

Modern science and the autonomy of mind

A neglected legacy in cognitive neuroscience

Introduction to the project

In this seminar, I will outline selected parts of a broader project that I am starting to wrap up during my Fellowship at the Italian Academy. The project deals with how the development of modern science and technology, in both theoretical and institutional sense, has impacted theories of mind and its place in nature until today.

The project is rooted in two lines of research that I have conducted in the past. First, an investigation of selected case studies in the philosophy of modern science, in particular Kant's philosophy of nature (Pecere 2009, 2016, 2022, 2024b), the philosophical reception of Einstein's relativity (Pecere 2007, 2021, 2023b) and of quantum mechanics (Pecere 2012, 2015). Second, an investigation of selected case studies in the history of philosophy of mind and neuroscience (Pecere 2012b, 2013, 2015b, 2020b), with a particular emphasis on Kant and the Kantian legacy (Pecere 2016, 2021b, 2022b, 2022c, 2023, 2024b, 2024, 2025), which has led to a book-length historical profile (Pecere 2020; revised and expanded in Pecere 2023).

While working on this second topic, I realized that a large part of problems and arguments in contemporary cognitive neuroscience and philosophy of mind had been already formulated in modern debates. Although the existence of these precedents has been recognized (Nida-Rümelin, O'Conaill 2024), parts of contemporary debates seem even to inadvertently replay the past ones (cf. Tennant 2007). This discovery led to the question whether cognitive science has done significant progress concerning a number of traditional philosophical problems over the last decades – as is often argued – and suggested further investigations.

Based on these premises, I am focusing now on the history and present importance of a *non-reductive* and *non-metaphysical* approach to conscious processes. This approach has been developed in early modern philosophy, notably in Kantian philosophy, leaving an important legacy in 19th and 20th century debates, while being relatively neglected in contemporary cognitive science compared to empiricist, reductionist and metaphysical approaches.

"Non-reductive", here, means that this kind of approach denies the possibility of *explaining* conscious processes *solely* in terms of the concepts and laws of natural science, although it is granted that these processes are empirically *correlated* with physical processes. According to this kind of view, there are qualities, norms and structures of conscious experience that necessarily require a description on their own terms, although the cognition of their neural correlates can add relevant information concerning their instances in individuals. Examples include the perception of colors, the criteria of aesthetic taste and the features of personal identity.

“Non-metaphysical” means that the introduction of mental processes in the scientific world picture does not entail the endorsement of any of the metaphysical hypotheses that have been developed for this purpose in modern philosophy, such as materialism, dualism, panpsychism etc.

The final objective of the project is a book-length historical and comparative reconstruction of selected debates on the reduction of mental processes ranging from the 17th to the 20th century, focused on the mentioned non-reductive and non-metaphysical paradigm and divided into three stories:

1. The neural explanation of sensory perception
2. The autonomy of norms (e.g. logical, ethical, aesthetic)
3. The neural explanation of the self and other animal minds

In this seminar, I will focus on the first one and include some remarks on the second.

First find: contemporary problems and historical precedents

As I mentioned above, this project started with the discovery that significant elements of contemporary debates were already present in previous ones and that these precedents were scarcely reconsidered. For the sake of introducing the seminar, I will present here some examples drawing from contemporary debates on “physicalism” (or “materialism”). An important argument in contemporary philosophy of mind is the “knowledge argument” (allegedly) introduced by Frank Jackson (1982, 1986) in order to argue that “there are more properties than physicalists talk about”. In other words, a complete world picture includes the perception of qualities, such as red, that cannot be accounted for in physical terms. Jackson illustrates this claim with a thought experiment: the scientist Mary knows *every* information about physical processes, including the wavelength of colors and the physiological processes of human vision, but she lives in a black and white room. Once she comes out and experiences colors for the first time, so the argument suggests, she will learn something new. Therefore concepts and inferences of natural science cannot provide a full account of sensory qualities: physical knowledge is incomplete. In other thought experiments, the conceivability of physical duplicates of humans with no conscious experiences is introduced to highlight this “explanatory gap”. A connected problem has been formulated by David Chalmers as the “hard problem of consciousness”, that is, as he puts it in his 1995 seminal paper: “Why is it that when our cognitive systems engage in visual and auditory information-processing, we have visual or auditory experience: the quality of deep blue, the sensation of middle C? [...] It is widely agreed that experience arises from a physical basis, but we have no good explanation of why and how it so arises”.

Based on these arguments and thought experiments, a number of philosophers and neuroscientists maintain that consciousness cannot be explained by concepts and inferences of standard science, and some have pointed out that the solution to this problem entails the endorsement of metaphysical hypotheses. On the contrary, a number of materialists argue that these problems and thought experiments are misleading. The field of research on brain and subjective experience is now big and full of controversy.

Similar problems and thought experiments have been formulated many times since the very beginning of modern science. The mental experiment of a “machine” replica of humans with no conscious experience has been cast by Descartes in order to test the capacities and limits of his new “mechanical philosophy”. According to Descartes, the essential property of matter as “extended substance” entailed that mental processes such as judging and sensing cannot inhere in it (I call this an ontological argument). Based on a similar picture of “automata”, Leibniz argued that mechanics cannot explain perception (I call this an epistemological argument).

The prominent 19th century physiologist Emil Du-Bois Reymond – one of the discoverers of electrophysiology – formulated a different version of epistemological argument in his famous speech “On the limits of natural science” (*Über die Grenzen des Naturerkennens*), delivered on August 14, 1872, at the meeting of the Gesellschaft Deutscher Naturforscher und Ärzte. His argument is that no inferences of natural science will ever explain “undeniable facts as these: ‘I feel pain, pleasure; I experience a sweet taste, or smell a rose, or hear an organ, or see something red’” (examples of what he calls “sensation” or “consciousness”). On this argument, it is not the essence of matter anymore (which du Bois-Reymond considers unknowable), but the logical structure of scientific explanation that is relevant. Science always connects mechanical states of matter according to laws of dynamics and principles such as the conservation of energy, but “sensation” never occurs in these inferences. Hence the claim of materialists that neurophysiology can explain sensation is ungrounded, and the same limit concerns more complex conscious processes, such as the composition of a symphony.

Chalmers (2002) has formulated a similar argument against materialism, the “Structure and Dynamics argument”, which is generalized to features of *all kinds* of standard scientific theory. Each scientific theory is based on structural elements of a system (“distribution of particles, fields and waves [...] characterized by their spatiotemporal properties, and properties such as mass, charge, and quantum wavefunction state”) and dynamical principles of their evolution. From these premises one will never deduce “truths about consciousness”. Nevertheless, a non-standard scientific theory, including a non-materialist metaphysics, *could* achieve a scientific theory of consciousness.

In the light of the similarities, it is striking how the two arguments concerning the limits of scientific explanations led to different perspectives. Du Bois-Reymond entirely accepted the material origin and the physical base of mental states, but he excluded any possible scientific explanation of consciousness (including all kinds of metaphysical hypotheses). In order to illustrate this point, he introduced a thought experiment based on a perfect “Mind” (originally defined by Laplace), who knows every value of every physical variable of the universe and its dynamical laws (the “world-formula”), but still cannot conceive of human sensations: its world is “a dumb show”, a “pantomime”, just as the counterfactual “zombie world” of contemporary philosophy of mind.

The same idea has been reprised many times in order to criticize *or* to defend physicalism. An example of the first approach is the thought experiment of an “archangel” formulated by C.D. Broad in his 1925 *Mind and its Place in Nature*; an example of the latter is the “Martian super-scientist” discussed by Herbert Feigl in his 1954 paper “Physicalism, Unity

of Science and the Foundations of Psychology". Mary the Scientist appears as a replica of these Laplacean Minds, Archangels and Martians.

There are many examples of this kind concerning the topics of my project. But they don't mean that history repeats itself. Philosophical arguments don't float in an eternally identical environment: different scientific, philosophical and cultural contexts bring different motivations and perspectives on open problems. A philosophical history of these problems, I argue, is not only interesting in its own right; it can also help examine contemporary controversies with a clearer awareness of their roots and motivations. To this end, I developed a method and structure for my project.

Method and structure

I follow three methodological guidelines for the construction of this philosophical history:

- 1) To formulate a **taxonomy** of anti-reductive arguments.

Example – Descartes' argument, based on the essence of matter and mind, is *ontological*, while du Bois-Reymond's argument is *epistemological*. I will also talk of *normativity* arguments, meant at establishing the non-reducibility of norms. Different kinds of arguments come in different variants.

- 2) To assess how the **interplay of science and philosophy** has impacted the design of these arguments.

Example – In Aristotelian science, sensation was unproblematically inherent to the sensitive soul. The rise of mechanical philosophy in the 17th century has produced the new problem of explaining sensation.

Example – According to many philosophers and scientists, revolutions in early 19th and 20th century exact sciences have changed the representation of the physical object and hence narrowed or bridged the gap between the mental and the physical.

- 3) To consider how the broader cultural and institutional context impacts the **motivations** of philosophers and scientists in the formulation of arguments and research programs.

Example – du Bois-Reymond reacted to a context where, after 1848, materialism was politically suspect, metaphysics and religion disputed the discoveries of empirical science, and neurophysiology lacked its own institutional space in universities. Hence he was arguably drawing the limits of natural science in order to defend the autonomy of scientific investigation. This autonomy was barely an issue in the late 20th century, as philosophers and scientists started to reconsider the limits of materialism in front of the phenomenon of consciousness, so their motivations have been arguably different (technological, theoretical, ethical).

Example – Darwinian biology has deeply changed the scientific perspective on sensory qualities: while Descartes ascribed the importance of pain and hunger for the “conservation of the body” to the teleological design of God (the “institution of nature”), post-Darwinian science abounds in alleged naturalist explanations of these feelings, including attempts at solving the problem of consciousness in functional terms.

Based on these principles, in the planned book I will tell three stories about how debates on the non-reducibility of sensation, norms and personal identity have been impacted by the changing scientific and technological contexts, and how changing cultural and institutional settings have brought different motivations in these debates. This reconstruction is supposed to be of help for a reassessment of contemporary open questions. I will argue that the growing gap between the technical education of philosophers and scientists can explain the replay of past debates and suggests the need for deeper interdisciplinary connections in order to better design research programs.

Perception and norms: a historical path

In my seminar I will trace a path connecting different historical accounts of perception and reduction of laws, with a focus on the Kantian legacy. Although I won't be able to thoroughly examine any single case study, this overview will illustrate my work and set the stage for the discussion.

Here is an outline of the path.

17th century mechanical philosophy

As is well known, Galilei's endeavor to support the Copernican system and develop a new mechanical physics entailed the distinction of primary and secondary qualities: while the former, including shape, size, position and speed, are necessarily attached to bodies, the latter, including flavor, color and sound, only belong to the “sensitive body” (*corpo sensitivo*) and besides the animal are but “names” (*The Essayer*, 1624). Galilei's concern was to replace the Scholastic primary qualities (heat, cold, wet, dry) with a new set of primary qualities, that could be described by mechanics. The corpuscular explanation of heat, in the context of *The Essayer*, was meant to overturn the Aristotelian-Ptolemaic account of comets formulated by the Jesuit Orazio Grassi. Galileo seems to argue – following Democritus – that only primary qualities exist, but he does not offer a complete account of sensory qualities (a controversial topic since the Greek Antiquity). Indeed, he seems to borrow the Scholastic theory of sensation as an activity of the animated body, but since he has dropped the full Aristotelian account of these qualities and their transmission from external substances to the senses, this view can no longer yield a consistent theory. Galilei's interest concerning animals lies rather in the investigation of anatomical structures with the help of the same instrument that he successfully used for the heavenly bodies: the lenses. Both the telescope and the microscope are depicted on the frontispiece of *The Essayer* and Galileo's followers will significantly develop this anatomical program.

This revival of ancient Atomism elicited different views of sensory processes in 17th century natural philosophy. Some authors – notably Hobbes – build a *materialist* theory of mind, while others welcome Descartes' separation of soul (with its conscious perceptions) and body as different kinds of substances (*substance dualism*). Interpreters immediately asked about his metaphysical view about how these substances interact, starting a debate that would last for centuries. However, Descartes' original view of this problem was subtly dismissive. Similar to Galilei, he denies the objective existence of sensory qualities and attaches the latter to the animal body. Descartes resists any metaphysical explanation of the unity of mind and body, which is the condition of sensory perception, arguing that the intellect and the imagination (sources of metaphysics and physics) cannot really understand this union, while the senses in *ordinary experience* are the source of their cognition. The arch-dualist doubts that metaphysics will ever explain sensation, and resorts to the inscrutable action of God for its explanation.

In 17th century mechanistic science we see the early manifestations of a tension between the progress of empirical and technological research, on the one hand, and the search for a philosophical or metaphysical explanation and sensory perception, on the other hand. Philosophers struggle with the problem: how can mind and body interact in the mechanistic world? Leibniz introduces an epistemological argument on the impossibility of a mechanistic explanation and suggests a complex metaphysical solution to these problems by resorting to incorporeal grounds of bodies (monads). Parallel to the development of anatomy and mechanistic physiology, more metaphysical alternatives to Aristotelian philosophy are formulated, such as *monism* (Spinoza) and *panpsychism* (Margaret Cavendish, Anne Conway and others), in what has been called an era of "metaphysical chaos".

Forces, powers, and new philosophies

From the late 17th century to the 18th century, new conceptual tools are developed for the understanding of sensation as a natural phenomenon. The notions of active powers in the study of heat, gravity and chemical reactions inspire different kinds of theories. Newton's theory of gravity in the *Principia* (1687) is a new exemplary model of explanation: his universal force of attraction provides an empirical law that explains phenomena, while its cause is unknown. Locke (1689) famously argues that organized matter might have a power to think, and a new kind of materialism (vital materialism) takes this hypothesis seriously. In the mid-18th century, Diderot claims that the age of mathematical mechanism is gone, and new experimental investigations on life (e.g. embryology) will confirm materialism and overthrow dualism: matter is intrinsically sensitive and there is nothing beyond matter. This is a metaphysical claim, yet unsupported by solid empirical science, elicited by Diderot's enthusiasm for the constant progresses of science and technology in Europe. In the light of these progresses, the Enlightenment brings new motivations of cultural and social reform in philosophical debates. Both the idea of the autonomy of reason and the religious and political challenge of materialism belong to this context.

This is the background for Kant's original contribution to the debate, which is the model of the non-metaphysical and anti-reductive approach that I will be focusing on. Kant's claims on brain and consciousness are based on the philosophical system established with the three *Critiques* between 1781 and 1790, but their formulation can be found in a short critical afterword to the book *On the Organ of the Soul* (1796) by the anatomist Samuel Sömmering. The latter suggested that the soul could be located in the ventricular fluids of the brain, where afferent nerves seemed to converge, hence this "water" would be "animated". In his comments on this materialist physiological hypothesis, Kant makes three claims that will form a new philosophical paradigm for the approach to these problems:

- 1) **Anti-metaphysics.** The very task of localizing the soul is "contradictory", as the allegedly existing soul transcends the spatiotemporal conditions of experience (in fact, the soul is an idea of reason and no object of cognition). Kant compares this task to the operation " $\sqrt{-1}$ ".
- 2) **Neurophysiology of mind.** A physiological analysis of mental representations *is* possible, and Sömmering's project is promising in this regard. Indeed, Kant suggests a possible development of the hypothesis based on contemporary science: Lavoisier's chemistry had recently demonstrated that liquids can be composed and decomposed in their elements. According to Kant, a similar chemical process might "underlie" the psychological process of association of ideas and allow of a chemistry of sensory experience (even a complex one: e.g., as he puts it in letter to Sömmering, a "polyphonous concerto").
[A new question is raised by this hypothesis: how can temporal phenomena of inner sense correspond to spatial phenomena of the brain? A response is suggested by Kant's claim, in the *Critique of pure reason*, that psychological and physical phenomena might have the same ground. This kind of monist hypothesis transcends the limits of possible experience – for experience refers to phenomena – and cannot be translated into a scientific hypothesis: this "same Something" is unknown. Hence – contrary to Spinoza's monism – this kind of monism lacks any demonstrative value. I call it "x-monism".]
- 3) **Anti-reductionism.** A priori principles (e.g. rational laws of logic and morals) cannot be reduced to empirical laws. For example, the validity of a law of logic is neither explained nor challenged by the actual thinking of people; the same can be said of a rational moral imperative compared to the actual behavior of people with their psychological and physiological inclinations and conditions. Similar observations can be done concerning principles of aesthetic judgement, law and religion. On the whole, there is a dimension of conscious processes that cannot be the object of the physiological analysis of mind. In order to avoid this category mistake Kant ascribes those principles to a "pure consciousness", a universal condition of experience that individual subjects instantiate (on Kant's pure I and its "instantiation" see Longuenesse 2017). Its principles are the subject matter of his new philosophy (replacing the old metaphysical "psychology", the doctrine of the soul) and do not belong to the empirical domain of anatomy and physiology.

Hence psychological materialism, as the view that wants to reduce all psychological activity to empirical laws of nature, is false.

On Kant's view, these conditions set the stage for a philosophical program that fulfills the idea of Enlightenment: the transcendent soul of old metaphysics and the claims of reductive materialism are both excluded, hence the "autonomy" of pure reason in theoretical and moral matters is preserved. Parallely, the empirical investigation of the mind can be pursued to understand the behavior of humans in the disciplines of empirical psychology, physiology and anthropology. As the rector of his university, Kant was indeed also sketching an institutional separation of domains in order to avoid "unwanted" and misguided "conflicts" between philosophy and medicine.

This threefold paradigm will have a lasting legacy.

19th century: new scientific revolutions and reform of the Kantian paradigm

Extraordinary scientific developments set the stage for new insights about sensations and consciousness since the mid-19th century, in a time of political revolutions and constant preoccupation for the freedom of scientific investigation. The progresses of neuroanatomy and electrophysiology run parallel to the discovery of the conservation of energy and electromagnetism. These new resources for the study of the brain raise renewed attention among philosophers and psychologists. At the same time, cell theory revives debates about the origin of sensory capacities and the unity of the self. On the whole, the empirical investigation of the neural correlates of sensory consciousness becomes a solid empirical enterprise. Besides these fields, Darwin's formulation of the theory of evolution adds more reasons for a naturalist understanding of the mind. These groundbreaking results are often accompanied by a profession of empiricism (or "positivism"). However, metaphysical alternatives still abound, and a new problem becomes evident in research on consciousness: the *underdetermination* of empirical data with respect to hypotheses, that is, the fact that multiple hypotheses are equally consistent with the available empirical evidence, hence no empirical selection among them is possible. The same evidence can be associated to different localization hypotheses and lead to hugely different philosophical implications.

This is the context for the above-mentioned 1872 speech by Emil Du-Bois Reymond. I have already sketched his thesis about the impossibility of a neuroscientific explanation of sensory consciousness. This episode sparked a huge debate – the so-called *Ignorabimusstreit* – that lasted until the early 20th century. Du Bois-Reymond was a thorough empirical scientist (he experimented with his own body and a galvanometer to prove the identity of animal electricity and the electricity of the inorganic. His students Fritsch and Hitzig will start experiments of electrostimulation of the motor cortex). Nevertheless, his physicalist epistemology is explicitly borrowed by Kant's philosophy of natural science, where sensory qualities are reduced to spatiotemporal quantities and relations. His rejection of metaphysical hypotheses about consciousness is also related to the Kantian legacy, for he maintains that – were it not for the impossibility of knowing the

essence of matter and forces – *monism* would be the most plausible hypothesis for the understanding of the correlation of sensory phenomena and material processes.

In fact a number of his fellow scientists and philosophers were reworking the original Kantian program in the light of neurophysiology. Two major related figures are Hermann von Helmholtz and Friedrich Albert Lange. Helmholtz rephrases the main Kantian claims about mind and sensation in terms of the new scientific context and a physicalist epistemology that he shares with du Bois-Reymond. His two seminal books *On the Sensations of Tone as a Physiological Basis for the Theory of Music* (1863) and *Handbook of Physiological Opticks* (1867) expound a physicalist physiology of sensations based on a new set of a priori principles (the general intuition of space and the law of causality) and on experimental investigations, while rejecting all kinds of metaphysical hypotheses about the essence of mind. His work will have an enormous influence on physiology and psychology (e.g. Wilhelm Wundt was his assistant and borrowed many of his ideas, and Freud's education was influenced by his views).

A similar view is defended by the philosopher Friedrich Lange in his monumental *History of Materialism and Critique of its Present Importance* (1866; 1873-75²). Lange presents a critical overview of contemporary natural science and emphasizes the Kantian elements in Helmholtz's view. He defends a threefold paradigm that results from an updating and reform of the original Kantian one:

- 1) Search for the correlates of sensation in distributed brain processes, guided by the idea of a perfect correspondence between the two.
- 2) Rejection of metaphysics (accompanied by the idea that physical and psychic phenomena are different manifestations of a non-spatiotemporal, "unknown ground").
- 3) Antireductionism concerning a number of psychological properties and principles. A favorite example of Lange are musical melodies and paintings, conceived as higher-order complexes of sensations (emergent properties), that are perceived as wholes and evaluated according to historically changing values.

Compared to Kant's version of the program, a major difference stands out: the antireductionism is not grounded on the *a priori* character of laws anymore (the only a priori laws are those of formal logic); it is rather the *complexity* of psychological objects and the historical variability of norms that requires a non-naturalist account. E.g., a Madonna by Raphael is a psychological complex that is evaluated by means of historically changing aesthetic criteria, although all its components (patches of color, lines, etc.) are grounded on physiological processes. Lange maintains that different forms of psychological "synthesis" resist a reduction to components and correspond to the cooperation of "infinitely many nerve impulses". Nevertheless, in the second edition of his book – including an account of recent experiments in electrostimulation – Lange replaced the word "infinitely" with "very many": as if he was considering further perspectives of research.

Lange's motivations were the defense of empirical science against the ungrounded claims of metaphysics and religion (that were still well represented), and, in broader perspective, the reform of contemporary society inspired by socialist ideas. His herculean effort to keep track of scientific development reflects the growing specialization of research and

the declining importance of philosophy as a common ground. This divide between science and humanities will become wider and wider in the 20th century.

Problem solved? “Scientific philosophy”

The final stage of my historical reconstruction ranges from about the end of the 19th century to the 1950s. In this interval, again, revolutionary scientific achievements impacted the persisting debates about brain and sensory perception. Non-Euclidian geometries, relativity theory and quantum mechanics changed the notions of space and time and suggested a revision of the corpuscular representation of matter that had characterized modern physics since Galileo. In 1906, the mathematician Henri Poincaré had published a paper with the title “The end of matter?”, and this question was answered in the positive by a number of philosophers and scientists, including Werner Heisenberg and Niels Bohr, at least with respect to the classical view of matter as a visualizable part of extension. The neo-Kantian philosopher Ernst Cassirer talked of a scientific “dissolution” of the “matter” of sensory intuition, which is reduced in General Relativity to a non-Euclidian continuum of spatiotemporal events.

The meaning of these theories was a major topic of investigation for the representatives of the Vienna Circle and other participants to the project of a “scientific philosophy”. The group shared the idea that a logical or empirical solution of philosophical questions had to open the ground to scientific progress and social reform in a time of crisis (the Circle was close to the cultural movement of *Neue Sachlichkeit* and to the Bauhaus). Three prominent members of the Wiener Kreis – Moritz Schlick, Rudolf Carnap and Herbert Feigl – claimed that they had finally solved the mind-body problem, providing different accounts of sensation.

Schlick’s solution to the mind-body problem in the *General Theory of Knowledge* (1919, 1925²) is presented as a reform of Kant’s own view. Kant had argued that non-spatiotemporal things-in-themselves could be homogeneous to mental representations, but unknowable: this would suffice to neutralize the metaphysical problems of dualism. According to Schlick, Kant was misled by his theory of space as form of intuition *and* a condition of objective cognition. Non-Euclidian geometry and relativity theory have shown that there are (at least) two different kinds of space: the space of human sensory intuition and the abstract space of physics. Hence, it not necessary anymore to consider subjective sensations (inscribed in the space of intuition) and scientific objects (inscribed in the space of physics) as heterogeneous. According to Schlick, indeed, subjective qualities can be considered as fundamental elements of the same “reality” that science describes with its structures. In other words, the reference of psychological concepts and physical or neuroscientific concepts can well be the same. Compared to Kant’s view, the main difference is that reality in itself is now accessible to cognition: “qualities” (a subset of which are human conscious perceptions) are the objective constituents of the world. This was a bold metaphysical monism (which, I would argue, was hardly connected to relativity theory). Carnap, who considered metaphysics as a source of pseudo-problems, could not accept it. He agreed that the mind-body problem can be solved, but considered Schlick’s realistic talk of “reality” unnecessary. Mental and physical events can be

described in different languages, a psychological and a physical one, and these languages can be connected to empirical observations by means of logical postulates and empirical laws. Scientists are then free to adopt a physicalist or a phenomenological language for their statements, e.g. to reduce their objects (including the brain) to sensory data, or to reduce psychology to statements of observable behavior and physiological states. That is enough for philosophy. Any further talk of reality in itself is a matter of personal views. What is really important is not to waste time with the old-fashioned problem of connecting two apparently irreducible domains of reality, which no data and no reasoning will ever solve.

A common feature of these views was their optimism concerning the future of neurophysiology (a “physics of the brain”, in Schlick’s words). The logical work of philosophy was basically done, all the knowledge would result from empirical science. In this regard, the discovery of the fluoroscope appeared as a promising sign. Schlick’s student Feigl, in his reformulation of his teacher’s monism in the essay *The ‘mental’ and the ‘physical’* (1958), argued that a future “autocerebroscope”, an instrument that would allow to observe the neural activity of live and conscious people, would confirm that sensory qualities *are* the referents of concepts of structures and processes in the brain. Feigl admitted that this was a “promissory note” that science would arguably pay in the distant future. Meanwhile, I maintain, he postulated a kind of monism that was no less metaphysical than hypotheses formulated in the past: Feigl’s (and Schlick’s) postulate of “intrinsic” qualities of reality is indeed more speculative than Kant’s reference to the transcendent unknown ground of phenomena, and certainly more audacious than Galilei’s modest talk of “corpo sensitivo” or Descartes’ pragmatic recognition of the unity of mind and body. Given the original empiricist program of “scientific philosophy”, I see a strange twist here.

Feigl published his 1958 essay in Minnesota. During the Second World War, all the major members of the original movement of “scientific philosophy” had left Europe because of Nazism and moved to the United States (Schlick was killed in 1936). The introduction of European “scientific philosophy” in the fertile ground of American philosophy led to the foundations of cognitive science and a “fresh start” of philosophy of mind. A side effect was the gradual oblivion of the original context of many philosophical ideas. Feigl himself recognized, in a footnote of his book, that his hypothesis was just a rephrasing of Schlick’s, and that the latter, in turn, was rooted in 19th century Kantianism, and recommended an English translation of Schlick’s *Allgemeine Erkenntnislehre*, where this legacy was spelled out.

Consciousness still unexplained, or where are we?

The joint enterprise of cognitive sciences, since the early 1950s, has produced great scientific and technological results, and the development of techniques of neuroimaging, such as fMRI, PET and TMS, has apparently realized in a few decades Feigl’s dream of an “autocerebroscope”. Meanwhile philosophers of mind have focused on different formulations of materialism. This search has led to Hilary Putnam’s functionalism and since the 1970s, in the light of critiques to functionalism, to a new debate on the

explanation of subjective experience. Looking back at 70 years of interdisciplinary research on what is now called phenomenal consciousness and its neural correlates, two features stand out:

1) The analysis of huge amounts of data and the development of models in psychology, neuroscience and AI have taught a lot about mechanisms underlying cognitive and affective processes and received strong institutional and financial support because of potential applications in many fields. This progress has also stimulated the enterprise of a neuroscientific theory of consciousness. According to Eric Kandel in his textbook of neuroscience (2000, 16–17), the “neural representation of consciousness” is the “deepest riddle” that recent advancements of neuroscience are starting to solve. Indeed, different theories have been sketched by distinguished scientists such as Francis Crick, John Eccles, Jean-Pierre Changeux, Gerald Edelman, Jaap Panksepp and Antonio Damasio. A notable feature of these theories is that their formulations – usually focused on the process of sensory perception – are heavily characterized in familiar metaphysical terms (reductive materialism, substance dualism, vital materialism, emergentism, panpsychism). This shows that scientists still consider some philosophical or metaphysical principle as a necessary ingredient of a theory of consciousness. However, these theories are still underdetermined with respect to available data and none prevails. Moreover, scientists are generally unaware of the previous philosophical debates about their problem.

2) On the other hand, philosophers have been developing more and more technical analyses of reductive theories and metaphysical theories that might account for the facts, waiting for the “promissory note” to be paid by science. In the light of our story, we might wonder whether this can actually happen, or whether scientific theories will just provide a better understanding of the neural *correlates* of conscious sensation (and other mental processes).

As a matter of fact – I submit – the vast majority of theoretical alternatives and tools in the field had been already established before the 1950s and are now applied to new data and technologies. What seems to be lacking is a shared view of the most promising ideas, and some agreement on programs that might be non-starters. Also, the Kantian legacy is quite neglected.

I will conclude with two final remarks concerning the motivations and the institutional setting of contemporary research.

As for the motivations, besides the pursuit of purely theoretical aims, there is certainly a strong practical interest in the artificial reproduction of mental capacities and the medical applications of neuroscience. Different *ethical* motivations have been occasionally formulated by researchers, including the detection of sensory awareness in individuals unable to report because of various pathological conditions and the attribution of feelings and some kind of self-awareness to non-human animals and even to machines (the latter point plays a major role in the third chapter of my story). I suspect that the interest in non-reductive and non-materialist theories is also associated to the need to locate an intrinsically *valuable* dimension of *felt experience*, as “the stuff we are made on”, against the background of modern science, technology and society. In any case, if we look back

at the beginning of this story, we see that an overturning has happened: while Galileo wanted to defend the prospects of his new science and take for granted sensory qualities, leaving them off the picture, today sensory qualities are in the foreground of philosophical-scientific investigation and the mechanization of the world is taken for granted (if not felt as a restrictive framework).

As for the institutional setting: the fact that prominent scientists have returned to a problematic metaphysical language, while philosophers work on *possible* rather than actual theories, can be explained with the growing gap in education and research. Compared to the previous contexts that I have considered, scientists today know little philosophy, and philosophers know little science. In this context, the ambitious project of consciousness science is at risk of losing support in the scientific community (Lau and Michel 2019). At the same time, scientists can be helped by philosophy for the interpretation of data and the design of experiments, as much as philosophers need science to test and rethink their theories. An implication of the stories that I am reconstructing is the need to return to more cross-disciplinary education and cooperation. In this perspective, to reconsider the non-metaphysical and non-reductive tradition that I have sketched might be helpful.

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