Neyman. We have selected letters which were written between 1941, the year of Loève's thesis, and 1949, one year after he settled in Berkeley.

The letters provide a looking glass into the beginning of Michel Loève's career. They highlight his difficulties in printing his thesis under the circumstances of war, his first year spent teaching in London, his endless requests to become a French citizen, his preparations to move to the US and finally his adaptation to his host country. At the time, Michel Loeve was not the only "brain" to migrate to the United States. Since the beginning of the 1930s, a considerable amount of Eastern European and German migrants, who eventually became prominent mathematicians, arrived in America. The most famous ones were: J. von Neumann, K. Gödel, George Polya, Richard von Mises and William Feller. The two greatest figures amongst American mathematicians reacted differently to this new type of immigration: whereas G. D. Birkhoff was concerned about this flood of foreign mathematicians, O. Veblen worked very hard to find them a way to settle and to benefit from long-term positions.

The new necessities imposed by World War II and the mass-immigration to the United States enabled American mathematicians to boost their research and, as a result, dramatically changed their objectives. After having been turned towards abstraction during the first half of the twentieth century, the American mathematical school made a major breakthrough in applied mathematics, especially in probability and statistics. To support that trend, several contracts were delivered by the Applied Mathematics Panel (AMP). This organization was created in 1942 in order to provide other scientists with mathematical aids and improve military research. The Department of Statistics of Berkeley, founded by Jerzy Neyman, especially benefited from it, because it was granted one of the greatest contracts the AMP ever delivered, and that indeed contributed to the university's reputation.

In wartime, communication between mathematicians around the globe was very restricted and researchers could not share their results. Harald Cramér, who undertook mathematics research in Stockholm during the war, relives his memories on that point in [7]:

> "On the few occasions when there was mail from the United States, we received letters and reprints from Feller, and so were able to follow his work on Markov processes and on the perfection of the iterated logarithm law mentioned above in 4.3 and 4.6. Mathematicians in war-making countries became often engaged in work with antiaircraft fire control and noise filtration in radar. It appeared that stationary stochastic processes provided an efficient tool for this kind of work. In particular the possibility of making predictions for the future course of such a process, based on observations during the past, was of vital importance. Independently of one another, Kolmogorov in the Soviet Union

> and Wiener in the United States made important contributions to this subject. They do not seem to have been aware of one another's work until after the war.
>
> After the great turmoil of the war years, it gradually became possible again to take up scientific research work on an international basis, and to renew contacts with colleagues in other countries. It was now clear to everybody concerned that **mathematical probability theory had passed through a radical change during the twenty-five years between 1920 and 1945**. While in 1920 it had hardly deserved the name of a mathematical theory, in 1945 it entered into the postwar world as a well-organized part of pure mathematics with problems and methods of its own, and with an ever growing field of applications to other sciences, as well as to many practical activities. There were intimate mutual relations between the applications and the purely mathematical theory, and already it was hardly possible for an individual research worker to survey the whole field. The years after the war brought a further powerful development in many different directions."

Right after the war, the American Mathematical Society set up the Committee on Applied Mathematics. This committee organized regular symposiums for applied mathematicians, and promoted collaboration with physicists, engineers, biologists, and others. Professional mathematicians got in touch with the governmental laboratories in universities. Besides these research colloquiums, which offered a wide range of subjects, Summer schools aimed at initiating PhD students and new scientists into the recent developments. After 1945, the United States became a big mathematics power thanks to its huge scientific community and the variety of its research fields.

This article attempts to show the whole context behind the immigration of a famous mathematician. Thanks to his letters, Michel Loève shared all of his feelings concerning his departure. After overcoming several difficulties during the war, he hesitated to accept the proposition of Jerzy Neyman in taking a permanent position in Berkeley. When he finally arrived in the United States, he had to adapt to his new country, with its new atmosphere and its new lifestyle.

1 Michel Loève: his first years in France (1941-1947)

1.1 The war circumstances

Michel Loève was born in Jaffa (Palestine) in 1907, and lived in a French community in Alexandria until 1933. He became a mathematics teacher and immigrated to Paris after his marriage with Line Cohen. He hoped to find a suitable PhD thesis. His search began working with Darmois, but the problem Darmois posed for him was too difficult. Then Loève met Wolfgang Doeblin[1] who advised him to visit Paul Lévy. This meeting had a large influence on the future of Loève. After he had read Paul Lévy's book *Théorie de l'addition des variables aléatoires* [26], he decided to focus his research on probability, and began his thesis work with Maurice Fréchet. Later, Loève confessed to Paul Lévy:

[1] Doeblin (1915-1940) was a young promising mathematician who was interested in the theory of probability. He was of German origin, but he ran away from the Nazis and settled in France in 1934. He worked brilliantly under Paul Lévy, but he was called up for front service in September 1939. In 1940, with the Nazi troops just minutes away from him, he decided to take his own life rather than giving himself up as a prisoner of war. For Doeblin's biographies, see [5], [13], and [27].

"I owed my love for the probability theory to your wonderful work[2]."

Being Jewish in World War II Europe made his life complicated. When he hoped to publish his thesis in 1941, he was confronted with the restrictions imposed on the Jews. Concerning scientific publications during World War II, we get information in [1]. The Jews Status in 1940 stipulated:

> "The Jews will be not allowed, unconditionnally and without reservation, to practise the following jobs: banker, stockbroker, editors for newspapers, magazines, periodicals, except strictly scientific publications[3]."

It seemed that any scientist, even a Jewish scientist, was authorized to publish articles, but the reality was very different. Lots of newspapers were printed in Paris, in occupied territory, where the German censorship was very active.

During the war, the Université de Paris printed no more PhD theses, and Loève had to find an alternative solution. Maurice Fréchet helped his student and advised him to get in contact with a Jewish Tunisian, Maurice El-Milick [**letter 01**]. Eventually, Loève managed to print his thesis in 1941, but only published it in 1945 in the *Journal de Mathématiques pures et appliquées.*

Loève's thesis was entitled *Asymptotical study of dependent random variables*[4]. In 1940, several major results were already obtained, notably concerning asymptotic properties:

(i). of independent random events, with

- the law of large numbers (Bernoulli, Poisson)
- the strong law of large numbers (Borel)
- the central tendency (de Moivre)

(ii). of sums of independent random variables, with

- the law of large numbers
- the strong law of large numbers (Borel)
- the central limit theorem (Laplace-Gauss distribution)

However, these theorems explicitly used the independence of random variables, and Michel Loève wanted to get rid of these constraints. He was originally inspired from Bernstein's works on the extension of Liapounov's theorem[5] and Lévy's works on dependent variables [26], and looked to improve their both results. Loève wrote in the introduction of his thesis:

> "We are starting from the idea that since these properties are asymptotical, there is every reason to attempt to assure their validity thanks to asymptotical hypothesis.[6]"

[2] "Je devais déjà à votre admirable oeuvre l'amour que je porte à la théorie des probabilités."

[3] "Les juifs ne pourront, sans condition ni réserve, exercer l'une quelconque des professions suivantes : directeurs, gérants, rédacteurs de journaux, revues, agences ou périodiques, à l'exception de publications de caractère strictement scientifique."

[4] *Étude asymptotique de variables aléatoires liées.*

[5] *Sur l'extension du théorème limite du Calcul des Probabilités aux sommes de quantités dépendantes*, Mathematische Annalen, Vol. 97, p. 1-59 (1927).

[6] Nous sommes partis de l'idée que ces propriétés étant asymptotiques, il y avait lieu de tenter d'assurer leur validité par des hypothéses asymptotiques.

His thesis was divided in four parts:

(i). The first part was devoted to the introduction of new notions and the demonstration of particular cases of his forthcoming theorems.

(ii). The second one was exclusively dedicated to the law of large numbers and its extensions to dependent random variables.

(iii). The third part, the most important one, focused on the Gaussian distribution. Loève gives a sufficient condition to obtain the convergence of the law of the sum of n dependent random variables towards the de Moivre-Laplace law.

(iv). The fourth one applied the previous results to general cases of central tendency.

After the first reading of his student's thesis, Paul Lévy was impressed with the work, as he wrote to Maurice Fréchet in 1943[7]:

> "My first impression is very favourable. He tackles the problem from a point of view that seems to be new. [8]"

A few days later, Lévy changed his opinion, since he realized that Michel Loève just generalized his own theorem. He wrote:

> "Concerning Loève's thesis, the first few pages lead to an observation that is not justified by what is coming afterwards. I am disappointed in this sequel for that matter. I just skimmed through the first fifty pages, but I paid attention to his fundamental theorem. [...] it seems to me [...] to be an insignificant generalization of one of my theorems. [...] Therefore I consider that Loève's theorem can be considered as trivial by anyone who would have understood the spirit of my report of 1935 and some extracts of my book.[9]"

Finally, a few weeks later, he changed his mind again and confessed that he still had good opinion of Loève's works:

> "My impression is still the same: few new ideas, but a good use of known ideas, and results which slightly overcome previous results. Anyway, I am still very well disposed towards the author, who [...] showed to me that he could have ideas - and what you wrote to me is justifying my opinion. I believe that we have to carry on encourage him.[10]"

Michel Loève received his Docteur ès Sciences (Mathématiques) in 1941. He was unfortunately compelled to interrupt his research with a period of imprisonment in Drancy. He was denounced by his neighbour and sent to the internment camp because of his

[7] For the complete letters, see [2].

[8] Ma première impression est très favorable. Il aborde le problème sous un point de vue qui me semble nouveau.

[9] Pour la thèse de Loève, ce sont bien quelques pages du début qui ont provoqué une observation que la suite ne justifie pas. Cette suite me déçoit d'ailleurs un peu. Je n'ai fait que parcourir les 50 premières pages ; mais j'ai lu avec attention l'énoncé de son théorème fondamental. [...] il ne m'apparaît [...] que comme une insignifiante généralisation d'un de mes théorèmes. [...] Je considère donc que le théorème de Loève peut être considéré comme banal par quelqu'un qui aurait bien compris l'esprit de mon mémoire de 1935 et certains passages de mon livre.

[10] Mon impression reste la même : peu d'idées vraiment nouvelles ; mais une bonne utilisation d'idées déjà connues, et des résultats dépassant légèrement les résultats antérieurs. Je n'en reste pas moins très bien disposé en faveur de l'auteur qui [...] m'a montré qu'il pouvait avoir des idées - et ce que vous m'écrivez me confirme dans cette opinion. Je crois qu'il faut l'encourager à continuer.

Jewish religion. Fortunately, he was appointed mathematics teacher and managed to be transferred to an English camp in 1944 thanks to the social connections of his wife. He regained his freedom a few months later. After his release in 1944, he held a teaching position at the Institut Henri Poincaré from 1944 to 1946. Loève was still not a naturalized French citizen despite his numerous requests. Due to this, he could not held a permanent teaching position in France. In 1946, he grasped the opportunity offered by the University of London, and spent two years in England during which he already prepared for emigration to the United States.

1.2 The attractions of the United States

Loève soon understood that the best way to be known as a great mathematician was to publish articles in the United States. He did not rest until Paul Lévy had been internationally recognized for his research in probability. In 1947, Michel Loeve encouraged his mentor to give a lecture at the Birbeck Seminar in London, and to print his future book in the USA [**letters 05-07, 10-11**]. He wrote in one of his letters:

> "I am convinced that you will be asked to give lectures in the United States. Especially if your book is published there. If you are interested in, we could begin acting[11]."
>
> "I hope that, in France, people will realize the impact of your work abroad[12]."

Paul Lévy was not as enthusiastic as his student, mainly because he was not very comfortable with the English language, but Loève did not give up the idea of promoting Lévy's works, and he was right! For Paul Lévy's biographies, we refer the reader to [22], [28] and [2]; we just give a few elements. Paul Lévy was one of the symbolic figures of the Calculus of Probability in France. He was born in Paris in 1889 and raised in a Jewish family. He undertook brilliant studies, and chose to enter the École Polytechnique. One year later, he published his first article, and completed his thesis in 1911. He became a mathematics teacher at the École des Mines in Paris, and after the war he came back to the École Polytechnique to give lectures. There he discovered his favorite field in mathematics, the Calculus of Probability. Even if he had little time to do research, for a period of fifteen years he was the only great French probabilist. Unfortunately, as he was separated from the University, he had very few students in France. He molded the young German mathematician Doeblin, who died during World War II. His only real student was Michel Loève.

During the Second World War, he lived almost clandestinely. He deluded himself: for example, he was surprised to hear that he was deprived of his teaching position in the École Polytechnique in 1943[13]. He had false identification documents and was forced to receive his mail at his son-in-law Robert Piron's address in Grenoble, but did not use pseudonym to publish his articles. In 1942, the Gestapo ransacked his flat and Lévy lost many of his belongings.

After the war, Michel Loève, together with Jerzy Neyman, promoted Paul Lévy's research developments in the United States. Thanks to their involvement, other American probabilists like Doob discovered the scientific contribution of Lévy to the Calculus of Probability. When he was invited to the Second Berkeley Symposium on Mathematical

[11] "Je suis persuadé que l'on vous demandera de faire des conférences aux États-Unis. Surtout si votre livre y parait. Si cela vous intéresse on pourrait commencer à agir."

[12] "J'espère qu'on se rendra compte un jour, en France, du retentissement de vos travaux à l'étranger."

[13] In a letter to Maurice Fréchet, in [2].

Statistics and Probability in 1950, he was given a very warm welcome. Jerzy Neyman said:

> "This colloquium will be the one of Paul Lévy's works."

1.3 The quarrel with Harald Cramér

Michel Loève suffered from the communication restrictions during the World War II. In 1947, Harald Cramér and Michel Loève disputed the priority of a theorem [**letters 08-09, 26, 28-31**]. They both worked on the spectral representation of second order stationary random functions, but could not communicate their results under the circumstances of war. When Paul Lévy began to write his book *Processus stochastiques et mouvement brownien* [25], he wanted to pay homage to the mathematician who first stated the theorem. Michel Loève vigorously defended his position, but he did not manage to convince Paul Lévy.

Actually, the two probabilists obtained the same result from two distinct points of view. Michel Loève focused on the harmonic analysis of stationary random functions, whereas Harald Cramér looked more generally at the spectral representation of stochastic processes and did not apply his result to probability theory.

Paul Lévy reconciled Cramér to Loève by noting in his book [25]:

> "Even if, in Cramér, it is a matter of measure in a functional space, and even if the adaptation to the stationnary random functions is only briefly mentioned, his priority makes no doubt. However it is worth remembering that at that time, due to the situation of Europe, Michel Loève, who founded the theorem in March 1945, could not know the paper of Cramér[14]."

Interestingly, Cramér mentioned his work on the spectral representation in [7], but did not talk about his confrontation with Michel Loève:

> "In 1942 I published a paper [6] on the spectral representation (5.1.1), explicitly pointing out the relations to Wiener's generalized harmonic analysis. But it was not yet clear to me that what I had done was really to give a probabilistic version of Stone's theorem on the spectral representation of a unitary group in Hilbert space. The method I had used for my proof employed stochastic Fourier integrals, but no Hilbert space theory. The fundamental importance of this theory for the study of stochastic processes did not become known to us until after the war."

Before going any further, it is worth briefly remembering the context of the scientist immigration to the US.

2 European scientists emigration to the United States

2.1 In the 1930s and the 1940s

As we said earlier, the flood of emigrated European scientists caused two opposite reactions. In particular, the behavior of George Birkhoff and Oswald Veblen illustrated the

[14]"Bien que dans Cramér il s'agisse de mesure dans un espace fonctionnel, et que l'application aux fonctions aléatoires stationnaires ne soit que brièvement mentionnée, sa priorité est incontestable. Mais il ne faut pas oublier qu'en raison de l'état de l'Europe à cette époque M. Loève, qui a en mars 1945 retrouvé le théorème en question, ne pouvait pas encore connaitre le mémoire de Cramér."

rift[15].

Birkhoff was a nationalist and he was religiously dedicated to promoting mathematics in the United States. He had such power that he had a virtual veto over every appointment in academic mathematics in the United States. In 1933 Einstein came to America. Sensing that his European Jewish colleagues were in grave danger, Einstein tried to find jobs for them. Apparently Birkhoff and some colleagues, who were looking after the prospects of their own students, were not enthusiastic to free up opportunities for these particular immigrants, quite possibly at the expense of qualified Americans. This reluctance induced Einstein, who may also have been irritated by Birkhoff's persistent professional criticism, to make a strong accusation of anti-Semitism against the Birkhoff group. He said:

> "G D Birkhoff is one of the world's great anti-Semites."

Similarly, Chandler Davis, in a personal communication, wrote:

> "G D Birkhoff was an early teacher of mine.[...] G D (but not Garrett) was consistently anti-Semitic, as shown in correspondence over the years; see R Phillips' article[16] and S Mac Lane coming to Birkhoff's defence[17]. He systematically kept Jews out of his department, but apparently relented late in life and favoured appointing ONE by the 1940s. He also helped some Jewish refugees find jobs NOT at Harvard in the 1930s, while acting generally to hinder their entry. Though his record is mixed and some were more implacably anti-Semitic than he was, his actions in this regard are important because of his very great influence."

At the same time, other leaders of American mathematics such as O.vVeblen and AMS secretary Roland G. D. Richardson labored tirelessly in this Depression era to welcome and to accomodate the displaced scholars, some of whom had been stars of the European mathematical scene. In 1932, Veblen spent time in Germany and lectured at Göttingen, Berlin and Hamburg. Zund writes that this experience:

> "... gave him a first hand glimpse of the approaching turbulence in Germany, and he subsequently worked tirelessly to help place refugees who came to the United States."[18]

Leon Warren Cohen, in an interview in 1984, recalled Veblen's attitude towards placing refugee mathematicians:

> "It was the Depression. Young American mathematicians were finding it hard to get appointments, and the question of whether to bring in foreign mathematicians to occupy positions which would then not be available to American mathematicians was debated. Veblen took what I would call the broader view. I hesitate to attribute views to Veblen, but the considerations that seem to have actuated him were two: a concern for the welfare of mathematics itself, and a human concern for certain individuals who had talent. Veblen was a grand man, and the people for whom he made it possible to come to the United States made a great contribution to mathematics. G D Birkhoff opposed him on this. ... [Birkhoff said] *If these distinguished people come and*

[15]The following information comes from [30], [12] and [8].

[16]R Phillips, Reminiscences about the 1930s, *Math. Intelligencer* 16 (3) (1994), 6-8.

[17]S Mac Lane, Jobs in the 1930s and the views of George D Birkhoff, *Math. Intelligencer* 16 (3) (1994), 9-10.

[18]J D Zund, Oswald Veblen, *American National Biography* 22 (Oxford, 1999), 307-308.

take the positions, the young American mathematicians will become hewers of wood and drawers of water."

2.2 After the war

Lots of American mathematicians realized that the close co-operation between scientific research and military organizations during the war contributed to promote many fields of mathematics. In 1945, the Applied Mathematics Panel was disbanded. Vannevar Bush, the supervisor of scientific work during the war, underlined the importance of fundamental research, the only means to acquire new knowledge and develop new applications. In 1946, the Office of Naval Research (ONR) was created and ensured that the policy concerning scientists would carry on. It first aimed at supporting applied mathematics, statistics and numerical analysis. After a short time, the Navy provided financial means to free mathematicians from some constraints and give them more time to do research. Mina Rees[19] wrote:

> "It had been worried that mathematicians would be suspicious for a military organization like the Navy supporting mathematics, but virtually every one had been won over to accepting a contract with the Navy to support his own research and that of his students. ONR's research program proved to be an extremely effective operation. In addition to support faculty research, it gave support to young students who were getting their doctorates. It gave secretarial help, it gave travel opportunities ; it helped Mathematical Reviews ; it did most of the things that mathematicians felt had to be done"

The salaries of researchers significantly increased, and the Office of Naval Research granted funds towards mathematics fields such as statistics and logistics. Moreover, the Committee on Applied Mathematics set up by the AMS carried on promoting research, organising colloquiums and providing help for publications. That is why European scientists went on migrating to the US after the war. American universities were in a position to offer them comfortable working conditions and high salaries, and attracted all the eminent foreign mathematicians who could increase the reputation of their laboratories.

3 Loève's leaving for Berkeley (1947-1948)

From 1946 to 1948, Jerzy Neyman did everything possible to make Michel Loève enter the Statistics Department of Berkeley [**letters 2-4, 12-20**]. The two mathematicians were both immigrant scientists and could share same feelings. In 1947, Neyman wrote in one of his letters to Loève [**letter 16**]:

> "From what I saw I judge that your position in this world is somewhat similar to my own. [...] Quite for a few years I was what may be called a professional foreigner. I felt foreign in Russia. Then, unexpectedly, I felt foreign in Poland and this continued when I moved to England. [...] within a year or so after my arrival in Berkeley, I stopped feeling foreign."

[19] Mina Rees worked for the AMP, and then was appealed to be in charge of the mathematics programme of the ONR. The following quotation is extracted from *Mina Rees, interviewed by Rosamund Dana and Peter J. Hilton*, in Albers (D.J.) and Alexanderson (G.L.) (ed.) *Mathematical people. Profiles and interviews*, Boston : Birkhäuser, 1985.

3.1 Jerzy Neyman, the founder of the Statistics Department

We begin giving a little information about the American statistician: Jerzy Neyman was born in 1894 in Bendery, Russia. He was the second of four children of Czeslaw Splawa-Neyman and Kazimiera Lutoslawaska, who were Polish and Roman Catholics. In 1906, his father died of a heart attack and his mother moved to Kharkov where she had relatives. Enrolling in the local school, Neyman proved a superior student and graduated in 1912.

He began studies at Kharkov University in 1912, where he was taught by Russian probabilist Sergei Natanovich Bernstein. When Neyman was introduced to the advancements in calculus made by French mathematician Henri Lebesgue, he refocused his studies on mathematics and continued in the field for the remainder of his life. Although he did not meet Lebesgue until 1926, Neyman considered him his mentor. In September 1917, having completed his undergraduate studies, Neyman remained at Kharkov University preparing for an academic career. He lectured and assisted with tutorial sessions and began to take an interest in statistical ideas. However the last year of the war, the Russian Revolution, and the civil war, totally disrupted the academic life of the University. In 1920, ten days after he married Olga Solodovnikova, Neyman was imprisoned and held for about six weeks as an enemy of the state due to his Polish heritage.

Despite the difficulties that he was under, Neyman passed his examinations and became a lecturer at Kharkov University, teaching higher algebra, integration, and set theory. In 1921 he went to Poland and made contact with Sierpinski. He received a doctorate in 1924 for a thesis applying probability to agricultural experimentation after being examined by a panel which included Sierpinski and Mazurkiewicz.

In the fall of 1925, with the help of a postdoctoral fellowship from the University of Warsaw, Neyman travelled to London to study at the Biometric Laboratory at University College. The laboratory was run by Karl Pearson, author of the influential mathematical work Grammar of Science and commonly considered the founder of modern statistics. He did become friendly with Egon Pearson, Karl Pearson's son.

Disappointed at the lack of mathematics in the statistics being studied at University College, London, Neyman obtained an extension of his fellowship to allow him to spend a year in Paris. He arrived in Paris in the summer of 1926 to visit Borel. In Paris for session 1926-27 Neyman attended lectures by Borel, Lebesgue (whose lectures he particularly enjoyed) and Hadamard. However his interest in statistics was stimulated again by a letter from Egon Pearson, who sought a general principle from which Gosset's tests could be derived. Neyman went on to produce fundamental results on hypothesis testing and, when Egon Pearson visited Paris in the spring of 1927, they collaborated in writing their first paper. The two decided to continue their investigation via letters and occasional meetings.

Neyman returned to Poland in May 1927 and immediately tried to set up a biometric laboratory in Warsaw. He spent time in both Warsaw and Kraków and on 26 June obtained his habilitation and began lecturing as a docent. In June 1927 Neyman wrote:

> "Certainly [the laboratory] is not yet sure, especially as our loan in America is not yet signed."

However by 1928 he had managed to set up a Biometric Laboratory at the Nencki Institute for Experimental Biology in Warsaw. Life in Poland was becoming increasingly hard, and in 1931 Neyman wrote to Egon Pearson:

> "... we have in Poland a terrific crisis in everything. Accordingly the money from the Government given usually to the Nencki Institute will be diminished considerably and I shall have difficulties in feeding my pups."

Neyman's 'pups' were the research workers in his laboratory! By 1932 things seemed even worse for Neyman who wrote:

> "I simply cannot work, the crisis and the struggle for existence takes all my time and energy."

What resulted from the combined work of Neyman and Pearson between 1928 and 1933 became known as the Neyman-Pearson theory, or the Neyman-Pearson fundamental lemma. Their first joint paper in 1927 was followed by a series of ten published papers that culminated in 1933 with the publication of "On the Problem of the Most Efficient Tests of Statistical Hypotheses."

At the end of 1933, Pearson invited Neyman to join him on the faculty of the University College in London, and Neyman accepted. In 1936 he was put in charge of the University's statistical laboratory. During his tenure at University College, Neyman wrote two significant papers.

After a successful speaking tour of the United States in 1937, Neyman the following year accepted an offer from the University of California at Berkeley to join its faculty as a professor of statistical mathematics and to start a statistical laboratory. He remained associated with the University of California for the remainder of his life. Although he was eager to establish his program at Berkeley, World War II interrupted his plans, and by March 1942, Neyman had turned his attention to military research, namely bomb sights and targeting accuracy and patterns. In 1944, Neyman became a citizen of the United States.

Once his attention was returned to the development of statistical studies at the University of California and its Berkeley Statistical Laboratory, Neyman methodically developed his work. Known as a generous and personable man, Neyman was steadfast in creating an intellectually superior program in mathematical statistics. In 1945 he established the Berkeley Symposia in Mathematical Statistics and Probability, which drew the best statistical minds in the world as speakers.

In 1954, he succeeded in establishing the Department of Statistics as a separate program, and he was named as chair of the new department. He made an indelible mark on the field of statistics and probability as mentor and teacher to 39 Ph.D. students, several of whom became leading statisticians at Berkeley, including Erich Lehmann, Joseph Hodges, and Elizabeth Scott. Neyman retired from teaching at Berkeley in 1961 but remained director of the Statistical Laboratory.

3.2 The insistent requests from Neyman

The French school of probabilists from which Loève emerged was world famous. Jerzy Neyman wanted to bring Loève with the hope that he would establish an equally renowned collection of scholars and courses in that discipline at Berkeley. Michel Loève rejected the first proposal in 1946 since he had already accepted a lectureship at London University. One year later, Neyman renewed his offer, hoping that an increased salary might be able to draw Loève to Berkeley. The yearly pay rose from 3900 to 4800 dollars per annum. Unfortunately, Loève accepted an other position again, this time as Visiting Professor at Columbia University. After a few months, Jerzy Neyman made a last attempt to recruit Michel Loève. He wrote in October 1947 that he obtained the authorization to offer a full professorship at 6600 dollars per annum! He also invited Loève to participate in Summer Sessions at Berkeley and to give lectures on stochastic processes. Jerzy Neyman even added a personal touch. In one letter, he described his own experience of immigration and ensured Loève that he would not feel foreign at Berkeley. Lastly, Neyman went as far as to write to Maurice Fréchet and ask him to argue in his favor.

Michel Loève was more and more lured by the prospects offered by Berkeley, but still had lots of questions, and especially particular requests. He wondered about the required content of his lectures, his teaching obligations, and more importantly the travel allowances. He expected Berkeley to pay the family travel from Europe to Berkeley and to find suitable accommodation. Eventually, he demanded a fast answer, since he had to renew his Egyptian passport, and "without an authorization residence, [he would] become a displayed person that no country accepts."

After they had both settled all of these problems, Michel Loève could finally begin his career at the Statistics Department in Berkeley in July 1948, and accepted the position of Professor of Mathematics.

3.3 Loève's beginnings at Berkeley

The beginnings at Berkeley were not so easy for Loève and his family [**letters 21-31**]. He wrote to Paul Lévy at the end of August:

> "We are far from being acclimatized. But I like so much teaching that I am not feeling miserable. This is not the case for my wife[20]."

He kept in touch with Paul Lévy: Michel Loève went on correcting the proofs of his book and invited his mentor to the United States. Paul Lévy hesitated to accept, and only agreed to come under two conditions: he could not pay for the trip and wanted to wait for his best health.

Michel Loève wanted to be invited to colloquiums and seminars in France, but all the necessary conditions were not easily fulfilled. Lastly, Paul Lévy did not manage to obtain the naturalization of Michel Loève, after three requests and three full files.

Despite his intense and persistent attachment to French culture, Loève took his place fully in the New World to which he moved. He enthusiastically described his lectures to Maurice Fréchet, and constantly encouraged Paul Lévy to take part in the Summer Session [**letters 31-48**].

He became a naturalized citizen in 1953, and helped to form and inform public opinion on critical issues of a social and political nature. Ten years after his arrival in California, Loève obtained the title Professor of Statistics. In 1974, he was appointed Professor Emeritus and awarded the Berkeley Citation, the highest honor bestowed by the campus.

Mathematicians everywhere were inspired by Loève, who familiarized them with modern theory of probability. Loève's influence extended far beyond his numerous research contributions mainly because of the dominant position of his works, both as references and graduate texts, these being attained in his book *Probability Theory* ([23] and [24]). It has since been called "the first comprehensive account of modern probability theory", and was affectionately known as "the Bible".

Loève's success as a teacher was phenomenal. Reputed for the hard work he demanded, his classes were nevertheless jammed with students at both undergraduate and graduate level, for they knew that he would help them to penetrate to the core of the subject. He conceived the teacher's role broadly. He once wrote:

[20] "Nous sommes très loin de nous être acclimatés. Mais j'aime tant l'enseignement que je ne me sens pas malheureux. Ce n'est pas le cas pour ma femme."

"The teacher ought to come down from the podium, shed his magisterial aloofness, and expose himself to the buffetings of the groups he joins. The student must do; the teacher must help and catalyze, but never command."

A few years after he died, the Academic Senate of the University of California paid homage to the French migrant (*In memorian*, 1980) :

"In a larger realm, Loève inspirited much of the Berkeley campus.[...] His friends were to be found among colleagues in dozens of departments and included students from freshmen to postgraduates for more than three decades. For Loève, a great university was truly a community of scholars, and he undertook almost as a personal mission to cross-fertilize the widest range of ideas. [...]

Yes, Michel Loève inspirited "this place" - The Faculty Club, the Berkeley campus, the international community of probabilists. But in the largest sense the place that he inspirited was the world of mankind. For just as he would not accept impermeable boundaries between the scholarly disciplines, so Loève was unwilling to grant that the world of scholarship could be isolated from the broader concerns of humanity. His interest in politics, in justice, in art, grew simultaneously from his reading and from the broad experience of his life. While he would often comment on these themes with humor, or occasionally with irony, he did not hide the fact that his deepest views were held with a passion that sprang from his devotion to the human spirit. [...]

A fine spirit had lived among us, had enriched our lives and intensified our sense of participating in a community of scholars. Now the man is gone; but his spirit still dwells in "this place."

(*L. A. Henkin, S. P. Diliberto, L. M. Lecam, C. Muscatine, J. Neyman*)

Conclusion

The immigration of Michel Loève to the United States had two positive impacts. Obviously it boosted his carrier, since he had the opportunity to work with the most famous probabilists around the world and participated in the most renowned Colloquiums. Many mathematicians discovered his talent when he was in the USA. Moreover, the presence of an eminent researcher at Berkeley helped Jerzy Neyman to create an intellectually superior program at the Statistics Department. Michel Loève is an illustration of a worldwide phenomenon : the immigration of great scientists to the US, who looked for comfortable working conditions and opportunities to boost their career, and finally contributed to the reputation of American research.

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