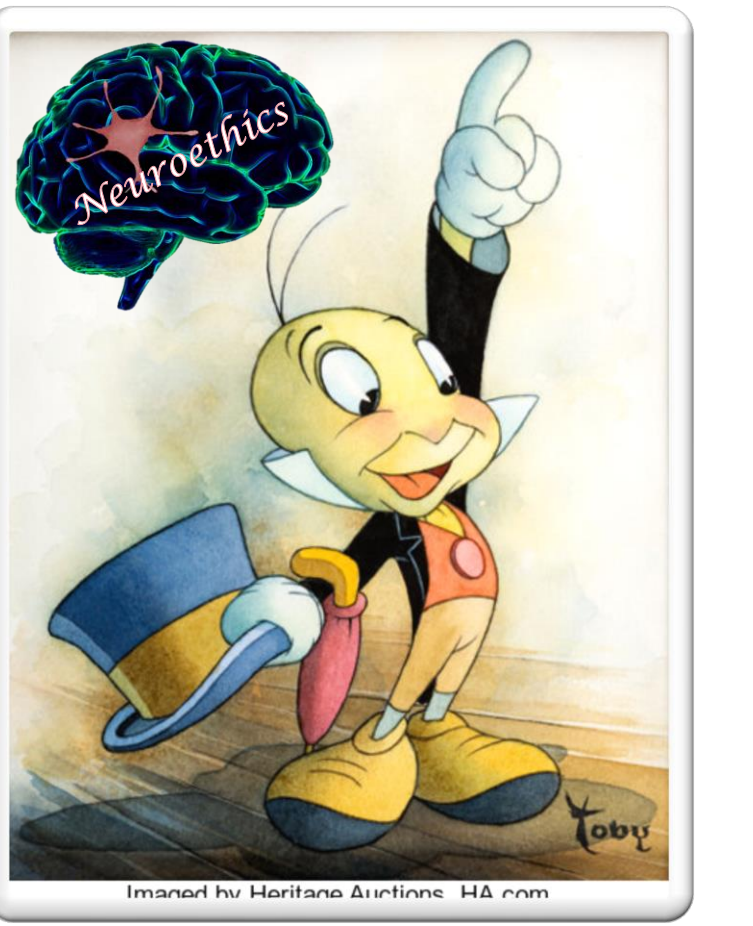


# Proposal of a “neuroethics by design” for the convergence of neuroscience, computer science and engineering through the study of neurotechnologies



Dr Tabouy Laure, PhD<sup>1,2</sup>. [laure.tabouy@universite-paris-saclay.fr](mailto:laure.tabouy@universite-paris-saclay.fr)

<sup>1</sup>. CESP U1018-INSERM, Université Paris-Saclay, UVSQ, Team Ethics and Epistemology Research, Villejuif, France.

<sup>2</sup>. Agence de la biomédecine, medical and scientific department, Saint-Denis la Plaine, France.



## Introduction – scope

## Methodologies

How can we rethink neuroethics in light of the convergence of neuroscience, computer science and engineering?

Reading minds, deciphering dreams, communicating and writing with thoughts, downloading the human mind into a machine... This world, which is the stuff of science fiction, raises questions in my mind. Do I want my innermost thoughts and intentions to be available to everyone? What kind of world are we building for tomorrow?

→ We need to rethink the way we define neuroethics, and tailor it to the issues at stake, in order to deal with them effectively and appropriately.

→ Take the case of neurotechnologies, which are devices for studying the structure and functioning of the brain. The convergence of neuroscience, computer science and engineering, and their growing sophistication on the global market, are making them more miniaturized, more efficient and more powerful. This accentuates the porous boundaries between medical and non-medical, civil and military uses, as well as the diversity of objectives, uses and investments. They bring hope, but their capacity to influence or manipulate is worrying.

→ How will the use of neurotechnologies, by modifying the structure and functioning of brain networks and processes, influence the human person?

→ It is becoming crucial to approach empirical ethics, bioethics, neuroethics, research and innovation ethics and digital ethics together, and to work on these issues in a transdisciplinary way and in concert with European law on artificial intelligence and data (AI Act and DATA Act) and neurolaw.

Considering ethics as constructive criticism aimed at protecting our future from our present actions, I seek to define a neuroethics tailor-made for these neurotechnologies, through the problematic of convergence, I seek to define an adequate neuroethics, to think and understand how to take care of the present and the future, without constraining the promise of useful innovation →

- 1) by drawing on an interdisciplinary literature review in neuroscience, ethics, law, the history and ethics of digital technology/neuroscience and philosophy
- 2) by exploring the field of possibilities and desirable futures, with the help of philosophy and science-fiction literature. Because the convergence of neuroscience, computer science and digital technology is making it increasingly possible to develop innovations similar to those imagined in science-fiction literature.
- 3) by examining the economics of innovation, insurability and financing of neurotechnologies, as well as their commercialization.

To complete this reflexive work, I carried out :

- ❖ a qualitative survey of researchers and entrepreneurs
- ❖ a risk mapping and flow chart, in collaboration with a company and a law firm.

The aim is to create a low-code, open-source algorithm that will ultimately create legal documents at the end of the flowchart, enabling organizations to have a single official document with all existing laws, recommendations and codes relevant to neurotechnologies and AI.

## Objective

Anticipation and prospective are crucial to the development of neurotechnologies, but how can we operationalize ethics so that these innovations are adapted to the sociological, ethical and legal values of each culture?

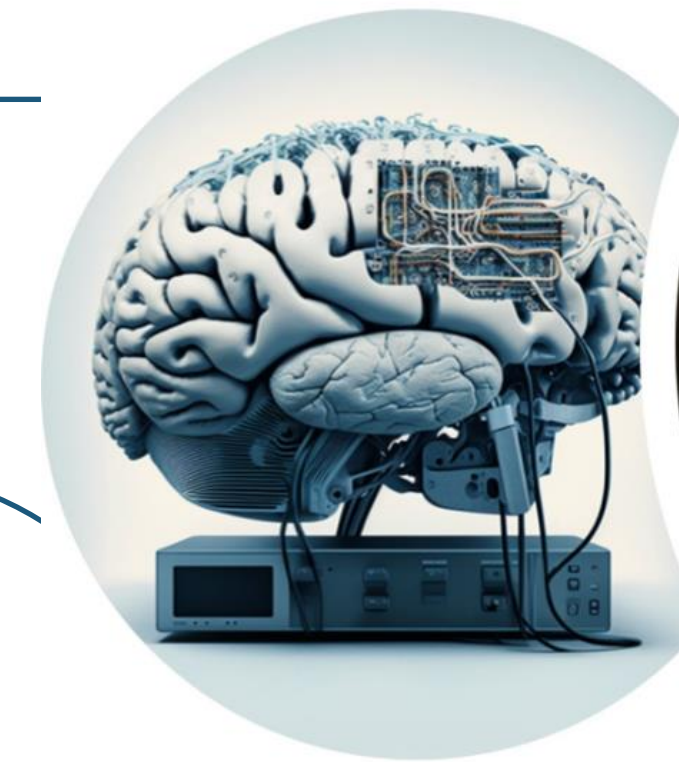
One of the first ethical issues is that of mental privacy. As the brain is the last refuge of our privacy, their development calls for ethical vigilance in the face of the risk of violating personal integrity and freedom of thought.

The challenge is to devise an ethic that looks to the future of human rights.

My project is to determine what neuroethics are conceivable for these neurotechnologies.

The aim of my thesis is to propose an applied and embedded neuroethical framework, constructive and applicable in the reality of these innovations, and adapted from their conception to their commercialization. I therefore seek to define the limits, potentials and consequences of their use on human identity and society, as well as on research itself.

The aim is to propose a "Neuroethics by design" approach to support academic and private research, as well as companies, by defining a philosophically adapted neuroethics.



## Result and conclusion → proposal of “neuroethics by design”

This investigative work in the field enables me to gather expert opinions, detect the main dilemmas, issues and desirable futures for future generations.

This invites me to anticipate and position myself strategically in the field of innovations, while reinforcing the consideration of transdisciplinary and cultural dimensions, desirable values to be put forward and defended according to contexts and purposes, as well as the consequences of these innovations on society, users, future generations, politicians and individuals.

➤ At the end of the research, after empirical and field work, prospective scenarios for proactive management will be sketched out, as part of a wider field of investigation: that of “neuroethics by design” for responsible neurotechnologies, which constitutes the strategic and operational relevance of the last scenario.

➤ The aim is for this by-design proposal to be an accompaniment encompassing all existing recommendations and codes, and laws on neurotechnologies and AI/digital, to articulate them together.

The challenge for those involved in research and business is to establish a genuine dialogue and build with society. We need to strike a delicate balance between the development of reliable neurotechnologies that respect the time required for research, and rapid development for commercial purposes to keep pace with international competition. The challenge for all of us is to devise a neuroethics that is mindful of the future of humanity in the face of the risk of undermining personal integrity and freedom of thought.