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Organic Materialism and Philosophy of Technology

On the Speculative Relationship between Thought and Matter

Kamila Kwapińska



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Palgrave Perspectives on Process Philosophy

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Praise for *Organic Materialism and Philosophy of Technology*

"Kwapińska makes the compelling case that a revitalised philosophy of nature (drawn from Schelling and Whitehead) is the much-needed shift in our habits of thought that can undermine the mechanistic materialism underpinning capitalist dynamics of self-destruction. If you have followed Stiegler and Hui on similar terrain, then pick up this book and add it to your reading list."

—Iain MacKenzie, University of Kent, Kent, UK

"If the history of philosophy teaches us anything, it is that philosophy is a sacrifice to a future. Hence Kwapińska's Organic Materialism and Philosophy of Technology concisely vectorizes Whiteheadian process ontologies and Schellingian naturephilosophies into a speculative cosmology of planetary artifice. This cosmic re-enchantment is additionally rendered existentially poignant by Kwapińska's revelation of it in concrete, bio-economic detail."

—Iain Hamilton Grant, University of the West of England, UK

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1. Introduction

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1 Metaphysics and Institutionalisations of Habitual Thinking

This is a metaphysical project with an aspiration to stay grounded. To speculate about the nature of reality is to create limitations to our thinking. Essentially, the aim is to challenge such limitations, but this sets the project to do something nearly impossible, to overthrow metaphysics (Hui 2021, p. 5). Since thinking itself must be schematised to make sense of reality, metaphysics cannot be overcome. There will always be some set of principles guiding our thought. Henri Bergson argues that metaphysics is a result of our evolution, that the human intellect has evolved to help our bodies get adapted to their environment, *to think matter.* To survive, we had to figure out how to use solid materials and manipulate them into tools, and how to control the external causation coming from harsh environments. Our minds developed some ideas about the nature of reality, and we feel comfortable when operating in the 'logic of solids' (Bergson 2005, p. xix). This tendency has been concretised in science: while to some extent it always remains speculative, the end of experimentation is when the theory is successfully put in practice (Bergson 2005, p. 358).

Intellectual habits make it difficult to think matter outside of its logical forms and external, mechanical causality, not least because these habits are useful for positivist sciences. The mechanistic view of the nature of reality has established itself in a descriptive metaphysics, such as mechanistic materialism. Philosophising is against the natural tendency of the mind to seek control over matter and achieve practical utility. Bergson notes that the intellectual habits embodied in mechanistic materialism amount to a 'theory of knowledge' but not a 'theory of life' (Bergson 2005, p. xxi). In a Socratic manner, he claims that 'the duty of philosophy' lies precisely in our obligation to examine life, but he adds that this examination should dare to see the world outside of 'practical utility,' outside of intellectual habits and pre-existing forms (Bergson 2005, p. 215). Yuk Hui, whose works have been inspirational to this book, similarly claims that 'thinking must dare to think in view of difficulties and limits it has to confront' (2021, p. 5). The first aim of this project is to critique mechanistic materialism from the perspective of *organic materialism*: to *speculate* on nature as life instead of generating knowledge of how to manipulate it; to challenge the intellectual habits that limit thought to practical utility.

Bergson points out that viewing matter in mechanistic terms is a natural intellectual habit. However, the Western tradition of mechanistic materialism (corresponding with descriptive metaphysics) and positivist scientific methods have established themselves *as the right way* to discover truth about the universe using supernaturalism. Iain Hacking argues that the belief that there must be 'one full and complete account of nature' that scientists will eventually discover at the endpoint of the progress of science, together with the ultimate truth about the universe, is deeply rooted in 'Jewish, Christian, and Muslim cosmologies' (Hacking 2012, pp. xxxiv–xxxv). The natural tendencies of mind to think of matter and the external world in mechanistic terms are explainable from an evolutionary perspective. The idea that there can be an exhaustive explanation of the nature of reality comes out of a belief in the supranatural qualities of human reason. The human intellect has a tendency to treat its environment as an external factor

and insist that the mind has distinctive qualities. The problem lies in this unnecessary opposition between thought and matter, and between knowledge and life. I will employ organic materialism (corresponding with speculative metaphysics) to critique mechanistic materialism for the limitations of thinking it imposes, and the reductive tendencies of atemporal truths or positivist methods. Grounding metaphysics must aim to think of thought and knowledge as limited to life, and to its material and temporal constraints.

This is also why this project is an exploration of cosmologies. *Cosmos* meant "world" in Ancient Greek—it is the singular form of *cosmoi*, "worlds." While today "cosmos" is typically used as a synonym of outer space or the universe, in the works of some Hellenistic philosophers, such as Epicurus, we find a more nuanced terminology where "universe" refers to "the whole," *tó pân*, and consists of many worlds, *cosmoi*. Epicurus made the distinction between the universe, which we can conceive of as an infinite totality, and cosmos, a world which we are able to observe (Longo 1991, p. 433). Cosmology is a study of how we schematise our experience of the observable world through symbolic orders and how we position ourselves in the entirety of the system of nature, in the universe. The specific positionality of the human in the universe will then guide how we should act. Martha Nussbaum explains that Hellenistic philosophy was typically performed in such a way. Philosophical knowledge about nature was to inform us how we should live as a part of it. In each school, this contextualisation of a human in nature shed light on our needs and capabilities, and emphasised our finitude and mortality to give up 'socially induced longings that take us beyond those limits' (Nussbaum 1994, p. 497). The role of philosophy in Ancient Greece was not just to provide knowledge about the nature of reality but also to inform life. The plurality of cosmological systems was reflected in a plurality of institutions. When Aristotle came up with a metaphysics that ultimately departed from Plato's, the Lyceum was set up on the other side of Athens than the Academy (Map of Hellenistic Philosophical Schools 2025). Epicurean metaphysics recognised the lack of afterlife and the

temporal nature of life itself. Emphasis on the finitude of human existence gave it a special value that was translated into the negation of seeking power over others and placed friendship at the centre of human relations. In turn, participation in formal politics was discouraged. The Epicurean Garden was an inclusive space where all including women and slaves were allowed and invited to do philosophy (Long 1974, p. 15). Stoics believed in self-sufficiency (*autarkês*), resulting from the idea that every being carries their proper function (*kathêkon*) according to their nature (*homologia*). This meant that there was no need for a formal institution, and they simply gathered in a painted porch (*stoa poikile*) just outside of the Agora (Durand et al. 2023). Bergson's distinction between theories of knowledge and philosophies of life is secondary to how philosophy was originally practised. In this book, I will return to philosophy as cosmology in response to Bergson's criticism—a cosmological method brings a theory of knowledge back to the theory of life.

Over the course of history, philosophy refrained from engagement in social life. Pierre Hadot argues that this shift occurred when Christianity influenced Ancient Greek and Roman thinkers and established itself as the only true cosmology, as the only set of ideas that could tell us how we should conceive of the nature of reality and live accordingly (Cooper 2012, pp. 8–9). Only in the twentieth century did philosophy as life practice come back in the form of psychology and some forms of political philosophy. In today's academic philosophy, there is a distinction made between philosophy as a purely theoretical exercise, philosophy as theories of knowledge where the theory is limited by practical utility, and philosophy as a theory practised in life.[1] There are of course branches of philosophy which are very practical, such as applied ethics or logic, but they are practical in the sense that knowledge is reduced to practical utility, and philosophers who study these fields do not necessarily live according to them. Ipso facto, philosophy is no longer practised as in Hellenistic times and its performative aspect has been discounted to a large extent. Cosmology as a method of studying metaphysics is not a purely theoretical

exercise. Rather, it investigates how the study of metaphysics has concrete consequences for how we act, at least for those who spend time thinking about the nature of reality. On the one hand, a scientist might be busy with the pursuit of one total and final truth about the universe (underpinned by theistic cosmologies). On the other hand, she is constrained in her practice by whatever metaphysics she follows in her discipline (e.g., mechanistic metaphysics). Cosmology helps us schematise our experience of the observable world, and at the same time it shapes how we experience it. Philosophy as presented in this project—a cosmological and speculative reflection—is to think life outside of control over matter and knowledge of practical utility, but it does not mean that it is disconnected from practice as such.

Speculative cosmology as a study of the positionality of a human in the system of nature helps to direct the focus on the limitations of life and thought and tame the longings for what is beyond—the desire to find the absolute truth. Over the following pages, I will show, however, that not every cosmology has a grounding effect. Sometimes, the reflection on the finitude of matter has the opposite effect of distancing thought from nature.[2] The first part of this project presents a categorisation of speculative metaphysical systems from this perspective and explains nuances between them. As noted already, Christianity long shaped philosophy in the Western tradition. We can find forms of theism in many of the works of speculative thinkers. For example, Georg W. F. Hegel is concerned with the finitude of life and matter, but still argues for the special, God-like qualities of human Reason as superior to matter. In contrast, works of Friedrich J. W. Schelling and Alfred N. Whitehead insist that thought is an inherent part of the system of nature and, as such, matter is primary to reason, even if the system of nature is in some way co-extensive with God.

In this project, I will develop a specific kind of speculative metaphysics that falls under the category of biological organicism. It is based on the works of Schelling and Whitehead, but it departs from the rich theological scholarship on these thinkers and reinterprets them in an atheistic and non-mystical way. The concept of God, theism, and

pantheism is removed completely. This interpretational move owes a justification not just because it is the theological tradition that has been the driving force of expansion of Whitehead's thought over the last century, but also because God as a concept is central to his metaphysics. A removal of the concept from his works entirely is an unorthodox reading. First, I have to emphasise that I do not disagree with this tradition, and I believe that it serves its own purpose. This interpretational move is by no means the main point of this book, nor is it a moralistic statement. As it will become very apparent throughout the following pages, I argue for cosmological and metaphysical pluralism, and for diversification of the modes of thinking. If this work must be contextualised in a strand of secondary literature on Whitehead, then I am writing in a dialogue with the works of Isabelle Stengers, Steven Shaviro, and Didier Debaise who repurpose his metaphysics for a philosophy of science and speculative realism. In the book, I argue that it would not be possible to ground the metaphysical system in an experience of nature in a way that can be functional and pragmatic in the context of contemporary science if it incorporates some form of theism.

In both Schelling and Whitehead's philosophies, the creativity of matter places the contingency of becoming as the foundation of a metaphysical system, thereby opening them to speculate on life, and allowing for the temporality of their systems of knowledge and the possibility of self-annihilation. Even if Schelling and Whitehead's cosmologies are the theories of *tó pân*, (the whole/universe) they do not claim to be the endpoint, the ideal truth, or even the possibility of reaching such a point. Biological organicism treats reality as elusive because thought, matter, and life are temporary. It is a form of radical empiricism or panexperientialism—the view that there is no reality that is not also experience (understood as the temporality of matter, life, and thought). In this sense, biological organicism is better equipped to confront positivist science and mechanistic materialism. At the core of the mechanistic perspective is a supernatural cosmology

that grants the human mind special qualities and the ability to think the one atemporal and universal truth outside of the system of nature itself.

If we are to rethink the relationship between thought, matter, and temporality today, then the question of technology must be addressed. Bernard Stiegler defines technology as an exteriorisation of memory that helps thought to move through time (Stiegler 2025). Technological development has changed how thought relates to matter—it can now transcend the temporal existence of organic life. This book has concretised my thoughts by means of technology and they can now exist independently from me. Consequently, technology poses the cosmological question—what is the positionality of the human in the system of nature? Inorganic matter can carry thought, and approaches such as post- or trans-humanism are an attempt to tackle what is the meaning of technologically crippled/enhanced humanity. A speculative metaphysics enables a philosophy of nature that deconstructs the linear idea of progress, and machines no longer cause us to think about humanism in a post or trans-state (Kwapińska 2022, p. 58). Moreover, cosmology has to address the question of technology because, as Hui explains, any cosmological thinking is in fact cosmotechnical—it is focused on the concretisation of human and non-human relations (Hui 2021). Hui also underlines that every cosmology is necessarily technically mediated, as there are sets of tools that we use for their creation. Technicity (understood not just as tools but also sets of practices that shape subjectivity) is an inherent part of every cosmology and of every scientific method. Stengers notes that each discovery or invention of a new scientific truth is always constrained by the experimental apparatus (Stengers 2000, p. 86), the artificially mediated thought and nature. Similarly, Thomas Kuhn points out that the revolutionary moments in science are defined by the need to provide new sets of tools, just as in a manufacture (2012, p. 16). Cosmologies and their scientific methods are technically mediated, and metaphysics and philosophies of nature have ignored this mediation for too long. For this reason Hui argues that simply coming back to philosophies of nature is not enough to tackle contemporary issues

(2019, p. 20). In this project, I will also present philosophies of technology from the perspective of biological organicism to demonstrate how technicity is an inherent part of cosmological or scientific methods. This is a necessary step to address the second aim of this book: to demonstrate how mechanistic metaphysics is totalised via technology into the dominant political and economic paradigm.

Metaphysics as such cannot be overcome, but there is a point in tilting at windmills. Metaphysics is nothing but widely accepted sets of abstractions. These abstractions change over time and space and are particular to those who think them, e.g., specific scientific communities. Taking Kuhn's understanding, a scientific community means a paradigm in a 'global' sense: 'various kinds of commitment and practices, among which he emphasizes symbolic generalizations, models, and exemplars' (Hacking 2012, xxiv). There were moments in the history of every discipline of thought when these abstract sets were revolutionised. Kuhn describes these revolutions as paradigm shifts. They occur whenever there is an observable anomaly that is no longer explainable by the existing set of tools, thus prompting a discussion on fundamental ideas. He also recognises that the adoption of a new paradigm takes time and effort. It is not so easy to change someone's mind, not least the minds of a whole group of people who benefit from thinking a certain way. In the words of Bergson, intellectual habits are such that the human mind seeks resemblance and congruity with what it already knows, and intuitively selects fragments of nature that can be described by its existing knowledge. Science is precise, but always involves an aspect of repetition and the past (Bergson 2005, p. 34). Kuhn said that the 'normal' operation of scientific research does not aim to produce any major novelties (Kuhn 2012, p. 37). There is little incentive to reconceptualise the nature of reality within a paradigm. It takes a lot of studying and commitment to get qualified and be recognised as a scientist by a respectable institution in the first place. A researcher's training is held deep in their mind (Kuhn 2012, p. 5). It prepares them to do research as a professional practice with a widely accepted set of methods. There is a certain number of conceptual boxes

in which a scientist can express nature within one discipline (Kuhn 2012, p. 5). Paradigms based on particular sets of metaphysical abstractions are institutionalised in certificates, educational textbooks, specialised societies, specialised journals, and grant applications. Publishing against the grain of established methods might entail reputational damage and diminished career prospects (Kuhn 2012, p. 20). The rigidity of habitual thinking is reinforced by these institutional constraints. Established scientific practices are stuck in their bureaucratic chains of decision-making processes and are resistant to fundamental changes. As widely shared sets of abstractions, metaphysics shapes how we schematise experience, our explanations of reality, and provides a habitual structure that orders knowledge. In turn, metaphysics regulates societies via the institutions that they embody (e.g., scientific communities). Thinking about scientific communities as paradigms is useful as it links metaphysics to cosmology as an institutionalised practice. It also makes possible a form of metaphysical pluralism that is not relativistic—metaphysical systems are dynamically emerging from the mesh of scientific revolutions in distinctive traditions and schools of thought (Kuhn 2012, p. 204). Each of these schools describes the same reality but of different localities and with different sets of technicities.

It has been hinted already that this project will speculate on the nature of reality as non-linear and recursive, whether we consider the evolution of technology within nature, or scientific progress. The point is therefore not to say in a linear manner that cosmologies or metaphysics comes first before institutional practices, and that we have to create metaphysics for an institutional change to follow. Rather, the point is that they are co-constitutive. Following Hui's approach to philosophy, biological organicism as developed in this project is a cosmotechnical event, it is a 'radical opening to the beginning of thinking' (Hui 2021). It is an invitation to think through some problems with a cosmological method. Biological organicism is an interpretational, speculative framework for understanding of how different metaphysical systems co-evolve and why some of them are

reductive and can become totalising. Speculation means that biological organicism treats scientific truths and metaphysical theories on a continuum with change and any elements or indeed the whole system can be disposed of at any time. If the nature of reality and thought is non-linear and recursive, then a cosmotechnical event is a contingency that allows us to enter the circuits of thinking.

The third and final aim of this project is to demonstrate how the totalisation of capitalist cosmotechnics embodied in intellectual habits, scientific practices and institutions creates an obstacle for a deeper paradigmatic change. Kuhn explains that a paradigm does not have to be set up by a scientific community in a formal way with sets of rules and shared beliefs. However, there are commitments in terms of concepts, instruments, techniques, theories, and methods corresponding with a persistent exemplar (Kuhn 2012, p. 42). One scientific community can be composed of smaller groups and so there can be small revolutions within members of a subspecialty (Kuhn 2012, p. 49). There have been numerous paradigmatic turns in scientific communities, several of them based on organicism. However, the totalisation of capitalist cosmotechnics based on mechanistic materialism makes it harder to change habitual thinking. Biological organicism is therefore a cosmotechnical event that allows us to think this problem from a new perspective.

The grand question that this book implicitly addresses is the value of a return to metaphysics in the tradition of continental philosophy. Ben Turner notes that the totalisation inherent to metaphysical systems 'forms the central problem for continental political thought for theoretical and political reasons' (Turner 2023, p. 4). Continental methods critique metaphysics because such conceptual constructs tend to be exclusionary and limit creative theorising which in turn serve political domination. There is an assumption that a rigorous conceptual system cannot account for the complexity of political and social life (Turner 2023, p. 5). Post-foundational ontologies attempted to remove totalisation from metaphysics by elevating change, becoming, complexity or differentiation as axioms. Nevertheless, it can be argued

that any axiomatic system is totalising, despite the meaning of the axiom (Turner 2023, p. 5). Perhaps, at first glance, this book seems to be repeating this trick of post-foundational ontologies: it builds a coherent system of philosophy of nature based on Schelling and Whitehead's concepts of contingency and creativity. It also draws on the works of New Materialists. But it differs from them because it postulates metaphysical pluralism rather than monism, and it does not pretend to avoid totalising judgements.

Metaphysical pluralism is here pursued from the cosmological perspective. Metaphysical systems are theories of knowledge that result from cosmologies. A cosmology is how we schematise experience of the observable world through symbolic orders, and how thereby we position ourselves in the entirety of the system of nature, in the universe. The specific positionality of a human in the universe guides how we should think and act. Metaphysics is present in habitual thinking and concretised in institutions. They are also always technical in how we produce and reproduce them. Therefore, they are reducible to the people who think them as well as the technics and institutions. In this respect, this book draws on Hui's understanding of cosmotechnics. Metaphysics does not exist outside of these material reiterations. This grounding of metaphysics in spatio-temporal localities recognises that, as humans, we will always schematise our experience and create systems of knowledge that are based on certain sets of principles. There is a plurality of metaphysical systems across scientific communities and cultures and a methodical critique of metaphysics in continental political thought can be at times limiting. A return to the study of metaphysics acknowledges the fact that whether we find them oppressive or not, they are here and constrain how we think and act.

To postulate metaphysical pluralism, I approach the analysis of metaphysics on two levels: how metaphysics can operate on reductive assumptions (from within metaphysical systems); and how metaphysics can become a totalising political force (metaphysical systems as political structures and agents). As noted already, I argue that these two levels are co-constitutive. This distinction is made only

for analytical purposes, as it works against the continental critique that any metaphysical system limits creative theorisation and tends to be exclusionary. This critique is self-defeating because it stops us from theorising metaphysics creatively. We have to revisit metaphysics to argue for pluralism in our schematisation of thinking, and to understand what assumptions tend to be reductive, limit noodiversity, and in turn tend to be totalising politically. Conversely, why does the global capitalist cosmotechnics totalise habitual thinking, limit noodiversity and metaphysical pluralism? Rather than avoiding metaphysics altogether, it is worth studying why they can become oppressive. Metaphysics, or theories of knowledge, are a natural tendency of the mind trying to think matter and cannot be overcome.

In the book I explain how descriptive metaphysics is reductive and demonstrate that the tendency to express a unified theory of the nature of reality is deeply rooted in the Western tradition of thought. I examine how this tendency is linked to dualist understandings of nature. Atemporal and universal metaphysics stem from a paradox hidden in positivist methods. The Western tradition of philosophy mystifies metaphysics that recognises that we cannot know nature in its totality (e.g., Romantic or some of the Eastern cosmologies). But they are missing the point, and I aim to dispel this misconception. Organicism as an approach to metaphysics is radically empirical, as it is based on an experience of nature that is always spatio-temporally constrained. It entails realism. Western metaphysics is based on a paradox insofar as finite human consciousness is in some (unexplainable) way able to make atemporal judgements. Our experience of nature is different to our comprehension of it. This paradox is the cosmological legacy of Christianity, Judaism, and Islam that shaped the Western tradition of thought for centuries.

A unified theory of science has been a holy grail for generations of intellectuals. In a way, Schelling's and Whitehead's projects are shaped by this same motivation. Schelling's universal organicism is formulated around the idea that there must be a singular process that can describe the origin and operation of thought and matter. Whitehead bridges the

psychological and physical with his understanding of events as the fabric of the universe. The events are processes of cosmological becoming where the mental and physical are their interdependent poles (Weekes 2012, p. 26). He proposes a non-reductive form of monism which is nevertheless driven by a proposition of metaphysics that unifies the abstract language of physics with our real experience of nature. The grounding of metaphysics through cosmotechnics is a gesture against reductivism but also against monism. I do not have this ambition to propose a unified theory of reality.

I formulate biological organicism as a metaphysical system only insofar as it forms a general hypothesis of how plural metaphysics relates to each other in an experience of nature. They operate on different localities and are studied with different sets of technicities, so they cannot be fully translated, derived or explained by one theory. It is an interpretative apparatus that builds connections between specific scientific disciplines and contributes to a general understanding of the processes that constitute reality. Rather than offering definitions of primary ontological categories, it speculates on how they evolve and relate to each other.

The second level of analysis explains how metaphysics is political. I will argue that the reductive habitual thinking shapes institutional practices in a way that it becomes a totalising political force. To reiterate, cosmotechnics describes how metaphysics is culturally and technically mediated, but it is a recursive process in which individuation (e.g., of a researcher in a particular paradigm) and a collective individuation (e.g., of a tradition of thought) are shaped by cosmotechnics. Equally conditional for the functioning of metaphysics in the world are cosmopolitics. I understand this term to have two meanings. First, it can be used as a synonym for planetary techno-politics or the politics of a technicised planetary system. Second, cosmopolitics refers to the politics of what cosmologies are considered valid for a specific group of people, be it a scientific community or a national culture. The cosmotechnical and cosmopolitical approaches allow studying metaphysics as politically produced and reproduced, but

also as concrete political agents that shape practices. With these analytical cosmological tools at hand, it becomes possible to demonstrate how mechanistic materialism is totalised via technology into the dominant political and economic paradigm, how a metaphysical system can become totalising on the planetary level, where the reductive and atemporal scientific approach results in politics that lead to an impoverishment of noo- and biodiversity.

While in this book I critique mechanistic materialism as the metaphysics for all sciences, I do not reject its explanatory value in e.g., classical physics. Mechanistic materialism works perfectly fine when explaining certain cosmic localities. It is linked to political domination only when it is universally totalised in capitalist cosmotechnics, when it subjects all life to atemporal imperatives. As Turner writes, '[c]alculation and capitalism are totalising, insofar as all is calculable, but they do not provide meaning beyond the profit motive. Totalisation here operates without critique, judgement, or a vision of the future' (Turner 2023, p. 8). I agree with Turner that, confronted with this totalising force, value statements become a necessary form of resistance. From this perspective I will make totalising political judgements about capitalist cosmotechnics: it is bad for us insofar as it leads to the exhaustion of mind and nature; it works against a diversity of cosmologies and methods in science; it encloses how we can imagine our future. I argue that these critical judgements are necessary insofar as all necessities are themselves contingent. In this instance, biological organicism is a form of pragmatism. This pragmatism results from speculative empiricism, a method I outline in detail in the third chapter. In short: if the temporal experience of nature is all there is, then our methods should reflect this experience. If at this stage we need to diversify metaphysics and cosmotechnics to resist what is destructive to life, then we have much to gain and little to lose in trying. If it proves ineffective then the search continues for other solutions. Speculative empiricism is therefore pragmatic and at the same time open to revision. These judgements are totalising but they seek to enable pluralism and diversity by way of speculation.

2 Book Outline

The next two chapters address the first aim of this book: to critique mechanistic materialism from the perspective of *organic materialism*. The second chapter focuses on metaphysics and ontology to present a philosophy of nature where thought and knowledge are linked to experience (temporality of thought and matter). The third chapter is on epistemology and scientific methods to present a philosophy of nature that can deconstruct reductive tendencies of methods and atemporal truth-making, thereby presenting cosmological consequences of metaphysics.

The next chapter presents a history of scientific thought in two strands—a descriptive metaphysics that corresponds with substance ontology and mechanistic materialism; and a speculative metaphysics based on process ontology and organic materialism. The narrative begins with Whitehead's critique of mechanistic materialism. Speculative philosophy was already present in Pre-Socratic philosophy, but since this project follows Whitehead's works, it presents speculative metaphysics as a countermovement to the descriptive, mechanistic metaphysics established by the Aristotelian tradition. From this perspective, it becomes apparent that there was no major paradigm shift from Aristotelians to Immanuel Kant (Grant 2008, p. 30). In the post-Kantian period, drawing on Hui's study of organicism in *Recursivity and Contingency,* the focus will turn to Romanticism which brought back speculation and process ontology to the Western tradition. The main problem will be pinned to the fallacy of the bifurcation in the sense of nature. Whitehead's main criticism of mechanistic materialism is that it treats differently nature as a cause of thought and nature as an effect of thought. As a result, mechanistic materialism conceives of knowledge as different in kind to nature. This problem is then reformulated in the paradox of freedom in nature—how can a free thought be a part of nature which is subject to the determinism of natural laws?

Aside from critiquing mechanistic materialism, the second chapter will present the Romantic turn in great detail. This is to show how speculation based on process ontology and organicism has re-emerged in the Western tradition in Schelling and Hegel's reflections. The paradox of freedom in nature was foundational to how they both developed their distinctive approaches to the philosophy of science. Bringing freedom that was previously seen as exclusively human (if at all) back to the system of nature forced them to rethink the relationship between human and matter. If freedom is an inherent part of nature, then nature itself can no longer be described just as mechanistic materialism. Thus, in the works of these thinkers we can find two types of organicism. While not every speculative philosophy is necessarily organic, German Idealists brought speculation and process back to philosophical reflection by explaining how the system of nature is self-organising. Not all speculative metaphysics are the same, and not every organicism has the same understanding of processes of self-organisation. A significant portion of the first part of the project is dedicated to Schelling and Hegel's cosmologies to present the nuances in organic approaches. Given the many ways in which we can conceptualise the relationship between thought and matter, a typology of metaphysical systems is warranted. The typology of metaphysical systems, like the historical narrative, is drawn from Whitehead's work on the distinction between descriptive and speculative metaphysics, corresponding to substance and process ontology, and mechanistic and organic materialism respectively; and Hui's works on the differences between machinic and biological organicism. Whitehead and Hui's categorisations have not been drawn together before (Fig. 1.1).

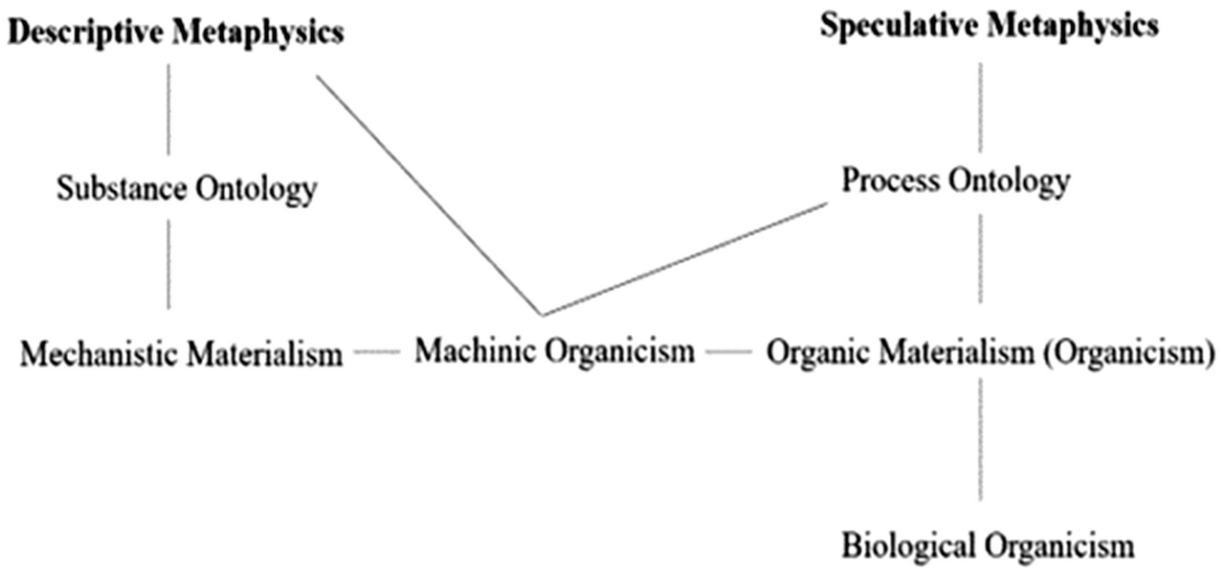


Fig. 1.1 Typology of Metaphysics Based on Works of A. N. Whitehead and Y. Hui

Undoubtedly, the narrative and typology presented are limited, and there are more nuances in how the nature of reality was understood over thousands of years. There have been more speculative and organic thinkers than are included here and more connections to be drawn. Writing a history of process philosophy would amount to a separate project, which could not fit within the scope of one book. The first ever attempt at this task has been undertaken in the upcoming publication by Keith Robinson, *Process Philosophy: A Reader* and will include other major process thinkers such as Gilles Deleuze, Martin Heidegger, and Henri Bergson, who are mentioned in this project but are not covered in detail (n.d.). While these thinkers also played a role in the development of continental philosophy of technology, it is my judgement that adding more authors will complicate a very broad scope of literature within the post-Kantian tradition that this monograph already examines. To be more specific on this. I draw on an already existing distinction between descriptive and speculative metaphysics, and then introduce the subcategories of speculative metaphysics (after Hui), namely biological and machinic organicism. This is to make a clear case for how philosophy of technology can be situated within the existing traditions of metaphysics, and how

different metaphysical assumptions for philosophy of technology will have very specific outcomes for a philosophy of nature (and vice versa). These categories can be expanded in the future works by authors who wish to contextualise existentialism (such as Heidegger and Nietzsche) within this categorisation of metaphysical systems, but I did not have space to do this in this monograph.

It is also important to emphasise again that the history here is limited to the Western tradition. Process ontology is an inherent part of Buddhism, Confucianism, Daoism, and traditions that are older than the pre-Socratics. They are not included here again due to the physical limitations of writing a book. However, process ontology and speculative metaphysics were not invented by the West.

The history of the philosophy of science told through Whitehead's criticism of materialism, and Schelling and Hegel's philosophies, reveals that thinking matter, life, and thought together requires not only an ontological change from substance to process but also forces us to rethink the relationship between subject and object. The historical narrative is also told as a critique of the canon of the Western tradition of thought that is largely dominated by substance approaches and descriptive metaphysics and countermovements are dismissed as digressions. Schelling and Hegel's philosophy of science were both rejected by the mainstream because their methods were considered insufficiently positivist, ergo unscientific. The third chapter elaborates on these implications. It will explain how speculative metaphysics entails onto-epistemology, the idea that the construction of cosmos is simultaneously a construction of knowledge. Hegel, Schelling, and Whitehead build their philosophies of science based on processual understandings of matter, but it will be shown how their methods are not anti-scientific. Speculation does not reject scientific discoveries of truths but is rather a tool that limits the reductive tendencies of truth-making. The speculative physics of these thinkers will be linked to the debates in contemporary philosophy. Connections will be drawn from Hegel to Quentin Meillassoux, and from Schelling to Iain Hamilton Grant, to the New Materialism debate on epistemology (Fig. 1.2). The

third chapter will also include a synthesis of biological organicism and will connect it to the current debates on issues related to scientific experimentation. In so doing, biological organicism will be presented as a viable method of interpretation of scientific methods. The analysis of different types of speculation as a method will outline how metaphysical assumptions lead to scientific and institutionalised practices. For example, I will demonstrate how machinic organicism underpins the institution of private property, and how biological organicism conditions ecological thinking.

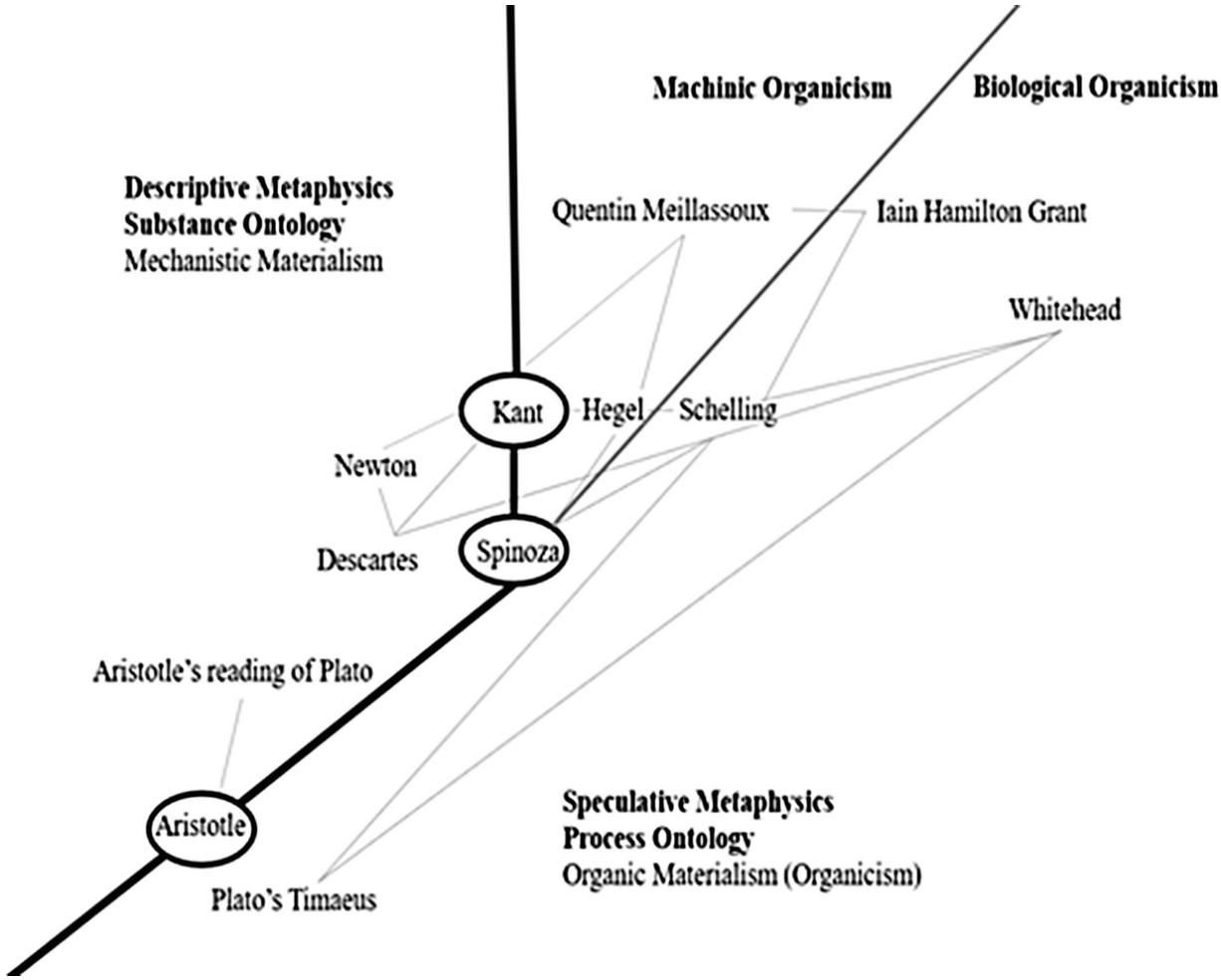


Fig. 1.2 History of Speculative Metaphysics as presented in this book.

The second and third chapters set the ground for the overall argument of this book. When read together, they amount to an original contribution of the first part of the monograph. The metaphysical

categorisations outlined in these chapters have to be first drawn together (as this has not been done before) so I could examine the proposed metaphysical systems from the perspective of Whitehead's fallacy of bifurcation in the sense of nature, which is achieved at the end of chap. 3. The second part of the monograph (chaps. 4 and 5) is where I transition to presentation of the main argument of the book which is an original contribution to the contemporary debates, and it draws on the established categorisation and critique of the metaphysical systems in the first part.

In the second and third chapters biological organicism is presented as a philosophy of nature/philosophy of science. The fourth chapter deals with how the philosophy of technology can be contextualised in the philosophy of nature (biological organicism). Thereby, I begin to address the second aim of this book: to demonstrate how mechanistic metaphysics is totalised via technology into the dominant political and economic paradigm. I begin with an overview of evolutionary approaches in the philosophy of technology to then argue that approaches that take technology as a part of human evolution imply organic metaphysics. The argument is framed by an analysis of the influence of Whitehead's work on Stiegler's general organology. The rest of the fourth chapter gathers the philosophy of technology or rather the philosophy of technics and mechanicism that is scattered throughout the works of Schelling and Whitehead. It will also include Romantic approaches more broadly, where the thinkers grasped the peculiarity of machines that forces us to doubt the mechanistic understanding of nature. In the organic perspective, machinic matter is a mediation between organic and inorganic forms and processes of organisation of life and thought. The fourth chapter concludes with rethinking this relationship between thought and matter, to emphasise how there is a recursive cycle between thought and matter, contrary to what has been conceptualised in the mechanistic paradigm.

The fifth chapter will bring the previously outlined arguments together to present biological organicism as a cosmotechnical event, and continue to address the second aim of the book and deal with the

third one: to explain how the totalisation of capitalist cosmotechnics embodied in intellectual habits, scientific practices and institutions creates obstacles for a deeper paradigmatic change. As Whitehead argues: 'the recourse to metaphysics is like throwing a match into the powder magazine. It blows up the whole arena' (1964, p. 20). Rethinking metaphysical groundings of any scientific discipline poses a need for a scientific revolution, for onto-epistemological and methodical retooling suited to the new scientific reality. The guiding question here will be how the metaphysical reflection on philosophy of nature/science, and philosophy of technology amounts to a cosmological approach to issues in scientific communities; how the totalisation of mechanistic metaphysics in capitalism creates institutionalised difficulties for a change of scientific practice. An evolutionary approach to technology implicates tensions between the universal evolution of technology and the local technicisation of environments, and the chapter will include their possible interpretations. Global capitalism can be understood as a universalisation of one type of technopolitics. According to Stiegler, since industrialisation, the anthropological universality of using technics has been accompanied by the totalisation of technology as a cultural, political, and socio-economic programme (Stiegler 2020, p. 73). The technicised planetary system erodes the possibility of cosmological practices that are not based on mechanistic materialism. Using the example of biological organicism, I will argue that cosmotechnics and cosmopolitics are adequate to address the totalisation of capitalist technopolitics.

References

Bergson, Henri. 2005. *Creative Evolution*. New York: The Modern Library.

Cooper, John M. 2012. *Pursuit of Wisdom*. Princeton University Press. [https://doi.org/10.23943/princeton/9780691138602.001.0001]

Durand, Marion, Simon Shogry, and Dirk Baltzly. 2023. Stoicism. *The Stanford Encyclopaedia of Philosophy* (Spring 2023 Edition), ed. Edward N. Zalta and Uri Nodelman. Accessed 14 February

2025. https://plato.stanford.edu/archives/spr2023/entries/stoicism/

Grant, Iain Hamilton. 2008. *Philosophies of Nature after Schelling*. London and New York: Continuum.

Hacking, Iain. 2012. Introductory Essay. In *The Structure of Scientific Revolutions*, edited by Thomas S. Kuhn, vii–xlvi. Chicago and London: The University of Chicago Press.

Hui, Yuk. 2019. *Recursivity and Contingency*. London: Rowman & Littlefield International Ltd. [https://doi.org/10.5771/9781786600547]

Hui, Yuk. 2021. This Strange Being Called the Cosmos. *Foundations of Science* 27 (4): 1409–1414. [https://doi.org/10.1007/s10699-020-09740-7]

Kuhn, Thomas S. 2012. *The Structure of Scientific Revolutions*. Chicago and London: The University of Chicago Press. [https://doi.org/10.7208/chicago/9780226458144.001.0001]

Kwapińska, Kamila. 2022. Technological Evolution and the Political Agency of Artificial Intelligence from the Perspective of General Organology and Universal Organicism. *Információs Társadalom* XXII (2): 57–71. [https://doi.org/10.22503/inftars.XXII.2022.2.4]

Long, Anthony A. 1974. *Hellenistic Philosophy*. London: Duckworth.

Longo, Oddone. 1991. Epicurean Cosmology: A Steady-State Universe. *Memorie della Società Astronomia Italiana* 62:433–441.

Map of Hellenistic Philosophical schools. 2025. 323–31 BC, Athens, Greece. The Metropolitan Museum of Art (The Met). New York City

Nussbaum, Martha. 1994. *The Therapy of Desire*. Princeton University Press.

Robinson, Keith. n.d. *Process Philosophy: A Reader*. Bloomsbury Academic.

Stengers, Isabelle. 2000. *The Invention of Modern Science.* Translated by D. W. Smith. Minneapolis and London: University of Minnesota Press

Stiegler, Bernard. 2020. Noodiversity, Technodiversity. Translated by D. Ross. *Angelaki* 25 (4): 67–80

Stiegler, Bernard. 2025. Within the Limits of Capitalism, Economizing Means Taking Care. Ars Industrialis. Accessed 14 February 2025. http://www.arsindustrialis.org/node/2922

Turner, Ben. 2023. *Returning to Judgment: Bernard Stiegler and Continental Political Theory*. Albany: State University of New York Press. [https://doi.org/10.1353/book.133706]

Weekes, Anderson. 2012. The Mind-Body Problem and Whitehead's Non-reductive Monism. *Journal of Consciousness Studies* 19 (9–10): 1–27.

Whitehead, Alfred North. 1964. *The Concept of Nature*. Cambridge: Cambridge University Press.

Footnotes

1 All of these forms are equally valuable and needed, and often a philosophy fits into more than just one of these categories.

2 Such as stoic cosmology or Christianity but they will not be covered in this book.

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2. From Mechanistic to Organic Materialism

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1 Whitehead's Criticism of Materialism in Western Science

When exploring metaphysical systems, it is worth first checking how they conceptualise the relationship between thought and matter or between mind and nature more broadly. The inquiry can be framed as follows: How can thought give us an accurate image of matter and of the nature of reality? This very fundamental problem has far-reaching consequences for how we conceive of science and scientific methods. Any answer to this question also carries metaphysical implications. For example, assuming that we can master nature because of the distinctive qualities of the mind implies a *duality between thought and matter*; if knowledge is a result of *interlocking processes of thought and matter*, then mind and nature have shared qualities. Ontological dualism is linked to mechanistic materialism which views the objects of science as static, imbued with some unchanging substance. Our minds, bearing the distinctive qualities, help us describe and systematise the nature of reality in its totality. In contrast, organic materialism conceives of

nature as always changing and thus the objects of science escape exhaustive descriptions. As a result, we can only speculate on the nature of reality. This chapter presents an overview of descriptive metaphysics and substance ontology against speculative metaphysics and process ontology to outline the main points of difference: how they define the structure of reality, and the spatio-temporal constraints of thought and matter. I demonstrate how these ontological differences are foundational to their distinctive conceptualisations of the object of science, and how it can lead to the fallacy of bifurcation in the concept of nature. This is to begin addressing the first aim of this book: to critique mechanistic materialism from the perspective of *organic materialism*.

This section will outline the origins of descriptive and mechanistic approaches to nature in the Aristotelian tradition of substance metaphysics, Cartesian dualism, and Newtonian metaphysics. The next section will present Whitehead's organic materialism as an alternative, speculative approach. Organic materialism is a far-reaching reconceptualisation of the dominant concept of nature in the Western sciences and a major challenge to its underlying dualistic assumptions. From this perspective, there is no major paradigm shift in the relationship between thought and matter from Aristotle to Kant (Grant 2008, p. 30).

Whitehead argues that the dualistic approach to nature in classical metaphysics results from the concept of matter that scientists extracted from Aristotle, and Aristotle's reading of Plato (Whitehead 1964, p. 11). According to his critique, the concept of matter developed by Aristotelians leads to the *bifurcation of nature*, that is, an implicit scientific belief that there are two natures: the nature that is 'apprehended in awareness and the nature which is cause of an awareness' (Whitehead 1964, p. 21). In Aristotelian tradition, these two natures are different in kind, with the former corresponding to a formal systematisation of nature (*logos*), and the latter to a concrete material compound of being (*synholon*) (Grant 2008, p. 35).

Before analysing how substance ontology grounded the fallacy of the bifurcation of nature in the Aristotelian tradition, it has to be clarified that substance and matter are not synonymous in his metaphysics. Definitions of substances vary across his works, and some suggested that there are two systems of substances (Graham 1987), or that Aristotle moves from Platonist to Empiricist interpretations between *Categories* and *Metaphysics* (Jaeger 1948), and others that that there is one coherent system of substances where conceptual development logically follows (Athanasopoulos 2010, p. 212). Despite these interpretational debates, there is a consensus that Aristotle differentiates between two types of substances (*ousiai)*: primary and secondary. Primary substance refers to a particular individual, which has an ontological priority and in which essence exists, and secondary substances are the categories that define the essence of primary substance most closely (such as species) and are logically the best description of the nature of a thing (Athanasopoulos 2010, p. 219–221).

For Aristotle, reality is mainly structured by primary substances (*ousiai*) (Grant 2008, p. 35). In *Metaphysics,* primary substance, *ousia*, is defined negatively as 'the underlying subject (…) of which the other things are said but which is itself not further said of any other thing' (Z 31028b36–38 Aristotle 2016, p. 106). *Ousia* is a principle of determinacy of a substantial individual. It can be understood as a structure of an individual that both defines what the thing is and why it is not anything else. Primary substance can be understood as an individual object, insofar as an individual object is an instance of the primary substance. However, an individual object is not *ousia* if we take it as a spatio-temporal compound (Lobkowicz 1989, p. 30). It is the structure of a thing that we know of via the being (Athanasopoulos 2010, p. 221). Here, being encapsulates both material and immaterial becoming of a thing, the potentiality and actuality. *Ousia* connects the interdependent factual, intelligible, and receptive realities (Haring 1956, p. 328). *Ousia* is then what can be abstracted from a thing to a universal, not being a universal by itself. It can be understood as containing an isomorphic pattern that helps us define the thing in

relation to all other things in the world, insofar as the empirical world is constituted by these individual structures relating to one another (Lobkowicz 1989, p. 33). For example, from an encounter with an individual human, a primary substance, we can abstract its essence of being (*to ti en einai*) and define it with secondary substances. A human being can be defined as the *Homo sapiens* species, and by having a soul/reason. Therefore, the essence (*to ti en einai*) of a human being is to be a rational animal. *Ousia* is 'the very nature of being something,' an ultimate but not a universal or individual, a self-containment (Haring 1956, p. 314). For Aristotle, *ousia* should be the focus of a metaphysical inquiry; it is the question of 'what is being' defined in terms of its essence (Lobkowicz 1989, p. 29). Therefore, primary substance holds its essential attributes of being.

Primary substance can also be defined as something that is predicated about, the logical subject. An individual human, *ousia*, will change her appearance and unfold different modes of being throughout her life, relating to the world. All the accidents of life that happen to her, the modes of unfolding in and relating to the world, are the predicates (Lobkowicz 1989, p. 42). Primary substances relate to each other in the world through predicates (modes of being). In this sense, reality is predicamental rather than transcendental; it is structured by individual substances and their relations (Lobkowicz 1989, p 42). Secondary substances are the essential predicated attributes of an individual object. Her essence (*to ti en einai*) is what provides the identity to her being through these changes.

Whitehead claims that even though Aristotle discussed change in ontological terms, the change occurs in attributes, qualities of the enduring substance (1985, p. 79). Hui also argues that Aristotle differentiates between change that happens to predicates of a subject, while subject remains identical to self (2019, p. 12). Similarly, Tina Röck notes that after Aristotle, stable identities are foundational to the Western philosophical and theological tradition, where change is not about transformation of an identity over time, but rather change of attributes (2024, p. 8–9). In Aristotelian ontology, change does not

apply to the primary substance; it is described as its predicate. Whitehead's critique of the concept of nature is specifically against this imprint of the Aristotelian tradition in Western science.

Aristotelian tradition degrades matter to a secondary understanding of nature because it is less important in the formal systematisation, even though it is the cause of experience. We can find the reason for this in how this tradition complicates the concept of matter. For Aristotle, in principle, every material substance is made out of form, matter, and a composite of form and matter (*Metaphysics* Z 31029a1–5 Aristotle 2016, p. 106). There is therefore a substantial form (*morphe*) and a substantial matter (*hyle*), and also the concrete individual object, as it presents itself to our senses (rather than the logical subject). Broadly speaking, Aristotle uses the concept of matter (*hyle*) to describe what things are made of: flesh, wood, iron. However, it could be said that in some sense, all of the three are material as we experience them in an individual object, even if there are disagreements on their ontological primacy (Peramatzis 2015, p. 197), and on the essence of form (Peramatzis 2015, p. 195).

Form (*morphe*) is defined as a principle of unity of the complex parts that compose an individual object (Johnston 2006, p. 658). It is debatable whether form is just another material part that plays a unifying role or something essentially different (Johnston 2006, p. 659). For example, 'purists' see that part as immaterial and, in definition, non-reliant on the material compounds of an object, or as a purely functional telos. 'Compound first' interpretation assumes that it exists only in thought as an abstraction from a material compound, immaterial but reliant on matter in definition. The 'true grit' view claims that form involves matter; it is reliant on the material object and non-reducible to its telic functions (Peramatzis 2015, p.195–196). The relation between form and matter is also that of potentiality and actuality, where matter is the composite substance and potentiality, and form is the actual way of being (Witt 1987, p. 677). 'Matter exists in a potential state, just because it may attain to its form; and when it exists actually, then it is in its form' (*Metaphysics* 1050a15–16, cited by Witt

1987, p. 677). Matter is a substance in potentiality, but it is the form and the underlying identity of a thing that is more substantial to what a thing is (*Metaphysics* Z 31029a27–29 Aristotle 2016, p. 106). Form forms substance as telos in practice and realises the potential of matter. Here, we lean on the 'true grit' interpretation, where form is material, grounds all the necessary characteristics of matter in actuality with a principle of unity and the final cause, and is ontologically prior to the compound of matter (Peramatzis 2015, p.197). This is because the more detached the concept of form is from matter, the more it encourages the bifurcation in the sense of nature.

Form functions as a tool to describe nature, to abstract and systematise knowledge from concrete experience of matter. While we experience the form and matter of an individual object, matter is temporal, but a form can recur in the eternal activity of nature. For example, a material reiteration of an individual fruit fly is temporal compared to the fruit fly as a species. For Aristotle, such relationship between form and matter was the rationale for why we can talk about the nature of things and reality in formal (logical) terms. Matter necessarily submits to form, which means that it is necessarily structured in a logical way (Grant 2008, p. 35). Form grounds the essence in the actual reality; it is closer to essence in definition (Peramatzis 2015, p.198). Form serves as a functional telos of matter, making matter intelligible, transcending the sensual perception of the concrete (*synholon*) into understanding of being (*logos*). Thanks to that, we can logically categorise primary and secondary substances.

Even though the primary understanding of nature, that is, metaphysics as formal ontology, is dependent on and derived from concrete experience (as in inductive empiricism), matter is secondary in its systematisation. Bodily and sensible nature is the realm in which we observe mechanical, natural laws, such as death of an individual human, the decay of a fruit fly, or a deterioration of a stone. It is the mind, however, which allows us to think the primary understanding of nature in sense awareness, different to the nature in sense perception (atemporal truths). Aristotle splits the systematisation of the nature of

reality into two types. First, philosophy is the metaphysical and formal investigation, because it brings us closer to the actual understanding of things. The study of the concrete and its processes of change is secondary, because it is about the mere potentiality; matter is degenerative and perishable (physics). The Aristotelian doctrine of matter successfully differentiates the qualities of physics and metaphysics (Grant 2008, p. 35). In so doing, matter has been removed from the formal systematisation of nature. The actual nature is metaphysics as formal ontology.

We can talk about two dualisms in Aristotle's metaphysics. The first one is the ontological principle of being (where every concrete thing is necessarily a compound of form and matter), which harbours the second dualism, bifurcation in the sense of nature (between metaphysics as formal ontology and physics as the study of the concrete experience of nature). As Whitehead frames it, this bifurcation implies that there are two natures, where 'one is the conjecture, and the other is the dream' (Whitehead 1964, p. 21). He implies that in the Aristotelian conception of nature, the metaphysical understanding of substance is a creation of the mind. At the same time, matter in the secondary understanding of nature is elusive to our senses, even though it causes the experience of it. Whitehead's critique is against the overemphasis on Aristotelian logic in the European tradition of thought, that imprinted on habitual thinking during the medieval period (Whitehead 1985, p. 51). Grant argues that the Aristotelian first substance, which loses materiality through a language of logic, becomes *hypokeimenon*, *subjectum,* extensional logos (2008, p. 34). It becomes 'what something is ontologically predicated of' (Shatalov 2020, p. 231). 'All ontological predicates ultimately take primary substance as *hypokeimonenon*' (Shatalov 2020, p.234). *Hypokeimenon* is the basic, underlying subject that persists throughout different modes of being *ousia*.[1] S*ubjectum*, apprehended in awareness, is a subject of formal logic, and as a pure thought it is metaphysical (Grant 2008, p. 34). A predicate is true only if it stands in an appropriate metaphysical relation to the *subjectum* (Shatalov 2020, p.230). Being able to discuss

nature in its atemporal, abstracted forms, we can describe things and their essential, substantive characteristics—we can talk about *objects of science*. Descriptive metaphysical systems that follow the Aristotelian tradition are predominantly based on formal understandings of the nature of reality. Leemon McHenry explains in his study of metaphysical systems that Aristotelian metaphysics is *descriptive* because of the grammatical rules that we can find in the language of logic. Logical categories *describe* substances, treating grammar as an ontological guide (McHenry 2015, p. 12). McHenry argues that Aristotle, seeking the nature of things, discovered it in their highest level of generality. 'Being qua being' is, in the Aristotelian tradition, categorised through ordinary language, which 'means that nouns and proper names identify properties and identify substances, verbs, and adverbs identify actions or events, and adjectives identify properties and class relations' (McHenry 2015, p. 12). The main ontological categories of being are deduced from linguistic forms (McHenry 2015, p. 11). English language inhibits the ontological presumption that it is the subject that endures with an underlying identity and the attributes and qualities are changing in the predicates. The subject-predicate form of expression and the trust in linguistic expressions as the ontological categories became the key to understanding metaphysics and objects of science and are ingrained in Western thinking as deeply as it is in language (Whitehead 1985, p. 79). They are listed as two of the nine most persistent fallacious procedures and myths in the habitual thinking that Whitehead aims to counteract in *Process and Reality* (1985, p. xiii). This tendency to express the universe in the networks of words where the actual operation of nature is confused with the norms and rules of human convention is specific to the Western traditions of thought (Watts and Chuang-Liang Huang 2011, p. 42).

Metaphysical conceptualisations abstracted from temporal matter and based on grammatical rules are problematic insofar as they dictate that language always accurately represents reality. In grammatical structures, we imagine things as something that always endures with persistent qualities (i.e., a stone is solid), which is not always true (i.e., a

stone will eventually disintegrate). In turn, the abstraction of *enduring* objects into formal subjects, or as Whitehead terms them *bare objects*, forces us to disregard temporality and take it as external to their essence (Whitehead 1964, p. 6). Sciences that are concerned with *bare objects* dematerialise nature. They distort matter by minimising the significance of its temporality. In substance metaphysics, what is bodily and sensible is a secondary understanding of substance. Grant notes that the whole and concrete (*synholon*) submits to formal nature (*logos*) because it can degenerate and cease to exist.

This relationship between logic (reason) and matter translates to a specific relationship between *cosmos* (here understood as a world which we are able to observe/the order of things) and *logos* (the theories of how we can describe cosmos in a reasonable, organised way). To recall, cosmology is a theory of how we schematise our experience of the observable world through symbolic orders and how we position ourselves in the entirety of the system of nature, in the universe. We schematise our position in the universe based on how we conceptualise the notion of reason and how thought relates to matter. We can trace the Aristotelian bifurcation of nature in Cartesian dualism. In *Process and Reality*, Whitehead points out that Descartes drew from the Aristotelian understanding of the substance when he stated that it 'requires nothing but itself in order to exist' insofar as this statement mirrors the assumption of how the primary substances structure reality (1985, p. 50). Aristotle's primary substance, in its metaphysical abstraction, harboured the distinctive qualities of body and mind. When Descartes begins his philosophical reflection, he starts by doubting the existence of material nature. He finds the material nature elusive and deceptive, but what he cannot doubt is indeed the primary nature apprehended in awareness. Subsequently, Descartes argues that the nature that we perceive in our sense perception is devoid of thought, and purely mechanical.

Hui emphasises that Cartesian mechanistic materialism is not just analogical but primarily ontological. Bodies, including human bodies, are regulated in the same way as clocks. A mind, a soul, makes a

decision, and then a body moves itself through a distribution of neuronal sensors, as simple mechanical motion (Hui 2019, p. 154). Thoughts are primary to the motion of matter. Descartes' *logos* and metaphysics have an exclusive role in the constitution of novelty. Cartesian mechanistic materialism sees nature as a mechanistic system of self-regulation. Mechanistic matter needs an external creator. When concrete, material nature is reduced to mechanical laws and is identified with a hylomorphic mechanism, the first nature is elevated to the level of the divine. Dualism treats dynamism and creativity as a divine gift (initiated and granted by the Primus Motor in Aristotle's metaphysics or the First Creator in Descartes' metaphysics) and the production of novelty as the exclusive jurisdiction of the mind. Nature as a mechanistic matter is in motion but it is not productive.

The Aristotelian primary substance is also to be found in two arguments of classical physics. Firstly, reality is composed of individually existing bodies (subjects with some primary attributes) with external characteristics (predicates); and secondly, time and space are their absolute conditions. For Newton, the basic units of reality were particles composed of solid unity. In classical physics, for a particle to be solid, it must have a location which it occupies for a certain amount of time (McHenry 2015, p. 44). This solidity results from the particle's primary substance having logically necessary primary attributes, namely, spatial and temporal coordinates. Whitehead argues that the presumption about the particles being solid was the *bare object* rephrased. The abstract unchanged 'endurance of substances' was encapsulated in a particle with 'essential attributes,' time and space (1985, p. 78).

Thanks to these two primary attributes (space and time), particles are solid and can move in a continuous manner which allows them to establish external characteristics (causal links). *All* particles have these two unchangeable attributes which ascertain their linear movement (McHenry 2015, p. 44). Thus, the laws of nature can be interpreted as the external, causal relations between bodies. For these reasons, 'Newton's theory is sometimes called the "billiard ball model" of the

universe' (McHenry 2015, p. 32). Causality is linear and external, where relationships between objects are established between individually existing bodies (solid particles).

Moreover, absolute space and time exist as the extensive continuum, which the particles occupy by establishing external relations (McHenry 2015, p. 45). The logical primary substance becomes the *cosmic now*, or *cosmic absolute*, which is central to Newton's theory. Space and time are absolute in the sense that they are universal and ahistorical. Absolute time is used in mathematics as a corrective of 'common time' and absolute space is necessary for gravity to function as an 'action at a distance' (McHenry 2015, p. 32). Whitehead notes that absolute space and time result from the same fallacy of subject-predicate thinking. The bare objects are first abstracted from their material iterations, from time and space. Then, they are prescribed time and space as their unchanging attributes, and finally these attributes are generalised into the underlying substratum of reality (Whitehead 1964, p. 14).

Despite being systematically anti-Cartesian[2] Newton's cosmology is a redefinition of Aristotle's materialism for classical mechanics.[3] The mechanistic theory of nature as a foundation of modern cosmology held for centuries, until Einstein's theory of relativity launched a scientific revolution in modern physics. Even though theoretical and quantum physics moved on, the mechanistic Newtonian cosmology still conditions classical physics.

Bifurcation in the sense of nature that we find in Aristotle, and then Descartes and Newton, persisted in Kant's philosophy. He moved the problems of the natural sciences from objects to perceiving subjects with his Copernican manoeuvre but did not overcome the bifurcation. As Grant points out, Kant was indeed following the dualistic doctrine when constructing his own conceptualisation of physics and metaphysics (Grant 2008, p. 37). Kant states that 'we cannot discover the fundamental principle of these [phenomenal] occurrences in bodies themselves,' referring to the concrete composites (*synholon*). He then claims that we can describe the rules of occurring phenomena with the help of a priori forms and the categories of understanding (content of

metaphysics), because it is mind that provides structures that organise nature (Grant 2008, p. 37). We observe certain elusive phenomena in nature, but metaphysics helps us to schematise our experience and achieve the level of abstraction necessary to understand the rules of nature. Using Whitehead's language, the problem that we still find in Kant's philosophy is that he embraces scientific methods of thought that force us to abstract phenomena of nature into bare objects of science defined by their external relations.

We can here recall Aristotle's splitting of understanding of *ousia* between *logos* and *synholon* (Grant 2008, p. 35). Primary *ousiai*, the concrete individuals, are the substances that structure reality, and their becoming is unified by form and telos, concretised in matter, but due to the temporal, exhaustible potentiality of matter, they eventually perish. Therefore, to uphold realism, where *ousia* is the foundational metaphysical category of a system of nature, Aristotle had to implement the highest form of *ousia*, a pure form of actuality that is immaterial, does not have a limited capacity for change, and is eternal, devoid of temporality of matter: it is one in its account, the Primus Motor (*Metaphysics* Λ 81074a32–38 Aristotle, p. 210). The primary mover as the cosmic spirit, the ultimate telos, form of all things, is pureactuality, but she cannot be reached by sensual perception. 'There is a substance that is eternal and immovable and separate from perceptible things (…) must be without parts and indivisible. For it moves something for an unlimited time, and nothing finite has unlimited capacity' (*Metaphysics* Λ8 1073a3–8 Aristotle 2016, p. 207). Metaphysics as first philosophy (*logos*) is what results from this highest form of *ousia*, even though it is first disclosed to our senses in the concrete reality of being (*synholon*). Aristotle's concept of *ousia* makes nature paradoxical. Our experience of nature differs from our pure comprehension of it. Aristotelian substantial description of nature concludes in the concept of the highest pure form, inaccessible to our senses but derived from them. This is a direct outcome of removing potentiality of matter from the primary understanding of nature.

In Kant's philosophy we can encounter the concept of *noumenon*, something that is still closed to our sense perception. While we know phenomena because our senses are affected by them, we can only think of noumena. We know of noumena because there must be something more than the phenomena (observable nature) and a priori reasoning (epistemically prior to nature). Still, we do not really know, and we cannot know the ultimate nature of things (*Prolegomena* B307 Kant 2004, p. 66–67). Methods of thinking based on the Aristotelian doctrine of matter reduce the natural sciences to the study of derivative details (Whitehead 1958b, p. 60). Studying nature as objects with external attributes entails a limited understanding of nature.

In this section, we can see that mechanistic metaphysics originated in Aristotle's substance ontology in which material things are compounds of two principles: form and matter. A primary substance has an underlying logical subject that persists through changes due to having an essential identity. Modes of being and relating to the world are described as predicates. Matter's potentiality is actualised by form as its principle of unity and final cause. Form gives us access to the essential, necessary characteristic of being. Primary understanding of nature, metaphysics, is the extensional logos, ontology as formal logic. Matter is perishable and submits to form. Pure actuality, the highest, eternal *form* of *ousia*, is god. This resulted in a dualism in the sense of nature (bifurcation of nature) that has persisted in some scientific methods to this day. Our linguistic habits are partially to blame. Ordinary language inhabits the structures that helped Aristotle logically categorise observable nature, and we are used to saying that something is. We describe things with predicates, and in this way, we derive descriptions of the nature of reality. Since the language of logic gives us access to some universal truths, such as the laws of nature, we can explore the nature of reality with our minds. In Aristotelian doctrine, matter is less important because it is temporal, and elusive. This doctrine inspired Descartes' body and mind dualism, and he argued that our minds have special qualities, distinct from observable nature. He reasoned that if matter submits to form, then the production of

novelty must be exclusively the function of a creative, divine mind, and not submissive, temporary matter. Consequently, bodies in nature are *nothing else but mechanisms governed by the laws of nature*. Minds have special qualities that allow us to create, but also to understand and schematise the mechanistic processes of nature.

The predicative formulation of truths can also be found in the methods of classical physics. The scientific observation is based on the occurrence of natural phenomena, and our minds can derive universal natural laws from them. Objects are abstracted from their material environments to become individually existing bodies, and then we can describe the synthesised external causal relations between them in absolute space and time. While we have access to primary and secondary understandings of nature, Aristotle, Newton, Descartes, and Kant believed that nature in itself is closed to our sense perception. We can think of god or of things that cannot be known, even if we have never felt them.

The first reason for the first aim of this book—to critique mechanistic materialism from the perspective of *organic materialism*—is that mechanistic materialism and descriptive metaphysics imply a paradoxical explanation of the relationship between thought and matter. On the one hand, our mind has the distinct ability to synthesise atemporal, universal truths about the nature of reality. In scientific methods, we can abstract objects from the observation of phenomena and conceive of them as bare objects of science in absolute time and space. Studying the external relations between them gives us the possibility to conceptualise laws of nature, to explain the mechanistic regulation of nature. In this way we can see the system of nature in its totality; the truths derived are universal and atemporal. This method of thinking entails that reason has access to the omnipresent and eternal. On the other hand, we perish. Matter has a limited potentiality. We cannot experience nature in itself; we do not feel what causes nature and physical laws, or what grounds the things in themselves. The substantial approach to nature does not correspond to our actual experience of it; it causes bifurcation in its sense.

2 An Organic Approach to Materialism

Having established how Aristotelian substance metaphysics laid the ground for the bifurcation of nature and descriptive, mechanistic metaphysics, we will now examine organic materialism as an alternative approach to ontology. Whitehead argues that a stable substance with extensive attributes is an abstraction (Whitehead 1985, p. 79) and a problem that has to be overcome. Mechanistic materialism claims universal truths about laws of nature that are embedded in absolute space and time. Whitehead points out that absolute space and time do not correspond to our *actual experience* of nature where everything *is temporary and elusive*. To overcome this issue, Whitehead's philosophy substitutes substance with actual entities and processes of becoming which destabilise Aristotelian dualism and overturn a hylomorphic construction of things. As there are no superior modes of being, matter and mind constitute themselves and reality through the becoming of the cosmos. Nothing slips out of this principium as time and space are also created through this process. A processual understanding of matter overcomes the Newtonian concepts of absolute space and time and advances the relative theory of spacetime after Einstein (McHenry 2015, p. 33). This section also explains how organic materialism and a reconceptualisation of the extensive continuum imply an evolutionary approach to natural laws. To continue addressing the first aim of this book, organic materialism is here presented as a critique of how mechanistic materialism conceptualises matter as a passive component of reality.

Descriptions of mechanical laws that regulate nature provide only a fragmentary picture of reality. In mechanistic physics (and metaphysics), we can only describe how nature submits to its laws, rather than how it actively produces them. As Grant frames it, nature: '… cannot be reduced to sensible nature because it is the production of sensible nature that is itself not sensible. Production exceeds empirically apprehensible becomings' (Grant 2008, p. 37). The conceptualisation of nature in organic materialism is no longer limited

to the description of external causations acting on individual bodies, but rather provides a non-dualistic relationship between mind and matter.

In *Process and Reality*, Whitehead outlines an ontological system of *organic realism* which he defines as a shift from substance materialism to a new outlook in physics driven by 'the displacement of the notion of the static stuff by the notion of a fluent energy' (Whitehead 1985, p. 309). Inspired by the discoveries of quantum theory, Whitehead understood energy as action and flow primary to the construction of matter. McHenry notes that the main scientific development of the quantum theory was the invention of microscopic processes that constitute the solidity of macroscopic bodies (2015, p. 46). Therefore, in quantum theory physical reality is "quasi-continuous"; enduring objects that we see undergo constant internal changes. This view is inconsistent with the Aristotelian definition of the nature of reality. Aristotle coined the notion of the highest substance to have something that persists eternally in pure actuality, where nothing in it is material and potential and thus cannot be exploited by the capacity for change,[4] something that cannot be experienced but forms and actualises the existence of all being. If change constructs reality, then the concept of highest substance holds no explanatory value anymore. Instead, Whitehead proposes the 'Category of the Ultimate' which dictates that the only universal— creativity—is what brings forth reality, from multiplicity to one conjunctive becoming of the cosmos (Whitehead 1985, p. 21). By taking the self-creative processes as indicative of what constitutes nature in itself, we can finally experience the inherent creativity of the universe. Nature in itself is the creativity. Considering that the becoming of matter is grounded by creativity on a lower level, in a non-material way, primary essence is no longer conceptually necessary.

Whitehead's approach to metaphysics adds this third, non-material level to the material-ideal dialectic. In the Aristotelian tradition dualism in understanding of nature is between thought and sensory perception, the logical (*logos*, metaphysics as formal ontology) and the material

(*synholon*, matter that submits to form). With this imprint of the Aristotelian tradition on our habitual thinking, the idea that nonbeing, the quasi-continuous non-material processes, can be creative is difficult to comprehend. Note that for Aristotle and Descartes creativity was a divine gift exclusively granted to mind. In the Western thought, void has been associated with nothingness, or with the possibility of 'the permanent end of the universe' and not creativity (Watts, Chuang-Liang Huang 2011, p. 23). But recent discoveries suggest that even nothingness is creative. Quantum fluctuations were found in the void—it was shown to be filled with buzzing energy and particle–antiparticle pairs popping in and out of existence (Riek, et al. 2017 p. 376–379). In Whitehead's works we can find a metaphysical triad rather than a dialectic, which accounts for the creative processes that can be found in quantum physics or in the void. First there are non-material, creative processes of nature, second there is the material concrete experience of nature, and third is the immaterial thought and logic. These three levels are inexorably intertwined and co-constitutive (Whitehead 1978, p. 220).

Whitehead rejects not only the existence of the underlying identity and essence (*to ti ên einai*) of primary substance (*ousia)*, but also the hylomorphic composition of a concrete thing (*synholon*). For Aristotle, form (*morphe*) is not just a shaper of matter (*hyle*) but characterises the essence of the object (O'Hara 2019, p. 226–227). Recall the fruit fly example: the recurring form of a fruit fly as a species is superior to the material iteration of a singular fruit fly. Whitehead argues that in the act of self-creation, matter (*hyle*) might or might not come back to its form (*morphe*) and there is no 'identity of a substance' that is decisive to the process. In fact, the lack of an underlying substance or 'identity' is precisely why things endure. Matter is now viewed as active in its nature (Whitehead 1985, p. 78). Enduring objects escape the hylomorphic understanding of matter in a process of becoming. Substance ontology is substituted with process ontology. From one act of creation to another there is nothing identical.

The core ontological assumption that becoming constitutes being changes how we understand the construction of matter and, by extension, the construction of space and time. Newton's theory is based on particles that must occupy a location for a specific amount of time to be solid. In contrast, quantum theory is based on a concept of energy that does not have any specific location. 'Pulses of energy have an approximate location in spacetime and interact in fields that bear and transmit the forces of nature' (McHenry 2015, p. 44). The discontinuity of micro becoming (quantum leaps) and its lack of a specific location is therefore not coherent with an understanding of matter that has a 'self-contained local existence' (McHenry 2015, p. 45). To translate these discoveries of quantum physics into his philosophy, Whitehead coins the ontological concept of 'actual occasions' which 'occur as durations of space-time' (McHenry 2015, p. 45). In Whitehead's ontology, these basic events, actual occasions, are primary to the existence of matter and create spacetime itself. Whitehead states that 'we must identify the atomized quantum of extension correlative to an actual entity, with Newton's absolute space and absolute duration' (1978, p. 73). Spacetime is created during processes of becoming of quanta, which have non-uniform dimensional lengths dictated by their lifespans. Actual occasions are real in a sense that spatio-temporal world is made out of them (Whitehead 1978, p. 18). They constitute the actual world (Whitehead 1978, p. 73). They are the events in which nature is present in our sense awareness (Whitehead 1964, p. 10).

The self-creation of matter at the quantum level means that space and time are no longer universal attributes of the elementary entities of reality, and therefore cannot be taken as cosmic absolutes. For Newton, solid particles occupy location in *real time*. Absolute space and time are the *cosmic now*, meaning that the continuum is understood as extensive in the real. However, if we take the waves of energy of sub-atomic particles with non-uniform lifespans to be primary to solid particles, then we can no longer assume that there is a uniform, non-relative, and absolute now; actual entities do not hold any identical essential attributes, and the extensive continuum cannot be real.

With his critique of Newton,[5] Whitehead also constructed an alternative understanding of an extensive continuum. He assumed that the creative processes at the quantum level are unexhaustive, and the *extensive continuum lies in their potentiality of becoming*. Continuity is in potentiality (Whitehead 1985, p. 61). Newton incorrectly argued that the continuity of spacetime lies in real actuality, and not real potentiality (Whitehead 1985, p. 73). Whitehead distinguishes between two types of potentiality: the first is 'general,' provided by the entanglement of all consistent and alternative possibilities of becoming, absolute insofar as it results from the ultimate category of creativity bringing forth reality; and the second is 'real,' related to the specific standpoint of becoming of an actual entity and the actual world defined from that standpoint. 'Real' potentiality is relative: it can express any time (past, present, and future) and definition of the world, depending on other temporal actual entities (Whitehead 1985, p. 65). Here, Whitehead draws on Einstein's theory of relativity (Whitehead 1985, p. 66). However, he diverges from it when he argues that spacetime is a duration of actual occasions. Since Whitehead claimed that the processes of self-creation of matter are relative to spacetime creation in events, it would be incoherent to support Einstein's view that the nature of spacetime is based on the 'apparent distribution of matter.' Instead, Whitehead argues that spacetime relativity depends on the distribution of actual occasions in events (McHenry 2015, p. 53). Continuity is purely potential. Each becoming is composed of overlapping phases—it starts from its pure potential (future), then it endures in a variable lifespan, and then it ends in future which is also potential (Whitehead 1985, p. 61 and 65). Time and space are not absolutes (as classical physics dictates), or relative to the distribution of matter (as in Einstein's theory of relativity); they rely on the self-creation of matter.

In Whitehead's process ontology, self-creation of *each actual entity* contributes to the extensive *continuity of cosmic becoming*. Whitehead writes that the world is a process composed of becoming of actual occasions (1985, p. 22). Actual occasions are used by Whitehead

interchangeably with actual entities (Whitehead 1985, p. 22). The actual world is composed of entangled multiplicities of actual entities which endure depending on their own creative, self-determining, and relative processes of becoming. Grounding all material objects in non-uniform and non-material processes of becoming means that existence must be considered from the perspective of this relative temporality. Moreover, this relativity implies that each actual entity is 'divisible' and 'analysable' in an indefinite number of ways (Whitehead 1985, p. 19). Each actual entity defines its process of becoming relative to its environment, and the actual world can be described in an infinite number of ways, from the perspective of each actual entity. This point is well illustrated by Watts and Chuan-Liang Huang: '…[p]ick up a blade of grass and all the worlds come with it. In other words, the whole cosmos is implicit, and every point in it may be regarded as its centre. This is the bare and basic principle of organic view' (2011, p. 35).

It is worth noting that the quantum mechanics from which Whitehead draws his philosophy do not disprove classical mechanics. They are both correct in describing the laws of nature at different scales, the micro scale and the macro scale respectively. The abstraction of absolute time and space is still useful to study the laws of nature, but it is no longer a primary ontological category, such as the substances. The discoveries of quantum physics are a starting point, but actual occasions or entities as an ontological category are not reducible to the quantum processes. Still, the logic of understanding of these ontological elements is the same—an actual entity is creative, it self-determines its existence, and its self-determination is relative to its occurrence in the concrete universe. Cosmic continuity is derivative from actual entities becoming in conjunction with one another. The process of concrescence implies that each actual occasion is a potential for every becoming in the universe. This real potentiality constitutes the principle of relativity (Whitehead 1985, p. 22). The actual world is a conjunctive concretisation of actual entities. From this relative perspective, an actual entity can be defined as processes enduring in time with one

nexus of becoming in the concretisation of the cosmos (Whitehead 1985, p. 20).

One of the main reasons why Whitehead built a whole new metaphysical system was to demonstrate that the lowest level of nature's activity—the construction of matter—is built on the same processes that operate at nature's most general level—the cosmos. The commonality of these processes allows us to understand how the different scales of reality connect to each other. For Whitehead, basic organisms are 'electrons and hydrogen nuclei' (Whitehead 1967b, p. 110) —they are things that endure thanks to the unity of processes of organisation. If we zoom out from the quantum level, the totality of relationships and actions of molecules constitute the lifespan of a cell; cells and the totality of their relationships constitute the lifespan of organs and so on, up to the self-organisation of a body. The same processes, understood as the interrelatedness of creative actions, constitute the life of a stone or a flower (Hall 1930, p. 34). By examining enduring objects in different localities (scales), we can see that they embody environments within environments that constitute themselves discontinuously and interrelatedly in an act of self-creation through self-organisation. Furthermore, the same understanding of ontological processes is applicable to other scales of becoming: societies, economic systems, ecosystems, etc. It even concerns the cosmic perspective. According to Whitehead's theory, each universe is an actual entity and has a lifespan, and it collapses when the future potential of the totality of relationships is exhausted, giving birth to a new one (McHenry 2015, p. 80).

Organic realism is radically evolutionary.[6] Everything becomes as a creative and contingent adjustment to its environment, including the universe, and the natural laws that emerge from within it. Nature itself is undergoing a process of adjustment to its environment; it is a limited mode of the broader evolution of spacetime that gave the conditions for the laws of nature to emerge (Whitehead 1967b, p. 93). Whitehead argues that the evolution of the laws of nature is concurrent with the existing environment (1967a, p. 112). He advocates that since matter

has a processual character, the laws of nature also undergo evolutionary change. In other words, the laws of nature as we know them are only internal to our cosmic epoch, and will change when our universe dies, and a new one emerges (McHenry 2015, p. 81).

Life and its temporality are the basic characteristics of all existence from the quantum to cosmic scale, including the laws of nature. This is the reason why Whitehead conceives of the nature of reality as organic materialism, rather than mechanistic materialism. Laws of nature are no longer understood as 'eternal laws regulating all behaviour' (Whitehead 1967a, p. 112). Neither are they purely phenomenal causal relations *between* individually existing bodies that do not exist *in* bodies. Instead, Whitehead argues that nature in itself is creativity primary to materially existing bodies. Matter is self-constitutive, and the laws of nature emerge subsequently to the primary processes of self-organisation. Nature actively produces its laws—they emerge as a side effect of processes of self-organisation, and are therefore found in what Aristotle described as temporal and elusive matter.

The question that still needs to be addressed is how organic materialism, in which there is just one underlying process linking all of becoming, deals with the relationship between thought and matter. How does it overcome the bifurcation in the sense of nature that removes the processes of mind from the processes of matter? The short answer is that actual entities, here understood as objects of experience, always have two poles of becoming, mental and physical, which are not to be strictly distinguished from each other. Mental experience is physical insofar as the division between mental and physical experience is purely conventional (Whitehead 1958a, p. 20). In our experience of nature, the sensory impressions appear immediately in our minds; sense perception and sense awareness are two poles of the same process. Objects of experience, actual occasions, emerge instantly from without us as well as from within us, and so nature as a cause and effect of awareness are not qualitatively different, or superior to one another.

A more detailed answer can be derived from Whitehead's inversion of Descartes' body and mind dualism. Whitehead reasoned against Descartes' assumption that a thinker could just have a thought without the processes constituting the actual world. A thought is an object of experience like all other actual entities and it is relative to other actual entities that compose the world. An entanglement of a multitude of actual occasions, objects of experience, endures by establishing relations with other actual entities. A sensory impression and an awareness of this impression are relative, simultaneous and 'mutually arising.' Thus, a thinker is just as much a result of a thought as a thought is a result of a thinker (Whitehead 1985, p. 151).

If we take these two assumptions—that the physical and mental are two poles of the same experience, and that thought can be described by the same processes as matte—and add that actual entities are defined as objects of experience, and that actual entities relating to one another by experiencing one another is all that there is, then organic realism entails *panexperientialism*—the view that all that there is is experience. Whitehead indeed argues that the basis for the existence of *all* (actual) entities is the temporality of their experience (the potentiality of establishing future relationships). Lower entities thoughtlessly obey harmony in aesthetic adjustments, and their experience is manifested through their conformity to immediate reality—there is always an amount of sense-data that each entity must process in order to become. This is true for a stone, a flower, a fruit fly, and a human. What differs between them is the level of certainty with which they act and anticipate the future (Whitehead 1958a, p. 42). The difference between aesthetic adjustments and mental processes is that of the complexity of the sense-data being processed and the capacity to reflect on it. More complex beings use creative determinations which transcend the occasion in question, and this is why they are capable of error and uncertainty. Unlike uncertainty and error, however, experience is ubiquitous. Some form of perception and data processing, even if sometimes very minimal, is foundational to *all* existence.

The relationship between thought and matter is not just of kind but also of origin. The relativity of becoming entails that there was and is a mutual constitution of thought and matter. This changes how we can perceive the relationship between mind and nature. All the ingredients necessary for the construction of more complex organisms with greater mental capacities were already there in the primordial soup. McHenry notes that '[f]or example, it has been shown that amino acids necessary for the development of proteins emerge spontaneously in environments containing more primitive chemical compounds' (McHenry 1995, p. 4). Organic thinking allows us to see continuity in the evolution of the world, in processes that shape both environments and the organisms that emerge from them, against the bifurcation in the sense of nature. Nature as cause of awareness and nature as effect of awareness are one and the same. McHenry explains that mechanistic materialism assumes a rupture between dead matter and organic life processes, making it more difficult to explain nature as 'one ontological type' (McHenry 1995, p. 4). 'Thoughts grow in brains and grass grows on fields. Any correspondence between them is as abstract as between ten roses and ten stones' (Watts and Chuang-Liang Huang 2011, p. 42). Organic materialism maintains that organic processes condition both organic and inorganic life, granting the latter the possibility to actively participate in the processes of the constitution of matter and mind.

Here, the difference between Cartesian ontological mechanicism and Whiteheadian organicism is striking. Once we reject an ontological dualism of body and mind, a mechanistic understanding of reality becomes incoherent. In Descartes' dualism, there is no creativity involved in mechanistic, causal processes, even if they are complex. The creative capacity is given to mind, a qualitatively different substance that resides outside of the mechanistic realm. Thus, a new organisation in a mechanistic system will only come about if it is induced from the outside. Mechanisms are made—they are partitive (Watts, Chuang-Liang Huang 2011, p. 50)—and we can reconstruct them if we follow instructions. In the context of nature, the instructions are never-changing mechanic laws (McHenry 1995, p. 156) that allow for a

smooth operation of clocks and ducks. In mechanistic materialism, as Hui notes through George Canguilhem, life is not recognised as a metaphysical object. Death of a duck qualitatively equals 'malfunctioning of a clock' (Hui 2019, p. 153). In contrast, Whitehead asserts that organic life has an inclusive, metaphysical definition that incorporates molecules, stones, fruit flies, flowers, ducks, clocks, humans, universe, and so on; actual entities construct the continuity of the actual world with the potentiality of their lifespans. Organic realism defines life as the temporality of experience. Nature is not made of parts. Actual entities, organisms, differentiate, meaning that we cannot reconstruct them by putting their parts together. 'A tree is not made of wood; it is wood. A mountain is not made of rocks; it is rocks' (Watts and Huang 2011, p. 50). Matter is based on organic patterns of creative self-organisation, and not just on self-regulations based on sets of instructions. This is evident in the case of biological organisms. We would not be able to find two identical ducks, but we could, of course, build identical-looking mechanisms or produce clocks on an industrial scale. The point is that they are not really identical; they seem identical on a particular scale, but on different scales there is organic life in them, and they *endure* only due to the self-differentiation of these scales. Two identical clocks could have different lifespans depending on temperature and humidity of an environment.

Whitehead reconceptualises mechanistic materialism into organic materialism (organic realism) through his recognition of creativity as the underlying substratum of nature.[7] It is the complexity of relationships that actual entities establish between themselves, and a history of becoming of a given actuality, that results in the self-organisation of the system of nature. Laws of nature are simplifications of these complex relationships, and they historically emerge from them. Because there is no qualitatively different substance that creates—creativity is an aspect of all processes. Nature is governed by processes, here understood as a capacity to creatively (positively) act upon received sense-data. A reaction will still be creative, unique, and dependent on the relationships established by an actual entity in its

environment. In contrast to the Aristotelian tradition and Cartesian theory, it is the concrete world that is the creator. Whitehead notes that the concrete world has a capacity to self-create and self-transcend, where the transcendent refers to the possible future form of an actual occasion (Whitehead 1978, p. 85). Hence, the philosophy of organism removes the abstractly imposed superiority of metaphysics to physics by reconnecting the creative function to all entities.

This section continued to address the first aim of this book—to expose the shortcomings of mechanistic materialism from the perspective of organic materialism. Whitehead's organic realism provides more reasons for a critique of the previously outlined Aristotelian doctrine of matter, Newtonian cosmology, and Cartesian substance dualism. Whitehead was inspired by the discoveries of quantum mechanics—they served as an example of something that he wanted to grasp in his metaphysical system, namely, the temporality of experience of nature. For him the static, absolute, cosmic now and enduring substances are derivative of methods of thinking about nature, rather than ontological categories that resonate with our actual experience. The discoveries of quantum physics were a handy starting point to propose a metaphysical system coherent with not just our experience, but also a conviction that we, as a part of nature, can feel it and know it in itself. The discovery of immaterial energy as constitutive of matter was indicative for him that nature in itself is creativity. Mechanistic materialism describes nature as a passive component of reality, which according to organic materialism amounts to a description of reality that does not reflect our actual experience of nature.

A non-uniform and discontinuous pre-material level of existence also undermines the assumption of classical mechanics that the laws of nature are causal processes between individually existing bodies. Whitehead had grounds to believe that the self-construction of matter is also a construction of spacetime. Therefore, the laws of nature emerge concurrently with the construction of the environment where they are observed, and nature creates rather than submits to the laws

of nature. If there is no absolute space and time, or eternal laws of nature, we can no longer describe reality as it *is.* By switching the perspective to what *becomes*, we are obliged to propose some alternative ontological structure of reality which binds all our experience to something more than elusive existence. The extensive continuum of becoming, and the continuity of the actual world, lies in the real potentiality of all actual entities that contribute to the processes of concretisation of actual reality. Reality is composed of an entanglement of actual entities, defined as enduring objects of experience.

This is a radically evolutionary view where all actual entities become by adjusting to their environments. All actual entities have to process sense-data to be able to come into being by establishing potential relations. However, mental and physical are two poles of the same process of experience, and not distinctive substances. In such a unified conceptualisation of reality, mental and material processes have the same logic of becoming. Groups of actual entities, which are ordered by a common nexus of becoming (giving them a certain form), promote each other's objectification in an analogous way, are self-sustaining, and can be described by a class-name, what Whitehead termed *societies*. Each actual entity in a society contributes to ordering of its environment and is connected to other member of a society by 'reason of the genetic relations between its own members' (Whitehead 1978, p. 90). Examples of societies can be anything: electrons, forests, stones, fruit flies, roses, ducks, clocks, chairs, cosmos, philosophers, economic systems, etc. Societies vary by the complexity of their experiences and capacities to reflect on them. Societies always exist within societies, and the environment of actual entities in which they are embedded must positively contribute to their objectification not to cause a disorder (Whitehead 1978, p. 91). If reality is composed of actual entities and how they relate to one another, then experience is all that there is.

So why is matter organic, rather than mechanistic? Firstly, it is creative and not passive in how it functions in environments. It produces the laws of nature rather than submits to them. Secondly, the

processual nature of things means that matter continuously processes data and must establish relations to endure. These relations are not just between entities but also within them. Thirdly, matter and thought are not the same just in kind, but also in origin. There is just one ontological type of processes linking all the scales of the universe and types of existence. Matter and thought mutually arise, and mind originated from nature. This is why thought, much like life and matter, is elusive.

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3 The Relationship Between Physics and Metaphysics in Organic Realism

Previous sections have drawn multiple connections between physics and metaphysics to make ontological claims. For example, in the case of Newtonian cosmology, physics amounts to a metaphysical system and ontology. The "billiard ball" model of the universe is true on the level of both particles and planets; it indicates how we can conceptualise nature in abstract, fundamental categories, as well as what reality is made of. In comparable fashion, critical claims were derived from quantum mechanics. It was also shown how dualism enforces a mode of thinking in which physics and metaphysics inform each other but are nevertheless describing different types of nature. The method implies that we first observe phenomena, then abstract the notions of substances from them and reason about nature in its eternal forms. Metaphysics as formal ontology gives us the possibility to describe the nature of reality as it *is*. Hence, this descriptive method creates stable metaphysical systems composed of natural eternal attributes. In organic realism, there is no such bifurcation in the sense of nature; there is but one matter. While metaphysics as formal ontology is a useful method of thought to derive laws of nature that apply to certain scales of reality, it does not amount to a primary ontological category. If the laws of nature themselves can change with the evolution of matter, formal metaphysics cannot state eternal truths about nature. Therefore, we cannot say what *is* but rather what becomes.[8] Organic materialism entails speculative and not descriptive metaphysics. Still, creativity as

the ultimate ontological category has been derived from observation of phenomena and generalised into a metaphysical and ontological doctrine. This section will explore the relationship between physics (and scientific discoveries in general) and metaphysics in Whitehead's organic realism. It will also outline the main differences between descriptive and speculative metaphysics.

Although Whitehead's metaphysics and ontology were obviously inspired by discoveries in quantum physics and their implications, he does not argue that all the processes of the cosmos are explainable by quantum physics. Indeed, quantum physics is not ontologically axiomatic for his metaphysics. Whether quantum discoveries will be modified or disproved would have revisionary impact on the system, but it would not necessarily refute it for three reasons—historical, ontological, and one that we can derive from Whitehead's view on the relationship between physics and metaphysics.

From a historical perspective, quantum physics could not be foundational to organic realism because of the timing of the theories: '… the main direction of Whitehead's thought took shape before quantum physics achieved full expression as a mathematical theory' (Folse 1974, p. 1). *The Concept of Nature*, where Whitehead outlines the problem of the bifurcation of nature, was first published in 1920. The systematisation of the philosophy of organism was first expressed in the 1927–1928 Gifford Lectures (published as *Process and Reality* in 1929) parallel to the developments from "old" to "new" quantum theories developed by Heisenberg, Bohr, Schrödinger, and others between 1924 and 1930 (Epperson 2004, p. 121). His works reflect more the general issues of theoretical physics of his time, rather than a particular theory. As presented in depth by Michael Epperson, Whitehead often mixes parts of old and new quantum theory in his writings.[9]

There is of course a strong correlation between quantum physics and Whitehead's metaphysics; the direct influences are obvious, and it can be taken as an exemplification of his system (Epperson 2004, p. 128). Whitehead writes that how the actual entities are constructed

reflects the description of the general principles of quantum mechanics (Whitehead 1985, p. 116). There is an "absolute agreement" between how he presents the process of construction of the basic ontological elements and how it is described in quantum theory. We can find numerous correlations specifically in how their basic ontological elements are contrary to mechanistic materialism and classical physics (Folse 1974, p. 1). Firstly, organic realism entails that there must be something so anything can become, or, to recall the ontological principle, the universe becomes from disjunction to conjunction. This is reflected in quantum mechanics insofar as 'the existing interrelatedness of facts' (Epperson 2004, p. 129) is always presupposed. Secondly, according to quantum theory, we can no longer take single particles as the most basic elements with a defined position in space-time (McHenry 2015, p. 44). Quantum theory is therefore against a materialism that assumes the 'undifferentiated endurance of substances' (Whitehead 1978, p. 78). Whitehead diagnosed this assumption as the 'fallacy of misplaced concreteness', which means ignorance of the level of abstractness necessary for creation of the bare object of science (Whitehead 1978, p. 7–8), along with the 'fallacy of simple location' which incorrectly states the independent existence of individual objects (Whitehead 1978, p. 137). A third overlap can be found in the epochal evolution of a quantum system. Epperson points out that the movement of becoming from potentiality to actuality is similar in both theories. In quantum theory, the process of concrescence moves from potentiality to fact; entities themselves 'arise from antecedent facts (data)' (Epperson 2004, p. 130). This corresponds to how Whitehead views the becoming of the actual world, where the concrete is relative to the real potentiality of the actual entities.

Despite these overlapping points, organic realism diverges from quantum mechanics in the most crucial ontological aspect—the bifurcation in the sense of nature. Quantum physics is not ontologically axiomatic to organic realism per se because they do not resolve the main ontological issue addressed by Whitehead's philosophy. As long as

a scientist simply replaces the notion of substance with the notion of energy, but still takes that notion of energy as 'the object that causes our experience' (Folse 1974, p. 5) rather than 'nature that is the field of experience (Folse 1974, p. 5), she would follow the Aristotelian doctrine of matter, even if the account is processual. The lack of material concreteness does not prevent her from treating the nature that is apprehended in awareness as qualitatively different to nature that is the cause of awareness.

Quantum mechanics is an exemplification of organic realism and helps us understand how Whitehead views the relationship between physics and metaphysics. He found the discoveries in the field to be supportive of the broader thesis that the nature of reality is characterised by temporality, just as our general experience dictates. He believed that metaphysics should account for our experiences of nature, as opposed to stable systems categorising the nature of reality. Speculative philosophy (such as organic realism) is 'the endeavour to frame coherent, logical, necessary system of general ideas in terms of which every element of experience can be interpreted' (Whitehead 1978, p. 4). Philosophical investigation starts from particular observations but the generalisations derived therefrom should have applications beyond the particular empirical evidence in question (Whitehead 1978, p. 5). The method starts from specific experiences of nature, to then form general sets of hypotheses and perform further observations to identify potential differences (Whitehead 1978, p. 5). Throughout the process, imaginative rationalisation should consistently test potential inconsistencies. Thus, metaphysics forms a general hypothesis and a scheme of thought that unifies experiences of nature. What is more, metaphysics is an interpretative apparatus that enables interconnections between specific scientific disciplines and general understandings of the processes that constitute reality. To elucidate this relationship, Whitehead compares metaphysics to a genus, while 'the special schemes of sciences are the species' (Whitehead 1958b, p. 76). Organic cosmology interprets the discoveries of quantum physics, so they contribute to general speculations about the nature of reality.

Speculative metaphysics turns cosmology into a method; it becomes a theory of knowledge that is also a theory of life. If a cosmological system does not account for life, then it perpetuates the dualism in the sense of nature. To reiterate an earlier point, life has an inclusive definition of the temporality of experience. A cosmological explanation is metaphysical only insofar as general processes function on all levels of a system (Whitehead 1958b, p. 61), but these processes are deduced from within the system, and are not treated as unchanging categories. This is a distinctive method of thinking about metaphysics. According to the Aristotelian doctrine of matter, reasoning is linear—we observe nature, abstract the eternal attributes, and then create categorisations which are unchanging. Nature as contained in the secondary matter must bend to these categories. In organic realism, metaphysics is underpinned by recursive thinking. We observe nature, generalise abstracted processes, and, when they no longer reflect our experience of nature, we revise the metaphysical categories. A metaphysical system should revise its own vocabulary if it is no longer applicable to the sciences, bending language ever closer to our experience of nature. The language of logic no longer accurately describes reality. Metaphysics, just like life, is characterised by the temporality of existence. If we encounter some experience of nature that is unchanging (other than creativity which is the driving force of change, and the objectified actual occasions as the moments of time in the actual world, 'drops of experience')[10] (Whitehead 1978, p. 18), then the metaphysical system should be revised to reflect this finding. It is a system of thought that evolves synchronously with the nature of reality; a thought or an idea conceptualised in a metaphysical system is relative to the concretisation of actual reality. Thus, the theory of knowledge becomes the theory of life as we experience it.

Whitehead argues that the methods of physics based on the bifurcation of nature are irrational in how dogmatically they approach the impossibility of the existence of factors outside of the primary notions of a theory (1978, p. 6). Newton 'disclaimed metaphysics' because he was satisfied with the physical principles that he

established, principles that have since been subverted. The role of speculative (revisionary) philosophy is precisely to 'challenge the half-truths constituting the scientific principles' (Whitehead 1978, p. 10), and test the meaning of the core concepts of science. According to McHenry, this is the main difference between descriptive and speculative metaphysics. Descriptive metaphysics is a 'self-contained activity' that does not adjust to the new scientific realities, and the speculative metaphysics is 'on a continuum with science' (2015, p. 4). Descriptive metaphysics that remains unmoved in the face of actual events that can undermine its first principles does not pass the test of practical applicability. Philosophy is full of such nostalgic metaphysical systems even though it is difficult to imagine a situation where science becomes expressed in such a way that it is no longer possible to question its first principles. In other words, if the laws of nature emerge out of environments, and these environments themselves change, then the dynamism of the metaphysical system itself is a necessity of realism.

In summary, organic realism entails a specific relationship between physics and metaphysics. Firstly, it cannot be argued that process metaphysics is reducible to quantum physics, and quantum physics is not an ontological axiom in Whitehead's theory. This is clear for historical and ontological reasons. He developed his philosophy simultaneously to the discoveries of old and new quantum theories, and quantum physics per se does not resolve the main issue addressed by organic realism, namely, the bifurcation in the sense of nature. Speculative thought also entails a specific relationship between physics and metaphysics. The specificity of this relationship is another reason for a critique of mechanistic materialism from the perspective of organic materialism. Metaphysical systems do not arise from particular scientific discoveries, but rather from the general experience of nature, which includes scientific experiments. We can be inspired by science or nature in general. A speculative metaphysics is on a continuum with actual reality, revising its categories whenever a new inconsistent observation arises. Speculative metaphysics is characterised by

recursive thinking, rather than the linear thinking that is present in descriptive types of metaphysics. The second important difference between descriptive and speculative metaphysics is that descriptive metaphysics gives the formal understanding of nature explanatory priority, ontologises primary substance, and treats its essential attributes as eternal truths. The point of speculative metaphysics is to test totalising tendencies, and to challenge the first principles of every science. Finally, speculative metaphysics amounts to cosmology: the theory of life is the theory of knowledge. Creativity, temporality, and change in experience are core to life and the systematisation of thought.

The critique of totalising metaphysics that is present in continental political theory is applicable to descriptive metaphysics. This metaphysics is atemporal, serves as the ultimate categorisation of reality, and thus excludes and limits creative theorising. By contrast, the method of speculative metaphysics based on the temporality of experience aims to constantly challenge its own first principles. At the same time, it is an explanatory framework of how different branches of the sciences connect to one another. Speculation assumes a plurality of metaphysical systems that are valuable for as long as they succeed in describing the nature of a given locality and its material reiterations.

Later in this book, drawing on Whitehead and Schelling, I develop biological organicism as a speculative theory. This theory should be understood as a form of speculative metaphysics, as I do not provide a descriptive, exhaustive, or complete system, but an interpretative framework for how different branches of sciences co-evolve. It is speculative in the sense that it treats both scientific truths and metaphysical hypotheses on a continuum with change, where any part of the system, or the whole thing, can be disposed of if it does not correspond to our experience. In this sense of speculation, we can make positive statements about what is without claiming that it provides the ultimate description of reality. Therefore, the proposed theory is not atemporal or absolutist.

The criteria for the usefulness of metaphysical hypotheses should be pragmatic. As the main argument will be developed throughout the

book, I will demonstrate how metaphysical constraining of our thinking has consequences for how we relate to technology and organise political, socio-economic systems. Here, metaphysics is not treated as existing independently from its spatio-temporal iterations, such as thinkers, books, scientific communities, institutions, and organisations of societies. Metaphysics is an outcome of technically mediated practices, and they shape practices. Since I come out of the assumption that we must schematise our experience into systems of knowledge, or otherwise our thoughts and lives would dissolve into chaos, there has to be a way of doing metaphysics that is not negative, only critically stating what it should not be. We have to rethink metaphysics positively —how we can approach it in a creative way that encourages diversity of thinking against reductivism and political totalisation of these systems. Hence, speculative metaphysics must result in pluralism due to both realism, as we encounter much of it in practice, and pragmatism, because in practice, it has meaningful consequences that produce diverse realities.

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4 The Paradox of Freedom in Nature

Previous sections presented mechanistic materialism and Whitehead's organic materialism as its critical counterpart. The outlined Aristotle–Descartes–Newton lineage ended in a description of the Kantian approach to the systematisation of nature, characterised by a method of thinking where we study observable phenomena (secondary nature), and we can also conceive of nature a priori (primary nature), but we do not know what really grounds the existence of things. This systematisation of nature inhibited a paradox in which the mind is capable of knowing eternal truths about nature but we cannot experience nature in such form, as we eventually perish. Kant was aware of this peculiar relationship between mind and nature and contained it in the antinomy of teleological judgement, the 'mutual exteriority of nature and freedom' (Grant 2008, p. 17). How can the mind be free (to explore eternal truths), and not free (subject to the

necessity of the laws of nature) at the same time? In the *Critique of Teleological Judgement* Kant outlines the antinomy as follows:

> The **first maxim** of the power of judgment is the **thesis**: All generation of material things and their forms must be judged as possible in accordance with merely mechanical laws.
>
> The **second maxim** is the **antithesis**: Some products of material nature cannot be judged as possible according to merely mechanical laws. (Kant 2000, p. 258).

Kant resolved this problem of freedom in nature in a Newtonian manner by keeping the mechanistic causation as purely phenomenal, established externally to individually existing bodies. Freedom, as a primary attribute of the soul, contained in the soul itself, is "untouched" by the laws of nature. The laws of nature cannot affect the depths of the mind directly; they only act as impressions on our bodies (observable phenomena). His solution is, yet again, based on a bifurcation in the sense of nature, where nature as a cause of awareness is different in kind to nature as apprehended in awareness. Not everyone was satisfied with this resolution, and it remained a subject of discussion (Grant 2008, p. 17). Alternative resolutions to the antinomy that appeared in post-Kantian philosophies of nature initiated organicism and process ontology in modern, Western philosophy (Hui 2019, p. 2–3). Here is why the philosophies of Schelling and Hegel are important for our investigation. They managed to address this antinomy by disposing of substance, embracing organicism, *and* (partially) overcoming the bifurcation in the sense of nature. However, their philosophies are very different to each other and studying them reveals distinctive types of organic approaches to matter. They also inspired Whitehead's organicism. He references Schelling (Whitehead 1964, p. 31), and *Process and Reality* was written in conversation with British Idealism (British Hegelians), especially Francis C. Bradley whom Whitehead credits in the preface (Whitehead 1978, p. XIII).

There are many differences between Schelling's and Hegel's metaphysics, but only a few are important from the perspective of the problem at hand. Schelling's materialism embraces a speculative approach and biological organicism, while Hegel's materialism is based on descriptive metaphysics and machinic organicism. The way in which nature is conceptualised again translates to different relationships between thought and matter, between mind and nature. As they both worked on resolving the antinomy, the relationship between thought and matter is shaped by the problem of presenting a coherent metaphysical system where freedom (of thought) is part of the system of nature (unfree and subject to mechanical laws). Can thought enclose the nature of reality in its unchanging form (descriptive)? Or is nature free to escape rigid thinking (speculative)? While addressing these issues Schelling and Hegel were at the same time concerned with the self-organisation of matter, and the system of nature. Is nature free and creative, or subject to mechanical laws? Despite these overlapping questions and concerns, we see major differences in how their metaphysics unfolded. Importantly, the paradox of freedom of nature is conceptualised with a very specific understanding of freedom itself. It is framed as a relationship between recursivity and contingency.

It must be underlined that in this and the following section the analysis is based on the framework developed by Hui in *Recursivity and Contingency*, and this is because I use his categorisation between biological and machinic organicism. Hui categorises Schelling's and Hegel's organicism as biological and machinic respectively (Hui 2019, p. 86). My contribution in this chapter is that I link Hui's categorisation of metaphysical systems with those present in Whitehead's and McHenry's works outlined in the previous sections: between descriptive and speculative metaphysics. The analysis in these sections differs from Hui's works insofar as I examine Schelling's and Hegel's philosophies with the question of the bifurcation of nature. I also draw from Hui's works in how I use the concepts of recursivity and contingency as the analytical tools to unravel differences in mechanistic and organic understandings of matter. The laws of nature are

understood as recursive movement, and contingency is freedom. For example, in Kant's system, nature is mechanistic, and in its realm there is no freedom, i.e., there is nothing contingent. However, before moving on to the final section on ontology and metaphysics, it is important to define a number of concepts for the sake of coherency in the interpretation of the complex Romantic philosophies of nature.

Freedom. The tension of Kant's antinomy is critical for a philosophy of organism, and it must set itself free to avoid necessitarianism. For any systematic metaphysics, it is quite complicated to build a completed system without a denial of freedom (Schelling 2006, p. 9). As such, a metaphysical system must challenge the limitations on thinking that it creates. The concept of freedom is a speculative idea, and we will look at its definitions on different levels. The idea of freedom engages in different processes of becoming or being. Hegel's reductionist approach to nature, in which the becoming of nature is superficial, grants freedom to *being*, rather than *becoming*. For Hegel, freedom *is* in a pure form in the Absolute, but there is also an objective freedom of human individuals, and subjective freedom in nature which he immediately opposes to the freedom of Reason. In Schelling's approach, all *becoming is free* rather than *being.* Freedom is granted to all *actants* in nature, and it is a central condition for all becoming as well as for the system of nature itself. In Schelling's late works, this definition is expanded to include the moral aspects of the experience of freedom. Whitehead also sees freedom in *becoming* rather than *being* and explains freedom as a metaphysical category in the ninth Categoreal Obligation, i.e., the Category of Freedom and Determination, which dictates that an 'individual actual entity is internally determined and externally free' (Whitehead 1985, p. 27), and also in the context of history as the 'practicability of purpose' (Whitehead 1967a, p. 66). The many ways in which freedom will be redefined aim to show the specificity of freedom in process philosophy, and to present freedom as a process intertwined with becoming. An examination of freedom by the organisation of systems will allow us to think freedom in nature, to recognise its

natural creativity as a drive of a system, and to show how the organic organises itself.

Recursivity and Contingency. Hegel's metaphysical system is a prototypical example of organised organicism (Hui 2019, p. 45). In this form of recursion, contingency is necessary for the system to function and improve; contingency is a function of being examined by logic and does not equal freedom. In Schelling's philosophy, recursion is between two contingencies, *natura naturans* (nature as productivity, nature as a subject) and *natura naturata* (products of nature, nature as an object). Recursion from nature as a subject to nature as an object encloses the system from bifurcation to bifurcation as a struggle of difference against indifference (Hui 2019, p. 56). Life, therefore, is the struggle of organisation against dissolving into chaos (disorganisation). In this form of recursion, contingency is a stage to which a system must return in order to progress; contingency is a core pillar of becoming and equals freedom. Whitehead defines the concept of recurrence (rather than recursivity) in relation to endurance. In *Adventures of Ideas*, endurance (Whitehead 1967a, p. 41) is a mere recurrence of occasions, a persistence, exhibiting the minimum of creativity insofar as mere recurrence is a repetition in the line of physical ancestry (Whitehead 1978, p. 104): '…the art of persistence is to be dead' (Whitehead 1958b, p. 2) (e.g., inorganic matter). What brings life its novelty is the creativity of nature, the contingency of actual occasions. Freedom is the creative synthesis of the universe (Whitehead 1978, p. 27) with which the actual occasions come to life.

Becoming and Being. A need for a broad definition of these two concepts arises from the nature of freedom in process ontology. Process ontology can be broadly defined as one in which it is becoming that constitutes being. This contrasts with substance ontology, in which being constitutes becoming. For Schelling, Hegel, and Whitehead, whose organicisms are based on process ontology: the actual world is a process, and this process is the becoming of the world. Being is coming back to oneself. It is a form of recursion to oneself as a constitution of continuation. In Hegel's philosophy, there is also something that just *is*,

and it is the Absolute Idea, logic, which navigates the unfolding of the universe. For Whitehead, being *is* only as creativity and the actual world with its potential of becoming. Similarly, for Schelling, what *is* is the potential of productivity of the actual.

The first three sections of this chapter described the differences between substance and process ontology, speculative vs descriptive metaphysics, and mechanistic vs organic materialism, based on Whitehead's critique of the doctrine of matter in science. The next section will complicate these distinctions by showing how other organic philosophies can draw across these categories. The above outlined definitions will become useful in explaining how organicism (e.g., Hegel's system) can retain a machinic outlook on nature and does not overcome the bifurcation in the sense of nature, despite being processual.

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5 Modern Types of Organicism

Hui claims that the notion of organism has conditioned modern philosophy ever since Kant overturned Cartesian mechanism. The *organic* was an answer to the 'antinomy between mechanical laws and freedom' posed by Kant and it progressed from German Idealism to thinkers such as Whitehead (Hui 2019, p. 2–3). Philosophies of organism explore this antinomy by unifying nature and mind, and in so doing enable an analogical approach to the organisational and operational structures of *cosmos* and *logos*. Recall the previously outlined definitions of *cosmos* (a world which we are able to observe/the order of things) and *logos* (the theories of how we can describe cosmos in a reasonable, organised way). In the Aristotelian tradition *logos* referred to formal metaphysics. The observable cosmos is organised by logos but does not creatively contribute to its actualisation insofar as it was set in motion by the Primus Motor. Thought has been in a distinctive realm to matter. Organicism and a processual understanding of matter changes this relationship. Cosmos and logos are mutually constitutive, and cosmology becomes a

philosophical method for a simultaneous exploration of the system of nature and mind. As the antinomy and divisions collapse, freedom can be explored through the observation of nature's becoming, and the conditions of such becoming. Freedom no longer constrained to the primary understanding of nature, and matter embedded in the secondary nature, must compromise the necessity of the laws of nature and the infinite becoming of the cosmos within the singularity of finite beings and the principle of creativity. The infinite *becoming* of continuity which brings forth the reality of temporal *beings* reframes the problem of freedom within the question of the difference between becoming and being. Hence, the problem of freedom and its relation to the organic can be understood through the recursivity of nature and its contingent forms. Thus, the concept of freedom can be analysed in the context of nature, as a product of nature, as nature itself and as its inherent drive. In cosmological approaches, nature is a ground of becoming but also a means of explanation—as Schelling remarks, '…to philosophize about nature means as much as to create it' (2004, p. 5).

Taking the cosmological approach to nature implies analysing the concept of freedom within the ongoing self-differentiation of the universe which nature exhibits. We can therefore look at nature from two perspectives: as a free subject, which actualises itself, and as an object within which freedom is observable. This understanding of nature was appropriated by post-Kantian German Idealists from Spinoza (Knappik 2019, p. 129). Spinoza believed in just one infinite substance constitutive of the universe. God/Nature in its subjective, freely actualising, productive form (*natura naturans*, which can be only explored in theory) and Nature/God in its objective form (*natura naturata*, the products of nature which are studied by empirical science). Unlike Descartes, Spinoza disregarded substance dualism. However, his positing of an infinite substance that is equivalent to God turned freedom into necessity. The Spinozist understanding of nature inherits the problem of 'necessitarianism'—'the view that everything that is actual is necessary' (Knappik 2019, p. 130) and, by extension, that there is nothing contingent in nature (Ethics IP29, Spinoza 1996, p.

20). It is documented that Hegel and Schelling read and discussed *Letters on Spinoza* by Jacobi, which sparked their interest in Spinoza's definition of substance and its modes as a means to overcome Kant antinomy (Lucas 1986, p. 40–41). Both of them developed their distinctive process philosophies as critiques of Spinoza against Kant.[11] They aimed to resolve both Spinoza's necessitarianism and Kant's antinomy of freedom in nature without repeating substance ontology. Similar to Whitehead's thought, their philosophical systems overcome dualism with process ontology and a reinterpretation of the relationship between thought and matter. However, Schelling's and Hegel's metaphysics disagree on numerous points. We will now explore their ontologies to see exactly how they overcame the paradox of freedom in nature and the differences in their organicism.

Hegel's dialectics emerged as a critique of determinism in Spinoza. Hegel viewed Spinoza's necessitarianism as a result of self-negation of the infinite substance by finite beings. He reasoned that if: (1) substance is infinite and holds all possible modes of being; (2) there is no contingency in nature; and (3) all that is actual is necessary, then (4) all that is actual and *determined must be a negation* of the one substance. If finite beings had to negate the infinite substance to exist, their existence would be dependent on infinite substance. Therefore, its negation would either make their existence illusory or disprove it. A Hegelian reading of Spinoza is acosmic insofar as the *finite* world is an illusion projected by the one *infinite* substance. Following Yitzhak Melamed, Hegel's critique is based on the faulty assumption that Spinoza derives modes of being from the essence of infinite substance (Melamed 2010, p. 81). Melamed argues that Spinoza's modes result from the definitions of things, that is, from their properties (*propria*). These properties and definitions flow from the infinite substance and are affirmative to the existence of their essence. No negation is supported by the doctrine of the *conatus* by which all definitions affirm the infinite essence (Melamed 2010, p. 83). This inaccurate critique of Spinoza was for Hegel foundational to the processual understanding of his own system. To resolve the trap of universal unfreedom and acosmic

illusion, Hegel substitutes the eternal subject-substance with the subject-process, preserving what he thought was Spinoza's method. The Hegelian doctrine 'every determination is a negation' is derived from his interpretation of Spinoza's monism (Melamed 2010, p. 83). Hegel's deep appreciation of what he called *immanent dialectics* is a key to unlock the intertwinement of recursivity, contingency, and freedom and see how they set forth the processual reality (Lucas 1986, p. 45).

How is it, then, that in Hegel's system nature is both necessary and contingent, and how does the interrelatedness of freedom and determination form a process of becoming? In Spinoza's understanding, the infinite subject and nature are the same substance—Hegel substituted this substance with the process of becoming of an infinite subject (determination as negation), thereby separating the infinite subject (*natura naturans*) from its finite forms in nature (*natura naturata*). By creating this processual distance, Hegel removed what he conceived of as the self-negation of the system. For Hegel, process is the self-actualisation of the universe as a free subject and this subjectivity of the universe is primarily unnatural and represented by the Idea (or synonymously by a 'cosmic spirit'). This Idea existed prior to nature, but it is present in the dialectical unfolding of the cosmos (Harris 1986, p. 22).

This processual distance between the logical Idea and nature is constituted by a distorted identity of the cosmos. Hegel frames the *immanent dialectics* in an immanent reflection (Hui 2019, p. 86). The Idea, by 'reflecting on the ground of its existence, (…) recognizes that its existence as absolute necessity must contain in itself contingency' (Hui 2019, p. 101). Thus, the contingency of nature is necessary to affirm the freedom of the universal subject-process (Hui 2019, p. 14). It is worth underlining again that, in Hegel's *panlogical* system, the process of becoming is rooted in the Idea. The Idea *is* known by the notion of Reason, and the self-actualisation is a recursion of this notion forming what is actual through the dialectical movement of negation. The recursion, navigated by the Idea, gives *form* to what is necessary for the progression towards the Absolute, in which the cosmic spirit restores

its identity. All determinations in nature, which are negations of the cosmic spirit, result in alienated products of the ideal. Following Slavoj Žižek's interpretation of Hegel, these alienated forms of the ideal resemble it, but as they undergo a constant change in the self-actualization of the cosmos, they *appear to us* as 'perturbation of accidents' (Žižek 2007, p. 129). Over the course of history, the products of nature are organised into temporary harmonies through the force of Reason, but as the reproduction continues the cosmos will never return to its original state. Žižek explains that this recursive movement is not, as some Hegelians claim, the cosmos returning to its original unity, but rather it creates new harmony in which all contingencies are consummated (Žižek 2007, p. 105). The recursive movement is driven by the consumption of what is irrational, contingent, and unreasonable. In both of the interpretations, the self-organisation of the cosmos encloses contingency. What seems to be an accident is in fact a necessity for the realisation of the becoming of the cosmos on its path towards the Absolute. The conjunction of the Hegelian cosmos is therefore teleological, insofar as Reason ablates all contingency until the completion of history in which all that there is *is*. The end of history is the Absolute and static cosmos, and Reason drives this process until it arrives at the fatalistic end of this journey. The predestination of the universe as a subject is determined even if the path of self-differentiation towards it is contingent. Hui, similarly, explains this driving and formal role of Reason. Contingencies are necessary for bringing forth the realisation of cosmos in nature and history. Reason has to integrate them in order to progress (Hui 2019, p. 11).

Concluding on this process of becoming in Hegel's system, and how it situates nature, it must be emphasised that a free creative act is *not* the foundation of the system of nature, and nature as such is freedom-driven only to the extent that the Absolute Idea is pure freedom. For the alienation of natural products, the difference between their becoming and being is that of contingency and recursion. A difference generated in dialectical determination creates a certain asymmetry between the becoming of the organic and the organising notion (Hui 2019, p. 93),

and this asymmetry is that of freedom. The organic becomes in the same way as the organising, i.e., structurally and operationally (Hui 2019, p. 86). However, organic becoming is organised by the Notion (the harmony of knowledge reflecting actuality). Hui argues that 'Hegel's logic anticipates a machinic organicism' (Hui 2019, p. 86), not to be confused with the philosophy of organism as such, but rather a particular expression of such a philosophy.

Quite perversely, to achieve his processual standpoint, Hegel employed Aristotle in his critique of Spinoza by granting nature a purposeful activity (Lucas 1986, p. 42). Hui explains this using Hegel's example of a plant's growth from a seed. All the information about the future form of the tree is imprinted in a seed. Its growth is a recursive movement to itself through the contingencies it must overcome. 'For what is to become, already is; or the becoming is this merely superficial movement' (Hegel 1970, §346a). Hegel's Aristotelian understanding of the formal cause and purposeful activity of nature is striking, but we can also note that here *being* is a recursion of form, and that being comes back to itself without exercising freedom. Nature is purposeful insofar as it is logical, as there is a *formal cause* in nature. Nature is purposeful because it is in-formation.[12] Freedom, for Hegel, is necessarily part of becoming only for the subjective, unnatural, and *infinite* universe (*natura naturans*) but not for the objective natural and *finite* forms of it (*natura naturata*). As Hui notes, Hegel sacrifices nature for the affirmation of logic (*Tod des Naturlichen*) (Hui 2019, p. 12). In the panlogicist approach to the system proposed by Hegel, nature is annihilated and subordinated to the negation of immanent dialectics.

Hegel elevates freedom to a central organising concept only in his social philosophy (Patten 1999, p. 4). The 'cosmic spirit' is nevertheless an inseparable dimension of freedom as the pure form of rational freedom is the cosmic spirit (Patten 1999, p. 23). Rational freedom is an actualisation of pure freedom in its contingent forms over the course of history only insofar as human individuals can reflect on their freedom objectively (Patten 1999, p. 24). Only through rationally overcoming natural desires, by raising them to objectivity, can human individuals

actualise the pure freedom of the cosmic spirit (Patten 1999, p. 51). In this way Hegel differentiates freedom between its subjective and objective forms, where the subjective refers to natural desires. Non-rational, subjective freedom is given by nature, a natural determination (Hegel 1983, p. 216). Non-rational freedom is therefore an illusion of freedom that is present in nature.

Hegel proposes a unique resolution to the Kantian antinomy of freedom in nature. Kant overcame it by maintaining Newtonian cosmology, and mechanistic causality, where thought and mind remain free because the laws of nature only affect the body; causation is external between individually existing bodies, which perpetuates the bifurcation in the system of nature. Hegel's ambition was to create a system of nature of which freedom is a coherent and integral part. Inspired by Spinoza, he intended to search for a non-dualistic solution. He knew that just relying on substance monism would not be helpful because of the necessitarianism that it entails. The solution was to change Spinoza's universal substance into a universal process. This process is the unfolding of the cosmos (or productive nature understood as a subject) driven by dialectics. Despite the introduction of a processual ontology, Hegel still follows the Aristotelian doctrine of matter. Primary nature is infinite logic, and the finite secondary nature submits to the logical formation of matter. The main difference between Aristotle's or Kant's dualisms and Hegel's processual ontology is how they understand causation. Logic and Reason penetrate bodies and can be found in the things themselves. The unfolding of the cosmos in its objective form, the products of nature as we see and experience them, have the logic of becoming embedded in them. Causation is no longer external and between individually existing bodies, but in and within them, as a mesh of relations that construct temporary harmonies (Notion). The unfolding of the cosmos towards the absolute means that all the products of nature submit to the purpose of the formal cause. We can find freedom in nature, but it is illusory insofar as all contingencies have to submit to the necessity of logic. As the only products of nature that can access logic with their minds, humans can enjoy the actual

freedom of the cosmic spirit. The human mind has distinctive qualities that help us access eternal truths about it.

Hegel's metaphysics is descriptive as he provides an absolute, completed cosmological system. It is based on process ontology, but the formal logic which it reflects cannot be changed. The necessity of contingency in the process (the freedom of nature) is enclosed and does not allow for the opening of an entirely new metaphysical system. At the same time, panlogicism offers a new relationship between thought and matter, and mind and nature. We can find reason in how nature fulfils its formal purpose; causation is found in bodies themselves, and we know what grounds their existence. Although nature is reasonably organised, there is no reason in it. It organises like our minds but has no mind of its own. Contingency found in matter submits to the laws of nature. This is why Hegel's organicism (matter self-organises itself) is machinic. Just as in modern machines, an algorithm will incorporate any contingencies in order to improve itself and progress, and this process of becoming has a pre-defined finality. As Hui explains, such a recursive algorithm can be found in all machine learning (2019, p. 14).

In Hegel's nature, and in self-learning machines, there is freedom that allows for creativity, but it is limited, and it cannot challenge the rules upon which the system is built. This differs to how mechanistic materialism or a clock functions where the process of self-regulation does not result in any creativity and there is no overcoming of contingencies, only linear, external causality. With the reconceptualisation of the relationship between thought and matter Hegel moves from seeing nature as a passive mechanism to a partially active machine. His view is somewhere in between the Cartesian outlook on nature and Whitehead's organicism in which creativity can overcome the laws of nature or the logical rules of the metaphysical system itself. But does Hegel's conception of the relationship between mind and matter overcome the bifurcation in the sense of nature? As with quantum mechanics, a simple replacement of substance with process does not deal with the problem. The answer to the question

from Hegel's viewpoint retains an Aristotelian doctrine of matter in his processual understanding of the cosmos. Mind still has qualitatively different capacities to the secondary bodily matter that allows it to access the cosmic spirit. Reason was also primary to finite existence. Therefore, Hegel's machinic organicism does not resolve the bifurcation fully. There is thought in matter, and matter can be partially free to create. However, thought and matter are still different in kind and origin.

Having outlined how Hegel resolved the paradox of freedom in nature, and how it moved him away from mechanistic materialism to machinic organicism, we can now move on to Schelling's solution. Schelling and Hegel both propose process philosophies of organism; their systems of nature might seem conceptually close, and Schelling's works often suffer from being read as Hegel's beginnings. In the English-speaking world, Schelling was largely forgotten and his works were usually read in relation to Hegel's *Phenomenology of Spirit* (Writh 2005, p. 5). What also impoverished the impact of Schelling's philosophy was the proximity of the concept of nature in Schelling's and Spinoza's works, often leading to the conflation of Schelling with Spinoza in Hegel's critique (Lucas 1986, p. 43). Martin Heidegger notes that Hegel appreciated the *Freedom Essay* as a piece of speculative philosophy that stands alone, but that he missed the key point of how freedom is foundational to his philosophy of nature (1985, p. 13). Another interpretational confusion in the secondary literature arises from Žižek's reading. He offers a Hegelian reading of Schelling, and focuses on the *Freedom Essay*, when he relates freedom to an essence lying outside of becoming, creating a figure of the "vanishing mediator." For Žižek, freedom in Schelling's philosophy is experienced as a choice between good and evil in a finitude, and is characterised by a struggle to overcome self-predestination in order to be freely against what we have already always been (Schelling 2006, p. 43). Žižek recognises freedom as a timeless act (not related to history) but he also conceives of finitude exclusively as an unfulfilled dimension of a human individual's becoming (Žižek 2007, p. 19). Since we have contextualised

the problem of freedom in Spinoza and how it unleashed process thinking in German Idealism, it would not be accurate to claim that Schelling develops a philosophy of freedom from the *Freedom Essay* onwards. Here, I lean more towards Heidegger and Hui's assertion that the *Freedom Essay* is 'based on the system of nature which he [Schelling] constructed in the earlier days' (Hui 2019, p. 68). I will therefore primarily refer to the *First Outline* where Schelling makes it clear that the existential aspect of freedom constrains all nature, and that there is no essence outside of nature's productivity.

Like Hegel, Schelling turned to Spinoza when he first attempted to resolve Kant's paradox of freedom in nature. However, he did not reject him as easily as Hegel did. Schelling identified himself as a Spinozist, especially in his early works (Hui 2019, p. 63). In *The First Outline of a System of the Philosophy of Nature,* Schelling claims that *natura naturans*, the productive nature as a theoretical concept, and *natura naturata*, nature as an object of science, are the same thing. 'Nature as a whole is (…) at once the cause and effect of itself' (Schelling 2004, p. 202). With this appropriation of Spinoza, Schelling was aware that he inherited the problem of necessitarianism. As his works became an elaborate response to this question of 'blind necessity,' freedom became central to his metaphysical system (Knappik 2019, p. 130), and his natural philosophy unfolds on freedom as the ground of nature (with the exceptional contingency of the laws of nature).[13] To deal with the necessity resulting from Spinozist substance monism, he went in the opposite direction and substituted it with a freely creative process. In this regard, his philosophy is also contrary to Kant's transcendental idealism and Hegel's absolute idealism, which took the processes of logic as necessary and primary to freedom in nature. Schelling's process ontology is therefore closer to Whitehead's. Where Whitehead sees void as creative, Schelling views pure freedom as an abyss. It is the source of creation, the ground of nature and a primordial fact of contingency (Žižek 2007, p. 15–16). The first radically contingent act of the cosmos was to freely create itself in a new form. Freedom coincides with necessity in the act of self-positing, in a recursive contraction of

the two contingencies of *natura naturans* and *natura naturata* which produces reason. Reason is hence a product of the necessities of nature, but these necessities themselves are contingent (Hui 2019, p. 64). Schelling can be interpreted as an intermediate thinker between idealism and post-idealism concerned with finitude and contingency (Žižek 2007 p. 8). This intermediacy of Schelling's thought takes shape in the *universal organism*—the emergence of nature in a free form allows his analysis to focus on its productive force. For these reasons, it is important to read Schelling as a realist, who aside from systematising nature gives new methodological tools for investigating natural phenomena that embrace freedom as the primary aspect of all becoming, and who, by stretching the ontological grounds of his own system, overcomes duality (Writh 2005, p. 8), introduces difference in a form of progressivity rather than contradiction (Deleuze 2014, p. 250), and reevaluates the fatalism of finitude. It is this search for *the unconditioned in nature* (freedom) that leads Schelling to the discovery of the first dynamic of nature— the contraction of nature against itself.

Natural forces produce and reproduce, and everything emerges from this perpetual contraction. Freedom as a concept unfolds as a tension between being and becoming for all nature, to become creatively, against the recursion of natural laws, in the act of self-position of *the universal organism*. Nature's self-actualisation depends on its contingent and indeterministic acts of freedom as a subject (*natura naturans*) and also on the free acts of its products (nature as an object, *natura naturata*). Schelling grants the agency of self-differentiations to *actants*, where a simple actant is understood as an 'absolutely productive character' of nature. Nature's productivity is infinite and 'because an infinite product evolves in Nature as object, there would have to be an infinite multiplicity of simple actants, thought as the elements of nature and of all construction of matter' (Schelling 2004, p. 5). Subsequently, he recognises that there must be both '*freedom* (mutual independence) and the greatest linkage (reciprocal dependence) of actants to one another (Schelling 2004, p. 32). There are many productive natural forces at play in a given

product, and that is why[14] the products of nature seem to be at once accidental and a concretisation of *blind necessity*. However, he underlines that 'in every individual actant is an activity that strives to *freely* develop—according to its nature. Its receptivity for or restrictedness by all others, really lies in the tendency to *free development* of its own nature' (Schelling 2004, p. 34). Schelling's nature is therefore characterised by the interrelatedness of all actants in the universe, which composes universal becoming, a feature common in different types of organicism. What is specific to his system is this free development of nature, in which freedom comes as self-differentiation, as a becoming from difference to a difference. The products of nature constitute themselves by recurring to their own intensive production, but this recursion is itself contingent. Schelling derives this definition of freedom from gravitation theory and the chemistry of his times, which also resonates with Whitehead's metaphysics and method. He generalises the experience of nature of some specific branches of science to understand what connects becoming on different scales more broadly, and concludes that the freedom in which all actants freely adjust to changes in their environment is the overarching process which drives the process of the becoming of the cosmos.

Taking another example from nature, Schelling often uses a figure of a whirlpool in which natural forces are constantly trying to suck becoming (difference) back into chaos (Žižek 2007, p. 105) (indifference) and this figure presents itself somehow against the fine line of Hegel's logical spiral in which the asymmetry helps push the progress upwards. For Schelling every organism is like a whirlpool: it constantly transforms, inhibiting the productive forces of nature. Every object of nature is at the same time a material iteration of the productive forces of nature, meaning that nature that we can observe inhibits the original pure identity; there is no distance between *natura naturans* and *natura naturata* (Schelling 2004, p. 18). Unlike in Hegel's system there is no distortion of cosmic identity or alienation of the products of nature.

The whirlpool depicts a few pillars of Schelling's system: it shows the processual understanding of matter, the crucial importance of self-differentiation as a production of novelty, and the force of nature as a factor shaping all the products of Nature in its totality. Nature becomes as a self-differentiation of itself without creating an asymmetry between the regulatory notions of the system and its products. We could see that this asymmetry was generated in Hegel's system by the unnatural notion of Reason. For Schelling, freedom and reason are non-rational and nonanthropogenic. Reason entangled in the self-realisation of the universe is *a product of nature*. Thinking is nothing else but a production and reproduction of thoughts. Whatever is produced anew inhibits the original creative force within a single organism, as much as other products of nature do (Peterson 2004, p. xviii). Because of this totality of nature, in which everything becomes through the medium of the organism, as a result of two contingencies, *natura naturans* and *natura naturata*, there is no causation from outside of a system. Hui describes Schelling's understanding of general organism, and the type of organisation of his system, as *organising organic*, and claims that Schelling's system can be classified as biological organicism, a prototype of ecological thinking whereas Hegel's system, his machinic organicism, is a precursor of cybernetics (Hui 2019, p. 86).

After critiquing Hegel's unnatural conception of the origin of thought and reason, Schelling dismisses Hegel's unnatural approach to freedom. For Schelling, natural appetites and desires are also just another example of natural creative forces. They are necessary for self-preservation and survival of every existence; they are the driving forces of self-creation. It would therefore be inaccurate to claim that they are added characteristics to pre-formed organic forces (Schelling 2006, p. 43). In Hegel's reductionist approach, the freedom that can be found in nature is superficial. It is not a real freedom as it is subject to the necessity of desires and appetite. Humans are free because their Reason allows them to reflect on their desires, e.g., create social institutions to control them. In Schelling's approach, desire and appetite are part of the creative productivity of nature. Freedom is

universal to all actants in nature insofar as they can freely create themselves anew through self-differentiation, which does not have to be dialectical and does not need reflection. Reason is therefore a product of the creativity of nature, in the same way as desire and appetite.

Schelling's metaphysical system is speculative. The ontological process is recursive, between productivity and products of nature, but this recursive necessity is based on contingency and freedom. Therefore, the system can overcome the rules upon which it is based and there is no longer a pre-defined finality. The results are never completely defined like, e.g., in evolution (Hui 2019, p. 14). A process ontology where there is no necessity underpinning the logic of the process itself can be classified as biological organicism. Matter self-organises (organicism) but there are no mechanistic rules (where there is no creativity at all, e.g., Descartes' clock) and no machinic rules (creativity is allowed within the pre-programmed rules, e.g., Hegel's panlogicism and self-learning machines). Schelling's understanding of matter is incompatible with mechanistic or machinic conceptions of matter. Biological organicism is also the type of philosophy that resolves the bifurcation in the sense of nature. Mind and other products of nature have the same origin—the productivity/creativity of nature primary to matter. There is also no underlying necessary process (logic, laws of nature), and metaphysics can also be overcome by natural creativity. Thought and matter are also the same in kind. Mind does not have any superior qualities that allow it to suppress the temporality of experience. There is only one nature that is cause and effect of awareness.

This section explored how Hegel and Schelling dealt with Kant's paradox of freedom in nature by constructing process ontologies. Their approaches were methodologically cosmological. The unfolding of the cosmos as the main ontological process explains operational and organisational structures, how matter and thought relate to each other, and how that relation positions the mind in the broader system of nature. To contextualize freedom in the cosmological process of

becoming, we can study the products of nature as interior to the self-organisation of the cosmos. Freedom is processual, and it can be explained as a process between becoming and being in the self-organisation of the cosmos. Freedom is a component of the cosmos; without freedom the cosmos cannot recreate itself into a novel form. Such systematisations of nature can inhibit a problem of (pre)determination. Freedom in Hegel's and Schelling's systems can be understood through the notion of contingency—opposed to Spinozist necessitarianism, which claims that there is nothing contingent in nature. Although freedom and contingency are not mutually explanatory and are not equal (more contingency does not equal more freedom), the more *actual* contingency in a system, the broader the definition of nature (e.g., reason is natural and not unnatural). In Hegel's system, the cosmos is full of contingency, but it all must be consummated by a dialectical process. Contingency in nature means a superficial, limited freedom. The full enjoyment of freedom is reserved for unnatural Reason. For Schelling, everything is based on actual contingency, and everything, including thought and reason, is a natural product.

The ontological processes of *synholon* and *logos* in Hegel's system are asymmetrical and repeat an Aristotelian dualism in the sense of nature. Even though nature is contingent, it is not able to exercise freedom. This is because freedom remains formal, and therefore not natural. By virtue of the formality which navigates change, Hui rightly classifies Hegel's system as a type of machinic organicism, where contingency, although necessary for progress, is not foundational to mechanical laws. Nature is primarily formal (*logos*). Here, the teleology of a system is important insofar as, in a system of a pre-defined finality, improvement is understood as progress which consummates natural contingency. In contrast, in Schelling's system, progress is more chaotically organised, materialism is fully organic, and natural necessities are contingent. In biological organic materialism, change can be understood less formally—as the movement from difference to difference against indifference. This sort of understanding of evolution

is specific for biological organicism as an environment seeks conjunction now, rather than in the future when progress reaches its pre-defined finality. The self-organisation of the cosmos is therefore understood differently depending on how we conceive of contingency and the relationship between mind and nature.

Chapter 1 outlined the reasons for a critique of mechanistic materialism from the perspective of organic materialism. Firstly, mechanistic materialism entails a paradoxical conception of nature where on the one hand we can produce universal and atemporal truths about nature, and on the other hand we cannot feel what really grounds the existence of things, or what causes the laws of nature to be. Secondly, these truths based on the 'bare object' of science do not reflect our actual, temporal, and relative experience of nature where things constantly change. We are limited and we perish. Thirdly, unlike mechanistic materialism, which is linked to descriptive metaphysics, organic materialism can be anti-dogmatic. Organic materialism that employs speculative metaphysics tests totalising tendencies to challenge the first principles of every science. Moreover, I presented the case for biological rather than machinic organicism. If we retain machinic description of nature in organic materialism (as in Hegel's approach), there is a risk of preserving the fallacy of the bifurcation in the sense of nature, which is self-defeating for the main premise of this critique. Hegel's metaphysics, despite being based on process, is descriptive, rather than speculative, because Reason which navigates the dialectical logic of the unfolding of cosmos cannot be changed by the contingencies of nature. The presented critique of mechanistic materialism is to formulate a philosophy of nature that brings back a theory of knowledge to the theory of life. It is impossible to achieve it if we continue to treat nature that is cause of awareness as separate in kind to nature that is an effect of it.

It is peculiar how philosophies of nature tend to distance us from our experience of it. We developed a habit of taking nature as apprehended in awareness not only as alien but also as superior to the nature in which we live. Perhaps the harsh environmental conditions

we have had to deal with have made nature seem inhospitable and alien. The triumph of our intellect to manipulate and shape nature as we wish when operating on the logic of solids revealed an appealing kinship of logical thought and unorganised matter (Bergson 2005, p. xix). The pervasive belief in special (god-like) qualities of the mind explains the dominance of a mechanistic understanding of nature in the Western tradition of philosophy. Descriptive metaphysics, dualisms, and mechanistic materialism shaped philosophies of nature from Aristotle to Kant, and then continued in Newtonian cosmology as the axiom for classical physics and scientific methods more broadly until the twentieth century. Some attempts to reconnect mind with nature were made by Romantic thinkers, but their ontologies have not had much of an impact on scientific methods. Hegel's metaphysics offers *machinic organicism*, where we find Reason in the secondary, bodily matter, but it still necessarily submits to logic. Logic is necessary and we can access it only because of the special qualities of the mind. Such thinking about recursive processes in nature is prototypical to cybernetics. Schelling's and Whitehead's biological organicisms are based on the immaterial creative processes of becoming where thoughts and matter are temporary and our minds, having nothing but our experience of nature, can only speculate. Biological organicism is therefore a form of realism where how we construct knowledge is grounded in our actual experience of nature—it is contingent and has no pre-defined finality. The recursive processes in biological organicism as found in Schelling or Whitehead are prototypical to ecology. The next chapter will continue an exploration of speculative metaphysics by moving on to epistemological issues. Speculation based on organic materialism will be presented as a philosophy of science.

References

Aristotle. 2016. Metaphysics. Translated by C.D.C. Reeve. Indiana Polis and Cambridge: Hackett Publishing Company Inc.

Athanasopoulos, Constantinos. 2010. "Ousia" in Aristotle's "Categories". *Logique et Analyse* 53

(210): 211–243.

Balme, D. M. 1939. Greek Science and Mechanism: I. Aristotle on Nature and Chance. *The Classical Quarterly* 33 (3/4): 129–138.

Bergson, Henri. 2005. *Creative Evolution*. New York: The Modern Library.

Deleuze, G. 2014. *Difference and Repetition*. London and New York: Bloomsbury.

Epperson, Michael. 2004. *Quantum Mechanics and the Philosophy of Alfred North Whitehead*. Fordham University Press.

Folse, Henry J. 1974. The Copenhagen Interpretation of Quantum Theory and Whitehead's Philosophy of Organism. *Tulane Studies in Philosophy* 23:32–47.

Graham, Daniel W. 1987. *Aristotle's Two Systems*. Oxford: Clarendon Press.

Grant, Iain Hamilton. 2008. *Philosophies of Nature after Schelling*. London and New York: Continuum.

Hall, Everett W. 1930. What Use are Whitehead's Eternal Objects? *The Journal of Philosophy* 27 (2): 29–44.

Haring, Ellen S. 1956. Substantial Form in Aristotle's "Metaphysics" Z, I. *The Review of Metaphysics* 10 (2): 308–332.

Harris, Errol E. 1986. The Contemporary Significance of Hegel and Whitehead. In *Hegel and Whitehead, Contemporary Perspectives on Systematic Philosophy*, edited by George Lucas, 17–28. Albany: State University of New York Press.

Hegel, Georg W. F. 1970. *Philosophy of Nature* Vol. 3. Translated by M. J. Petry. London: George Allen and Unwin

Hegel, Georg W. F. 1983. In *Die Philosophie des Rechts: Die Mitschriften Wannenmann (Heidelberg 1817-1818) und Homeyer (Berlin 1818-1819)*, edited by K.-H. Ilting. Stuttgart: Klett-Cotta Verlag.

Heidegger, Martin. 1985. *Schelling's Treatise on the Essence of Human Freedom*. Athens, Ohio, and London: Ohio University Press.

Hui, Yuk. 2019. *Recursivity and Contingency*. London: Rowman & Littlefield International Ltd.

Jaeger, Werner. 1948. Aristotle. Translated by Richard Robinson, Oxford: Oxford University Press

Johnston, Mark. 2006. Hylomorphism. *The Journal of Philosophy* 103 (12): 652–698.

Kant, Immanuel. 2000. In *Critique of the Power of Judgement*, edited by Paul Guyer. Cambridge: Cambridge University Press.Trans. Paul Guyer and Eric Matthews.

Kant, Immanuel. 2004. Prolegomena to Any Future Metaphysics; with selections from Critique of Pure Reason. Edited by Gary Hatfield. Translated by Gary Hatfield. Cambridge: Cambridge

University Press

Knappik, Franz. 2019. What is Wrong with Blind Necessity? Schelling's Critique of Spinoza's Necessitarianism in the *Freedom Essay*. *Journal of the History of Philosophy* 57 (1): 129–157.

Lobkowicz, Nicholas. 1989. Substance and Reflection: Aristotle and Hegel. *The Review of Metaphysics* 43 (1): 27–46.

Lucas, Hans-Christian. 1986. Spinoza, Hegel, Whitehead: Substance, Subject and Superject. In *Hegel and Whitehead, Contemporary Perspectives on Systematic Philosophy*, edited by George Lucas, 39–60. Albany: State University of New York Press.

McHenry, Leemon B. 1995. Whitehead's Panpsychism as the Subjectivity of Prehension. *Process Studies* 24:1–14.

McHenry, Leemon B. 2015. *The Event Universe; The Revisionary Metaphysics of Alfred North Whitehead*. Edinburgh: Edinburgh University Press.

Melamed, Yitzhak Y. 2010. Acosmism or Weak Individuals?: Hegel, Spinoza, and the Reality of the Finite. *Journal of History of Philosophy* 48 (1): 77–92.

O'Hara, Michael. 2019. Transversing States: A Reflection on Digital Technology and Simondon's Critique of Hylomorphism. *Culture, Theory and Critique* 60 (3-4): 226–227.

Patten, Alan. 1999. *Hegel's Idea of Freedom*. New York: Oxford University Press.

Peramatzis, Michael. 2015. What is a Form in Aristotle's Hylomorphism? *History of Philosophy Quarterly* 32 (3): 195–216.

Peterson, Keith R. 2004. Translator's Introduction. In *First Outline of a System of the Philosophy of Nature*, edited by Friedrich W. J. Schelling, xi–xxxv. Albany: State University of New York.

Riek, C., P. Sulzer, M. Seeger, et al. 2017. Subcycle quantum electrodynamics. *Nature* 541:376–379.

Röck, Tina. 2024. Encountering genuine change. Reflections on speaking about what is in movement. *Manuscrito, Campinas* 47:2–35.

Schelling, Friedrich W. J. 2004. *First Outline of a System of the Philosophy of Nature*. Albany: State University Press of New York.

Schelling, Friedrich W. J. 2006. *Philosophical Investigations into the Essence of Human Freedom*. Albany: State University Press of New York.

Shatalov, Keren. 2020. Hypokeimenon Versus Substance. *The Review of Metaphysics* 74 (2): 227–250.

Spinoza, B. 1996. Ethics. Edited. and Translated by Edwin Curley. London: Penguin Books

Watts, Alan, and Al Chuang-Liang Huang. 2011. *Tao: The Watercourse Way*. London: Souvenir Press.

Whitehead, Alfred N. 1958a. *Symbolism; Its Meaning and Effect*. Cambridge: At the University Press.

Whitehead, Alfred N. 1958b. *The Function of Reason*. Princeton: Princeton University Press.

Whitehead, Alfred N. 1964. *The Concept of Nature*. Cambridge: Cambridge University Press.

Whitehead, Alfred N. 1967a. *Adventure of Ideas*. New York: The Free Press.

Whitehead, Alfred N. 1967b. *Science and the Modern World*. New York: The Free Press.

Whitehead, Alfred N. 1978. In *Process and Reality; An Essay on Cosmology*, edited by David Ray Griffin and Donald W. Sherburne. New York: The Free Press.

Whitehead, Alfred N. 1985. In *Process and Reality; An Essay in Cosmology*, edited by David Ray Griffin and Donald W. Sherburne. New York: The Free Press.

Witt, Charlotte. 1987. Hylomorphism in Aristotle. *The Journal of Philosophy 84* (11): 673–679.

Writh, Jason M. 2005. *Schelling Now: Contemporary Readings*. Bloomington: Indiana University Press.

Žižek, Slavoj. 2007. *The Indivisible Reminder: On Schelling and related matters*. London and New York: Verso.

Footnotes

1 *Hypokeimenon* is a broader term than *ousia* because not every logical subject is a primary substance (Shatalov 2020, p.235).

2 For Descartes space is a bodily extension and for Newton space holds without anything external (McHenry 2015, p. 32).

3 This a major advance of Aristotle's ontology insofar as Aristotle was not an atomist.

4 'Capacity is understood as a potentiality/power to affect or be affected—change' (*Metaphysics* Δ12 1019b14–27) (Aristotle 2016, p. 83 and 207).

5 Interestingly, an Aristotelian critique of Newton would be similar. Aristotle claims that there is nothing but actuality, but potency is everywhere (Whitehead 1985, p. 40).

6 Not in a Darwinian way, which is explained in Chap. 4.

7 It is worth underlining here that in Whitehead's cosmology creativity is primary even to the concept of God.

8 We could say that only creativity simply *is*, since it is an ultimate category in Whitehead's process philosophy. This notion will be discussed in more detail in Chap. 3.

9 Epperson notes that Whitehead's intentional mixing of the elements of the "old" and "new" quantum theories does not cause substantive issues, as the "new" theory subsumed the "old" one (2004, p. 125–127).

10 Eternal objects could be also added to this list, but they are complex concepts which I approach critically and in detail in Chap. 3.

11 Both Schelling and Hegel are also critics of Fichte's philosophy of identity.

12 In Aristotelian mechanicism, *synholon* acts purposefully because it contains information about how it is formed (Balme 1939, p. 135).

13 His critique of Spinoza is drawn from Leibniz's understanding of exceptional contingency of laws of nature, but with exclusion of overrationalisation of God. For Schelling God is the purest love who requires a ground for his existence (Schelling 2006, p. 41–42).

14 Schelling explains this through a notion of *inhibition* which I will for now omit.

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3. Onto-Epistemology and Speculative Science

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1 Speculation as a Method in Organic Systematisation of Nature

Philosophies of nature observe the interrelated processes of becoming as causal relationships and describe them as laws and tendencies, and while their interest lies in systematising nature in general, philosophies of organism emphasise the self-organising aspect of nature as a whole. Here, a cosmological bias complicates a problem with philosophies of nature, namely, the continuation between knowledge about the world and the world as we experience it. How can dynamic nature be systematised into rigid categories of knowledge? The previous chapter delineated the rigidity of thinking in substance-based ontologies, and how dualism in the sense of nature causes a division between theories of knowledge and theories of life. The lineage of the substance-based theorisation of reality has also been traced back to the Aristotelian tradition[1] and its reinforcement has been found in Descartes, Newton, and Kant. This lineage, synthesised by Whitehead in his criticism of the natural sciences, encloses what we can know about nature into two

rigid categories—one is the cause of awareness, and the other is a result of it, leading to the *bifurcation of nature*.

Substance-based cosmologies illustrate a cosmos composed of two distinct domains—metaphysical and physical. Because of this dualism, its comprehension of nature is unachievable through sense-perception only, as the "essence of being" is only accessible to a mind, if at all. Hence, the philosophy of nature and science is concerned with phenomena and representations. If we intend to access nature beyond that, we have to turn inwards to follow a subjectivist-epistemological transcendentalism, and its 'isolation of physics from metaphysics' in accordance with the Kantian metaphysical turn (Grant 2008, p. 5). Therefore, in this tradition of thought, we can only explore nature in its entirety through two qualitatively different processes. In this way, mechanistic materialism and descriptive metaphysics create an epistemological distance between nature that is experienced bodily and nature that is enclosed in thought. Here, the problem of the sensual inabilities of perception refers to the dualism between the natural phenomena (enclosed in the hylomorphic understanding of nature) and logos (the theories of how we can describe cosmos in a reasonable, organised way), as framed by an Aristotelian legacy. The separate study of physics and metaphysics is therefore a logical continuation of dualistic cosmology (Table 3.1).

Table 3.1 The bifurcation in the sense of nature in dualism

Process ontology overcomes this dualism by resolving the paradox of freedom in nature. The introduction of a cosmological process into the systematisation of nature not only affects ontology but also epistemology insofar as the dynamism of perceived reality forces us to speculate on the previously established categorisations of being. Before returning to Whitehead's organic materialism and the speculative empiricism that results from it, this chapter will first look into how modern organicism reintroduced a speculative approach to physics and the philosophy of nature. The processual understanding of the

foundation of natural laws and the becoming of nature proposes speculation as a method for the systematisation of knowledge that can close the gap between nature and mind.

As Grant notes, Schelling resolves the Kantian antinomy of teleological judgement, where the claim that mind operates under the laws of nature contains a paradox of freedom, precisely by situating the productive forces of nature in matter. Philosophy of nature becomes redefined as a study of the *in itself,* where 'conceptual genesis and natural genesis become one' (2008, p. 19). Cosmos and logos reconcile: processual thinking introduces speculation that overcomes the dualistic stratification of knowledge because the cosmological-ontological process of becoming indicates that there is a common genesis to physics and metaphysics. It is this realisation that 'oneself and nature are one and the same process' that is crucial for an epistemological turn that rationalises non-descriptive methods (Watts and Chuang-Liang Huang 2011, p. 32).

This chapter is therefore concerned with the fact that the reconceptualisation of freedom, and subsequently of the mechanical (e.g., mechanical laws of nature), changes not only the cosmological order, and ontological substratum, but also how we conceive of the problem of natural knowledge that cannot be viewed outside of the question of the genesis of the mind. Essentially, in the Western tradition, whatever we classify as functioning but not free, organised but not organic, falls under the category of the mechanical, and ultimately becomes excluded from ethics and/or moral thought.[2] At the same time, disciplines that study natural phenomena, see themselves as separate from metaphysics. Nevertheless, the cosmological approach of this book rejects the very possibility of such a separation. This is a significant turn for what we typically understand as the philosophy of nature because it mixes the categories of knowledge established by the tradition that takes substance as an underlying structure of the universe. It is also what distinguishes organic approaches. Although, there is no one exhaustive answer to how to include metaphysics in physics or how to consider epistemology through historicity, the issue

is resolved by speculation as a method in the case of processual thought.

Similarly to the previous chapter, we will look at nuances between different approaches in organic thinking—machinic organicism and biological organicism. Any form of organicism assumes that the mechanical is organised in the same way as the organic. However, in Hegel's system, as an example of machinic organicism, it is not necessarily assumed that nature has a mind, but it will be assumed that nature is in the mind and that nature is as organised as our minds. This assumption implies that causal relationships can be understood as machinic—i.e., as a transfer of motion between objects (Stone 2013, p. 61). In Schelling's materialism, as in biological organicism, the mind has a natural explanation, which is observable in nature even if only to minimal degrees. After establishing how the ontological turn to cosmology and process changed the epistemological problem in Schelling and Hegel—we will look at what general set of rules characterise Schelling and Whitehead's philosophy and how they correspond with more recent issues in epistemology. Throughout these sections, speculative methods will be contextualised in the contemporary debates such as speculative realism and new materialism. New materialism can be considered a form of speculative realism. Leon Niemoczynski points out that Hegel inspired Meillassoux's challenge to 'follow the path of speculation rather than criticism or dogmatism' (Niemoczynski 2017, p. 35). As Meillassoux's speculative materialism is anti-absolutist (Niemoczynski 2017, p. 53), it will also be important to differentiate his approach from Hegel's absolute idealism. The previous chapter explained in detail why all contingencies are necessary in Hegel's cosmos—here we will define contingency epistemologically through Meillassoux's correlationism. Correlationism or a correlationist circle is defined as a lack of possibility to 'abstract from the real the fact that it is always-already given to an entity, and that since it is not possible to think anything that would not always-already be given to' (Meillassoux 2008, p. 37). In the speculative realism debate, Meillassoux's speculative materialism can

be contrasted with Grant's speculative idealism/transcendental materialism. His reading of Schelling constitutes another kind of speculative approach to the philosophy of nature. This book argues in favour of biological organicism, and so it will support Grant's approach to the issue complementing it with Whitehead's speculative onto-epistemology. Grant's call for speculation 'turns directly to nature as a main domain of inquiry' (Meillassoux 2008, p. 111). This issue has already been addressed by Whitehead's cosmology.

Overcoming the dualism in the sense of nature, forced by the common genetic root of physics and metaphysics, causes complications as it establishes a radically naturalistic understanding of both the mechanistic and the transcendental. Having a theory that encompasses mechanistic laws with the organisation of natural life and the transcendental, risks mutually exclusive claims, absolutisations of a perceiving subject, and some underlying vitalist force. The cosmological approach to epistemology based on biological organicism will also explain how the actualisation of physical laws is not problematic for speculation as a method for the construction of knowledge.

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2 Schelling's Philosophy of Nature and Speculative Physics

The problem of freedom and the mechanical laws in a systematisation of nature is a study of causal processes. In general, philosophies of nature look beyond the systematisation of laws and search for forces behind them, asking, e.g., what causes these laws? This descriptive (or speculative) side of their philosophies is heavily qualitative, placing nature on the spectrum of mechanistic, machinic, organic, mind-like, or mystic and vital elucidations. Alison Stone explains that some philosophies of nature conceive of naturalism[3] as a mechanical materialism and some, on the other end of the spectrum, are supranatural (anti-naturalist), relying on the intervention of something transcendental (Stone 2013, p. 60). Naturalism in post-Kantian German Idealism varies, and this variation is dependent on the freedom of

human and inhuman forms. The question of freedom in nature has to be posed within causal processes and takes the following form—when nature is stripped of all determination (forces), and possibilities of becoming (productivity) and the actual (its products), what remains? Schelling's understanding of freedom unfolds precisely from this suspension of ontology between the indifference of an abyss (chaos in a form of pure contingency), the production and reproduction of difference (*Logos* as necessities of nature), and its becoming (the actual) (Žižek 2007, p. 106). I believe this is what Lao Tzu had in mind when he said 'heaven does without doing through its purity, earth does without doing through its calmness' (2010, p. 105). The pure freedom found in the void, the absolute contingency, is the ground of all cosmic processes. The calm abyss is the force of the immense differentiation of nature. They ground natural phenomena in the same way that they ground the freedom of philosophical inquiry. Hence, freedom is a point of departure in the search for natural knowledge. Schelling reiterates this in the *First Outline of the System of Nature*, often stating that, to find the truth about nature, we must find it in its unconditioned form, free from any determination, insisting that it is impossible to look at the world in its *unconditioned* state as it *is* (2004, p. 202). As he famously states: '[n]ature should be Mind made visible, Mind the invisible nature' (1988, pp. 41–42). It is the mutual origin and constitution, the commonality of thought and matter that allows us to systematise it, not the supranatural quality of the mind.

This section will first explain Schelling's method of speculation that led him to believe that the underpinning process of productive nature is self-differentiation. Then, it will be shown how Schelling reasoned that this process is an origin for thought and matter. The concept of the organ will become central to his organic universalism, as a point of communication between many parts of the system of a universal organism. An organ is a sensible actuality that receives and produces difference. A universal organism is a figure depicting the cosmos as we know it and an organ is any locality within it. An organ is physical and metaphysical; it can be viewed as a pre-material process of

construction of matter and how thoughts emerge out of a recursive process in nature. Subsequently, we will see that Schelling argues for speculative realism in science, and how his method can be contextualised in the debates surrounding new materialism.

It is through "digging in this ground" that is freedom, the transcendental geology becomes a Schellingian method of finding "the truth" about nature. The search for the unconditioned is an inquiry into the "geological processes of mind and nature" simultaneously. Transcendental geology might sound like a strange combination but it is meant to capture the material and inorganic origin of thought. If we, as finite human subjects, are to comprehend nature in its infinity, we have to conceptualise it through natural processes that are in themselves infinite (or at least as old as *natura naturans*). Grant notes that for Schelling, freedom is the concept that inhibits our attachment to the evolutionary forces of the system of nature and its underlying abyss, it is the source of practical intelligence, insofar as freedom has been present in the productive, contingent series of events from a rock to a life. Human intelligence is in this case a practical iteration of the 'self-operation of the ground' or the 'will of the deep' (Grant 2008, p. 203).

Following Grant's interpretation, Schelling's theory of freedom ungrounds nature in two ways (Grant 2008, p. 203) by analysing the intensive, dynamic, and generative through retrospection of systems which are particular, finite, and concrete. Physical laws are first ungrounded from the particular system being analysed. Secondly, after ungrounding the laws from their (contingent) actuality, it ungrounds them again from what preceded the actual system (Grant 2008, p. 204). What preceded the actual system are productive forces, i.e., the production of difference. These productive forces are qualitatively the same for both the organic and the machinic. The motion that scientists observe in nature (the heavens and the earth doing) is a form of rest from that productivity and is secondary and derivative to the productive forces of nature (pure contingency and abyss). The analysis of mechanical motion in nature only treats what is not original and

primitive (Schelling 2004, p. 196). Mechanical laws describe nature partially, in an abstraction from the underlying cause of nature (ignoring the self-production of matter or intensity of natural forces). However, this does not mean that we should abandon our investigation of nature as soon as we realise that a study of mechanical laws does not provide the answer to what causes them nor that we should retreat inwards to metaphysical categorisations of observed phenomena. Instead, Schelling's method implies turning outwards, deeper into the experience of nature. We can observe how the second ungrounding deconstructs the potential dualism of Schelling's organicism. Phenomena and Logos come from the same geological root—from the same ground. Whereas in substance metaphysics the structure of dualistic ontology dictates that the second order of understanding nature—the knowledge of bodily and sensible (phenomena)—should submit to the first order (the pure knowledge of logos), in Schelling's organicism we find principles of natural knowledge in the experience of the concrete and *sensible*. The natural production of difference is a common root for the emergence of physical laws and the basis of thinking. The common ground of becoming asserts that there are no ontological asymmetries between body and mind. There is no regulatory force acting on the organisation of the cosmos other than the memory of the abyss which figuratively depicts the possibility of disorganisation.

Here the main notion of organicism, namely, organisation, defined by the functioning of organs in a *universal organism*, becomes crucial to understanding how one process can explain both nature's ontological structure and the construction of knowledge. Schelling's proto-ecological thinking takes the cosmos as one system, where we can explain any part of that system through one type of recursive model, and in which all parts of the system are interrelated and together compose the universal organism. In other words, the universal organism is a system of nature. An organ of a universal organism is a point of connection that allows for communication in that system between its many parts through sensibility and irritability, often

understood primitively as a physical reaction. Schelling derived the processual understanding of reality from chemical, electric, and magnetic forces that are constantly productive through a contraction of oppositions. By describing how they shape the natural world he synthesised the core, universal process—as a constant differentiation (Schelling 2004, p. 79). Although the chemical, electric, and magnetic forces constitute different orders of nature (according to Schelling's knowledge of science), the operation of the recursive process of differentiation can be synthesised as the same for all of them (which is why we can ignore Schelling's lack of knowledge of contemporary science). The point of speculative metaphysics is not to derive metaphysical axioms from the first principles of some sciences, but rather to see how they can contribute to understanding reality as we experience it more broadly. Science has evolved since Schelling's times, but the experience of nature can still be explained by the generic recursive process he conceptualised. Schelling claims that the operational structure of differentiation permeates through the original heterogeneity (productive forces in the void), the electrical and chemical processes, and the organic sensibility, and thereby all levels of nature are co-constitutive (2004, p. 10).

A synthesised recursive process in a natural system is embodied in the function of an organ, where "organ" is understood as an actual form of organic matter, and the principle of construction of matter itself. An organ is both—physical and metaphysical—it is a self-organisation (the production of matter) and a general principle of organisation in a system as a whole. The core of the recursive model is the concept of an organ, which depicts a unification of oppositions and the production of difference as the point in which the system ascends to a new form of organisation. An organ unites differences for a system to progress in a non-dialectical way (Hui 2016, p. 77). It stabilises the physical system of the cosmos insofar as it lets differentiations unite and progress, and it opens a metaphysical system to speculation as the production of difference is its only universal category. The figure of an organ is meant to depict how we can conceive of the physical and the metaphysical as a

process that is qualitatively the same. The difference between the two is organic, but not that of a different logic of becoming, and so we can access the "essence" of nature through sense perception. Further enquiry into natural processes gives us information about the general functioning of the mind. Hence, practical reasoning is also a source of knowledge about nature. The recursive model serves as a reminder that we cannot construct knowledge about nature without nature: that thought and matter are common in structure and origin. As Ben Woodard bluntly puts it: '[n]ature has to be in order for something like us to exist at all' (2019, p. 36).

The universal differentiation of nature is based on the sensibility of organs. An organ is both a recipient and a producer of difference in a system. It maintains a system by fulfilling its function and at the same time by adjusting to the received difference. In other words, once an organ receives a difference, it does not only react to it, but it also alters its functions accordingly. A difference in its functioning then also produces difference to which other organs must adjust. The organic process of self-organisation (and production of matter) is fundamental to the unfolding of cosmic becoming. Schelling notes that: 'the actuality of the dynamical process for every individual product is conditioned by communication, which takes place in the universe to infinity' (2004, p. 186). Therefore, if we take the system of nature as a form of a cosmic organism, and each locality in that system as an organ, the functioning of an organ can never be abstracted from the system of nature as a whole. An organ holds *the potential for differentiation and the possibility of actualisation*. An organisation of the system of nature is therefore a continuum of organic functions (Schelling 2004, p. 53) that facilitate an actualisation of the system of nature (Woodard 2019, p. 75). The systematisation of nature reflects its organic organisation. Their sensibility cannot be detached from the production of nature's ontological structure or ignored in the systematisation of knowledge. Organs then play a role in how we systematise natural knowledge. Organic epistemology is an analysis of the possible rather than actual. The question of onto-epistemology is—how *can* it be?

It is worth summarising here the assumptions in Schelling's philosophy of nature that are foundational to speculation as a method for physics and metaphysics and to a consideration of epistemology through ontological categories. First, in recursive processes, nature acts as a cause and effect of itself. This axiom of universal organicism entails that everything, including metaphysics, arises from nature. A metaphysical and physical organ is therefore conceived of as the same not only structurally (as an organic way in which matter, and a system of knowledge is constructed) but also genetically (as having the same genesis). The overlap of a material organ and its metaphysical conceptualisation is not coincidental, but rather a result of the fact that knowledge is possible because of experience, sensibility. As Grant explains, natural knowledge emerges out of sensing nature; intelligence and consciousness arise and are embedded within it in different forms of subjectivity. Nature is transcendental only to an extent in which the finite intelligence is regionally inhibited in its infinity (Grant 2008, p. 162).

Metaphysics, like anything else, is a contingent effect of the recursion of nature as a subject and reflects it, albeit in an imperfect way. The thoughts and knowledge that can constitute a metaphysical system are constrained by thinking as a finite consciousness is not capable of grasping the infinity of the productivity of nature—'nature is too large for finite reflective consciousness precisely because it is nature that generates it anew with each electromagnetic impulse' (Grant 2008, p. 162). The mechanical and the mind having one evolutionary origin constitutes the core of the organic understanding of the natural world as one mediating becoming. A thought and an object of thought can be described by one recursive model. The natural sciences are therefore reliant on a retrospective method and that is why practical reason comprehends both the metaphysical and physical. Reasoning about nature is a retrospection of the mind into its own successive epochs of becoming. The mind emerges from the many stages of nature's productivity. Thus, the continuation between the

mind of a scientist who systematised nature and natural knowledge is not only that of a method but also that of *genesis.*[4]

Secondly, Schelling's naturalised metaphysics is not materialist as the naturalisation of thought and knowledge is based on a dynamism of forces (as in the attraction and repulsion of electromagnetism)[5] and it does not view matter as a rigid structure of reality. Although naturalised, metaphysics does not require a material basis. It is an ontology of immaterial forces (Hui 2016, p. 78). To put it in other words, it is a meontology, an ontology of non-being. It is the memory of the abyss, the state of the cosmos before the first contraction that is foundational to ontology. Here, recall Whitehead's approach to metaphysics which adds the third, non-material level, to the material-ideal dialectic that accounts for the creative processes that can be found in the quantum physics or in the void. First there are non-material, creative processes, second there is the material concrete experience of nature, and third is the immaterial thought and logic. For Schelling and Whitehead, naturalisation of metaphysics avoids the reductive, flattening materialism because of the ontology of creative nonbeing.

Physics and metaphysics are speculative because of both difference as the driving force of non-dialectical development and the ontology of dynamic forces that precedes materialism. We are not able to observe indifference in the interrelatedness of becoming. Observing nature is in fact an invasion to which nature responds with the production of the observed phenomena (Schelling 2004, p. 197). The mechanistic approach to nature is fragmentary, as it observes nature as a sum of products as if it is 'already prepared and accomplished' (Schelling 2004, p. 201). The totality of products which empiricists investigate is in itself imagined, a thought about the world, and even this thought in itself is in a constant process of production and reproduction. A study of nature should, therefore, focus on this original productive force in its *unlimitedness,* rather than on the limitations of an empirical study. Here, we can refuse again the problem which descriptive metaphysics implies, where nature is not known in itself, and where our linguistic predicates reflect the substantial characteristics of things. The

heterogeneous infinity of the multitude inherent to cosmic organism is the main reason why its metaphysical system has to be open and speculative. Because difference constitutes products, any attempt at description through predicates provides a fragmentary outlook on nature, and a closed metaphysical system cannot inhibit freedom within it without contradiction. Nature, untamed by reason, escapes the systematisation of non-speculative method[6] through self-differentiation. A criticism of hylomorphism—a method that systematises the illusory—is against sameness and identity.[7]

Thirdly, this specific dynamism is anchored in the concept of an organ. This organisational/organic function of nature has its genesis in sensibility (sometimes understood primitively as a physical reaction). Metaphysics is the result of the sensibility of organs and a heterogeneous experience. Forces produce sensibility, embodied by an *organic process*, which is the function of a system that, aside from uniting all systemic contradictions, ascends it to the next form of organisation, and is also a common ground for physics, metaphysics, and aesthetics.[8]

Having outlined these three assumptions, how can we classify Schelling's philosophy of nature? Phenomena are the product *and* the productive (Schelling 2004, p. 197). The productivity of forces results from the ontological, self-organising aspect of the cosmos—all individuals are an effect of the self-organisation of the universal organism. As a result, the determination of the self-organising system cannot be deduced from "the transcendental" but rather from a transcendental within nature. Schelling states that philosophy of nature 'forms a science altogether peculiar, altogether different from, and independent of, every other' (2004, p. 200). As much as there is a place for the transcendental in Schelling's works, he definitely rejects any determination from outside of nature. Nor does he conceive of nature as a passive transmitter of motion. His philosophy of nature is neither naturalist, anti-naturalist, nor transcendentalist. It is a unique clash of organic materialism and ideal realism where ideas are nothing more or less than a mesh of concrete reality (Žižek and Schelling 2009, pp. 10–

11). Ideas are possibilities of actualisation and facilitate differentiation, and are therefore organic. In his reading of Schelling,[9] Grant accurately claims that transcendental geology is a method that proves that what is transcendental is only a surface of the world, the physical, rather than its depths (Grant 2008, p. 205). Not only is transcendence surficial and geological, there is also no substance and no thingness that is out of our reach.

What we observe in nature is the reproduction of forces, the laws of nature are, again, contingent necessities, but life itself is in no way supported by any vitalism. There is no mystic force required for the explanation of natural productive forces insofar as his metaphysics is derived from experience and the principle of organisation and differentiation is derived from the double ungrounding of physical laws. Life is a contraction against indifference (death) in the same way as the mechanic law of magnetism is defined by two contractive forces of attraction and repulsion. Activity itself is conditioned by difference and hence not by any absolute. Schelling moves away from Spinoza's monism by introducing process, and he overcomes the necessitarianism that it entails by demonstrating that all necessities are contingent. Thus, there is no absolutizing of nature as a subject, insofar as the metaphysical system remains open to contingencies that can annihilate it. A thought driven by freedom can comprehend the lack of nature in the form of an abyss and indifference, the memory of which is the reason why nature organises. For the speculative system of Schelling's philosophy, the vitalist explanation of nature is unacceptable not only because it takes us no further in the journey of elucidation but also because 'it is contrived solely as an expedient of ignorance and a genuine product of lazy reason' (Schelling 2004, p. 61). For Schelling, vitalism provides a non-contingent closure to a system that has to be free from necessity that is not contingent.

Meillassoux notes that 'the materialism that chooses to follow the speculative path is thereby constrained to believe that it is possible to think a given reality by abstracting from the fact that we are thinking it' (Meillassoux 2008, p. 36). By contrast, correlationism or a

correlationist circle is defined as a lack of possibility to 'abstract from the real the fact that it is always-already given to an entity, and that since it is not possible to think anything that would not always-already be given to' (Meillassoux 2008, p. 37). Schelling's philosophy of nature can be *somewhat* considered as an example of speculative materialism. His materialism exposes that even though thought is always conditioned by materiality, insofar as there is the principle of the sensibility of organs (physical and metaphysical), materiality is not dependent on how we think it. The speculative aspect comes from an ungrounding of matter and uncovering a non-substantialised nature. Grant underlines that Schelling's speculative physics goes beyond mere representation as process ontology desomatises determination, which is physical and dynamic but reflects organic logic (Niemoczynski 2017, p. 126). Simultaneously, there is no substantialisation of the object of knowledge as there is no substance in the ontology of forces. Facts about nature are not being stated in the predicative manner. Therefore, there is also no absolutisation of the knowing subject. Nature as a subject in Schelling's philosophy is not really an objective subject-object (here meaning the unification of subject-object relation into process monism) as Meillassoux claims (2008, p. 37). Meillassoux's argument fails on a number of aspects of Schelling's reasoning. There is no vitalist hypostatisation of subject-object that would absolutise it as an unchangeable metaphysical truth. Substance is substituted by meontology, the ontology of nonbeing, rather than by a mystic intensity of becoming, and the assumption of vitalism would close the metaphysical system to the possibility of indifference understood as death, annihilation of the system, or the memory of the abyss that drives organisation. Finally, Schelling also rejects any external explanation of nature when he argues that: 'it is an old illusion that organisation and life cannot be explained from natural principles – if it were thus to be said: the *first* origins of organic nature are *physically* inscrutable, then this *unproven* assertion serves only to discourage investigators' (Schelling 1798, p. 71).

Speculation does not abandon the sciences as a way of investigating nature but encourages scepticism towards their application of abstract methods. Woodard explains that 'Schelling rejects givenness as pure or non-conceptual but accepts the givenness of experience as proximate and local' (2019, p. 175). Materiality, sensibility, and reason construct the objects of science together in the location of the scientific apparatus. Schelling provides a sceptical approach to the applicability of knowledge outside of a local context, as he insists on the material basis for ideas (matter is here non-substantialised and based on nothingness). Insofar as ideas are on the periphery of the physical, and have their origin in the real, applying knowledge outside of a locality risks idealistic generalisations. We should not refuse practical reason as a valid way of investigating nature but acknowledge Schelling's statement that nature is untamed by it. Science is speculative and we should be sceptical of its excessive claims. Woodard notes that, according to Schelling, the fields of nature that a science examines correspond to real patterns in nature, but the creation of knowledge as an observation of the 'relation between mind and world (between knowing and being) in terms of extensity, in terms of fields, reveals that creation does not add to an existing world *ex nihilo* but expands the boundary of the known world outwards' (Woodard 2019, p. 176). The production of knowledge about nature is an organic differentiation of what we think of as given. Givenness, in an organic speculation, is formed by an onto-epistemological process. We cannot abstract thinking from the experience of reality insofar as thought and knowledge are produced by organic sensibility.

However, the double ungrounding of experience allows us to think of something outside of the correlationist circle. Schelling's philosophy constitutes a speculative materialism as the becoming of matter is preceded by two grounds—firstly by the intensive production of difference and secondly by the abyss, a form of pure contingency, where neither is metaphysically reified. As there is a common origin to matter and thought, we can non-paradoxically claim that an origin of thought is something that is not given but can be thought of. It is important to

note here that this claim is possible precisely because speculative physics is actually based on a strong cosmological realism. Schelling's materialism of forces can be taken as a cosmological realism insofar as the speculation of physics proves that what there is, is the cosmos, and that it has to be there for something to exist at all (Woodard 2019, p. 6). The production of knowledge is nature that flows through us. Speculative physics is a valid method of production of knowledge because it is nested in a cosmos that is real. This is also why Schelling's philosophy of nature is only a *somewhat* speculative thought. There is a realism present in a strong form, because of the realness of ideas (although as a peripheral mesh of physical experience) and because of sensibility proving the fact that we are what we are because of our concrete experience of the cosmos. Consequently, the opening of metaphysics and the philosophy of nature to speculation should not be taken as a movement against systematic knowledge. It only means that nature takes primacy over thinking, that the system of nature is what constitutes the possibility to produce systems of natural knowledge. 'Schelling, following Grant's reading, [is] a non-correlationist: he claims that nature *is* whether or not we humans exist or think of it' (Woodard 2019, p. 6).

The main goal of speculative science is to doubt a scientific method that generalises outcomes further than its material-experiential basis (a given field of science), assuming that what is real, is real but that it progresses through differentiation. Opposition is a difference that we have not clarified yet, and it can be systematised in an open system. According to the organic principle, oppositions unite in order for a system of knowledge to progress. Basing a philosophy of nature on the concept of freedom reconciles physics with metaphysics but also sets them in a dynamic motion of speculation that results in an onto-epistemology of difference.

To conclude, when we study processes of causation, we study a specific material locality. Only through the double ungrounding of these laws (firstly ungrounding laws from locality, secondly uncovering what causes these laws to be in this locality) can we reveal the underlying

ontological process of production of difference. This process is common to production of matter (also on pre-material level) and to the production of thought and knowledge. Therefore, our experience of nature gives us insights into the genealogy of thought, and why nature has to be treated beyond mere representations. Schelling's speculative physics and philosophy of nature are therefore proposing an alternative to substance-based and subjectivist-transcendentalist metaphysics, as they move away from the dualism between body and mind, and think of nature as a genesis of matter, mind, and of natural knowledge. The processes of the construction of the cosmos and the construction of knowledge have the same recursive model. Onto-epistemology results from that common genesis. Organs which facilitate the experience of nature show that thought, like matter, emerges out of processes of communication with its surrounding environment. Subjectivity and intelligence emerge out of the productivity of nature and are embedded in differentiation.

Speculation is a rational method for three reasons: the natural sciences are retrospective investigations of the mind into its previous stages of becoming; naturalised metaphysics is non-materialist (non-substantialised), it is based on immaterial productive forces; physics and metaphysics are both based on experience and sensibility which are elusive. It is a realist approach in which empiricism treats ideas as they emerge on the surface of the experience of nature. Speculation proves that what there is, is the differentiating cosmos. The speculative method is not about undermining the natural sciences and their "truths" but the emphasis on the contingent emergence of matter and necessities, and the contingent organisation of all laws. Instead of establishing limits on knowledge—that is, claiming that there is some essence that we cannot know, or that we cannot go outside of the correlationist circle—it criticises a scientific methodology that seeks to impose its results beyond its limited field of study. Here metaphysics remains open to adjust to more accurate descriptions of reality. Knowledge is about the production of difference and a movement towards a better organisation of thought and life.

Speculative thought is not meant, as it is often claimed about Romantic approaches, to mystify the natural sciences and favour poetry. Here metaphysics and aesthetics are as relevant as science because they all are based on the sensibility of organs. Romanticism prizes art forms that succeed in depicting elusive experiences that cannot be grasped by formal logic. Criticism of the methods of the natural sciences is based on the realism arising from an actual experience of nature. While fields of science are effective in grasping the laws of nature in specific material localities, they cannot claim to provide an exhaustive picture of reality. Having established how Schelling has dealt with the epistemological consequences of substituting substance with a cosmic process of becoming, we will now turn to Hegel and how machinic organicism merges physics and metaphysics with speculation.

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3 Hegel's Metaphysics of Nature and Petrified Intelligence

Hegel's philosophy of nature, along with his understanding of speculative physics and of the recursive epistemological process, will be outlined here only to the extent that they differ from Schelling and Whitehead's type of biological organicism. The aim is to establish why machinic organicism does not overcome the dualism in the sense of nature despite merging physics with metaphysics in a cosmic process. We have already discussed how machinic organicism views nature as 'dead,' locked in the panlogistic operation of the cosmos. Hence, Hui describes machinic organicism as a theory of the organised organic, as opposed to biological organicism's notion of the organising organic, in order to underline the passive activity in the ablation of a system. The becoming of nature, however active, is a superficial movement. Not being able to enjoy freedom fully, its contingent activity is ablated by necessities in the development of the cosmos. Freedom in its pure form is Reason; nature exhibits a subjective and irrational freedom that, according to Hegel, is not actually freedom as it can be reduced to the following of natural instincts. Humans can access freedom through

objective reasoning by overcoming their natural drives and desires. Reason gives access to the operational logic of nature and its structure that can be systematised into a process of dialectics. The fact that nature can never really achieve freedom, outside of the event of the completion of history, means that Hegel is a 'realist about universal forms that interconnect to comprise a self-organizing' (Stone 2013, p. 59) cosmos and that nature can therefore be explained through rational comprehension. As is typical for a philosophy of organism, causation is being explained from within the self-organising logic of the cosmos.

This section will first explain Hegel's form of speculation as a method for science, and two possible interpretations of this method. Hegel's panlogicism entails that scientists should study the necessary recursive processes (e.g., laws of nature), and rely on a priori reasoning in their methods. While collecting empirical data, they should revise their outcomes within the organic logic of becoming. It will be shown that, for Hegel as for Schelling, speculation as a method closed the gap between mind and nature, between empirical and theoretical explanation. There are, however, major differences in how they conceptualise the role of theory and how it should limit absolutising and totalising scientific truth claims. Then, Hegel's speculation will be compared to Meillassoux's method to contextualise their approaches to the main problem discussed so far, namely, the Aristotelian doctrine of matter, and the bifurcation in the sense of nature. Comparison between speculative methods of organic and machinic organicism will demonstrate how machinic organicism does not fully deal with these issues.

Just as in biological organicism, the continuation between nature and knowledge about nature is the operational logic, but is it that nature organises in logical patterns independently of thought or is it that the human mind constructs these patterns with reason? Are logic and reason inherent to nature or do they have some external origin? Alison Stone notes that, for Hegel, nature is rational but only in light of Reason. In this case, the continuation between mind and nature is without any disruptions, even though the Ideal will always remain

outside of nature. Scientists can use metaphysics as a means of deduction about the necessities of nature, as notional reasoning provides them an understanding of how nature is organised. Žižek claims that the sole fact of our ability to 'experience reality in a consistent totality' hints that first cosmos must exist independently from the subjective apprehension, and second that there must be some regulative Idea that organises the objects in a notional determination (2007, pp. 111–112).

Even though nature and its causal relationships are interior to the self-organising dialectical movement, the cosmic spirit is an Ideal force external to it. Determination in nature is predisposed by the function of Reason—contingencies of nature submit to the necessities of nature, and a 'free,' irrational self-constitution is necessary and is subordinated to these necessities. The forms of nature may seem as resulting from chaotic causes, but the essential effect of their 'being,' what 'is,' *is predicated.* Being prescribed in a system of natural knowledge, a negation of a particular accident of nature is already presupposed in the harmonious unity of the Absolute, that is, the universe as a pure and free subject. Stone notes that Hegel's philosophy of nature is concerned with a priori rationalisation and organisation of formal chains of causations (Stone 2013, p. 59). Scientists who study what 'is' systematise the recursion—not the alienated, produced and reproduced forms of the Idea, but the essential necessity of their being *(logos).* Natural products are captured by their own alienation. Sciences which study recursive processes (the laws of nature) focus on inorganic aspects (primary nature). Nature is being studied as a totality insofar as it can only be comprehended through a self-referential system of knowledge navigated by Notion (the harmony of knowledge reflecting actuality).

If we were to classify Hegel's philosophy of nature, the continuation between an experience of nature and the knowledge of nature implies naturalism, but the intervention of the cosmic spirit in all causal relationships places it on an anti-naturalistic spectrum. Stone argues that Hegel's philosophy of nature can be both naturalist[10] and anti-

naturalist,[11] but in either interpretation he is not a mechanistic materialist (2013, p. 62). The cosmological understanding of nature in Hegel's thought is specific because the metaphysical path of investigating causal processes in physics contradicts the usual empirical preferences of the natural sciences. Additionally, the typical empiricism of substance metaphysics assumes that the objects of science are *bare things*[12]—that they are 'intrinsically meaningless' (Stone 2013, p. xvii). In *Petrified Intelligence* Stone defends Hegel's philosophy of nature as a valuable method with a position of *strong a priorism,* countering both of these points. Stone's insight is against the widespread criticism of Hegel 'accusing him of developing a wholly a priori account of nature that can only be chimerical and fantastic' (Stone 2013, xvii). Stone defines *strong a priorism* as a method in which a scientist first rationalises and organises the formal chains of causation a priori (the necessity of what is), and second incorporates the empirical findings (the contingencies) into the formal reasoning. This method limits the possibility to absolutise 'fallible empirical claims' (Stone 2013, p. xviii).

Moreover, recognition of the rational patterns in the necessities of nature means that 'all natural forms are *intrinsically rational*: they act and transform themselves according to rational requirements' (Stone 2013, p. xvii). Even if the Idea is external to nature, it regulates its becoming and predetermines its form of self-organisation. Stone argues that these two aspects—an improvement of the scientific method by limiting falsely absolutising empirical claims and recognising the value of nature that must be metaphysically articulated—promote Hegel's mode of speculation as a valid method for science. However, following her analysis, we can also find in Hegel's works a weak a priori interpretation, where a scientist first accumulates forms of nature and their patterns observed in phenomena to then rationally deduce causal determinations (Stone 2005, p. 6). These interpretations are incompatible, and hence there are traces of inconsistency found in his philosophy of nature. Nevertheless, and importantly for our investigation, both interpretations assume a common role for

speculation in the systematisation of knowledge. Either scientists should organise and reorganise empirical observations to relate it to the organic logic of becoming or look for phenomena to fit them into already rationally deduced necessities. Speculation closes the gap between mind and nature, insofar as theorisation is a tool of finding correspondence between facts and laws. Hegel does not dismiss what he calls 'empirical physics' (Stone 2005, p. 2) as he views the observation of phenomena to be a necessary step for the recursive categorisation and systematisation of nature, however he insists on the importance of the theoretical mind in the process. Theorisation is a necessary step because a scientist and a philosopher of nature are ultimately interested in the same thing—understanding how nature as a whole organises into a system. Philosophy closes the gap between conceptual determination and empirical observations (Stone 2005, p. 4). Nature is a concrete example of logic. The strong a priori version of Hegel's approach does not claim that we can find contingent proofs a priori, or that we should attempt to a priori deduce scientific findings, insofar as it simply aims to 'sidestep from this trap of trying to deduce fallible empirical findings and lend them absolute justification' (Stone 2005, p. 12) However, difficulties arise when a scientific method claims that contingent observations are less valid as proof than a necessary conceptual determination (Stone 2005, pp. 10–11).

Therefore, the critical difference between the method of machinic and biological organicism is that the dynamism of speculation is motivated by the necessity of reason rather than the contingency of matter. The reconciliation of physics with metaphysics in organicism calls for speculation by announcing an intrinsic value of nature (be it its contingent production or necessary rationality) that should be metaphysically articulated to counteract the fallibility of empirical studies that are excessive in their claims. The tendencies of natural sciences to generalise empirical results should therefore be constrained by referring to the organic, operational logic of the cosmos which, in the case of machinism, means an inward movement to a priori reasoning and in biological version an outward movement to examination of

production of material localities. Hegel's understanding of the role of speculative physics is, similar to Schelling's, to close the gap between observation and mind, emphasising the role of theoretical reasoning for the validation of scientific facts. However, for Hegel, empirical findings should be validated if they correspond to the necessarily deduced a priori, leaving no space for a contingent possibility of change of the laws of nature. Schelling's method of speculation is, in contrast, hypersensitive to the contingent emergence of natural laws. Hegel states that speculative method of thinking is about formal demonstration of how a particular object is necessary in the absolute: how does the object bring forth the actualisation of the cosmos and the logical idea (1971, §379A/5). The function of empirical sciences is thus validated in how their findings fit into the speculative mode of thinking about the rational cosmos as a whole (Hegel 1991, EL §9R/33).

Hegel's philosophy of nature is concerned with the categorisation of forms, the conceptualisation of the recursion of these forms, and the recognition of necessitation according to reason. The cosmos as a subject is unnatural, and as an infinite Idea it is prior to finite nature. Thus, Hegel treats nature as an organised organic system, meaning that it is organised in the same way as our minds. The machinism of nature (its death) and the passive fulfilment of formal causes are organised in a logical way. Taking reason as the way in which nature should be explored, Hegel rejects sensibility as a mode of knowledge.

Hegel's mode of speculation resembles Schelling's method very narrowly. Metaphysics as a system of knowledge based on the organic logic of becoming limits the natural sciences. However, in Schelling's case, the freedom of nature means that contingency can alternate natural laws by the productivity of matter and can also overcome metaphysics and annihilate itself, thereby removing the basis for the emergence of ideas. For Hegel, practical reason gives access to the eternal logic of becoming and metaphysics limits physics to speculation in a different manner, insofar as all contingencies are necessary and predetermined. What is decisive for the sake of understanding freedom in Hegel's systematisation of nature, in contrast to Schelling's biological

organicism, is that the ground of becoming of nature is mediated through Reason, rather than freedom. Freedom (and all that *is* in nature) is mediated by a system of knowledge, inherent to a subject that conceives of nature. Pure freedom is a regulative idea of the system that intervenes insofar as human individuals are capable of rational self-determination. There is no suspension of ontology, and freedom is experienced through the subject only insofar as it is a rational self-determination. Philosophy of nature is a speculation on the series of stages, of the many moments, of the transition from necessity to freedom (Hegel, 1971). As Grant notes, Hegel's construction of organicism 'does not provide the ground uniting nature and freedom, but merely the locus of a failed attempt to accommodate physics' (2008, p. 15). The force of human productivity is therefore superior to natural determination.

Hegel's cosmological process also implies onto-epistemology insofar as an absolutisation of the force of Reason navigates ontological becoming and the systematisation of knowledge. As Anna Longo explains, Hegel's system should be categorised as a strong subjectalism. The correlation makes 'the limits of knowledge into a positive aspect of the in-itself.' What is exterior proves that there is nothing outside the correlation between thought and the real (Longo 2014, p. 36). In contrast, Meillassoux claims that in materialism 'there is a rational access to the inorganic *in itself* [emphasis mine], without projecting onto it a subjective property' (Longo 2014, p. 37). Hegel's speculative physics and real idealism are obviously not compatible with Meillassoux's speculative absolutist materialism. We can nevertheless agree with Niemoczynski in saying that Hegel is Meillassoux's 'secret master' (Niemoczynski 2017, p. 104). For Meillassoux, the necessity of contingency is central to an eradication of the correlationist circle precisely because it removes the absolutisation of a subject by the de-idealisation of reason. Meillassoux notes that: [c]ontingency expresses the fact that physical laws remain indifferent as to whether an event occurs or not (2008, p. 39). His tweak of Hegel's thought is subtle—for both, the necessity of contingency is foundational to how we conceive

of natural knowledge but, for Meillassoux, that necessity is derived not from the transcendental but from absolutist materialism. Meillassoux's speculation is free from real idealism because he claims that inorganic matter does not hold the intrinsic value of rationality, his thought 'can know dead matter as something with which it shares nothing, not an origin, nor the condition of being' (Longo 2014, p. 38). Rationally deduced functions of nature 'emerged (…) in an absolutely contingent way – out of nothing' (Longo 2014, pp. 41–42). Necessary laws (e.g., mathematics) are therefore not responsible for a production of thought or mind. Reality is not necessarily rational. Although the idealisation of a knowing subject is removed, it does not take away infinity from the power of thought. For Meillassoux, it is still logos (formal logic) that gives primary access to knowledge about the cosmos. Rational access to the *in itself,* provided by the superior quality of the mind runs the motion of speculation that closes the gap between mind and facts. Nature and reality become inexhaustibly mathematisable because rationality can give access to a reality that cannot be thought, a strong a priorism that proves materialism is very close to Hegel's form of speculation.

Meillassoux's conception of relationship between thought and matter, much like Hegel's, repeats the Aristotelian doctrine of matter. Meillassoux's argument is rooted in Aristotle's primary nature and treats formal ontology as a superior tool that gives us access to eternal truths. Hegel and Meillassoux differ in how they view the genesis of thought, but they still both see it as distinctive to the origin of matter. For Hegel, thought and mind originated from idealised and totalised Reason. For Meillassoux, thought and mind emerged as a pure contingency, but, as he emphasises, they share 'nothing, not an origin, nor the condition of being' (Longo 2014, p. 38). Their processual understanding of reality still follows the bifurcation in the sense of nature left by the Aristotelian legacy.

In Hegel and Meillassoux's philosophies alike, the production of natural knowledge is not locally specific, it is not physically surficial, it does not entail the possibility of the annihilation of a system of nature

and thought as such. Its recursive model of knowledge production is not from nature to nature but from nature to logic, which in turn embraces it in the deadly hug (*Tod des Naturlichen)*. The method of speculation in machinic organicism is therefore significantly different to the method of biological organicism. Meillassoux's materialism analyses nature as dead—an inorganic, 'dead independent exteriority' (Longo 2014, p. 47) which excludes the possibility of change in the transcendental order, and thought is also detached from finality, its axioms being dead. Speculation as a method in biological organicism counters this machinic outlook with the following points:1) organic differences allow knowledge to progress, 2) there is no transcendental structure that is not locally specific or cannot be overcome, 3) nature is not a mere representation, 4) access to the in-itself is given by the real, not exclusively by the mind. However, our criticism aims to focus on the problematic legacies of substance metaphysics rather than draw from anti-Kantianism. The previous chapter outlined how there is no actual paradigm shift from Aristotle to Descartes and Kant insofar as their understandings of the sciences are constrained to derivative methods that are unable to reach nature in itself. Although the book speaks against transcendentalist subjectivist metaphysics, the intention is to outline how this method is constrained by substance thinking. The problem of machinic organicism, which takes nature as dead, is that it cannot entirely shake off Aristotelian hylomorphism. Despite embracing processual ontology, it confuses what is the object of science and subsequently what is an object of the philosophy of nature. For that reason, we must briefly return to Aristotle.

Aristotle claimed that nature is in-formation and has its purposeful activity. It contains the information of how it should fulfil the necessary forms. Natural becoming is formal—it is logical. The becoming of nature is not free as its form is predefined. Since Aristotle, the capture of nature by a foreseeable logic moved freedom into the human realm, from phenomena (*synholon*) to logos. The becoming of the universe, the self-differentiation of the universe, its *endurance,* were provided by the eternal substance, and its infinite possibilities to change. Things in the

world are mere accidents of form and matter, of which substances have finite non-ideal ends. An accident is a negation of infinity—it is finite.[13] Metaphysical categorisations and predications about facts describe what recurs and predecides the forms of beings. We can here recall Hegel's quote in which he describes nature in an Aristotelian manner on the example of the acorn, which becoming is superficial, 'a formal repetition,' insofar as its freedom is constrained by coming back into its predefined identity, by hardening of the stems into the tree (Hegel 1970, §346). Hegel keeps the Aristotelian understanding of nature as purposeful activity that is the fulfilment of its formal cause. Because of these hylomorphic assumptions, it makes sense to focus on recursions and formal logic when studying nature. The philosophy of nature in machinic organicism implies that the sciences deal with *bare objects*, stripped from their actual environments of becoming, taken out of their material constraints. Instead of studying nature as it is experienced, it takes it as an abstraction. In contrast, biological organicism views the philosophy of nature as a study of becoming in its environment, always contextualised in a system where knowledge is created recursively from nature to nature, therefore focusing on a material difference rather than on what recurs as identical. Having no predetermined finality, evolution treats differentiation as opposed to a telos, against the self-identity of logical laws. For Aristotle, as much as for Hegel or Meillassoux, finite matter is negative to logic, it necessarily submits to laws; the universal forms, however, are unchangeable and formal. In this case, metaphysics is necessary and immutable, rather than being a logic of becoming that can be overturned. Aristotle identified in nature a recursion of ten universal categories and solidified the contingency of nature, the hylomorphic accidents, into a categorial logic which predominated continental European thought until the nineteenth century. The mechanism of nature in continental thought was already dead since Descartes' dualism.[14] Hegel's dialectics as attributes of beings in the primary order, the rule of life and the way of thought and spirit, cemented the existing tradition, rather than being a sudden rupture to it. How does Hegelian onto-epistemology affect how we

understand our place in nature? How does such a cosmology impact our actions?

By distancing practical reason from the environment in which it lives, machinic organicism suggests that human productivity is superior to natural determination. Interestingly, Stone defends Hegel's method of enquiry from an ecological perspective, by concluding that metaphysics as a philosophy of nature proves its internal irrefutable value. The rational organisation of nature, the necessary recursion of natural forms, fundamental to our experience of nature show its inherent value of rational purposefulness that should be metaphysically conceptualised to provide a basis for moral judgement (Stone 2005, p. 152). However, Stone also notes that, in Hegel's philosophy, we find a lot of claims that are incompatible with the rule of ecological preservation. Forms recur (the formal activity is necessary) until the end of history—meaning that there is an assumption that nature will return in its contingent forms, fulfilling its purpose until the fatalistic end of the cosmos*. It treats natural forms as unexhausted and a transformation of contingent particularities* as *a necessary step in civilisational progress*. The intrinsic purposefulness of nature is not, for Hegel, a moral premise to natural preservation. Stone notes that, despite the underlying value of nature, Hegel rejects that humankind has a duty to protect it. Quite to the contrary, '[h]uman individuals are morally obliged to remodel nature' (Stone 2005, p. 154). This duty is derived not from any intrinsic value but from practical reason. Matter and animals have no rights precisely because they do not have free will (Stone 2005, p. 157). Natural objects can be only improved when transformed by human activity. A human gives a natural object a new model of organisation that allows it to progress. This theory of value attribution enables the appropriation of natural objects as private property. Only by free will can a human know what is good. Practical reason dictates that 'it is a duty to possess things as property' (Stone 2005, p. 156). The duty to modify nature is derived from the institution of private property.

In summary, how organic philosophies conceive of the relationship between thought and matter affects the shape of ontological and epistemological processes. The relationship is indicative of the methods with which we should study nature to accurately represent it in a system of knowledge. A processual understanding of reality suggests speculation as a method to reflect on ontological assumptions. Speculation is also a tool that reconnects nature and mind—practical approaches are revised by theories and vice versa. Speculation aims to theoretically limit totalising and absolutising scientific truth claims, and new scientific discoveries challenge the conceptual limits of existing theoretical systems. A philosopher and a scientist both have the same goal—to discover the nature of reality. However, machinic organicism encourages empirical sciences to examine the generalisation of findings inwardly, with reasoning about how they fit to the broader organic logic of becoming. In biological organicism, the generalisation of empirical findings is tested outwardly, within the contingencies of material localities. The methods of speculation that can be found in Hegel and Meillassoux's systems repeat the Aristotelian doctrine of matter and fall, yet again, into the fallacy of the bifurcation in the sense of nature. Their methods clearly outline that only formal logic can give us access to eternal truths about nature, implying the inferiority of secondary matter. They assume that temporal and bodily matter must be qualitatively different to nature that is enclosed in awareness. These methods reflect the broader metaphysical conviction in mechanistic and machinic materialism, namely, that the human mind has superior qualities to the nature that it systematises. In the case of Hegel's cosmology, it was shown that it situates humans in a position that elevates the transformation of nature to a moral obligation. The superiority of human productivity to natural determination means that the transformation of matter by the mind helps the whole system of nature to progress.

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4 Biological Organicism

So far, this chapter has outlined speculative methods that correspond to process ontologies. We could see that, depending on how freedom is situated in the system of nature, speculation can still result in a dogmatic and totalising system, e.g. Hegel and Meillassoux's panlogicism. An epistemology that defines the mind as having some special qualities has cosmological consequences for how we then conceive of our role in the system of nature. This section will explain how biological organicism offers the possibility of a speculative but also non-dogmatic and non-reductive epistemology. Biological organicism's epistemology not only overcomes the fallacy of the bifurcation of nature, but it also emphasises that matter and thought share certain qualities and are involved in co-constitutive temporal processes. Biological organicism regards reality as elusive because thought, matter, and life are temporary. It is a form of radical empiricism or panexperientialism, the view that 'all there is, is experience' (the temporality of matter, life, and thought). This ontological claim is presented here as onto-epistemology. If all there is, is experience, then experience (including sensory perceptions) constitutes ontology. As a result, our system of knowledge (episteme) is based on our actual experience of nature. Onto-epistemology is therefore critical of supranatural explanations of creativity and mind. Panexperientialism also questions the traditional understanding of epistemology and opposes the distinction between a subject that actively experiences, and an object that is experienced.

The argument in this section is built on connections between Schelling and Whitehead's philosophies but presents a non-theological interpretation of their systems. As noted already, the categorisation of Schelling and Whitehead as biological organicism follows Hui's study of organic philosophies in *Recursivity and Contingency.* Their metaphysics bears striking similarities that facilitate a synthesis of their systems. Onto-epistemology will be outlined by examining the core processes that characterise Schelling and Whitehead's metaphysics. In organicism, the core processes explain how the system of nature, and in this case the system of knowledge as well, is organised. These recursive

processes postulate an ecological way of thinking. Ernst Haeckel defines ecology as the study of 'the relation between organism and environment' (Hui 2019, p. 28). Schelling describes his philosophy as a universal organicism, and Whitehead named his metaphysics the philosophy of organism. Their metaphysical systems present an approach where an entity is defined by what (potential) relations it can establish with its environment in its process of becoming (process-relational philosophy) (Mesle 2008). In Schelling's metaphysics, any actant must always be taken as a constitutive part (organ) of its environment (organism) and its becoming is physically constrained by its interaction with its milieu. In Whitehead's metaphysics, every actual occasion can become only by prehensions (what is perceived) of other actual occasions that constitute its environment. The core organisational processes in both systems study the relation of an organic actant (including inorganic matter) and its environment. An ecological mode of thinking requires an organic outlook on the nature of reality. It will be shown that, in the case of biological organicism, overcoming the Aristotelian doctrine of matter and the bifurcation in the sense of nature is necessary for ecological recursive processes. Marshall McLuhan pointed out that 'the end of nature is the birth of ecology' (Hui 2019, p. 28). In the system of nature containing the fallacy of bifurcation, nature is taken as a distinctive system that is alien to thought. In biological organicism, ecology can overcome the bifurcation if we take thought as an internal part of the organism and its environment. Ecology ends the understanding of the system of nature as a separate realm to the system of knowledge.

It is quite uncanny how Whitehead and Schelling's systems resemble one another even though Whitehead refers to Schelling only once via *opus citatum*. It seems that Whitehead was familiar with some of the secondary literature on Schelling as he quotes him after reading Nikolay Loosky's book *The Intuitive Basis of Knowledge* (1919) where we can find whole sections dedicated to his philosophy alongside other post-Kantian thinkers, such as Hegel. In *The Concept of Nature*, Whitehead cites Schelling after Loosky, where Schelling underlines the

structural and genetic continuity between a scientist and her knowledge, that philosophising nature is an iteration of nature's creative forces, and that nature and a scientist together create the systems of knowledge (Whitehead 1964, pp. 31–32). These aspects are key to understanding Schelling's critique of empirical methods which distant thought from the productivity of nature. Interestingly, Whitehead's interpretation of this quote is slightly critical as he suggests that the issue presented here by Schelling is not the same as what he seeks to address with his own philosophy, although the two might be confused. Whitehead argues that scientists typically study the data of time and space but disregard the simultaneous mental experience from which such abstractions are derived. Scientists remove from their field of study the relations of the entities that are revealed to us in the process of perceiving nature (Whitehead 1964, p. 32). For Whitehead, this problem is not yet metaphysical in *The Concept of Nature* as he simply outlines the issue of our understanding of nature in its bifurcated form between the one that is a cause of awareness, and the one that is an effect of awareness. Of course, seven years after publishing the book, Whitehead delivers the Gifford Lectures that compose the system of *Process and Reality*, which gives us grounds to dismiss his earlier hesitation to explain the problems of the philosophy of nature at the level of metaphysics, especially because these relations of the perception of nature, which will be discussed in this section, later become constitutive of the process of cosmological novelty (onto-epistemology). The guiding premise for comparing Schelling and Whitehead is that they had the same aim while constructing their philosophical systems. In *Process and Reality* Whitehead states that his mission is 'to lay the basis of natural philosophy which is the necessary presupposition of a reorganised speculative physics' (Whitehead 1978, p. 167). Similarly, Schelling first insists on proving that 'nature is *organic*' (Schelling 2004, p. 5) to then demonstrate that speculative physics (dynamic atomism) is the only reasonable consequence of such a presupposition. (Schelling 2004, p. 5). For both thinkers, the philosophy of nature expressed as process ontology aims to be the

ground for a speculative physics as a method of building a system of knowledge. Aside from the ecological recursive process that underpins their philosophies, it is this common goal that allows us to synthesise their philosophies of nature into an onto-epistemology.

It is important to first outline the broader influence of Romanticism on Whitehead's thought. Whitehead's *Science and the Modern World* contains a chapter in which he discusses the "Romantic Reaction" to developments in science of the eighteenth century which narrowed down the scheme of scientific concepts to what he calls 'mechanistic materialism' (Whitehead 1967b, p. 73). He criticises such an approach again because it takes the 'immediate experience of nature' (Whitehead 1967b, p. 73) out of scientific explanation. The lack of recognition of relations between mankind and nature consequently means that an analysis of material objects does not include such relations between them. Whitehead notes that such explanations of nature contain a paradox insofar as 'the world of men and of the higher animals' can self-determine but the world which they inhabit is governed by mechanistic determinism. (Whitehead 1967b, p. 76). Although this sounds like a rewording of the paradox of freedom in nature, he makes no reference to Kant. Mechanistic materialism disregards the way in which nature becomes an organic unity—it disregards the fact that natural laws result from an interaction between a scientist and nature, that they can only produce the laws of nature together. Therefore, it ignores the process of production of novelty out of which the laws of nature emerge. Whitehead found the reaction to this radical inconsistency of science in Romanticism.[15] He found the whole Romantic movement quite inspiring mostly because they are trying to address the same problem—a mechanistic materialism that disregards the actual experience of nature.

For instance, Whitehead thought of Romantic poetry as an argument against positivist empiricism (which he views as a direct result of mechanistic materialism). Positivist empiricism assumes the laws of nature are fundamental to our experience and scientific experiments, and not that they are constructed together with nature in

the process of scientific experimentation (Cartwright 1997, p. 65). Poetry is an expression of that immersion in the experience of nature that a mechanistic approach rejects (Hoffman 1952, p. 258) and it does not disregard other experiences of nature (including those of non-humans) as untrue (Hoffman 1952, p. 263). Whitehead is by no means anti-scientific; he does not reject scientific methods and views them as useful in explaining specific localities of nature as expressed in different branches of science. When he rejects positivist empiricism, he opposes the claim that only a scientific method can derive truth about the nature of reality, and that scientific truths are foundational to the nature of reality. He finds Romantic poetry compelling because it intended to grasp the very process which scientific methods omit—the perception of nature that shapes what we consider to be real. This is not to say that poetry is a superior method or should replace science. Whitehead's argument is that scientific truth claims should be compared with our actual experience of nature as a way of restricting science's totalising tendencies. This is another common topos in Whitehead and Schelling's works. Schelling also viewed poetry as an aesthetic judgement that should at least accompany the empirical comprehension of nature (Richards 2002, p. 114). Biological organicism challenges totalising truths by speculating and examining how truth emerges out of a perception of a scientist grasping the creativity of nature; that the immediate experience of nature cannot be fully removed from what is (onto-epistemology).

Whitehead said that he gained 'from the poets the doctrine that a philosophy of nature must concern itself at least with these six notions: *change, value, eternal objects, endurance, organism, interfusion*. [emphasis mine]' (Whitehead 1967b, 89). These notions formulate the main points against positivist empiricism and mechanistic materialism. They are also crucial components for Whitehead's metaphysics and, hereafter, biological organicism will be explained by examining these concepts and highlighting the parallels with Schelling's philosophy where they arise.

Whitehead explores *change* and *endurance* with Shelley for whom the experience of nature is: 'like ghosts from an enchanter fleeing' (Whitehead 1967b, p. 86). Nature always slips out of the grasp of experience insofar as it is always temporal and transforming. Change and becoming are what constitute being. Shelley says: 'I change but I cannot die' (Whitehead 1967b, p. 86). The permanence of change is the endurance of things. As Whitehead notes in *Adventures of Ideas, endurance* (Whitehead 1967a, p. 41) is a mere recurrence of occasions, a *persistence,* exhibiting the minimum of creativity in so far as mere *recurrence* is a repetition in the line of physical ancestry (Whitehead 1978, p. 104): 'the art of persistence is to be dead' (Whitehead 1958b, p. 2) (e.g., inorganic matter). What brings life its novelty is the creativity of nature, the contingency of actual occasions. Freedom is the creative synthesis of the universe (Whitehead 1978, p. 27) with which actual occasions come to life. The quantum creativity of the sub-atomic level that precedes materialism for Whitehead can be translated into the production of contingent difference which is necessary for matter and therefore for the organic and the inorganic to exist at all. We could also observe this immaterial, intensive, and natural, yet physical (e.g., electromagnetic) production of difference as the elementary notion of Schelling's metaphysics which shapes the recursive process of his whole system of nature. The recursive, creative, intensive production of difference is the first process that we must point out as a characteristic of a system of biological organicism. This is also the first characteristic of recursive ecological processes. From this perspective, a study of the relations between an organism and an environment must account for the temporality and differentiation of the conditions that constitute the environment to which the organism has to adjust. Only by first recognising that the environment produces itself and is always changing can we realise that adjustments to the changing environment precede the existence of an organism.

The next organic notion that Whitehead finds in Romantic poetry is that of *eternal objects*. Wordsworth writes about, 'The light that never was, on sea or land' (Whitehead 1967b, p. 87). Eternal objects can be

viewed as metaphysical ideas,[16] but they are not some truths about the world which we cannot discover or that remain unchanged and epistemologically dissociated from the material world, because then they would have fallen into the fallacy of bifurcation. Eternal objects are the most obscure and poorly explained concept in Whitehead's thought. They have resulted in many contradictory interpretations in the secondary literature (Kennedy 1974, p. 61) including a discussion on whether they are real and can exist independently at all (Hall 1930, pp. 36–37). They will not be all included here,[17] but most interpretations would agree that eternal objects serve some function towards universality, potentiality, and permanence, but it is difficult to say how they add to the concepts of actual entities, actual occasions, and events.

A convincing rationale for the existence of eternal objects is presented by a functional/operationalist interpretation—it explains how we can build a system of knowledge out of the recursive processes that constitute actual occasions. Some of the prehensive recursive processes are retained through the cosmic process, which is why we can generalise them, recognise them, and then give them names (Kennedy 1974, p. 72). If we are to systematise nature, we have to observe the recurrence of actual occasions into a nexus of becoming. Actual occasions compose societies of different types by having a shared nexus of becoming; they are characterised by a certain type of an order. An example of such a society is a rose. By observing roses, we can see that they are often red when they bloom. Thus, the idea of the redness of roses is recognised in our minds. Eternal objects result from the experience of the recurrence of societies and stay with us as ideas of summer, even when it's winter and no red roses are blooming. Eternal objects help us build a system of knowledge about nature (Hall 1930, p. 29). The word eternal is used here to underline that an object of thought can transcend the existence of the society from which it was initially derived, although it will exist for only as long as that system of knowledge persists, grounded in the material localities of thoughts of particular people and their books.

Another function of eternal objects, which proves to be more paradoxical in nature, is that they can endure in the form of potentialities, but they are grounded by the defined concreteness of spatio-temporal localities—'Pure Potentials for the Specific Determination of Fact or Forms of Definiteness' (Whitehead 1985, p. 22). They are 'a timelessness of what is potential' (Whitehead 1985, p. 40) that participates in the relational shaping of the universe. Although the subjective experience of redness is a differentiation of that object in the process of becoming, red as such endures as long as there is light in the universe and something to perceive it, in comparison to material objects which may seem eternal but are not e.g., rocks (Whitehead 1967b, p. 87–88). The potentiality of red exists before we bring it into concreteness by perceiving a rose or thinking about it. Therefore, the difference between eternal objects and actual entities lies in how they relate to space-time. Red is differently constrained by space-time than the endurance of actual entities that constitute the organisation of the persistent life of a rock. However, it is 'a nonsense to ask if the colour red is real. The colour red is an ingredient in the process of realisation. The realities of nature are prehensions in nature, that is to say, the events of nature' (Whitehead 1967b, p. 72). Space-time is what unites the assemblages of events, but 'the word *event* just means one of these spatio-temporal unities' (Whitehead 1967b, p. 72). The colour red does not pass, but it exists only in the events (prehensions of nature) themselves. Whitehead's rationale is that redness is just a factor or quality of an actual entity, and we can grasp it as an abstraction outside of a particular rose (Hall 1930, p. 31), as a specific potentiality, while we cannot conceive of rose-ness without conjuring an image of a particular rose. Thus, eternal objects can also be interpreted as a type of relation between actual entities. The confusion here remains in the question as to whether potentiality can be considered outside of the events and how then eternal objects could be actually eternal, not relating to any spatio-temporal locality, such as you, thinking about the redness of a rose right now, or the wavelength of the colour red, which is a pre-condition of any actual entity experiencing it.

A theological reading addresses this paradox, implying that the multiplicity of eternal objects, and the potentiality of the universe is the primordial nature of God. God solves the paradox for Whitehead: 'The concept of "God" is the way in which we understand this incredible fact —that what cannot be, yet is' (Whitehead 1985, p. 531). God in Whitehead's metaphysics is therefore complementary to the 'ontological principle' that 'everything is positively somewhere in an actuality, and in potency everywhere' (Whitehead 1985, p. 40). Although it may be of interest to some, this debate is peripheral to the definition of biological organicism. The unexhaustive potentiality of becoming has been explained in depth in the previous chapter as the non-material creative ontological processes that weave the fabric of space-time and existence come out of nothing (void/abyss). The interpretation of eternal objects as concepts that can transcend the actual occasions from which they are derived, and from which we can compose a system of knowledge is sufficient. This meaning of eternal objects emphasises that the division between the mental and physical aspect of experience is arbitrary, leading us again to a radical empiricism in which all that there is, is experience, including ideas. Bringing God into the argument is self-defeating for the broader project of overcoming bifurcation since it reintroduces supranatural forces into the construction of a system of knowledge, which can be defended without her.

The next concept in Romantic poetry that helps illustrate organicism are the *aesthetic values* inherent to the empirical experience of nature (Whitehead 1967b, p. 87). Romantic poetry paints the impressions of the aesthetic presence of nature. As Whitehead puts it: '[t]he nature-poetry of the romantic revival was also a protest against the exclusion of value from the essence of matter of fact' (Whitehead 1967b, p. 96). The *value* of nature as an organic category implies an internal limitation of the universe by an actual entity and its aesthetic attainment. Aesthetic attainment is 'interwoven in the texture of realisation' (Whitehead 1967b, p. 94). McHenry argues that 'the attainment of value is the realization of something that exists for itself'

(1995, p. 8). The process of realisation is different in complexity for societies, but the aesthetic value of nature can be prehended by humans and non-humans alike. In *Symbolism: Its Meaning and Effect,* Whitehead explains that less complex organisms thoughtlessly experience nature in aesthetic adjustments (Whitehead 1958a, p. 42). An experience of aesthetic values in nature by simple organisms indicates that eternal objects are accessible for the non-human in their definitive particularity. To put it simply, thanks to aesthetics, animals have their own experience of red. Red in nature often means danger and animals and plants learned to avoid it or use it in self-defence (Pavid 2025). This shows that eternal objects can participate in concrescence where there is no presence of thought as such. In stark contrast to more traditional approaches to epistemology, Whitehead proposes a non-anthropocentric aesthetic judgement inherent to the experience of nature of all sentient and non-sentient beings. A plant developing redness in self-defence contains an aesthetic value in its concrescence —it becomes a value for itself and is interwoven into the processes of novelty in that milieu. Debaise argues we find a radical form of speculative empiricism in Whitehead's thought (Debaise 2017b, p. 167) that is derived from a significantly different method than conventional empiricism. This method involves the interpretation of the immediate experience that both precedes the construction of knowledge itself and is a component of that construction. Recursive processes of becoming and the immersive experience of nature on a pre-conceptual level are impactful not just in ontological processes of becoming but also in how we systematise nature. 'Whitehead's actualist empiricism opens on to an empiricism of pure potentialities, infinite in their actualisations, always unknowable as they are but implicated in the entirety of factual existence' (Debaise 2017b, p. 98). We can find a similar relationship between transcendence and empiricism in Schelling's philosophy of nature. For Schelling, organs ground metaphysics and aesthetics, and the realness of ideas results from the peripheral, local mesh of experience. Synthesising the thought of these two thinkers, we can state that biological organicism accepts the existence of ideas, but they must

be studied in their particularity within the constraints of the experiences of organisms in spatio-temporal localities. Moreover, ideas can be pre-conceptual, with a very broad range of who and what can access them in becoming.

The next two notions that Whitehead found in Romantic poetry are *interfusion* and *organism*. These two concepts can be explained together as *organism*, a figure illustrating the interfusion of reality. In this context, organism should not be understood literally—it means a unity of assemblages of natural events, a dynamic community, always incomplete, the expansion of the universe is the process and 'any state of expansion is the first meaning of "organism"' (Whitehead 1978, p. 215). The cosmic organism refers to the unity of processes of organisation for our spatio-temporal, concrete epoch of the universe. Organicism means a study of these processes. It is easiest to see these patterns of organisation in living beings, but they are still there in 'larger aggregates of matter' (Whitehead 1967b, p.110) governed by physical laws. The cosmos can be viewed as an organism as long as we do not take it to be an actual cosmic body that would entail any form of vitalism. For Whitehead, vitalism bears the assumption that mechanism is somewhat compromised in a living organism. The problem with this assumption is that it bears an 'essential dualism' in how we conceive of matter that organicism rejects (Whitehead 1967b, p. 79). It is important to note the similarity between Whitehead's organism and Schelling's understanding of organicism. Schelling's metaphysics is rooted in the interrelatedness of organs in the becoming of the system of nature in which concrete forms of life (not any form of vitalism though) take precedence in shaping reality. This is to say that matter, thought, ideas, life, and the laws of nature arise in the same way out of the recursive differentiating becoming of concreteness.

Whitehead puts the interrelatedness of all becoming into the generic term *together* that expresses the simple ontological fact that entities are always existing together in any actuality (Whitehead 1978, p. 21). This rather obvious claim forms the foundation for the ultimate metaphysical principle according to which the novelty of the universe is

always from 'disjunction to conjunction, creating a novel entity other than the entities given in disjunction' (Whitehead 1978, p. 21). Togetherness also refers to the *solidarity* of the universe, the notion explaining that actual entities arise from experience (on non-conceptual and conceptual levels). These principles were already partially outlined in the chapter on ontology—the point here is that the actual and the real could not hold together as a process of cosmic unfolding if not for the fact that we all experience the world together. Even though this experience is relative to the becoming of a society (whether it's a nucleus, rose, or a human), nothing could become concrete without experience.

Having explained the core concepts of organicism, we can now unravel the tightly knotted meaning of *prehensions, feelings* and *events* which finally explain the relationship between ontology and epistemology in Whitehead's thought. Whitehead overturns Descartes and Kant by stating in *Process and Reality* that it is not a thinker who creates thought but rather the thought creates the thinker (Whitehead 1985, p. 151). Debaise notes that Whitehead actually drew on Descartes' *Meditations* while developing his theory of feelings. Descartes claimed that feelings cannot be false, he gave certainty to the experience of feelings, but he immediately equates them with thinking, taking that step which causes a bifurcation in the sense of nature (Debaise 2017a, p. 43). Whitehead subverts Descartes' conclusion by giving 'primacy to feeling over thinking' (Debaise 2017a, p. 44). Earlier, we discussed that Whitehead is opposed to a substance metaphysics that is based on our use of language in which the subject-predicate form of stating facts forces us to think of nature in its abstracted, logical form. The form of the sentence, 'the subject feels,' supports the Cartesian understanding of feeling as thought insofar as feeling is presented as an attribute of a subject. Debaise notes that, for Whitehead, the subject is only constructed retrospectively, its unity being expressed as a reaction to a feeling or a thought (Debaise 2017a, p. 55). Adding to Debaise's interpretation, it is worth emphasising that the construction of a subject is not just retrospective but also recursive.

For Whitehead, feelings cause the subject. This is to be understood as the genesis of a subject and an empirical study of nature expressed in the system of knowledge, which will be explained in more detail below. Traditional Western epistemology focuses on the subject that perceives and dismisses the ontological construction of the self, and that what we know is a result of what there is. This is a necessary step to overcome the bifurcation of nature (Shaviro 2014, p 3). In a metaphysics of feelings, as Debaise calls it, ontology is constituted of actual entities, or actual occasions which are nothing else but 'drops of experience, complex and interdependent' (Whitehead 1985, p. 18) implying that epistemology is an atomistic component of ontology. Ontologically, experience is what causes organisms to become, which is depicted by a form of recursive movement from experience to experience, from actual occasion to actual occasion and vice versa. The question is how, exactly, an enduring organism like a subject participates in this process?

We can start answering this question by examining *prehensions* which are processes of grasping the reality by actual entities. Actual entities can be divided into prehensions in indefinite ways, prehension is what constitutes actual entities. They refer to the external world by prehending and are reproduced by this process into the next actual form (Whitehead 1985, p. 19). For an organism composed from a multitude of smaller organisms, societies, and actual entities, prehensions are how each of them processes sense-data in their becoming. These processes of prehensions are atoms of difference, 'rather than self-identical substances' (Shaviro 2014, p. 3). Therefore, the actual world is composed of these onto-epistemological atoms; they are the most concrete and finite, 'conceived as what is in itself and for itself' (Whitehead 1967b, p. 71). Drops of experience (events/prehensions) are constitutive to the unity of an organism. An organism is composed of *drops of experience.* Thus, organism represents the togetherness of becoming of assemblages of prehensions (events), and this fact of togetherness in organism is also called a 'nexus' (Whitehead 1978, p. 20). An organism, similar to a

society, is characterised by a nexus of becoming (Whitehead 1978, p. 215).

There are two types of prehensions: positive and negative. Positive prehensions are feelings, and negative prehensions are these parts of a feeling which are not incorporated into the constitution of concrescence of the unity of a subject (Whitehead 1978, p. 24). We can think of feeling as sensations (*aistheseis*). These sensations are pre-conceptual; they cannot err. They are causes outside of us (effluences) giving evidence of what potential relations can be exploited in our process of becoming. These sensations, *aistheseis*, and feelings are pre-conceptual insofar as a red rose did not necessarily consciously pick the colour for itself. They are simply 'the basis of generic operation of passing from the objective data to the subjectivity of the actual entity in question. Feelings are variously specialised operations, effecting transition into subjectivity' (Whitehead 1978, p. 40). Feelings are aimed at a subject which, in turn, is a final cause for feeling (Whitehead 1978, p. 222). While there are many sensations that we feel at all times, as we are immersed in the experience of nature, not all of them will necessarily be picked up in the process of concrescence (negative prehensions). Although the character of a subject is shaped by feelings, it is the creativity of a subject that can transcend them to become an object that then conditions creativity beyond itself.

It is perhaps counterintuitive to discuss feelings on pre-conceptual or pre-subjective levels. This comes down to the previously explained linguistic constraints in English and other languages that embody Aristotelian logic. We are used to grammar categorising the structure of reality, where every sentence must include a subject and an action performed by the subject, which brings us back to Descartes' issue. He was so close to the ontology of feelings but thought of them as an action performed by a subject, trapped in the subject-predicate expression. Whitehead often complains about the rigidity of language as an obstacle to form the philosophy of organism. He invites philosophers to keep stretching the language out of its ordinary use to help us make an imaginative leap into new understandings of reality, to overcome the

technicalities that skew our worldviews (Whitehead 1978, p. 4). Perhaps this is why Whitehead rejected the traditional philosophical meaning of a subject, which loses its sense in his philosophy. Instead, he prefers the term *superject* (Whitehead 1978, p. 222). This is to show that a subject is also always an object that recursively conditions the environment of its own becoming. Feelings are aimed at the subject, but the subject is also always present as an object in this process. 'The feeling is an episode in self-production and is referent to its aim' (Whitehead 1978, p. 224). The subjective aim is what brings unity to feelings, and what governs the phases of becoming. Since subjects are simultaneously objects, an organism is composed of a multitude of subjects, where each subject is a centre of experience, and each of them has its own subjective aim in how it processes the sense-data in the event of prehension. For example, a dog is composed of atoms which have to fulfil their subjective aim for the animal to be materially coherent; the heart serves its subjective aim for the dog to live. Debaise notes that, in such cases, there is a subjectivity which superimposes itself on other subjectivities (Debaise 2017a, p. 56). He also points out that, if Whitehead still uses subject as a term in his philosophy, it should be understood as a tendency (Debaise 2017a, p. 57).

Feelings are constitutive of the process of concrescence of novelty, controlled by subjective aims. For Whitehead, every drop of experience, every feeling is always that of a difference. 'The same entity, be it an actual entity or be it an eternal object, cannot be felt twice in the formal constitution of one concrescence' (Whitehead 1978, p. 227). The becoming of the universe from disjunction to conjunction entails a recursive process in which objects are simultaneously subjects of creativity. A feeling is the disjunctive plurality of the universe (Debaise 2017a, p. 50) and subjective aims combine to steer the universe to conjunctive novelty. This, in turn, shapes a specific understanding of cosmic teleology. Here, prehension can be understood as the constitution of space-time relations in an actual entity—meaning that prehension can be used interchangeably with the word event. Onto-epistemology entails that actual entities become by exploiting the

potential of future relations, making prehension an ontological event. 'The word event just means one of these spatio-temporal unities. Accordingly, it may be used instead of the term "prehension," meaning the thing prehended' (Whitehead 1967b, p. 72). The subjective aim of all points of experience to construct 'the present [which] is the immediacy of teleological process whereby reality becomes actual' (Whitehead 1978, p. 214). Teleology is the creation of nowness. Biological organicism has a distinctive conception of teleology—of the present rather than of the future. The cosmos lacks the predetermination that we can find in mechanistic materialism or machinic organicism. 'Nature is a structure of evolving process' (Whitehead 1967b, p. 72) but the goal of its evolutionary activity is simply to survive into actuality. Teleology is the prehension of sense-data by the conjunctive unity of the cosmos. An event has a past and a present but its 'immediacy of realisation' (Whitehead 1967b, p. 73) is the ultimate metaphysical principle.

This understanding of teleology is also present in Schelling's thought—freedom, the absolute contingency underpinning his system of nature, means that it is nature itself that organises its intensive becoming. The telos of nature is differentiation against indifference (death). As a producer of ontology (organising organic), nature shapes the telos of the cosmos which constituted the crucial distinction in Hegel's system of machinic organicism where the telos of nature is predetermined by reason, from outside of nature (organised organic). Biological organicism is characterised by nonlinear, chaotic organisation, where the telos comes out of the creative act itself. In biological organicism, the production of actuality, creativity, is a telos in itself. Again, this is an ecological thought where the recursive process is about the production of difference, diversity being necessary for an environment to last, in contrast to the imperative of progress that we can find in machinic organicism. In machinic organicism, the telos of the recursive process is to overcome all contingencies.

Yet, subjective aims do not necessarily require consciousness in any form (Whitehead 1978, p. 232). There is a discussion in the scholarship

on Whitehead related to the problem of subjectivity that has yielded different interpretations. In recursive processes which happen in an immediate, nearly simultaneous manner for the concrescence of reality, it does not seem to be clear what comes first: feelings or subjects? Experience or some form of mentality? This confusion is exacerbated by the way the relationship between these concepts develops across Whitehead's works—there is a clear change in some elementary aspects of the system of nature (such as atomism) (McHenry 1995, p. 7). Some possible interpretations are pansubjectivism ('all events possess subjectivity'), panpsychism ('all events possess mentality') (McHenry 1995, p. 7), and panexperientialism (all events are experiences that do not require the presence of a subjectivity or mentality) (McHenry 1995, p. 3). It has already been signalled on multiple occasions that this book embraces panexperientialism. This is for pragmatic reasons, insofar as a radical empiricism that results from panexperientialism best clarifies how biological organicism underpins ecological thinking. The link between radical empiricism and biological organicism will be explained by the end of this section. I have also selected a panexperientialist interpretation for substantive reasons—Whitehead underlines the fact that some experiences are not mental even if the distinction between physical and mental aspects of experience is often arbitrary. We could observe that, when simple organisms fulfil their subjective aims with aesthetics rather than mentality, there is a terminological differentiation between material and mental occasions (McHenry 1995, p. 2). There is no mention of mentality when Whitehead explains how nuclei process sense-data. McHenry also notes that Whitehead 'never held the view that consciousness is fundamental to experience' (McHenry 1995, p. 3). Panpsychism is a possible interpretation of Whitehead's thought, but it is not stated explicitly in his works (Leclerc 1963, p. 126). A rejection of pansubjectivism is more subtle insofar as I have already argued that feelings always have subjective aims. However, it is clear that feelings precede subjectivity, as this is precisely the reason why Whitehead's entire metaphysical system is against substance ontology, as well as

Descartes' and Kant's approach to epistemology. Subjectivity is the result of creativity; it is that which gives aims and a nexus to the becoming of an organism.

Much like the concept of eternal objects erodes the conventional understanding of ideas, subjectivity in Whitehead's terms is dispersed in nature, and has no anthropocentric meaning. At the same time, ideas and subjectivity are rooted in nature, rather than separated from nature by the bifurcation between cosmos and logos. Cosmology as a method is an explanation of processes of concreteness against the bifurcation of nature, which is why the role of philosophy for Whitehead is to critique abstractions (Whitehead 1967b, p. 87). McHenry notes that Whitehead claimed that the 'philosophy of nature must be found in concrete experience' (McHenry 1995, p. 9). The concept of prehensions is derived from an introspective method, from our own experience of nature (McHenry 1995, p. 6). Whitehead argues that we have access to the metaphysical understanding of the system of nature because our experience of it, our bodily life, 'unifies in itself aspects of the universe' (Whitehead 1967b, p. 93). Prehensions combine perception with physical and biological processes; they merge experience with actual entities and subjectivities in nature.

To connect this point back to Schelling's philosophy, we have to return to transcendental geology which entailed the same method and the same blurring of the line between subject and object, specifically because experience is a necessary relation for cosmological novelty. For Schelling, organs constitute the core pillars of a universal organism; they are the points of communication in which differences in a system ablate into new conjunctions. An organ is also a basic unit of experience and, like in Whitehead's system, its meaning is broad to the point that 'the development of sense organs is not even a necessary condition for experience' (McHenry 1995, p. 3). *Irritability* and *sensibility* also happen at the atomic level. These two processes, similar to the concept of prehensions, signify a basic communication between different parts of the system of nature, a creative response to sense-data. Organs compose the universe on all scales (from physical to metaphysical).

This, in turn, implies the blurring of the lines between subject and object and between the study of nature and an object of study. For Schelling, the self-production of novelty is a recursion from nature as a subject (*natura naturans*) to nature as an object (*natura naturata*). The intensive productivity of all products of nature in the recursive process means that objects become subjects as soon as they are produced; the creative process is fuelled again by the disjunction of processes of organisation. Thus, transcendental geology insists that, to know about nature, we have to turn our attention outwards to the experience of concreteness, which in turn means an introspection into our own process of becoming. According to transcendental geology, the principles of natural knowledge are to be found in experiences of the concrete and the *sensible*. The natural production of difference is a common root for the emergence of physical laws and thought. For Whitehead and Schelling, the philosopher of nature has the same objective—to provide an explanatory framework that is coherent for both physics and metaphysics. Cosmology bridges the gap caused by the bifurcation in the sense of nature. Biological organicism is based on the study of experience but this experience proves 'a common world that is independent of our experience' (McHenry 1995, p. 9). This understanding of experience as that which weaves the ontological fabric of reality means that biological organicism is strongly in opposition to the Western philosophical tradition that subordinates feelings, aesthetics, subjective aims, ideas, and experience to consciousness or to a singular, human being. It also entails that, for biological organicism, an experience of difference is the ontological atom. As Whitehead puts it: 'apart from the experiences of subjects there is nothing, nothing, nothing, bare nothingness' (Whitehead 1978, p. 167). The final question that needs to be addressed before synthesising this set of processes is to unpack why this metaphysics/onto-epistemology would be termed *biological* organicism? The answer lies in how panexperientialism/radical empiricism is rooted in a biological understanding of reality and how it can underpin ecology.

In biological organicism, biology becomes metaphysics. Biological organicism entails that science is always a study of organisms. Whitehead claims that 'biology is the study of the larger organisms; whereas physics is the study of the smaller organisms' (Hui 2019, p. 103).[18] Metaphysics is no longer limited to formal ontology; physical laws are no longer primary to the construction of novelty but emerge out of matter; mechanistic materialism is substituted with organicism; a subject becomes a superject (an object in the environment that it constitutes), and epistemology becomes onto-epistemology. Therefore, biological organicism proposes a strongly naturalistic, unified outlook on evolution. Organisms and societies are understood as groups of actual entities with a common nexus, a study of evolution is the exploration of such enduring patterns in environments, and endurances are the evolved structures of activity. Societies are always embedded within other environments of actual entities that impact their ordering in the process of concretisation. In mechanistic materialism, the concept of evolution is limited to organisms, while matter endures (Whitehead 1967b, pp. 107–108). Hui notes that 'organicists wanted to overcome the opposition between vitalism and mechanism, and show that, for example, a cell can neither be reduced to physico-chemical explanations nor be understood as mysterious vital force, but rather comprises different forms and levels of organisation' (Hui 2019, p. 70). Panexperientialism provides 'one way of speaking which applies equally to physics, physiology, psychology, and to our aesthetic experiences' by deriving patterns of experience present in all levels of nature (McHenry 1995, p. 5). If we recall the definition of ecology here, it becomes quite self-explanatory why biological organicism can be presented as its metaphysics. Haeckel defines ecology as 'the entire science of the relationship of the organism to its surrounding external world, wherein we understand all "existence-relationship in the wider sense"' (Haeckel 1886, pp. 286–287). Process-relational metaphysics and onto-epistemology explain how the coupling of organic and inorganic matter produces novelty as well as scientific truths. It shows that immersion in nature is what produces feelings, concepts, and

knowledge about it. It brings a scientist and her thoughts back to the environment which she studies.

The question to ask here is whether ecology can be effectively practised if we continue using methods containing the fallacy of bifurcation. Does the bifurcation shape our experience of modernity and undermine ecological efforts? Yes, insofar as the scientific methods from which we derive truths about nature are still based on Kantian epistemology; how we conceive of civilisational progress is viewed through the lens of machinic organicism (as shown by Hegel's philosophy and divergent understanding of the telos of becoming); and so far, it has brought ecological destruction. Perhaps there is little space for biological organicism because its methods are too far from the conventional subject-object conception of reality. Do we need an epistemic turn and different metaphysics/cosmology to be able to practise ecology effectively (where the object of science is not removed from the temporality of its environment)? The final section of this chapter will contextualise the methods of biological organicism in contemporary approaches to the philosophy of nature to show that speculative realism is a viable scientific method.

This section explained the notions that are vital to Whitehead's organicism as a conciliation of ontology and epistemology. The shape of his onto-epistemology was largely influenced by Romanticism. Whitehead was inspired by the fact that Romantic works were opposed to the mechanistic materialism of science in that period. Romanticism can be viewed as a reactionary movement that sought to undermine methods that are based on the superiority of reason over nature. For example, Romantic poetry intended to grasp precisely what such methods omit—the immediate experience of nature that participates in our construction of a system of knowledge. Although there are almost no references to Schelling in Whitehead's works, their metaphysics shares a common underlying aim—to build a system of nature that reflects an experience of it. The processes of organisation that are found in their philosophies can be categorised as biological organicism, which conditions ecological thinking. Firstly, recursive onto-

epistemological processes reflect the principle that the differentiation of organic and inorganic matter is preliminary to the existence of an organism and knowledge, and that a study of an organism should not exclude the complexity of its relations to its environment. Secondly, these processes uncover that nature is also perceived on a pre-conceptual level by sentient and non-sentient entities. *Aesthesis,* sensations are the causal effluences of nature; without everything experiencing in togetherness, there would be no unfolding of the cosmos (panexperientialism). Thirdly, interrelated processes of becoming are simultaneous on all levels: bio-chemical, physical, and psycho-social; they all constitute our experience of nature. Mental states are arbitrarily differentiated from processes of becoming because effluences are immediate to them. As a result, ontology becomes reduced to the drops of experience of all actual entities. In Whitehead's philosophy, they are interchangeably called events or prehensions. This outlook deconstructs traditional Western epistemology because it dismisses the subject and replaces it with a superject (the immediacy of experience means that a perceiving subject is also an object of that experience), and because it expands experience to all sentient and non-sentient entities, organic and inorganic matter. Finally, onto-epistemology and panexperientialism condition ecological thinking because they reject the understanding of telos as civilisational progress and view the differentiation of nature as a telos in itself. Biological organicism also provides a method (speculative realism) for studying processes that constitute environments and how organisms relate to them, presented in more detail in the next section. As signalled in the previous chapter, biological organicism as a form of speculative metaphysics serves as a tool of interpretation for how systems of knowledge co-evolve. Organisms become on many intersecting micro- and macro-levels, and sciences describe their becoming in specific spatio-temporal localities.

By synthesising elements of Whitehead and Schelling's philosophies, we can now provide a list of rules which organise the system of nature and knowledge (as in onto-epistemology) in biological

organicism. In nature, there is no infinite reduction, and the most basic atom of ontology is difference, a drop of experience. The experience of reality causes the productivity of nature thanks to which actuality is composed of subjects and objects and becomes from disjunction to conjunction, from difference to difference. This is the basic recursive process that constitutes reality. Creativity is the threshold of ontology. Non-material, organic force precedes the material construction of a system, but this non-materiality is understood in a physical sense (quantum vibrations, electromagnetism, etc.). Processes of becoming are nonlinear and do not have any predetermined telos. Organisation is chaotic, based on a creative force of absolute contingency. An organic process underpins the whole universe, meaning that contingency carries the capacity of self-annihilation, and the laws of a system result from the endurance of the organisms that make up that system. The laws of nature, ideas, and the transcendence that emerge from material becoming have to be studied in relation to spatio-temporal localities, as they are specific to the experiences of the organisms that constitute them. The relation between subjects and objects is useful but arbitrary; experience is constitutive of reality in the broadest sense possible; and subjects and objects are products of experience. Radical empiricism entails cosmic realism, where nature/the universe is the largest scale of analysis in our epoch of becoming. There is no one, descriptive, exhaustive, metaphysical reality. Real potentiality is relative to the temporal becoming of every actual entity, which entails onto-epistemological pluralism. These hypotheses are open to revision by experience.

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5 Speculative Realism

According to Whitehead, substance thinking constrains science to focus on descriptions of *bare objects* abstracted from our experience of nature, where the observing subject can be taken as atemporal, logical *subjectum*. Organic materialism places *experience*, rather than knowledge about experience, as the starting point for the philosophy of

nature (Folse 1974, p. 4). Speculative realism reflects the temporality of the experience of nature and corresponds to a speculative metaphysics. We can only speculate about—rather than describe—reality. Speculative realism claims that an exhaustive description of reality by science is impossible; descriptive metaphysics is based on beliefs in supranatural capabilities of the human mind and a static universe. It is a rejection of the assumption that physics exhausts metaphysics—metaphysics does not arise from particular scientific discoveries, but rather from experiences of nature, which include scientific experiments. We can be informed by science or nature in general. In contrast to descriptive metaphysics, a speculative metaphysical system is on a continuum with actual reality. Metaphysics should revise its categories, whenever a new inconsistent observation arises. Equally, speculation aims to theoretically limit totalising and absolutising scientific truths, and scientific discoveries challenge the conceptual limitations of theoretical systems.

Previous sections already outlined two types of speculative methods found in the speculative physics of Schelling and Hegel. Their methods demonstrated different approaches to speculation. Machinic organicism encourages the empirical sciences to be examined inwardly, with reasoning about how they fit to the broader organic logic of the processes of becoming of nature. In biological organicism, the generalisation of empirical findings is tested outwardly, within the contingencies of specific material localities. This section will contextualise speculative realism as a method for biological organicism in more recent debates in the philosophy of nature and epistemology. Firstly, I will show how speculative realism corresponds to a specific interpretation of the paradox between subject and object in a scientific experiment of quantum physics. Secondly, the argument moves to a discussion on realism, positivist empiricism, and scientific experimentation more broadly. Speculative realism is in accord with philosophies of nature that view scientific truths as derived from experimental setups instead of believing that experiments uncover fundamental truths about reality. Positivist empiricism argues that the

laws of nature are fundamental to experiments, and not derived from repeated experimentation in (relatively) stable conditions (Cartwright 1997, p. 65). Finally, speculative realism addresses the issue of correlationism with a specific understanding of the contingency of the laws of nature.

Quantum physics is paradoxical in the context of mechanistic materialism because the presence of the perceiving subject always affects the results of the experiment, and because the perceiving subject cannot be described by the same physical laws as the experiment. Quantum mechanics dictates that the evolution of a system is partially an effect of the act of measurement (Putnam 1992, p. 4). The observer (apparatus of measurement) is *outside of/in addition, "cut out of"* the observed system and the observer must be described by the laws of classical physics. We encounter a paradoxical observation where ununified theories of physics relate to one another. This paradox can be interpretated in two ways: either the meaning of the system comes from the observer (linear and causal) or 'every property of the system is considered to have meaning and existence only in relation to particular experimental conditions' (Putnam 1992, p. 4) (nonlinear and quasi-deterministic). It is impossible to remove the observer from the experiment completely or claim with certainty that causation takes place externally to individually existing bodies (it undermines Newtonian cosmology and Kantian epistemology). The latter, Copenhagen Interpretation argued by Bohr, von Neumann, Heisenberg, and others correlates to the Whiteheadian understanding of redundance and reveals the inadequacy of the classical meanings of subject and object. Previous sections have discussed in detail the overlaps between quantum physics and process ontology as presented in Whitehead's thought. Biological organicism can provide a metaphysical explanation of the paradoxes it lays out in a unifying manner (Folse 1974, p. 2). If we understand the observer and the experiment as superjects, then they both are subjects and objects in the system and in an experience of that system—the field of experience is equivalent to a system of nature itself. The premise of biological

organicism is that the creation of novelty is conditioned by a subject that perceives it, hence the use of the concept of *superject* to underline that a subject is also always an object that conditions the environment of becoming. Importantly, different scales of becoming are governed by different laws of nature specific to their *locality*. But why, exactly, is Kantian epistemology incompatible with quantum mechanics?

Typically, descriptive metaphysics follows Aristotle's paradigm insofar as a subject is treated as a logical *subjectum*, abstracted from its material embodiment. Material nature is passive, governed by mechanical laws; it has been put in motion by a primary mover, *Primus Motor*, that is outside of the system of nature. We observe a similar bifurcation in Cartesian dualism, where only a thinking subject can be creative, in contrast to a mechanistic nature governed by physical laws. The *First Creator* who is outside of the system of nature began the process with a creative spark. Similarly for Newton and Kant, the subject has different capacities to the system of nature itself which allow it to make claims about that system from an impartial "God's-Eye" view. Hilary Putnam explains that the 'visualizability,' meaning that we can observe the universe from outside of it in its entirety, as a 'giant machine,' has originated from Newton, and that it entails that we are but subsystems in it. He states that this view shaped materialism and dualism in the Western tradition of thought (1992, p. 5). Following Putnam's analysis, in the cosmologies of Descartes and Newton, an observer is within the system of nature that she explains. She is subject to the same laws as the system of nature, she can make claims from *within it,* and she can state facts about the *whole universe*. This formulation of the construction of knowledge includes epistemic fallacies inherent to the desires of any philosopher who wants to establish knowledge as impersonal and objective. The "God's-Eye View" is rooted in the abstraction of subjects from their own experiences. Where Newton and Descartes insist that the observer and the act of philosophising are *within* the same system as the object of science, Kant moved the observer to the periphery of this system. Putnam writes that Kant's antinomies (paradoxes) are a result of this placement of a

subject in the system of nature where on the one hand our knowledge is shaped by our finitude and on the other hand it 'must yield (…) to "God's-Eye View"' (Putnam 1992, p. 18). For Kant, a subject has partial access to the "God's-Eye View" thanks to self-consciousness. That resistless difference between human and nature also means that we will never come close enough to the system of nature to know it in itself. While for Newton space and time exist independently of our experience (transcendental realism), for Kant we do not have access to "things in themselves" outside of our experience, and what is intuited in a space-time determination is a mere representation (transcendental idealism). The Copenhagen interpretation undermines both epistemological approaches because of what Putnam calls "a cut between observer and the system." An observer of quantum mechanics is not in the same system of nature as the experiment, even if her experience of the system alters its existence, because it must be explained by the ununified laws of nature (classical physics). If a subject is no longer at least partially *within* the system of nature, how can she state facts about that system? If in the traditional conceptualisation of the subject and object of science realism is established through the impartiality of the "God's-Eye View," how can we conceptualise what is real in a speculative manner that accords with the Copenhagen interpretation?

Putnam points to theories that already deal with a post-universal approach to philosophy like pragmatism, relativism, or some forms of poststructuralism, and deconstructivism (Putnam 1992, pp. 19–20). However, he also notes that some of these theories still fall under the same fallacy of the "God's-Eye View." Relativism, for example, assumes that one can stand within one's worldview and outside of it at the same time, as truth is both culturally constructed and personal. At the same time, it claims that all discourses can be understood without presupposing the notion of truth. Thus, it takes the "God's-Eye View" to state that none of the culturally and individually constructed truths are wrong. The problem of stating impartial facts by philosophers might be one of these philosophical issues that are irresolvable. But Putnam also

poses a more burning question for this book—*do we still need metaphysics?* The death of metaphysics has been announced several times. After Putnam, we can recall Wittgenstein who ridiculed epistemology and metaphysics altogether (Putnam 1992, p. 19). Following Hui, we can remind ourselves of Heidegger for whom cybernetics signified the end of metaphysics and philosophy (Hui 2020, p. 2). Scientists are searching for a *physical* theory that could unify classical and quantum physics (Putnam 1992, p. 5). There is also a general distrust to metaphysics in poststructuralism. We could also address the problematic resurgence of metaphysics in postmodernism.

Biological organicism's speculative metaphysics, which this book defends, responds that *we need a speculative metaphysics precisely to critique the abstractions and generalisations of sciences, to constantly test whatever science takes as its first principles and enforces as metaphysics*. As long as our experience of nature expands to new territories, and thanks to the sciences and the arts it always does, there is a need for a theory which can give us a set of hypotheses that provides an explanation in a unified manner. This theory does not need to be reductive or totalising. Instead, it should explain how plural metaphysical systems evolve and co-exist, and how the paradoxes and complexities of life somehow constitute a continuous flow of experience. This is an understanding of realism that is specific to the philosophy of organism which views reality as a mesh of interrelated processes, where the analysis of e.g., physics outside of biology, or nature separate from politics, is inherently problematic. Speculative realism is a theory that explains the mesh of processes that constitute milieus, linking the branches of sciences on a continuum of ever-changing experiences of nature. The critique of continental political theory that is suspicious of metaphysical systems conflates any metaphysical theory with totalisation. As a result, it withdraws from the possibility of theorising the fact that reality is composed of micro-localities, and that metaphysics informs how we act by schematising our experience into systems of knowledge. We should not be dismissive of metaphysics. There is a natural necessity of life to self-organise

against disorder, dissipation, and disintegration, to produce difference against indifference (death). As long as life persists, our thoughts require organisation, which means constraining them with metaphysical systems. Speculation as a method is about critiquing reductivism, absolutism and totalisation, and proposing pluralistic thinking. Metaphysical systems are problematic when they force their atemporal and universal statements on life and force their axioms on other branches of science. To reiterate it, we should make positive metaphysical statements from the standpoint of pluralism due to realism and pragmatism. If we take metaphysics as existing in spatio-temporal iterations of thinkers, institutions, and communities, then they shape our practices and are shaped by them. Biological organicism as an interpretative framework of speculative metaphysics is meaningful in terms of the consequences of practices. It can encourage diversification of thinking that promotes new realities under the circumstances of capitalist cosmotechnics, which we will delve into in the final chapter.

However, the question of realism from the perspective of the philosophy of organism still needs to be answered. There are two reasons why organic materialism overcomes the issue of "cutting the observer out" of the quantum experiment with the introduction of *locality*. First, organicism abolishes the rigid distinction between subject and object. Subjects are in fact constituted from a multitude of subjects which differ in scales; these subjects are at the same time objects which condition their environment of becoming. Quantum physics only becomes paradoxical within the system of nature described by classical physics if we understand the subject to be spatio-temporally continuous, as is the case in the tradition of Western mechanistic cosmologies. Rejecting realism because of the fragmentation of experience in a system of nature only makes sense if we continue to cling onto the classical understanding of a subject and the notion that the linear continuity of substances is necessary for the construction of knowledge. Second, localities in Whiteheadian metaphysics are *fractal*. We can zoom in and out from scale to scale, the

universe being the largest possible system of analysis, and a vibration of energy being the smallest (subject to revision by sciences). The paradigm of biological organicism asserts that a science always studies organisms, understood as enduring entities with a common nexus such as atomic nuclei. From the standpoint of biology, organisms living within organisms or environments within environments, governed by distinct sets of rules is common: humans cannot survive if not for the bacteria that inhabit them (even if we are usually consciously indifferent to their existence), or a sloth's fur is an ecosystem altogether distinctive from the ecosystem in which a sloth lives. Thus, the introduction of localities and scales in the study of nature is not antirealistic if we view them as fractal rather than fragmentary. Whitehead does not reject science and, in this respect, he is an empiricist. However, he believes that sciences can only accurately describe the localities they study. Scientific experiments are tied to the epoch of becoming of the organism being studied. Whitehead argues that 'every science must devise its own instrument' (1978, p. 11). *To some extent, the facts produced by a science are the results of the set of "instruments" employed by that science of a given locality of nature.* As the systematised regularities of nature, the laws of nature hold a truth value for the epochal becoming of the organism in question. However, these laws are invented rather than discovered.

We can translate this claim into the vocabulary used by Nancy Cartwright, whose *nomological machines* are clarificatory to what I think Whitehead argues in defence of science. The experimental realism that she presents resonates with Whitehead's outlook on how scientific observation serves as a starting point and grounding for metaphysical speculation. Cartwright defines nomological machines in the following way: '[i]t is a fixed (enough) arrangement of components, or factors, with stable (enough) capacities that in the right sort of stable (enough) environment will, with repeated operation, give rise to the kind of regular behavior that we describe in our scientific laws' (Cartwright 1997, p. 66). To put it in simpler terms, the results of experiments depend on the components that we include in the

equation, be it a specific planetary system or an actual laboratory setup. This statement opposes positivist empiricism insofar as the laws of nature are not fundamental—they are derived from repeated experiments in stable conditions (Cartwright 1997, p. 65). There has to be 'an arrangement of elements and the shielding conditions that keep the machine running and give rise to regularity' (Cartwright 1997, p. 66). The setup of nomological machines imposes an arrangement to which the arranged elements of nature respond with the regularity of laws. Cartwright points out that there are always certain rules, e.g., calculations, shielding conditions, capacities, properties, and a certain assemblage of such elements, needed to achieve the regularity of the laws of nature (Cartwright 1997, p. 72). If an experiment requires an assemblage of a number of nomological machines, they have to be set up to act together. Nothing can distort this setup if it is to yield regular outcomes (Cartwright 1997, p. 73). The laws of nature result from how we manipulate the environment with a nomological machine. Cartwright stresses that science does not act in accordance with British Empiricism and logical positivism, as if 'the world is made of facts and a fact at base consists in an object's displaying a property' (Cartwright 1997, p. 75). Her criticism resonates with Whitehead's diagnosis of substance thinking as the fundamental problem with positivist science. Cartwright also notes that, although an understanding of experiments as nomological machines is rather acceptable in the social sciences, physicists tend to insist on the speciality of their field which has the privilege of discovering a realm of nature that is independent of our experience of it (Cartwright 1997, p. 76). Cartwright's analysis of nomological machines is coherent with how Whitehead positions sciences in their search for "truth value."

Isabelle Stengers in *The Invention of Modern Science* (2000) also indicates that scientific "truths" are the results of experimental setups. After describing a schema found in Galileo's notes, she argues that science produces artefacts in a positive sense of this term, that science is an art of creating facts. Experimental apparatus is an art form that lets the author remove himself from the production of scientific facts

(Stengers 2000, p. 86). According to Stengers, the abstractions of science are not just what we generally refer to when we talk about the notion of abstraction in e.g., mathematics. The first abstraction is that of an event of nature—'it is relative to the invention of experimental practice that distinguishes it from one fiction among others while "creating" a fact that singularizes phenomena among others' (Stengers 2000, p. 86). A study of phenomena in an experimental setup is a tool of science used to unground that phenomena from the event of nature. Her analysis paints a familiar picture to what we could see in biological organicism: in Whitehead's thought, descriptive science is guilty of the abstraction of the bare object and the fallacy of misplaced concreteness; Schelling's method of transcendental geology (double ungrounding) criticises science for its description of fragmentary pictures outside of its productive, unconditioned form. Stengers argues that positivist science *derives rationality from atemporality* which is achieved by the abstraction of events from a system of nature and their material embodiments. Here, Stengers adds a second layer to the critique of science that we find in Cartwright's paper. Positivist science dictates that the laws of nature are discovered in the process of abstraction from experimental setups, ignoring the temporal constraints of these setups. Stenger's criticism is twofold: we should be aware firstly, of the constraints of truth dictated by the specific components of experimental setups and, secondly, of the power dynamic that is specific to the creation of that setup. The temporal becoming of what is considered "true" in milieus in which experimental setups are being created is dictated by a *contingent process* of the unfolding of history that has led to the invention of modern science (Stengers 2000, p. 72). To what extent are scientific representations in fact political, subject to numerous interpretations dictated by power dynamics, like the ability of positivist science to discredit knowledge that is viewed as non-scientific in the positivist sense? (Stengers 2000, p. 108). Stengers writes that 'every theory affirms a social power, a power to judge the value of human practices. No theory is imposed without social, economic, or political power being at play, somewhere' (Stengers 2000,

p. 113). The outcomes of scientific experiments are vulnerable to power because they are *invented*. Setting up an experiment means bringing phenomena into existence via the process of abstraction from the event of nature. An author of the artefact of knowledge brings it into existence and makes its history (Stengers 2000, p. 146). Therefore, whatever the standard for normal science is today—a standard shaped by the metaphysics of mechanistic materialism—it is certainly a scientific invention.

Stengers links the invention of modern science with the "utilitarian" interests shaped by "industries and states" that are always present, whenever and wherever we research. The choice is either precarity or the reduction of research to methods favoured by the power dynamic specific to the discipline (Stengers 2000, p. 118). Stengers finds a possibility to resist it precisely in the redefinition of the difference between subject and object (Stengers 2000, p. 134). If the object of science responds to the subject that interrogates, then it is also taking part in the process of the creation of the experiment (Stengers 2000, p. 147). She argues that we should acknowledge that the object of science always responds to the experiment, creatively bringing itself into existence, and co-constituting the regular results for as long as the setup of the phenomena remains shielded (Stengers 2000, p. 145). Recognition of the object of science as an active component in the creation of knowledge in the experimental setup could, according to Stengers, resist the tendency to produce knowledge under the pressures of persistent utilitarianism. However, what is more important for our analysis is how Stengers uses an organic metaphysics to describe the issues of positivist science, moving on different scales of milieus that condition the becoming of scientific truths. Cartwright's and Stengers' works are examples of how realism can be explicated without resorting to fundamentalism or insisting on the universalism of the laws of nature. In a similar way, speculative realism places scientific truths on a changing continuum of the experience of nature—as a philosophy of nature it explains where these laws of nature come from; as a cosmology, it is a method that can help with the analysis of the

reductivism of certain scientific truths. Having established how speculative realism can be used to address the issues of scientific experimentation and positivist empiricism, we will now contextualise it in the debate on speculative materialism in order to bring back the notion of the contingency of the laws of nature into the analysis and reiterate the formulation of realism in biological organicism.

It is important to recall here that the difference between Schelling's and Hegel's speculative metaphysics is situated in how they resolve the paradox of freedom in nature. They addressed that paradox with the question of how the necessities of nature (laws of nature) relate to contingency. While Hegel claimed that all contingencies are necessary (machinic organicism), Schelling argued that all necessities are contingent (biological organicism). Having categorised Schelling's and Whitehead's metaphysics as one type of organicism, we can add that their philosophies of nature should relate to the concept of contingency in a similar manner. Schelling's metaphysical system, like anything else in nature, is a *contingent* result of natural productivity. Knowledge and thought, as products of nature can comprehend the infinite becoming of nature only within the constraints of the finitude of human existence. Speculation is a necessity for this dynamic between thought and nature. In Schelling's thought, the way out of the correlationist circle is that we cannot draw a clear distinction between production of knowledge and organic sensibility. Thought is a product of nature in the same way as matter, and this common genesis allows us to construct knowledge about nature through the method of double ungrounding and introspection to phases of becoming outside of our existence. In contrast, for Hegel knowledge about nature is unnatural; logic, which is ultimately inorganic, gives us tools to comprehend the laws of nature. The cosmos is the subject of logic, and all *contingencies are necessary* in the unfolding of its history. We can find rationality in organic and inorganic matter. Thus, the absolutising of Reason necessitates contingencies into knowledge and forms a strong subjectalism. Meillassoux's way out of the correlationist circle is established through the *necessity of contingency;* however, instead of Hegel's real idealism,

he constructs an absolutist materialism. Shaviro notes that for Hegel we have access to things in themselves because our minds know nature's operational logic. In contrast, Meillassoux believes that thought and matter share nothing, and that we can be certain of what they are because they have no reason (Shaviro 2014, p. 135). Breaking away from Hegel, Meillassoux insists that there is no rationality in nature—reality is not necessarily rational, the emergence of thought is necessarily contingent. Yet a priori reasoning gives us access to knowledge about the cosmos out of the correlation because of the superiority of human thought.

It is worth noting that Whitehead's approach to epistemology complicates how the notion of contingency and its relationship to the laws of nature can be explained. It is difficult to express the issue within the correlationist *circle* because panexperientialism presents a fundamentally different approach to ontology to the one that can be found in Meillassoux. The strong sense of relations between all actual entities (Shaviro 2014, p. 30) that we can find in Whitehead's thought broadens the circle of correlation as wide as relational ontology dictates—ultimately it has to encompass all superjects and their prehensions that constitute a locality. For Meillassoux, the core premise that allows him to overcome the correlationist circle is that matter is dead. In Whitehead's onto-epistemology, matter is not dead but actively participating in the construction of reality, thought emerges from matter. Biological organicism is on a continuum with scientific discoveries and, with its speculative method, it blurs the lines that are crucial for Meillassoux's chain of thought. Shaviro points out that Meillassoux's metaphysics ignores the contemporary science where DNA proves that life, physical and chemical processes are continuous and complexity theory 'and system theory (not to mention quantum mechanics) have shown that even inorganic physical processes cannot be accurately conceived of in traditionally mechanistic and deterministic terms' (Shaviro 2014, p. 62). Arguing from Whitehead's standpoint, there is no longer a need for the traditional distinction between mechanicism and organicism that is necessary for

Meillassoux's correlationism (Shaviro 2014, p. 62). Shaviro notes that 'Meillassoux insists against all modern biology—both that life is radically discontinuous with mere matter and that thought is radically discontinuous with mere life' (Shaviro 2014, p. 75). Moreover, the strong distinction between subject and object, the two points between which the correlationist circle is constructed, cannot be upheld within panexperientialism because correlationism is constrained by the immanent dimension of a subject that experiences. The problem of correlationism is that the immanent sense of subjectivity entails that we must find a link between experience and the outside world (Shaviro 2014, p. 63).

Here is where we can return to the bifurcation in the sense of nature, which is in a sense Whitehead's own version of correlationism. Although problems of correlationism cannot be reduced to the bifurcation in the sense of nature (Shaviro 2014, p. 65), they are interrelated. Shaviro explains that Kant argued for his version of epistemology to counteract Humean scepticism (Shaviro 2014, p. 65). Hume's scepticism is based on the distinction between primary and secondary properties, physically extended objects and our psychical additions to them (Shaviro 2014, p. 65). From this distinction we can derive the standard Humean theory of contingency of the laws of nature. Causality is not something that we perceive in physicality, but rather something we add in a mental act. Thus, contingency is metaphysical for Hume (Huoranszki 2019, p. 489). Correlationism is rooted in this distinction between primary and secondary properties. From this distinction emerges the problem of the separation between the world and thought, where experience is necessarily enclosed in the immanence of the perceiving subject. Kant resolved this problem by stating that nature is organised 'in accordance with the conditions imposed by our minds' (Shaviro 2014, p. 66). Whitehead criticises Hume (and Kant) from an organic perspective—against the bifurcation of nature.

In *Symbolism,* Whitehead quotes the following passage from Hume to reveal how organic causality is presupposed in Hume's reasoning: 'if

it be perceived by the eyes, it must be a colour; if by the ears, a sound; if by the palate, a taste; and so on for the other senses' (Hume Part I section VI Whitehead 1958a, pp. 50–51). For Whitehead, experience is grounded in locality, and he argues that this is also what Hume presupposes when he states that a given experience *must* be *by* a specific organ. Whitehead claims that 'Hume with the clarity of genius states the fundamental point, that sense-data functioning in an act of experience demonstrate that they are given by the causal efficacy of actual bodily organs' (Whitehead 1958a, p. 51). Whitehead argues that the presentational immediacy of primary properties is as instantaneous as organic causal efficacy. 'The sense-data, required for immediate sense-perception, enter to experience in virtue of efficacy of environment. This environment includes bodily organs' (Whitehead 1958a, p. 52). Causality, therefore, is embedded in perception. Whitehead uses the concept of locality to criticise Hume and any dualism in the sense of nature.

How does this critique translate to the contingency of the laws of nature? For both Hume and Whitehead, the laws of nature are contingent, but Whitehead achieves this argument without the dualism of primary and secondary qualities. Similarly, as we could find in Grant's response to correlationism (which he bases on Schelling's thought), the contingency of physical laws is based on the infinite productivity of nature, where the laws of nature emerge out of matter that is constantly reproduced anew. We have established that this is a core characteristic of the metaphysics of biological organicism insofar as creativity/productivity is a necessarily contingent threshold of ontology that shapes the environment from which the laws of nature emerge, and so the method of metaphysics has to be speculative. In Whitehead's thought, speculative realism is derived from the characteristics of matter, rather than thought. For Hume, the contingency of laws of nature is metaphysical because we cannot find it in the primary properties of the physical world; there is no metaphysical necessity for causation in the laws of nature; the laws of nature are a mental construct

For Meillassoux, contingency is necessary also because the laws of nature are derived through a priori reasoning, thought and matter share 'nothing, not an origin, nor the condition of being' (Longo 2014, p. 38). According to Shaviro, Meillassoux reaffirms the bifurcation of nature because he rejects sentience in the 'physical universe' and 'paradoxically, because, in their evident epistemism, they aren't anti-correlationist enough' (Shaviro 2014, p. 122). Shaviro notes that Meillassoux only considers how an object can be known in itself, separate from a perceiving subject, but he does not focus on how thought could exist by itself—a noncorrelational thought—without giving it a 'transcendent status' (Shaviro 2014, pp. 124–125). Shaviro argues that, in Whitehead's works, we can find a pluralistic image of thought which is not tied to reason, abstraction, and sapiens (Shaviro 2014, p. 127). This Whiteheadian way out of correlationism would work only if we do not hypostasise non-human forms of thinking like e.g., feeling, and only if we do not insist on a mechanistic outlook on nature (Shaviro 2014, p. 125). Shaviro claims that Whitehead resolved correlationism *avant la lettre* as his organic ontology deconstructs the problem by insisting on the relationality of all actual entities in the universe rather than the opposition of subject and object. Things can relate without relating to a perceiving subject. Meillassoux repeats the fallacy of the bifurcation of nature—as Shaviro points out, for Whitehead 'no perplexity concerning the object of knowledge can be solved by saying that there is a mind knowing it' (Whitehead, 1964, p. 28). Ultimately, Whitehead would disagree with Meillassoux that correlationism has to be broken from within the circle (Shaviro 2014, p. 10), however, they both find resolutions to their respective epistemic issues by pushing the concept of thought to its limits.

For both Schelling and Whitehead, contingency is a metaphysical paradigm which we find in the experience of nature and matter. Here we have to disagree with Shaviro who, following Harman, argues that Whitehead's atomism (atoms as drops of experience) is "against the way" that Schelling sets up his mode of speculation (Shaviro 2014, p. 135). In *First Outline of the System of Nature*, Schelling formulates

dynamic atomism and speculative physics as consequences of organicism (2004, p. 5). For Schelling and Whitehead, atoms are non-substantial, built upon an ontology of natural forces/creativity, and the process of becoming. Atoms are indicative of centres of experiences in actual entities/organs, *as the difference* that facilitates the process of becoming of novelty. The environment takes an active part in the production of the laws of nature if we take organic sensibility to be a function of causal efficacy. The laws of nature are not a priori—we invent them in nomological setups, we find them in and with nature. The need for speculation comes out of matter and the inability of thought to describe the full system of nature due to its contingent becoming. Panexperientialism, the continuity of experience between organic and inorganic matter that constitutes novelty, overcomes correlationism once we reunify the dualism of primary and secondary properties in the experience of nature and situate organic sensibility within a relational ontology.

To sum up, in biological organicism, speculative realism is a method that corresponds to a speculative metaphysics—we can only speculate on the nature of reality because we are not able to provide an exhaustive description of it. Speculative metaphysics situates itself on a continuum with science. To ensure that a metaphysical investigation remains open to revisions and dismissal, that it will not become reductive or totalising, it should start with experience, create, or redefine concepts to fit within the speculative metaphysical framework, and end with testing these concepts through experience. Metaphysics is a set of hypotheses that explains what unifies the broad spectrum of experiences of nature as captured by the many branches of science. Scientific experiments tell us facts about reality, and metaphysical systems should bend and stretch to explain them in a pluralist and pragmatic way. The continuum of science can provide proofs for metaphysics, and if new scientific discoveries of science cannot be explained by metaphysics, it should revise its conceptual framework. Speculative metaphysics is rooted in the realism of organic thought. If the becoming of nature is dynamic and creative, a metaphysical system

cannot simply be a descriptive, self-contained conceptual system detached from ongoing discoveries in physics. Metaphysical speculation starts with experience and ends with experience. This relationship between metaphysics and physics can be described as radical empiricism and organic realism which are specific to biological organicism.

Quantum physics is an example of a scientific discovery that forces us to rethink metaphysics. It blurs the lines between subject and object (there is no longer a bare object of science that can be abstracted from the perceiving apparatus), and thus poses interpretational issues for the conventional approach to epistemology that we find in mechanistic materialism. Speculative realism resolves the paradox posed by quantum physics: an object of science is no longer abstracted from the environment of the perceiving subject; we have superjects instead (subjects that are constitutive to the environment that they embody); moreover, they can occupy different localities governed by ununified laws of nature. Following Putnam, we have argued that in positivist empiricism, realism is often derived from a stable position of the God's-Eye View, in a stable environment composed of objects of science; the subject is within the system of nature and can be abstracted from it. The concept of scientific localities resolves the issue of ununified laws of nature taking part in the same experiment (of quantum mechanics). These localities are no longer spatially fragmentary but rather fractal and overlapping.

Speculative realism moves away from how we conceive of realism in positivist empiricism—scientific experiments do not discover fundamental truths about the nature of reality but are specific to the material conditions of the experiments they stem from. Nature and the objects of knowledge are active in the construction of the laws of nature. They are active in the twofold understanding of change—from the perspective of the evolution of the laws of nature (the evolution of environments), and the evolution of science (Balashov 1992, p. 346), actively responding to the experimental setups of nomological machines. Speculative realism corresponds to experimental realism. As

a philosophy of nature, biological organicism provides a framework for analysis of interlocking processes that produce those laws: from creativity and potentiality of nature to nomological machines, and socio-political milieus that constrain experimental results. To be clear, speculative realism does not discard science; empiricism goes hand in hand with a radical form of experientialism, but it is not empiricism in the sense of scientific positivism. The laws of nature are derived from nature and not fundamental to it. Speculative realism is a method for the interpretation of how scientific truths are created and how they relate to one another, with an emphasis on the temporal and material specificity of how they are invented.

Speculative realism also proposes an explanation for another epistemological paradox: the correlationist circle. As with experiments in quantum physics, the problem here is posed by the necessarily immanent character of experience in conventional epistemology. The rationale of biological organicism is against the bifurcation of nature. It sees the fallacy of bifurcation as foundational to dualisms which constrain correlationism: the radical distinction between subject and object, as well as between primary and secondary qualities. Speculative realism provides the response to the correlationist question of realism, that is, the capacity to prove with certainty that the world exists outside of thought. However, situating the answer to the correlationist problem in the continuity of experience and thought between inorganic and organic matter might not be satisfactory for Meillassoux as it is not drawn from within the correlationist circle. It draws on cosmic realism and the assumption that nature has to be, for something like us to exist at all. Nevertheless, it provides a basis for realism based on a definition of thought without substantialising subject or object. The way out of correlationism presented by Meillassoux does not resolve the epistemological fallacy of the bifurcation of nature either. Importantly for this book, Meillassoux falls into mechanistic materialism in his conceptualisation of nature.

It is possible to think the nature of reality against the habitual refrain of the logic of solids, against the urge to manipulate the external

environment to make our subjects cosy. The mind resists thinking about the ceasing universe and the temporality of existence. However counterintuitive it is to our thought and feeling of immanence, thoughts and subjects emerge out of an organic sensibility that is not alien but rather foundational to the whole system of nature as we know it. Biological organicism is a philosophy of nature that can conceptually bring us closer to our actual experience of nature, against the bifurcation in the sense of nature, where matter and thought, nature and mind, share more with each other than we typically assume. This chapter has explored how several thinkers have attempted to tackle this vital relation between thought and matter with their scientific methods and epistemologies. Hegel and Schelling wrote their respective versions of methods for speculative physics, and Whitehead resorted to onto-epistemology. It was also shown that the issue is still pressing in the philosophy of science on the examples of the paradox in quantum physics, the debate between positivist empiricism and experimental realism, and the question of correlationism in speculative materialism. Speculative realism and biological organicism respond to these debates. Whenever the habits of mechanistic materialism grow strong, it is worth recalling the Last Universal Common Ancestor, LUCA, the first organic cell that emerged from inorganic matter and gave a foundation not just to all living beings, thoughts, and systems of knowledge, but also to the regulatory processes of the earth that allows life to thrive (Cooper 2017). Fast forward four billion years, we have manipulated our environments so much that we have alienated ourselves from nature to the extent that we are stuck in methods that are based on a belief in unique capabilities of the human mind that give us a right to manipulate nature. No doubt our tools and instruments of science have contributed to this process. The fourth chapter of this book rethinks the relationship between thought, matter, and temporality in the contemporary context by turning to the question of technology. If technology produces artefacts that change the temporality of thought and matter, then it also concretises our methods of thinking about the nature of reality.

References

Balashov, Yury V. 1992. On the Evolution of Natural Laws. *The British Journal for the Philosophy of Science* 43 (3): 343–370.
[https://doi.org/10.1093/bjps/43.3.343]

Cartwright, Nancy. 1997. Where do Laws of Nature Come From? *Dialectica* 51 (1): 65–78.
[https://doi.org/10.1111/j.1746-8361.1997.tb00021.x]

Cooper, Keith. 2017. Looking for LUCA, the Last Universal Common Ancestor. NASA. Accessed 17.February.2025 https://astrobiology.nasa.gov/news/looking-for-luca-the-last-universal-common-ancestor/

Debaise, Didier. 2017a. *Nature as Event: The Lure of the Possible*. Durham and London: Duke University Press.
[https://doi.org/10.1215/9780822372424]

Debaise, Didier. 2017b. *Speculative Empiricism; Revisiting Whitehead*. Edinburgh: Edinburgh University Press.
[https://doi.org/10.1515/9781474423069]

Folse, Henry J. 1974. The Copenhagen Interpretation of Quantum Theory and Whitehead's Philosophy of Organism. *Tulane Studies in Philosophy* 23:32–47.
[https://doi.org/10.5840/tulane1974232]

Grant, Iain Hamilton. 2008. *Philosophies of Nature after Schelling*. London and New York: Continuum.

Haeckel, Ernst. 1886. *Generelle Morphologie der Organismen*. Vol. 2, 286–287. Berlin: Georg Reimer.

Hall, Everett W. 1930. What Use are Whitehead's Eternal Objects? *The Journal of Philosophy* 27 (2): 29–44.
[https://doi.org/10.2307/2014071]

Hegel, Georg W. F. 1970. *Philosophy of Nature, vol. 3.* Translated by M. J. Petry. London: George Allen and Unwin

Hegel, Georg W. F. 1971. *Philosophy of Mind.* Translated by A. V. Miller and W. Wallace. Oxford: Clarendon Press.

Hegel, Georg W. F. 1991. *Encyclopaedia Logic*. Translated by T. F. Geraets, W. A. Suchting, and H. S. Harris. Indianapolis: Hackett

Hoffman, Charles G. 1952. Whitehead's Philosophy of Nature and Romantic Poetry. *The Journal of Aesthetics and Art Criticism* 10 (3): 258–263.

Hui, Yuk. 2016. The Parallax of Individuation; Simondon and Schelling. *Angelaki* 21 (4): 77–89.

[https://doi.org/10.1080/0969725X.2016.1229427]

Hui, Yuk. 2019. *Recursivity and Contingency*. London: Rowman & Littlefield International Ltd. [https://doi.org/10.5771/9781786600547]

Hui, Yuk. 2020. The Strange Being Called the Cosmos. *Foundations of Science* 27 (4): 1409–1414.

Huoranszki, Ferenc. 2019. The Contingency of Physical Laws. *Principia* 23 (3): 487–502. [https://doi.org/10.5007/1808-1711.2019v23n3p487]

Kennedy, Bart F. 1974. Whitehead's Doctrine of Eternal Objects and its Interpretations. In *Studies in Process Philosophy I. Tulane Studies in Philosophy*, edited by Robert C. Whittemore, vol. XXIII, 60–86. New Orleans: Tulane University.

Leclerc, Ivor. 1963. The Concept of Experience in Whitehead's Metaphysics. In *Alfred North Whitehead: Essays on His Philosophy*, edited by George L. Kline, 124–133. Englewood Cliffs: Prentice Hall.

Longo, Anna. 2014. The Contingent Emergence of Thought. In *Time Without Becoming by Quentin Meillassoux*, edited by Anna Longo, 31–51. Mimesis International.

Loosky, Nikolay. 1919. *The Intuitive Basis of Knowledge*. Translated by Nathalie Duddington. London: Macmillan and Co.

Lucas, Hans-Christian. 1986. Hegel, Whitehead, and the Status of Systematic Philosophy. In *Hegel and Whitehead, Contemporary Perspectives on Systematic Philosophy*, edited by George Lucas, 3–16. Albany: State University of New York Press.

McHenry, Leemon B. 1995. Whitehead's Panpsychism as the Subjectivity of Prehension. *Process Studies* 24:1–14.

Meillassoux, Quentin. 2008. *After Finitude; An Essay on the Necessity of Contingency*. London and New York: Bloomsbury Academic. [https://doi.org/10.5040/9781350252059]

Mesle, C. Robert. 2008. *Process-Relational Philosophy: An Introduction to Alfred North Whitehead*. West Conshohocken: Templeton Foundation Press.

Niemoczynski, Leon. 2017. *Speculative Realism; An Epitome*. Leeds: Kismet Press.

Pavid, Katie. 2025. Rainbow Nature: Wildlife in Ravishing red. Natural History Museum. Accessed 17 February 2025. https://www.nhm.ac.uk/discover/rainbow-nature-ravishing-red.html

Putnam, Hilary. 1992. In *Realism with Human Face*, edited by James Conant. Cambridge and London: Harvard University Press.

Richards, Robert J. 2002. *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe*. Chicago and London: The University of Chicago Press. [https://doi.org/10.7208/chicago/9780226712185.001.0001]

Schelling, Friedrich W. J. 1798. *On the World-Soul. An Hypothesis of Higher Physics for Explaining Universal Organism*. Hamburg: Perthes.

Schelling, Friedrich W. J. 1988. *Ideas for a Philosophy of Nature.* Translated by Errol Harris and Peter Hath. Cambridge: Cambridge University Press

Schelling, Friedrich W. J. 2004. *First Outline of a System of the Philosophy of Nature*. Albany: State University Press of New York.

Shaviro, Steven. 2014. *The Universe of Things: On Speculative Realism*. London and Minneapolis: University of Minnesota Press.
[https://doi.org/10.5749/minnesota/9780816689248.001.0001]

Stengers, Isabelle. 2000. *The Invention of Modern Science*. Translated by Daniel W. Smith. Minneapolis and London: University of Minnesota Press

Stone, Alison. 2005. *Petrified Intelligence; Nature in Hegel's Philosophy*. Albany: State University of New York.
[https://doi.org/10.1353/book4879]

Stone, Alison. 2013. Hegel, Naturalism and the Philosophy of Nature. *Hegel Bulletin* 34 (1): 59–78.
[https://doi.org/10.1017/hgl.2013.2]

Tzu, Chuang. 2010. *The Tao of Nature*. London: Penguin Books.

Watts, Alan, and Al Chuang-Liang Huang. 2011. *Tao: The Watercourse Way*. London: Souvenir Press.

Whitehead, Alfred N. 1958a. *Symbolism; Its Meaning and Effect*. Cambridge: Cambridge University Press.

Whitehead, Alfred N. 1958b. *The Function of Reason*. Princeton: Princeton University Press. Reprinted Boston: Beacon Press

Whitehead, Alfred N. 1964. *The Concept of Nature*. Cambridge: Cambridge University Press.

Whitehead, Alfred N. 1967a. *Adventure of Ideas*. New York: The Free Press.

Whitehead, Alfred N. 1967b. *Science and the Modern World*. New York: The Free Press.

Whitehead, Alfred N. 1978. In *Process and Reality; An Essay on Cosmology*, edited by David Ray Griffin and Donald W. Sherburne. New York: The Free Press.

Whitehead, Alfred N. 1985. *Process and Reality: An Essay in Cosmology.* Edited by David Ray Griffin, Donald W. Sherburne. New York: The Free Press.

Woodard, Ben. 2019. *Schelling's Naturalism; Motion, Space and the Volition of Thought*. Edinburgh: Edinburgh University Press.
[https://doi.org/10.1515/9781474438193]

Žižek, Slavoj. 2007. *The Indivisible Reminder: On Schelling and related matters*. London and New York: Verso.

Žižek, Slavoj, and Schelling, Friedrich W. J. 2009. *The Abyss of Freedom/Ages of the World; An essay by Slavoj Žižek with the text of Schelling's Die Weltalter (second draft, 1813).* Translated by Judith Norman and Ann Arbor: The University of Michigan Press.

Footnotes

1 Although I could go back further to pre-Socratics, some limits have to be put in the analysis so it can fit into the physical limitations of a book.

2 Ecological thinking e. g. environmental ethics, deep ecology, ecofeminism, new animism etc. are movements against this distinction, and are a relatively new emergence (1960'–1970') within the dualistic cosmology.

3 Naturalism meaning that efficient and final causes can be found in nature.

4 The notion of genesis will be explained later alongside Schelling's conceptualisation of evolution, involution, and analogy.

5 The ontology of forces is explained in detail later in this section.

6 All approaches that are based on substance/descriptive metaphysics.

7 Schelling as a Real Idealist is a late Platonist (Timaeus' Platonist)—where cosmology of celestial bodies provides an ontology of circular processes, and where the Ideal and what becomes is the way to understand the multitude (Schelling 2004, pp. 26–46). Iain Hamilton Grant explains in detail how the Aristotelian reading of Plato creates the dualism in the sense of nature in chapter 2 of *Philosophies of Nature after Schelling* (2008).

8 I will return to this point when discussing the overlap of techne and physis (art and physics being the same).

9 Surprisingly Deleuze does not distort Schelling's thought with his reading, which is perhaps due to the fact that his ontology is indebted to Schelling's definition of difference.

10 For interpretation of Hegel as a naturalist see works of Frederick Beiser.

11 For interpretation of Hegel as anti-naturalist see works of Sebastian Gardner.

12 Meaning of this term was explained in the previous chapter with Whiteheadian criticism of a *bare object* of science.

13 Christian appropriations of Aristotle pushed this understanding of the world to its limits. Finitude has become a source of sin, and by exercising the ten universal laws and repeating rituals, they could bring themselves closer to the infinite being in the eternal substance.

14 Or since the Christian appropriation of Aristotelian thought.

15 In the *Science and the Modern World,* Whitehead focuses on British Romantic poetry, but it is worth noting here that the *PR* was written in conversation with British Idealism (British Hegelians), especially Francis C. Bradley whom Whitehead credits in the preface (Whitehead 1978, p. xiii). PR is also written against British Empiricism, and Whitehead's own early works with Bertrand Russell, as a "speculative turn" towards cosmology (Lucas 1986, p. 4).

16 Eternal objects as Ideas is only one of possible interpretations, as discussed in this section, they also provide types of relation to space-time and operate in form of pure potentialities.

17 I will omit mathematico-logical, emergent, and ontological parity interpretations, and a full description of Platonic interpretation. For these distinctions see: Kennedy (1974).

18 It must be added to this quote that physics also deals with the largest organisms, e.g., in the field of astrophysics.

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4. Rethinking Matter

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1 Evolutionary Theories of Technology

Speculative metaphysics and organic realism paint a picture of an elusive onto-epistemology, where the laws of nature and what we know is incomplete, and knowledge is open to self-annihilation. In this temporary grounding, we can still construct a metaphysics with categorial claims and rules that guide the unfolding of the cosmological process, claims and rules that are biological and focus on what is natural. But we could argue that the cosmos in the current epoch is no longer biological or natural. Technology is deeply entrenched in the literal ground and waters of the planet; we are muffled by a technologically enhanced noosphere (Hui 2019, p. 14). Earth became an artificial construct and there is more to it than just organic and inorganic matter. The question of technology must be addressed for at least two reasons. Firstly, it must be clarified how technology is situated within biological organicism. The common view that technological progress is a process distinctive and/or in opposition to nature is a product of mechanistic materialism which treats inorganic matter as passive, reproduces the dualisms caused by bifurcation of nature, and is characteristic of modernity (Hui 2021). The view functions and

flourishes in today's Western world. Biological organicism offers an alternative understanding of technology and its relationship to nature. Secondly, the book expresses Romanticism in its approach to nature, in line with Schelling's thought and Whitehead's appropriations of the topos. As Mark Cockelbergh points out, Romantic thought is viewed as opposed to technology or even against the 'rationalist, and instrumentalist side of modernity,' and 'most classic philosophers of technology share this assumption' (Cockelbergh 2017, p. 3). Hui, whose works serve as the main inspiration for this book, shares that outlook insofar as he insists that a return to Romantic philosophies of nature is not enough to deal with contemporary issues and that technology has to be placed as the 'primary object of inquiry and dialogue' (Hui 2021). This is the major point of difference between Hui's philosophy and the position outlined in this book. I argue that organicism as a philosophy of nature leaves plenty of room for the philosophy of technology, and that developing an organicist philosophy of technology can provide valuable insights to cosmological issues. We need to return to philosophies of nature to diversify methods of sciences. In fact, organic metaphysics is foundational not just to accurately express ecological but also technological issues. While Hui would agree with this statement, he would argue for machinic rather than biological organicism, but as it was outlined before, such a metaphysics carries the Aristotelian doctrine of matter and the fallacy of bifurcation.

Hui systematises different types of metaphysics from the perspective of how contingency is processed by recursion. By this criterion, he examines the degree to which different types of systems not only allow the organic to be involved in the ontological process of the production of novelty but also how it shapes the mechanistic outlook on nature. For example, in non-organic approaches, where nature is taken as a *mechanism* (Descartes), *no contingency is allowed* (Hui 2019, p. 14). In *machinic organicism* (Hegel), where *contingency is necessary* for a system to progress, nature is organicist insofar as it self-organises as part of the unfolding of the cosmos, but the logic of this organisation is inorganic and external to nature (Hui 2019, p. 100). In

biological organicism (Schelling, Whitehead), the organisation of nature is neither subject to mechanical laws nor to a 'mysterious vital force,' where the opposition 'between mechanism and vitalism' is overcome (Hui 2019, pp. 16–17), *necessities are contingent*, contingency is the ground of nature (Hui 2019, p. 43). Essentially, we return to the paradox of freedom in nature but with a novel conception of freedom as a gradient that varies by type of matter—reorganised organic and inorganic matter (e.g., GMO and robots). It is important to note here that for Hui the question is not about what comes first, biology or technics. It also is not about whether we can reduce biology to technics or vice versa. Instead, philosophy should focus on systematic articulation of the relationship between the organic and inorganic as the technical objects (Hui 2019, p. 157). Taking Hui's approach to philosophising technology, we are not so much concerned with the premise of biological organicism that all entities result from the productivity/creativity of nature, but rather the focus has to be placed on relational ontology: the tendencies found within and between organic and inorganic matter.

In biological organicism, relations between organic and inorganic are interwoven with the evolutionary process of the cosmos. If machines in Schelling and Whitehead's works have an organic and contingent ground, the question of technology should be formulated within the process of the unfolding of the cosmos, where technological progress takes place within the cosmic organism. Technology is a contingency of cosmological unfolding, however, like organic and inorganic matter, it serves an evolutionary purpose—it is an exteriorisation of memory that helps thought endure through time (Stiegler 2025). Theorising technology within a biological organicist framework means searching for a theory of technological evolution that de-centres the human. The concept of technology suitable for biological organicism would therefore have to comprise both aspects—be processual/relational and non-anthropocentric. However, the evolutionary processes of technology and nature are not identical even if metaphysically they have the same logic of becoming and genetic

root. To construct a fitting concept of technology, we will first very shortly review several theoretical perspectives drawn from the works of Charles Darwin, Gilbert Simondon, and André Leroi-Gourhan which all posit technological progress as an evolutionary tendency. Secondly, we will examine how Whitehead's work influenced Bernard Stiegler's philosophy, and how organic materialism underpins the evolutionary approach to technology in his works. Thirdly, we will return to the philosophies of Schelling and Whitehead. Neither thinker develops a specified theory of technology or technological evolution, although we can find some scarce commentary on mechanicism in Schelling's works and on technology in Whitehead's. Still, it is necessary to return to their works if we are to articulate philosophy of technology in biological organicism. The chapter will conclude by considering a Romantic understanding of technology and what it teaches us about our own nature, to finally arrive at a philosophy of nature that encompasses the question of technology.

Before reviewing Simondon's and Leroi-Gourhan's evolutionary approaches to technology, we must first examine Darwin's theory of evolution. Although Darwinian evolution is biological and could therefore potentially serve as a point of reference for biological organicism, the problem is that it is based on a mechanistic understanding of nature. As John Foster argues, the Darwinian process of evolution is Newtonian insofar as it is described as a gradual and linear progress which is *not* 'subject to nonlinear discontinuities' (Foster 1997, p. 432). Similarly, Michael Ruse (1982) notes that Darwin consciously constructed his theory of natural selection in accordance with Newton's theory of the universe (Foster 1997, p. 432). The linear and mechanistic conception of evolution in Darwinism is well expressed by Bergson: 'the Darwinian idea of adaptation [is the] automatic elimination of the unadapted. (…) [W]hile an organic structure is just the accumulation of those small differences which evolution has had to go through in order to achieve it' (Bergson 2014, p. 39). Environmental conditions are conceptualised as sets of external causes that act upon individually existing organisms and mould their

structures accordingly. Variations produced by random mutations are kept only if they are advantageous to the survival of a species. Darwin writes that the principle of the Natural Selection is based on the preservation of characteristics that are useful in the struggle of life in the offspring (2008, p. 98). In Darwinism, biological mechanisms are made—they are partitive, and we can reconstruct them if we follow certain instructions. In evolutionary progress, the main instruction is the imperative of Natural Selection. There is linear causation—even if organisms live in contingent conditions and there are random variations in a species, over time, similar conditions will lead to similar organic structures. The mechanism of evolution can be explained as a gradual linear chain of adaptations over time—the mechanism being the elimination of inefficient contingencies.

As outlined before, biological organicism is incompatible with Newtonian cosmology, whether we think of processes of causation, or the understanding of matter. In Andres Vaccari and Belina Barnett's application of Darwinism to technological evolution, we see that these underlying cosmological assumptions make technology and organic matter quite alien to each other. Firstly, technical objects can reappear and appropriate innovations across "species." Secondly, they virtually cannot go extinct in the same sense of the term (Vaccari and Barnet 2009, p. 5). Vaccari and Barnett claim that, in technological evolution, the mechanisms of variation and inheritance, the notions of lineage, individual and species, the question of origins and order are different to those found in biology (Vaccari and Barnet 2009, pp. 5–6). Their analysis gestures towards the fact that the Darwinian theory of evolution is not fully compatible with technological progress, because of the underlying distinctions between organic and inorganic matter. The irony is that, despite its mechanistic understanding of nature, Darwinism cannot explain technological evolution. Mechanistic understanding of nature that cannot encompass technological evolution brings us back to the paradox of freedom in nature and the fallacy of bifurcation. Technological evolution serves as an example that

inorganic matter can have the freedom of containing a thought; that thought, and matter are not so alien.

When we switch from a mechanistic to an organic approach to evolution and its speculative method, the focus shifts from what makes species similar (recursion) to the processes of differentiation at play. While the object of study is still an evolutionary tendency, this tendency is reimagined. Technology relates differently to its environment than animals or plants, as it can transcend a *temporal and material* locality. To systematically address this particularity of technological evolution, we have to rethink the relationship between organic and inorganic matter. A compelling explanation of technological evolution that takes this approach is found in French philosophies of technology.

Hui explains that André Leroi-Gourhan frames the question of technological progress between *technical tendency* and *technical fact*. Technical tendency is universal and abstract, but also imminent and predictable, while technical fact is particular and concrete, requires invention even if it is constrained by history, culture, environment, etc. (Hui 2016a, p. 58). In this approach to technological evolution we can differentiate between the necessity of technological tendencies (the invention of a wheel) and the contingency of technical facts (the invention of a wheel specific in a culture) (Hui 2016b, p. 8). Leroi-Gourhan's theory provides an abstract understanding of technology that cannot be reduced to the contingent products of nature, i.e., technological artefacts. Again, we are interested in how technological tendencies can be explained by an evolutionary process from differentiation of relations between organic and inorganic matter. When Darwin sought to understand why some genetic variations in species endure while most were eliminated (elimination of the unadapted), he studied the evolutionary tendency as the recursion of similar organic structures. Leroi-Gourhan was not concerned with the similarities of concrete inventions/variations which are contingent, but rather with evolutionary tendencies as the drivers of organic differentiation.

This difference between understanding an evolutionary tendency as recurrence and as differentiation changes how we conceive of processes of causation in evolution. This change is made apparent when we consider Darwin's and Leroi-Gourhan's differing explanations of the emergence of technology. Darwin's take is based on a logical chain of evolutionary development—bigger brains in humans led to the development of an intellect that could come up with better survival strategies, such as building tools and shelter in harsh environments. Over time, the feature of a bigger brain was necessitated in the human's organic structure by environmental conditions (Ingold 1999, p. 414). In contrast, Leroi-Gourhan claims that the creation of tools is incidental to locomotion rather than brain size. The brain is constrained by the physical limitations of a skull, and a skull can only hold a big brain thanks to how it is positioned on our vertebral column. If not for the adoption of an upright posture, humans could not develop bigger skulls, the containers of bigger brains. 'Brain enlargement [is] an incidental by-product of a more fundamental evolutionary change in posture' (Ingold 1999, p. 415). An upright posture also liberated the hands with which we can bear tools, and liberated the face from its earlier grasping function that allowed for the development of speech (Ingold 1999, p. 417). Humans, therefore, arrived at technology thanks to the combination of a bigger brain, liberated hands and face (Ingold 1999, p. 417). Leroi-Gourhan's theory presents evolutionary tendencies in the form of changing relations: not linearly between environments and species, but as changing complex relations of organic differentiation in specific environments. 'For Darwin the brain secretes the thought, which in turn is realised in the form of tool. For Leroi-Gourhan, to the contrary, conscious thought is bypassed, such that the tool is a direct secretion of brain and body combined' (Ingold 1999, p. 420). Thus, Leroi-Gourhan argues that the exteriorisation of practices for survival cannot be reduced to linear mechanisms of adaptation by the elimination of the unadapted, in this case of individuals with smaller brains.

Leroi-Gourhan's theory explains how humans (and other animals) can arrive at technology through organic differentiation. Therefore, his theory is focused on technics, an evolutionary tendency understood as exteriorisation of practices of survival. Leroi-Gourhan's theory does not discuss technological artefacts as a specific type of reorganised inorganic matter. From the perspective of biological organicism, the question how it is possible that reorganised inorganic matter can contain thought and transcend life is equally important to the question how organic processes can lead to technics. For the conceptualisation of the process of differentiation that can be found in the matter of technological objects, we must turn to the work of Gilbert Simondon.

Simondon develops a theory of technical evolution that is independent of human determination. His theory revolves around *functional overdetermination* and the 'process of *concretization*, the condensation of various functions in a single structure oriented towards efficiency' (Vaccari and Barnet 2009, p. 8). These two drivers make technical objects evolve 'in the direction of a small number of specific types' (Simondon 1980, p. 17). For Simondon, the functions of technical objects are defined by their potentiality to carry information (Hui 2019, p. 203). Processes of evolution are associated with the transmission of information across generations that, in the context of technological evolution, can be formulated as a potency and organisation of matter. The process of concretisation that propels technical evolution is inextricably tied to the material basis of the technical object. Technical objects enable the transmission of information *across time*. Technical evolution is different from natural evolution because it can carry the potentiality of relations between organic and inorganic matter across time.

For both Leroi-Gourhan and Simondon, technical and technological evolution is conceptualised as a tendency of differentiation. While Leroi-Gourhan presents a planetary perspective as to why humans developed technics, Simondon's theory provides an understanding of processes that reorganise matter such that technological objects are possible at all. The reorganisation of matter, which he describes as a

process of trans-individuation, underpins the evolutionary tendency present in technological objects themselves. Simondon views technicity as the result of the potentiality of matter, and a relation between the organic and inorganic. Drawing on these two authors we can conceptualise technical evolution as a theory of a planetary tendency on one hand, and processes on the micro-level that result from the potentiality of matter, on the other hand. In both cases, technicity and the emergence of technical objects are approached through a study of processes of differentiation and changing organic relations. Thus, technology can be examined with a cosmological method that studies the interlocking processes of micro- and macro-levels.

This section presented the reasons why biological organicism must address the question of technology, the main one being that the cosmos is no longer made up of just organic and inorganic matter. The cosmos has become artificial, wrapped in reorganised organic and inorganic matter. This new type of matter can carry thought through time; technicity is the ability to exteriorise the means of survival and manipulate the environment. Humans can exteriorise thoughts into matter that can then transcend the temporality of organic life. Technicity emerges out of complex relations between organic and inorganic matter that can be systematically articulated. An organic approach explains technicity and technological objects as interlocking processes—an evolutionary tendency of organic differentiation and the potentiality of matter. Organicism proposes an evolutionary approach to technology that is incompatible with Darwinism and its Newtonian cosmology. Darwinism cannot conceive of an evolutionary theory of technology because mechanistic materialism splinters matter and thought and thus fails to explain a technicised planetary system.

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2 Organic Materialism in General Organology: Whitehead's Influence on Stiegler

An organic explanation of technics encompassing interlocking macro- and micro-processes on many cosmological levels can be found in

Bernard Stiegler's general organology. Stiegler is a philosopher of technics who draws on a multitude of thinkers, including Whitehead. Stiegler admits that he owes the method of speculative cosmology to Whitehead on multiple occasions.[1] The cosmological formulation of the question of technology that we find in his works provides an opening for the theorisation of technology in biological organicism. It is worth noting, however, that Stiegler differentiates his organological approach to technology from organicism. His approach is organic insofar as general organology is based on organic rather than mechanistic materialism, but he argues that his philosophy amounts to an organology rather than organicism. This section will establish the difference between organology and organicism and demonstrate in detail how Stiegler's approach is based on organic rather than mechanistic materialism. The organic materialism in his general organology will be presented with a focus on Whitehead's influence.

Stiegler's understanding of technological evolution is also shaped by the works of Leroi-Gourhan and Simondon, but he mixes their ideas with many other theories and concepts. Stiegler defines technics as planetary tendencies (evolutionary tendencies) and as processes that reorganise matter, but he also conceptualises technics at the levels of the pre-individual and the individual. On a pre-individual level, technics are practices that can *transmit knowledge and form subjectivities*. On an individual level, technological artefacts serve as exteriorised, non-biological organs, 'technical prostheses' (Bishop and Ross 2021, p. 117), which retain memory 'outside of living organisms themselves' (Bishop and Ross 2021, p. 113). On a planetary level, we find technical systems that are a globalisation/universalisation/deterritorialisation of these technical dependencies, that is specifically apparent in the exploitation of natural resources and interdependence of the global capitalist market (Stiegler 1998, p. 31). On a micro-level, Stiegler presents a theory of hyper-matter to conceive of the reorganisation of matter that enables thought to endure through time (Stiegler 2020, p. 269). Technics are tendencies that have material dimensions, such as the externalisation of organs, the production of artefacts and the

reorganisation of matter, as well as immaterial dimensions, present universally for human evolution, and as pre-individual practices. Technology is therefore defined as the product of a contingent tendency of evolution that transforms both nature and what it means to be human. General organology is a modified form of speculative cosmology; a cosmological method for studying how technics express themselves in different tendencies at many scales of becoming, and how changing relations between these levels are consequential for our practices. Stiegler reiterates the ontological relationality of processes, as well as their different levels that contribute to the production of human facts. He defines general organology as 'the rules for analysing, thinking, and prescribing human facts at three parallel but indissociable levels: the psychosomatic, which is the endosomatic level, the artifactual, which is the exosomatic level, and the social, which is an analysis of relations between organic organs, technical organs, and social organisations' (Stiegler 2017, p. 130). Thus, general organology explores how we relate to the cosmos, and how technics change our positionality in the broader system of nature.

Aside from adopting a cosmological, speculative method, Stiegler's organology draws on organic materialism. This is apparent when Stiegler uses concepts that can also be found in Whitehead's works. For example, he refers to the process of concrescence[2] defined by Whitehead as the process of coming into being from the abstract to concrete (Stiegler 2020, p. 41). For Whitehead, this is one of the basic ontological processes of becoming. In these processes of concrescence, prehensions and feelings form the ontological relations of events. Prehensions and feelings shape the subjective forms for the 'one determinate integral satisfaction' (Whitehead 1985, p. 26). In a process of concrescence, events are formed through collective processes *and* processes of individuation. Thanks to these processes, actual entities can become by fulfilling their subjective aims. The process of individuation cannot be separated from collective individuation as they are always happening *together*. Stiegler views such processes as "primordial" and foundational to understanding how organological

relations with technology exteriorise thought and reason, and how technicity existing on a pre-individual level can be interiorised. Daniel Ross notes that concrescence is a process that reflects Stiegler's organological understanding of the process of individuation 'insofar as they are at once psychic, collective, and technical' (Ross 2018, p. 33). Stiegler's understanding of the process of individuation resonates strongly with Whitehead's ontology insofar as human becoming is always shaped by psychic and collective individuation. The difference lies in that Stiegler understands these processes to be technically conditioned. 'Organology [i]s the co-individuation of living organs, artificial organs and the organizations that links them together' (Stiegler 2015, p. 222). Still, this argument can only be constructed from the perspective of an organic materialism that rejects the ontology of individually existing bodies and considers pre-individual and collective processes as conditions of the process of individuation itself.

Stiegler explains how processes of concrescence became technically conditioned when he presents his theory of evolution. He moves to a form of post-Darwinism, where our survival is no longer dependent just on organic but also on artificial organs. With the invention of tools, we are no longer just dependent on our genetic history, but we can also recraft our future with technical objects (Moore 2017, pp. 191–212). Artificial organs reshape the functionality of organic organs and in turn they change how we experience our environment. Therefore, Stiegler claims that Artificial Selection suspended Natural Selection in human evolution. Moore notes that this recursive, mutual shaping of the organic and inorganic organs changes the functionality of our bodies. We can write, mould, engineer, and navigate, and this in turn also changes our subjectivity, how we experience the world and imagine the future (Moore 2017, pp. 191–212). Technicity is now embedded in organic differentiation and shapes how we experience our environment (Moore 2017, pp. 191–212). For example, when the invention of writing changed our cognitive processes, it reorganised our sensory cortex. Through these evolutionary pre-individual and individual processes, feelings become technically inscribed. For both Whitehead and Stiegler,

there is a certain ontology of feelings that is constitutive of processes of individuation conditioned by organic sensibility. The difference is that, for Stiegler, these organs can also be artificial. In organicism, feelings are described as organic sensations (*aistheseis*) that are always pre-conceptual (Whitehead 1978, p. 24). In Stiegler's general organology, Artificial Selection taps into this specific process where technical inscriptions of *aistheseis* take place organically. We are 'suspended between our bodies and tools, between our technical heritage and the visions of a world that this heritage enables us to project' (Moore 2017, pp. 191–212). According to Stiegler, the process of concrescence has been transformed by technically conditioned feelings and in turn processes of individuation are limited and enabled by technicity.

It is worth noting how Stiegler differentiates himself from Leroi-Gourhan insofar as he claims that, at a certain moment in human evolution, Natural Selection was suspended by Artificial Selection. Stiegler argues that 'humans evolve biologically insofar as they are animals, but only become human through technics' (Moore 2017, pp. 191–212). Technics is what distinguished humans from animals. At the same time, he notes that technics contingently happened to be hegemonic for humans, and it does not mean that other species cannot exteriorise their means of survival (Turner 2016). Leroi-Gourhan claims that technicity is a zoological fact, and humanity became distinctive with the formation of social groups (the transition from zoological to sociological). Technicity was primary to social life; and only technics combined with social life allowed humans to exteriorise thought. Tactics of survival were no longer just inscribed in genes, indicating that humanity is not just defined by technics but more by the way that social life enabled us to use technicity (Ingold 1999, pp. 417–418). In either case, adaptation is now also happening outside of us, transmitted through processes of collective individuation that are supported by technicity.

General organology is rooted in organic materialism because Stiegler assumes that human becoming is always shaped by processes of psychic and collective individuation, that these processes are

conditioned by organic sensibility (whether artificial or not), and he argues for the *continuity between thought and matter*. However, general organology is altogether different from biological organicism, and not just because feelings are technically conditioned. A significant difference is that, even if technics and nature constitute the same parallel and indissociable level of becoming, there is a distinctive type of recursive process that characterises the technical mediation of human activity. This is the main and fundamental difference between organology and organicism. Hui explains that, while 'organicism is a recursive thinking, organology signifies a shift from one recursive form (in nature) to another' (Hui 2019, p. 25). Organology is a mode of thinking that focuses on a relation *between* two systems—between an organism and a machine (Hui 2019, p. 25). Organicism, meanwhile, maintains that a problem has to be considered *within* the system of nature characterised by one type of recursive process: this will become especially clear when we expand on Schelling's conceptualisation of mechanism. However, Stiegler's organology does not reject the idea that an organism and a machine can be treated as an organic whole (Hui 2019, p. 25). There is an assumption in Stiegler's work that nature and culture, and the organic and artificial organs evolve as one system of interrelations (Hui 2019, p. 26), e.g., as the system of universalisation and deterritorialisation of technics. Still, Natural Selection was suspended by Artificial Selection at a certain point in human evolution, and organology examines how the technical mediation of human becoming produces different recursive processes—how it changes relations between organic, artificial organs, and social organisation. Perhaps this main difference between general organology and biological organicism is determined by the aims of each philosophical project. Biological organicism seeks to unify the processes of becoming between the different branches of science to provide a coherent philosophy of nature that reflects actual experience. General organology seeks to answer how the technical conditioning of human organic relations changes society, politics, and our future. Stiegler draws on organicism because these questions of organology can only be

formulated from within an organic metaphysics. However, he modifies them and uses general organology as a method, and *hyper-materialism as an epistemology* which amounts to what we can classify as a form of *organic materialism,* distinctive from the organicism that can be found in Schelling, Hegel, or Whitehead.

Nevertheless, Stiegler's specific formulation of *hyper-materialism* should be situated in the tradition of process thought that is opposed to substance-based ontologies. Like Whitehead, Stiegler critiques the influence of Aristotelian metaphysics on Kant, and the institutional dominance of non-organic cosmologies in Western philosophy. Kant's cosmology makes it impossible to theorise 'the idea of rational cosmology' (Stiegler 2020, p. 42) or to pose the question of technology in organology (Stiegler 2017, p. 131). Stiegler argues that the problem that Kant perpetuates is twofold. Firstly, reason is considered a faculty of understanding that cannot exteriorise and penetrate the processes of formation of matter, given that matter submits to form, which is necessary. Secondly, Kant overlooks the possibility of a technical condition of thought. Because he treats technics and the possibility of contingency as separate to cosmic fixities (forms), technics cannot impact the formal, cosmological fabric of ontology. Thus, for Aristotle and Kant, the world is a fixed sphere and the accidents of matter in different forms are in fact cosmic necessities. In this substance-based approach to matter where things endure as ontologically identical because of cosmic necessities, matter cannot change its own formation, which is to say that it is not organic. If matter cannot create forms, and reason cannot exteriorise, technics cannot be understood organologically. Technics mediate thought, transmit knowledge, and shape matter, meaning that they are incompatible with mechanistic materialism (Stiegler 2017, p. 131).

Stiegler opposes Aristotelian ontology because of its hylomorphic schema based on the endurance of substances (Stiegler 2017, p. 269). Instead, he argues that matter can form itself with the exteriorisation of thought. In the recursive process of individuation, thought and reason can shape and be shaped by matter. As is typical for process philosophy,

Stiegler points out the interlocking processes of the formation of novelty that make it possible to theorise matter and thought in continuity. At the same time, hyper-materialism explains technics on a micro-level—how is it possible that reorganised inorganic matter can transmit thought through time? According to Stiegler's *hyper-materialism*, technics should be understood as a specific type of organisation of matter, namely, organised inorganic matter. This is because of the function that hyper-matter serves in the evolutionary processes, where it constitutes and accumulates "a hyper-material memory." Stiegler calls this epiphylogenetics, where evolution is formed by the biological, the artificial, and the shared knowledge of technics (Stiegler 2020, p. 269).

Different types of matter, characterised by their potency in memory transmission, affect each other in the recursive processes of evolution. Stiegler differentiates between: '1. Inert or inorganic matter (steel, silicon etc.); 2. Organic matter (organic, endosomatic organs); 3. Organized inorganic matter; (robots, AI, exosomatic organs, and artifactual level of evolution, etc.); 4. Disorganized and reorganized matter (plants and animals manipulated in the process of agricultural selection, human brain and body)' (Kwapińska 2022, p. 63). This systematisation reflects the switch in the recursive process of novelty between the human and the machine that is specific to organology and shaped by the function of reason, which we will now focus on.

In hyper-materialism, *reason* has a specific *function* in shaping evolutionary processes and in reorganising matter, unlocking its potentiality to transmit thought through time. To define this function of reason, Stiegler draws once more from Whitehead's philosophy. Ross notes that Stiegler specifically uses Whitehead's speculative cosmology to reinterpret reason from a faculty, in the Kantian meaning of the term, to a function (Ross 2018, p. 31). As with the concepts of feelings and concrescence, the main difference between general organology and organicism is that Stiegler reads Whitehead's *organ of novelty*, reason, as (accidentally) necessarily technical in the case of humankind. To explain this function of reason in evolutionary processes more

precisely, it is worth first outlining its meaning in Whitehead's organicism. In organic realism, there is only one organic process that underpins cosmological unfolding: the production of difference based on the creative processes from disjunction to conjunction. Despite this metaphysical logic of the construction of matter and the production of novelty, we can still observe different tendencies in cosmic processes of concrescence. In *The Function of Reason*, Whitehead describes reason as a relation of 'two contrasted aspects of history' (1958, Introductory Summary), downward and upward evolutionary tendencies that cannot be reduced or explained simply by the rule of survival of the fittest (1958, p. 2). The upward movement he defines as the course of biological evolution and the downward movement is 'the degradation of energy,' the wasting of matter, and 'a slow decay of physical nature' (Whitehead 1958, Introductory Summary). These two contrasting tendencies can be differentiated within other evolutionary processes at the many levels of life that matter exhibits, and the degree to which it can modulate its environment (Whitehead 1958, pp. 2–3). Whitehead's theory rejects the reduction of evolutionary processes to the linear causation present in the mechanism of natural selection. A classification of evolutionary tendencies is presented according to the criteria of organic differentiation: how much difference is produced in the production of novelty. When little to no difference is produced, there is little to no life; the more difference is produced, the more complex the organism, the more the function of reason is exhibited. This of course does not translate to longevity because the persistence of a hundred million year-old rock can be juxtaposed to the comparatively shorter lifespan of a creative human (Whitehead 1958, p. 2). The function of reason, as an organ of novelty, is one way in which life produces difference and changes its environment in relation to the two cosmic upward and downward tendencies. The function of reason is 'the promotion of the *art of life* [emphasis mine]. The primary function of Reason is the direction of the attack on the environment' (Whitehead 1958, p. 5). Human activity is specifically characterised by how our reason can transform matter. Whitehead also emphasises the

complexity with which other life in nature can “attack” environments—beavers dam rivers, insects have elaborate social relations (Whitehead 1958, p. 5). Animals, but also plants modulate their environments to be able to live more satisfactory lives.

This evolutionary function of reason in the production of novelty and the manipulation of the environment is what Stiegler specifically takes from Whitehead. The ability of reason to actively attack environments and reorganise matter is what both thinkers associate most readily with human existence. However, in Stiegler’s interpretation of Whitehead’s concept of the function of reason, he is concerned with the two main evolutionary tendencies and describes the downward tendency as the law of entropy, and the upward tendency as negentropy. This change in interpretation definitely adds new meanings. Entropy is the second law of thermodynamics (Stiegler 2020, p. 40) which dictates that, in a closed system, such as the universe, ‘when energy is transferred or transformed, more and more of it is wasted’ creating more disorder or entropy in the system (Lucas 2022). Referring to Schrödinger, Stiegler explains that negentropy is a struggle against entropy. Life itself is ‘the differentiation of organs and species in order to defer entropic tendencies’ (Ross 2018, p. 23). At this organic level of concretisation, the function of reason supported by technical mediation can reorganise inorganic matter into an organised inorganic matter. Technics, here understood as organogenesis, is a stage of evolution that contributes to negative entropy (negentropy) (Stiegler 2020, p. 10). Stiegler also adds to these two tendencies the third category of anti-entropy which marks the processes in which organic stability is produced and creates new possibilities (Turner 2023, p. 172). While inorganic matter always dissipates into a state of disorder, organic matter not only defers disorder but can also create new order. An organism can ‘produce new functions that are integrated into existing negentropic structures’ (Turner 2023, p. 173). Stiegler’s reinterpretation of Whitehead’s function of reason is informed by the scientific developments that occurred in the interim. However, as Turner notes, Stiegler uses these scientific concepts in a manner that is

no longer speculative as he universalises their meaning (Turner 2023, p. 173).

Stiegler uses the language of thermodynamics to explain how the evolution of societies conditioned by technics can yield a variety of outcomes. The evolutionary relations between organic and artificial organs can be entropic and negentropic depending on how they contribute to the transmission of information in a process of concretisation. Entropic relations produce no organic differentiation, while negentropic relations, marked by the function of reason, produce organic differentiation, and contribute to *the art of life*. Negentropic processes of concrescence are presented in Stiegler's vocabulary as transindividuations. This concept explains what happened in the process of social transformation such as education where 'one that does not rest with the individuated "I" or with the interindividuated "We," but is the process of co-individuation within a preindividuated milieu and in which both the "I" and the "We" are transformed through one another' (Stiegler and Rogoff 2020, p. 1). Negentropic relations are typically described by Stiegler as practices of care such as 'culture, education and knowledge' (Ross 2018, p. 24). He uses the concept of transindividuation to describe *creative* social transformations, that promote *the art of life*, in which individual processes of becoming stabilise collectively via technicity (Stiegler 2025). Reason gives us 'the urge to transform mere existence into the good existence, and the good existence into the better existence' (Whitehead 1958, p. 23). This is where the first major difference between organology and organicism reveals itself—in organicism, creativity is the threshold of ontology, without processes of concrescence which are always creative, there is nothing; in organology, human becoming can transindividuate (undergo creative concrescence) or not, depending on organic and technical relations. In general organology, the change in a recursive process results in entropy and negentropy, and the function of reason is to determine how these two tendencies relate to each other in human becoming. In other words, for Stiegler, the function of reason is always technically conditioned, and it modulates between entropic and

negentropic evolutionary relations, where the former have no creativity nor organic difference and the latter are imbued with creativity and the production of organic difference. With this interpretation of the language of thermodynamics, the Whiteheadian tendencies that have a rather neutral tone become political judgements about how societies should relate to their artificial organs.

For Stiegler, the technical conditioning of becoming poses a problem of dependency and addiction to artificial organs. The problem of addiction underlies the possibility of entropic processes of individuation that do not produce enough difference to amount to negentropy. In entropic becomings at the level of the individual, there is no desire that we can understand as a process of meaning making (Stiegler 2014, p. 20) that would help shape existence into a good existence and support the process of transindividuation. In the context of collective becoming, if the urge to transform existence into a better form is ignored, a society becomes automated (Stiegler 2020, p. 290). 'In automated society, automated understanding becomes purely computational and in so doing short-circuits the function of reason' (Stiegler, p. 290). The function of reason is vital to the transformation of environments and societies in the pursuit of a better existence.

For Stiegler, this noetic function of reason, combined with planetary industrial technics, is the underlying cause 'of the anthropization of the milieu that will eventually give rise to the Anthropocene' (Ross 2018, p. 30). The Anthropocene is 'a geological era, which appeared two hundred and fifty years ago, with industrialisation and capitalism, this being also a new stage in the history of exosomatisation' (Stiegler 2020, p. 10). Stiegler's diagnosis of today's societies is negative in light of the two organic evolutionary tendencies of cosmic becoming insofar as the Anthropocene is characterised by 'a vast and rapid increase of the rate of entropy in the biosphere' (Stiegler 2020, p. 10) which 'necessarily leads to destruction of all kinds of life, and firstly, of human life' (Stiegler 2020, p. 10). Automated societies destroy desire and reduce reason to calculation. The slow entropic destruction of societies is based on the consumerist model, which short-circuits the knowledge of

how to live better (Stiegler 2020, p. 12–13). With no function of reason employed, there is no *bifurcation* that could create an opening for negentropy (Stiegler 2020, p. 60). Here where we encounter a conceptual nuance between negentropy and neganthropy. Where negentropy can be understood as the struggle against entropy, neganthropy is a localised technicisation that is based on a bifurcation (Ross 2018, p. 31).

Bifurcation is another term that Stiegler takes from Whitehead—however, Stiegler defines it in a very different way. This book has outlined in detail how bifurcation in the sense of nature is a negative concept used by Whitehead to define the onto-epistemological error that differentiates between nature that is cause of awareness and nature as enclosed in awareness. It is a problem of metaphysical categorisation and a scientific fallacy, from which emerge other dualisms characteristic of modernity. Stiegler discusses bifurcations as something positive: 'it will be necessary to overcome the current concept of negentropy – noesis being itself, in my view, what produces neganthropic bifurcations, where this concept of bifurcations comes from Whitehead' (Stiegler 2020, p. 80). Hui also notices this issue and to avoid the confusion of the meaning of the term bifurcation, he retains Whiteheadian understanding in his writings, where it means a dualist thinking characteristic of modernity that should be resisted, and substitutes Stiegler's term with "fragmentation" as a process of multiple openings of new ways of thinking (Hui 2021). Stiegler understands bifurcation as a moment in which thinking has a power to break through and rupture the automatisation of societies (Stiegler 2018, p. 41). Ross explains that, for Stiegler, bifurcation is about that function of reason that urges us to live a better life that could foster the 'revolutionary courage' to care (Stiegler, p. 32), and the possibility of neganthropy. As the organ of novelty, 'reason is (…) always *beyond* calculation: it is the experience of the incalculable that requires, on each occasion, a decision, which means a neganthropic bifurcation' (Stiegler 2020, p. 326). It is not quite clear why Stiegler claims that he takes this term from Whitehead to then define it in a very different way.

Summarising, Stiegler's philosophy is a different type of organic thought compared to the works of Schelling, Hegel or Whitehead because general organology is concerned with the technical conditioning of human becoming and how it signifies a change in recursive processes. Nevertheless, his philosophy demonstrates that to talk about the issues of technology in a systematic way, we must first rethink the philosophy of nature and rid it of the bifurcation in the sense of nature (understood in Whiteheadian terms). Stiegler uses the method of general organology—a modified version of speculative cosmology which places technics at the forefront of its analysis. The method allows Stiegler to define technics as tendencies that affect human life and the planet on many interlocking levels, namely, at the pre-individual, individual-collective (transindividual), and planetary levels. Thus, technology can be studied as a product of relations between organic and artificial organs and changing social organisations. Technology can be defined systematically as relations between organic and inorganic matter. Stiegler also draws from Whitehead's organic ontology when he uses the concept of concrescence to explain processes of transindividuation and how our experience became technically inscribed over the course of evolution. Moreover, Stiegler's hyper-materialism assumes a continuity between thought and matter. He argues that the questions of technology cannot be addressed from within substance ontology and the Aristotle-Kant tradition of thought. This is because substance ontology treats reason as a faculty, rather than as a specific evolutionary function for the manipulation of matter and environments by which thought is concretised in matter. Without recognising this function of reason, it would be difficult to describe how technicity changed human evolutionary processes or the emergence of the Anthropocene. Even if Stiegler and Whitehead define bifurcation in their own distinctive way, it does not really matter for the broader diagnosis of the condition of modernity. Both Stiegler and Whitehead link our inability to confront the issue of the destruction of life to the constraints of an epistemology that ignores organic materialism. For Stiegler, the wrong epistemology

and, consequently, method applied to the question of technology translates into detrimental consequences of political economy (Stiegler 2020, p. 273). Dualist methods flourish because they are rooted in our habits of thought, and in our conceptions of mind and nature, as dictated by the Western tradition. Speculative philosophy allows us to rethink the relationship between thought and matter. The point here is that organic materialism becomes necessary to accurately discuss the conditions of modernity. Mechanistic materialism is now obsolete—not as a method for classical physics, but as a viable description of the underlying structure of reality.

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3 Whitehead's Philosophy of Technology

General organology and biological organicism are philosophical projects with different but compatible aims. Biological organicism's speculative metaphysics does not dismiss other methods, such as mechanistic materialism or general organology as invalid or incoherent. Speculative realism critiques the totalising tendencies of theories in general. Mechanistic materialism is necessary for classical physics, and general organology explains how technicity changed the human course of evolution and how it impacts how our societies organise. As outlined in the chapter on speculative science: the point of having a speculative philosophy of nature is to have a broader interpretative framework that explains how the different branches of science connect. Speculation as a method aims to do both: critique descriptive metaphysics that has totalising and absolutist tendencies and to promote metaphysical pluralism. The intention is not to dismiss metaphysics that are useful in the explanation of certain localities of becoming, but to interpret how they relate to each other and when they can become oppressive. In contrast to Hui's conviction that philosophies of nature are no longer useful in describing a technicised reality, I argue that we need a philosophy of nature that helps us express how we experience nature in a cohesive way, with the possibility of different processes of becoming in different localities. The

remaining sections in this chapter will present the philosophy of technology and philosophy of mechanicism found in Whitehead's and Schelling's works respectively, as well as in Romanticism more broadly. The point is not to create a philosophy of technology that would compete with general organology. Rather, it is to demonstrate how technology can be expressed as a tendency in the philosophy of nature in general, and biological organicism specifically. Biological organicism does not reject that there can be different evolutionary tendencies in nature such as those conditioned by technicity. Technology runs on distinctive recursive processes, but it emerged out of nature, and is still a part of it. This claim challenges the distinction made between nature and culture. It is possible to develop a philosophy of nature that accounts for technology if we remove the bifurcation in the sense of nature.

To present Whitehead's philosophy of technology as a philosophy of nature, we must return to reason as a relation between organic and inorganic matter. As previously noted, Whitehead argues that the function of reason is 'the active attack on the environment' and that it defines human existence (Whitehead 1958, p. 5) but can also be found in other species. He also suggests that, to properly understand organicism, we should look at the lower levels of life to comprehend the continuity between matter, life, and thought (Whitehead 1958, p. 11). Even if we take a simple entity that produces no 'disturbance of the repetitive character of physical fact' (Whitehead 1958, p. 27) such as a silicon rock[3] that endures in a progressive relapse, only as a potential of mentality, it still demonstrates a shared quality between organic matter and mind. A silicon rock holds in itself a potentiality to become an integrated circuit. The becoming of less complex organisms is based on the recurrence of occasions, a *persistence,* exhibiting the minimum of creativity in so far as mere recurrence is a repetition in the line of physical ancestry (Whitehead 1978, p. 104): '*the art of persistence is to be dead*' (Whitehead 1958, p. 2) (e.g., inorganic matter). The difference, or a qualitative threshold between experiential features present across all forms of matter and mentality is the complexity of self-regulation.

For example, slugs demonstrate the function of reason as they can also manipulate matter to live a more satisfactory life (in Whitehead's terms —akin to their subjective aims). Whitehead recognises the specificity of reason as an organ of novelty that struggles against the decay of nature (the *art of life*), and we should understand technics, and in the case of humankind technological objects, as a materialisation of this struggle. Human becoming is specific because the function of reason can counteract the inevitable slow decay of matter. It can bring novelty into a mere repetition in a way that helps carry thought through time, as Whitehead says, it can literally 'save the world' (1958, p. 28). Even though in biological organicism there is one logic of becoming explained as the process of the construction of matter and other organisms, there are different types of tendencies in life, and some of them produce so little difference that they decompose or decay. What to our eyes looks like stability is a slow decay of the universe that is just 'slipping away from under us' (Whitehead 1958, p. 66).

Whitehead also names different tendencies of becoming in human life in respect to different types of reason. Practical reason serves a function of detecting purpose, and effectively fulfilling it (Whitehead 1958, p. 30). It can be found in the animal kingdom and traced back in 'sporadic flashes of life' across millions of years (Whitehead 1958, p. 31). Speculative reason appears only in humankind; it is understanding for the sake of understanding. It is the foundation of the freedom of thought (Whitehead 1958, p. 30). Importantly, it can lead to an 'accumulation of understanding' (Whitehead 1958, p. 30) but also an ability to turn 'thought into a creative future,' to transcend immediate fact (Whitehead 1958, p. 65). In general, technics results from that urge to live a better life which entails the manipulation of environments, the organic forming of matter, and a concrescence of thought. While the social lives of bees are marked by the technics of practical reason, they fall short of civilisational progress. The specificity of human technics therefore lies in the employment of practical reason combined with the accumulation of speculative thought. Whitehead traces the beginning of speculative reason to the beginning of the history of civilisation

(Whitehead 1958, p. 32). He writes that, from the perspective of evolution, we can observe an improvement in how humans change their environments with technologies to provide physical ease and the ways of communicating and thinking to live a more satisfactory life (Whitehead 1933, pp. 60–61). The practical function of reason as a manipulation of the environment is present in some form from the beginning of the evolution of organisms. However, speculative reason only materialised (mathematics, philosophy, etc.) in early civilisations and accelerated the production of technology (Ferré 2004, p. 197). Technology is therefore a materialisation of speculative thought that can transcend an immediate fact with the passage of thought through time. Whitehead describes civilisational progress not as 'the march of discovery and the growth of mechanism,' which is marked by practical reason, but rather civilisations should be assessed by 'the fullness and the quality of life, of our thoughts and ideas' (Whitehead 1923, p. 2) which can only be achieved with help of a speculative reason that can improve human existence. As such, he values technological progress not when it is limited to practical utility, but when it promotes the art of life.

Following Whitehead, the slowing down of technological progress during the Medieval ages was indeed caused by the silencing of speculative methods and the limitations imposed on thought by dogmatism (Whitehead 1958, p. 35). In contrast, the fast advance of technology observed ever since the Industrial Revolution and the invention of the steam engine can be explained by the effective combination of practical and speculative reason (Whitehead 1958, p. 34). For Whitehead, the difference between technology before and after the industrial revolution is that pre-industrial technology was treated as an improvement of life with instruments (Whitehead 1958, p. 39). The invention of the steam engine was a breakthrough of speculative reasoning in scientific method. Speculative method frees thought from sticking to a limited pool of scientific methodologies. In the era of modernity, speculative reason is limited by dogmatism yet again, but that dogmatism has now taken the form of practical reason and

scientific materialism. Speculative ideas are constrained by science's insistence on positivist methods. Whitehead finds an explanation for the popularity of mechanistic materialism in human nature insofar as we tend to turn 'a successful methodology into a dogmatic creed' (Whitehead 1958, p. 40) particularly in Europe where dogmatic habits were fostered and nurtured for centuries. He also notes the separation of these functions of reason in universities, such as the separation of philosophy and the natural sciences, which he attributes to the domination of Newtonian materialism (mechanistic cosmology.) Again, the role of speculative metaphysics is to act against dogmatism in thinking and question the sets of first principles in natural sciences. The problem of mechanistic metaphysics lies in how it became institutionalised in the sciences in general even if it is a fruitful method for e.g., classical physics.

All in all, Stiegler and Whitehead come to a similar conclusion on the function of speculative reason as the ability to think freely, against the dogmatism of mechanistic materialism—against the repetition that leads to a slow decay. They both view that function as a necessary tool for the production of novelty in societies that seek a better existence. Whitehead's philosophy of technology can be defined from the perspective of a natural struggle for self-preservation and the betterment of life. It is a relation between life and matter, and an attack on an environment with reason, a specific type of concrescence. Both Stiegler and Whitehead view reason and technicity as mediating forces that can potentially transcend a locality of becoming, as a manipulation of nature. The question of technology was never central to Whitehead's works, and he never uses the term technics, as he was concerned much more with the philosophy of science. Nevertheless, as this interpretation of his works shows, he arrives at the conclusion that technology emerged out of the natural tendency of practical reason that is present in all forms of life. He also recognises that reason can be deployed by humans in different ways (practical and speculative) which contribute differently to the organisation of societies.

4 Machinic Matter as a Mediation Between the Organic and the Inorganic

Whitehead's philosophy of technology outlines how technics is present on different scales of becoming as tendencies to attack environments, but he does not really discuss technology as a type of reorganised matter. The question of technology is framed in relation to different tendencies of reason in human civilisations. In Schelling's philosophy of nature, there is no philosophy of technology that would resemble Whitehead, Leroi-Gourhan, or Stiegler's approaches which focus on how technology serves human evolution as exteriorised organs to manipulate matter. Nevertheless, Schelling provides a philosophy of mechanicism as a tendency between organic and inorganic matter with a focus on the micro-level. In fact, he describes his philosophy of nature as an attempt to 'take it out of the dead mechanism' to free it from the pre-conception as it is only a passive component of reality, and to describe matter in an active form (Schelling 2004, p. 14). His philosophy is closer to elements of Simondon's works because he was concerned with how mechanical tendencies in matter are transitory between the organic and the inorganic. Building on Whitehead's macro-level analysis, this section continues to develop biological organicism's philosophy of technology at the micro-level. It demonstrates how mechanicism can be described as a type of organic sensibility in matter, thus revisiting the question of contingency and determinism in nature.

An analysis of the mechanical and mechanicism in Schelling's cosmology must begin with a definition of process as a *substratum* of the universe. Biological organicism posits a single ontological evolutionary process unfolding the universe which underpins both the organic and the mechanic. While an explanation of the organic through evolutionary processes is quite common, applying the same explanatory categories to the mechanical is not. Depictions of evolving mechanisms recall the prediction of technological singularity, as if a natural line of progress has a predefined finality in the form of a mind and reason. This tendency is evident in *machinic organicism* (Hegel)

where the self-organisation of a machine leads to an improvement of the machine, and the overcoming of contingency is a sign of progress towards the better (Hui 2019, p. 14). Machines which purposefully fulfil their natural aim formally organise their matter in an evolutionary process. In Schelling's thought, mechanical progress does not necessarily entail an improvement, it is not qualitatively different, but it is a state of an organic form.

Schelling's system of nature grants freedom to all products of nature and sees them as active components (actants) in the production of novelty rather than passive effects of mechanistic laws. Here we come back again to the paradox of freedom in nature and how it shapes speculative physics. Nature does not passively transfer motion; it actively and freely produces and reproduces itself. What, then, is the ontological status of a mechanism and mechanical laws? The creative reproduction of nature in the form of difference is a source of life 'of which the mechanical is a mere consequence' (Schelling 2004, p. 158). Schelling argues that the self-organising, the productive *organic*, is the prevalent force of the universe, and the mechanical in Schelling's ontology is its consequence rather than a counter force or an improvement (Schelling 2004, p. 86). What we observe in nature is the reproduction of difference, which is life, death being pure indifference. Everything that is organic within the universe contributes to the continuity of the universe through *sensibility*; the eternal metamorphosis of the world perpetually *reproduces* what *is*. Nature unfolds as a contraction against itself and life, understood as the endurance of being, resists Nature's will, 'for it is preserved only by means of struggling against Nature' (Schelling 2004, p. 160). A dead object exhausted of its productivity (death as a 'recuperation from life') mediates activity through receptivity which is also an organic sensibility (Schelling 2004, p. 182). All that just *is*, is an activity mediated by receptivity, and *is* is being reproduced; *is* is only a potentiality. The mechanical is, therefore, organic insofar as any state of rest is a reboot and reuse of productive forces. The mechanic is organic; death awaiting to be contracted into other organic life forms. The

mechanic is both a consequence and a special form of organic potentiality. Thus, the *mechanic is a mediation between the organic and the inorganic. It is a contraction of nature against itself that serves as a mediation between life and death—transcending the constraints of a locality with its mediating potentiality.*

The production of difference and life is always subjected to such mediating potentialities insofar as it is subjected to the forces of mechanical laws. These mechanical laws are recursions facilitated by contingent products of nature. Schelling's philosophy is the result of a search for the unconditioned in nature, to build an open system that includes both contingency and necessity without 'relying upon or metaphysically reifying either' (Woodard 2019, p. 146). Contingency can be interpreted ontologically insofar as it can be read as the potentiality of all ontological forces (powers) (Woodard 2019, p. 146). It is a potentiality of differentiation that can create new necessities—including new laws of nature, new organisms, and new forms of matter(s). Schelling incorporated mechanical laws and necessities, inorganic forms of life, in his outline of both cosmological and evolutionary processes precisely through the notion of contingency, in contrast to philosophies that traditionally view these processes as exclusively mechanical, as a repetition with little to no difference.

We can also find the concept of *mechanism* in the *First Outline* when Schelling explains the processes of construction of matter and evolution. Here mechanism is viewed as a process internal to the evolution of a cosmic organism, which Schelling calls *metamorphosis*. Put differently, metamorphosis is the self-construction of an organic form of the cosmos, the processes of construction of matter. Cosmologically, the organic principle of the formation of matter is also a principle of evolution, as Schelling views these processes as simultaneous and corresponding. He writes that 'all formation occurs through epigenesis [metamorphosis/dynamical evolution]' (Schelling 2004, p. 48). Matter is in a state of constant formation, shaped by opposing organic and mechanical tendencies. The constant reproduction of matter by natural forces means that matter is

characterised by a high potentiality. As Grant notes, Schelling's philosophy of nature is not somatic, meaning that it is not about "things" or "bodies," but rather it is a theory of how materiality is grounded in nature's activity (Grant 2008, p. 8). This disembodiment of activity is foundational to the organic approach to materialism. Here, materiality is defined by its measure of organic activity; specifically, its receptivity conditioned through its activity (Schelling 2004, p. 60). Matter is therefore a result of action, and the intensification of becoming (natural activity) (Schelling 2004, p. 21) is a measurement of being where the difference between 'material' and 'immaterial' is arbitrary. The process of materialisation unfolds from the intensity that precedes it. Matter self-constructs, as intensity is an inherent process of its becoming, however, this dynamic process is not reducible to matter itself (Grant 2008, p. 13). Matter organises through forces,[4] and organisation is a power of the self-construction of matter (Grant 2008, p. 11). Such processes, being caused by organic sensibilities, continue the axiom of the universal organism, which is the production of novelty from difference to difference. As Hui notes, the organic construction of matter is both immaterial and material insofar as it is evident in the operational logic of the concretisation of matter (Hui 2016, p. 80). Here it is worth commenting on Hui's discussion of the similarities and differences between the ontological process of individuation in Simondon and Schelling. Firstly, both processes of construction of matter require tension. This tension is not understood in a dialectical way, as emerging from opposition, but more about changing relations within an actant and between actant and its milieu. The difference is that the "third" stage in the process is, for Schelling a container of new tensions, as the becoming is always fuelled by contractions, and for Simondon "the third" temporarily eases these tensions (Hui 2016, p. 84).

For Schelling, progress in the process of individuation requires a unification of difference (what Hui calls the third), but it does not mean that it does not involve further tensions. In the process of metamorphosis, evolution is always also accompanied by involution to

provide tension at the level of cosmic becoming. Involution is the aggregation of mechanical, regressive, and contractive forces (Schelling 2004, p. 187). This is to say that, in the process of construction of matter (and the cosmic becoming which corresponds to all processes of formation) as well as in every single organism (every actant of nature), both processes are always at play. Mechanical regressive forces contribute to shaping matter together with the production of difference, and together they interact with the reciprocation of our organs. For example, our bodies are shaped by gravitation specific to the earth and can only function well when exposed to 9.8 m/s^2. A body of an astronaut on a long space expedition changes functioning of her organs. Although mechanism is a contraction of nature to itself, it is a state of rest or productive forces; it is still an organic consequence and potentiality rather than an opposition to nature. The unification of differences in the production of matter is necessary to progress, and we cannot treat these processes as separate determinants (Schelling 2004, p. 187). Any strong distinctions in an organic process are arbitrary. Schelling argues that 'for the moment, a being only conceived in evolution – [is] a being oscillating between evolution and involution' (Schelling 2004, p. 188). To illustrate how the mechanical is present as a force in an organic process of individuation in nature, Schelling describes the process of crystallisation. In this process, the technical drive is a reversion of the organic force, a mediation between the organic and the inorganic; it crystallises the organic strive of life. Schelling says that 'the lesser the sensibility, the more the technical drive— is a universal law' (2004, p. 135). We can observe that technical drive is a reflection of mechanical forces on all levels of nature—in organic and inorganic matter. Involution contributes to the processes of cosmic metamorphosis, as well as to the processes of the construction of matter and of individuation. The technical drive and mechanism are present in Schelling's systematisation of nature cosmologically.

The commentary on mechanism that we find in the *First Outline* does not amount to a philosophy of technology. However, these two conceptualisations of mechanism—first as a mediation between life

and death, the potentiality in the state of rest from the production of difference; and, secondly, as a tendency of regressive forces in the production of matter, evolution/metamorphosis of the cosmos—illustrate where technical objects fall in the relations between organic and inorganic matter. This reflects Hui's approach to the question of technology. To repeat an earlier point, the matter of philosophy of technology is not to establish what comes first, organic or mechanical forces, nor is it about whether biological organism can be equivalent to a technological one, but rather how to outline the relationship between them in systematic terms (Hui 2019, p. 157). From Schelling's conceptualisation of mechanism, we can derive the evolutionary role of mechanism embedded in the cosmological processes, and in the system of nature, as a relationship between organic and inorganic matter, where we find technical objects. However, there is still more explanation required to bridge the gap between mechanisms that we find in nature and technology.

The starting point on the links between the mechanical tendencies found in nature and those found in technology is the concept of an organ as articulated in Schelling's metaphysics. Following Stiegler, we can conceptualise technological objects as precisely that—artificial organs that mediate human becoming in nature. For Leif Weatherby, an Aristotelian *organon* is the bearer of a function—a 'potential with respect to a field of actuality on which it is concentrated' (Weatherby 2016, p. 17). An organ is a tool that bears the possibility of an imitation and the actualisation of a natural function (form)—a cosmological telos. An *organon*/tool is situated precisely in between a distinction of physis (nature) and techne (artifice). As he notes, 'artifice is an imitation of nature,' a mimesis. An organ/tool brings forth a concrete actualisation of a cosmological telos (form, function) by a mimesis of nature. Weatherby argues that Schelling's conceptualisation of an organ rejects the distinction between nature and artifice, discarding the mimesis of nature by claiming that, in reality, physis and technics are always combined. The contradictions in the system of nature that an organ embodies, and that 'run as deep as the ones we are capable of

producing' (Weatherby 2016, p. 205) establish a reality that we must theorise. Abandoning this distinction illustrates the actual condition of reality. Following Weatherby, there is no interpretational stretch in contextualising the questions of technology, and technics in the Schellingian philosophy of nature. In fact, it is a principle of his philosophy to progress by unifying contradictions to make a difference. Technology is not a mimesis of nature, but the natural contradiction/contraction thanks to which the system of nature reproduces itself anew.

Another interpretation of technics in Schelling's philosophy is possible if we take it to be a particular ability to modulate an efficient cause. Jason Tuckwell argues that there are two dimensions to technics. The first dimension is universal—technics in general, artifice, and a condition of the development of humanity. The second dimension is particular—a function of an individual/thing, an object/subject's ability to modulate its efficient cause. This second dimension brings us closer to understanding technics as a component of becoming. Here, it can be viewed in a more fundamental way as the purposive manipulation of an efficient cause that is 'an abductive and purposive dimension' (Tuckwell 2002, p. 85) where technics can both overcome and create contingency (Hui 2015, p. 139). In this conceptualisation, technics approximates the organic view of an actant's (organ) individual capacity to modulate its own functionality that also adjusts and organises a system. It reflects the main function of an organ in a system of organisation. Schelling's philosophy suggests that technological objects are concretisations of the broader mechanical tendencies in nature. As products of nature, technological objects run on a technical drive (if it overdrives organic sensibility) and as a specific form of potentiality that can mediate between life and death that brings forth concrete actualisation (formation) by the modulation of efficient causes. However, artifice is physis, technology is nature rather than its mimesis, as it concretises certain natural tendencies that we can observe cosmologically. The difference between technological objects and other products of nature

lies in how they relate to contingency, the production of difference, and therefore the localities of their becoming.

Summarising Schelling's philosophy of mechanicism it should be stressed that he presents a distinctive approach to the mechanical tendencies in nature which is neither for its betterment nor its destruction. Mechanical tendencies are an inherent part of cosmic evolution insofar as mechanical forces impact each and every organ as an involution. A mechanical matter is the third state of matter between the organic and the inorganic, a mediation between life (differentiation) and death (indifference). The mechanical is therefore characterised by a specific relation between contingency and necessity. This understanding of mechanism can be presented as part of a philosophy of nature because it is not based on dualistic distinctions between the realms of contingency (freedom and thought) and necessity (determinism and mechanical laws). Our brains, for example, are subject to the laws of gravitation but are still free to think whatever; their organic functionality results from the combination of complex organic and inorganic relations. The human intellect could not however be possible without the upright posture and the shape of the skull which are a result also of the mechanical forces of gravitation. Nature is full of contractions and contradictions that are the results of organic differentiation. Thus, Schelling rejects a distinction between physis (nature) and techne (artifice)—techne is not a mimesis of nature, it is a product and an active producer in and of nature, just another contraction of it. Like other organs, technological objects mediate the actualisation of cosmic becoming even if they relate to nature in a specific way, mediating life and death.

These sections on Whitehead's philosophy of technology and Schelling's philosophy of mechanicism demonstrate how biological organicism can account for different tendencies in the creative becoming of the cosmos. Technics does not appear in their works, but it is still possible to provide an interpretation that describes how technics and technology are present on many scales and the many processes implicated in technological production. We can view the origins of

technological objects in mechanical forces and a technical drive that run through the whole cosmos, a tendency in the process of becoming, as well as a result of a natural tendency of organisms to manipulate their environments in order to better their existence. This tendency to live a more satisfactory life, 'the art of life,' is a form of organic differentiation against the slow process of cosmic decay. Technological objects have a specific form of potency present in the process of their concretisation that transforms the ontological fabric of reality by reorganising matter in a way that allows thought to transcend life, and amounts to inorganic organs of survival. From a planetary perspective, technology is an integral part of civilisational progress that enables the accumulation of knowledge, but how we relate to technology depends on whether we use practical or speculative reason, that is, whether we reduce knowledge to practical utility or not. The formulation of the problem of technology from the planetary perspective reflects a cosmotechnical approach 'where an adequate thinking about modern technology must proceed through a wholesale reconceptualization of traditional metaphysical categories to uncover within them fundamental relations to technics' (Tuckwell 2002, p. 81). Therefore, the philosophy of nature is compatible with the philosophy of technology. Organic materialism serves its purpose here insofar as the philosophy of nature presents an understanding of the underlying structure of reality that can help us describe it as we experience it, as the technicised planetary system in the Anthropocene.

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5 Romantic Philosophy of Technology

When organicism reemerged in Romanticism, it gave us a new outlook on nature. It was the beginning of a new epistemology which also changed how we can relate to technology. Following Cockelbergh's analysis in the *'New Romantic Cyborgs,'* we can find traces of Romantic sensibility in today's expressions of technology, more often than is usually admitted (Cockelbergh 2017, p. 8). The main traces can be found in the approach to the philosophy of technology based on organic

materialism as this chapter has demonstrated. Although organic thought was not invented by the West, this Romantic offshoot of the philosophy of technology is particular to the Western tradition.

Cockelbergh points out that, while "classical machines" such as clocks imply that nature and our knowledge of it are stable and fixed, "romantic machines" reveal processes of epistemological recursion. They are not just reactive, but animated and living. They are interwoven with nature, which is understood as a set of complex interrelations accessible and transformable with human feelings and knowledge (Tresch 2012, p. xi). Romantic epistemology and imagination let us think machines as organic, merging nature with humans, and humans with their tools, an expression of which can be found in *Frankenstein* by the Romantic author Mary Shelley, considered by some to be the first science-fiction novel ever written (Cockelbergh 2017, p. 47). John Tresch argues that Romantic, organic machines are indeed not mere instruments but "tools of transformation" on an individual and collective level, with an inclusion of nature (Cockelbergh 2017, p. 102). The Romantics understood that technology changes the relations between everything, so it incurred a need for rethinking the organisation of society in nature and in the universe (Tresch 2012, p. 26). Romantic epistemology made it possible to think technology organically for the first time (in Western thought), as a mediation changing the cosmological fabric, merging with what is human and nature. Cockelbergh points out that Romantic epistemologies were also foundational to Heidegger's understanding of technology (Cockelbergh 2017, p. 76). We can categorise Heidegger as a Romantic thinker because of the influence of ancient Greek philosophy and the works of the German Romantic poet Hölderlin on his thought (Cockelbergh 2017, p. 74), not to mention his work on Schelling (Heidegger 1985). Cockelbergh notes that, in "The Question Concerning Technology," Heidegger suggests to 'look to the ancient Greek ways of bringing forth (techne) and read the (Romantic) poets' (Cockelbergh 2017, p. 76). An interesting connection here is that Hölderlin was a seminarian with Hegel and Schelling (Cockelbergh 2017, p. 75). Drawing on Romantic

epistemology, Heidegger views technology as always in an organic relation with nature and thought, where technology is revealing to nature, turning it into a standing-reserve (Cockelbergh 2017, p. 76). Technology takes part in the epistemological recursive process between thought and nature, by mediating and changing both thought and nature.

Both Hui and Stiegler draw on Heidegger in their works. It must be highlighted that, although Stiegler stays in dialogue with Heidegger, there are a lot of disagreements between them (Stiegler 2003, p. 156–158). Neither Stiegler's nor Hui's works should be reduced to Romantic influences. However, there are links between Romanticism and contemporary philosophies of technology that are generally overlooked. This might be especially the case for Stiegler who, in *Technics and Time 1*, engages with Greek mythology in a Romantic style. To explain how the evolutionary contingency of technics defines humanity, Stiegler refers to the Protagorean version of the myth of Prometheus, where Prometheus brings the gift of technics to humans, the "de-fault of origin" of technicity—'religion, speech, politics, invention' (Stiegler 1998, p. 193). In his discussions of the origins of technics, Stiegler also refers to Rousseau for whom 'originary man is originary only because he is not contaminated by the artificial, the mediate, the technical, and the prosthetic' (Stiegler 1998, p. 113). Stiegler explains that, according to Rousseau, 'the first man' accidentally indulged in 'the power of prostheses,' where artifice and technics deprive him of an 'originary power' (Stiegler 1998, p. 115). For Stiegler, however, technics was already present in the series of transformations between a fictive originary man and 'civilised man' because a hand stops being a paw once it starts to manipulate tools and instruments (Stiegler 1998, p. 113).

Without going into more detailed analysis on the links between Romanticism and contemporary philosophies of technology, it is worth giving credit to the epistemology that emerged out of that period. Romantics are often disregarded in the history of thought as peripheral to the Western tradition of philosophy. However, their persistence in

asking questions about the immediate experience of nature led them to rethink the relationship between thought and matter. In turn, organicism gave us a philosophy of nature that is at least a bit closer to how we actually experience it, with its paradoxes, contractions, and contradictions on many levels.

This chapter rethought matter with the question of technology. It was demonstrated that the question of temporality of knowledge is central to understanding what the role of technological objects in human evolution is. Technics and technology are present as evolutionary tendencies of species and as processes forming matter, mediating tensions between organic and inorganic relations in the greater unfolding of the cosmos. This evolutionary approach to the philosophy of technology, whether from the perspective of animal evolution or the evolution of a cosmic organism, cannot be described with Darwinism. Darwin did account for the emergence of technology in human evolution but the underpinning logic is mechanistic rather than organic. A mechanistic explanation of technological evolution is insufficient because its dualism imposes an irreconcilable difference between thought and matter. The technicised planetary system of the Anthropocene demands an explanatory framework where technicity reorganises matter and concretises thought in our environments which in turn reorganises our own organic sensibility. An organic materialist approach to the study of the system of nature understands these technicised evolutionary processes to be changing relations between organic and inorganic organs and their environments.

Technics as a survival strategy that attacks an environment in order to live a more satisfactory life was initially operating in what Bergson calls ‘the logic of solids’ to account for the harsh conditions of external environments. However, the possibility to manipulate matter to our liking has always been organic—caused by our organic sensibility and the possibility to transform and reorganise matter. Mechanicism is indeed part of the cosmic evolution—hence why the methods of Newtonian cosmologies work in classical physics. However, extending the logic of mechanistic materialism to all aspects of existence fails to

consider that the differentiation of organic and inorganic matter is life's basic process of survival. Techne is not a mimesis of nature but rather one of its integral components. We still need a philosophy of nature, but one that understands that our planetary system is both ecological and technological. This chapter proposed that biological organicism is capable of accommodating and advancing a philosophy of technology that is suited to our moment. The next chapter will demonstrate how different outlooks on nature and technology compete in institutional setups—how habitual thinking and cosmologies become universalised and institutionalised, and how biological organicism can serve as a cosmotechnical event.

References

Bergson, Henri. 2014. *Creative Evolution*. United States: Createspace Independent Publishing Platform.

Bishop, Ryan, and Daniel Ross. 2021. Technics, Time and the Internation: Bernard Stiegler's Thought – A Dialogue with Daniel Ross. *Theory, Culture & Society* 38 (4): 111–133. [https://doi.org/10.1177/0263276421990435]

Cockelbergh, Mark. 2017. *New Romantic Cyborgs; Romanticism, Information Technology, and the End of the Machine*. Cambridge and London: The MIT Press. [https://doi.org/10.7551/mitpress/9780262035460.001.0001]

Darwin, Charles. 2008. In *On the Origin of Species*, edited by Gillian Beer. Oxford: Oxford University Press. [https://doi.org/10.1093/owc/9780199219223.001.0001]

Ferré, Frederick. 2004. Whitehead and Technology. In *Whitehead's Philosophy; Points of Connection*, edited by Janusz A. Polanowski and Donald W. Sherburne, 197–212. Albany: SUNY.

Foster, John. 1997. The Analytical Foundations of Evolutionary Economics: From Biological Analogy to Economic Self-Organisation. *Structural Change and Economic Dynamics* 8 (4): 427–451. [https://doi.org/10.1016/S0954-349X(97)00002-7]

Grant, Iain Hamilton. 2008. *Philosophies of Nature after Schelling*. London and New York: Continuum.

Heidegger, Martin. 1985. *Schelling's Treatise on the Essence of Human Freedom*. Athens, Ohio, and London: Ohio University Press.

Hui, Yuk. 2015. Algorithmic Catastrophe – Revenge of Contingency. *Parrhesia* 23:122–143.

Hui, Yuk. 2016. The Parallax of Individuation; Simondon and Schelling. *Angelaki* 21 (4): 77–89. [https://doi.org/10.1080/0969725X.2016.1229427]

Hui, Yuk. 2016a. *On the Existence of Digital Objects*. Minneapolis and London: University of Minnesota Press.
[https://doi.org/10.5749/minnesota/9780816698905.001.0001]

Hui, Yuk. 2016b. *The Question Concerning Technology in China*. Falmouth: Urbanomic Media Ltd.

Hui, Yuk. 2019. *Recursivity and Contingency*. London: Rowman & Littlefield International Ltd.
[https://doi.org/10.5771/9781786600547]

Hui, Yuk. 2021. This Strange Being Called the Cosmos. *Foundations of Science* 27 (4): 1409–1414.
[https://doi.org/10.1007/s10699-020-09740-7]

Ingold, Tim. 1999. 'Tools for the Hand, Language for the face': An Appreciation of Leroi-Gourhan's *Gesture and Speech*. *Studies in History and Philosophy of Biological and Biomedical Sciences* 30 (4): 411–453.
[https://doi.org/10.1016/S1369-8486(99)00022-9]

Kwapińska, Kamila. 2022. Technological Evolution and the Political Agency of Artificial Intelligence from the Perspective of General Organology and Universal Organicism. *Információs Társadalom* XXII (2): 57–71.
[https://doi.org/10.22503/inftars.XXII.2022.2.4]

Lucas, Jim. 2022. What is the Second Law of Thermodynamics? Livescience. Accessed 08.September.2022.https://www.livescience.com/50941-second-law-thermodynamics.html

Moore, Gerald. 2017. On the Origin of *Aisthesis* by Means of Artificial Selection; Or, the Preservation of Favoured Traces in the Struggle for Existence. *boundary 2* 44 (1): 191–212.
[https://doi.org/10.1215/01903659-3725941]

Ross, Daniel. 2018. Introduction. In *The Neganthropocene*, Bernard Stiegler. Edited and Translated by Daniel Ross. London: Open Humanities Press

Ruse, Michael. 1982. *Darwinism Defended: A Guide to Evolutionary Controversies*. Reading: Addison Iasley Publishing Company.

Schelling, Friedrich W. J. 2004. *First Outline of a System of the Philosophy of Nature*. Albany: State University Press of New York.

Simondon, Gilbert. 1980. *On the Mode of Existence of Technical Objects*. Ontario: The University of Western Ontario.

Stiegler, Bernard. 1998. *Technics and Time, 1; The Fault of Epimetheus*. Stanford and California: Stanford University Press.
[https://doi.org/10.1515/9781503616738]

Stiegler, Bernard. 2003. Technics of Decision, an Interview. *Angelaki* 8 (2): 151–168. [https://doi.org/10.1080/0969725032000162639]

Stiegler, Bernard. 2014. *The Re-enchantment of the World: The Value of Spirit Against Industrial Populism*. London and New York: Bloomsbury.

Stiegler, Bernard. 2015. *Symbolic Misery Vol.2*. Cambridge and Malden: Polity Press.

Stiegler, B. 2017. General Ecology, Economy, and Organology. Translated by Daniel Ross. In *General Ecology: The New Ecological Paradigm*, ed. Erich Horl with James Burton, 129–150. London and New York: Bloomsbury Academic

Stiegler, Bernard. 2018. *The Neganthropocene*. Edited and Translated by Daniel Ross. London: Open Humanities Press

Stiegler, Bernard. 2020 *Nanjing Lectures 2016–2019*. Edited and Translated by Daniel Ross. London: Open Humanities Press

Stiegler, Bernard. 2025. Within the limits of capitalism, economizing means taking care. Ars Industrialis. Accessed 19.February.2025. http://www.arsindustrialis.org/node/2922

Stiegler, Bernard and Irit Rogoff. 2020. Transindividuation. *e-flux Journal* Issue #14 02/10: 1–10

Tresch, John. 2012. *The Romantic Machine: Utopian Science and Technology after Napoleon*. Chicago: University of Chicago Press. [https://doi.org/10.7208/chicago/9780226812229.001.0001]

Tuckwell, Jason. 2020. Technics and Agency; The Pluralism and Diversity of Techne. *Angelaki* 25 (4): 81–96. [https://doi.org/10.1080/0969725X.2020.1790837]

Turner, Ben. 2016. Life and the Technical Transformation of Différance: Stiegler and the Noopolitics of Becoming Non-Inhuman. *Derrida Today* 9 (2): 177–198. [https://doi.org/10.3366/drt.2016.0132]

Turner, Ben. 2023. *Returning to Judgment: Bernard Stiegler and Continental Political Theory*. Albany: State University of New York Press. [https://doi.org/10.1353/book.133706]

Vaccari, Andres, and Belina Barnet. 2009. Prolegomena to a Future Robot History: Stiegler, Epiphylogenesis and Technical Evolution. *Transformations* 17:1–18.

Weatherby, Leif. 2016. *Transplanting the Metaphysical Organ; German Romanticism between Leibniz and Marx*. New York: Fordham University Press. [https://doi.org/10.2307/j.ctt19rm9k0]

Whitehead, Alfred N. 1923. Science and Economic Liberty: A Comparison of England and America. *Alfred North Whitehead Archive Collection MS-0282*, Special Collections. John Hopkins University: Sheridan Libraries

Whitehead, Alfred N. 1933. *Adventures of Ideas*. New York: The Macmillan Company.

Whitehead, Alfred N. 1958. *The Function of Reason*. Princeton: Princeton University Press. Reprinted Boston: Beacon Press.

Whitehead, Alfred N. 1978. In *Process and Reality; An Essay on Cosmology*, edited by David Ray Griffin and Donald W. Sherburne. New York: The Free Press.

Whitehead, Alfred N. 1985. In *Process and Reality; An Essay in Cosmology*, edited by David Ray Griffin and Donald W. Sherburne. New York: The Free Press.

Woodard, Ben. 2019. *Schelling's Naturalism; Motion, Space and the Volition of Thought*. Edinburgh: Edinburgh University Press. [https://doi.org/10.1515/9781474438193]

Footnotes

1 See: Stiegler (2017, p. 131) (2018, p. 52) (2020, p. 39).

2 Concrescence is a different process to the process of concretisation (explained in the previous section) that Stiegler appropriates from Simondon.

3 Life is here understood in Whiteheadian terms, as an epoch of becoming marked by a common nexus which ends with exhaustion of potentiality of becoming of that nexus.

4 Schelling, with his knowledge of science lists: light, electricity, magnetism, and 'general' forces.

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5. The Totalisation of Mechanistic Metaphysics in Capitalism

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1 The Universal Evolution of Technology and Technicisation of Local Environments

A cosmological approach to studying nature entails that there is one observable world, the cosmos, but many worlds (*cosmoi*) of which we can conceive in the entirety of the infinite universe (*tó pân*). Cosmic realism means that the cosmos must exist for anything to exist at all. Within this framework, radical empiricism claims that all that there is is an experience of the cosmos. While the observable cosmos must exist, the issue of how we schematise it and situate ourselves as humans is quite complicated. Humans have produced many cosmologies, i.e., symbolic orders that explain our relationship to the cosmos, which make mutually exclusive claims. The perennial issue of the Western tradition of thought has been to confuse the symbolic orders (numbers and grammar) with the actual operation of nature, which in turn gave the illusion of nature being a distinctive process to human becoming, civilisation, and technology. As Watts and Chuang-Liang Huang note, technology is harmful to nature only when used by those who live in the

conviction that they are a separate process to the universe (2011, p. 21). Speculative cosmology aims to reconnect methods to our experience of nature, and it does not disregard the plurality of cosmologies, but instead provides an interpretive framework to understand how these different metaphysical systems might complement each other, as is the case with the branches of science for example. Contradictions, contractions, the temporality of experience, and its changing nature are all part of the onto-epistemological processes of the unfolding cosmos. This speculative method is meant to reflect our actual experience of nature with the slow and sudden paradoxes that punctuate it. On the one hand, this method allows for a critique of descriptive metaphysics that are absolutist and reductive, which aim at the final and coherent description of reality; on the other hand, it promotes a creative, pluralist approach to metaphysics, where they should continuously be revised by our experience and examined by how they organise our lives in practice. This approach promotes diversification of thinking and production of new realities. Metaphysics is an outcome of technically mediated practices, and it shapes practices. They matter in how we position ourselves in the system of nature and understand the role of technology in our evolution and civilisational progress.

Crucially, the production of cosmologies is always technically mediated. With technological progress, the limits of the observable cosmos are always changing. Moreover, since tools change our organic sensibility, they can enable and/or limit the construction of future cosmologies. Consequently, as Hui explains, all 'cosmo-*logies* are always cosmo-*technics*' (Hui 2022). It means that how we rationalise nature is never purely theoretical, because it is mediated by technical practices that regulate human and non-human relations (Hui 2022). The study of cosmology should account for the technical aspects of how these relations emerge and function. Another key term for further theorisation of cosmologies is cosmopolitics. This term has been used in the literature in different contexts which I will describe in more depth in the next section. I define this term as having two key

meanings. First are the planetary techno-politics, or in other words politics of technicised planetary system. Second are the politics of what cosmologies are considered as the valid explanatory framework for description of reality or deriving truth value by a group of people, be it a scientific community or a culture. Like cosmologies, cosmopolitics are always technical.

The previous chapters focused on the metaphysical reflection on philosophy of nature/science and philosophy of technology. Based on this reflection, this chapter examines how a cosmological approach can be used in the context of scientific communities. The first section outlines how metaphysics affects the organisation of contemporary societies, looking specifically at the tension between the universalisation of capitalist cosmopolitics and cosmotechnics, and the technicisation of local environments. The first section will also address whether we need technodiversity to resist the totalisation of capitalist cosmotechnics. Technodiversity means a cultural diversity in how technics can be understood in relation to a concrete reality, and an exchange of these conceptions between cultures. Noodiversity means diversity in thinking and understanding of reality (Hui 2023). Technodiversity assumes that science and technology are linked to cosmologies produced by a culture. Since organic sensibility and how we produce knowledge are also technically mediated, technodiversity is a requirement of noodiversity, which both maintain biodiversity. Hui notes that, in the age of the Anthropocene, where we live in a technicised planetary system, both noo- and technodiversity became a requirement of biodiversity (Hui 2023). Therefore, the question is whether we need to diversify how we relate to technology and science with new cosmologies to resist the totalisation of capitalist cosmotechnics. The second section will elaborate on the metaphysics of global capitalism and whether they are still based on mechanistic materialism. The third section will dwell on the concepts of cosmotechnics and cosmopolitics to ask whether biological organicism can be consider a cosmotechnical event.

To demonstrate the impact of cosmotechnics on the organisation of a society, we have to first analyse an important implication of an evolutionary approach to technology: the tensions between the universal evolution of technology and the local technicisation of environments. Both Stiegler and Hui elaborate on this issue to explain the process behind the totalisation of capitalist cosmotechnics, and how this totalisation is detrimental to the emergence of new ways of bettering existence, but they interpret the processes involved differently.

Stiegler defends the position that 'technics is logically universal' the variations in technological developments of cultures are explainable by the concrete local circumstances that inflate this technical tendency (Hui 2016, p. 19). However, it is worth noting that he does not equate the anthropological universality of technics present in human evolution with the universalisation of technology as a cultural, political, and socio-economic tendency. Whereas the former can produce diverse technical practices, the latter works against diversity due to the increasing automation of societies. In automated societies, a calculation-based way of life coupled with the hegemony of information-based machines successively defers the multiplication of improbable events that are necessary for any form of diversity (Stiegler 2020, p. 71–72). The universalisation of technology results from a capitalist information-based economy that regulates societies in accordance with Hayek's theory of organisation in which a market system based on information 'reduces all reality to calculability' (Stiegler 2020, p. 71–73). Thus, for Stiegler, there are two types of technical universalism: the first being an evolutionary tendency (universal anthropological technics) which is tied to the know-how of practices that shape subjectivity (Stiegler 2020, p. 72), and the second being a political, totalising tendency of technology under capitalism. While the first tendency is an evolutionarily contingent necessity, how the second type of technical universalism will impact societies is a matter of "choice" insofar as humans are capable of social transformations and revolutions. Stiegler writes that modernisation

and globalisation implicitly requires accepting the Western historical tendency to reduce life to calculability and the physics of Newton (Stiegler 2020, p. 74). The question of resistance to the global cosmotechnics is whether the current single global technosphere has already successfully destroyed the possibility of diversifying techno-industrial concepts (Stiegler 2020, p. 75).

In contrast to Stiegler, Hui represents the position that technics is not logically universal. Technics is always cosmotechnics and is shaped by the cosmological understanding of the universe in that culture. Technics is culturally constructed and cosmologically specific (Hui 2016, p. 19). Here cosmotechnics means that the cosmos itself is constructed through culture and technics. In a recursive movement, a given culture is part of the cosmos, but the cosmos is also deeply cultural and technically reproduced; the cosmos is constructed 'from bottom up framed and structured through symbolic grids and institutionalised habits' (Pavanini 2020, p. 28). This view cannot be equated with cultural constructivism because the recursive production of cosmology does not simply proceed from culture to culture. Technics is equally important in the recursive movement of cosmological production. Cosmotechnics is therefore a broader concept than culture; it determines culture because it organises experience through technical habits. Every culture has its own cosmotechnics which regulates practices, rituals and value systems, and we can witness the concretisation of cosmotechnics (Pavanini 2020, p. 27) in institutions, ways of life, and art. As Marco Pavanini explains, culture schematises our experience with cosmotechnics, with the technical practices (2020).

Hui broadens Whitehead's understanding of the role of cosmology in society by adding the practices of technics—technics is always cosmotechnics because it is conditioned by specific cosmological practices. Conversely, cosmology is never purely theoretical, and technics is always part of its rationalisation specific and characteristic of a locality (Hui 2022, p. 2). Hui claims that philosophy much like science is specific to a concrete milieu and cosmology which they

emerge out of; they are interrelated with each other in a dynamic way (Hui 2016, p. 18). Thus, there is no universally understood evolution of technics. Technics is exteriorised naturally, but cosmotechnics explain how this exteriorisation is conceptualised and regulated culturally. As Tuckwell explains, the recursive, progressive technical geneses are grounded in the episteme of technics and cosmology which together with nature and culture transform one another (2020, p. 84). Unlike Stiegler, Hui does not differentiate between universal technics present in human evolution and the capitalist universalisation of technology. Since technics produce and are reproduced by cosmology and culture, and are not anthropologically universal, the totalisation of capitalist cosmotechnics is problematic due to the cultural domination of the West through global capitalism.

Hui also differs from Stiegler in how he conceives of the source of decreasing technodiversity and how to resist it. As explained above, Stiegler sees the oppression of totalising capitalist technopolitics in the reduction of life to calculability and economic predictability, and resistance must entail "the revolution of care." Technodiversity can be recovered by the neganthropic technicisation of localities and by the diversification of techno-industrial concepts opposed to the hegemony of global information-based capitalism. For Hui, the oppression lays in the destruction of the diversity of cosmotechnics. Since both nature and culture determine the exteriorisation of a technical milieu, industrial revolution based on totalising capitalist cosmotechnics withered techno-diversity (Pavanini 2020, p. 29). Resistance to the totalising power of capitalist cosmotechnics lies in diversifying cosmotechnics, that is, the production of cosmotechnical events per se. Hui defines a cosmotechnical event as 'a call for the transformation of metaphysics as the possibility of the impossible within thinking itself' (Hui 2022). To counteract the totalisation of capitalist technopolitics we must rethink the relationship between humans and technology. Hui argues that this is achieved through 'the unification between the cosmic order and the moral order through technical activities' (Hui 2016, p. 19). The preservation of diversity lies specifically in the conservation of diverse

cosmotechnics, against the structural dualism that underpins modernity. Hui encourages us to reconceptualise technics with 'a commitment to an epistemic and critical vigilance' (Tuckwell 2020, p. 91) in order to pursue technodiversity, to reinvigorate cosmotechnics inspired by other cosmologies (Hui 2022, p. 3). The transformation of industrial technology has to start with new cosmotechnical events (Hui 2022, p. 5).

To illustrate cosmotechnics at work, Hui poses 'Needham's question': 'why didn't modern science and technology emerge in China?' (Hui 2016, p. 37) Following Hui, the answer is to be found in distinctive metaphysical systems. The conventional answer points to the event of modernisation, after which Western science and technology outstripped China's innovations. Hui considers this interpretation to be weak as it relies on an accidental rupture, instead of finding the cause for that rupture in its metaphysical groundings (Hui 2016, p. 37). In the *Question Concerning Technology in China*, Hui gives a detailed account of the comparative metaphysics done by Joseph Needham, Feng Youlan, and Mou Zongsan. Summarising and oversimplifying the issue, we can point out that the main difference between European and Chinese metaphysics is the same as the difference between the Aristotle-Kant metaphysical tradition and process philosophy. As this book describes in detail, process thought reemerged in the Western tradition with Romanticism, but it has never become the mainstream metaphysics institutionalised in science, specifically because its view on realism was sidelined. The Chinese tradition rooted in Daoism resonates with processual and organic modes of thinking. Hui explains that, after Mou Zongsan, the core difference between Western thinking and Chinese thought lies in the distinction between phenomena and noumena. Zongsan was a reader of Kant and uses his vocabulary to describe Western metaphysics as phenomenal ontology. Daoism presumes that philosophy engages with noumena (noumenal ontology), that is, a knowledge apprehended by the heart or the void or nothingness—to know nature we must go beyond phenomena and physical causality. The source of knowledge is

an absolute unity of subject-and-object: The Chinese tradition tends to put an emphasis on intellectual intuition and much less on the phenomena (Hui 2016, p. 38). According to Zongsan, Western scientific thinking, in contrast, is based on the Kantian assumption that noumena are unknown and cannot be known. The subject is the one that gains knowledge through the study of objects and the processes between them, and these processes are subjected to mechanical laws (Hui 2016, p. 38). Here we must raise the resemblance of Whitehead's thought to the Chinese tradition insofar as Whitehead's project opposes Kant's metaphysics and dualism by elevating the concepts of process and speculation in his philosophy. Against the bifurcation in the sense of nature, we are meant to disregard the distinction between noumena and phenomena and treat nature as one. Indeed, both Zongsan and Needham appeal to Whitehead to present the essence of Chinese thinking) (Hui 2016, p. 69). Zongsan proposes a reunification of the two metaphysical systems: the speculative of noumena, and the descriptive of phenomena (Hui 2016, p. 38). In this way, Zongsan claims that Chinese thought could have led to a modernisation, but needed a new method for it (Hui 2016, p. 38). Hui notes that this claim summarises the task of New Confucianism (Hui 2016, p. 38).

Following Hui's analysis, an organic mode of thought in China shaped the country's socio-economic politics. He writes that the lack of mechanistic materialism translated to the lack of a political programme that would seek to manipulate environment and organise societies under a mechanistic paradigm (Hui 2016, p. 172). China held the organic way of thinking, living and being (Hui 2016, p. 169). He clarifies that this amounts to the cosmotechnical determinant why the event of modernity did not emerge in China. Hui's point is not to return to traditional Chinese thought, and he does not argue that we can resolve current socio-economic issues imposed by capitalism by returning to earlier philosophies of nature, or process philosophy, as the world is now too embedded in technical systems for such theories to hold enough explanatory value. The point is to create cosmotechnical events that allow us to embed technologies in cultures where practices are

underpinned by the reunification of dual metaphysical systems (of the inert moral order and the outside cosmos). Although this book is very much influenced by Hui's work, it limits itself to an investigation into how organic metaphysics and biological organicism's onto-epistemology are useful as a philosophy of nature that can shape scientific practices, and it refrains from theorising morality in that respect. It reunites metaphysical systems to overcome the bifurcation in the sense of nature with no further analysis of how a moral order would be reflected in it.

From the perspective of biological organicism, the problem with the totalisation of capitalist cosmotechnics lies somewhere between the two interpretations proposed by Stiegler and Hui. Stiegler points out that technology in global capitalism concretises the laws of universal science which he describes as Newtonian physics and the mathematics of calculability (Stiegler 2020, p. 74). He identifies the epistemological constraints of mechanistic thinking as the factor undermining the production of diverse techno-industrial concepts. He never names these constraints in Whiteheadian terms, as the bifurcation in the sense of nature, because he uses this concept in a different manner. Nevertheless, his diagnosis is very close to what Whitehead views as modernity's greatest problem. Hui's interpretation is perhaps even closer to pointing out the bifurcation because he frames the issue of the totalisation of capitalist cosmotechnics in cosmological terms. Especially in the *Question Concerning Technology in China*, he singles out Western cosmology and Kantian ontology and epistemology as foundational to the processes of industrialisation, and how their totalisation in global capitalism diminishes diversity. For Whitehead, it is substance metaphysics that dominates science, structures knowledge, and is characteristic of modern institutions. On one hand, biological organicism accepts technics as a universal tendency to manipulate one's environment to live a better life, and a tendency to exteriorise knowledge so a thought can endure through time, approximating Stiegler's claim that technics is anthropologically universal. On the other hand, the actual concretisation of cosmology

and the production of technological objects are constrained within a particular civilisation and culture. For example, Whitehead argues that the slow-down in technological progress during the medieval period was caused by dogmatic constraints on speculative reason. In this sense, biological organicism also accepts Hui's thesis that cosmologies are technically and culturally conditioned. Onto-epistemology in biological organicism is based on relational, process thought, and any becoming is always simultaneously local and cosmic. Local diversity is an iteration of a universal tendency, just as any necessity is contingent and any tendency can only be measured by organic differentiation.

To summarise, treating technological progress as a universal evolutionary tendency raises the question of how one explains the diverse rhythms of technicisation in different local environments. Stiegler and Hui provide distinct answers to this question. Stiegler differentiates between technics that are anthropologically universal, and the universalisation of the technological and cultural programme of global capitalism. Hui claims that technics is always linked to the production of a cosmology specific to a given culture. These answers entail different ways of resisting the totalising forces of global capitalism. Stiegler advocates for a revolution of care and the diversification of techno-industrial concepts as they could result in the technodiversity required for noodiversity and biodiversity. Hui calls for cosmotechnical events. He believes that the diversification of cosmotechnics (and cosmologies) is fundamental to any revolutionary change. In either case, both Stiegler and Hui point out that the diversification of concepts is necessary to rethink the relationship between humans, technics, and nature. Therefore, a return to metaphysics and a rethinking of humanity's place in the system of nature is essential to resist a capitalist system that is based on mechanistic materialism. Biological organicism is an example of such an intervention in our habits of thought. The next section will present how the bifurcation in the sense of nature has been concretised in the global capitalist technological project.

2 Metaphysics of Global Capitalism

The concept of the bifurcation of nature is not the same as substance or other dualisms and the criticism of this philosophical tradition in Whitehead's writing. It refers to a theory of nature which is specific to our experience of modernity (Debaise 2017, p. 6). This bifurcation can be read as a process by which nature is divided into distinct branches more generally than just in philosophical paradigms. Biological organicism is a type of ecological metaphysics that rejects the machinic expression of nature that we find in modernism. As a philosophy of nature, biological organicism can help us systematically reconceptualise the relationship between thought and matter. This relationship is vital for how we schematise knowledge, and how we can relate to the technicisation of societies and environments. This section will elaborate on how this relationship between thought and matter also constitutes the basic economic relation. But biological organicism as a reconceptualisation of this relationship is only useful if the metaphysics of global capitalism is based on the bifurcation in the sense of nature. As Stiegler points out, global capitalism is not just based on Newtonian physics but also on an information-based economy that regulates societies in accordance with Hayek's theory of the self-organisation of market-based economic systems (Stiegler 2020, p. 73). It is therefore necessary to assess the extent to which Hayek's theory involves mechanistic materialism, before discussing neoliberal metaphysics more broadly.

In his famous essay 'The Use of Knowledge in Society,' Hayek describes the field of economics in rather organic and speculative terms. According to Hayek, the main problem for economists is that they always lack complete knowledge of an economic system. They always have to deal with the fact that they will not be able to have complete "data" on the whole society and nature. Economic calculus is meant to compensate for this lack, but Hayek argues that it is a misconception that mathematical formulas can predict the rational redistribution of resources based on incomplete data. He argues that

the real problem is methodological. Central planning fails when faced with an economic reality where knowledge is fragmentary, insufficient, and conflicting (Hayek 1945, p. 519–520). The problem of methods, thereby, lies in the misconception that we can accurately describe social phenomena with our habitual thinking about nature (Hayek 1945, p. 520). The scientific knowledge of experts became so legitimate in the public sphere that their methods are unquestionable, and few people dare to challenge their relevance. But Hayek argues that in the context of an economic system, '…the knowledge of particular circumstances of time and place' (Hayek 1945, p. 521) held by any single individual in an economic locality is unique and advantageous compared to the scientific knowledge of experts. He criticises the materialist fallacies that totalise scientific methods and treat knowledge as given and unchangeable for the sake of a statistical representation of reality, and he favours knowledge that is particular to a locality.

The similarity in his argument is not accidental as Hayek refers to Whitehead when elaborating on the issue of methods in sciences as well as later when explaining the institutionalisation of habitual thinking. Hayek writes that the issue of abstraction of nature into symbolic orders was foundational to civilisational progress, and that has been practised by scientific institutions and embedded in our habitual thinking (Hayek 1945, p. 528). Hayek's critique of economics draws on Whitehead's critique of science and has an element of organicism. However, he only uses these arguments to criticise centrally planned economies. Hayek claims that central planning will always fail because the scientific knowledge of experts will never be sufficient to account for the diverse knowledge of individuals in a large economic system (Hayek 1945, p. 525). Therefore, letting an economic system self-organise is the right solution. The problem with Hayek's interpretation of Whitehead is that he locates the principle of economic self-organisation in the price mechanism.

Hayek views the price mechanism as a perfect alternative to the totalising forces of the scientific methods employed by central planners who believe they hold knowledge superior to that held by individual

people in their localities. He argues that an individual person does not need to know why a certain thing is more or less difficult to procure outside of her locality. When something is more difficult to procure its price goes up because buyer and seller can negotiate the price rationally and according to their needs. Prices coordinate actions of people who have limited knowledge about the entirety of the economic process (Hayek 1945, p. 526). The price mechanism resolves the issue of fragmentary knowledge because it contains in itself the dispersed knowledge of many people. The price is the symbol that contains trans-individual knowledge (Hayek 1945, p. 528). He then calls the price mechanism a 'marvel' and 'the greatest triumphs of the human mind' (Hayek 1945, p. 527). Thanks to the price mechanism, an economic system can regulate itself to utilise resources in the most efficient way, overcoming the issue of insufficient knowledge in central planning.

Hayek critiques central planning for its methods but does not apply that critique to his own solution insofar as the price mechanism retains an arithmomorphic view of reality. Arithmomorphic concepts are characterised by rigid definitions, such as triangle, circle, one, or two. They have strictly defined conceptual boundaries and 'they can be clearly distinguished from one another' (Bonaiuti 2011a, p. 13). Arithmomorphic concepts are abstracted from the material representations to allow for operation on the logical language. The representation of economic reality in prices places it in a realm of primary, formal logic. Money is the commodity that stands for 'land, labour and capital' and that allows the quantification of economics (Daly and Cobb Jr. 1994, p. 113). It assumes that matter will always necessarily submit to form, and the possibility of actual contingency is removed. It seems that Hayek did not quite grasp that the dogmatism of scientific methods lies in an ontology that assumes the bifurcation in the sense of nature. Hayek's price mechanism accounts for how resources can be utilised in the most efficient way in the context of fragmentary and sometimes contradicting knowledge but it does not account for how the potentiality of matter is eventually depleted in the process: the fact that resources will eventually be exhausted (the

processes are not reversible without qualitative change), that unforeseen events (the contingency of biological and psycho-social systems) can disrupt the price mechanism, and that there are spatio-temporal limits to economic growth.

The neoclassical school of economics that Hayek belongs to, views economics 'as a sister science of mechanics' (Georgescu-Roegen 2011a, p. 58). An economic system is expressed as timeless kinematics based on the rule of complete reversibility (Georgescu-Roegen 2011b, p. 58). Hayek's economic system self-regulates rather than self-organises because it does not account for organic differentiation in the process. Thus, economic processes are detached from the environments they are part of and do not account for how they affect matter in any way. The abstraction of economic thought from matter reimposes the methodological fallacy that Hayek criticises.

To explain how arithmomorphism in neoliberalism leads to the exhaustion of matter, it is best to refer to works of Nicholas Georgescu-Roegen. A founder of ecological economics, Georgescu-Roegen had planned to work for the Economic Barometer in Cambridge Massachusetts at the beginning of his career. He had already tested some statistical components for his Ph.D. there but he had to change his career plans because the institute was shut down. Just a week before Black Tuesday in 1929, economists had claimed that the economy was 'perfectly healthy' (Bonaiuti 2011a, p. 6). Later in life, he began to investigate the shortcomings of arithmomorphic methods. This is when he discovered the works of organic thinkers. In a letter to his friend, he writes that he has appreciated how Bergson's works can be considered against the law of entropy, and that he believes that Whitehead was 'a philosopher who possesses a vision of reality superior to that of Positivists' (Zamagani 1979, p. 89). It is after his encounters with organicism that he became a critic of economic models based on mechanistic materialism. Georgescu-Roegen's issue with neoclassical economics was that, even though it viewed economic systems as self-organising, it kept treating reality as something that could be expressed in mathematical formulations, and therefore retained all the core

assumptions of Newtonian cosmology. The shortcoming of this arithmomorphism is that the economy's self-organisation is reduced to mechanistic self-regulation. Simply put, Georgescu-Roegen argues that numbers do not account for change in an economic system (Bonaiuti 2011a, p. 16). This epistemic choice, he argued, simply cannot account for the complexity of causation present in an economic system, where change takes place not just in quantitative but also qualitative ways (Bonaiuti 2011a, p. 18). He believed that *transformation* (Bonaiuti 2011a, p. 27), how nature becomes a commodity, how the organisation of societies becomes dependent on the availability of a certain commodity, and how energy is lost in the process, are central to understanding economic processes. Bioeconomics defines economic behaviour as 'the outcome, on the one hand of the complex network of relationships/constraints at the physical and biological level (i.e. the dissipation of matter/energy), and, on the other, as the result of the evolutionary changes in social structures and cultural frameworks' (Bonaiuti 2011b, p. xi). In turn, the economic system is better explained in the organic terms of changing relations and the qualitative transformations that accompany them. This understanding is impaired in neoclassicism by the epistemic choice of arithmomorphism.

Georgescu-Roegen insisted on the qualitative rather than quantitative conceptualisation of change because he approached economics from the perspective of changing complex relations between organs and environment. In reference to Alfred Lotka, he wrote on the exosomatic nature of human evolution, that is, the idea that biological evolution has been transgressed by artificial evolution, the production of exteriorised organs being complementary to biological, endosomatic organs (Georgescu-Roegen 2011c, p. 81). An economic system operates on the necessity to uphold the production of exosomatised organs. Consequently, industrialised societies are trapped in a vicious circle where the continued production of exosomatised organs exhausts the natural resources necessary for their survival. Georgescu-Roegen formulates it as problem of addiction, distinctive to the nature of evolutionary processes in other species. This problem is both biological

and economic. Thus, it requires a bioeconomic approach concerned with the limits of economic growth set by socio-cultural and biophysical systems (Bonaitui 2011a, p. 36). That the survival of the human species and our economies are tied to the biophysical limits of the world is the core ecological premise of his works. The functioning of an economic system should be assessed through the transformation of energy and matter, that is, by the law of entropy. Georgescu-Roegen claims that thermodynamics is the physics of economic value. He considers every action in nature (any organic process) as necessarily causing a deficit to an economic and a biophysical system. The increase of entropy is present with every expense of energy, in any economic (trans)action (Georgescu-Roegen 2011d, p. 61). Contrary to neoclassical economics, bioeconomics does not believe that economic processes are reversible or timeless. Energy expenditure is entropic, meaning that the energy in a sub-closed system will eventually dissipate to the point that it is no longer of any use (Georgescu-Roegen 2011a, p. 63).

Georgescu-Roegen conceptualises the earth as a closed subsystem of the universe. While there is available energy that we can draw from renewable and non-renewable sources, once it is transformed, some of it can be reused but the rest becomes unavailable energy (Georgescu-Roegen 2011b, p. 63). The question that economic systems should account for is not the most efficient redistribution of resources but their limited accessibility. In the case of non-renewable sources of energy, the argument is self-explanatory, but it also applies to renewable sources. The argument here is that the production of electricity, even in the case of solar power requires work that uses energy and contributes to the entropy of the closed subsystem. Moreover, 'solar energy comes to us with an extremely low intensity, like a very fine rain, almost a microscopic mist' (Georgescu-Roegen 2011c, p. 84). While Georgescu-Roegen views solar energy as the most sustainable solution, it would have to be harvested on a scale large enough that it could provide enough concentrated energy to fuel our ever-deepening addiction to exosomatic organs. Building this

infrastructure would require a vast amount of energy, work, and time but, in the long run, it is nearly pollution free and the survival of our species depends on solar energy anyway, so it would not create an additional dependency (Georgescu-Roegen 2011d, p. 84).

A second equally important economic issue is what Georgescu-Roegen calls a crisis of matter (Georgescu-Roegen 2011a, p. 120). He debunks the myth of recycling. Matter, just like energy, can become unavailable insofar as it continuously degrades and can reach a point in which it can no longer be recycled. Moreover, not all matter on earth is in a form available to us (Georgescu-Roegen 2011b, p. 120). Advocates of recycling claim that, since everything on earth is made out of minerals, we will never run out of them (Georgescu-Roegen 2011c, p. 121). One could just as easily claim that we will never run out of wood because trees grow out of sunlight, soil, and water (Georgescu-Roegen 2011d, p. 127). But the processes of industrialisation and urbanisation have a degrading effect on matter. More technological progress means that more matter is inevitably dissipated in the process of production. Moreover, at this stage of scientific progress, matter cannot be created from pure energy. Theoretically this is a possibility, as matter comes from an initial hot soup of protons and neutrons. In practice, however, we would not be able to produce any mechanical work at such temperatures, or support life. Thus, the original process that transformed pure energy into matter, and gradually into life, is not reversible (Georgescu-Roegen 2011a, p. 120).

Georgescu-Roegen claims that 'it is a myth that the price mechanism can offset any shortage whether of land, energy or materials (Georgescu-Roegen 2011b, p. 66). The price mechanism clings onto the Newtonian timelessness of the cosmic now. The law of supply and demand in a given moment simply cannot account for the scarcity of resources in thousands of years (Georgescu-Roegen 2011c, p. 87). The mechanistic character of economic processes in neoliberalism exhausts matter and energy because its ahistorical approach to change dismisses the issues of transformation described by Georgescu-Roegen. Only within this mechanistic paradigm could a fixation on economic growth

be considered rational. Georgescu-Roegen writes that growth-mania continues to be a standard, the political project of the technocrats and mainstream economists. This obsession with growth as the remedy to socio-political issues is linked to techno-theism, the belief that technology will save us, and that it can transcend nature. But these predicates of modernity and post-industrial societies ignore the most fundamental laws of nature and are based on the bifurcation, where technology is not considered nature, ignoring the vicious cycle of growing addiction to exosomatic organs. The faith in the timeless truth of symbolic orders blinds them to the inevitable bioeconomic disaster of humans as a species (Georgescu-Roegen 2011d, p. 111).

Consequently, bioeconomics is an anti-growth project, and finds the remedy to energy and matter crisis in degrowth economies. The minimum bioeconomic project amounts to eight points. First, all production connected to war machine should be stopped. Second, the productive forces previously utilised in the war machine should be used to help under-developed[1] countries build necessary infrastructure. Third, demographic growth should be limited. Fourth, the overconsumption of all energy sources should be limited until we fully transition to solar power. Fifth, we should reduce our consumption of gadgets. Sixth, fashion should be about long-term practicability. Seventh, production should be about the longevity of goods. Lastly, we should seek to spend more time on leisure and less on inventing faster ways to work (Georgescu-Roegen 2011a, p. 91). While this project is arguably utopian in terms of the disarmament of all nations, and morally questionable in terms of the limiting of population growth, it accurately lists the addictions propelling us towards climate catastrophe.

A similar criticism of neoliberalism's mechanistic materialism is presented by other representatives of ecological and evolutionary economics. John Foster claims that since the 1990s 'we have witnessed little weakening of the grip of "economic rationalism" in the teaching of economics, in mainstream publishing and in the policy prescriptions adopted by governments' (Foster 1997, p. 428). This, he adds, is

because Keynesians have enriched mainstream economics with complex rather than simple deterministic processes that they claim account better for complex outcomes and complex equilibria. Their solutions, however, did not change certain fundamental neoclassical assumptions, as they continue to rely on mechanistic understandings of change that are supported by formal mathematics (Foster 1997, p. 429). Neoclassicism provides timeless explanations, because its laws are ahistorical, meaning that they 'do not account for a process of unfolding in history' (Foster 1997, p. 432).

John Gowdy notes neoclassical economy inhibits neo-Darwinism. Gowdy argues that 'in the standard view economic change occurs through successive favourable innovations. (…) Eventually, the cumulative effect of these changes results in a product or process that bears little resemblance to its forerunner' (Gowdy 1997, p. 380). The employment of evolutionary metaphors in the neoclassical view does not compensate for its lack of understanding of the transformative processes in matter. Gowdy explains that neoclassical theory paints a picture of a market in which the existence of a firm depends on its competitiveness for resources and adjustment to fast-paced innovations (Gowdy 1997, p. 380). Hence, business competition is analogical to the 'survival of the fittest' in the Spencerian meaning of this phrase. In this scenario, however, economic actors behave mechanically. This is because there is only one motivation standing behind their actions, namely, increasing profit. Thus, the economic future is predictable and the behaviour of markets can be anticipated, giving credence to financial speculation and the financialisation of economies. In this case, the assumption is that 'economic evolution is inherently "progressive"' (Gowdy 1997, p. 380) and that economic selection is based on the optimisation of profit. Consequently, the products of economic evolution, following the biological metaphor of neoclassical markets, are mechanic, rather than contingent and organic. They are predictable insofar as they are embedded in conditions of perfect competition, behave rationally and seek efficiencies, which

amounts to a deterministic and mechanistic understanding of market forces.

The price mechanism and other rational models in economics are based not just on a reductive understanding of matter, the cosmic now, but also on rational actors. An elaborate criticism of *Homo economicus* (a rationally behaving individual who is always acting in their economic self-interest) is presented in works by Herman E. Daly and John B. Cobb Jr., perhaps the most popular and established Whiteheadian scholars. Daly and Cobb Jr. point out that the neoliberal economic model behaves rationally because it is based on an individual that is never satisfied, but still experiences a drop in desire for additional consumption (Daly and Cobb Jr. 1994, p. 85). Both of these assumptions are expressed in the 'utility function' (Daly and Cobb Jr. 1994, p. 86). This function always assesses the needs of an individual in isolation. Daly and Cobb Jr. argue against this extreme form of individualism in which '*Homo economicus* is indifferent to relative position in society, but in the real world much of the satisfaction in life felt by individuals is a function of how they stand in relation to other individuals; in other words, their relative status in their community' (Daly and Cobb Jr. 1994, p. 86). In turn, neoliberalism undermines the general good by organising societies in favour of 'subjective individual pleasure.' The abstraction of human desires from their communal life for the sake of scientific methods amounts, in their words, to the fallacy of misplaced concreteness (Daly and Cobb Jr. 1994, p. 96). Neoliberalism's mechanistic epistemology is based on the functions of utility and self-interest. Only when economic behaviour is reduced to the choices of rationally and logically behaving actors can it be measured by a Newtonian framework that assumes the lack of internal qualitative change (causal links are established between individually existing bodies). It does not account for the exhaustion of individual consumers, the problem of addiction, or that welfare can be assessed by the quality of the bonds between human and biophysical communities (Daly and Cobb Jr. 1994, p. 37). The main fallacy lies in abstracting individuals from their communities and communities from their biophysical environments (Daly and Cobb Jr. 1994, p. 51). Organic

differentiation is reduced to growth, individualism became the only rational way of life, and land is a passive constant, all to fit economic realities into an arithmomorphic language and a deductive science.

It is worth noting that, although Georgescu-Roegen and Daly and Cobb Jr. are heavily influenced by Whitehead and organic epistemology, they provide different alternatives to neoclassical economies. Georgescu-Roegen argues against the price mechanism and advocates for a degrowth economy. Daly and Cobb Jr. are also anti-growth but prefer a steady-state economy. Like Hayek, they support the price mechanism, but only if it can be based on principles that restrain self-interest and if it is supplemented by enough collective action (Daly and Cobb Jr. 1994, p. 59). Consequently, they propose a system in which the well-being of a community and its milieu is placed at the centre of the economic model. They argue that this is a third perspective outside of the right-left divide because capitalist and socialist models do not question the desirability of industrialisation and growth, their distinctions resting instead on how goods should be allocated. 'Whatever their ideological differences both systems are fully committed to large-scale, factory-style energy and capital-intensive, specialised production units that are hierarchically managed' (Daly and Cobb Jr. 1994, p. 13). Daly and Cobb Jr.'s economic model is ecological because it focuses on the depletion of resources, rather than their distribution, which includes what they call moral capital, i.e., the sense of community with a social and biophysical milieu (Daly and Cobb Jr. 1994, p. 51).

To summarise, biological organicism as a means to diversify techno-industrial concepts is only useful if global capitalism is constrained by the bifurcation in the sense of nature. This is still the case insofar as it operates on the habitual thinking of Newtonian cosmology and calculability. For example, Hayek's theory of self-organisation is based on the price mechanism. This mechanism implies the formal understanding of matter and individualism where there is no qualitative change exhausting the potentiality of becoming of nature or mind. Moreover, it is set in the cosmic now, meaning that it is

ahistorical. Some economists inspired by organic epistemology have proposed alternative models that account for evolutionary and transformative change. Georgescu-Roegen, for example, proposes bioeconomics, where economic value is defined by the law of entropy, and economic behaviour should be assessed against socio-economic and biophysical limits. The core economic problem is our addiction to exosomatic organs and how to sustain their perpetual production without running out of energy and matter. Like Georgescu-Roegen, other evolutionary economists argue that the conception of complexity and change in mainstream economics is still too reductive insofar as it operates on arithmomorphism which in turn reduces economic systems to calculability and mechanistic predictability. Furthermore, neoclassical economists who tend to describe economic reality using neo-Darwinian analogies also reiterate a Newtonian cosmology, where change is the cumulative result of successful innovations over time. Daly and Cobb Jr. accuse neoliberalism of the fallacy of misplaced concreteness. They argue that individuals are abstracted from their communities and human communities are abstracted from their biophysical environments. Ecological economics, in their terms, provides a "third perspective" insofar as it accounts for the depletion of natural resources and community bonds. Even if neoliberal economic theory treats economic systems as complex mechanics with the ability to self-regulate, it is still based on mechanistic materialism, Newtonian cosmology, and epistemic choices that prioritise form over matter. In short, its view of economic reality is distorted by the bifurcation in the sense of nature.

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3 Biological Organicism as a Cosmotechnical Event

The last section of this project is a conclusion to the cosmological method. It investigates how mechanistic metaphysics has established itself in capitalist cosmotechnics to the point that the mainstream neoclassical economics has been resistant to change, even though there

were paradigmatic shifts in the meantime. Here, paradigm is also understood in the "local" sense, as an exemplar, a standard example that is used to express the nature of things (Kuhn 2012, p. 23). The exemplar for mainstream economics is to understand the nature of reality as mechanistic, insofar as reality can be presented in a quantifiable way. Kuhn explains that a paradigm does not have to be set up by a scientific community in a formal way with a set of rules and shared beliefs. However, there are commitments in terms of concepts, instruments, techniques, theories, and methods corresponding with a persistent exemplar (Kuhn 2012, p. 42). One scientific community can be composed of smaller groups and there can be small revolutions within a scientific subspeciality (Kuhn 2012, p. 49). The case of political economy is especially interesting from the perspective of this project: there have been a number of epistemic revolutions involving speculative philosophy that formed subspecialties. Hegel's cosmology inspired Marx's political economy; Whitehead's organicism heavily influenced the works of Georgescu-Roegen, the founder of ecological economics; even Hayek's defence of the price mechanism was inspired by a speculative critique of science. Yet, the mainstream is persistent in explaining the nature of reality in mechanistic terms. There are three major reasons behind this persistence. Firstly, from the perspective of formal ontology, the issues of fragmentary knowledge, the exhaustion of resources, and the complexity of economic processes are addressed within the paradigm of mainstream economics. Secondly, capitalist technopolitics are based on a belief that the mind can transcend nature, that is, on the bifurcation in the sense of nature. Thirdly, capitalist cosmotechnics institutionalised habitual thinking that runs deep in the minds of Western thinkers. Biological organicism can serve as a cosmotechnical event to rethink the philosophy of nature against these three factors and global capitalism's totalising mechanistic materialism.

The persistence of mechanistic materialism in totalising capitalist cosmotechnics is problematic because it leads to the exhaustion of people and nature. It is quite clear that pro-growth economies are pushing us in the direction of climate catastrophe and global mental

health crises. Pro-growth is only rational in highly abstract economic models. It became anti-rational because it is a self-satisfied rationalism (Whitehead 1967, p. 201). Pro-growth policies rooted in intensified industrial production are typical of both neoliberal and classical Marxist approaches. While neoliberalism reflects mechanistic materialism, Marx was inspired by Hegel's metaphysics that uses a machinic organicism to describe the system of nature. In Hegelian metaphysics, nature is still understood formally; natural forms are unexhausted and the transformation of contingent particularities is necessary to civilisational progress. Only through the human transformation of nature can a natural object acquire value. From the perspective of biological organicism, the issue with both approaches is that they also strip nature of actual contingency. As a reconceptualisation of the philosophy of nature and the question of technology, biological organicism can explain what Hui terms *algorithmic catastrophes* (Hui 2015, p. 122). These catastrophes, though mostly caused by automated algorithms, exhibit a failure of reason (Hui 2015, p. 122–123). The obvious examples of algorithmic catastrophes are financial crises caused by AI, e.g., noise trading (especially bitcoin and forex), speculative bubbles on insurance-based securities, and flash crashes (Hui 2015, p. 125) (i.e., the spectacular May 2010 New York market crash). These catastrophes result from mechanistic materialism's erroneous habits of thought. Even if algorithms are not mechanisms in the Cartesian understanding of the term and are machines capable of self-learning, they process economic behaviour in terms of formal ontology—they reduce life to calculability and buttress the predictability of the market and its financialisaton. Such algorithms are problematic only if we have institutions that believe in the predictability of the market and enable the algorithms. Economic crises induced by financial speculation, be it the 2008 global financial crisis or the above-mentioned market crashes, were rooted in the institutionalisation of habitual thinking that removes contingency, creativity, and the ontological unpredictability of nature from our understanding of reality.

The less obvious algorithmic catastrophes are those that result from an evolutionary natural productivity. Hui notes that a natural disaster is algorithmic insofar as nature is governed by laws and principles of emergence (Hui 2015, p. 122). The Covid-19 crisis is an example of how nature can disrupt bioeconomic systems, but the mainstream economy fails to recognise even human creativity. Shifts in the economy caused by creativity are especially visible in the development of applications, such as Airbnb and its effects on the urban-economic landscapes of major European towns. Contingent events cannot be foreseen or avoided, but their destructive results can be minimised insofar as accidents can be incorporated into bioeconomic systems, by means of a response. To respond to them at all, a system must recognise the possibility of contingency in the first place. Mainstream economics cannot process changes caused by the *organic* in what we habitually conceive of as *inorganic*, i.e., that the organisation of a system can be disrupted and modulated contingently. Mainstream economics seems blind to this possibility.

As a discipline, economics is too abstracted from reality. It presents a theory of knowledge blind to existential constraints of life. The mechanistic exemplar does not work in practice; a major paradigmatic shift is needed. According to Kuhn, an anomaly could be grounds for a major shift. Usually, a scientific community searches for a novel theory 'after a pronounced failure in the normal problem-solving activity' (Kuhn 2012, p. 75). However, it is not uncommon that scientists stick with a paradigm even when confronted with 'severe and prolonged anomalies,' and even if they have alternative theories available (Kuhn 2012, p. 77). This is definitely the case for mainstream economics. Repeated market crashes, looming ecological crisis, and the depletion of community bonds have not led to the reconsideration of its set of first axioms. But revolutions do not take place just because a system is failing; they happen when people decide to take action in response to repeated failures. Kuhn argues that scientific revolutions are no different to political revolutions. Revolutions happen when a community responds to a growing sense that institutions are

inadequate in addressing problems of an environment which they have themselves at least partially created. Scientific revolutions are driven by the fact that the description of nature they have created (and institutionalised with scientific practices) no longer adequately functions in the explanation of natural phenomena (Kuhn 2012, p. 93). The issue is not that economists cannot see the economic crises unfolding before their eyes, nor is it the case that economic thought lacks diversity. As we have seen, there are many alternatives to traditional economics, such as ecological, evolutionary, and community-based models. The reason that a major paradigmatic shift has yet to occur has to do with how knowledge is organised. Daly and Cobb Jr. note that the way in which universities and post-industrial societies organise knowledge and think through life is the underlying cause (1994, p. 33). Fundamentally, the problem revolves around what methods are deemed sufficiently scientific, and what knowledge served to utilitarian aims of the state and industry. This brings us back to the question of how cosmology, cosmotechnics, and cosmopolitics shape our practices. Thinking about scientific communities as paradigms is useful as it links metaphysics to cosmology as an institutionalised practice. Each school of thought describes the same reality but with a different set of 'tools.' Thus, as Kuhn argues, a major paradigmatic shift is essentially a change in worldview (Kuhn 2012, p. 128).

Global capitalist cosmotechnics is foreclosing the possibility of changing the mechanistic materialist worldview for at least three reasons. First, the pro-growth global market economy propagates the notion that it is indeed possible to address current and future challenges without a major epistemic shift. In mainstream economics, it is widely believed that the price mechanism 'can offset any shortage whether of land, energy, or materials' (Georgescu-Roegen 2011b, p. 66). Keynesians added the complex rather than simple deterministic processes to economics, which now account for complex outcomes and complex equilibria. Still their solutions continue to be based on determinism and a mechanistic understanding of change supported by formal mathematics. Schumpeter's theory of creative destruction,

which expresses a non-Darwinian discontinuous evolutionary understanding of changes in business cycles and reflects a creative rather than rational economic actor (Georgescu-Roegen 2011c, p. 161) has been appropriated by neoliberalism to place technological innovation at the centre of its economic analysis and to glorify the idea of entrepreneurship. This is despite the fact that Schumpeter was not a neoliberal thinker and criticised 'overly economized, competitive, disruptive entrepreneurial mentalities' in his theory (Piano 2022, p. 732). Generally, mainstream economics believe that all anomalies can be resolved by the existing paradigm. In reality, however, this is a clear-cut instance of self-satisfied rationalism. From the perspective of biological organicism, the fact that pro-growth economy encourages empirical sciences to be examined within the existing exemplar is problematic because it reflects a worldview based on the formal ontology. It is descriptive to an extent that it does not allow for a critical approach to the first set of axioms. In contrast in speculation as a method integral to biological organicism, the generalisation of empirical findings is tested within the contingencies of material localities, which encourages change in the set of first principles.

Secondly, pro-growth economics is grounded in the belief that the human mind is superior to nature. This means that pro-growth economies trust that technological progress can continue exponentially (Georgescu-Roegen 2011d, p. 77) and will compensate for any potential ecological or health related losses. Georgescu-Roegen names this an issue of growth-mania and he points out that it is also present in Marxist approaches that believe 'that the power of technology is without limit' (Georgescu-Roegen 2011a, p. 71), and that we can always find a way 'to increase the productivity of any kind of energy and material' (Georgescu-Roegen 2011b, p. 72). Hui describes this phenomenon in the context of capitalist cosmotechnics, calling this belief that technology will save us technothesim, which he considers to be a universal political project that thrives on the technological universalisation of capitalism. Growth-mania or technotheism is inherent to the cosmopolitics of global capitalism that views the

technicisation of the planetary system as an exoskeleton that increases our chance of survival rather than a crisis of the Anthropocene. Here, technology seemingly transcends nature, thus giving us the means to control it. From the perspective of biological organicism, growth-mania or technotheism are based on the bifurcation in the sense of nature and require an onto-epistemological intervention, which is to say a reconceptualisation of cosmopolitics.

As previously noted, the concept of cosmopolitics has many definitions so it needs to be specified what it means here exactly. The concept can be defined as: (1) the politics of a technicised planetary system, (2) the politics of the philosophy of nature (Hui 2017, p. 1), (3) cosmopolitanism in Kantian meaning of this term, where people become unified under liberal economic rule and understanding of human rights, and where peace achieved with commerce is a understood as the end-goal for the global society (Stengers 2010), and (4) Stengers' reinterpretation of Kant's *jus cosmopoliticum* (2010, p. 79). The Kantian understanding of *jus cosmopoliticum* means peace. Stengers defines it as a peace that is violently imposed on the rest of the world, insofar as it colonises other worldviews: it gets rid of "the multiple worlds (Stengers 2010, p. 80). It is contrary to cosmotechnical diversity. She criticises Kant's belief in the West as the global peacemaker. Stengers argues that the West bringing peace to the world brought to other people new modalities of warfare and suffering (2010, p. 79). We can still find Kantian cosmopolitanism in modernisation and pro-growth economic thinking to which all other rules have to conform (Stengers 2010, p. 80). In contemporary global capitalism we have to constrain all thinking within a single metaphysical paradigm. Global commerce was meant to bring peace, but 'commerce, whenever it is confused with the well-known ideal of the free circulation of goods, is nothing but a generalised state of war' (Stengers 2010, p. 82). To resist it we should adopt cosmopolitics as the politics of the philosophy of nature which, in the context of today's technicised planetary system, is the epistemology of the "unknown." For Stengers, the cosmopolitical unknown is what Gregory Bateson calls the "epistemology of the

sacred," an epistemological method for what, from the modern point of view, cannot be consistently schematised into knowledge (Stengers 2010, p. 78). The unknown is how to 'present the present' that we do not yet have the ability to consider (Stengers 2010, p. 79).

The 'challenge of the cosmopolitan unknown' (Stengers 2010, p. 83) is to practice an epistemology of the unknown, which in Whitehead's terms means radical empiricism in the form of cosmological speculation. It is to admit that knowledge is temporary and contingent. While this approach could be easily discredited as anti-scientific, the chapter on speculative realism outlined in detail how radical empiricism is critical of science only to the extent that it makes dogmatic or totalising claims, and details how metaphysics should adjust to experience. We can see this issue of a totalising cosmology in neoclassical economics consistently—as abstractions detached from the environment into economic equations (Stengers 2010, p. 96). The Western tradition of scientific thought has successively removed the human from the system of nature, and its intellectual habits had led to an organisation of knowledge in which other worlds are hardly conceivable. One potential intervention in this onto-epistemology is to advocate for the speculative methods of the present unknown.

Thirdly, the issue lies in the institutionalisation of habitual thinking. A major paradigmatic shift, or a scientific revolution in economics, is difficult because of how deeply the habits of mechanistic materialism are ingrained in a mind born into the Western tradition of thought. The logic of solids can be explained from an evolutionary perspective, insofar as it helped us learn how to manipulate hostile environments, to think matter and use it as tools (Bergson 2005, 2014, xix). Then, it became a useful method in science. Mechanistic materialism has shaped scientific thought from Aristotle to Kant, and then continued in Newtonian cosmology to this day. This is not to disregard it completely as it clearly works when applied to certain localities. The issue is rather a cosmological organisation of knowledge that results from the bifurcation in the sense of nature and places the human mind above nature. We still treat nature as alien, believing that our minds and

technological progress will somehow let us transcend the natural biophysical limits of growth. In rejecting the finality of our own minds, we undermine our means of survival. From the standpoint of biological organicism, we can only save ourselves if we embrace the temporality of thought and matter and turn to an epistemology that assumes the speculative and self-annihilating nature of knowledge.

To conclude, the problem of mainstream economics is that it does not account for the transformative, qualitative change of matter and mind, or the absolute contingency/differentiation of nature in its understanding of economic processes. As a discipline, it is so abstracted from our actual experience of nature that it has become a self-satisfied rationalism, ignoring anomalies that require a major paradigmatic shift, i.e., a reorganisation of knowledge and new technics of truth making. Working against the habits of thought based on the bifurcation in the sense of nature is meant to bring methods back to the secondary understanding of matter and embrace the temporality of the mind. Hui explains that any cosmological thinking is in fact cosmotechnical—it is focused on the concretisation of human and non-human relations, where a cosmotechnical event is a "radical opening to the beginning of thinking." I argue that biological organicism is adequate to address the totalisation of capitalist technopolitics if we consider the cosmotechnical and cosmopolitical foundations of the problem. Although the death of metaphysics has been announced on several occasions, and for different reasons, the underlying factor for why certain metaphysical systems are marginalised lies in the totalising force of capitalist cosmotechnics. Metaphysics should not only serve to speculate on the unknown, but also to reveal how we order the cosmos in knowledge, to uncover how we schematise experience, and how in turn this schematisation regulates societies via the institutions that it embodies (e.g., scientific communities.) The diversification of metaphysical systems is a form of resistance that opens up new beginnings for rethinking the fundamental relationship upon which our societies are organised—the relationship between thought and matter.

4 Conclusion

Growth-mania encourages scientific communities to only produce knowledge of how to manipulate environment and limits thought to practical utility. In turn, we think of theories of knowledge as separate to theories of life. Cosmology as a method is meant to bring these two together again, grounding metaphysics in the temporality of thought and matter. We use metaphysical systems on a daily basis insofar as we have an idea of the positionality of humans in the system of nature which is concretised in practices—intellectual habits, scientific communities, and modern institutions. Biological organicism is a philosophy of nature that is an interpretative framework explaining how the sciences can relate to each other without resorting to totalising methods. The core imperative is that any first set of principles of science has to be tested outwardly within material localities. This is not the same as conducting an experiment which represents that locality in terms of formal ontology. The second main assumption is that sciences can contradict each other because they apply to different localities. They still produce truths about the laws of nature, as in experimental realism, but these necessities are based on absolute contingency. We can schematise our experience of nature and its tendencies because of the underlying organic differentiation. We must be aware that any new technics employed in schematising our experience of nature will change our organic sensibilities and how we anticipate the future, and that our schematisation of knowledge, just as our experience of nature, is temporary and full of paradoxes that become in harmony.

It is worth bringing metaphysics as cosmologies to continental political theory to affirm a diversity of theories of knowledge, that they inform how we live, and to recognise when and how they become totalising. This book has explored in depth the origins of the tendency to totalise in the Western tradition of thought stemming from the Aristotelian doctrine of matter that was later reiterated by Descartes, Newton, and Kant. I also presented some alternative approaches, such as speculative realism, experimental realism, and organicism in the

philosophy of science, and degrowth, and community-based economics. The issue is not a lack of alternative modes of thinking, but rather that capitalist cosmotechnics is limiting their reach. The rationale of growth together with technology is the universal political project are destroying technodiversity and biodiversity, while shaping our organic sensibilities and our imaginaries of the future. Biological organicism is an invitation to rethink how the sciences should relate to each other, to facilitate a major paradigmatic change enabling restructuration of scientific communities. Obviously, biological organicism is not enough to stop the totalisation of capitalist cosmotechnics by itself. However, it gives us the conceptual tools to understand that, for as long as we are habitually and institutionally stuck in metaphysics based on an atemporal understanding of life, we will find it difficult to recognise that growth-mania leads to the exhaustion of people, communities, and natural resources. The totalisation of capitalist cosmotechnics propagates growth-mania as the only viable rational solution to these issues, but it is rational only in very abstract terms when we view the nature of reality from the position of primary ontology. The diversification of cosmologies should open a space from which to counteract self-satisfied rationalism. This is a critical political judgement that can be viewed as totalising. Solutions based on other cosmologies should be tried as alternative remedies to the catastrophe we are heading towards. The point is to be pragmatic and resist the totalisation of capitalist cosmotechnics.

We must return to metaphysics to speculate on the relationship between thought and matter: to uncover the reductivist tendencies in the Western tradition of philosophy of nature and methods of science; to understand how cosmologies organise our societies; and to enable metaphysical pluralism, and noo- and biodiversity necessary to resist global capitalist cosmotechnics.

References

Bergson, Henri. 2005. Creative *Evolution.* New York: The Modern Library.

Bergson, Henri. 2014. *Creative Evolution*. United States: Createspace Independent Publishing Platform.

Bonaiuti, Mauro. 2011a. Introduction: Geourgescu-Roegen, the man and scientist. In *From Bioeconomics to Degrowth; Georgescu-Roegen's "New Economics" in eight essays*, ed. Muro Bonaiuti, 1–48. Abingdon: Routledge.

Bonaiuti, Mauro. 2011b. Preface. In *From Bioeconomics to Degrowth; Georgescu-Roegen's "New Economics" in eight essays*, ed. Mauro Bonaiuti, x–xiv. Abingdon: Routledge.

Daly, Herman E., and John B. Cobb Jr. 1994. *For the Common Good; Redirecting the Economy toward Community, the Environment, and a Sustainable Future*. Boston: Beacon Press.

Debaise, Didier. 2017. *Nature as Event: The Lure of the Possible*. Durham and London: Duke University Press.

Foster, John. 1997. The Analytical Foundations of Evolutionary Economics: From Biological Analogy to Economic Self-Organisation. *Structural Change and Economic Dynamics, Issue* 8:427–451.
[https://doi.org/10.1016/S0954-349X(97)00002-7]

Georgescu-Roegen, Nicholas. 2011a. Quo vadis Homo Sapiens Sapiens? In *In From Bioeconomics to Degrowth; Georgescu-Roegen's "New Economics" in Eight Essays*, ed. Muro Bonaiuti, 158–170. Abingdon: Routledge.

Georgescu-Roegen, Nicholas. 2011b. Energy Analysis and Economic Evaluation. In *From Bioeconomics to Degrowth; Georgescu-Roegen's "New Economics" in Eight Essays*, ed. Muro Bonaiuti, 114–141. Abingdon: Routledge.
[https://doi.org/10.4324/9780203830413]

Georgescu-Roegen, Nicholas. 2011c. Energy and Economic myths. In *From Bioeconomics to Degrowth; Georgescu-Roegen's "New Economics" in Eight Essays*, ed. Muro Bonaiuti, 1–48. Abingdon: Routledge.
[https://doi.org/10.4324/9780203830413]

Georgescu-Roegen, Nicholas. 2011d. Inequality, Limits and Growth. In *From Bioeconomics to Degrowth; Georgescu-Roegen's "New Economics" in Eight Essays*, ed. Muro Bonaiuti, 103–113. Abingdon: Routledge.
[https://doi.org/10.4324/9780203830413]

Gowdy, John. 1997. Introduction: Biology and Economics. *Structural Change and Economic Dynamics Issue* 8:377–383.
[https://doi.org/10.1016/S0954-349X(97)00021-0]

Hayek, Friedrich A. 1945. The Use of Knowledge in Society. *The American Economic Review* XXXV (4): 519–530.

Hui, Yuk. 2015. Algorithmic Catastrophe – Revenge of Contingency. *Parrhesia* 23:122–143.

Hui, Yuk. 2016. *The Question Concerning Technology in China*. Falmouth: Urbanomic Media Ltd.

Hui, Yuk. 2017. Cosmotechnics as Cosmopolitics. *e-flux Journal* #86:11–17.

Hui, Yuk. 2022. This Strange Being Called the Cosmos. *Foundations of Science* 27 (4): 1409–1414. [https://doi.org/10.1007/s10699-020-09740-7]

Hui, Yuk. 2023. Rethinking technodiversity. The UNESCO Courier. https://courier.unesco.org/en/articles/rethinking-technodiversity. Accessed 31 March 2023

Kuhn, Thomas S. 2012. *The Structure of Scientific Revolutions*. Chicago and London: The University of Chicago Press. [https://doi.org/10.7208/chicago/9780226458144.001.0001]

Pavanini, Marco. 2020. Cosmotechnics from an Anthropological Perspective. *Angelaki* 25 (4): 26–38. [https://doi.org/10.1080/0969725X.2020.1790833]

Piano, Natasha. 2022. Neoliberalism, leadership, and democracy: Schumpeter on "Schumpeterian" theories of entrepreneurship. *European Journal of Political Theory* 21 (4): 715–737. [https://doi.org/10.1177/1474885120960439]

Stenger, Isabelle. 2010. *Cosmopolitics I*. Translated by Robert Bononno. Minneapolis and London: University of Minnesota Press, 2010

Stiegler, Bernard. 2020. Noodiversity. *Technodiversity. Trans. D. Ross. Angelaki* 25 (4): 67–80.

Tuckwell, Jason. 2020. Technics and Agency; The Pluralism and Diversity of Techne. *Angelaki* 25 (4): 81–96. [https://doi.org/10.1080/0969725X.2020.1790837]

Watts, Alan, and Al Chuang-Liang Huang. 2011. *Tao: The Watercourse Way*. London: Souvenir Press.

Whitehead, Alfred N. 1967. *Science and the Modern World*. New York: The Free Press.

Zamagani, S. 1979. *Georgescu-Roegen: I Fondamenti della Teoria del Consumatore*. Milan: ETAS Libri.

Footnotes

1 Geourgescu-Roegen has a very specific understanding of development which is not connected to economic growth or an endpoint of a democratic and neoliberal state. He views development as innovative sustainability measured by 'the total rate of resource depletion (and the rate of ensuing pollution)' (2011c, p. 75).

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Footnotes

1 Note: Page numbers followed by ‘n’ refer to notes.

Table 3.1 The bifurcation in the sense of nature in dualism

Nature that is a cause of awareness (*Synholon—Hyle* and *Morphe*)	**Nature that is an effect of awareness (*Logos*)**
body	mind (sometimes spirit)
mechanical laws (no freedom)	ethics and morality (freedom)
physics	metaphysics, logic, formal ontology (e.g., mathematics)