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On the Waves of a Pulsating World

An Engineer's Adventures in Innovation, Education and Politics: From Russia to the West

VLADIMIR BABITSKY

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Vladimir Babitsky

To the luminous memory of my parents and sister.

Author's Preface: It's a Long Way to Tipperary

I was born before the war began. My first impressions of the world are as alive as only first impressions can be. A world at war, as heard through the radio. In early 1943, my father became Head Doctor of the Soviet Railways' Healthcare system. My mother, my sister and I had been evacuated, but this appointment meant we could join our father in Moscow the following year. My older cousins all fought at the front. The talented pianist Michael Marmurstein went missing within the first few days of fighting. His brother Leonid, a bright cellist, returned from the front with his hand hanging limp from his wrist. He was fortunate enough to recover and graduated from the Moscow Conservatory with honours. Fresh from his high school graduation, Boris Graus joined the war right from the start and served in aviation. As a kid, I tore out pages from my school notebooks just so I could write Boris letters to the front.

In kindergarten, our children's choir learnt a British song from the First World War. We sang it with Russian lyrics in translation. The chorus went:

It's a long way to Tipperary,
It's a long way to go.
It's a long way to Tipperary,
To the sweetest girl I know.
Goodbye Piccadilly,
Farewell Leicester Square.
It's a long way to Tipperary,
But my heart's right there!

I remember we got to sing "It's a Long Way to Tipperary" to some British officers stationed in Moscow. One of the British officers approached me, probably because I was the tallest kid in the group and as such commanded instantaneous authority. The officer had an interpreter with him.

"You like it here?"

Not really.

"Why not?"

We have to get up really early every day. I like to sleep in.

"In my country, children are allowed to sleep three hours longer than here!" the officer told me with a smile.

Being a child, I believed him without question, and thus began my dream of ending up in Britain, where the morning was sweet as sleep.

My childhood dream came true. For more than two decades, I have lived in a land with a real Queen, in a rural part of the country where people say hello to each other in the street and discuss the weather no matter what.

If my wife Ella is ever struggling to find her bearings, I remind her that the United Kingdom constitutes the bridge between Europe and America, and that at the centre of the UK is the village of East Leake, where we live, and that in the centre of the centre, on the tallest hill, is our house. And so, really, we live right at the centre of the Western World. That's where we are, darling: right in the middle of it all.

After 60 years of research and innovation in my field, which began in Russia, continued in Germany and flourished in Britain, I have so many colleagues to thank, so many collaborators to mention, so many students to be grateful for… But most of all I am thankful to my parents for bringing me into this fascinating world; a world of immutable physical laws that is nevertheless filled with inexhaustible possibilities. The author thanks the translator of the book, Alex Gruzenberg, for the great work that has been done to create a compact English version, which representatively reflects the main content of the Russian prototype.

East Leake, UK Vladimir Babitsky

Vladimir and His Memoirs—A Translator's Note

Vladimir Babitsky has always been entranced by the vibrations at the heart of our world. Light and sound oscillate. Stars glimmer. The surface layers of oceans fall and rise according to the Moon's attraction. There exist different and permanent pulsations inside every living organism. Metabolism… Heartbeats… The tremors of pupils… Voice modulation… Music… We live in a vibrating, pulsating world.

Vibration chose Vladimir to uncover its secrets. Over time, Vladimir developed machines that could deliver up to thirty thousand micro-impacts per second. His engineering concept, which he called "auto-resonance," helped to create the world's safest and most efficient jackhammer. When humans drill Martian rock, we will be using auto-resonance to do the drilling. Vladimir's vibration machines will travel past the Moon, all the way to Mars.

It is hard to describe just what a kind, bright and special man Vladimir is, but I will give it a try, using his temper as a prime example. Vladimir is almost always calm. Yet this husband and father is not reserved or aloof, as scientific greats are often portrayed. Quite the opposite. He shines with great enthusiasm, great energy and great joy. He has, if you might excuse the cliché, a glint in his eye. He tells funny jokes. He writes lovely poetry. He is a wonderful storyteller. He is critical and encouraging. He makes room for people to feel like they can give the best of themselves. When we argued over the edit, someone else might have interpreted my passion as agitation, but Vladimir kept his cool and never made me feel like I was inferior for having a voice filled with raw emotion. We had a rule which Vladimir suggested early on in our collaboration: "No hard feelings." This allowed us to

have honest discussions about the material, which was crucial for the best ideas to triumph in the edit.

From Vladimir's original memoirs, written in Russian, I have made many cuts, but all of them with the intention to tell a better, more concise story. If Vladimir ever wanted any cut material back, I always gave him the option, as long as we had a discussion about it first. The story, it was agreed, was our common priority. We made other editorial decisions, like dropping footnotes and patronymics—all for the sake of clarity. To give us a fresh eye, my friend Alina Young proofread the text and ironed out infelicities with her distinctive insight and precision. Alina knows my voice, so it was encouraging to hear her tell me that I managed to capture Vladimir's voice in my translation.

The book is filled with anecdotes, and each one holds surprising lessons. There are many short essays that breeze by, but the three longest chapters—"Chronicles of MARS during Perestroika," "The Eighth Liberal Art" and "A Genius of Faultless Beauty"—deserve also the most attention. The first two are about the fascinating trajectory of engineering breakthrough. The third is about talent, told through the story of a famous chess Grandmaster.

Each chapter in this book is its own world and can be read separately, in any order. If you are not enjoying a chapter and want to skip it, go ahead; you have Vladimir's blessing: he is a kind soul that way. There are chapters about history, chapters about science, chapters about machines and chapters about people. Aside from vibration of nonlinear discontinuous systems, recurring themes include the Soviets, great teachers, success under autocracy, clashing cultures, migration, dynamic breakthroughs, and the way something as mathematical as engineering can become politicised. This book is also about small-time heroes. That's who Vladimir is, at least to me: a humble hero who is happy to be heroic with a small h.

Hackney, UK
2019

Alex Gruzenberg

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The Documents That Did Not Burn

I was born in the city of Gomel, in South-Eastern Belarus, in 1938. Gomel was traditionally a place of the Jewish Pale of Settlement. In Imperial Russia, this meant that Jews were allowed permanent residency there. According to the records, about forty thousand Jews lived in Gomel around my birthdate, which accounted for thirty to forty percent of its population. Until the war there were even state-run schools where instruction took place in Yiddish.

To say that the war ravaged the city would be an understatement. Battles in the Gomel region began in July 1941. In the course of the war, fifty-five thousand of the city's citizens were killed. More than five thousand were taken as working prisoners to Germany. The city's population diminished tenfold. Four fifths of Gomel's housing stock was destroyed. Practically all Jews who did not evacuate in time were liquidated in the Gomel ghetto. After arduous battle, the city wasn't freed until the end of 1943.

My parents had no roots in Gomel. My father, Ilya Solomonovich Babitsky, was born in Kursk. His father was the son of a military *cantonist* who came to the city after completing his service in the Imperial army. *Cantonists* could be taken into military training as early as twelve. Only after turning eighteen would their twenty-five-year military service in the Russian Imperial Army officially begin.

From my father's relatives I heard that my great-grandfather's first wife, Polina, moved to Chicago with their three sons and two daughters. According to my calculations, this took place in the 1870s or 1880s. Perhaps it was not unlike the family conflicts that would re-emerge a hundred years later when Jews began to evacuate the Soviet Union *en masse*.

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After completing his military service, my great-grandfather received equal rights and a state pension, so he decided against migration. Instead, he stayed in Kursk and re-married, and my paternal grandfather became the sole child from this second marriage.

In 2000, during the International Congress of Mechanics in Chicago, curiosity made me venture to the vestibule of our hotel to peruse the city's thick telephone book. Two pages were filled entirely with the surname Babitsky. Some even retained the Russified female Babitskaya. In no other American city except Chicago did I encounter such a nomenclatural phenomenon, though I certainly looked for it whenever the chance presented itself.

My father dreamt of being a doctor, but educating children in specialised schools that would allow enrolment into medical faculties was beyond his family's means. So my father went to an ordinary school and after graduating in 1916 sent his documents to three universities.

Two declined his application on religious grounds, openly citing his Jewish heritage as an impediment to his studies. The Kharkov University did take him on, enrolling him as a student of Law with the provision that, if he passed his Latin exams within the year (ordinary schools did not teach Latin), he could be transferred to Medicine. Thus, in 1922, my father's dream came true when he received his Doctor's Diploma (Fig. 1).

It was a tumultuous time to be studying in Kharkov. In the years it took my father to complete his medical degree, the city kept changing hands: from the Donetsk-Krivoy Rog Soviet Republic to the Germans, and from Hetman Skoropadsky to the Directory, and from the Volunteer Army of Denikin to the Workers and Peasants' Red Army.

Medical students were moulded by war. They went hungry and had to earn their living assisting in military hospitals where the conflicts dumped their wounded. In such spaces, one could catch a deathly bacterial fever, so the work produced its own dead and wounded. My father contracted typhus, which was often a death sentence, but survived.

A few years into my father's medical career, his organisational talents became evident. By 1928 he oversaw a Railways' clinic in Kursk, his home town. This was a medical establishment dedicated to the healthcare of railways workers and their families. The following year he was appointed head of the Medical Unit of the Western Railways in the city of Kaluga, about ninety miles southwest of Moscow. There, he became a member of the city council.

Fig. 1 Ilya Babitsky as a medical student (1918)

Finally, in June 1936, my father was assigned to Gomel as head of the Belarusian Railways' Healthcare system. By all accounts it was an enviable post.

My mother, Maria Moiseevna Graus, came from a different economic background altogether. Her family were wealthy merchants from Elisavetgrad (now Kropyvnytskyi, in central Ukraine). They supplied the Elisavetgrad Cavalry School, which was the central training facility for the cavalry of the Russian Empire (Fig. 2).

Maria Graus was one of seven children and one of five sisters. The family owned horses; the children were taught to ride them. At school my mother learnt German and French, languages she mastered in adulthood. She also took music classes with Gustav Neuhaus—the father of the famous pianist and pedagogue Heinrich Neuhaus.

They lived in a house where young people of note would gather at night. Among the names that stood out for me was that of the brilliant Georgy