

Herbert Busemann

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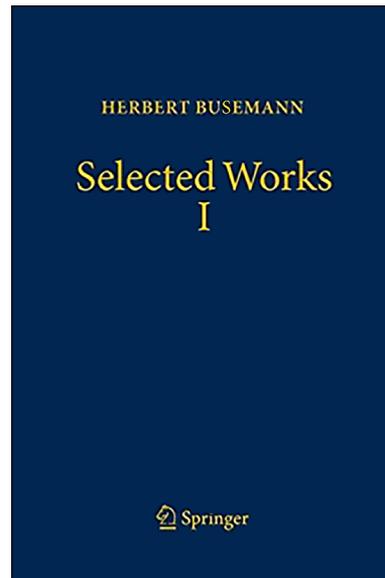
Herbert Busemann, 1954

EDITOR'S NOTE. Athanase Papadopoulos has kindly let us publish these excerpts from his introductory material¹ to *Herbert Busemann: Selected Works I and II*². Busemann was deeply involved in fundamental questions of convexity and is the main founder of metric geometry as we intend it today. He was a member of the Royal Danish Academy, a winner of the Lobachevsky Medal (1985), president of the California chapter of the Mathematical Association of America, a member of the council of the American Mathematical Society, and an accomplished linguist and artist.

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Herbert Busemann, Selected Works in two volumes by Herbert Busemann; Athanase Papadopoulos, ed. Springer, 2018 908 and 842 pages.

Initially, Busemann was not destined for a mathematical career. His father was a very successful businessman who wanted his son to become, like him, a businessman. Thus, the young Herbert after high school spent two and a half years in business. Several years later, Busemann recalls that he always wanted to study mathematics and describes this period as “two and a half lost years of my life.”...

Several years after he left Göttingen, Busemann shared his recollections on the teaching he received there....

Busemann recounts the following:

Officially, I took my degree with Courant. This was only officially, in the sense that I was really inspired by Paul Alexandroff, who visited Göttingen regularly. He gave me the idea of the subject of the thesis. I wrote it, but of course he could not be the official reviewer of my thesis, so he was my co-referee. [...] I must say that my thesis was partly in protest against Courant [...] I went away to Rome. I was angry with Courant, and I wrote my thesis on my own....

In a letter dated August 8, 1930, Courant informs Busemann that his “geometric work” done in Rome is sufficient

¹arXiv:1710.05591v1 (16 Oct 2017)

²Herbert Busemann, *Selected Works in two volumes* (A. Papadopoulos, ed.), Springer Verlag, 2018.

for a “reasonable” dissertation. The final dissertation was submitted in December 1930....

The doctoral degree that Busemann obtained in 1931 would have led him in principle to a position of lecturer, but practically it did not. He recounts:

Normally I would become an assistant but this was of course the depression time. Since my father had money and Courant knew it, he asked my father whether he wouldn't support me instead of having me become an assistant. This would make it possible for some other youngster to become a mathematician. That fact did me a lot of harm later on, in the sense that the German government after the Second World War tried to make good, but in my case they refused, because I had never had a paid position. If I had a paid position I would have had a pension.

Courant, as the director of the Mathematics Institute in Göttingen, told Busemann that they had run over their funds and asked him to make it possible to meet his father in order to get some financial support from him for the institute. The two men met. Busemann says: “How they settled this situation I don't know and I thought I shouldn't ask.” Reid reports on this in her book on Hilbert³ (p. 132):

During the increasingly hard times, a number of informal assistantships came into being at the institute in addition to the official ones funded by the government. Often duties were vague or non-existent. Courant once gave a student a stipend because he thought the young man was on the verge of a nervous breakdown and needed a skiing vacation. He also contrived to have some students work without pay. One of them was Busemann.

Busemann adds, concerning his former advisor:

Courant was rather reactionary in his mathematical outlook, and so he prevented many things which should not have been prevented. In Göttingen, he constantly tried to prevent the concept of Lebesgue integral. This has in the meantime conquered the whole world. He didn't see the importance of many things of modern mathematics. He had no relations at all with algebraic geometry. ...The Russians had played quite a role in Göttingen. I believe that I was the only one who was directly inspired by them. But their course was very popular. They filled a gap. They were familiar with certain modern tendencies that were not represented in Göttingen, e.g. topology.

His first permanent position was at the Illinois Institute of Technology in Chicago, a position which he described as a “horrible permanent job.” He recalls that this was a

period where “everybody was looking for jobs, and one had to take whatever.” He says he spent “five miserable years” in Chicago, from 1940 to 1945. He adds:

The head of the department made it difficult. He did not like foreigners in the first place. He belonged to those people who had done a couple of good things when they were quite young and he was against anyone who was too active mathematically. On the other hand the administration forced him to take good people, and he resented them.

In 1945, Busemann was appointed Assistant Professor at Smith College in Northampton.

Busemann stayed in contact with Courant, and the two men had a regular correspondence, but essentially on practical matters. Talking about the institute that Courant founded later in New York, Busemann says: “In America, Courant tried to do again what he did before in Göttingen. ...His institute is excellent but very one-sided too. The mathematics represented there goes all, or most of it, in one direction.”

In 1947, Busemann was appointed professor at the University of Southern California, and he spent there the rest of his career. In 1964, he was made distinguished professor.

At USC, Busemann worked in relative isolation, and practically his only collaborators were his PhD students. His work started to be recognized only in the 1980s, when metric geometry was revived in the West, especially by M. Gromov, and when the methods of synthetic global geometry were introduced in the study of geodesic metric spaces. W. P. Thurston, in his approach to geometry, also started from basic principles. Before that, Busemann's work was only appreciated in the Soviet Union, where A. D. Alexandrov founded an important school on the subject, with a large number of collaborators and students. Alexandrov, like Busemann, was only interested in the most basic notions of geometry. Classical problems of convexity, isoperimetry, and isoperiphany became the forefront of research, and classical projective geometry took its revenge upon a certain Riemannian geometry based on linear algebra and tensor calculus in tangent spaces. In some sense, it was a return to Euclid and Archimedes. In a tribute to Alexandrov's memory, S. S. Kutateladze writes:

“Alexandroff contributed to mathematics under the slogan: ‘Retreat to Euclid.’ He remarked that the pathos of contemporary mathematics is the return to Ancient Greece.”

Busemann's work is profound. He was capable of formulating problems and working on them, without relying on the trends that were fashionable in his time. In an article that appeared in the *Los Angeles Times* on June 14, 1985,⁴ on the occasion of the attribution of the Lobachevsky prize to Busemann, the author reports the following: “Few mathematicians ever make it into public consciousness, but

³C. Reid, Hilbert, Springer Verlag, Berlin-New York, 1970.

⁴L. Dembart, *An unsung geometer keeps his own plane*, Los Angeles Times, June 14, 1985.

Busemann has had a hard time even within his own field, in part, at least, because he never followed the crowd. ”

The journalist quotes Busemann saying: “If I have a merit, it is that I am not influenced by what other people do.” He then quotes Bob Brooks, who was Busemann’s colleague at USC:

Tastes change a lot and interests change a lot in the space of five years. But there are people who aren’t so interested in keeping up with today’s fads. Busemann is very definitely in that category.

We also read in the same article:

Busemann characterizes his basic mathematical approach this way: “Any apparently difficult problem can be done with very simple methods. This is the property of many of my things. I see a simple geometric reason which others have overlooked.”

Talking about the *Geometry of Geodesics* for which the Lobachevsky Medal was attributed, Busemann declares, in the *Los Angeles Times* article, that the approach is more important than the results: “The emphasis is more on the radically new approach than on the individual problem.”

Busemann retired in 1970. In 1971, he received from USC an honorary degree of Doctor of Laws. He was also a linguist. He spoke several languages, including, besides German and English, French, Spanish, Italian, Russian, and Danish. He wrote papers or translated articles and monographs from all these languages. Busemann published in the *Mathematical Reviews* a large number of reports on articles written in Russian. He could also read Arabic, Latin, Greek and Swedish. In the article in the *Los Angeles Times* mentioned above, the journalist quotes Busemann: “Every two years I read the *Odyssey*, I like it so much. And Plato.” Busemann was also a painter. In the same article in the *Los Angeles Times*, we read: “Despite a lifelong desire to paint, Busemann never took it up, fearing that it would divert him from the arduous work of mathematics. But retirement freed him, and he built a studio in his home that is now chockablock with dozens of large canvases painted in vibrantly colored geometrical designs. His mathematical vision carried over into art.”

Busemann got married in 1939. Little is known about his personal life. In a recent letter to the author of the present article, Peter Woo, who was a student of Busemann, writes:

Busemann had a funny way of writing on the blackboard. Some important theorem, he would write in big letters, from left edge to right edge, some 15 feet wide. Then he would scribble the proof underneath, and say, “See how easy it is,” and then erase his proof. We had to beg him not to wipe away until we finished copying it. He would give us a puzzled look, as if we were wasting his time.

He wanted me to discover theorems about new geometrical spaces with the rule : $AB+BC \leq AC$ unless A, B, C lie on a “geodesic curve.” First I found this funny. Then I began to make conjectures, and he encouraged me to prove them, first in some particular cases, then in more and more general cases. At some point he said, “You have done enough for the PhD dissertation.”

He often took us to his home. Together with three other PhD students, we used go to his house one afternoon per week. Each of us was supposed to present some theorem or unsolved problem, on a blackboard hanging on the wall at his backyard. He would make some remarks on what direction we should turn to, some easy special cases we had to study first, etc. After that, he would invite us into his house, to have a piece of pastry, and tea or coffee. He was always positive. He did not tell us much about his life. He knew a lot about history of mathematics, and this tied us with the European cultural heritage. He liked plants. He had a cactus garden where we loved a little thing about 9" tall, 4" wide, like a ridged dark green okra, with much white hair spreading from the top all around. He called it “the Old Man.” We loved it. He had no children, he loved us almost like his children.

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Photo of Herbert Busemann courtesy Author: Konrad Jacobs. Source: Archives of the Mathematisches Forschungsinstitut Oberwolfach. Printed photo is a crop of the original.

Image of *Herbert Busemann, Selected Works* in two volumes (A. Papadopoulos, ed.), courtesy of Springer Verlag, 2018.
Photo of Athanase Papadopoulos courtesy of the author.

ABOUT THE AUTHOR

Athanase Papadopoulos studied engineering at Ecole Centrale de Paris, then obtained a PhD in mathematics at Université de Paris-Sud. Since then, he has been a research fellow at the French CNRS. He edited the complete musical works of Euler and Menelaus’ *Spherics*. He has four children, all of them musicians.



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