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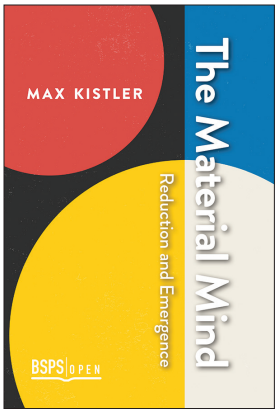

THE MATERIAL MIND: REDUCTION AND EMERGENCE

Max Kistler

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Foreword and Acknowledgements

This book is the result of a long project beginning in 2002. A new version of the French edition, first published in 2016, appeared in 2023.

Many people have helped me to clarify my ideas about the place of the mind in nature and about the concepts of reduction, emergence, and disposition on which my analysis is based. Of those who helped me to improve my arguments, I would like to mention François Athané, Alexander Bird, Tim Crane, Javier Cumpa, Alexandre Guay, Paul Noordhof, Robert Kirk, Georges Jobert, Alex Manafu, Thomas Pradeu, and Jürgen Schröder as well as my colleagues in the philosophy departments of Université Paris X-Nanterre, Université Pierre Mendès-France in Grenoble, Université Paris 1 Panthéon-Sorbonne, Institut Jean Nicod, Institut d'histoire et de philosophie des sciences et des techniques, and Centre d'histoire des philosophies modernes de la Sorbonne. I am much indebted to Reinaldo Bernal Velasquez, who read a version of the entire manuscript and provided me with numerous critical comments; to Etienne Ligout, Yanis Pianko, and Vincent Ardourel for their generous advice concerning physics; and to Duncan Lee and Dallas Harrison, who helped me to improve the English version.

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Introduction

According to the Western philosophical tradition, we have a dual nature: we are both spiritual and corporeal beings. It feels natural to us to classify our properties into two categories: body and mind. On the one hand, our weight is a bodily attribute; I have weight because I have a body. On the other hand, recalling the sea bath that I took the past summer is a mental attribute; I can recall it because I have a mind. The problem of the relationship between body and mind arises from the dual conception of human nature. Once the duality of attributes has been established, a question inevitably arises: how can body and mind act on each other? Traditional metaphysical doctrines explore different ways of conceiving of mind and body in order to reconcile three seemingly incompatible convictions.

First, both mind and body are real. We have reason to think so because both have causal effects. The weight of my body moves the needle on my weight scale; my memory of the sea bath makes my vocal cords vibrate when I tell a friend about it. This argument for the reality of both mind and body presupposes a traditional metaphysical principle found in Plato, which can be called the "causal criterion of reality": everything that is real is capable of having a causal influence, and everything that has a causal influence is real.

Second, body and mind are radically different because they obey different logics: the body is subject to the laws of nature because of its physical properties. I am attracted to the mass of the Earth like any other massive object. Yet the processes that take place in our minds seem to be exempt from physical laws, obeying rules of a completely different nature. My remembering obeys only a logic of association of ideas; the words to which it gives rise are chosen (most often unconsciously of course) according to criteria of rationality. This allows me to express myself in a language that I believe my friend understands: I choose words that I believe will give her a faithful representation

of the events that I have experienced; I omit things that are obvious or that I think my interlocutor already knows in order to focus on information that I think is new to her. The link between my words and the memory that they express therefore obeys criteria of rationality rather than laws of nature.

Third, despite the difference between their natures, body and mind interact. When I recount my memory, my vocal cords vibrate: the mind acts on the body. In the physical world, the breaking of ocean waves on the shore acts on the body, for example by causing the sensation of the sound of these waves, and it is this sensation that plays an essential role in the causal chain that leads to my memory. The physical world and the body, therefore, appear to act on the mind.

Property dualism and reductionist monism are two doctrines that aim to reconcile these three theses and that I will consider in this work. Property dualism holds that mental properties are fundamentally *irreducible* to brain properties. There are two major reasons for thinking that cognition is irreducible to the physical sciences. First is the aforementioned heterogeneity of the criteria for attributing mental properties and physical properties and the corresponding heterogeneity of the norms of correction of these attributions and the explanations in which they are used. Specifically, the attribution of mental properties obeys the norms of practical rationality, whereas physical properties obey the norms imposed by the logic of scientific explanation. Second is the *multi-realizable* nature of psychological properties. Since the 1970s, it has often been taken for granted that the same psychological property can exist in physically different people. If we have taken a sea bath together, then it is possible that we have shared some of our experiences and that we will end up having memories sharing some content, although there might not be any physiological or physical properties that we share that correspond to that shared content.

The problem with property dualism is that it cannot explain the interaction between mind and body. Descartes failed to explain how the thinking substance (i.e., mind) and the extended substance (i.e., matter) can act on each other. Once the radical heterogeneity of the two substances has been established, it is impossible to explain their interaction: if the mind is not in space, then why can my mind act only on my body but not on the bodies of other humans? Why can the mind interact only with the body when the brain is intact? Contemporary property dualism no longer postulates the duality of substances, only the duality of types of property. But this creates

an analogous problem: if mental properties and physical properties belong to radically different spheres, then it is hard to see how one can be causally responsible for the other. According to the nomological conception[1] of causation, this requires at least the existence of a psychophysical law of nature, but the second thesis of the radical heterogeneity of the two types of properties forbids the existence of such laws.

The main alternative defended in the current debate on the relationship between mind and body is reductionist materialism, which exists in several variants. Some challenge the radical heterogeneity of physical and mental properties, as expressed in the second thesis above. There are indeed reasons to reject some of the premises of the argument for the irreducibility of psychology to neurophysiology. One reason is that one can doubt the reality of the multi-realization of cognitive properties, at least among the species of animals with which we share some of these cognitive properties. Research within cognitive neuroscience, for example, on the mechanisms underlying vision or memory presupposes that these mechanisms are shared by the various species used in the laboratory for that research. The success of this research justifies the presupposition that many of the neurophysiological mechanisms underlying our visual system are shared by macaques and cats. Furthermore, it justifies that we share certain fundamental mechanisms of memory fixation and learning by conditioning not only with mammals but also with the modest *Aplysia*.[22] Now, if these cognitive properties are not multi-realized, then there is nothing to prevent the existence of psychophysical laws that can be used in a reduction of these cognitive properties.

Some advocates of materialism believe that it is the first thesis above that needs to be sacrificed in order to re-establish the coherence of our conception of ourselves as beings with both a body and a mind. According to eliminativism in its various forms, the second thesis must be interpreted in the sense that mind and body are radically different and even incommensurable conceptual systems. However, the existence of two conceptual systems does not imply the existence of two kinds of properties. At the level of reality, in the sense of causal efficacy, there are only physical properties in the broad sense

1 The word nomological, which derives from the Greek words *nomos* (law) and *logos* (discourse), is the adjective used to designate what relates to the laws of nature.

2 *Aplysia californica* is a marine slug whose very simple nervous system is a favourite object of study for exploring the neurophysiological mechanisms underlying learning.

that includes neurophysiology. Either all real properties are physical (i.e., they are among the properties studied by physics), or they are reducible to these properties. Insofar as psychological concepts cannot be integrated into a scientific theory reducible to neurophysiology, and indirectly to chemistry and physics, they are concepts that might be useful in practice, but they are not reliable guides for judgments about existence. It is certainly convenient to explain my report by referring to my recalling a memory, but this is not a good reason to believe that such events of recalling memories really exist. Insofar as memories are irreducible to entities recognized by neurophysiology, it is more reasonable to locate the causes of my report about last summer exclusively at the level of neuronal activity in my brain. This reasoning leads to denial of the first thesis of the reality of the mind: the mind exists only as a conceptual system; however, there are no real properties that correspond to psychological concepts.

The reasoning developed in this book will lead to a variant of reductionist materialism. I will come to the conclusion that, contrary to the second thesis, the heterogeneity of mind and body is not absolute. But this judgment will be mitigated by a new perspective: rather than reflecting on the relationship between two domains of properties and regularities, each of which appears to be heterogeneous in relation to the other, I propose to situate mind and body within a whole hierarchy of levels of reality. Persons endowed with cognitive properties are corporeal beings composed exclusively of cells; these cells are composed exclusively of organelles and molecules; the organelles are also composed of molecules and the molecules of atoms. In the final analysis, like any other material object, people are composed exclusively of atoms and nothing else. Atoms — and the more fundamental objects discovered by physics of which atoms in turn are composed — are real and act on other real objects according to their physical properties, which therefore are also real. However, there is no reason to deny the existence or reality of the properties of objects composed of atoms. According to the conception developed in this book, new properties *emerge* in complex compound systems.

According to a traditional understanding of emergence, it is incompatible with reduction; an emergent property defies scientific explanation. The emergentists of the early twentieth century considered, for example, that the properties of chemical compounds were emergent in relation to the physical properties of the atoms of which they are composed. It is not controversial that the red colour of rubies is a *systemic* property (i.e., a property possessed

only by whole crystals but not by their atomic components); neither aluminum nor oxygen nor chromium (the components of rubies) is red. But the thesis that this red colour is an emergent property of the ruby crystal is stronger than that: in its traditional sense, it means that it is impossible to predict, from knowledge of the atomic components and their properties alone, that the crystal has the property of being red. However, quantum physics has shown that the classification of many chemical properties as emergent was premature: the impossibility of predicting and explaining them in a reductive way (i.e., on the basis of the physical properties of the physical components of molecules) characterizes only the state of science at a given time. Once physics predicted a chemical property, we knew that it was not emergent in an absolute sense but only appeared to be within the framework of a certain theory. More important for my purposes here is that the evolution of science as a whole toward increasing unification authorizes inductive reasoning about all properties that appear to be emergent at a given moment. The conclusion is that emergence is only provisional and relative to a certain theoretical framework. The properties that appear to be emergent today will (probably) be reduced tomorrow. Their reduction is only a question of time and the development of more powerful theories.

This reasoning is entirely justified. However, rather than showing that there are no absolutely emergent properties, it shows only that the concept of emergence used was too strong: imposing the condition of irreducibility leads to the result that absolute emergence does not exist. However, the fact that we manage to construct reductive explanations of certain high-level phenomena is perfectly compatible with the real existence of these phenomena. The link between emergence and reduction that I will develop in this book is as follows. In Chapter 1, I will propose a model according to which the reduction of a property has two logical components. The first is the discovery of a law of composition. This is a non-causal law that can be explained by more fundamental laws. Such an explanation shows that complex objects with a given structure possess certain systemic properties that only appear in structures of this type. The second component is the existence of a structural analogy between the theory deduced from the reducing theory and the theory that preceded the reduction. I will show in Chapter 2 that the discovery of a law of composition is empirical. I will defend this thesis against the influential doctrine of "conceptual reductionism," according to which it is possible to construct the concepts of complex objects a priori, only on the basis of

conceptual analysis and knowledge of the microphysical level. In principle, all of the properties of objects belonging to a given level of the hierarchy that reaches from the microscopic to the macroscopic are reducible in this sense. However, the reduction of the properties characterizing a level (e.g., that of macroscopic solids such as crystals) to the level underlying it (e.g., the level of the atoms that make up the crystal) does not remove the reality of the reduced properties. Reduction is not equivalent to identifying the reduced property with the reducing property.

The conception of reduction developed in Chapters 1 and 2 will serve as the basis for a conception of emergence compatible with reduction. This conception will be the subject of Chapter 4. The concept of emergence remains essential to the foundation of the hierarchical conception of reality: it is used to explain why each level possesses new properties (i.e., properties that do not belong to any lower level).

This framework will provide the means to consider the relationship between the mind and the body from a new angle. Cognitive systems, both animal and human, are complex systems with precise structures. Cognitive neuroscience performs the same task of unifying knowledge as physical chemistry or molecular biology: they are sciences "between levels," to use an expression coined by Darden and Maull (1977), built around reductions. The aim of cognitive neuroscience is to explain the systematic appearance of certain cognitive abilities and processes in systems with a certain neurophysiological structure. When it succeeds in explaining the emergence of a cognitive ability, such as the ability to store experiences in long-term memory, it helps to reduce the sense of mystery that the appearance of the mind in nature inspires. In the same way, the process of unifying science as a whole contributes to reducing our lack of understanding of the multiplicity of levels of reality: the reductive explanation in physical chemistry of the chemical bond that causes hydrogen molecules to emerge from hydrogen atoms, or of the colour of a ruby from the electronic structure of this crystal, contributes to reducing our lack of understanding of the existence of a chemical level of properties and laws above the physical level. The reductive explanation of chemical properties and laws based on physics also indirectly helps to reduce the mystery of the emergence of the mind from a body equipped with a sophisticated nervous system. This is because it makes the relationship between the mind and the body appear to be just one of many cases of relationships between properties and laws belonging to adjacent levels in the hierarchy that

extends from elementary particles to the mind. The emergence of the mind from the body obeys the same logic of determination according to non-causal laws of composition as the emergence of crystals from their atomic structure.

I have kept the term "emergence" to characterize the relationship between the properties and laws at one level of reality and the levels below it. This might appear to be a contradiction of terms in the context of an analysis that considers that emergent properties and laws are all reducible in principle to the properties and laws of lower levels. However, this terminological choice is justified by the persistence of an element of mystery. The reductive explanation of a property gives us the means to predict and explain its presence, based on the knowledge of the laws of composition and the properties of the underlying level. In this sense, their existence is not truly mysterious. However, there remains an unavoidable element of mystery: insofar as the laws of composition are not laws of reason, we cannot deduce them a priori. These laws are necessarily the subject of empirical discovery. It is true that the progress of science makes laws become progressively incorporated into theories. In such a theory, many "experimental" laws, initially discovered by pure induction from observations, are transformed into theorems. It is possible to understand them insofar as they can be deduced from theoretical axioms. However, by the very definition of the concept of axiom, an axiom cannot be deduced. So, with regard to axioms, there is no answer to the question why does the law have this form rather than another? This is the ultimate and inescapable remnant of mystery that nature retains even when its scientific explanation is complete. The mystery of emergent properties has no other source. It is nevertheless a limit to our ability to understand. This justifies keeping the term "emergence" to characterize the relationship between properties and laws belonging to adjacent levels of reality. Even a complete reductive explanation does not make this relationship absolutely transparent to reason. The residue of incomprehension that we feel when faced with a phenomenon, particularly a cognitive phenomenon, even when its reductive explanation is complete, has its ultimate source in the fact that the fundamental laws of nature cannot be discovered by conceptual analysis a priori but only through experience.

I will arrive at a conception that gives the mind (i.e., our cognitive properties and the laws that they obey) a reality of their own: when I recount a memory to my friend, the mental representations of the sea bath and the desire to share these experiences are among the causes of the vibration of

my vocal cords. Now the thesis that mental properties have their own causal efficacy, different from that of the underlying neurophysiological properties, faces a powerful argument developed in particular by Jaegwon Kim (1998). Kim seeks to show that it is impossible for a mental property to influence physical events causally. Insofar as the vibration of my vocal cords is a physical event, its causes can only be physical. The aim of Chapter 5 is to show that this argument is contestable and that there is a way of escaping the verdict that the mind is merely an "epiphenomenon" — something that has no effect at all. Shadows can help to illustrate the concept of an epiphenomenon. When the sun casts a shadow of me while I walk beside a wall, this shadow is an epiphenomenon of my passage because, although it is caused by my presence, it has no causal influence on the subsequent stages of the shadow's appearance on the wall. In this sense, to say that cognitive properties have no causal power is to take them to be epiphenomena. The terms in our mental vocabulary express concepts but not real and causally efficacious properties.

The conception of the mind developed in this book can be plausible only if there is a flaw in Kim's (1998) argument. In fact, Kim's argument for the epiphenomenal character of mental properties, in other words for their being unreal in the causal sense, is simply the application of a more general argument for the unreality of dispositional properties. Indeed, most mental properties — with the possible exception of certain qualities of subjective experience — are dispositional. The fact that I remember my sea bath gives me the disposition to produce a narrative about that bath. The fact that I have learned that there is (normally) someone at the door when the doorbell rings gives me the disposition to behave appropriately when I hear the doorbell ring. One argument against the reality of dispositions is to show that the manifestations of a disposition are always caused by what is called the "causal basis" of the disposition. The causal basis of my disposition to open the door when I hear the doorbell ring is a certain state of the neurons in my brain. The cause of my act of opening the door is not the fact that I know what the sound of the doorbell means but the state of the neurons that act as relays in the causal chain that runs from the fact that I hear the doorbell ring to my act of opening the door. In Chapter 3, I will attach great importance to refuting this general argument against the reality and causal efficacy of dispositional properties. This is justified by its importance for the question of the reality of the mind.