

## “OUTSIDE OF PHYSICS”

b. 1922 Hamburg, Germany; in 1926 family moved to Valparaiso, Chile. In the 19<sup>th</sup> century this was the first port on the West Coast of South America where sailing ships could reprovision after having rounded Cape Horn on their way from the Old World. Here my great-grandfather had started a kind of trading post, a building with an office in front, stables for the horses in back, and sleeping rooms upstairs for the young clerks who would while away the time until a ship sailed in from Hamburg, quickly supervised unloading, answered the mail, and then relaxed, looking forward to the end of their obligatory time abroad before they could return “home.” During those leisurely weeks, these young men participated in the active social life among the German-Chilean colonist. Quite a few fell in love with one of the notoriously beautiful Chilean maiden, as happened later to my father.

In Valparaiso I attended school including the *Colegio Aleman* (which, with imported teachers, followed the curriculum of a German science-oriented *Gymnasium*). After graduating, I gained employment with *Lavadora de Lanas S.A.* in Viña del Mar, and for them became a wool buyer in the province Aysen, in Chilean Patagonia.

With a colleague we were based in Coyhaique near the Argentine border in the lower Andes Mountains, a hamlet consisting of a school, a church, a house of ill repute, a few other buildings including our wool shed and a boarding house, where a colleague and I stayed. This was run by an energetic, substantial Spanish lady whose prime aim in life apparently was to feed her guests a five-course dinner every evening. There was no North-South road from the mainland; groceries had to be brought in by steamer (surplus Danish island ferries) from Puerto Montt, the Southern terminal of the Chilean Railway. For meat, the landlady had to rely almost exclusively on mutton, and we had to become accustomed to seeing as lonely pickled sheep’s eye on a leaf of lettuce for appetizer, followed by mutton soup, delicious roast mutton for main course, etc....

We traveled to the *estancias* whose annual clip we attempted to purchase, drawing on detailed proprietary information on their clips in previous years. This included the wool’s strength and grade i.e., thickness, which could range from as high as 64 (British units) suitable for weaving the finest cloth to as low as 32, used mostly for rough carpets. The previous year’s weather also played a role in determining the wool’s value including, most importantly, the “yield,” i.e., what percentage of the weight of a fleece would be left after the lanolin had been scoured out---this could range widely. A difference of a percent or two could determine whether the price we offered to a rancher would ultimately result in a profit for the Company or a loss. The wool buyer’s skill in estimating yield would determine his worth to the Company, and hence, his future in that career. Among many factors, he would need to include the likelihood that a rancher would cheat by adding weight to a fleece, rocks when fleeces were rolled up or chasing the sheep around so they would sweat before being shorn. (Not saying “his or her” reveals the fact that not to this day, to the best of my knowledge, has there been a female wool buyer). To acquire this skill (to a high extent, I must confess in self praise) I had spent a year in the clammy sorting sheds of Buenos Aires, among crowds of other workers.

For the ranchers and their families in their remote homesteads this was the high point of the year and we had to join the families around the fire to drink *yerba mate* for hours, passing the gourd around the circle (including toothless elderly relatives), often having to stay for several days.

We had to travel on horseback on muddy roads where the ox carts would sink to the axles, starting at dawn before the ice sheet covering the mud had melted and the horses would cut their fetlocks. Over nights, we sometimes were lucky to come across one of the far-spaced ranchers' homesteads, where we unfailingly encountered generous hospitality (in one place, even, a young daughter played Chopin on a piano that must have been brought in by ox cart). If we had to camp, we would take advantage of the local custom to roast a lamb, permitted as long as one hung the pelt over the nearest fence for the owner to retrieve (this being the only part of the animal considered of value). The problem was to catch a sheep first; the pampas in Chubut are so semi-arid that these animals are spread out a great deal. Here we took advantage of one of a sheep's characteristics (also shared by some of our best physics students): curiosity. One could quietly lie down on the back, totally motionless. After some time (which could be quite long), a sheep would approach to see what the object was that contrasted with the usual landscape of *coyrones* (pampas grass) that extended seemingly to infinity. Then came the exciting moment, grabbing the animal, which led to a delicious mutton roast!

Otherwise, sheep are not particularly intelligent (here the analogy with physics students ends). When it snows, they will crowd together for warmth and suffocate as the snow cover builds up, unless a gaucho rides through the flock to let air in. Nevertheless, we would develop a kind of affection for these animals, not only as food but also as purveyors of our livelihood, not lacking in adventures.

During the long quasi-subarctic nights in Patagonia, I studied works like Bertrand Russell's formidable *Principia Mathematica* and *Philosophical Foundations of Quantum Mechanics*, as well as *Wittgenstein's Tractatus*... (in previous years I had been writing articles on popular aspects of philosophy for the *feuilleton* section of the newspaper *El Mercurio*). I became fascinated, not to say mesmerized, by insights that philosophers had gained into science---e.g., as early as in the 14<sup>th</sup> century *Occam's Razor* was formulated (named after William of Ockham): *Pluralitas non est ponenda sine necessitate*, "given two equally predictive theories, choose the simpler"---through Russell's characterization of "metalanguage," levels of language that allowed solution of age-old riddles and seeming paradoxes. Ernst Mach, around 1900, advanced the concept that no statement in natural science is admissible unless it is empirically verifiable. This "verifiability criterion" has stuck with me to this day and guided me, as Editor of *Physical Review*, to proscribe metaphysical discourse from the Journal, insisting that it is not science. (Not all my editorial colleagues agreed!)

Much as I enjoyed working among the sheep, once WWII ended and travel to the US became possible (albeit with difficulty for German-born persons), I succeeded in obtaining a student visa (with the kind help of a Jesuit friend) and a place on an ore freighter bound for Mobile, Alabama. My plan had been to study at UCLA where Bertrand Russell had been teaching, but on arrival in Los Angeles found that Russell had left, purportedly under pressure from the Mothers' Club for having advocated what was then called "Free Love," a euphemism for something that these days is rather commonplace.

It was immensely fortunate for me that Russell was succeeded at UCLA by Hans Reichenbach, founder (in 1926) of the Berlin school of logical positivism. (*Inter alia*, he had been one of the only five people who attended Einstein's first course on relativity). Reichenbach had studied mathematics, physics and philosophy; among his teachers were Planck, Sommerfeld, Hilbert and Cassirer. After fleeing from Germany in 1933 and teaching in Turkey until 1938, he immigrated to the USA. Reichenbach wrote path-breaking works on quantum mechanics, time, induction and probability. Most impressive I found his *Elements of Symbolic Logic* in which he showed how thoughts can be reduced to expressions of multi-valued symbolic logic and analyzed in terms of

deductions from axioms, clearly unveiling flaws and contradictions. With a small group of "disciples," in informal settings as on hikes in the Santa Monica Mountains as well as at seminars, Reichenbach's group became imbued with admiration for his rigorous approach to science, distilled in his *The Rise of Scientific Philosophy*, completed shortly before he died in 1953. Small wonder that on graduation I followed the master's advice and engaged in graduate study in pure science, viz., physics.