

It Is Time to Think the Anthropocene! A Manifesto.

WHAT COULD BE THE MEANING of a scientist engaging in art? What could be his or her motivation? Why such an imperious feeling, as if touched by a magic wand and relinquishing all free will, as if obeying a command to explore and physically expose flesh and blood to slings and arrows—from beneath the armor of scientific proof?

I have been wondering about this for a long time: Whence does this acute sense of urgency and this intimate conviction that scientific outreach to the general public is mostly awkward and inadequate originate? The question accompanies the intuition that we, scientists, should reveal the other side—dark and bright, shadowy and sublime, the side we do not master or even understand, but where true progress and scientific breakthroughs happen—and the need to end our soliloquy, to allow the story to be told by the public, in an inversion of the flux that would then permit public “inreach” and input to be injected into science, almost as an enrichment.

The work I have been conducting within the art collective *Labofactory*, with Anaïs Tondeur, the duo HeHe and several other artists, aims not to demonstrate scientific phenomena, assign proof, or invite the public to join a scientific journey to discover facts, but to suggest a different point of view: an unsettling transgression, an uncomfortable simile, a physical experience, a metaphor of physics that makes use of scientific imagination to reinvent our perception of the world and question its relative and fragile truth.

In the *Fluxus* installation with *Labofactory*, thin, transparent wave tanks are envisioned as silent, soft drums. The artistic narration then becomes a score ruled by the physical properties of the drums, their resonant notes, attacks, and vibratos building a visual fantasy with inverted materiality: the only visible matter being the water that remains transparent while the cold fog rises into the air above the interface [1].

In *Domestic Catastrophe #3: La Planète Laboratoire*, also created with HeHe, a realistic toy globe rotates in a tank that looks like a scientific installation. At regular intervals, a fluorescent green cloud is emitted and spreads a thin atmosphere

that spirals out from the pole to the equator and then merges into the liquid ether. Although the physical phenomena at work on the toy globe does not correspond to anything similar on our full-sized planet, the metaphor still operates and conveys our vision of planet Earth as a delicate spaceship with no windshield and no protection against our actions from the inside [2].

In the *Earthquake machine*, created with Anaïs Tondeur, basalt rocks brought back from an expedition to the emerged part of the mid-Atlantic ridge, stressed by the constraint of spring-mounted tectonic plates, suddenly tremble, rotate and slide, and their giant shadows threaten the very stability of the showroom [3]. Meanwhile, the *AMOC Last Water Dive* installation stages a parallel ocean in which deep water periodically forms and eventually sinks, mixing the entire volume of water and thereby slowing down the real ocean's thermohaline circulation. The density variations, turbulences and wave motions inside the fluid are revealed by shadows on the gallery wall. They keep evolving visually over weeks as the waters continue to mix until they totally disappear, when, by the end of the exhibit, the contents of the tank become homogeneous [4].

These joint ventures with artists engaged in such different statements and public interactions, who are coming from diverse research paths—collaborators, all puzzled by my mysterious and compelling commitment to art-science—have brought me to realize, however, that these projects entail a deeper meaning and involvement.

Humankind, which should have been but an ephemeral, marginal event on the geological scale, is for the first time in history facing a lethal threat directly linked to its own actions and to its unquestioned, unspoken, unthought use of science and technology. The fascination generated by science—starting with scientists themselves—is still extremely powerful, as testified by the media coverage of the probable observation of the Higgs boson; it has given science a tribune and changed critical thinking into permafrost. Science needs to be re-enchanting, re-invested—in a humane way—in order to allow new stories to be thought and told, as part of a

modern *chanson de geste*, dedicated to globally sustainable acts and viable ideas.

Scientific omnipotence and faith in progress have now become nineteenth- and twentieth-century narratives. They have lost their edge, and their elusive, fading voices call for a global rewriting of the story. Presently, scientific advances are more often perceived as a threat than as progress. Scientists are starting to grasp that science—and the scientific approach itself—might be inefficient to solve or even envisage the reality and the meaning of, say, climate change or of “new” frontiers, such as the unsolved questions about life and consciousness.

A large part of my scientific research and Art & Science works have been concerned with the question of climate change and, more precisely, with how to predict, analyze and envision what is presently encompassed by the word “anthropocene.” The controversial use of this very term as a manifesto questions humans’ impact and ethics. It calls for collective, as well as individual, involvement in the definition and the construction of a new deal with our small, lonely, fragile vessel Earth.

Such global issues and challenges escape the scope of science, which is meant and expected to split apart a complex, intricate problem into smaller systems in isolation, broken down to the limit where the issue may be studied in a lab experiment, through computer memory or as a model inside a scientist’s mind. Science was never intended to reassemble the fragile and complex system in its comprehensiveness, much in the way that, as a child, I kept disassembling broken watches and clocks to gain a proper understanding of their mechanics, fascinated by their spinning gears and spiral hearts, but always failing to make them tick and beat again.

In fact, we need a different protocol, a novel approach and analytical scheme to tackle the multiple complex and challenging phenomena involved in the anthropocene concept. We need global thinking or, more precisely, a syncretistic vision that, like the intuitive perception of small children, has been overshadowed by academic rational thinking that misses the relevant representation and simply breaks down the right questions into worthless, rigorous sub-questions. In art, this unfragmented, amalgamated representation has been explored in particular through cubism, in a quest to “learn how to draw like a child.” But in science, the question of how to acquire and develop such a universal, more intuitive and more direct vision is pending and has not yet even been articulated.

The precautionary principle, first endorsed when the World Charter for Nature was adopted by the United Nations in 1982, has been designed to deal with questions so complex

that science has failed to find a solution for them with our present knowledge, established facts, observations and certainties. But such a principle is extremely difficult to apply, since coming up with a strategy would require at least three ingredients that are presently lacking. The first is quantifying statistics for the uncertainty, stemming from both our present ignorance of the system and from the intrinsic variability of the physical mechanisms involved. The second is quantifying with a measure of potential dangers (lost functions), and the third, of actions that we may undertake (cost functions). Should such a strategy be designed, we would still lack the means to enforce it upon governments and populations that would reappraise its politics and weigh it against their own interests. In particular, responses to the crucial issues raised by the new anthropocene era would certainly require drastic changes in behavior that could not be obtained through mere pedagogy, since the necessary level of action could be achieved only by an intimate conviction and implication of all. Only then does the tragedy of the commons have a chance to end [5].

In order to tackle such composite issues, our vision needs to be not only syncretistic but also global, i.e. shared and carried by an extremely large group of human beings. The precise meaning of the word “anthropocene” and the very nature of the coming era will be the result of the sum of all individual and collective human stories and actions we will undertake in response to this collective representation and verbalization of the trajectory of humankind. Science alone, however, cannot produce such a vision.

Science is simply a specifically contrived and powerful protocol. In order to cope with present observations, it offers some new mathematical models that are highly idealistic and extremely limited in essence. Then it derives new predictions to be confronted with new measurements until the model becomes inconsistent with the observations, and then it starts all over again. Through such a protocol, science seems to be doomed to perpetually move from incomplete models to inconsistent models, without any hope of ever reaching what was once thought of as the available truth—or the universality—as Gödel [6] formally demonstrated for a family of problems in his celebrated incompleteness theorems in the 1930s.

The scientific narrative, then, is to pretend that the model itself is a representation of the world—disregarding the fact that science will never be able to fully describe the dynamics of this model. If we imagine the universe as the interaction of all the elementary particles, for example, it does not bring any insight, even at a statistical level, since the process that would smoothly reconnect the microscale to the macroscale is largely still to be invented, in particular for systems out of

equilibrium. Nor will science be able to validate the model (because of the extension of the incompleteness theorem) or even to establish the model for complex systems in interaction as are involved in climate dynamics, since partial models are lacking (as in the case of the cryosphere) and since the coupling between subsystems also remains to be determined (even for simple quantities such as heat fluxes between the cryosphere, the oceans and the atmosphere).

Considering all these limitations, science itself should be viewed as a way of rethinking our world, but only as one among many other protocols and practices. In my opinion, science should be considered one specific approach, which I will call “artistic” in the sense that scientists—like other artists—enact their specific approach in the real world and engage their vision through real or virtual expeditions and thought experiments. Once the performative nature of scientific research is recognized and science itself perceived as a distinct artistic practice, a shared syncretistic vision of societal challenges may emerge. But it will require a confrontation with other artistic practices, all as legitimate as science, since they simply use a larger variety of narratives to examine our perception, representation and thinking about the world. Art and science encompass all performances and narratives necessary to stage this confrontation and question our beliefs and observations—as well as the nature, legitimacy and ethics of our scientific practice—without the usual limitations imposed on critical thinking by the quasi-sacralized (and thus unquestionable) “proof” protocol. Once such a sensible common view has been constructed through art, art and science, and science narratives, it should affect the actions of all individuals and communities and, as a side effect, may contribute in determining the most pragmatic path that science should take—or at least bring back critical thinking into science [7].

The *Lost in fathoms* exhibition [3,8], conceived with Anaïs Tondeur, is enticing the public to cross-examine their own

perception of the anthropocene through the fictional lost island Nuuk, with its physical presence and invocation of telluric forces, the mantle convection, the ridge and the abyssal plunging of a now fading deep-ocean circulation. The *Terra bulla* video, made for the Carbon 12 exhibition, in which a hemispherical soap bubble is illuminated in bright and dark orange fringes and animated by internal motions forced by wind, evokes the fragility of the planet itself rather than the vanity of ephemeral human life. The *Fluxus* installation convenes our memories of the ocean, but the waves themselves are strange and disturbing due to the pervasive presence of fog. *Domestic Catastrophe #3: La Planète Laboratoire* recalls hours spent spinning a globe in childhood, but the bright green cloud that now envelops the planet seems to reach space itself, to pollute the very luminiferous ether. These installations do not aim at taking a position nor pretend to popularize any scientific fact or give definite answers. Unsolved fiction and the multiplicity of forces at play, with their own fascinating dynamics involving a large range of time scales and the derisory and sublime human nature, of scientific pieces and evidences collected, should raise public—but first of all scientists’—awareness for a necessarily broader critical view. This would reinterrogate our own perceptions, memories and stories for our common responsibility in building a new syncretistic vision, a *Minimal Ethics for the Anthropocene* [9], that would be the first steps toward a thought and shared future.

JEAN-MARC CHOMAZ

Director of Research

Laboratoire d’Hydrodynamique (LadHyX)

CNRS-École Polytechnique

91128 Palaiseau Cedex

France

Email: <jean-marc.chomaz@ladhyx.polytechnique.fr>

References and Notes

- 1 J.M. Chomaz, “La science et l’art de sculpter les fluides,” *Images Interactives*, (Collection essais, ed. La lettre vole, 2016) pp. 157–167.
- 2 HeHe (H. Evans and H. Hansen), *Man Made Clouds* (Ed. H.YX, 2017).
- 3 J.M. Chomaz, “Les boucles mémorielles de la Terre,” *PLASTIR* (N° hors série *Les plis de la Mémoire*, Ed. PlasticitéS, 2015).
- 4 Chomaz [3].

- 5 G. Hardin, “The Tragedy of the Commons,” *Science* **162** (1968) pp. 1243–1248.
- 6 K. Gödel, *On Formally Undecidable Propositions of Principia Mathematica and Related Systems* (New York: Dover, 1962).
- 7 T. Morton, *The Ecological Thought* (Harvard Univ. Press, 2010).
- 8 J.M. Chomaz, “De la science cinétique à la science sensible. Un manifeste,” *MDC* **79** (2015) pp. 42–45.
- 9 J. Zylińska, *Minimal Ethics for the Anthropocene* (Open Humanities Press, 2014).