

Sophie Houdart

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Assunta Viteritti *Sapienza Università di Roma*

“The Large Hadron Collider (LHC) [...] is the largest and most powerful particle accelerator in the world. It is in the form of a 26.659-kilometre ring and located 100 meters underground beneath the small town of Meyrin, on the border between France and Switzerland. It’s a huge machine made of magnets, superconductors and acceleration structures that increase the energy of particles that circulate in it. Every day, two beams of particles circulate inside the accelerator in opposite directions at very high levels of energy before they collide. The particles, launched at 99.99999991% of the speed of light, complete 11,245 revolutions of the accelerator per second and collide approximately 600 million times per second. *Les Incommensurables* is a meticulous field study of this buried “cathedral”. It offers us the opportunity of connecting with the mysteries and immensity of the universe and access something that, while it goes well beyond humanity, also contains it, a modern expression of transcendence.”

The back cover of the book encourages the readers and the volume doesn’t betray their expectations. Increasingly large instruments for studying the infinitely small, developed over decades across numerous fields of physics research; thousands of physicists from around the world working with and on the machine; thousands of practical observations conducted every day; the constant accumulation over time of data and knowledge produced collectively; the stratified construction over time of a machine that grows on itself in order to peer into the depths of matter: this is the world of CERN (European Centre for Nuclear Research) seen through the eyes of Sophie Houdart who, with a marvellous and lucid narrative, takes us, historically and geographically, inside, through and over the Large Hadron Collider (LHC). The LHC is an underground place where generations of physicists from around the world accelerate and intersect particles in a circular underground tunnel, twenty-seven kilometers in circumference and built one hundred meters below ground. The author leads her readers into the world of particle physics research with an ethnographic work conducted together with two artists – a photographer and a visual artist – in order to connect languages and create resonances and bridges between science and the outside world.

Sophie Houdart is an anthropologist and researcher at the French National Centre for Scientific Research (CNRS). She is the author of numerous books and research papers and is a passionate scientist of human and non-human things (Houdart and Thiery 2011), insects – such as the drosophile – included (Houdart 2008). She specialized in Japanese studies, taking a particular interest in methods of construction, on a local scale, of

modernity, innovation, science and technology. Her body of work is a journey from the scientific culture of Japanese microbiology laboratories to the world's largest particle accelerator. On the long trail of STS studies, her research focusses on the key area of laboratory studies (Latour and Woolgar 1979) taking us inside the world of science, like Lilliputians in the world of Gulliver. Scientific practice, in all fields, is not immune to be investigated by social sciences (as Robert Merton normatively prescribed).

In this book, Houdart leads and challenges her readers through a work of scale and measurement, from the large to the small, attempting to track all connections that make this passage possible (p. 8). She draws us inside and around a place that has acquired the image of a sacred monument of contemporary science, highlighting the massive nature of the LHC, while finding a language that allows us to appreciate the dizzying size of knowledge of the universe. She describes how the great machine, ever since its inception, has been a mobile process that seeks to stabilize connections in order to render commensurable the incommensurable.

The author takes us on a journey into the history and the geography of the CERN. We begin at the end of the 1950s, when the CERN was a European expression of Big Science. Governments, countries and populations were all involved in the decision to install it on the border between Switzerland and France. She describes the site inspections, the negotiations of accords, the controversies on a local and global level between administrators, politicians, international agencies, physicists and farmers with their pasturing cows, allowing us to witness first-hand the conception of a highly exceptional machine. In the same way that Bruno Latour, in his work on microbes and Pasteur, took us into the pasteurization of France, here Houdart shows us how the setting up of CERN and the LHC built the culture of modern physics in post-war Europe. The geography of the place became a laboratory, not in the open air – as in Pasteur's case (Latour 1984) – but underground and precisely on the border between countries and cultures, but also the geography of the place – le pays de Gex –, becomes a laboratory. It is indeed this incommensurable tension between territory and laboratory that Houdart describes (pp. 177-178).

In her description we see how Mertonian communitarianism challenged history and geography with a thousand compromises, the financial effort involved, the accumulation of projects, and the ceaseless struggle in the search for the Higgs boson – the subatomic particle involved in the formation of stars, planets and life itself after the Big Bang of 13.7 billion years ago – that fueled years of work at the LHC, culminating in the Nobel Prize for Higgs in 2013.

The author takes us alongside the work of various researchers, technicians, operators and, as readers, we become knowledgeable. We follow, in the trails of laboratory studies, the routine nature of the work of pro-

ducing scientific data and, thus, we see how permanent maintenance of the great machine require the uninterrupted production of data and the subsequent elaboration of the mountain of data produced. We follow her description of the daily and nightly work in the control center and see how routines break down whenever a critical mechanical failure occurs, which is also a significant event in the daily life of the workers involved. The work of the scientists moves back and forth between the machine, the data and the particles. It is an uninterrupted task of constant connections between the many work teams, where routine is everything and also nothing. What the ethnographer follows is the bricolage work, where the profession of the scientist fluctuates between the maximum precision of measurements in a highly-sophisticated device and the daily challenges of an artisan: the practical aspect of knowing how to do science. The scientists, who live night and day next the great machine (which is always under construction), are described by Houdart as the artisans that meticulously, and with daily care, live with and love their machine. Houdart's work shows how discovering the Higgs boson was not the result of some miraculous collision, but rather the final result of billions of statistical elaborations of billions of measurements taken in a constant work of refining, homogenising and monumentalising science, but also the work of a constant monitoring of the environmental conditions taking place above and around the CERN. The book takes us inside the machine rather than inside the theories of physics and highlights the symmetry of the social and material dimensions of the scientific work. Houdart gives us a highly impassioned description and displays sensitivity towards something that we do not understand, demonstrating the sociomaterial heterogeneity of the knowledge produced around this enormous scientific device.

In the first chapter, "Le pré des vaches" [The cows' pasture], the author writes as a historical anthropologist. She tells, through many details, anecdotes, photos and documents, how the CERN was born, and how farmers, scientists, and administrators of different countries found agreements, over time, to decide where to build the research center.

The second chapter called "Maillage" [Mesh] tells how as ethnographer she entered in the field. As readers, we are immersed in the daily life of the ethnographers who build trust and relationships with the scientists, technicians and operators who constantly monitor the territory above and around the CERN and that allow it to work properly.

In the third chapter "Le LHC, the vaisseau spatial et les opérateurs" [The LHC, the spaceship and the operators] the ethnographers get in the big underground spaceship. Night and day operators (the working scientists) are at work. They monitor the body of the machine and every one of its breath.

In the fourth chapter titled "Précisions" [Precisions] we follow the uncertain and the ambiguous work, in which the scientists are engaged: the measurements. What we find, through the storytelling of Houdart,

are distortions, deviations and continuous attempts to find alignments between the different measurements – forms of commensurability. This is the everyday work of scientists: looking for alignments between measurements.

The fifth and last chapter, “Grandeurs et certitudes” [Magnitude and certainties] assuming the non-visible appearance of the Higgs boson on the scene, and the quantification of the certitude of such appearance at 99,9999% proposes a summarizing reflection on the tension between commensurability and incommensurability across many scales that the precision of measurement of the CERN requires.

Assumed theoretically by Higgs from the beginning of the 60s, the boson now enter in the (im)material world produced by the LHC hard work. Though not seen, the detection of the traces left by its mass allows it to change mode of existence passing from a virtual to a real entity. But such detection has been made possible by the constant work of monitoring, controlling, maintaining of the scientists, technicians and operators above and below the pays de Gex, so wonderfully described by Houdart.

In 2017 the film *The Sense of Beauty* was released. It had been shot inside the CERN, under the direction of Valerio Jalongo. A steadycam takes us inside the mysterious, almost sacred international laboratory of research physics and face-to-face with the LHC, the poetic machine, the particle accelerator that allows us to approach the very brink of the Big Bang. The film goes inside the community of scientists working like bees in a hive on and around the machine. It creates a resonance between the vision of the machine and the works of international artists inspired by the discoveries of physics: art revealing the invisible of physics. As Sophie Houdart shows, the machine of the incommensurable is the result of enormous economic investments (estimated at more than six billion euros), the largest mobilisation in the world of the scientific community of physicists, the contribution of governments, computers, machines, ingenuity, theories, bodies and journals; what Houdart defines as “le texture de la cosmologie moderne” [the texture of the modern cosmology]. What will happen now, after the discovery that led to the Nobel Prize? Where will Fabiola Gianotti take the CERN after the invisible vision of the Higgs boson?

References

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