

## **TURBULENCE AND UPTHURST**

**Award-winning Sergej Zilitinkevich suspects that it has taken all his life-experience for him to fully reconsider some of the most fundamental concepts of atmospheric sciences.**

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“My parents made me study the piano. I guess I reached decent technical proficiency, but as my teacher put it, my heart was not in it. I replied that the teacher’s heart probably wasn’t too near the teaching. I wonder where it was. Yet, I don’t regret too much I didn’t learn genuine musical interpretation from her. As for compensation, she did introduce an important concept to me. Since then, I have been fond of listening not only to Bach and jazz but my heart and a few other hearts as well.

During my student years in Soviet Union all the philosophy we were offered was Marxism-Leninism. I preferred the real thing. Great novelists do philosophy, too, albeit in the form of characters and situations. One might say the same about the *Bible*. I think we need to follow this lead in exact sciences. The essential in a mathematical dilemma, or the most important thing in a physical puzzle, is usually something simple and attractive. What is complicated, sometimes misleading and often frustrating is the scientific language covering it. The blame for this can be put on the scientists. Modern science suffers much from the insufficient education its practitioners have in humanities.

Really new ideas and fundamental conceptual novelties require fresh linguistic means. Needlessly cumbersome and convoluted language produces unnecessary hindrances of understanding and even repulsion. A lot of what strikes unfathomable and uninviting in scientific matters is due to poor presentation.

Creative science finds a balance between organized and chaotic thinking. Ability to follow the established plan is as important as sensitivity to unprecedented and still hazy principles. Ideas and solutions tend to come to scientists when they are just waking up or already half-asleep. This applies to me too. Perhaps I’m not an expert of boundary layers for nothing: I must pay attention not only to solids but whatever is flowing in their vicinity.

An old friend of mine is a brilliant physicist. He has a method of refining intellectual insights into theoretical breakthroughs with the help of alcohol. On the verge of an invention, he can drink up a bottle of hard liquor. It works for his thinking. Sadly, if inevitably, it doesn’t work for his health.

Quantitative progress is not always possible. Arts remind us of this fact. Likewise, we should be wary in measuring advances in sciences. Yes, science is on the market. Education is on the market. No reason to deny these realities. But shouldn’t we fight and fix the shortcomings involved in the current trend? Well, at least my mathematician and physicist friend, president of the Estonian Academy of Sciences, Professor Tarmo Soomere, finds that large parts of our job as scientists escape quantitative analysis. Our profession, our *forte* is thinking. And we don’t argue in order to win our opponents but to attain truths. Not to preach but to learn. Ultimately, this benefits everybody. Politicians have a different game to play. Artists, too: Tolstoy and Dostoevsky are more like prophets than teachers. Scientists and, *a fortiori*, people doing basic research ought to preserve their special role as independent thinkers. By and large, they should be left alone to figure things out by themselves.

In the Soviet system, science was one of the very few fields for gifted people to try to make the most of their capacities and not to become integrated to the regime. I wasn’t personally

very close to the famous probability and turbulence theoretician Andrei Kolmogorov, but I naturally knew him and watched him deliver a few papers. Sagacious and open-minded as he was, he was naturally against the regime, just as my teachers in mathematics, Vladimir Smirnov and Olga Ladyzhenskaya. My own work in the 60's and 70's was carried out in the main within Kolmogorov's theoretical tradition. It was a period of adjustment. Having gained position in the national scientific community I was able to turn down collaborative projects with the military, but due to my resistance against party membership and party instructions, and reluctance of the Academy of Sciences to accomplish my dismissal from administrative position, I was sentenced on trumped-up charges and sentenced for five years. Just a little turbulence, one might say.

As for the old paradigm for conceptualizing turbulence, I have only later become to see that it is not complete. The Kolmogorovian concept is too restricted. A new paradigm is already on the way. It appears that I need all the experience accumulated over the years to begin to warm up and be ready for revolutionary changes in my line of expertise. In part, it has to do with an enhanced ability to face strong criticism. The most competent people in their line of work, on whatever field, are the ones most readily receptive to critical counterarguments. I remember when an eminent scholar did not, to my surprise, get mad about my challenging him. He proposed a toast of cognac for us both, to the memory of the old and defective and to the honor of the new and improved. Right there and then, I saw a role model for all of us.

Turbulence, yes, the whole thing derives from Lucretius. And it goes even deeper to the clash of cosmic and chaotic forces as seen by the ancient Greeks. Now, we could conceive of this as the conflict of good and evil or the one between the predictable and the unpredictable. It might well help you as a scientist, if you can move from one interpretation to another, and see the ample background of your field and its individual problems. I'm not a big fan of lecturing but in seminars people do appreciate historical approaches and cosmogonic or even mythic excursions to turbulence and convection. I'm the son of a natural scientist born in a long line of scholars and clergymen. Maybe that equips me with a bit deeper and wider perspectives.

Youth is a paradise for many people. Particularly, in an older age, as paradise lost. For me, paradise is here and now: in Helsinki with its high culture, liberal society, international atmosphere and St. Petersburgesque features. I'm so full of ideas I find it hard to sleep at night. Call it buoyancy, if you like.

Life in the USSR was terrible for millions of people. It wasn't easy for me either. "The war came as a breath of fresh air", goes the horrible line in Pasternak's *Doctor Zhivago*. As a survivor of the Leningrad siege, I hate to use it just like that. But it does resonate with my experiences. An internal enemy messed up everything: security officials rounding up neighborhood people at night made everybody defenseless, helpless and hopeless. In my memories of the war years, however, the emphasis is on solidarity and my own strengthening resourcefulness. There were exceptional individuals helping our family. There were the precious Rokolainens saving us from starvation with vegetables and other farmhouse goods during the first hideous winter. And my nanny or second mother Maria had lost everybody she loved in the purge of Soviet Ukraine, but she was there for me with all the affection and wisdom I needed.

Small wonder if the Soviet regime couldn't crush me after that. All those decades are part of me. It has not been such a tremendous task to adapt myself to a number of different scientific cultures during the past three decades of my career, when I had first been forced to adjust myself to a gang of criminals during my years in Soviet hard labor.

Nice ladies at the Leningrad University library gave me, early on, full access to all that philosophy and art that was prohibited in Soviet Union. I realized I had a knack for graphic arts. I did a couple of self-portraits. I even had an exhibition and earned KGB's reproach for that. It was a success."

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Born in St. Petersburg in 1936, Sergej Zilitinkevich is a researcher in atmospheric sciences. His career started in the geophysical and ocean research institutes of his hometown, called Leningrad in the Soviet times. Already in the 1970's he made an international name for himself with new approaches to turbulence and convection. In the beginning of 1990, he moved west and has worked in Germany, Denmark and Sweden. He joined the institution of atmospheric sciences in the University of Helsinki after retiring from the chair of meteorology in the University of Uppsala. He is currently stationed as research professor in the Finnish Meteorological Institute. Zilitinkevich's oft-cited books and articles, his influential theories and results have been used for both fundamental geophysical and astrophysical research as well as in modeling and forecasting of climate, weather, wind-energy potential, and air and water quality. In 2015, European Geosciences Union awarded Mr. Zilitinkevich with the prestigious medal named after the legendary Alfred Wegener.